The Rye Creek Project: Archaeology in the Upper Tonto Basin

Volume 3: Synthesis and Conclusions

Mark D. Elson
Douglas B. Craig

Contributions by

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Alan Ferg
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Elizabeth Miksa
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Center for Desert Archaeology
Anthropological Papers No. 11

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PART 5: SYNTHESIS AND CONCLUSIONS

CHAPTER 23

WESTERN APACHE AND YAVAPAI POTTERY AND FEATURES FROM THE RYE CREEK PROJECT

Alan Ferg

This section reports on the sherds and chipped stone recovered from Feature 122, a Western Apache pot-break, at the Deer Creek site (AZ O:15:52). From the main site area, an additional seven Western Apache sherds were recovered from the site surface, and six sherds believed to be Yavapai were found in the fill of Features 21, 34 and 48. Features 15, 43 and 44 at this site may be either protohistoric Western Apache or Yavapai roasting pits and discarded rock.

At AZ O:15:71, an ephemeral masonry structure (Feature 2) and a slab-lined cist (Feature 4) may also be protohistoric in origin, although no Western Apache or Yavapai pottery was recovered at this site.

These sherds and features represent all of the identifiable and possible protohistoric materials recognized from the entire Rye Creek Project area. The use here of the term "protohistoric" is rather loose, but also convenient, in that none of the materials under discussion can be precisely dated. Inferred or known to date after the prehistoric occupation of the area, they are also assumed to postdate European entry into the Southwest in 1539. Whether they date before or after actual contact with Spaniards, Mexicans, or Anglos is uncertain. The complete absence of metal and glass at these sites, and the removal of most of the Northern and Southern Tonto and their Yavapai neighbors to military reservations in the 1870s make it quite likely that the Rye Creek Project materials date prior to 1875. How much earlier they may date will be discussed at various points throughout this chapter.

WESTERN APACHE AND YAVAPAI HISTORY AND ARCHAEOLOGY IN THE RYE CREEK AREA

Given the small amount of protohistoric archaeological material recovered by the Rye Creek Project, a lengthy discussion of Western Apache and Yavapai ethnography is not warranted; readers can find additional information in the literature sources cited. Some background is necessary as context for the discussion of what was found. Likewise, only a summary of previous pertinent archaeological work will be presented now; specifics will be cited later in the discussions of the sherds and features.

Ethnographic Information for the Area

Khera and Mariella (1983:38, Figure 1) recognize four subtribes for the Yavapai: Tolkapaya (Western Yavapai), Kewevkapaya (Southeastern Yavapai), Wipukpaya (Northeastern Yavapai), and Yavepe (Central Yavapai). E. W. Gifford (1932, 1936) lumped the last two named as Northeastern Yavapai. The Northeastern Yavapai bordered the Northern Tonto group of the Western Apache, and, in the area of the Rye Creek Project, the Southeastern Yavapai bordered the Southern Tonto (Figure 23.1). In general these groups can all be considered as having been primarily hunters and gatherers, with minimal agricultural pursuits, located in the same environmental life-zones, who had friendly relationships with one another, and combined in various alliances against their individual or common enemies, including the Pima and Maricopa (White 1974:128).

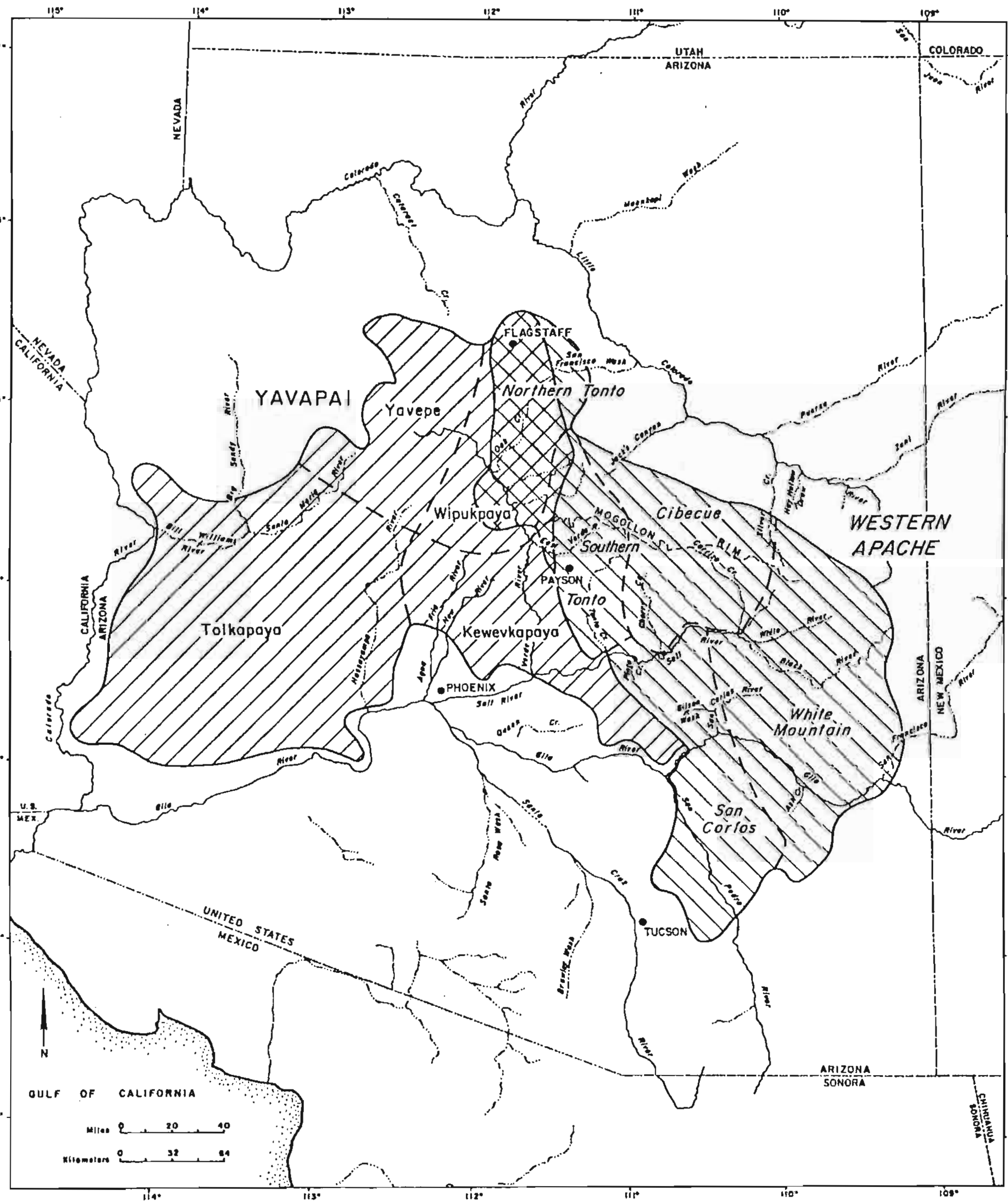

Figure 23.1. Location of Yavapai and Western Apache.

The prehistoric origins of the Southeastern Yavapai are uncertain. Some researchers view them as the historic representatives of a longstanding, indigenous prehistoric tradition (either Hakataya, Prescott or Southern Sinagua). Others believe they are the easternmost extension of a Yuman migration from California into Arizona, which either replaced, or perhaps displaced, the prehistoric inhabitants of the area no earlier than A.D. 1100, and possibly after A.D. 1300 (see Pilles 1981:172-177 for an excellent summary of these various arguments). Regardless, when the Spanish arrived in the Southwest, the Yavapai appear to have been occupying what Gifford mapped in the 1930s as their traditional territory. Schroeder (1955) argues that Fray Marcos de Niza in 1539, and Coronado in 1540 both passed through Southeastern Yavapai territory. Even if his arguments for these very early contacts are not accepted, there are several Spanish accounts of the Yavapai in their home territories from throughout the 1700s. The Spanish usually discerned the same three divisions that E. W. Gifford did, speaking of the Cruzados (Northeastern Yavapai), the Tejuas (Western Yavapai), and the Nijores (Southeastern Yavapai). In the 1800s the U.S. Army also differentiated these groups, but, because of considerable difficulty in distinguishing the Yavapai from their neighbors, the army muddled the picture by referring to them as Apaches, Apache-Mohaves, and Apache-Yumas (Schroeder 1974b:27). Between 1871 and 1873, the U.S. Army concentrated many of the Yavapai on the Rio Verde Reservation, treating them as "hostiles" along with some groups of Western Apache and Chiricahua. During a forced mid-winter relocation to the San Carlos Reservation in 1875, over 100 Yavapai died (Corbusier 1969). Some Yavapai avoided this roundup, and others escaped during the march. In the 1880s and 1890s the Yavapai were allowed to return to their former homes, although many stayed at San Carlos, intermarrying with Apaches (Khera and Mariella 1983:41).

The Western Apache are not indigenous to the Southwest, but the date of their arrival in eastern Arizona, and more specific reconstructions of their expansion once there, have been the subject of much discussion. Wilcox (1981) has summarized the various routes proposed for Athapaskan migrations down from Alaska and western Canada onto the Plains, and from there into New Mexico and finally Arizona. In 1539 and 1540, de Niza and Coronado reported no one living between the Salt River and Zuni. But by the late 1600s and early 1700s, several Spanish reports clearly indicate that there were Apaches living north of the Gila River in eastern Arizona, and they were apparently distinct from other Apache living even further east. The latter would become the modern-day Chiricahua (Schroeder 1974a:343-351). One hundred and fifty years later (ca. 1850) the Western Apache occupied the territory mapped by Grenville Goodwin (1942:4) (Figure 23.1).

It is uncertain when the Western Apache spread into the Upper Tonto Basin, the Upper Verde Valley, and above the Mogollon Rim. Also uncertain is the direction from which they were coming. Schroeder (1952; 1974b:155) speaks of the Western Apache as spreading north and northwest from the San Carlos area in the 1700s, probably coming into contact with the Southeastern Yavapai around 1750, and reaching the Mogollon Rim sometime in the late 1700s and early 1800s. Brugge (1965:367-368), coming from another direction (literally), suggests that the Western Apache may have split from the Navajo around the time of the Pueblo Revolt (1680) and the Reconquest (1692-1696), spreading southwestward over the Mogollon Rim.

The linguistic and cultural identity of the people on the northeast side of the Verde River, north of Fossil Creek, has been much debated. Located immediately north of the Rye Creek Project area, Schroeder and Gifford identify this as Northeastern Yavapai territory, while Goodwin and Brugge identify it as primarily Northern Tonto Western Apache (Figure 23.2). Certainly by the American period, the area was one of mixed language, use and heritage, and this is the time period from which all four scholars derive most of their information.

The Rye Creek Project falls within the Southern Tonto area as defined by Goodwin, and although this area generally is acknowledged in the literature to be Western Apache territory (the Mazatzals being the dividing line), some of the same arguments presented above for the Northern Tonto area apply here too, and there is the question of whose territory it was earlier in time. Schroeder (1974b:139-141, 155, 260) argues that the Western Apache were forced westward into Southeastern Yavapai territory by Spanish pressures from the south and east between about 1747 and the early 1770s. He argues that the Tonto Basin originally had been Yavapai territory, and that it was used jointly by the Yavapai and Western Apache, until members of both

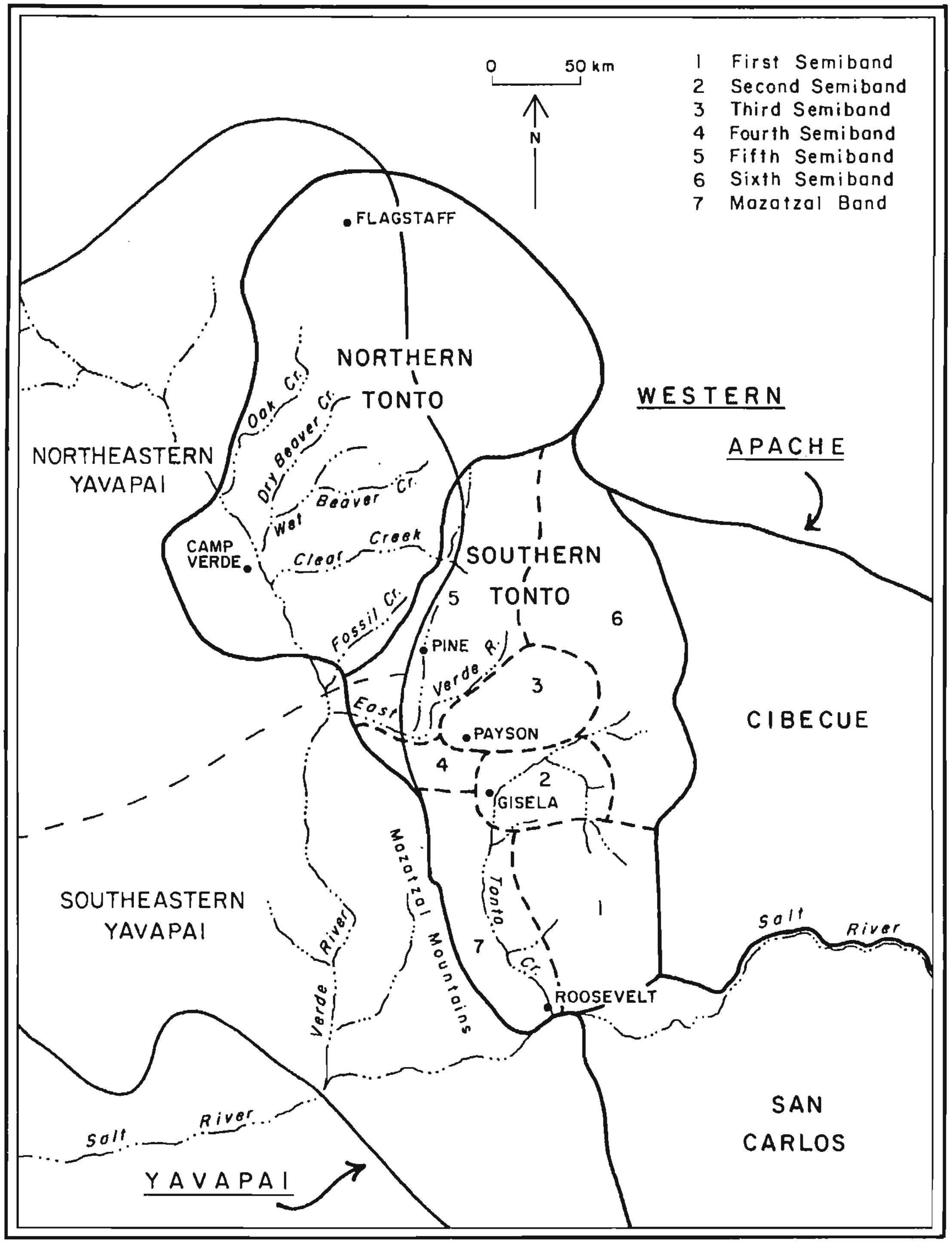

Figure 23.2. The eastern extent of the Yavapai, and western extent of the Western Apache around 1850, as mapped by Gifford (1936:Map 1) and Goodwin (1942:Map I) and presented by Brugge (1965:356). AZ O:15:52 (ASM) and AZ O:15:71 (ASM) are in Southern Tonto territory, but much of the area claimed as Northern Tonto by Goodwin was claimed for the Northeastern Yavapai by Gifford.

groups were pushed further north into Northeastern Yavapai territory by the U.S. Army in the 1860s and 1870s (1974b:256-260).

The differences between Schroeder's and Brugge's arguments seem to be largely a matter of emphasis, with Schroeder viewing the Upper Verde (and Tonto Basin) as predominantly Yavapai with some Western Apache admixture, and Brugge seeing a greater dominance of Western Apache language and culture within this same area. In terms of archaeological remains, Schroeder's outline of events, which is based on an abundance of historic documents, does provide a framework that can be tested. From about 1540 to about 1750, materials in the Rye Creek area should be purely Yavapai in origin. From about 1750 to 1850, one could expect a mixture of Yavapai and Western Apache traits, with the latter becoming progressively more dominant or numerous through time. After 1850 the area would have to be considered Southern Tonto Apache Mazatzal Band territory, but, after years of close contact, architecture and items of material culture may well be indistinguishable from those of neighboring Southeastern Yavapai.

By about 1850, AZ O:15:52 and AZ O:15:71 were located inside Southern Tonto territory, probably in the extreme northeastern corner of the area claimed by the Mazatzal Band (see Goodwin 1942:4-5). Goodwin (1942:35-36) recorded the boundaries of this band as west to the divide of the Mazatzal Mountains, south to the Salt River and its junction with Tonto Creek (now under Roosevelt Lake), and east to Tonto Creek and somewhat beyond. On the northeast and north the Mazatzal Band bordered the Second and Fourth semibands, respectively. If these two sites are not in Mazatzal territory, they are in the southwest corner of the Second Semiband area or the southeast corner of the Fourth Semiband: AZ O:15:52 must be somewhere very near to where these three territories touch one another on Goodwin's map.[1] Exact placement is not terribly important for our present purposes in that all three groups were friendly toward one another, shared some clans, traded and visited the Yavapai on the west slope of the Mazatzals, and were in turn visited by them, although there was apparently no intermarriage in this particular area. As Goodwin (1942:35-39) states:

> The Mazatzal band, *tséno·'łtł'ì·jǹ* ("rocks in a line of greenness people"), took its name from *tséno·'łtł'ì·j*, the Mazatzal Mountains, and claimed the east slope of this range. The west slope was Yavapai territory, and the people sometimes visited the Yavapai living in Sunflower Valley, west of the divide, but they remained unmixed and were purely Apache in language. . . .The crest of the Mazatzal Range. . .was a fine place for the people to camp in the heat of summer, with good hunting and plentiful plant foods. . . . While many of the band spent most of their time in the Mazatzal Mountains and had no farms, others planted at various places along Tonto Creek. . . . People from the Mazatzal Mountains without farms came to Gisela every September to visit and obtain corn [from the Second Semiband], and even the Yavapai from west of the Mazatzal Mountains occasionally did the same.

Forced to move to the San Carlos Reservation by the U.S. Army in 1875, along with many Northern Tonto and Yavapai, remnants of the Southern Tonto returned to their home territories after 1898. In the 1930s, members of the Mazatzal Band and Second and Fourth semibands lived mainly at Gisela, and some at Camp Verde. Some Southern Tonto stayed at San Carlos, "at their farms along the Gila River, but in 1937 the last of these moved back to Gisela, Camp Verde, and Payson. Lately, many have returned to San Carlos and live on Gilson Wash. One or two are at Bylas, and several are intermarried with Yavapai at Fort MacDowell" (Goodwin 1942:43).

Western Apache and Yavapai Archaeological Remains

General summaries of Western Apache archaeological sites, features, pottery, and other artifacts can be found in Gifford (1980:182-188) and Gregory (1981). For Yavapai archaeological remains, see Pilles (1981) and Euler and Dobyns (1985).

Surveys in the Upper Tonto Basin and the upper Verde River areas conducted by Gila Pueblo in 1929 (Gladwin and Gladwin 1930) and later by Fred Peck (1956:24-27) recorded a number of sites with Apache and probably Yavapai components. More recent surveys by Arizona State University field schools (Dittert 1976:19-20; summarized in Redman and Hohmann 1986:5-6) and ongoing surveys by Tonto National Forest archaeologists (e.g., Kaiser 1983; Wood 1983a, 1983b, 1983c; Wood and Kaiser 1984) continue to record Yavapai and Apache ceramics and sites.

Projects with excavated protohistoric components are far fewer in number. In the immediate Rye Creek Project area, only Huckell (1978) and Ciolek-Torrello (1987) encountered ceramics and features that could be identified as Apache and Yavapai. More specific discussion of these materials, and others from further afield, will be presented below as comparative material for the ceramics and features found during the Rye Creek Project.

THE DEER CREEK SITE, AZ O:15:52

Feature 122: A Western Apache Pot-break

Feature 122 is located immediately outside the proposed western boundary of the State Route 87 right-of-way at the Deer Creek site (see Volume 1, Figure 7.2). This small surface scatter of sherds was recognized as a Western Apache pot-break by Stone (1986:37-38) during his survey and reevaluation of the sites in the project area. During the testing phase, all ceramics and lithic tools west of the highway, within the right-of-way, were collected as a single unit; none of the sherds were Apache. During data recovery a single trench was dug between the highway and the existing fence line; no features were found. No further work was conducted on this side of the highway, other than to excavate the Apache pot-break. Permission to work outside the right-of-way was given by Tonto National Forest.

Methodology

A grid of 1-m by 1-m units was measured in from a stake at Deer Creek site grid coordinates N210/E185. A rectangle 5 m by 6 m encompassed all the visible sherds. All sherds and lithics visible on the surface were point provenienced on a map, but collected as a group, because all of the sherds appeared to be from a single vessel. All of these sherds were small, ranging from about 0.5 cm to 2.0 cm on a side, and probably averaging 1 cm on a side. Immediately north of this rectangle was a recently burned tree trunk and a small dense patch of live scrub oak (*Quercus turbinella*). Examinations of this area prior to the beginning of data recovery did not reveal any sherds, however, with the tree and scrub oak denuded by fire, surface erosion exposed five considerably larger sherds in this area, and the collection and excavation units were accordingly extended northward (Figure 23.3). In fact, excavation showed the majority of large sherds to be buried in this northern area, the dense brush having apparently protected them from being repeatedly trampled by cows and campers. Immediately south of the grid was a modern hearth or campfire, half outlined with rock. The associated artifacts included a beverage can pop-top and three fired Winchester 30-caliber WW Super Mag cartridge cases. These were not collected and the hearth was not excavated.

Fifteen square meters were excavated by shovel-stripping and troweling. All dirt was passed through a 1/4-inch mesh screen. Unlike the methods used at the main site area, all sherds, no matter how small, were collected. Excavated materials were bagged by grid in order to compare surface-to-subsurface artifact densities (see below), but were subsequently combined with all of the surface materials for analysis. The fieldwork took two person-days, and was done by the author and Beth Grindell over August 26, 27, and 30, 1989.

Initially this pot-break appeared as a small, well-defined area of small, battered body sherds. Research potential appeared so limited that it was questionable whether any work beyond a surface collection was warranted. But because of the rarity of Western Apache archaeological features, and the small amount of work involved, excavation was approved. Although no features were found, a good portion of the Apache Plain jar was recovered, including much of the rim, thereby adding to our database for this pottery type. Had only the area south of grid stake N214 been excavated, the extra effort might legitimately have been considered unnecessary: bedrock was only 5 cm below surface in this whole area, surface artifact density was representative

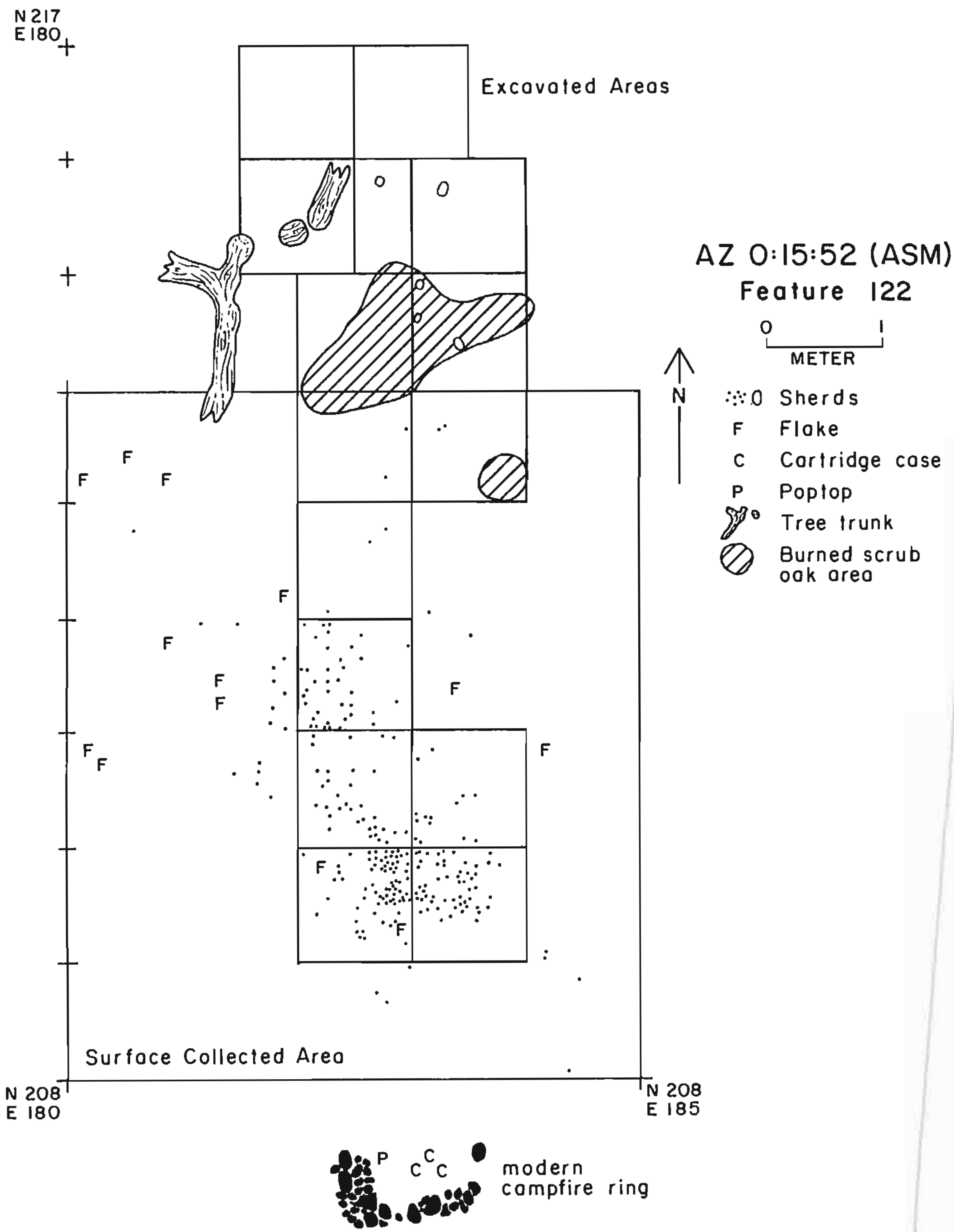

Figure 23.3. Surface artifacts at Feature 122, AZ O:15:52 (ASM). The entire outlined area was surface-collected, and all of the individually outlined 1-m by 1-m and 1-m by 0.5-m units were excavated.

of subsurface density, and sherds from both contexts were very small. North of stake N214, the soil was deeper and, protected by brush, the sherds were larger. These grids were excavated to sterile soil which was 10 cm below surface. Excavation was continued to the north, east and west until no more sherds were encountered. Quantitative records of sherd numbers and weight, by grid, are presented in Tables 23.1 and 23.2.

This feature was visited again in February 1990, after heavy rains had further eroded both the excavated and unexcavated grids. Only three tiny sherds were found in N211-212/E183-184. Because of this, Feature 122 is considered to have been 100 percent excavated.

Table 23.1. Comparison of total numbers of sherds recovered from Feature 122 and their average weight for the surface and subsurface of the more protected north area (units north of N214) and the exposed south area (units south of N214). The single largest sherd recovered (*) weighed 42.0 gm.

		Number of Sherds	Weight (gm)	Average Weight Per Sherd
North Area:				
	Surface	5	99.6	19.92 gm
	Subsurface	91	477.5*	5.25 gm
South Area:				
	Surface	242	400.4	1.66 gm
	Subsurface	256	410.1	1.60 gm
Total		594	1387.6	2.34 gm

Chipped Stone

Twenty-nine pieces of chipped stone were recovered: 12 from the surface and 17 from excavation (both are Provenience-Bag [PB] Number 525-2). The material is a mix of nondescript flakes, retouched fragments, and one hammerstone, made of a variety of materials (Table 23.3). More chipped stone was seen scattered in all directions around the gridded area. The ubiquity of chipped stone across the entire site area, along with the heterogenous nature of the assemblage found in the immediate vicinity of Feature 122, suggests that the chipped stone collected from Feature 122 is not contemporaneous with the pottery there, and probably not of Western Apache origin. Western Apache chipped stone technology generally is considered to be rather rudimentary, with an emphasis on making arrow points from white flint and obsidian (Gifford 1940:120; Basso 1971:231; Ferg 1987:Figures 5.3 and 5.23; Tagg 1992); the preponderance of rhyolite, andesite, and metasediment at Feature 122 also argues against this assemblage having been manufactured by Western Apache. Finally, there is no evidence of recent flaking of old (prehistoric) patinated flakes and tools, something found in two other small sites that had Apache pottery and appeared to be essentially purely Apache in age (Huckell 1978:47, 51; Bradley and Ferg 1980:11, Figure 2i).

In trying to determine if there might be a Western Apache component to the Deer Creek site chipped stone assemblage Craig (Chapter 14, Volume 2) attempted to discern any material types or attributes that distinguished the chipped stone found on the surface of the site (particularly near the Feature 15 roasting pit) from that directly associated with prehistoric features. The results were inconclusive.

Table 23.2. Tabulation of sherds recovered from the surface and subsurface of the excavated units at Feature 122 at AZ O:15:52 (ASM).

		Surface	Subsurface
North			
	N214-215; E181.5-182	0	0
	N214-215; E182-183	0	7
	N214-214; E183-184	3	39
	N215-216; E181.5-182.5	0	3
	N215-216; E182.5-183	1	2
	N215-216; E183-184	1	36
	N216-217; E181.5-182.5	0	4
	N216-217; E182.5-183.5	0	0
South			
	N209-210; E182-183	74	35
	N209-210; E183-184	55	49
	N210-211; E182-183	33	101
	N210-211; E183-184	15	36
	N211-212; E182-183	39	30
	N212-213; E182-183	2	4
	N213-214; E182-183	2	1
	N213-214; E183-184	2	0
Total		227	347

Note: In the north area, where scrub oak protected the sherds and probably trapped soil and duff, most sherds were recovered subsurface. In the south area, where the sherds were essentially sitting on bedrock, surface sherd densities were relatively representative of subsurface densities. In particular the very low counts for both surface and subsurface in the three units excavated in N212 and N213 suggest that few sherds were missed in those units with low surface counts that were not excavated.

Attempts to define Western Apache chipped stone assemblages usually are thwarted by an inability to isolate them from the prehistoric assemblages with which they are usually mixed; the fact that they probably exhibit a rather generalized technology with few, if any, distinctive attributes; and because they can include raw materials, debris and finished artifacts scavenged from prehistoric sites. This is true for both chipped stone (Goodwin 1942:63; Reagan 1930:303) and for ground stone (Martin and others 1952:481; Gifford 1980:13; Buskirk 1986:201). In fact, freshly retouched prehistoric flakes or points can occasionally help identify an Apache site component (e.g., Huckell 1978:41, 57-58; Bradley and Ferg 1980:11).

Two of the eight small sites excavated north of the town of Miami on the Miami Wash Project produced Apache Plain sherds within prehistoric components. In connection with the supposed Apache predilection for white "flint," Doyel (1974:52) made a tantalizing observation about materials recovered at the Shurban site:

"One interesting discovery was a number of flakes of a distinctive white chert, not found on any other site excavated during the project. There is a possibility that this material is Apachean, and it is hoped that this idea will be pursued during analysis." Unfortunately, it apparently was not. Although Levine-Lischka (1975, 1978) did address the problem of separating Salado and Hohokam elements from mixed assemblages, there is no similar discussion for Apache chipped stone in either her dissertation on the Miami Wash Project chipped stone, or in the final report for the project, which was excerpted from her dissertation. In fact, Levine-Lischka (1975:68) seems not to even consider the possibility that some of the chipped stone on these sites may be nonprehistoric, except for a single observation that the unusually high percentage of multiple platform cores and low percentage of bifacial cores at the Shurban site may support the evidence of the Apache sherds in indicating that the site was, in part, Apachean. Although this correlation may indeed be real, it may also be related to site function or even sample size, rather than any cultural preferences. The Shurban site was the only site without any architecture, and had numerous manos and metates, and bedrock metates and mortars. It was also the smallest of the sites excavated, and produced only 372 pieces of chipped stone. Furthermore, no such correlation was noted for the Columbus site, which produced six times as many Apache sherds. But with a sample of 2,705 pieces of chipped stone, even if such a pattern were present, it might be masked by the presumably much larger prehistoric components. In short, materials from the Shurban and Columbus sites have the potential to shed light on Apache chipped stone assemblages, but it will take a reanalysis of the project materials to decide the matter.

Table 23.3. Chipped stone from Feature 122 at AZ O:15:52 (ASM).

Material	Hammerstone	Whole Flake	Split Flake	Flake Missing Distal End	Medial-Distal Flake Fragment	Nonorientable Fragment	Retouched Piece	Uniface Fragment	Thermal Shatter	Total
Rhyolite		3	3	1	5				1	12
Andesite		1								1
Metasediment	1	1	2	1		1	1	1		8
Chert				3	2	1	1			7
Chalcedony							1			1
Total	1	5	5	5	6	2	3	1	1	29

Near Payson, Hohmann and Redman (1988:52) reported on a prehistoric site with numerous associated chipping stations composed of a local white chert. They believed, based on the presence of Apache pottery, that use of these chipping stations spanned the prehistoric and Apachean use of the site area, but again, there is no discussion of how to separate the assemblages.

On the Apache Camp site near Payson, Hohmann and Redman (1988:231-274) report one wickiup circle in particular, dating around 1880 to 1900, which appears to have an associated chipped stone assemblage (Structure 3). Two other, apparently later, wickiups at the site have associated chipped glass assemblages. Although promising, the Structure 3 area also produced 80 percent of the prehistoric sherds found at the site. Again, the chipped stone here could be prehistoric, scavenged by Apaches from prehistoric sites, or wholly

Western Apache in origin. A more detailed comparison of this assemblage with nearby known prehistoric assemblages needs to be made.

Dittert (1976:20) and Reichenbacher and Smith (1976) describe a small assemblage of sherds and chipped stone recovered from a 1-m by 1-m test pit at what is identified as an early historic Yavapai site located at Kohls Ranch near the Mogollon Rim (AZ O:12:10 [ASU]). The excavators encountered a use surface and, cut down into it, a straight-sided pit approximately 70 cm in diameter and 15 cm deep. Dittert identified the excavated ceramics as Aquarius Brown (2 sherds), Cerbat Brown (6), and Tizon Wiped (10); Euler concurred (Euler and Dobyns 1985:88). Dittert (personal communication, 1991) also noted that another dozen sherds from the site surface (now missing) included additional sherds of Tizon Wiped.

The chipped stone items recovered were primarily flakes and shatter. On the basis of 20-x and 40-x microscopic examinations and comparisons with use-wear on modern experimental flakes made of the same materials, Reichenbacher and Smith classified these items as cutting tools (17), gravers (13), scraping tools (11), spokeshaves (4), cutting-spokeshaves (2) and scraping-gravers (1). These categorizations appear to be based on their observed use-wear, edge-angles, and length of working edges. However, these are not formal, retouched tools and other researchers might well categorize them quite differently. The cherts present appear to break naturally into angular pieces that resemble cultural knapping shatter. Of the 41 labeled pieces in the curated collection that could be specifically identified as one or another of Reichenbacher and Smith's "tool" types (1976:Tables 5-10), Ken Rozen of the Arizona State Museum and this author considered 22 to be noncultural.

Stafford (1979:139) included this site in her examination of chipped stone assemblages from the Payson area, but then specifically excluded it from an analysis of site use and her technological and functional groupings of chipped stone because it "did not fit into one of the categories of habitation, limited activity or storage." Actually it appears to have been excluded because it was identified as a historic, rather than a prehistoric site.

Suffice it to say that this assemblage too is of limited use in defining Yavapai chipped stone technology. The chipped stone is very informal, the site is not precisely dated (although there is some charcoal in the pit that could be radiocarbon dated), and the sherds are rather small and somewhat weathered. Conceivably the wiped sherds might even be Northern Tonto Apache in origin.

Finally, farther south, Wasley and Benham (1968:271, Fig. 29*a-e*) suggested that five chipped stone items from the Buttes Dam Site near Florence might be Apache in origin. They suggested this because these tools differed from the Hohokam materials at the site in both shape and material, and possibly because they were found on the surface. A reexamination of these materials suggests that all are probably Archaic in origin, based on their workmanship and form. Made of rhyolite, Wasley and Benham's Figure 29*e* looks to be a finished scraper, Figure 29*c* was probably a finished biface, Figures 29*b* and *d* were probably either finished bifaces or, more probably, preforms for making projectile points like that in Figure 29*a*. Concave-base, convex-sided points of this type have been recognized in various Late Archaic contexts in southern Arizona (Cattanach 1966:Fig. 3*j-k*; Simpson and Wells 1983:Fig. 23, 1984:Fig. 40; Tagg et al. 1984: Fig. 2.20 *g-n*; Downum et al. 1986:Fig. 4.6; Dart 1987:Fig. 10.1), and have recently been christened "Cortaro Points" (Roth and Huckell 1992). Although Apaches conceivably might have dropped these tools on the Buttes Dam site, they almost certainly did not make them.

Apache Plain Jar

All 594 of the sherds recovered from Feature 122 (all PB# 525-1) are from a single jar of Apache Plain, Apache Variety.[2] The surface of this vessel may originally have been covered with pine pitch, but being in an open site, if pitch was ever present, it has all weathered off. The exterior surface now ranges in color from a tan or light brown color in oxidized areas to a light gray to black in fire clouded areas. The interior uniformly is darkened, black near the bottom, ranging to gray at the rim, suggesting the jar was fired upside down. A few sherds have been scorched or thoroughly blackened, presumably by the fire that burned down the scrub oak in which they were found. A fresh break tends to be jagged and crumbly, and several breaks appear to be along coil bonds. The core is gray with moderate amounts of subangular granitic sand for temper, with occasional opaque white feldspar inclusions. No mica is present. A very few particles are 1.5 mm to 2.0 mm across, but the vast majority are 0.5 mm to 1.0 mm in size. Wall thickness measured at 10 points equally spaced between the center of the base and the lip ranged from 4.4 mm to 6.2 mm, and averaged 5.1 mm.

Surface treatment is perhaps the single most distinctive attribute by which Western Apache pottery can be identified, especially in sherd form. The Feature 122 jar is typical in that both interior and exterior surfaces are unevenly covered with wiping striations of various depths, which generally are parallel to the rim, but can cross each other at oblique angles (Figure 23.4a, c, e)(see also Doyel 1978:105 for a good photograph of striated Apache sherds). On Navajo pottery these marks are the result of wiping the surface with a corn cob to obliterate the dimples and gouges left over from pinching coils together. The finer striations on Western Apache pottery probably were made with a grass brush, probably similar, or identical to the type used for brushing one's hair (see Ferg 1987:Figure 7.3). This wiping has produced some very rough areas on the surface, dragging up tiny balls of clay, or sand grains coated with clay, which were then mashed back into the surface through subsequent handling, but before firing. This wiping did not remove all of the dimples, particularly around the interior of the shoulder. Temper particles are visible on both surfaces, with the flat faces of the quartz grains reflecting little points of light.

The jar also exhibits a notched lip (Figure 23.4a, b). On average, there are two to three notches per centimeter, and they appear to have been made with a fingernail. The top side of the nail was consistently to the left as one looks at the jar from the side. This decorative treatment can be found occasionally on some prehistoric or protohistoric Lower Colorado buffwares, and some prehistoric plainwares from the Papagueria. To date, whenever this attribute has been found on pottery in Western Apache territory, that pottery has been Apache Plain. Notched lips do not occur on prehistoric pottery in this area, nor have they yet been described on any pottery attributed to the Yavapai. Within Western Apache territory, this jar is the only example from the Southern Tonto area; the other seven occurrences are from San Carlos and White Mountain group areas (see Gifford 1980:Figure 125 and Ferg 1987:Figure 5.30). This could indicate that this jar was traded in from one of these latter areas, but it is more probably a local reflection of close stylistic ties that the Mazatzal and First Semiband members had with the San Carlos Group: "The people of the first semiband sometimes distinguished themselves and the Mazatzal band from the Southern Tonto, claiming that they are to be classed not with them but with the San Carlos group. Apparently, they had affiliations in both directions" (Goodwin 1942:37).

In addition to the notched lip, this jar exhibits another decorative feature found on Western Apache pots: incised lines on the neck or upper shoulder. About 2 cm below the lip on one sherd is a group of at least six vertical incised lines (Figure 23.4a - arrow), the longest of which was at least 2 cm long. They are shallow, and irregularly spaced within about 1 cm, but they are not simply oddly angled wiping striations. There are two other free-floating sherds from the neck area of this jar (as shown by their curvature and the wiping striations on their interiors) with the same treatment: both have seven vertical lines spread over about 2 cm. In all three cases there might have been more lines that are now broken away. Incised decoration is recorded ethnographically for both the Western Apache (Goodwin n.d.a) and for the Chiricahua (Opler 1941:383), but actual examples are rare. In addition to the Feature 122 jar, only one example is known to the author for each group. The Western Apache example is from White Mountain territory and has four wavy vertical lines more or less evenly spaced around the neck. The Chiricahua example has four crosses evenly spaced around the neck. This leads me to believe that there may have been four evenly spaced groups of incised vertical lines around the neck of the Feature 122 jar. Unfortunately, although approximately half of the rim or lip for the jar can be reassembled, the area located 90 degrees away from the lines shown in Figure 23.4a is broken away, and neither of the floating sherds can be attached to any portion of this reconstructed piece.

Although partially reconstructible, this vessel's extremely fragmented condition made it somewhat difficult to obtain exact dimensions and vessel form. The largest sherd measured 8 cm by 9 cm, the smallest, 0.6 cm by 0.9 cm. As is often the case with pot-breaks, the recovered sherds represent only a portion of the vessel, and what became of the rest is unknown. Probably between half and three-quarters of the jar is present. Fifty-

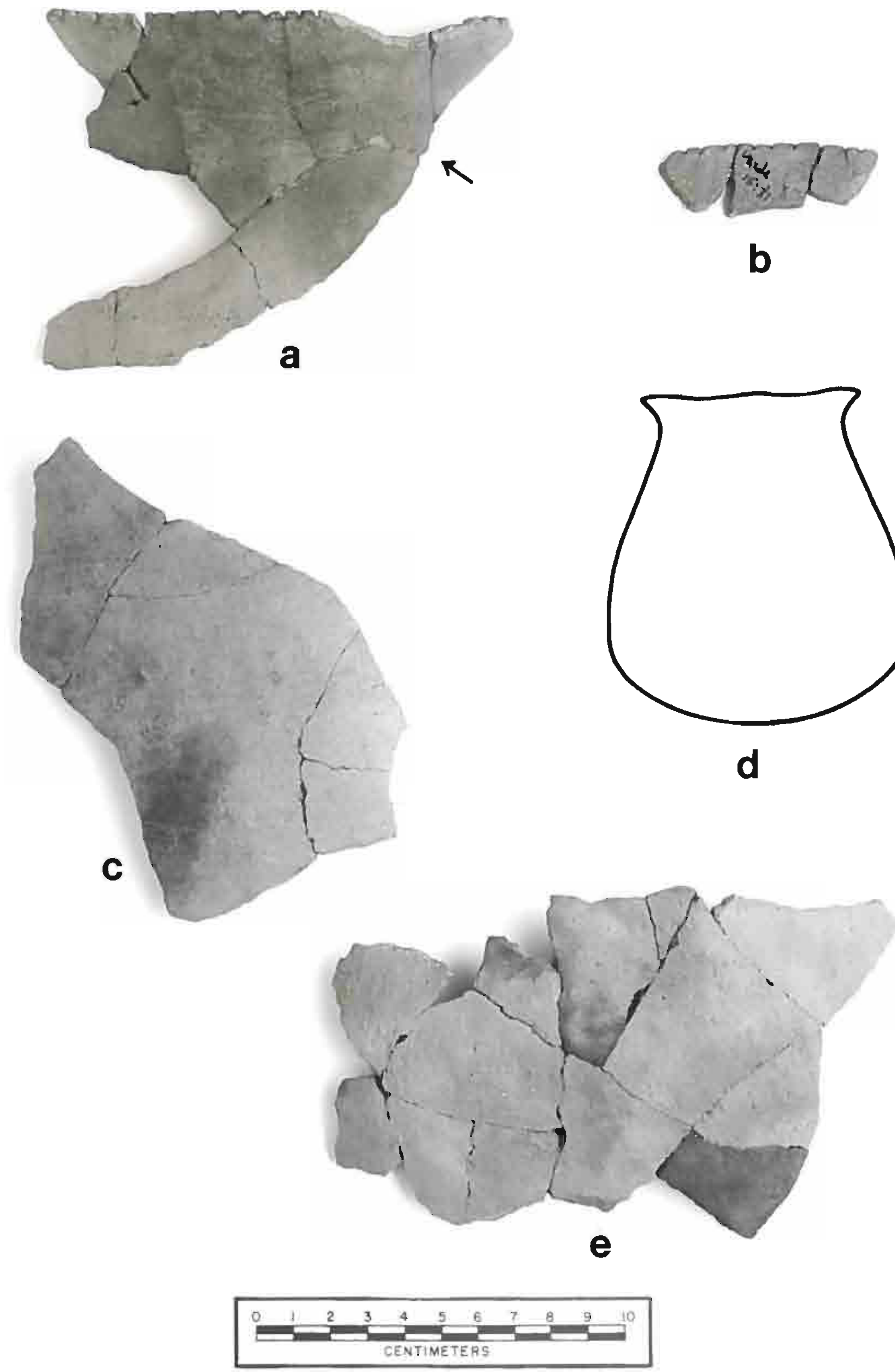

Figure 23.4. Apache Plain jar from Feature 122 at AZ O:15:52 (ASM). Shown are the exterior surfaces of the rim (a,b), the body above the soulder (c), and the base (e); a is 12.3 cm wide. d shows the reconstructed outline of the vessel, measuring approximately 32 cm in diameter and 30-35 cm tall. The arrow points to the decorative incised lines on a. On b, the center sherd was collected by Gila Pueblo in 1929, while those flanking it were collected in 1989 by Desert Archaeology.

three pieces were reconstructed to form a continuous profile from the very bottom of the vessel up to what is believed to be the upper body. A second large piece reconstructed from 27 sherds consists of about 45 percent of the rim, with a profile extending downward about 9 cm. Additional rim sherds, which cannot be attached to this piece, bring the total amount of the circumference represented up to almost exactly half. The body and rim pieces do not attach, but based on their curvatures relative to one another, jar height is estimated as between 30 cm and 35 cm. Mouth diameter was 23 cm to 24 cm. The greatest constriction of the neck was to about 20 cm, some 3 cm below the lip. The greatest body diameter was about 32 cm, and this shoulder is some 10 cm above the base. These measurements produce a rather squat outline (Figure 23.4d) with (for an Apache jar) an unusually rounded base. Although rounded bottoms are known, Western Apache jars more often have pointed bottoms and their shoulders are above the midline (both forms are illustrated in Ferg 1987:Figure 5.26). If this jar was made locally by a Southern Tonto, its squat form may be attributable to proximity to the Yavapai, whose jars were often low-shouldered (see Euler and Dobyns 1985:Figures 10, 11).

If we accept Schroeder's reconstruction of the timing and location of Western Apache expansion, we can suggest that the Feature 122 jar was made sometime after about 1750, and probably after 1775, but this depends entirely on the accuracy of his scheme (see below). In all likelihood it was made sometime prior to the 1875 removal of the Northern and Southern Tonto and their Yavapai neighbors to the San Carlos Reservation. Even if made by an Apache who managed to remain in the area, or even if this pot is of White Mountain manufacture and was brought into the area, it was probably made no later than about 1900. An exact date for when the Western Apache stopped making pottery is not recorded historically. A few individuals in the White Mountain Group might have made a small number of vessels as late as 1903, but even there, the disruptions caused by relocation to various reservations in the 1870s, and the greater availability of Anglo metal and ceramic vessels, probably halted most pottery production before the turn of the century.

It is difficult to assess Schroeder's framework with the archaeological data currently available, but already the few pertinent radiocarbon dates suggest Apaches may have been in the area prior to 1750. Dates from seven hearth and roasting pit features in Western Apache territory are discussed in more detail below. Here we can simply note that two features from sites immediately south of the Rye Creek Project area had associated Apache Plain sherds (which the author has examined) and dates of A.D. 1620 ± 80 and 1845 ± 70 (Ciolek-Torrello 1987[2]). Two features near Payson had sherds in direct association, and dates of A.D. 1579 - 1699 and 1673 - 1793 (Hohmann and Redman 1988). The sherds were identified as Rimrock Plain, but none were illustrated, and they should be reexamined to make sure they might not be Tizon Wiped. Regardless, these associations suggest that Western Apaches may have been in the Rye Creek area earlier than Schroeder's late 1700s or even his 1750 date. Only additional absolute dates will help clarify this matter, and no good beginning bracketing date can be given for the Feature 122 jar at this time.

Finally, the Feature 122 pot-break also shed light on a matter completely unrelated to Apache culture history. In documenting the distribution of rim-notched Western Apache pottery, I found that only one site in my files in Southern Tonto territory had such sherds. This site, Verde 15:31 (GP), was recorded by Monroe Amsden on November 26, 1929, during Gila Pueblo's survey of the Verde Valley. A surface collection of 30 sherds was made, including one Apache Plain body sherd and one Apache Plain notched rim sherd. Presumably Amsden was aware that he was collecting only two sherds out of a pot-break, which would be in line with the Gila Pueblo strategy of trying to collect a roughly representative sample of what was on a site, sometimes weighted toward diagnostic types (Gladwin and Gladwin 1928; Ciolek-Torrello and Lange 1990:133). The description of these two Apache sherds in my notes corresponded well to the Feature 122 jar. Amsden's description of the site and its location indicated that Verde 15:31 could be AZ O:15:52. This is confirmed by the fact that three small rim sherds recovered from Feature 122 fit on either side of the rim sherd collected sixty years earlier by Amsden (Figure 23.4b). This refitting of sherds would probably not have been possible had not all sherds, of all sizes, been collected from Feature 122. For those who are interested in how the site was viewed in 1929, the filled-out portions of Amsden's site form are presented below. He did not take any photographs at this site.

Site: Verde:15:31 ***Location:*** About 1 mile southwest of Verde:15:30 [Rye Creek Ruin] at point of mesa which slopes down from foot of mountain. Site is on a flat east of mesa-point, extending from edge of Deer Creek valley to (and on the tops of) low benches running from north to foot of point. ***Type of ruin:*** No traces of building except a few stones on bench which might have been something else. ***Sherds:*** 2-3 acres ***Remarks:*** Good plot of land below site in Deer Creek valley which is cultivated at the present time, evidently by dry-farming. Note complete absence of decorated wares. Collection was carefully made. Found fragment of maul of coarse red stone with pecked groove apparently all around.

Sherds and Features from the Main Site Area

Sherds From the Main Site Area

In addition to the Feature 122 pot-break, seven sherds recovered from the main site area east of State Route 87 represent a second Western Apache jar, and six other sherds are tentatively identified as Yavapai in origin.

During the testing phase, seven Apache Plain jar body sherds (PB# 6-1) were recovered from the surface collection made between N100-120 and E280-300. All appear to be from the same vessel, with reddish brown exteriors, and dark gray to black interiors. Both interiors and exteriors are smooth but not polished, and exhibit shallow wiping striations, most of which are parallel and oriented horizontally (Figure 23.5a). All of the sherds have a fine paste with small amounts of what appears to be mainly small, subangular and rounded diabasic sand grains. Minimum and maximum thickness was measured on each sherd; for all seven, thickness ranges from 3.7 to 5.9 mm, and averages 4.4 mm. In short, they correspond well to typical sherds of Apache Plain, Apache Variety.

Six more plainware sherds have surface treatments that are reminiscent of the wiped, striated surfaces found on Western Apache pottery, but they exhibit one or more attributes that are not typical of Apache Plain. They contrast markedly with the sherds from Feature 122 and the seven surface sherds just described, and better fit descriptions for either Cerbat Brown or Tizon Wiped, both thought to have been made (in part) by Yavapai. All six of these sherds contain temper, which is both larger in size, and far more abundant than that in the Apache sherds, making up perhaps as much as half of the clay body. Individual temper grains average 1.0 to 2.0 mm across, with the largest seen being 3.5 mm across. Surface treatments, colors, and vessel and rim forms as detailed below all suggest that these sherds are Yavapai, rather than Western Apache, in origin.

One sherd from the fill of the Feature 21 pithouse (PB# 263-1)(Figure 23.5c) strongly resembles the surface treatment found on Apache Plain. The abundant, large temper distinguishes it, however, from the other sherds at this site identified as Apache Plain, and from Apache Plain from other sites and whole vessels. Apparently from a jar, it is dark gray to black in color, with distinct wiping striations inside and out, and a thickness of 5.4 mm to 5.9 mm. I would classify this sherd as Tizon Wiped (Dobyns and Euler 1958; Euler and Dobyns 1985; compare in particular to Euler and Dobyns 1985:Figure 7).

Two more sherds from the fill of Feature 21 (PB#'s 225-1 and 279-1)(Figure 23.5e, b) and one from the fill of the Feature 48 crematorium (PB# 311-1)(Figure 23.5d) have wiping striations on their surfaces that clearly distinguished them from the prehistoric plainwares recovered on the project (see Chapter 13, Volume 2). Their surfaces are much smoother than typical Apache Plain, however, and these sherds too contain abundant large temper. They are brown to gray on the exterior, and brown to gray to black on the interior. Figure 23.5e is from a jar with a short (approximately 1.5 cm) vertical neck with a somewhat flattened lip (Figure 23.5e') and an exterior mouth diameter of approximately 20 cm. This contrasts with Apache Plain forms which have taller, outflaring necks with generally rounded lips. Figure 23.5b and d appear to be jar body sherds.

Identification of the temper in these sherds by James Heidke (see Chapter 13, Volume 2) shows that Figure 23.5b, and e have "local" sand temper, and could be from the same vessel. Figure 23.5c also has "local" temper, but its surface treatment suggests it is a separate vessel (see above). Figure 23.5d is almost certainly from yet

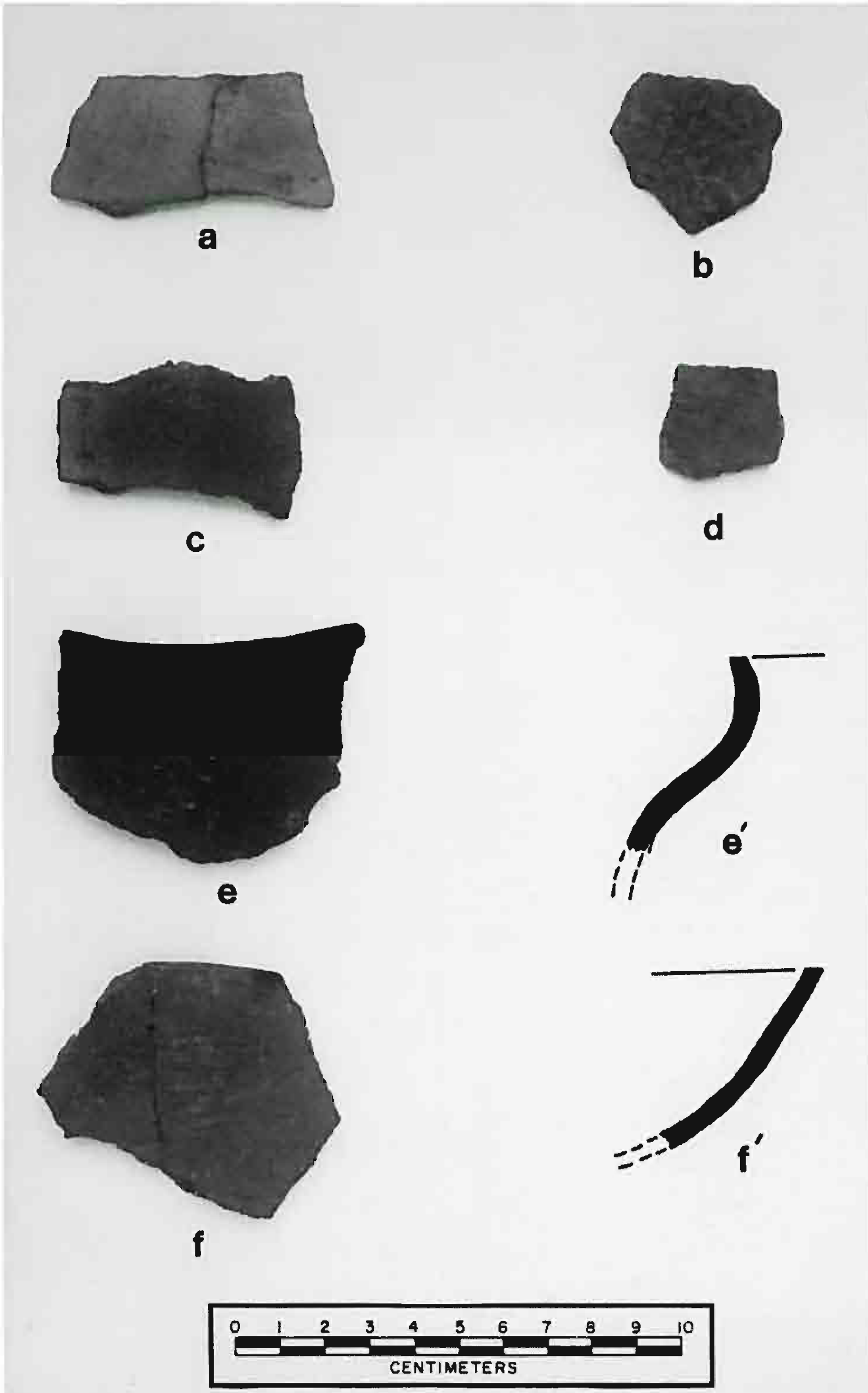

Figure 23.5. Apache Plain (a) and Tizon Brown Ware (b-f) sherds from the main site area at AZ O:15:52 (ASM). a-e show jar exteriors, f shows bowl interior. Width of a is 6.3 cm.

another vessel, having indeterminate metamorphic-plutonic sand temper. The surface treatments of Figure 23.5b, d, and e are extremely similar, and I would classify all three as either Cerbat Brown or Tizon Wiped. Thickness for these sherds ranges from 4.9 mm to 7.7 mm, and averages 6.2 mm. Again, this contrasts somewhat with Apache Plain, which ranges from 3 mm to 8 mm, and averages only 5 mm thick. Taken all together, the large and abundant temper, striated but smoothed surfaces, greater wall thickness, and straight, relatively short neck and flattened lip all argue against these three sherds being Western Apache in origin, and compare well with Tizon Brownware (Dobyns and Euler 1958; Euler and Dobyns 1985).

Finally, two sherds from the fill of the Feature 34 pithouse fit together to form a rim sherd from a shallow bowl (PB# 143-1). The exterior is smooth but not polished, while the interior exhibits wiping marks, but no distinct wiping striations (Figure 23.5f). The interior, exterior and core are all essentially brown, although much of the exterior is covered by a black fire cloud. The surface texture of the exterior appears to be much like that of the bowl illustrated in Euler and Dobyns (1985:Figure 4), what I presume to be what they called a "locally fused float" (Dobyns and Euler 1958). Wall thickness ranges from 3.9 to 5.0 mm. Although somewhat subjective, I consider this bowl not sufficiently striated to be called Tizon Wiped, and would rather consider it Cerbat Brown. Regardless, the inference is that it is of Yavapai manufacture. Heidke identifies the temper as plutonic sand with minor amounts of diabasic sand. Curvature of the sherd is so slight that it is difficult to estimate the size of the whole bowl; it was probably at least as large as 20 cm in diameter and 7 cm deep. The angle at which the cross section is oriented in Figure 23.5f is my best guess, but could be off by a number of degrees in either direction, which would result in either a smaller, deeper bowl, or a larger, shallower bowl.

An additional point supporting the identification of these two bowl sherds as protohistoric Yavapai is that bowls are extremely rare in Apache Plain, but are a standard form in Cerbat Brown (Dobyns and Euler 1958; Euler and Dobyns 1985). Ethnographic accounts of Yavapai pottery include large and small shallow food bowls, and small deeper food bowls (Corbusier 1886:284; Gifford 1932:220; 1936:280, Figure 9). Of several ethnographic accounts of Western Apache pottery, only Gifford's (1940:141) Southern Tonto informant mentioned bowls--2 feet in diameter! This should probably be viewed with some skepticism. Only two actual specimens of Apache bowls are known to the author, and not surprisingly, both were found in areas either adjacent to, or within Yavapai territory: one complete specimen comes from the Red Rocks area (Pilles 1981:Figure 2), while the other is from the Pine Creek area of the East Verde River. Also the bowl size inferred for the AZ O:15:52 sherds and their predominantly brown color compare well with Cerbat Brown bowls, and contrast with the dark gray to black color and smaller diameter (13 cm to 15 cm) of the two Apache Plain specimens.

In sum, I think there is no question that the seven sherds from the surface are all from a single jar of Apache Plain (Figure 23.5a). The other six sherds are less easily classified, but the most likely identification is either Cerbat Brown or Tizon Wiped; these and other closely related Tizon Brown Ware types have been identified as made by the Walapai, Havasupai and Yavapai (Euler and Dobyns 1985; Pilles 1981). The inference here is that the sherds from AZ O:15:52 probably were made by Kewevkapaya (Southeastern) Yavapai, or possibly by one of the other Yavapai subtribes.

Wood (1987:115-116) makes the point that Yavapai and Western Apache pottery can be difficult to differentiate in sherd form, and that Yavapai and Western Apache sites also can be hard to tell apart. The early sites of both groups have relatively thin, striated pottery (if they have pottery at all), and the late sites mimic contemporary Anglo sites with a camouflage of Anglo-manufactured metal, glass, and commercial ceramics. Clearly the challenge to archaeologists working in this area is to distinguish the materials of these groups in order to illuminate the geographic distribution of the Yavapai prior to the arrival of Apaches from the east, attempt to date that arrival, and plot the subsequent ebb and flow of territories and settlements.

A much more detailed study of purported Yavapai and Apache ceramics will be needed to determine whether the two can be differentiated with any consistency. Surface treatments, vessel form (when discernable), temper type, quantity and size, and in some cases, color, may prove sufficiently distinct to separate the two. Manufacturing techniques will probably not help. It can be difficult to distinguish coil-and-scrape from paddle-and-anvil-thinned pottery, particularly on small sherds, and the pottery traditions of both the Western Apache and Yavapai were so informal that both may have been used (Wood 1987:115).

As discussed earlier, the boundary between the Southern Tonto and the Southeastern Yavapai is generally accepted as the Mazatzal Mountains, with the Tonto claiming the east slope, and the Yavapai the west. To the northwest, the greater intermixture of Northeastern Yavapai and Northern Tonto and the disputed area claimed for both of them by ethnographers (Figure 23.2) will make interpretation even more difficult. It may be that the pottery from this area will prove to resemble that found further west in undeniable Yavapai territory, that found further east in Apache territory, or it may exhibit attributes of both. Moreover, these affinities may shift through time. At AZ O:15:52, the stratigraphic relationships of the Apache and Yavapai pottery (surface and subsurface, respectively) suggest that such shifts may have occurred in Southeastern Yavapai/Southern Tonto territory, and the squat shape of the Feature 122 jar certainly suggests some mixture of pottery traditions in this area.

Features 15, 43 and 44

Feature 15 was located at the eastern edge of the site. It consisted of a large scatter of fire-cracked rock and dark soil visible on the modern ground surface, and measuring some 9 m by 12 m by 40 cm deep. There was no oxidation visible and no charcoal to collect for a radiocarbon date. Evidence from the flotation analysis is equivocal; charred remains were sparse, however a large number of taxa are represented by uncarbonized remains, including one agave tooth, and what appear to be florets from a non-native grass (see Chapter 7, Volume 1 and Chapter 18, Volume 2).

The Feature 44 rock cluster overlies the Feature 43 roasting pit, which is in turn intrusive into the Feature 6 pithouse. Feature 44 measures 4.1 m by 5.2 m by 14 cm deep, and was just below modern ground surface. Feature 44 may be discarded rock from Feature 43. Charred archaeobotanical remains from the flotation analysis of Feature 43 included Bromus-Elymus (broom grass)-type grains, Cheno-am seeds, and a single Sphaeralcea (globe mallow) seed. Feature 44 was not sampled for flotation analysis.

All three of these features may well be Western Apache (or Yavapai) in origin, based on their high stratigraphic position in the site, and the presence of uncarbonized or introduced taxa. This is the best interpretation of these features at this time. Lacking radiocarbon dates, however, the possibility cannot be ruled out that all three were made by prehistoric visitors. A number of other Western Apache roasting pits and piles of fire-cracked rock have been identified at various sites. Some of these identifications are supported by radiocarbon dates or associated Apache Plain ceramics, while others rely on stratigraphy or superposition. A brief review of these is presented below. As Gregory (1981:267-268) pointed out, dating of roasting pits will probably be one of the easiest, most direct ways to start defining dates of entry and expansion of territory by Apaches in Arizona. Contract excavations over the past ten years have contributed the first dates to what will hopefully be a growing database.

It is worth noting that most of these features are presumed to have been used for roasting mescal, and this is very likely their primary function. It does not, however, preclude their having been used for roasting other plant foods and even meat. Reagan (1930:292-293) describes the roasting of corn in pits with heated rocks: "The abandoned pit is left as a sort of mound for the speculation of future generations." Buskirk (1986:82-83) describes two square pits for roasting corn, one measuring 4 feet on a side and 2 feet deep, the other 7 feet on a side and 4 feet deep.

Comparable Features at Other Sites.

Hohmann and Redman (1988) report two historic radiocarbon dates from sites near Payson. A roasting pit outside the mouth of Horton Rock Shelter produced a date of A.D. 1579-1699. This pit measured 1.12 m by 1.23 m; depth is not stated. Apparently the lower fill of the feature contained prehistoric ceramics, while the upper fill yielded Apache ceramics. Although the possibilities of a contaminated sample or Apaches in the

1800s using old wood in this feature are both noted, the editors seem to lean towards accepting the date at face value (Hohmann and Redman 1988:22, 25, 36, 49). At nearby Scorpion Rock Ruin, an undescribed "campfire" in the upper fill of a prehistoric masonry room had associated Apache ceramics, and produced a date of A.D. 1673-1793 (Hohmann and Redman 1988:75).

Working on the Ord Mine sites along State Route 87 immediately south of the Rye Creek Project area, Ciolek-Torrello (1987) excavated three roasting pit features, which produced historic radiocarbon dates. Mazatzal House, a small prehistoric masonry compound, produced a few sherds of Apache pottery, and had a 7-m by 9-m by 50-cm-deep roasting pit visible on the surface, which intruded the compound plaza; it produced a date of A.D. 1845 ± 70 (Ciolek-Torrello 1987(2):4, 42-44, 49). La Piedra House had two sherds of Apache pottery on the surface, and a small roasting pit measuring 1.90 m by 1.55 m by 45 cm deep was found while excavating in front of the roomblock; it produced a date of A.D. 1620 ± 80 (Ciolek-Torrello 1987(2):62, 74, 77). The Black Hole site was an isolated low mound of dark earth and gravels measuring 10 m by 12 m by almost a meter deep in the center. No ceramics were associated, but the abundant charcoal produced a date of A.D. 1785 ± 70 (Ciolek-Torrello 1987(2):258-262).

South of Roosevelt Lake, adjacent to Pinto Creek, Windmiller found seven roasting pits, which he either recorded (1973:3, 7, 17, 21-22), excavated (1972:19-20; 1974b:34-35), or excavated and dated (1974a:16, 29). These varied from isolated mounds around 6 m in diameter, to a large mound of fire-cracked rock 10 m by 16 m by 1 m deep, which when cut in half revealed at least five different roasting pits (1974b). At Scorpion Ridge Ruin, a 2.5-m-diameter rock pile in the plaza of the prehistoric compound was published by Windmiller (1974a) as having a radiocarbon date of A.D. 1660 ± 190 (290 ± 190), although the date published by Long and Muller (1981:215) is 140 ± 120. From Ta-e-wun, Windmiller (1972:19-20) submitted radiocarbon samples from two roasting pits, which he suspected might be Western Apache, but did not have the dates at the time of publication. Gregory (1981:261) indicated that they were apparently never run, however, letters in the project files from the Radiocarbon Dating Laboratory (Long 1972, 1973) and dates published by Long and Muller (1981:216) indicate that both are prehistoric in age. Apache ceramics were not reported at any of these sites.

Gregory (1979:237-239) described three roasting pits from lower Cherry Creek and Pinal Creek, east and southeast of the Sierra Ancha. Two were crescentic mounds of rock about 4 m across, located atop prehistoric roomblocks, while the third was 10 m in diameter, located near a roomblock. None were excavated. Based on the superposition of the two crescentic mounds, the fact that all were within Western Apache territory, and their apparent dissimilarity to prehistoric roasting pits, Gregory speculated that all three might be Western Apache in origin. He also noted their similarity to the features recorded by Windmiller (1974b).

Gregory (1981:259-261) illustrates two isolated large mounds of fire-cracked rock in the Grasshopper area. One may have been associated with historic trash, while the other had only a scatter of white chert flaked stone around it.

Finally, at NA18,343 near Show Low, Dosh (1988:54-55) excavated a roasting pit measuring 1.70 m by 1.65 m by 0.30 m deep. It was visible on the surface of a prehistoric site as a low mound of blackened fire-cracked rock. A flotation sample yielded numerous juniper seeds, but Ruppé (1988:321) notes that they may simply have been on branches used as fuel, and may not relate directly to what was being cooked in this feature. Charcoal from the upper fill of this pit yielded an uncalibrated radiocarbon date of A.D. 1710 ± 60. Tree-ring-calibrated dates for this sample include A.D. 1500-1675, A.D. 1715-1805 and A.D. 1930-1950. Dosh (1988:66-67) accepts one of the two earlier dates, and notes that the occurrence of agave on this site may be responsible for this Western Apache reoccupation of the site.

Ethnographic Descriptions of Mescal-Roasting Pits

Although ethnographic accounts of the Western Apache, Chiricahua, and Mescalero almost always make some mention of collecting and roasting mescal, descriptions and photographs of the roasting pits themselves are rare. Descriptions for the Western Apache can be found in Curtis (1907), Reagan (1929:145-146), Goodwin (n.d.b), and Buskirk (1986:170-171), and for the Chiricahua and Mescalero Apache in Castetter and Opler (1936:35-38) and Opler (1941:356-358)(see also Castetter et al. (1938:27-36) for additional, briefer references). Three sets of photographs of Western Apaches gathering, roasting and processing mescal are known to the author, taken by Edward Curtis in 1906 (?), Pliny Goddard in 1909, and Grenville Goodwin in 1931 or 1936. Individual pictures from these series have been published in Curtis (1907:opposite pages 16, 18, 20, 22, 128), Basso (1983:Figure 2), and Ferg (1987:Figures 5.1, 5.9, 5.10). Pits can range from 3 ft to 20 ft in diameter and 2 ft to 4 ft in depth, and the pile of earth covering them could be up to 8 feet high.

The Northeastern and Western Yavapai cooked mescal in pits 4 ft deep and up to 10 or 12 ft in diameter (Gifford 1936:259-260). The Southeastern Yavapai did the same, in pits 3 ft deep and at least 6 ft in diameter (Gifford 1932:206).

Taken all together these descriptions and photographs document a wide range of variability in size and shape for both the mescal-roasting pits themselves, and presumably the piles of discarded fire-cracked rock associated with them. This variability generally is related to the number of people using a pit, and the number of times a pit was reused. Certainly all of the burned-rock features described above could be accommodated within this range, along with most prehistoric mescal-roasting pits. Positive identification of both the ages and functions of these features may not always be possible. Identification of Western Apache and Yavapai roasting pits on the basis of gross morphology must await many more absolute dates from well-recorded features.

At present, only stone-lined pits such as that shown in Hammack (1969:Figure 19) seem safely excluded from identification as Western Apache. Even this is a presumption based on only two points. First, there are no ethnographic descriptions of this type of lined roasting pit for the Western Apache, but it must be noted again that the ethnographic record may not be complete, and that such features are recorded for the Chiricahua and Mescalero (Castetter and Opler 1936:36; Opler 1941:357). Second, for those stone-lined pits excavated within Western Apache territory, general evidence (associated ceramics, stratigraphy) indicates they are prehistoric. These features also should be subjected to absolute dating to confirm or refute this temporal placement.

AZ O:15:71

This site consists of a single masonry fieldhouse (Feature 1), which appears to date to the Classic period. Feature 2 is a semicircular structure, basically one course high, apparently constructed from stone fallen from the north wall of Feature 1, at an unknown date after the abandonment of Feature 1. There is also a slab-lined cist (Feature 4) (see Figures 6.5 and 6.7, Volume 1).

Feature 2

Elson (Chapter 6, Volume 1) notes the informal nature of this structure, and concludes that it *might* represent a Western Apache structure, but that lacking any diagnostic artifacts, this is uncertain. There is little to add to this assessment. Nothing precludes the possibility that Feature 2 is some sort of short-term windbreak. Unfortunately, our knowledge of Western Apache constructions is meager, and is largely related to more formal, more permanent wickiups. Ethnographic descriptions, and archaeological sites believed to be Western Apache, have stone constructions that tend to be multicoursed full circles, larger than Feature 2, and are presumed to be everything from complete structures in themselves to supports for brush structures, to hunting blinds, to defensive fortifications (known rock-ring sites on Fort Apache Indian Reservation and Tonto National Forest: see Hrdlicka 1905:483; Asch 1960; Lange and Riley 1970:93, 101, 113; Donaldson and Welch 1989).

The circular features on other nearby archaeological sites tend to be larger, complete circles. However, these sites are of uncertain cultural affinity and cannot be satisfactorily dated. They are briefly noted here for comparative purposes.

Brandes (1957) recorded several circular features of various sizes in the Globe area. Associated artifacts seem to clearly identify three as Apache (Site 60, Figure 14), three more could be either Salado or Western Apache (Sites 33A, 37 and 37A, Figures 4 and 5), and one (Site 61, Figure 15) is built next to, and may be part of, what appears to be a two-room Salado house. Windmiller (1973:9, 21-22, Figure 15) recorded a small circular feature near Miami, 2.0 m to 2.5 m in diameter, which may originally have stood 60 cm to 70 cm high. He suggested it might be a hunting blind or look-out, but could not date it.

Approximately three miles south of the Rye Creek Project area is a site with two unusually large circular structures, each 8 m to 9 m in diameter (Ciolek-Torrello 1987(2):321-326). Salado rooms are nearby, but the circular features themselves cannot be dated at this time.

Feature 4

Feature 4 at AZ O:15:71 was a circular, slab-lined cist measuring 40 cm in diameter and 27 cm deep (Figure 6.7, Volume 1). It was made of eight vertical slabs with a ninth set flat in the bottom. It was the only slab-lined cist found on the entire project. This, and the construction of the Feature 2 structure, caused Elson to speculate that both might be Western Apache in origin, but there was no additional information from the site that could support this. A pollen sample from Feature 4 was analyzed, but contained insufficient pollen to shed light on its function. Both features might also simply be later prehistoric constructions. Similar features from other sites have the same interpretive and dating problems.

At the same site near Show Low (NA 18,343) where Dosh excavated a Western Apache roasting pit (see discussion above), he speculated that three slab-lined pits were also probably Western Apache in origin, based on their being stratigraphically higher than similar pits that were clearly associated with prehistoric structures. Features 5, 11, and 13 were all less carefully made than Feature 4 at AZ O:15:71, all were slightly larger (up to 85 cm diameter and about 40 cm deep), and none had a slab in the bottom (Dosh 1988:50-51, 59-60, 63-65). The fill of each contained either charcoal flecks or fire-cracked rock. A radiocarbon sample from Feature 13 produced an uncalibrated date of A.D. 1030 ± 50, but Dosh believes this probably dates old wood from the prehistoric structure in whose fill Feature 13 was built. A flotation sample from Feature 13 also produced an agave or yucca leaf fragment, the only evidence of such utilization found at the site. It should be reiterated that with definite prehistoric slab-lined cists at this site, Features 5, 11, and 13, like Feature 4 at AZ O:15:71, *could* simply be prehistoric features constructed after a hiatus in the use of the site, (but see the description that follows of pits used for pounding cooked agave).

Less than a mile and a half south of AZ O:15:71 is Mazatzal House. Three slab-lined cists at this site, Features 15, 16, and 17, appear to be prehistoric in origin (Ciolek-Torrello 1987(2):36-39). All are located close to one another in a heavily used extramural activity area in the "Northwest Plaza." Although Feature 4 at AZ O:15:71 was the only slab-lined cist found on the Rye Creek segment of the State Route 87 Project, it appears that such features are not unknown in the area prehistorically, and we should not place too much emphasis on its uniqueness when trying to assess the likelihood of it being Western Apache in origin. In fact, there is nothing to say that it might not be contemporaneous with the prehistoric Feature 1 structure.

Another feature in the Northwest Plaza at Mazatzal House again exemplifies the difficulties in distinguishing multicomponent prehistoric use of a site from possible Apache reoccupation of a site. Feature 12 was a shallow roasting pit located in the fill of the plaza. A radiocarbon date of A.D. 1390 ± 80 placed it some 100 years after the presumed abandonment of the compound proper. Ciolek-Torrello (1987(2):36) notes that this could be interpreted as a later prehistoric use of the site, or it might simply be a contaminated radiocarbon sample producing an inaccurately late date. It is worth noting here that without the radiocarbon sample, this feature might well have been categorized as a possible Apache feature because of its high stratigraphic position and because there is an Apache roasting pit on the site, as well as Apache Plain pottery. I emphasize this because it recalls the situation at NA18,343. Dosh (1988) may well be correct in suggesting that his Features 5, 11, and 13 are probably Western Apache, but they might just as easily be a prehistoric reuse of the site. The Feature 13 radiocarbon date may indeed represent reuse of, or contamination by, old wood from the pithouse below it, but taken at face value, it might also point to a multicomponent prehistoric use of the site area. But again, the presence on this site of a roasting pit with a historic radiocarbon date makes interpretation difficult.

Ethnographic descriptions of Western Apache hearths do not include slab-lined pits. Hearths usually were very informal, often just a scooped-out depression in the ground. One of Grenville Goodwin's informants did, however, describe a rock-lined conical pit, 2.5 ft in diameter at the top, used with a sotol-stalk pestle to pound up cooked mescal (Goodwin n.d.b). Such pits were constructed and used by men, at mescal camps, close by the roasting pits. The pits described by Dosh at NA18,343 could conceivably be of this type, but Feature 4 at AZ O:15:71 would be too small.

Pits for caching food or tobacco or seeds might be slab-lined, but all accounts known to the author describe pits much larger than any of the slab-lined cists discussed previously. Anna Price, an Eastern White Mountain Band Apache, described bell-shaped pits excavated deeper than she was tall, and about 6.5 ft in diameter at the bottom. These pits were allowed to dry out and were then lined with grass, filled with food, or food in pots or pitch-coated baskets (*tus*), covered with dirt and stone slabs, capped with an earthen plaster, and then covered over with more grass and dirt (Goodwin n.d.b). John Rope, a Western White Mountain Band Apache, described similar caches dug into "sloping ground" (hillsides? arroyo banks?), which measured about 3 ft in diameter and 5.5 ft deep (Goodwin n.d.b). Price was in her 90s and Rope was an old man when these conversations were recorded in the 1930s, and they were describing the types of caches used in the 1800s. Buskirk's informants recalled the same types of caches being used in the Cibecue area in the 1800s, and he illustrates one with the cover slabs still in place (1986:169, Figure 22). Apaches at Cibecue in the 1960s recalled that caches were dug into arroyo banks and could be from 2 ft to 6 ft deep, straight-sided or bulbous at the back, and could be either unlined, or lined with grass, clay, or stones (Basso and Jernigan n.d.).

Finally, at Orme Ranch Cave, Breternitz (1960:25-27) excavated two circular slab and cobble-lined features, both believed to be Northeastern Yavapai. One of these, a hearth, was 50 cm in diameter at the top, tapering to 35 cm at the bottom, and about 40 cm deep. The other was a storage cist measuring approximately 1 m in diameter and 20 cm deep.

In sum, the slab-lined cist at AZ O:15:71 *may* be Western Apache in origin, but the evidence is not supportive. The best match for Feature 4 is with the presumed Northeastern Yavapai features at Orme Ranch Cave. Those at NA,18,343 could be interpreted as Western Apache mescal-pounding pits, but the possibility of their being late prehistoric still cannot be entirely ruled out.

Summary

The discussion above may seem overly detailed, only to have concluded that no definite attribution of Features 2 and 4 at AZ O:15:71 is possible. It remains a possibility that Feature 2 may be a prehistoric reutilization of the site, and Feature 4 could be contemporaneous with either Feature 1 or 2, or could even be totally unrelated to them. In comparing these features to available ethnographic and archaeological information it becomes clear how important it is to consciously note just how tentative the identifications of features on various sites can be and until relatively recently Western Apache archaeological features rarely were recognized (see Gregory 1981). It is important to critically assess all possible origins for stratigraphically anomalous features, including the distinct possibility that they may represent later, ephemeral prehistoric utilization of a site area. Lacking clear artifactual associations, or absolute dates, we will have to continue to classify some features as possibly prehistoric, possibly Apache, possibly Yavapai, and some as possibly natural (see Ciolek-Torrello 1987(2):31 - Feature 11). We need to keep these features in mind when trying to reconstruct protohistoric settlement and land-use patterns, but we need to be wary of reconstructing such patterns using equivocal data.

SUMMARY AND COMMENTS

> [Western Apache] sites are generally small, inconspicuous and individually productive of limited data, which indicates that large numbers of such sites will be required to provide the kinds of quantifiable data needed to allow recognition and confirmation of patterns. . . .Unless the workers in contract archaeology are attuned to the questions important in Apachean archaeology, however, a great deal of potentially useful information may well be lost. . . .the careful accumulation of data from many of the less impressive sites will be necessary to provide solutions to the problems of population movements and composition. (Brugge 1981:288-289)

The same can of course be said for Yavapai sites. Every effort needs to be made to completely recover and thoroughly describe Yavapai and Western Apache features and artifacts. Acknowledging that any inferences based on only a few features and a handful of sherds are necessarily very tentative, with the material from the Rye Creek Project we have nevertheless been able to comment on several specific points, and a few larger questions of culture history in the area. Recovery of additional, similar materials in the future will allow us to reassess these comments. To sum up this study, we can simply reiterate the following points.

1. The functions of the features in question at AZ O:15:52 and AZ O:15:71 are not amenable to very detailed interpretation, but if we accept them all for the moment as protohistoric in origin, we are probably safe in ascribing them to short work camps related to roasting some food item. In all likelihood this was agave, but could have been corn, some other plant crop, or even meat.

2. At present it is impossible to positively identify the cultural and temporal origin of Features 2 and 4 at AZ O:15:71, and it may never be possible.

3. Although Features 15, 43 and 44 at AZ O:15:52 cannot be absolutely dated, their high position in the site, and the materials recovered from their flotation samples, are strongly indicative of a protohistoric origin. Whether they are Western Apache or Southeastern Yavapai is an open question.

4. The ceramics at AZ O:15:52 do add to our general knowledge of the gross geographic distributions of Western Apache and Yavapai pottery and features, even though none could be dated with precision (but see # 6). In particular, the jar from Feature 122 helps fill out our knowledge of the distribution of notched lips on Western Apache pottery. It also appears to lend some physical evidence in support of Goodwin's remarks, based on oral history, about the ambiguity of the Mazatzal Band and First Semiband's affiliation with the San Carlos Group on the one hand (as reflected in the notched lip), and the Southern Tonto Group on the other (a squat jar form reminiscent of neighboring Yavapai pottery).

5. An unexpected benefit of the essentially complete collection of the Feature 122 pot-break was the unusual opportunity to positively relocate and identify a site recorded 60 years earlier by Gila Pueblo: AZ O:15:52 (ASM) is Verde 15:31 (GP).

6. Perhaps the most intriguing possibility hinted at by the AZ O:15:52 data is that the finding of Apache sherds only in surface contexts, and the Yavapai sherds only in subsurface contexts may actually be indicative of a true temporal relationship in the use of this particular area by these two groups: the Yavapai used AZ O:15:52 an unknown number of years after its abandonment by prehistoric peoples, and, after another hiatus of indeterminate length, and more soil deposition at the site, it was subsequently used by the Western Apache. This might also imply that the roasting features at the site are more probably Yavapai, in that they were partially buried.

This mutually exclusive subsurface-surface distribution of Yavapai and Apache sherds supports, albeit in a small way, the inferred culture history sequence for this area presented by Schroeder, based on Indian and European historical accounts. The Yavapai are thought to have originally occupied the Tonto Basin, but were apparently pushed back westward by the Apache coming in from the east. Obviously, 12 sherds and a pot-break are not an overwhelming sample, and perhaps the pot-break should be excluded from the discussion, in that it could never have gotten buried very deeply, sitting as it was essentially on bedrock. And in the main site area, plant, animal, and recent human disturbance could admittedly be a factor in the distribution of sherds. But given the paucity and poverty of protohistoric sites, this complementary distribution is worth underscoring, in the hope that, as Brugge admonished above, enough small scraps of archaeological data will someday, when viewed collectively, produce a pattern that can be integrated with ethnohistorical accounts to provide a more accurate reconstruction of these early times. With all of these disclaimers in place, we can now simply suggest that the relative depths of the Yavapai and Apache sherds at AZ O:15:52 may be a very straightforward reflection of this supposed displacement in protohistoric times: undated in absolute terms, but correct in stratigraphic relationship.

Comparative data are scant at present, and equally undatable. Materials identified as Yavapai and Western Apache have been found in close proximity to one another at other sites in the general area, and this suggests that there may be more opportunities to address this problem in the future. Ed Dittert is currently analyzing the protohistoric ceramics found on various sites near Payson, recovered as part of the surveys done by Arizona State University for Tonto National Forest over the past 15 years. When completed, this may shed additional light on the distribution and contemporaneity of Yavapai and Apache in the area.

Between Payson and Rye, Huckell (1978:55-59) recovered a partial vessel of Apache Plain, Rimrock Variety and two arrow points at Locus 3 of AZ O:15:67 (ASM). These were found associated with an ashy, possibly burned area some 30 cm by 50 cm that had been truncated on either side by the ruts of a dirt road. Huckell (1978:58) suggested that the locus might date to between 1600 and 1800. He based this in part on Schroeder's (1960:141-142) dating of this variety of pottery, and the thinness of the vessel wall. Schroeder's "probably post-1750 A.D." dating is based not on the absence of Spanish and Anglo trade goods in cave sites along Beaver Creek, but upon his reading of historic documents and oral history, as discussed earlier. Nevertheless, at AZ O:15:67, the lack of European material, the thinness of the Apache Plain jar, and the presence of chipped stone, rather than metal, arrow points *does* suggest a relatively early age for the site. Huckell's suggestion of an age between 1600 and 1800 is the best estimate, but dates earlier and later, to around 1875, cannot be completely ruled out.

Some 40 m away, in Locus 2, Huckell (1978:41, 50, 53-54) found a single sherd of Orme Ranch Plain, two points made of heavily patinated basalt flakes, and a freshly pressure-worked flake, all in close proximity to one another. Because the points did not fit either Western Apache or Yavapai ethnographic descriptions, and the mixture of these groups in this area is well documented, he simply identified these materials as representing a "late protohistoric" visitation to the site.

Finally, Pilles (1981:Figures 1 and 2) illustrates two bowls that are in the Sharlot Hall Museum, one Yavapai Orme Ranch Plain and the other Western Apache, Apache Plain. They appear to have come from near Hancock Ranch. Pilles (personal communication, 1991) suspects both may have been found in Honanki, a prehistoric cliff-dwelling in the Sedona area. If indeed they were found together, and were deposited in the site at the same time, they can be cited as another example of Yavapai-Western Apache trade in this area. If left at the site at different times, they can be viewed as additional evidence of either the sharing of this particular geographic area by both groups, or of the displacement of the Yavapai by the incoming Western Apache. Obviously the provenience information is so limited that we will probably never be able to do more than speculate about the circumstances surrounding their deposition, but they are another indication of the *potential* for reconstructing Yavapai and Western Apache interactions and culture history based on archaeological materials.

END NOTES

1. It is difficult to precisely place the shared borders of these three groups. On the northeast the Mazatzal Band was bordered by the Second Semiband, whose territory included Gisela and the juncture of Rye Creek and Tonto Creek (Goodwin 1942:37-38), only about 6 miles to the northeast and 5 miles to the southeast, respectively, of AZ O:15:52. Goodwin also notes that the Mazatzal band had farms along Tonto Creek, as

far north as "the box canyon above the entrance of Gem Creek" (1942:36). I could find no feature on recent maps identified as "Gem Creek," but in the area under discussion is a "Gun Creek" with a box on Tonto Creek, immediately above its mouth, in T7N, R10E, Section 2 (see U.S.G.S. 1964 Kayler Butte Quadrangle). It appears that when Goodwin's manuscript was prepared for publication, "Gem" was somehow transcribed for "Gun." The "box" referred to *cannot* be that located just south of Gisela, because it is north of the Rye Creek Tonto Creek confluence, which was clearly identified as being in Second Semiband territory. Using the same sources, Pool (1985:14) also tentatively equated Gem Creek with Gun Creek. Also, in Goodwin's handwritten list of Western Apache place names in Southern Tonto territory, "Gun Creek" is clearly written at least once (1932:35).

Goodwin does not mention Rye Creek specifically, but if Rye Creek forms the northern boundary of the Mazatzal Band and the border with the Second and Fourth semibands, then AZ O:15:52 is in Mazatzal Band territory. If, however, the boundary is immediately south of, and paralleling Rye Creek, in a line running north-northwest from the above-mentioned box on Tonto Creek (or even *between* this box and the Rye Creek-Tonto Creek junction), then AZ O:15:52 could actually be in the extreme southwestern portion of Second Semiband territory, or even the extreme southern portion of Fourth Semiband territory.

2. Nomenclature follows that recommended by this author at the 1985 Southern Athapaskan Ceramics Conference (see Baugh and Eddy 1987) based on his examination of over 30 whole or reconstructed vessels, and over 1,000 sherds from throughout Western Apache territory. Apache Plain, Apache Variety is essentially synonymous with Apache Plain as described by James Gifford in 1957, and published in 1980. Primacy was given to Gifford's type name over Schroeder's (1960:141-142) Rimrock Plain because, although actually published later, Gifford's description was written earlier, is more complete, and Rimrock Plain appears to be a local variety of a far more widespread type. Accordingly, it is now classified as Apache Plain, Rimrock Variety. Rimrock vessels are basically Apache Plain vessels with one or more decorative rows of fingernail indentations around the neck or shoulder. The author has seen sherds of this variety primarily from Northern Tonto Apache territory as defined by Goodwin, but Wood (1987:115) also reports it from Southern Tonto territory. The third proposed variety, Strawberry Variety, does not bear on the Rye Creek Project materials, and is not discussed here.

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CHAPTER 24

CROSS-DATING THE GILA BUTTE PHASE AND A RECONSIDERATION OF THE CERAMIC TYPE GILA BUTTE RED-ON-BUFF

Henry D. Wallace

This chapter evolved from what began as an investigation into the significance of the possible association of Gila Butte Red-on-buff with Kana-a Black-on-white ceramics at the Deer Creek site (AZ O:15:52), a sizeable pithouse hamlet fully excavated as part of the Rye Creek Project. This site produced a large assemblage of Gila Butte phase decorated and plainware ceramics. Included in this assemblage are 131 sherds of Gila Butte Red-on-buff, 10 sherds of Kana-a Black-on-white and 26 sherds of unidentified Tusayan whiteware that are probably Kana-a based on the lack of other decorated whitewares (other types are listed in Table 12.2 of Volume 2). Given previous assertions that Kana-a postdates Gila Butte Red-on-buff (Haury 1976:328-329; David Wilcox, personal communication, 1990), the dominant decorated ware on the site, the possible association of these wares and the potential ramifications for dating the Gila Butte occupation became important considerations during the course of the project. Two avenues of inquiry were initiated. The first dealt with a contextual assessment (see Chapters 11 and 12, Volume 2 and Wallace and Heidke 1991) of the ceramic deposits at Deer Creek. The second involved an exploration into the utility of ceramic cross-dating for pinning down the Gila Butte phase in the Hohokam chronology. A significant part of the second avenue involved a search for other possible cases of Gila Butte/Kana-a associations. The investigations held a number of surprises for me and the other archaeologists working with these sites. The following presents the details of these investigations as well as the sequence and process we went through to arrive at the conclusions presented.

GOALS AND METHODS

The principal goals of this study were to determine whether Gila Butte Red-on-buff and Kana-a Black-on-white pottery temporally co-occurred at the Deer Creek and to assess the potential utility of ceramic cross-dating in the dating of the Gila Butte phase. As a result of some of the difficulties encountered, the research also addressed problems in the existing application of the Hohokam Colonial period ceramic typology and the current description of the type Gila Butte Red-on-buff.

The starting point of this investigation involved an investigation into the ceramic type Gila Butte Red-on-buff, its validity and description, and the previous application of the label. The buffware ceramics from the Deer Creek site are then considered in this light.

The next step involved a background check into all cases where Gila Butte Red-on-buff has been found in association with dated pottery types or in independently dated contexts. No such review has taken place since Bullard's (1962) often overlooked study, and much new data, including data unavailable to Bullard, have been compiled for the purposes of this analysis. The investigation involved a literature search, examinations of field and laboratory records from excavations in the Arizona State Museum (ASM) and Arizona State University (ASU) archives, re-analysis of existing collections in the Arizona State Museum, and consultation with a wide variety of archaeologists with expertise in the regions in question and the ceramics involved. In the latter respect, the author must admit to having only a limited degree of experience with the ceramics of the areas outside of the Hohokam territory. As a result, reliance for identifications of the various non-Hohokam types was placed in the generous and capable hands of Kelly Hayes, Christian Downum, Alexander Lindsey Jr., and Barbara Montgomery of the University of Arizona, Victoria Clark of the Navajo Nation Cultural Resource

Management Division, and Stephen Lekson of the Laboratory of Anthropology, New Mexico. For the Hohokam types, second opinions were obtained from Douglas Craig and James Heidke of Desert Archaeology. Illustrations of representative sherds of the Rye Creek ceramics are provided in Chapter 12, Volume 2.

Specific analytic procedures for various collections are provided as appropriate. In terms of actual sherd analysis, the greatest level of effort outside of the Rye Creek Project material was focused on the material from Ushklish, which is at the Arizona State Museum. All of the remaining decorated sherds and vessels from this site curated in the ASM collections are recorded.

At one point, the author had intended to compile all existing data on radiocarbon and archaeomagnetic dates pertinent to the Gila Butte phase but this investigation was abandoned pending the results of the Shelltown analyses by Northland Research, Inc., and the work by Desert Archaeology at Meddler Point on Roosevelt Lake, both of which are expected to provide many new relevant dates. For those interested, I have compiled most of the currently available information and note that the results of my preliminary inquiries support the findings of this chapter. With the exception of the La Ciudad data, a total of 104 radiocarbon and archaeomagnetic dates pertinent to the Snaketown, Gila Butte, and Santa Cruz phases were evaluated. The most significant finding of this preliminary inquiry was the paucity of dates that originate from sound archaeological contexts (where data are available to evaluate) that can be used for the purposes of chronology building (see also Chapter 25, this volume). Recent reviews of the Hohokam chronology have not fully considered the ramifications of poor contextual control and ceramic typological ambiguities in their efforts (Dean 1990; Eighmy and McGuire 1988). These points and the results of the investigations will be presented in a future paper.

David Wilcox of the Museum of Northern Arizona and Carl Halbirt kindly permitted the author to make use of Halbirt and Dosh's (1991) manuscript, now in press, which produced direct tree-ring dates for the Gila Butte phase and this information is considered here in conjunction with the information it provides on ceramic cross-dating.

The assumption is made in this study that Gila Butte Red-on-buff was in concurrent use throughout the area of its distribution.

GILA BUTTE RED-ON-BUFF: DESCRIPTION AND APPLICATION OF THE TYPE LABEL

The pottery type Gila Butte Red-on-buff is known primarily from the original descriptions provided by Haury (1965b:185-189, 1976:212-214). Because there have been no systematic attempts to offer explicit definitions of the type based on attribute studies of controlled contexts (see Wallace and Craig 1988:10-11) other than the preliminary efforts of Craig (1989) and Heidke (1989), researchers have relied on the general description offered by Haury. As a result, or perhaps through other reasons not apparent, there are some differences of opinion regarding the principle diagnostic attributes that one may assign to the type. While true of all the Hohokam buffware types, this is particularly pronounced in regard to Gila Butte Red-on-buff. Several examples should prove sufficient to demonstrate this problem. Antieau and Pepoy (1981:149-151) describe trailing lines as "rare" on Gila Butte ceramics recovered from the Cashion site. Other researchers (Henderson 1987:203; Mitchell and Lane 1989:97) have noted that trailing lines are common on Gila Butte bowl sherds, observations consistent with Haury's original observations. Although it is possible that the Cashion sample was temporally restricted to the earlier portion of the phase (and thus may have more full-exterior designs on bowls rather than trailing lines), the large sample recovered and the presence of large numbers of Santa Cruz sherds in the assemblage suggest otherwise.

A second example is that of Haas' (1971a, 1971b) analysis of the Ushklish ceramics (see Chapter 3, Volume 1, for a description of this site). In it, Haas reports that Gila Butte Red-on-buff was distinguished from Santa Cruz Red-on-buff solely on the basis of incising; Gila Butte sherds were incised whereas Santa Cruz sherds were not. Haas supports this stance by stating that "the two design styles often overlap in the Snaketown sequence" (Haas 1971b:45). As will be seen, this led Haas mistakenly to view Ushklish as a multicomponent site with most occupation in the Santa Cruz phase. A reanalysis of the extant collections in the ASM from Ushklish (8.1 percent of the buffware and all of the whitewares were preserved in the ASM collection) revealed that over 99 percent of the classifiable sherds that had been typed as Santa Cruz Red-on-buff by Haas due to a lack of incising were actually Gila Butte Red-on-buff (see Table 24.1). Thus, due to a mistaken application of the typology, Haas concluded that the site dated to the Santa Cruz phase in the published report (Haas 1971b:12), going so far as to say that the whitewares at the site supported this interpretation. As seen in Table 24.1, even this conclusion is seen to have been biased by the error in buffware classification; the whitewares and graywares, taken with the near absence of Santa Cruz Red-on-buff pottery and complete lack of Sacaton Red-on-buff ceramics reveal a hiatus in the excavated portions of the site. That is, the reanalysis strongly indicates an initial occupation in the Gila Butte (possibly late Snaketown) phase was followed by a hiatus and a reoccupation in the A.D. 1000s or 1100s with the introduction of Black Mesa and Sosi Black-on-white pottery and large numbers of redwares. A minor late component with Roosevelt redwares is also present, though not addressed by Haas.

The published information concerning the decorated ceramic assemblage from El Caserio (Mitchell and Lane 1989:89-98) illustrates what appears to be the same approach applied by Haas; that is that Gila Butte ceramics appear to be defined and distinguished from Santa Cruz Red-on-buff solely on the basis of incising. Because the criteria for identifying the types are not made explicit in the report, this conclusion is inferred from Tables 5.13 and 5.15 (Mitchell and Lane 1989:96-97). These tables indicate that all of the Gila Butte sherds analyzed were incised. In a normal collection of the type, going by other assemblage data, this should not be the case. At Snaketown, for example, Haury (1976:213) reports that 85 percent of the Gila Butte pots were incised. Table 5.13, which provides frequencies of the "key" motif, further suggests that some of the Gila Butte sherds are being erroneously classified as Santa Cruz Red-on-buff. Because no definitions of the attributes are provided in the report, it is assumed here that the "key" motif cited in this table is the same as that referred to by Haury (1976:187) in the type description for Gila Butte Red-on-buff. If this assumption is correct, then it is apparent that Mitchell and Lane are not classifying the types as they are described by Haury given that Haury clearly states that the "key" motif is diagnostic (i.e., limited) to Gila Butte Red-on-buff and Mitchell and Lane are showing Santa Cruz Red-on-buff sherds with this trait. As a result, if I am correctly interpreting the El Caserio report, the typological assignments for sherds and features at El Caserio must be considered suspect for the Colonial period phases. Unfortunately, this makes it impossible to use the absolute dates obtained from the site without a reanalysis of the collections.

The list of classificatory problems continues when the analysis of the Beardsley Canal site ceramics (Weed 1972:78-79) is considered. Again, criteria for type identifications are not provided; however, a photograph of what are assumed to be representative sherds is presented by Weed (1972:79, Figure 8). I would ordinarily be somewhat hesitant to type a sherd based on a black-and-white photograph, but the identification of the sherd in Figure 8*c* as Santa Cruz Red-on-buff runs counter to the description of the type according to Haury. The sherd in question clearly displays "key" motif used in a manner identical to that illustrated by Haury as diagnostic of Gila Butte Red-on-buff. On the basis of the depth and character of the serrations for the scrolls on the sherd illustrated in Figure 8*i* identified by Weed as Santa Cruz Red-on-buff, this assignment is also contestable. These illustrations call Weed's type counts, and presumably phase designations for features, into question. Because no description of her classificatory scheme is presented, there are no measures that can be applied to reassess the presented data short of reevaluating curated sherd collections, if any exist.

Given the problems in identification revealed in these studies, the reader may wonder whether 1) Gila Butte and Santa Cruz red-on-buff are valid or useable types; 2) there is any agreement on the classification of the types among researchers, and 3) if they are valid types, what are the useful criteria for distinguishing them. As to the validity of the type, the presence of single component sites such as the Rock Ball Court site (Wasley and Johnson 1965:4-15), single component features at a number of sites (Wasley and Johnson 1965:93; Heidke 1989; Haury 1965, 1976), and numerous cases of stratigraphic confirmation (Haury 1976:106-110) leave little doubt. It is the criteria for identification that can be seen as the problem in the cases cited above. Fortunately, many researchers *are* applying the type descriptions in comparable ways contrary to the examples

Table 24.1. Correspondence between Haas' (1971b) classification of curated decorated sherds from the Ushklish site and the identifications made by Henry Wallace, Kelly Hayes, and Christian Downum.

Reanalysis Type[a]	Haas Type[b]	Count
Snaketown or Gila Butte Red-on-buff	Undec. Incised	1
Gila Butte Red-on-buff	Gila Butte Red-on-buff	43
Gila Butte Red-on-buff	Santa Cruz Red-on-buff	35
Gila Butte Red-on-buff	Undec. Incised	23
Gila Butte Red-on-buff	Untyped	7
Gila Butte or Santa Cruz Red-on-buff	Santa Cruz Red-on-buff	18
Santa Cruz Red-on-buff	Santa Cruz Red-on-buff	1
Indeterminate Red-on-buff	Santa Cruz Red-on-buff	2
Indeterminate Tusayan Black-on-white	Untyped	1
Indeterminate Tusayan Black-on-white	Kana-a Black-on-white	1
Indeterminate Tusayan Black-on-white	Black Mesa Black-on-white	19
Indeterminate Tusayan whiteware	Lino Gray	16
Indeterminate Tusayan whiteware	Black Mesa Black-on-white	2
Tusayan Gray	Lino Gray	49 (24 of these are probably Lino Gray; 1 is fugitive red)
Lino Gray	Lino Gray	1
Kana-a Black-on-white	Kana-a Black-on-white	2 (12)[c]
Black Mesa Black-on-white	Black Mesa Black-on-white	11
Black Mesa or Sosi Black-on-white	Black Mesa Black-on-white	21
Sosi Black-on-white	Black Mesa Black-on-white	4
Lino Black-on-gray	Lino Gray	6
Lino Black-on-gray	Kana-a Black-on-white	2 (4)[c]
Lino Black-on-gray or Kana-a Black-on-white	Kana-a Black-on-white	3
Holbrook B Black-on-white	Black Mesa Black-on-white	1
La Plata or Kiatuthlana Black-on-white	White Mound Black-on-white	2
White Mound Black-on-white	White Mound Black-on-white	17 (Fugitive Red)
Indeterminate whiteware	Lino Gray	1
Indeterminate Tusayan or Little Colorado whiteware	Black Mesa Black-on-white	1
Indeterminate Roosevelt Redware Polychrome	Gila Polychrome	1
Pinto Polychrome	Gila Polychrome	1
Pinto or Gila Polychrome	Gila Polychrome	2 (4)
Pinto or Gila Polychrome	Untyped	1

[a]As marked on boxes and bags in the ASM collection.
[b]Numbers in () are total sherd counts when multiple sherds from individual vessels were present. Numbers not in () are vessel counts.

cited above. Henderson (1987:203-205), Wasley and Johnson (1965:12), Schroeder (1940:125A), Craig (1989), and Heidke (1989) all appear to be typing Gila Butte Red-on-buff in a manner consistent with the description provided by Haury (and undoubtedly there are others).

Due to the various problems noted above, the attempt has been made in this study to make the criteria applied by the author as explicit as possible. The criteria applied have been independently checked and discussed "hands-on" with other researchers familiar with the types including Douglas Craig and James Heidke.

Clarifying the Type Description

As noted above, the basis for the type identifications applied in this study are derived from Haury (1965:185-189, 1976:212-214). The reader is directed to Table 24.2, which lists the traits Haury explicitly lists as diagnostic. Haury also describes other traits but does not make them explicit. Foremost among the latter are closely spaced numerous exterior trailing lines on bowls and fire clouding. The illustrations provided by Haury and subsequent work by the author and other analysts (including Douglas Craig, Karl Reinhard, William Deaver, and James Heidke) has resulted in the identification of additional traits that may be used for identifying Gila Butte Red-on-buff as well as some inconsistencies in Haury's description that merit clarification. As to the additional traits, some are merely refinements of those discussed by Haury. They are listed in Table 24.3. Generally, for identifying a particular sherd as Gila Butte Red-on-buff, a series of traits must be considered together to arrive at a suitable identification. For example, the combination of a flare-rim bowl sherd with an unpainted rim, thick, bold linework, a curvilinear scroll on the interior and a trailing line on the exterior would indicate Gila Butte, but any one of these traits considered in isolation would not be diagnostic. The identification of types as applied here may be seen more as a process that approaches identification from two completely different points of view. The first looks for single diagnostic traits that in and of themselves will identify the particular sherd to a given type or multiple traits that together may serve this goal. The second, applied if such defining traits are not present, searches for traits that will identify what types the sherd *cannot* be. It thus becomes a process of elimination in the latter case as each trait is considered in conjunction with each other trait. In the case of the above example, we would know that the sherd could not be Santa Cruz because the linework is thick and bold, it cannot be Snaketown because the scroll is not hatchured, and it is not likely to be Sacaton due to the unpainted rim. In a practical sense, it has been found that the most useful and commonly applied traits include deeply serrated scrolls, shallow, irregular incising, and for bowls, multiple, closely spaced trailing lines or hatchured triangles pendant from the rim on the exterior (see Figures 12.5 and 12.6 [Volume 2] for illustrations of Gila Butte Red-on-buff from the Rye Creek Project).

Table 24.2. Diagnostic traits of primary and secondary importance identified by Haury (1965:185-189, 1976:212-214).

Primary Importance (i.e. Diagnostic to phase)	Secondary Traits
Keys	Flare-rimmed shallow bowl
Life forms with hatch-filled bodies	Massive linework in design elements
Haphazard shallow exterior incising	Hatching with scrolls
	Hatching in backgrounds for life forms
	Negative painting

Distinguishing Gila Butte Red-on-buff from Snaketown Red-on-buff

Distinguishing Gila Butte Red-on-buff from its forebearer, Snaketown Red-on-buff, primarily focuses on three different characteristics of the types. Given the poor preservation typical of these types, often the most important criteria relates to the depth and precision of the exterior incising. Although a definite "gray area" between the types is present, the modes of the two types are readily separated on this criteria alone. Also

Table 24.3. Additional traits used to define Gila Butte Red-on-buff for this study.

Diagnostic:
Scrolls with pronounced serrated edges as seen in Haury (1965:Plate CLXXVI*g*, *h*, *k*; 1976:213-214, Figure 12.33*a*, second row, second from right; Figure 12.37*f*).

Other Important Traits:
Broken-barred gridiron small element (1965:Plate CLXXVIII*x*, *y*; 1976:246, Figure 12.99, element numbers 40, 41). These may occur in Santa Cruz based on Haury's (1976:246) listing for the phase; however, the element is thought to be much more common on Gila Butte.
Tick-marked rim (only observed on Gila Butte vessels by the author; requires additional investigation to be considered a useful trait).
Hatchure-filled triangles on bowl exteriors pendant from rim
Fire clouding
Hatchure-filled elements

important for bowl exteriors is the degree of exterior decoration; when complex exterior hatchure-filled designs are present, it is virtually certain that the vessel predates Gila Butte Red-on-buff. Gila Butte Red-on-buff most commonly will have only closely spaced trailing lines or hatchure-filled triangles pendant from the rim. For interior design, the primary distinction is drawn between the use of hatchure as a filler for design elements or ancillary spaces in the overall design in Gila Butte Red-on-buff as opposed to its utilization as a filler in the principle design of the vessel in Snaketown Red-on-buff. An additional distinction can be drawn regarding the fineness of execution of the hatchure between the two types, the nicer variety being earlier than the heavier, more "hurried" and closely packed look of the latter.

Distinguishing Gila Butte Red-on-buff from Santa Cruz Red-on-buff

Drawing the distinction between Gila Butte and Santa Cruz can be more difficult. Perhaps most important in this regard is the combination in Santa Cruz of much finer execution, thinner lines, a lack of exterior incising, and wider spaced trailing lines on bowls. Also important is the greater control over firing seen in Santa Cruz with the concomitant decrease in fire clouding and gray cores. Hatching used as a filler in the designs all but disappears in Santa Cruz Red-on-buff. Most difficult for the purposes of analysis are sherds from vessels that are not incised, and which have one of the design arrangements and sets of motifs common to both Santa Cruz and Gila Butte, such as flying birds or alternating free-floating fringes and small elements. These cases, which almost always originate from vessels with an organizational banding layout, are unfortunately common in the Colonial period. Doug Craig (personal communication, 1990) and I concur that these designs become commonplace in the latter part of the Gila Butte phase and continue as a popular layout into the latter part of the Santa Cruz phase when they give way to more sectioned layouts. Many of these sherds must be placed into an "either/or" category (Ceramic Type 309 in this study: see Appendix E). For a whole bowl of this nature, often the numbers and spacing of trailing lines can be used to distinguish the two, Gila Butte being the one with the highest density of trailing lines. Jars are ordinarily problematic. This problem in distinguishing the types resulted in the rejection of the most likely Gila Butte -- Kana-a association I encountered in this study: that of a cremation at Ushklish containing a restorable Kana-a bowl and a Colonial period red-on-buff restorable jar.

The difficulty in separating Gila Butte Red-on-buff from Santa Cruz Red-on-buff pottery has probably been made more difficult for some researchers due to some minor inconsistencies in the classification of the vessels and sherds illustrated in Haury's original Snaketown report (Haury 1965). In many cases, as seen by the discussion above, without contextual associations known, one cannot evaluate whether a particular vessel illustrated by Haury is Santa Cruz or Gila Butte (due to a lack of visible diagnostic criteria). In the case of Plates CLVI*f*, *g*, *h*, and *i*, and CLXX*d* and *l*, however, there is no question that the examples cited are in fact Gila Butte even though Haury classifies them as Santa Cruz. The use of hatching in the backgrounds for life forms as seen in these examples is noted by Haury as characteristic (though not diagnostic) of the Gila Butte phase (1965:187), and is thought also to occur in the Snaketown phase. The use of hatchure-fill as seen here died out in the Gila Butte phase (Haury 1976:212-213) and was largely gone from the scene in the Santa Cruz phase where it only rarely occurs in place of geometric solids. Contrary to the implication that the trait as applied to life form borders carries into Santa Cruz, I believe it was gone before the development of Santa Cruz Red-on-buff pottery.

Another trait cited above as characteristic of Gila Butte and useful for distinguishing it from Santa Cruz, is closely spaced trailing lines on bowl exteriors. The vessel illustrated in Plate CLX*c* as Santa Cruz Red-on-buff clearly falls within the range of what I have classed as Gila Butte Red-on-buff. Indeed, the bowl exteriors labeled as Gila Butte Red-on-buff in Plate CLXXIII*a'* and in Figure 111 in Haury (1965) are virtually identical to this vessel. Without seeing the vessel interior in this case, I hesitate to draw a definite conclusion but feel that it is important to note that if indeed it is Santa Cruz, it is an exception.

CROSS-DATING GILA BUTTE RED-ON-BUFF WITH DATED CERAMICS

The use of tree-ring-dated Mogollon and Anasazi ceramics found in association with Hohokam pottery provided the foundation upon which the Hohokam chronological sequence originally was formulated (Haury 1965, 1976; Bullard 1962). The discovery of both intrusive ceramics from these areas on Hohokam sites and Hohokam ceramics on sites in the Mogollon and Anasazi areas were, and continue to be used as support for various interpretations of the Hohokam sequence. In northern and eastern Arizona, dating structures with ceramics dated through tree rings from other areas has been a standard procedure for many decades at sites lacking detailed tree-ring-based sequences. The procedure is not without its problems, even in the tree-ring havens of northern Arizona, as illustrated by Downum (1988). The bible for researchers throughout the Southwest has been the impressive compilation of data by Breternitz (1966), but there has been little headway made in controlling for contexts and postdepositional formation processes, considerations of the time lag between construction and trash deposition in abandoned structures, and reworking of Breternitz's 25-year-old pioneering study. Too often, Breternitz's work has been applied without question. Downum's (1988) dissertation is a commendable step in the right direction and illustrates how tree-ring data may be reliably used for ceramic dating in the Flagstaff area.

Schiffer (1982:309-312) has raised three issues concerning the utility and application of cross-dating that require consideration here:

1. The temporal information provided is too broad to be useful.

2. The absence of a particular intrusive type cannot be taken as evidence that it was not produced during the period of time in question; that is, negative evidence is not proof.

3. Most cross-dated intrusive ceramics on Hohokam sites are small and occur in low frequencies making them more likely to be deposited in mixed or otherwise poor contexts.

The first issue is misleading and invalid for two principle reasons: 1) Schiffer discusses cross-dating sherds in isolation without regard to the arguments one can build based on multiple ceramic types and good contextual control; and 2) he does not take ceramic use life into account. Schiffer provides the following extreme example which will illustrate the points to be made here: "the intrusive artifact was manufactured at the beginning of the donor phase and deposited at the end of the recipient phase" (Schiffer 1982:310). As pointed out by Schiffer, under these hypothetical conditions, the time during which the deposit with the intrusive artifact could have been formed would be equal to the period of time between the starting point of the donor phase and the end point of the recipient phase. In Schiffer's example, 200 years is the period of time used for the donor phase and 200 years for the recipient phase, indicating that in his example, the span of time involved would be 400 years. But does this situation apply to the issue at hand, namely cross-dating Hohokam pottery? Clearly not. First of all, we should be clear that we are discussing ceramics here (as was Schiffer), not some other type of artifact. This is important to keep in mind because ceramics have use lives that tend to be relatively short, as attested by ethnographic studies (e.g. see Arnold 1985:152-155 and Longacre

1985 for reviews). Typical personal-eating bowls and small jars not intended for long-term storage (which tend to comprise the majority of any given assemblage) typically last 1-5 years, and certainly would not be expected to last more than 15 years (Arnold 1985:154 and Longacre 1985:335). Evidence from prehistory for the Hohokam may be used to support this inference. Although vessels dating to two successive phases are occasionally found in association with one another, there are no known instances (except for a rare case at Snaketown where previously deposited material was disinterred by the Hohokam) where ceramics dating more than one phase apart have been found in clear association. These data indicate that Schiffer's example, which postulates a particular vessel produced at the start of one 200-year phase being deposited at the end of another 200-year phase, is considered not only extreme, but unrealistic and misleading. He is suggesting a vessel use life of 400 years!

The author, and, it is believed, most researchers in the region, view dendrochronologically dated ceramics as indicators of a particular date range for a particular context, provided the context is sound. The date range will equal the span of time in which the particular type has been found in tree-ring-dated contexts. Theoretically, one could also add transport time to this as well, though researchers working in the region have found no evidence to suggest that this was ever more than a very short period of time (Lex Lindsey, personal communication 1990; Jeff Dean, personal communication 1990). This is no different than applying a radiocarbon or archaeomagnetic date to the context with the confidence intervals they supply. In fact, it is often better than these methods because of the error factors associated with these techniques and the lack of funding (and often suitable materials to date) in most cases to provide the suites of dates necessary for confidence in the results. Schiffer unrealistically overstates the case. Furthermore, he suggests that there are no means to utilize multiple cases of cross-dating at a site to assess phase lengths (Schiffer 1982:310). As will be seen in this chapter, it is exactly these cases that provide the necessary clues to tie down the chronology. Schiffer ignores cases where a continuous sequence of occupation at a site or sites can be discerned in which multiple types occur and shift in distribution and frequency. It is often in these circumstances that the most valuable clues may be found. Schiffer is suggesting that we discard the technique due to the remote (and I venture to guess almost impossible) scenario he comes up with. If we accept his rationale, I believe the more serious difficulties inherent in other absolute dating techniques such as radiocarbon dating and archaeomagnetic dating would make them the first to be discarded long before we would rid ourselves of ceramic cross-dating.

The second issue, the use of negative evidence to support a particular date assignment, is certainly something that must be viewed with caution; however, it would be unrealistic and inappropriate to ignore this information. Strong cases may be constructed with the appropriate regional databases and careful contextual control. Negative evidence is most useful, as Haury recognized, in conjunction with direct evidence. For a site that has Gila Butte and Santa Cruz as common intrusive types found in association with tree-ring-dated ceramics, one could say, following Schiffer, that the point where Gila Butte no longer occurs at the site is from that point on a case of negative evidence and so should be discounted. But this would ignore the evidence for continuous interaction represented by the succeeding type Santa Cruz Red-on-buff. The use of negative evidence is not as black-and-white as Schiffer implies.

The third issue, that of small sherd sizes and poor contexts is a very valid critique that will be dealt with in some detail in this report; however, it is not the bane that Schiffer suggests. He raises this issue in his critique as the death-knell for ceramic cross-dating. In fact, it is simply an appropriate critique of many of the noncritical interpretations found in the literature. I do concur that this is a serious problem. As will be seen, many of what have been touted as cases supporting various interpretations consist of sherds originating in mixed fill contexts within house pits, extramural trash-filled pits, and trash middens. In most published accounts, it is impossible to know from the information provided whether the sherd or sherds in question are large or whether they are small and weathered as might be expected in a sheet-wash deposit. These cases are uniformly suspect. On the other hand, if careful considerations of context are evident, it would be inappropriate to ignore the information intrusive sherds can provide. An excellent example are the two large sherds from a Mogollon Red-on-brown bowl found in the well-dated Gila Butte phase pithouse 9F:8 at Snaketown. Information concerning the distribution of types in the fill reveal no pre-Gila Butte phase material mixed in the context. Should we discard this context from consideration as Schiffer appears to advocate? I contend that to do so is to lose a very tight absolute date for the context and for Gila Butte Red-on-buff.

As a result of the problems in contextual control evident in many studies which cite intrusive ceramics, an effort has been made in this study to reexamine critical cases for this type of information. Where this was not possible (either because the collections were not curated, they could not be located, or because they were not accessible to me under the constraints of the project), I state that I am relying on the published information. In a number of cases that have been touted by various researchers as evidence in support of one interpretation or another, the published data were considered inadequate by the standards applied here for being considered strong associations. Examples in this regard include the Mound 29 data at Snaketown (exceptions noted below), the Bluff site buffware sherd (Haury and Sayles [1947:57] neglect to consider the possibility that this sherd may have originated from the Corduroy phase occupation of House 19, which is located upslope from Structure 3 where the sherd was found), most of the data from Stove Canyon and the Lunt site (Neely 1974; Haury 1976:330), and some of the Walnut Creek data (Morris 1967, 1970; Haury 1976:330). Although Dittert (1967) is cited by Haury (1976:330) as a reference to the specific association of Gila Butte Red-on-buff with White Mound Black-on-white and Lino Gray at Walnut Creek, this association cannot be verified with the clearly mixed contexts reported by Morris. Note that this association would be anticipated by the findings discussed below and there may well be unreported solid contexts at the Walnut Creek sites (though the dating offered here is different from that proposed by Haury).

Although the criteria for rejection or acceptance of specific cases are, it must be admitted, always somewhat subjective, nevertheless there are specific guidelines that are applicable. These include the following:

1. Contexts must be unmixed; i.e., sequential or discontinuous noncontemporaneous well-dated ceramic types cannot co-occur in the given context. An exception in this regard would be cases where multiple occupations are evident that are markedly distinct in time such as a pithouse occupation in the A.D. 800s overlain by a Pueblo III occupation in the 1200s. The types are easily separated and associations tend to be unambiguous in these cases. Another exception might be cases in the Hohokam area where some mixing is evident with later ceramic types, but the intrusive ceramic is indisputably related to the earliest Hohokam ceramics in the deposit. This situation is discussed more fully later.

2. Single sherd associations are considered weaker than multiple sherds, though they are not necessarily rejected out of hand.

3. There must be diagnostic ceramics in direct association. Phase assignments based on related features on a site or on stratigraphic information alone are not accepted.

4. Contexts considered suitable for consideration can include structure floors, floor pits, structure fill, and burials (although isolated sherds are not considered suitable in burial fill). Contexts such as extramural pits and trash middens are considered inadequate due to the very common problems of contextual interpretation and mixing that occur within them. This is not to say that these problems do not occur in houses; only that on a probabilistic basis the likelihood of there being poor associations is much greater in extramural pits and midden deposits. Needless to say, nonfeature and extramural surface contexts also are considered inadequate for the purposes of this study.

Collections that I personally examined during this endeavor include those from the following sites: Ushklish, Snaketown, Bear Ruin, San Simon Village, Roosevelt 9:6, and of course the Rye Creek Project material. The material from the Henderson site, Buh bi laa, East Fork, Tla kii, Wheatley Ridge, Crooked Ridge, and Verde Terrace were not examined.

Overall, Schiffer's critique, while utilized to discredit the application of ceramic cross-dating, does not accomplish this end. It is useful in that it does point to the cautions that need to be observed when attempting to use the technique. As will be seen, short of several unique cases of absolute dating, the cross-dating method actually offers as much, if not more, to the following analysis than absolute dates and the two approaches are considered complimentary.

Returning for a moment to the specific procedures applied in the present study, several comments are in order concerning the Snaketown material, given the extensive discussions in the literature concerning the intrusives from the site, and the data provided by Gladwin and Haury (Gladwin 1948:239-263; Haury 1965:213-214, 1976:327-328, 330). With few exceptions (namely the Mound 29 data and Cremation 6G:3), specific proveniences of the intrusives are not provided in the published reports and only the phase associations are available. As a result, due to the possible problems alluded to by Schiffer and others, I undertook a reexamination of all of the extant intrusive decorated ceramics in the Snaketown collections at the ASM. I focused my attentions on the intrusives of known temporal value and on the types that could pre-date A.D. 900 (so that types such as Trincheras Purple-on-red that are poorly dated were not examined in detail). Not all of the intrusive ceramics reported could be relocated in the existing collections, nor were all of those that could be located cataloged with provenience data. Those sherds that either could not be provenienced or that could not be relocated (i.e., were reported by Haury or Gladwin but not curated) were deleted from this study. Because of the problems with mixing in all trash mound contexts under consideration, the sherds from this type of association also were rejected from further consideration with the few exceptions discussed here. Contexts for the sherds remaining for consideration at this point were evaluated using the unpublished data in the ASM archives. In several instances, ambiguities in the recorded data forced me to reject what may otherwise have been excellent contexts.

No assumptions were made in this reexamination of the ceramic collections and contextual data regarding the accuracy of previous analysts' typological identifications (this applied to Haury as well as other analysts). For example, if a Kana-a Black-on-white sherd was recorded as originating from a Santa Cruz phase cremation, it was not assumed that the cremation was in fact of that age. Instead, other data were sought to establish whether or not that association could be substantiated; this usually involved an inspection of any associated decorated vessels or sherds. In several cases, color slides of the vessels were consulted. If collections could not be examined and photographs were unavailable, a general guideline was followed regarding the acceptance or rejection of sherds/vessels identified to one of the Colonial period buffware types. This involved the acceptance of Gila Butte identifications (no instances of misclassification of this type were identified in this respect). Identifications of Santa Cruz Red-on-buff ceramics were not accepted at face value without corroborative data on classificatory procedures or attribute information due to the problems cited earlier. These methods resulted in the necessary rejection of most potential Gila Butte phase associated intrusive ceramics at Snaketown (including, unfortunately, one Three Circle Red-on-white, as it could not be relocated). Wherever it was possible to reexamine important intrusive sherds, I did so and obtained second opinions regarding their identification if there was any doubt as to their classification. In some cases, all of which are stated later, I was forced to rely on other researchers' identifications.

Two different avenues of investigation are considered here: 1) dating Gila Butte via its occurrence in association with dated ceramics and/or tree rings where it occurs as an intrusive outside of the Hohokam area; and 2) dating Gila Butte via the co-occurrence of dated intrusive ceramics with it in Gila Butte phase contexts in the Hohokam area.

Dating Gila Butte Red-on-buff as an Intrusive and Through Cross-Dating

Table 24.4 lists all sites known to the author that have Gila Butte and Santa Cruz red-on-buff ceramics as probable intrusives with the exception of sites in the Tucson Basin and vicinity and points further south along the Santa Cruz River (where the type is very abundant). This listing expands that compiled by Crown (1984:272-275). As seen here, the types are widely distributed and do occur in a variety of areas that might be expected to produce direct tree-ring date associations. Sites within the Hohokam territory that have useful cross-dating associations are included in the following discussion.

Table 24.4. Sites outside of the Phoenix Basin, Tucson Basin, Safford area, and the Santa Cruz and San Pedro valleys where Gila Butte Red-on-buff or Santa Cruz Red-on-buff have been found as intrusives.

Arizona

NA 2385 (MNA) Calkins Ranch
NA 3528 (MNA) Verde Ballcourt
NA 3945 (MNA) Winneman Ranch
NA 3996B (MNA) Cinder Park
NA 17,903 (MNA) Buh bi laa
NA 17,962 (MNA) East Fork
AZ N:4:23 (ASM) Verde Terrace
AZ N:4:6 (ASM)
AZ N:4:12 (ASM) Perkinsville
AZ N:8:2 (ASM) Henderson Site
AZ O:5:6 (ASU) Verde Terrace
AZ O:15:28 (ASM)
AZ O:15:31 (ASM) Ushklish
AZ P:13:1 (ASM) Walnut Creek
AZ P:14:113 (ASM)
AZ P:16:1 (ASM) Bear Ruin
AZ P:16:2 (ASM) Tla Kii Ruin
AZ P:16:62 (ASM) Skiddi Canyon
AZ V:2:5 (ASU)
AZ V:2:7 (ASU)
AZ V:9:56 (ASM) Monitor
AZ V:9:57 (ASM) Columbus
AZ V:9:62 (ASM) Tin Horn Wash
AZ W:10:15 (ASM) Crooked Ridge
AZ W:10:111 (ASM) Nantack Village
AZ W:9:10 (ASM) Stove Canyon
AZ W:9:83 (ASM) Lunt Village
AZ FF:5:1 (ASM) Gleeson

New Mexico

Wheatley Ridge

Direct Tree-Ring Dating at the White River Sites

Only two sites actually have produced direct tree-ring associations with Gila Butte Red-on-buff ceramics and both are extremely important for the information they provide. The two sites are Buh bi laa (NA17,903) and East Fork (NA17,962), located on the White River south of Kinishba (Halbirt and Dosh 1991). The data from the soon-to-be-published manuscript (Halbirt and Dosh 1991) will be addressed in depth here due to their importance. Halbirt and Dosh document a Late Mogollon pithouse occupation at these two sites, including the full excavation of 12 pithouses. Other unexcavated structures remain at both sites. The site occupations overlap based on the ceramic and tree-ring data. Buh bi laa produced a ceramic assemblage that included 7 Gila Butte Red-on-buff sherds and one reconstructible bowl, and 2 sherds of Santa Cruz Red-on-buff from a single vessel. Other decorated wares are rare, the only other identifiable type consists of 3 sherds and 1 reconstructible vessel of Kiatuthlana Black-on-white. Approximately 8 percent of the assemblage is composed of redwares (primarily Forestdale Smudged and Forestdale Red (much of which is thought to be a local copy [Carl Halbirt, personal communication 1990], with a small quantity of San Francisco Red). Lino Gray is also present in small quantities. East Fork, on the other hand, produced only four sherds of Gila Butte Red-on-buff, but seven sherds and two reconstructible vessels of Santa Cruz Red-on-buff, in addition to six indeterminate red-on-buff sherds, two sherds of Kiatuthlana Black-on-white, three Corduroy Black-on-white sherds, and two Forestdale Red-on-brown sherds (Carl Halbirt, personal communication 1990; note that the counts here lump counts that are noted by Halbirt to be multiple sherds from the same vessel). Common to both sites is the type Alma Plain. Gila Plain also occurs in appreciable frequencies, with the highest percentages at Buh bi laa.

Tree-Ring Dating at Buh bi laa. At Buh bi laa, 17 charred beams of pinyon pine from seven features produced tree-ring dates, all but two of which are noncutting vv dates. On the basis of the tree-ring evidence (a discontinuous series of dates), different beam ring counts, cultural trait differences, and spatial distribution, Halbirt and Dosh conclude that there are two construction episodes separated by a 34- to 40-year gap. According to this interpretation, the early occupation comprises the majority of the dated houses with 13 dates from 5 structures in three of the house clusters. This construction episode is thought to date between A.D. 775 and 800. The second construction episode is represented by only two houses and four dates, two of which are cutting dates (A.D. 864+r and 831r). This episode is placed between A.D. 830 and 865. After consulting with Jeffrey Dean of the Laboratory of Tree-Ring Research at the University of Arizona on this matter, I must disagree with Halbirt and Dosh's reliance upon the noncutting dates at Buh bi laa in constructing their chronology. A variety of formation processes could be influencing the patterning Halbirt and Dosh discuss. This is not to say that other archaeological data do not suggest multiple occupations or construction episodes, only that they are not well supported by the dendrochronological evidence. Nevertheless, important data are provided by this site.

Of particular interest at Buh bi laa is structure 14a, interpreted as a large storehouse, that had a very large floor assemblage including a Gila Butte Red-on-buff reconstructible bowl and a Gila Butte Red-on-buff sherd. Five noncutting vv tree-ring dates were obtained from this feature ranging from A.D. 706vv to 763vv. In addition, two other noncutting dates are provenienced to the ramada feature overlying the structure, but which actually are thought to have originated from the storehouse. They are 755vv and 779+vv. Gila Butte Red-on-buff pottery was found in the fill of two other houses with tree-ring dates. These include 739+vv and 756vv for house 1asu and 831r and 850vv for structure 8. Kiatuthlana Black-on-white is found in the fill of only two structures (8 and 7asu), both of which have tree-ring dates placing them in the mid- to late-800s (831r and 850vv for 8, and 827vv and 864+r for 7asu). Only one Santa Cruz Red-on-buff sherd is cited for the site. It is reported from the floor of structure 38b, which has Gila Butte in the fill, but unfortunately no tree-ring dates. I am uncertain as to the significance of this sherd.

The latest date associated with Gila Butte Red-on-buff A.D. at the site is the 850vv date for structure 8 (which also produced a cutting date of 831r). The other structure that produced mid- to late-800s dates is Feature 7asu with A.D. 827vv and A.D. 864+r. Interestingly enough, despite a very large ceramic assemblage, no Gila Butte Red-on-buff pottery was found in the structure, although a single Kiatuthlana Black-on-white sherd was found in the overburden and an unidentifiable black-on-white sherd, also likely to be either Kiatuthlana or Corduroy black-on-white given the data from both Buh bi laa and East Fork, was found in floor contact. It is tempting to conclude that this structure, with its assemblage containing Kiatuthlana and no Gila Butte Red-on-buff, may postdate the deposition of Gila Butte Red-on-buff ceramics at the site. This would not be unreasonable to suggest given that it has the latest date for the site, the cutting date of 864+r. Taking the maximum end of pithouse use life postulated by Ahlstrom (1984), 20 years, this would mean that Gila Butte Red-on-buff might have been gone from the scene by A.D. 884 and possibly as early as A.D. 864 if the structure was abandoned soon after construction.

To summarize, the Buh bi laa site produced tree-ring dates indicative of construction in the A.D. 800s with the earliest possible date for the appearance of Gila Butte at the site based on the bowl found on the floor of structure 14a and the seven associated vv dates (taking the latest date in the sequence) being sometime after A.D. 779. Dean (personal communication to Mark Elson, 1990) reports that pinyon pine, the species involved, may easily lose 50 rings to sapwood erosion. Thus, the context could actually date somewhere in the early- to mid-A.D. 800s.

Kiatuthlana Black-on-white were recovered only from the overburden above Features 7asu and 8 and would appear to indicate a terminal occupation of the site when considered in conjunction with the East Fork data. Santa Cruz Red-on-buff pottery is conspicuous by its absence at the site (with the exception noted above), and it is likely that the fill deposits in the excavated structures generally predate its production. This negative interpretation is made possible due to the evidence from the nearby East Fork site since it would be anticipated to be present if contexts of the appropriate time period were present. Taken with the possibility that Gila Butte Red-on-buff may have been gone from the scene by the time that structure 7asu was abandoned, the possibility is raised that the transition from Gila Butte to Santa Cruz red-on-buff ceramics occurred between A.D. 850 and 884.

Tree Ring and Ceramic Dating at East Fork. Two of the five houses (Houses 1 and 2) at the East Fork site produced seven tree-ring dates on pinyon pine ranging from A.D. 827vv to 850vv with one cutting date from House 1 at 832r. Halbirt and Dosh (1991) argue that the two dated houses indicate a construction episode in the A.D. 830 to 850 range with House 2 being built after House 1 (though occupation may overlap and relative abandonment dates would be unknown). Although the sequencing proposed is probably valid, House 2 could certainly date later than its latest date (A.D. 850vv). As noted above, 50 years could easily be lost to outer ring erosion on pinyon pine. The ceramics tend to indicate that the houses were abandoned sequentially in that an unidentified incised sherd, presumably Gila Butte Red-on-buff rather than an earlier type, was found in the floor fill stratum of House 1, while the floor fill stratum of House 2 produced a sherd of Santa Cruz Red-on-buff. If the identifications of these sherds are accepted (judging from the data compiled in this report, the only question would be whether the Santa Cruz sherd was really Santa Cruz or whether it could be considered Gila Butte), and the sherds are assumed to be associated with the trash fill of these structures shortly after their abandonment, then the incised variant of Gila Butte Red-on-buff was still in use at least as late as the A.D. 830s (possibly as late as the A.D. 850s given a 20-year maximum pithouse use life). Santa Cruz Red-on-buff may be surmised to be present no earlier than this same period of time.

The remaining three structures (Houses 3, 4, and 6) at East Fork did not produce datable wood specimens but they did produce some very interesting ceramic associations. House 3 had a worked Kiatuthlana Black-on-white sherd on the floor, while House 4 had Santa Cruz Red-on-buff sherds and a Santa Cruz Red-on-buff seed jar on the floor. In addition, Cremation Pit 2 cuts through the wall of House 4 and this contained a Santa Cruz Red-on-buff jar. House 6 had what appears to be a trash deposit on the floor including single sherds each of the following types: Santa Cruz Red-on-buff, Corduroy Black-on-white, Kiatuthlana Black-on-white, Lino Gray, and an unidentified purple-on-red. Other sherds in floor contact include Gila Plain and Alma Plain. In the fill of this structure there were 12 decorated sherds including 7 sherds of Santa Cruz Red-on-buff, in addition to sherds of San Fransisco Red, Gila Butte Red-on-buff, and Corduroy Black-on-white. The Gila Butte Red-on-buff sherd in this context is undoubtedly mixed in, but the association of Santa Cruz Red-on-buff with Corduroy Black-on-white in this context and in House 4 is thought to be sound. The association of Kiatuthlana and Corduroy Black-on-white pottery in House 4 is also of interest and expected based on previous research. Kiatuthlana Black-on-white is currently dated at A.D. 850 to 950 (Mills 1987). Corduroy Black-on-white is a type defined by Haury based on his excavations at the Tla Kii Ruin (Haury 1985:75-79). The data from East Fork fit well with Tla Kii where Kiatuthlana and Corduroy were associated in the same burial. It appears that Corduroy Black-on-white is simply a sloppy version of Kiatuthlana produced in the Forestdale Valley, based on Haury's description and data. He dates the type at an estimated A.D. 800 to 900 though it is clear this is coming from cross-dating rather than any direct tree-ring dates and that this dating may be biased by his perspective on the antiquity of Gila Butte Red-on-buff (due to the presence of a Gila Butte sherd in a Corduroy phase context at Tla Kii). The two key points for dating Corduroy given the Tla Kii data are the apparent lack of association with White Mound Black-on-white (only one worked sherd was found) which indicates that Corduroy probably postdates White Mound; and the fact that it is coeval with and probably directly related to Kiatuthlana Black-on-white. Furthermore, it is not associated with Black Mesa Black-on-white. In this study, Corduroy Black-on-white is therefore considered coeval with Kiatuthlana Black-on-white and dated at A.D. 850 to 950.

Taken together, the Buh bi la and East Fork ceramic associations and tree-ring dates provide some very valuable clues to the placement of the transition from the Gila Butte to the Santa Cruz phases. There is the hint from the dated houses cited above that suggest that this might fall in the A.D. 850 to 884 range. At Buh bi laa, it was seen that the distribution of Kiatuthlana Black-on-white pottery was limited to the two late-dated structures, one of which, Feature 7asu, construction dated to A.D. 864+r, lacked any associated Gila Butte Red-on-buff (there were no Santa Cruz sherds either so the evidence may be considered equivocal). This would certainly fall within the accepted dating of Kiatuthlana Black-on-white pottery as it is presently known. Similarly, the lack of Kiatuthlana and Corduroy Black-on-white ceramics in the majority of houses at Buh bi laa containing Gila Butte Red-on-buff is significant. We know from Buh bi la that Gila Butte was present at the very earliest in the A.D. 780s and probably not until sometime later (the site may not date any earlier than this). The precise boundary between the Gila Butte and Santa Cruz phases based on the information from these sites rests on three specific points: 1) the incised sherd, assumed to be Gila Butte Red-on-buff, in House 1 at East Fork and the Santa Cruz sherd in House 2 at East Fork are in good contexts that can be considered to be closely associated with the features' abandonment (House 1 has a construction date of A.D. 832 with a maximum use-life date around A.D. 850, and House 2 postdates House 1); 2) Gila Butte Red-on-buff pottery was not found in good association with structure 7asu at Buh bi laa which is believed to postdate A.D. 850 despite a large ceramic assemblage; and 3) Santa Cruz Red-on-buff is found in association with Kiatuthlana and Corduroy Black-on-whites (which are dated to the period from A.D. 850 to 950), but neither is found in good association with Gila Butte at the sites. In addition, it is assumed that the cutting dates from both sites approximate the construction of the structures in question. Taken together, these data and interpretations suggest that the boundary can be placed between A.D. 850 and A.D. 884. If these interpretations are not accepted, one could still confidently say that incised examples of Gila Butte Red-on-buff ceramics were present in the region in the A.D. 800s.

Cross-dating Gila Butte Red-on-buff with Associated Tree-Ring-Dated Ceramics

The strongest ceramic associations with Gila Butte Red-on-buff are with three types: Mogollon Red-on-brown, White Mound Black-on-white, and Floyd Black-on-gray. Each type has been found at multiple sites in good Gila Butte contexts. In order to assess the significance of these associations, I will first address the dating of the types before proceeding to the specific cases involved.

Lino Black-on-gray. There have been no recent investigations that have reevaluated the dating of Lino Black-on-gray since the early work of Breternitz (1966:82), and the scope of the issue is beyond my resources for this study. Breternitz places his best guess interval at A.D 575 to 875, while other researchers (Kelly Hayes, personal communication 1990; Chris Downum, personal communication 1990; Alexander Lindsey Jr., personal communication 1990) indicate that a starting date in the A.D. 600s may be more realistic. It is certainly present by the middle of the seventh century (Kelly Hayes, personal communication 1990). Recent evaluations of the data from the Kayenta area by Jeff Dean (personal communication 1990) reveal an end date between A.D. 805 and 850, with a best guess placing it at A.D. 835. Conservatively, for the time being, my best guess range for the type is A.D. 600 to 835.

There is one relatively good association of this type with Gila Butte Red-on-buff. This is from House Feature 1 at Ushklish (Haas 1971a) which produced a large number of Gila Butte Red-on-buff sherds. Our reanalysis of the remaining collections at the Arizona State Museum (ASM) identified 2 Lino Black-on-gray sherds and 1 Lino or Kana-a Black-on-gray/white sherd. Also found in this context were 1 White Mound Black-on-white (two more were reported by Haas but were not relocated in the ASM collections), a sherd that could be either La Plata or Kiatuthlana Black-on-white, and a sherd of Black Mesa Black-on-white. The latter two are likely to be mixed in to the deposit and it is known that the Black Mesa sherd was in the upper fill. Most significant in terms of dating the context would actually be the White Mound Black-on-white sherds, if in fact the Lino Black-on-gray and White Mound Black-on-white are truly contemporaneous as the date ranges of the types overlap and White Mound's start date definitely postdates Lino's start date. The alternative hypothesis, that the White Mound is mixed in with an earlier Gila Butte Red-on-buff and Lino Black-on-gray component, is at present considered unlikely given the absence of any other data that would strongly support this inference.

Lino Black-on-gray pottery also was recovered from House 6 at Ushklish, which also produced a large number of Gila Butte Red-on-buff sherds, but this complex feature, actually two superimposed houses, had a greater degree of mixing evident in the fill and associations are difficult to make with certainty.

Mogollon Red-on-brown. At first glance, the dating of Mogollon Red-on-brown pottery appears to represent a morass of conflicting data not unlike Gila Butte Red-on-buff. Closer inspection reveals a relatively tight and useful body of data. Recent interpretations of the data contrast Haury (1976:330) with Breternitz (1966:86-87) and more recent studies (Withers 1985; Lekson 1990; Patricia Gilman, personal communication 1990). Breternitz (1966:86-87) suggests that the type "apparently begins at 775 or 800 and lasts until at least 950; it is probably most abundant between 875 and 925." Haury (1976:330) argues, based on the restudy of the Mogollon and Harris Village site tree-ring data (Bannister et al. 1970), that the type should be placed at about A.D. 625 to A.D. 850. However, as pointed out by Withers (1985) and Lekson (1990), there are no good data to support a pre-A.D. 700 date for the type. Indeed, as stated by Lekson, the data suggest that Mogollon Red-on-brown pottery does *not* occur prior to A.D. 700 due to its general absence in structures dating to this period of time. The earliest tree-ring dates for structures containing the type in what is presumed to be sherds-in-fill contexts are the series from Houses 4 and 5B at Mogollon Village: 728vv, 733vv, 736v, and 736r from House 4 and 736vv from 5B (Bannister et al. 1970:48-48; Haury 1986a:316-317). Also found in the fill of these houses were one sherd each of White Mound Black-on-white and Kiatuthlana Black-on-white (Haury 1986a:322). This apparent disparity may be accounted for by the recognition of a later occupation at Mogollon Village in the late A.D. 800s marked by House 2 with a large series of dates confirming an A.D. 898 construction date. As will be discussed below, the Kiatuthlana is likely to have originated from this later occupation at the site. The White Mound sherd is to be expected in the fill of a structure built in A.D. 736. As discussed for the Buh bi laa and East Fork data, it can be assumed that the Mogollon Red-on-brown sherds in the fill of the dated structures at Mogollon Village postdate the construction of the structure by some 5 to 20 years (the anticipated use life of the structure, not taking the time of trash deposition into account), placing the date for the deposition (not the production) of the Mogollon Red-on-brown in House 4 at A.D. 736 to 756. The fact that a sizeable number of structures dating in the 600s have now been excavated in the region that would be expected to have Mogollon Red-on-brown as a common intrusive or as an indigenous ware if it were present (e.g. Haury 1986b; Anyon and LeBlanc 1980; Bullard 1962), supports this interpretation of a post-A.D. 700 date for its deposition.

A concluding or last-use date for Mogollon Red-on-brown pottery is open to some debate given its probable short use life and nonlineal evolution into Three Circle Red-on-white and Mimbres Boldface Black-on-white. It is unfortunate that the phase sequence in southwest New Mexico elicits a Three Circle phase after the San Francisco phase as this has tended to imply an evolutionary sequence with Three Circle Red-on-white following Mogollon Red-on-brown (the dominant painted ware in the San Fransisco phase). Haury (1986b:381-383) clearly did not intend this interpretation of the data. He reports that Mogollon Red-on-brown precedes Three Circle Red-on-white in origin, but then occurs for a period of time coeval with it. He also clearly points out that Mimbres Boldface Black-on-white postdates Mogollon Red-on-brown and cites the fact that the two have not been found in association within burial contexts. Because Three Circle Red-on-white is believed to develop in a linear fashion into Mimbres Boldface, and Mogollon Red-on-brown does not co-occur with Mimbres Boldface, it is reasonable to infer that Mogollon Red-on-brown pottery ceases to be produced and deposited prior to the final dates of deposition for Three Circle (though this period of time may well be very short; perhaps on the order of less than a generation based on the current data). Anyon and LeBlanc (1984:158-162) support Haury's interpretations based on the recent work of the Mimbres Foundation though they infer a developmental sequence among the types. A problem in both of these investigations involves the definitions and resolution of the type descriptions of Three Circle Red-on-white and Mimbres Boldface Black-on-white. Although not necessarily a common problem, the type descriptions permit some overlap between the types for Mimbres Boldface sherds that have become oxidized, resulting in a red-on-white color scheme. This is the case due to the fact that the early Mimbres Boldface designs are identical to those on Three Circle Red-on-white and not all Three Circle Red-on-white vessels are red-slipped on the exterior (Anyon and LeBlanc 1984:151). For the purposes of this investigation, this is mainly a concern in regard to the dating of Three Circle Red-on-white rather than Mogollon Red-on-brown ceramics. Late end tree-ring dates for Mogollon Red-on-brown also are difficult to deal with due to the problems of mixing of Mogollon

Red-on-brown sherds into the fill strata of later features. We know that all three types were found in the dated structures at Turkey Foot Ridge, a site that appears to have been largely constructed in the A.D. 780s and occupied perhaps shortly into the A.D. 800s (Martin and Rinaldo 1950; Bannister et al. 1970:57-58). Note that this site may well have had some earlier occupation that did not produce tree-ring dates. Lekson (1990), following the lead of Bussey (1975:42-49) has suggested that there may be variability in the frequencies of Mogollon Red-on-brown and Three Circle Red-on-white in contemporaneous villages in different areas within southwestern New Mexico. The inference is that the types are more common in the western half of southwestern New Mexico than in the eastern (Mimbres Valley) portion. This may well be the case; however, the data from the three sites in close proximity within the Reserve area, Twin Bridges, Wheatley, and Turkey Foot Ridge, may be more indicative of problems with very short-lived ceramic traditions and mixed contexts than anything to do with regional variability. These sites require some reappraisal because I believe they may be providing us with the clues that will affirm the end date for Mogollon Red-on-brown we are seeking.

The two most important data sets in this regard are the well-reported Twin Bridges and Turkey Foot Ridge sites (Martin et al. 1949; Martin and Rinaldo 1950; Bannister et al. 1970:56-58). Turkey Foot Ridge is reported to have had significant quantities of Mogollon Red-on-brown, Three Circle Red-on-white, and Mimbres Boldface Black-on-white (Martin and Rinaldo 1950:372-373, 377-388) and the same may be said for Wheatley (Martin and Rinaldo 1950:372-373). Twin Bridges is particularly important because it is a very small site with only four pithouses and little to complicate the archaeological record (Figure 24.1). Plus, and very importantly, Pithouse D at Twin Bridges produced a large series of tree-ring dates, placing the construction of the house at A.D. 783 (Bannister et al. 1970:56). Contrary to what one might expect based on the above cited data from Turkey Foot Ridge, the large ceramic assemblage from Pithouse D, and indeed from the entire site failed to produce any Mogollon Red-on-brown. Three Circle Red-on-white and Mimbres Boldface were found in the fill and on the floor of Pithouse D, the latter being the dominant ware (Martin et al. 1949:191). An examination of the ceramic densities in the pit structures and site plan (Martin et al. 1949:109, 191) reveal an occupation sequence in which the abandonment of Pithouse D precedes at least a portion of the occupation of Pithouse A. This interpretation is based on the relative densities of artifacts between these two structures, their spatial proximity, orientation, and ceramic assemblages. The rationale here is as follows. The spatial patterning of the site suggests that trash would be deposited either over the side of the ridgetop or in the vicinity of the particular house involved. This means that because the houses are spatially segregated into two groups, with some 20 m between, it is likely that trash was discarded in the vicinity of each grouping of two houses and that not much trash was deposited between the two sets of houses. Furthermore, Martin et al. (1949:29-30) report that the surface of the site produced only a few plainware sherds; and no accumulated trash deposits are reported. This suggests that for at least the initial occupation of the ridgetop, trash may have been discarded down the hill slope. Once a structure, in this case what is assumed to be Pithouse D, was abandoned, the house pit would have been available for trash deposition; perhaps even more so since this structure is located behind Pithouse A in a suitable location to eliminate trash. These interpretations are supported by the orientation of these two structures: both face east, Pithouse D situated behind Pithouse A (Figure 24.1). This also argues for sequential rather than contemporaneous occupation. The ceramic count from Pithouse D is six times that of Pithouse A. Even accounting for differences in size, this difference is believed to be significant and is inferred to support these interpretations. Therefore, the occupants of Pithouse D, the earlier of the two structures, may have tossed their trash off the ridgetop. Pit structure D burned and was abandoned. The occupants (perhaps the next generation or even the same individuals) of Pithouse A tossed at least some of their trash into the Pithouse D pit shortly after its abandonment given the density of sherds in the floor fill zone. Some of these floor sherds may also have been in the structure when it burned. Pithouses B and C may also represent sequential occupations with C being earlier than B; though the data are less clear in this case. The decorated ceramic assemblage supports these interpretations in that Three Circle Red-on-white is absent entirely from Pithouse B and occurs in a relatively low percentage (3.89 percent) in Pithouse A. The fact that Pithouse B is described as more of a surface house, "possibly...a brush shelter" by Martin et al. (1949:114) could indicate a different scenario for structures B and C -- but the net result described here regarding Mogollon Red-on-brown would still hold true. In contrast, Pithouses C and D have Three Circle Red-on-white percentages in the 4.37 to 5.11 percent range. If this interpretation of the site is accurate, then Pithouse D, construction dated at A.D. 783, represents the inception of the village or at least the inception of the occupation within the western cluster of two houses. Trash deposited from the

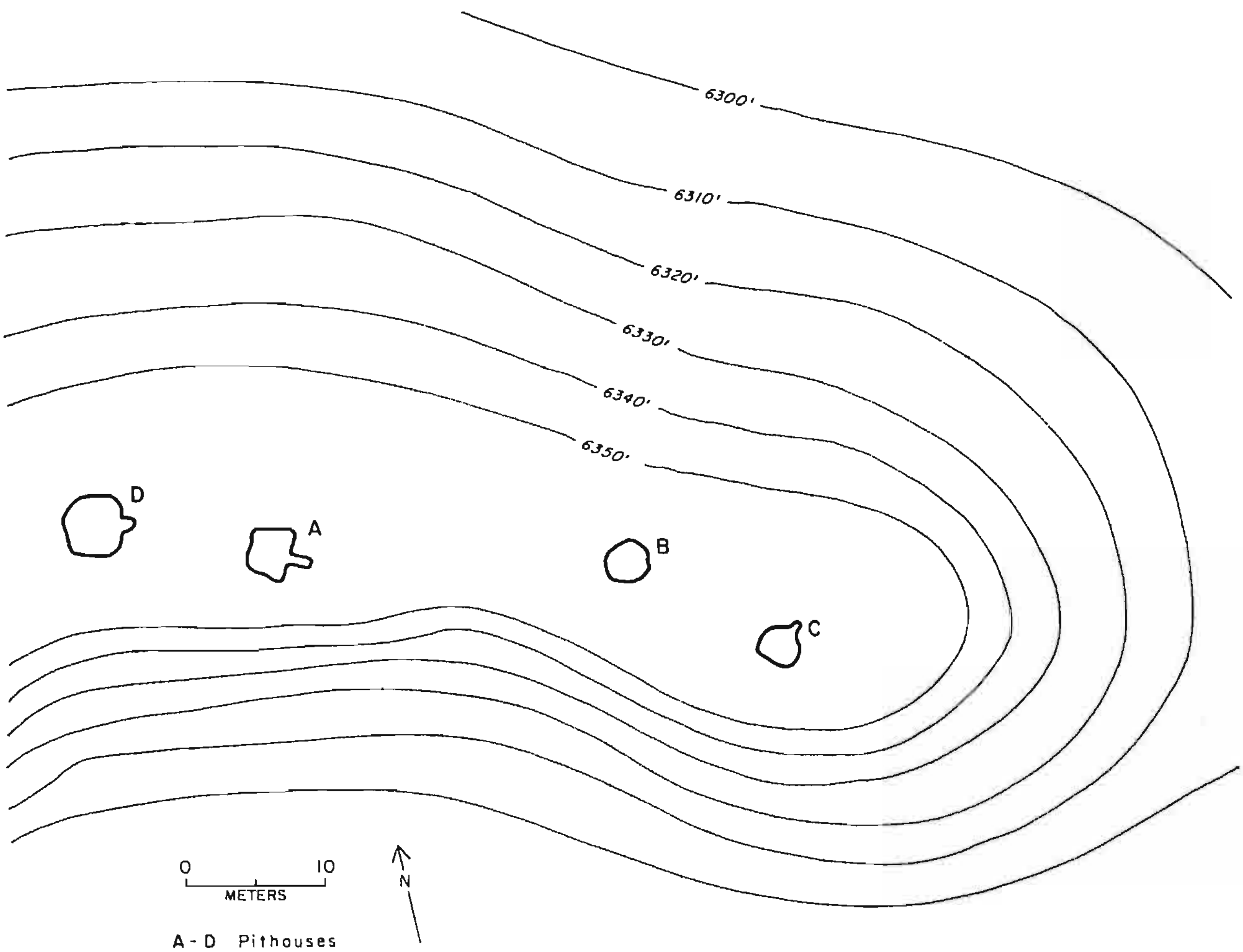

Figure 24.1. Plan map of the Twin Bridges site. Redrafted from Martin et al. (1949:109).

occupants of this structure may well have been lost to the sides of the steep ridge upon which the site is located as noted above, eliminating Mogollon Red-on-brown pottery that could well have been present at the site. If Pithouses A and B supplanted C and D, it would be reasonable to assume that the trash from these structures ended up in the deep abandoned depressions formed by these earlier houses, thereby accounting for the relatively dense trash within them. This interpretation places the initial dating of the reported trash composition of the site (in particular within Pithouse D) to the time of abandonment of Pithouses C and D. Therefore, the apparent anomaly of the dating of this site in comparison with Turkey Foot Ridge and the Wheatley site, both of which have contemporaneous dates and assemblages that include Mogollon Red-on-brown, is explicable. Plus it provides us with the very important clue of the point at which Mogollon Red-on-brown ceased to be utilized in the Pine Lawn Valley; namely by the time at which Pithouses A and B at Twin Bridges were constructed. To place a date on this point of time requires several necessary assumptions. First, it must be assumed that the occupation at the site was essentially continuous rather than there being a substantial occupational hiatus. This assumption is strongly supported by the extensive trash deposition in the early pit structures (C and D), including large numbers of sherds in floor contact that may well date to the abandonment of the houses. It is also supported by the lack of any ceramic types that would indicate an occupation span extending no later than A.D. 830. Second, I am assuming that the tree-ring dates from the site are an accurate reflection of the house construction, an assumption supported by Bannister et al. (1970:56). A third assumption is that pithouse use life averages between 5 and 20 years based on the work of Ahlstrom (1985). This range would place the abandonment of Pithouse D between A.D. 783 and 803. Thus, I infer from these data that Mogollon Red-on-brown had ceased to be in use before the period A.D. 783-803. In summary then, I am placing Mogollon Red-on-brown between A.D. 736 (based on the Mogollon Village data), and 803 (based on the Twin Bridges data).

Gila Butte Red-on-buff pottery has been found in good association with Mogollon Red-on-brown ceramics in two cases in the literature: At Crooked Ridge Village and at Snaketown. In pithouse Feature 23 at Crooked Ridge Village (AZ W:10:15 [ASM]) two Gila Butte, one Mogollon Red-on-brown, and six Vahki Plain sherds were found together with 79 San Francisco Red sherds in the floor fill stratum (Wheat 1954:177). Five more Gila Butte Red-on-buff sherds were found in temporally mixed fill deposits within pithouse Features 19, 20, and 23 at the site (the fill of Feature 23 also contained a single Snaketown Red-on-buff sherd and a single Gila Polychrome sherd). No absolute dates are available for Feature 23 and it is unclear as to whether it had burned or not, though two metates were left on the floor.

At Snaketown, Mogollon Red-on-brown ceramics are reported in association with Gila Butte Red-on-buff from contexts in Mound 29 (Gladwin 1948:239-263; Haury 1965:213-214, 1976:327-328, 330) (none of these sherds were relocated in the extant collections), and two large sherds (ASM collection no. A-27208) possibly representing a reconstructible vessel, were identified during this study in the ASM collections that originate from pithouse 9F:8. This structure is dated securely to the Gila Butte phase based on Gila Butte Red-on-buff sherds embedded in the floor (ASM archives). A Santa Cruz phase cremation (9F:1) is reported in the field notes to have cut through the floor (ASM archives). The Mogollon sherds are cited in the ASM catalog as being on the floor; however, the archival records concerning this structure report that they were in the fill. The fill of the structure is mixed; the breakdown being reported by weight for the ceramic types as follows: Gila Butte Red-on-buff 3.10 kg, Santa Cruz Red-on-buff 1.265 kg, Sacaton Red-on-buff 0.090 kg, and plainware 8.600 kg. Based on Haury's (1976:197) sherd weight to count ratios, the number of Gila Butte sherds in this fill deposit would be approximately 450. Although one could not state with certainty what the association is in this instance, it is possible to assert that Gila Butte Red-on-buff is the strongest contender and that the lack of Snaketown sherds in the deposit indicates that the Mogollon Red-on-brown is contemporaneous with Gila Butte or later types. Given the dating for Mogollon Red-on-brown cited above, it is reasonable to suppose that it is affiliated with the Gila Butte occupation rather than the later time periods.

Sayles (1945:47), from his excavations at San Simon Village, indicates that in the Galiuro phase, Mogollon Red-on-brown occurs in the highest frequencies with Gila Butte and Snaketown red-on-buff; less so than in earlier or later phases. The preceding Pinaleño phase was characterized by Snaketown Red-on-buff, Sweetwater Red-on-gray, San Lorenzo Red-on-brown, and Mogollon Red-on-brown ceramics. This is of particular interest for it indicates that Mogollon Red-on-brown may well have been produced and exported prior to the importation of Gila Butte Red-on-buff. Specific data from the site to support Sayles' observation are unfortunately now lacking. Very few field notes, maps, tally sheets, and so on were available in the ASM archives. The extant ceramic collections do contain provenienced Gila Butte Red-on-buff sherds, but no associations with other types could be derived and Sayles' comments must remain merely suggestive, not conclusive.

Other sites have possible associations of Mogollon Red-on-brown and Gila Butte Red-on-buff ceramics such as the Lunt site (Neely 1974:917-922) near Point of Pines and Wheatley Ridge in the Reserve area (Wheat 1955:17; Martin and Rinaldo 1949:192-193), but either the contexts are mixed, or insufficient data are available for evaluation.

White Mound Black-on-white. This type has not been seriously reevaluated in recent years despite a relatively substantial body of excavated tree-ring-dated contexts in northeastern Arizona and northwestern New Mexico. It was not possible as a part of this project to fully evaluate this sizeable database; however, it is noted that such information is available and it would be beneficial to conduct such a study to aid in tying down the end dates for Gila Butte Red-on-buff pottery. For the purposes of this study, I will provide the current estimates for the type and briefly review some of the pertinent literature with the caution that I consider these interpretations to only be best guesses at the present time.

Breternitz (1966:102) suggests "A.D. 675 to 900 or more as the best possible dates for White Mound Black-on-white" with A.D. 750 to 800 as the time during which it was probably the most abundant. Other researchers offer slightly different perspectives although it is clear that all of the assessments are subjective interpretations rather than rigorous evaluations of the data. These include Fowler's (1989) estimation of A.D. 700 to 850 and Robert Waterworth's (the ceramicist currently working at Zuni; personal communication 1990) best estimation at present of A.D. 750 to 950. There seems to be little doubt but that the type was in place as trash within structures dating in both the late A.D. 700s and early A.D. 800s, such as at the site of White Mound (Gladwin 1945:Plate V; Bannister, Hannah and Robinson 1966:21-22. The early end of the date range supplied by Breternitz was based on the general presence of White Mound Black-on-white at the Bear Ruin, which produced noncutting dates in the late A.D. 600s. This relationship is believed to be more an indication that undated structures postdate the dated ones rather than being any sort of a strong argument for this early a date for the type (Bannister, Gell, and Hannah 1966:29-30), because there were no White Mound sherds recovered from the dated contexts (Haury 1985). The A.D. 900 end date is similarly suspect, as Breternitz reported (1966:102). The type design-wise is identical to Lino Black-on-gray in the Cibola area (Fowler 1989), though perhaps encompassing slightly more symmetrical geometric designs (probably late in the type development; these examples may actually be better subsumed under Kiatuthlana Black-on-white). Examined on this basis, one might anticipate dates between A.D. 575 and 875 (Breternitz 1966:82). For the purposes of this investigation, I believe the best conservative range would place the type in the A.D. 700 to 875 range. If allowed to speculate to some degree, I think it will ultimately prove to be somewhat tighter in the range of A.D. 725 to 860 or 875 depending on how the type is ultimately defined.

Gila Butte Red-on-buff pottery has been found in association with White Mound Black-on-white ceramics in three cases that can be assigned a moderate confidence level: the Henderson site, Ushklish, and the Bear Ruin. At the Henderson site located in the Agua Fria drainage, Weed and Ward (1970:6) report that two sherds of White Mound Black-on-white were found in association with Gila Butte Red-on-buff. I have been unsuccessful in tracking down the fate of the Henderson site artifacts and field data to evaluate the specific contextual data (though not for lack of trying).

At the Ushklish site, Haas (1971a:52) reports three White Mound Black-on-white sherds from house fill contexts. Reanalysis of the remaining assemblage revealed eight sherds that could be assigned to specific features. The least mixed of these contexts is House Feature 1, which contained two of the sherds that were found in the lower fill (see Tables 24.5 and 24.6 for counts from our reanalysis and from the original excavation records in the ASM archives). Three sherds had been recorded in the archival records for the lower fill. Other sherds from the archival records for the lower fill include 27 Gila Butte Red-on-buff (5 of which were preserved; note that this count assumes that all Santa Cruz Red-on-buff identifications were erroneous as discussed earlier for the site), 5 undecorated buffwares, 7 miscellaneous undecorated or unidentifiable whitewares, 1 unidentified redware, and 606 plainwares. The only evidence for possible mixing in this structure based on both the original archival ceramic tallies and our reanalysis were three sherds identified by Haas as Black Mesa Black-on-white from the upper fill, one of which was relocated and recorded. Also recorded from our reanalysis, from unknown locations within the structure, are two Lino Black-on-gray, one Lino or Kana-a Black-on-white, one La Plata or Kiatuthlana Black-on-white, and three unidentified Tusayan graywares. Haas reports 34 sherds of what are now assumed to have been Gila Butte Red-on-buff from a large trash-filled floor pit (ASM archives). My conclusion from the reevaluation of these data is that this is a very good context and that we can be reasonably certain that the White Mound Black-on-white is in fact in association with the Gila Butte Red-on-buff within it.

Table 24.5. Decorated ceramic counts from Feature 1 at the Ushklish site that were located and reanalyzed at the Arizona State Museum in 1990. Type designations listed are those from the present analysis.

Ceramic Type	Count
Gila Butte Red-on-buff	1
Gila Butte or Santa Cruz Red-on-buff	3
White Mound Black-on-white	2
Lino Black-on-gray	2
Lino Black-on-gray or Kana'a Black-on-white	1
Black Mesa Black-on-white	1
Tusayan Gray (probably Lino)	2
Tusayan Gray	1
La Plata or Kiatuthlana Black-on-white	1

Haury (1985:211, 217-218) reports that six Gila Butte Red-on-buff sherds were found in "unmistakable Forestdale phase contexts" at the Bear Ruin (AZ P:16:1 [ASM]). Sixty-seven White Mound Black-on-white sherds are reported from the site. A reanalysis of the remaining collections (which were found to include most of the decorated wares) in the ASM uncovered four Gila Butte Red-on-buff sherds that could be assigned to specific proveniences based on the data inscribed on the sherds. Three of the sherds, including those illustrated as Plate XI*g* and *h* in Haury (1985:213), are from House 11, a round pithouse with a bench and long entry (Haury 1985:171-172). No data are available as to their specific locations within the fill of the structure. Four other decorated sherds also were discovered in the remaining sherd collections that originated from this structure. These include: one large sherd of White Mound Black-on-white, two very small unidentified black-on-white sherds, and a quarter-dollar-sized sherd of an unidentified White Mountain redware. Clearly the White Mountain redware and possibly the two small unidentified black-on-whites may be mixed into this context from the (much) later occupation of this site. Given the lack of stratigraphic data, it is difficult to be certain whether the White Mound sherd and the Gila Butte sherds should be viewed as being in association with one another. The odds seem to support such an association but I must admit to it being a weak case. No tree-ring dates are available from this structure.

Floyd Black-on-Gray. This type is the Cohonino variant of Kana-a Black-on-white and it is reasonable to think that it is coeval with it. It had only been recovered from three sites with tree-ring associations at the time of Breternitz's (1966:75) study, and little additional information has come to my admittedly southerly oriented attention. Breternitz dates it as being best between A.D. 775 and 937. If it were coeval with what is now the established dating for Kana-a Black-on-white (as is expected), the range would be modified to A.D. 835 to

1000 (Downum 1988; Jeff Dean, personal communication to Mark Elson, 1990). A conservative estimation would accept the range of from A.D. 775 to 1000.

One sherd of what was typed as "Snaketown/Gila Butte" Red-on-brown was found in association with three sherds of Floyd Black-on-gray on the floor, in floor features, or in the ash layer immediately above the floor of pithouse Feature 3 at the Verde Terrace site (AZ N:4:23 [ASM]) (Hovezak et al. 1989:38-42). Some historic disturbance of the structure is reported and it is unclear whether this might have affected the distribution of these sherds. Lacking additional information to the contrary, it is assumed that they are contemporaneous in deposition. Two radiocarbon dates were obtained from a carbonized branch and corn and corn stalk fragments from the ashy floor and floor fill: 1180 ± 60 B.P. and 1100 ± 70 B.P. Calibrated, these produce ranges of A.D. 773 to 943 and A.D. 783 to 998, respectively, with an averaged span of A.D. 780 to 978 using the Stuiver and Becker (1986) calibration and averaging technique. It is unclear in the report whether the designation "Snaketown/Gila Butte" refers to a transitional type designation or whether it means the sherd could be of either type. Following the most conservative route here, it is assumed that the designation implies "either/or." Therefore, the Snaketown or Gila Butte Red-on-buff pottery types (and Floyd Black-on-gray), are dated here as extending at least into the post-A.D. 780 period of time. As seen above, this is well within the expected range for Floyd Black-on-gray based on tree-ring associations in northern Arizona.

Table 24.6. Ceramic counts by stratum from Feature 1 at the Ushklish site that were listed on Haas' analysis sheets in the ASM archives.

Ceramic Type	Upper Fill	Lower Fill	Floor	Floor	Features
Misc. Plain	208(95)[a]	286(320)	1 RV	33(20)	354(441)
Misc. Red	-	1	-	1	3
Undec. Incised	-	1	-	-	-
Gila Butte Rd/Bf	3	11[b]	-	1	13
St. Santa Cruz Rd/Bf	4	-	-	1	4
Santa Cruz Rd/Bf	12	15	-	1	17
Undec. Buff	3	5	-	-	5
Lino Gray	1	-	-	-	-
White Mound B/W	-	3[c]	-	-	-
Black Mesa B/W	3	-	-	-	-
Undec. White #2	1	1	-	-	1
Undec. White #4	1	2	-	-	1
Carbon Paint B/W	-	3	-	-	-
Indet. B/W	1	1	-	-	1
Indet. Rd/Brown	-	-	-	-	1

[a]()=Denoted as type "21" on the project analysis sheets in the section listing plainwares. It is assumed that these are plainwares and that the total for each context will therefore include the sum of those in parentheses and those not in parentheses (i.e., the floor has 33 + 20 or 53 plainwares).
[b]Two are spindle whorls.
[c]One is a spindle whorl.

Note: St. is believed to represent "sand-tempered." Number definitions on the whitewares are unknown.

Mimbres Boldface Black-on-white. There is only a single context in which Gila Butte Red-on-buff appears to be associated with Mimbres Boldface and the association is tenuous. With this in mind, I turn to the information at hand to assess the utility of this potential association starting with the dating of the type.

Breternitz (1966:86) placed Mimbres Boldface Black-on-white at A.D.775 to 927 or more but noted that the type was not well dated and it is clear from a review of the cited early contexts in his study that mixed-in sherds are a distinct problem. The later end is more easily established than the early end due to some very well-placed contexts, but it is the early end that concerns us here. There are several substantive clues that permit some refinement of the dating of the type. The data concerning the end date of Mogollon Red-on-brown are considered to be of direct relevance here. It was noted earlier that Haury (1986b:376, 383), based on the evidence from Mogollon Village and the Harris site, believes that Mogollon Red-on-brown and Mimbres Boldface black-on-white follow a mutually exclusive temporal distribution with Three Circle Red-on-white filling the gap between and overlapping each. Such an inference is supported by the seriation study performed by Anyon and LeBlanc (1984:158-159), and at a gross level, by the seriation presented in Martin et al. (1949:192-193). Furthermore, the stylistic intermediacy of Three Circle has been attested to by a variety of researchers (Haury 1986a; Martin et al. 1949:186; Pat Gilman personal communication 1990). As reported by Anyon and Leblanc (1984:151), Three Circle Red-on-white and Mimbres Boldface are indistinguishable on the basis of design alone and the changes involved from Mogollon Red-on-brown to Three Circle Red-on-white are subtle and the distinction based more on the appearance of a thick white or buff slip rather than a significant shift in design. Relying on these inferences, I feel secure in placing Mimbres Boldface as post-dating the end dates for Mogollon Red-on-brown at a very minimum (with the knowledge that its actual start date would be somewhat later). This would be A.D. 788 to 803 based on the analysis of this type seen earlier or A.D. 783 if the structure (Pithouse D at the Twin Bridges site) had been built and burned in the same year. This provides an absolute oldest possible range for the type.

Perhaps also instructive is an examination of contexts where Mimbres Boldface occurs in relatively pure contexts independent of Mogollon Red-on-brown and Three Circle Red-on-white. The Harris site provides two contexts that fit these criteria. Both of these structures had only Mimbres Boldface in floor contact to the exclusion of Mogollon Red-on-brown and Three Circle Red-on-white (Haury 1986a:364-365). House 10 has a good group of cutting dates that confidently place its construction in A.D. 877 (Bannister et al. 1970:64) and House 15 has one clear cutting date of A.D. 861 (Bannister et al. 1970:64).

Without going into unwarranted detail here, the Wheatley Ridge data must be considered due to the reported ceramic data in Martin et al. (1949:192-193) and tree-ring dates in Bannister et al. (1970:59). The information are, at face value, contradictory to the data from Twin Bridges that produced the Mogollon Red-on-brown end dates. The Wheatley Ridge site excavations that provide the critical information have not been published other than a few specific types of information making it impossible to critically evaluate the contexts. House 4 at this site may be interpreted from a series of somewhat ambiguous tree-ring dates (noncutting dates of 780vv, 786vv, 841vv, 860vv, and one cutting date of 853r [Bannister et al. 1970:59]), to have been abandoned sometime after A.D. 860. Based on the bar chart provided by Martin et al. (1949:192-193), the structure has a ceramic assemblage composed of approximately 20 percent Three Circle Red-on-white and one percent Mogollon Red-on-brown, with no Mimbres Boldface in evidence. The lack of Mimbres Boldface in a context dating to this time period in the area would be unique, if the data could be accepted. Even ignoring the lack of Mimbres Boldface in this context for the moment, the value of 20 percent for Three Circle Red-on-white is far beyond the range anticipated from other sites with published data and comparable dating. I am more inclined to accept the well-reported data from Martin et al. (1949) for Twin Bridges than the bits and pieces of data from Wheatley Ridge. The problem may be nothing more than an error on the ceramic data table in Martin et al. (1949:192-193). Perhaps Mimbres Boldface really was present in structure 4. My guess is that there is an error, sample size problem, or misidentification of the pottery. Therefore, excluding this particular context from consideration, we are back to A.D. 783 to 803 as the period of time during which Mimbres Boldface could first makes its appearance on the scene.

The locations where direct associations of Mimbres Boldface and Hohokam pottery might be most expected to co-occur would include the Point of Pines area, and the site with the best data in this regard is Crooked Ridge Village (AZ W:10:15). Already cited in regard to the association of Gila Butte with Mogollon Red-on-brown, this site produced 52 sherds of Mimbres Boldface (Wheat 1954:179). The single best Gila Butte context, Pithouse 23, did not contain any intrusives other than Mogollon Red-on-brown; however, Mimbres Boldface does occur in Pithouse 19 in possible association with Snaketown Red-on-buff though if one were lacking in any ancillary dating information, it could just as easily be considered associated with Gila Butte or Sweetwater ceramics. Wheat (1954:177, 180) lists one Sweetwater Red-on-Gray and four Snaketown Red-on-buff in the floor fill of this structure; seven Sweetwater Red-on-Gray, four Snaketown Red-on-buff, two Gila

Butte Red-on-buff, nine Mimbres Boldface Black-on-white, and three Three Circle Red-on-white are reported from the fill. The fact that no Santa Cruz or Sacaton Red-on-buff sherds were recovered suggests, given the projected maximum antiquity possibilities for Mimbres Boldface, that it is most reasonable to assume that it was in fact associated with the Gila Butte Red-on-buff in this case. With the date range postulated above for Mimbres Boldface, and the range thus far apparent for Gila Butte Red-on-buff, it would be anticipated that Mimbres Boldface would overlap Gila Butte Red-on-buff on the early end of its distribution and extend beyond it into the Santa Cruz and Sacaton phases. Presumably, its frequency might be expected to increase as well if it was only starting when Gila Butte Red-on-buff was shifting into Santa Cruz Red-on-buff. This inference is supported by the high relative frequencies of Mimbres Boldface in Feature 21 (42 sherds) which has the most Santa Cruz Red-on-buff (6 sherds) of any structure at the site. Wheat (1954:58) reports that Pithouse 21 was severely rodent disturbed and unreliable for sherd analyses, but the mixing is easily taken into consideration here as it would be unlikely for the Mimbres sherds to have been associated with a Sweetwater occupation, nor are they likely to be with a Snaketown, Gila Butte, or Sacaton occupation as no sherds of these types were recovered. No absolute dates are available for the Crooked Ridge Village contexts.

Negative Evidence: Tree-Ring-Dated Ceramics Not Found in Association with Gila Butte Red-on-buff

Out of the seemingly thousands of Southwestern decorated ceramic types, there are four types of interest here that date to the A.D. 700s and A.D. 800s that could be expected to co-occur with Gila Butte Red-on-buff, since they are found in high enough frequencies either as tradewares in the areas of concern, or are common in areas where Gila Butte Red-on-buff occurs as an intrusive type. Two of these have been previously discussed as postdating Gila Butte Red-on-buff: Kiatuthlana Black-on-white and its companion type in the Forestdale area Corduroy Black-on-white. Kana-a Black-on-white has already been mentioned in regard to its occurrence at the Deer Creek site. The remaining type, clearly following a different distribution from Gila Butte Red-on-buff is Deadman's Black-on-red. Each type is briefly considered.

Kana-a Black-on-white. The most recent evaluations of this type consistently place it much younger than the dates published by Breternitz (1966:79) and Haury (1976:328). Breternitz places it at A.D. 725 to 950, appearing as a trade product about A.D. 775; but very few of the contexts cited by Breternitz fit the contextual standards applied here. Downum (1988:481-482) provides convincing evidence that the type is present in the Flagstaff area from A.D. 834 to 1052 (with the latter date being the possible type Wepo Black-on-white). He notes that the data are not available from the Flagstaff area for convincingly arguing a start date for the type other than to say that it postdates A.D. 688 based on the Cinder Park data (noncutting dates from A.D. 683 to 688 with a complete lack of Kana-a Black-on-white). The end date is also subject to question, although one can argue that because the A.D. 1052 date applies to the possible Wepo type (a late variant of Kana-a), Kana-a Black-on-white itself probably predates this time period. This would place the end date in the period between A.D. 964 and 1052 if we ignore house uselife. Of course, the important issue in this study is the early end. If we can pin down the start date for Kana-a Black-on-white as it applies to Deer Creek, and the Gila Butte Red-on-buff at Deer Creek is shown to be related, or conversely unrelated to it, then important dating information will be available for that site. Jeff Dean (personal communication 1990) informs me that a series of sites in the Kayenta area have helped to pin this down. Apparently, sites dating to A.D. 805 have Lino Black-on-gray but not Kana-a Black-on-white, whereas sites dating between A.D. 805 and 850 have both types in association. Dean therefore places the end date for Lino Black-on-gray and the start date for Kana-a Black-on-white around A.D. 835. This would certainly accord well with Downum's (1988:481) early date of 834. Also supporting the 805 to 850 transition is site NA 88300 which produced a context tree-ring dated to A.D. 825 containing a bowl with a Kana-a Black-on-white interior design and a Lino Black-on-gray exterior. Such cases are not unusual for this time period according to Dean (personal communication 1990).

Despite an extensive literature and collections search, no cases of positive association between Kana-a Black-on-white and Gila Butte Red-on-buff were identified in this study. Cremation 3 at Ushklish may, however, represent such a case given the ceramic composition of the site. Included in this cremation were a Kana-a Black-on-white bowl and a buffware jar that cannot be identified beyond the label of "Gila Butte or Santa Cruz" red-on-buff based on our reanalysis. Given the virtual lack of Santa Cruz Red-on-buff in the assemblage labeled as such in the ASM collections from the site, it may be questioned as to whether an occupation dating to this phase actually occurred within the excavated portions. If not, this vessel would be Gila Butte Red-on-buff by default. It would not be unusual, however, to see Kana-a Black-on-white in association with Santa Cruz Red-on-buff -- several such strong associations were encountered in this study.

Kiatuthlana Black-on-white and Corduroy Black-on-white. These two types have been discussed earlier as probably dating between A.D. 850 and 950. The mutually exclusive distribution of Gila Butte Red-on-buff and these types at East Fork and Buh bi laa has already been commented on. At Crooked Ridge Village, Feature 21, which has definite mixing with an easily separated late component, contains 2 Kiatuthlana Black-on-white sherds in possible association with 42 Mimbres Boldface Black-on-white and 6 Santa Cruz Red-on-buff sherds (Wheat 1954:177, 180). No Kiatuthlana Black-on-white is present in association with the Gila Butte Red-on-buff sherds at the site.

Deadman's Black-on-Red. This widely traded type is indigenous to the Flagstaff area but has often been recovered in the Phoenix Basin. It appears to comfortably postdate Gila Butte Red-on-buff. It shows up consistently in Sacaton associations at Snaketown (Haury 1976:328, Figure 16.3; personal analysis of the Snaketown collections) and Las Colinas (Beckwith 1988:241-244). It is dated by Breternitz (1966:73) at A.D. 775 to 1066 (1067 is now the accepted date for the principal Sunset crater eruption rather than Breternitz's 1066 date). Downum (1988:491) places the type from A.D. 760 to 1114. Consideration of the contexts involved reveals only very weak evidence in support of a pre-A.D. 865 date for the type. The data are limited to individual sherds on pithouse floors within multicomponent sites and Downum (personal communication 1990) notes that the type is easily confused with Abajo Red-on-orange, a type that dates to the A.D. 700s and early 800s from the San Juan area. There is very weak evidence--conflicting ceramic counts from a somewhat ambiguous context--for the post-A.D. 1066 date (see Downum 1988:403-407). Therefore, a date range of A.D. 865 to 1067 is considered most appropriate. This is more in keeping with Breternitz et al. (1974) who place it at A.D. 800 to 1000. To my knowledge, this type has not been found in association with Santa Cruz Red-on-buff or Gila Butte Red-on-buff, possibly indicating that either it was not being produced prior to about A.D. 900 to 950, or that it did not become widely traded until this time. Either possibility limits the effectiveness of the type as negative evidence in this study except in a broad collective sense.

Haury's placement of Cremation 6G:3 in the Santa Cruz phase (Haury 1965:Plate XXXII), which contained a Deadman's Black-on-red bowl would seem to contradict these statements, but elsewhere in the report (Haury 1965:Plate CXLVI*a*), the small flare-rim buffware bowl from the cremation is labeled as Sacaton Red-on-buff. Additional problems were encountered when trying to track down other artifacts from this cremation and its dating must, unfortunately, be considered open to debate.

Discussion

Table 24.7 summarizes the date ranges identified for the pottery types discussed in this section. Table 24.8 summarizes the cases of cross-dating discussed here where intrusive ceramic types are involved. Taken with the direct tree-ring data from Buh bi laa and East Fork, the following interpretations can be made regarding the placement of Gila Butte Red-on-buff pottery. The data from the Buh bi laa site taken in conjunction with East Fork indicate that Gila Butte was present at the abandonment of structure 14a at Buh bi laa sometime after the latest noncutting date of A.D. 779 and prior to A.D. 850-884 when Kiatuthlana Black-on-white and Santa Cruz Red-on-buff first appear. The East Fork data also suggest that Gila Butte Red-on-buff was still in use in the period between the A.D. 830s and A.D. 850s. The best guess end date for Gila Butte Red-on-buff is thus set from these sites between A.D. 850 and 885. The early end for the type is, however, still left open. The A.D. 779 date is the latest noncutting date from the most secure Gila Butte context at Buh bi laa and all that can be really said with certainty is that the true date for this vessel would be sometime after this date -- there is no measure of how early this context actually dates.

The possible association of Gila Butte Red-on-buff with Mimbres Boldface Black-on-white at Crooked Ridge Village supports a post-A.D. 783 date for Gila Butte. The Mogollon Red-on-brown data from Snaketown and Crooked Ridge Village help in regard to the early end of the spectrum. With its relatively tight and early date range of A.D. 746-803, Mogollon Red-on-brown indicates that Gila Butte Red-on-buff was on the scene prior to A.D. 803 (assuming no transport time). How much farther back is difficult to ascertain. The association with White Mound Black-on-white at Henderson, Ushklish, and the Bear Ruin all suggest that it could go as far back as A.D. 700; but the data could just as easily support a date closer to A.D. 800. The comments of Sayles in regard to San Simon village are tantalizing as he indicates that Mogollon Red-on-brown was found most commonly with Gila Butte and Snaketown red-on-buff. If true, this would indicate that the transition between these two types occurred sometime between A.D. 746 and 803. Unfortunately, without the original field data, I have been unable to verify his statements.

Table 24.7. Date ranges in this study for ceramics used in cross-dating Gila Butte Red-on-buff. All dates are in years A.D.

Ceramic Type	Date Range
Lino Black-on-gray	600-835
Kana-a Black-on-white	835-(?964-1052)
White Mound Black-on-white	700-875
Kiatuthlana Black-on-white	850-950
Corduroy Black-on-white	850-950
Floyd Black-on-gray	775-1000
Mogollon Red-on-brown	736-803
Mimbres Boldface Black-on-white	(?783-803)-927
Deadman's Black-on-red	865-1067

The strongest negative data are the indications that Kiatuthlana Black-on-white, Corduroy Black-on-white, and Deadman's Black-on-red postdate Gila Butte. This suggests that Gila Butte Red-on-buff ends sometime prior to the late A.D. 800s. In addition, it was noted that Lino Black-on-gray may only rarely occur in association with Gila Butte (perhaps indicating the type is at its terminal stages). Therefore, prior to a consideration of the radiometric and archaeomagnetic data, we are able to reasonably argue for Gila Butte Red-on-buff being present from A.D. 800 to 850/885 with the early end as yet poorly defined.

THE DEER CREEK SITE AND KANA-A BLACK-ON-WHITE

At the start of this chapter, it was noted that the Deer Creek site produced contexts containing both Gila Butte Red-on-buff and Kana-a Black-on-white. At a superficial level, the two types appeared associated at the site, particularly given the dominance of Gila Butte Red-on-buff among the buffware types found and the fact that Kana-a was the only identifiable black-on-white type. Because of the important implications for dating the site should this association prove valid, a contextual investigation of the site ceramic assemblage was initiated. Chapter 11, Volume 2 outlines the basic procedures involved in this approach and Victoria Clark details the investigation as it applied to the Tusayan whitewares at Deer Creek in Chapter 12, Volume 2. Clark reports that despite what at first appeared to be good associations, there are no cases at the site where one can be confident that Kana-a Black-on-white is definitely associated with the Gila Butte phase occupation of the site. Perhaps the strongest evidence lies in the unidentified Tusayan whiteware sherds recovered from several of the crematoria, as the crematoria are believed to date to the Gila Butte phase. Countering this argument is the possibility that some of the unidentified Tusayan whitewares are actually Lino Black-on-gray. No definite Kana-a sherds were found in the crematoria.

Although I agree with Clark's conclusions regarding the ambiguous nature of the Deer Creek evidence, one additional approach not considered by her requires attention if we are to be complete in our presentation. Clark notes that there is spatial patterning in the locations of unincised and incised Gila Butte Red-on-buff sherds at the site and that this is probably related to the portion of the Gila Butte phase represented. Earlier

Table 24.8. Summary of cross-dating cases utilized in this analysis.

Buh bi la (NA17,903 [NAU]) and East Fork (NA17,962 [NAU]): Santa Cruz Red-on-buff associated with Corduroy Black-on-white and Kiatuthlana Black-on-white; Gila Butte Red-on-buff *not* associated with these types. Tree-ring dates place transition from Gila Butte to Santa Cruz Red-on-buff to between A.D. 850 and 884.

Ushklish (AZ O:15:31 [ASM]) Feature 1: Gila Butte Red-on-buff associated with Lino Black-on-gray and White Mound Black-on-white.

Crooked Ridge Village (AZ W:10:15 [ASM]) Pithouse Feature 23: Gila Butte Red-on-buff associated with Mogollon Red-on-brown; possible association of Gila Butte Red-on-buff with Mimbres Boldface Black-on-white in pithouse Feature 19. Kiatuthlana Black-on-white seen in association with Santa Cruz Red-on-buff, but not with Gila Butte Red-on-buff.

Snaketown (AZ U:13:1 [ASM]) Pithouse 9F:8: Gila Butte Red-on-buff found in association with Mogollon Red-on-brown.

Henderson site: Two sherds of White Mound Black-on-white are reported by Weed and Ward (1970:6) to be associated with Gila Butte Red-on-buff. Lack of contextual data on the cases make the association subject to question.

Bear Ruin (AZ P:16:1 [ASM]) House 11: Gila Butte Red-on-buff found in association with White Mound Black-on-white.

Verde Terrace site (AZ N:4:23 [ASM]) Feature 3: One sherd of "Snaketown/Gila Butte Red-on-buff" (Hovezak et al. 1989:38-42) found in association with Floyd Black-on-gray. Calibrated averaged radiocarbon dates (Stuiver and Becker 1986 calibration) for the structure produce a span of A.D. 780 to 978.

contexts are believed to have higher frequencies of incising. There is some spatial correlation between the unidentified Tusayan whitewares and the locations with the highest percentages of incised Gila Butte Red-on-buff. Likewise, Kana-a Black-on-white sherds are somewhat spatially correlated to the distribution of unincised Gila Butte Red-on-buff and the few Santa Cruz and Sacaton red-on-buff sherds at the site. One hypothesis to account for this patterning is that the unidentified Tusayan whitewares are primarily Lino Black-on-gray that is associated with an early Gila Butte occupation of the site. The Kana-a Black-on-white sherds may then be related to a late Gila Butte/early Santa Cruz occupation. Some of the Kana-a Black-on-white could also relate to the Sacaton phase reoccupation of the northern portion of the site. Kana-a Black-on-white is expected on the basis of data from other regions to be found in association with Santa Cruz and Sacaton red-on-buff pottery. Indeed, at the Rooted site (AZ O:15:92), Santa Cruz Red-on-buff, Sacaton Red-on-buff, and Kana-a Black-on-white ceramics were all found together in the fill of pithouse Feature 14. The dating of Gila Butte Red-on-buff cited above corresponds well to such a conclusion. Kana-a would be expected in contexts dating to the latter part of the Gila Butte phase. Unfortunately, with the Deer Creek data, we cannot offer conclusive evidence that this is in fact the case.

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CHAPTER 25

TEMPORAL ISSUES IN TONTO BASIN PREHISTORY: THE RYE CREEK CHRONOLOGY

Mark D. Elson

Temporal patterns within the Tonto Basin have been used to argue a wide variety of cultural and developmental issues. In many respects, chronological considerations lie at the core of the numerous, heatedly debated scenarios proposed for the settlement of the Tonto Basin and the cultural affiliation of its inhabitants. Yet many of these arguments are based on very little hard data: only a comparatively small number of sites actually have been excavated, and these have yielded a corresponding small number of absolute dates. No absolute dates were recovered from the general Tonto Basin vicinity prior to the Miami Wash Project in the mid-1970s (Doyel 1978). Within the Tonto Basin proper no absolute dates were recovered until the early 1980s (Ciolek-Torrello 1987; Elson and Sullivan 1981; Reid 1982b; Rice 1985).

Therefore, for most of its archaeological history the chronology and culture history of the Tonto Basin have been primarily based on the ceramic cross-dating of a few intrusive sherds, largely from surface contexts. The lack of a chronologically sound culture history is due to several factors: a general dearth of unambiguous absolute dates; a reliance on the low frequency of decorated ceramics for dating with little regard for archaeological context; and the use of cultural systematics from neighboring areas as a basis for interpreting the archaeological data. Our resultant understanding of the Tonto Basin temporal frame, and therefore the nature of its cultural patterns, are far from complete. For these reasons the absolute and relative dating of the Rye Creek sites was considered to be of primary importance.

This chapter presents a critical review of chronometric dating within the Tonto Basin. The relative cross-dating of the sites based on the intrusive decorated ceramic assemblage has been presented in Chapter 12, Volume 2. These data are used in conjunction with the absolute chronometric data to discuss the chronology of the Rye Creek sites and the Tonto Basin in general.

CHRONOLOGICAL ISSUES

Chronology is a particularly critical issue in resolving two primary problems that form the basis for much of the debate on Tonto Basin culture history. The first concerns the nature and timing of the initial settlement of the Tonto Basin. The second pertains to the nature and timing of what has been defined as the Salado occupation. These problems are related intrinsically to a third extremely influential factor in interpretations of Tonto Basin prehistory: the borrowing and application of Phoenix Basin Hohokam systematics with their attendant temporal and cultural implications to Tonto Basin prehistory. Due to this, for example, the Classic period in the Tonto Basin, with its relatively well-established cultural, architectural, and artifactual changes, is assumed to be linked temporally and organizationally to the Classic period transition in the Hohokam area. Yet very few absolute dates have been recovered that actually document the time of these changes. Similar temporal and cultural relationships between the Phoenix and Tonto basins have been posited for the Colonial and Sedentary periods as well. Several illustrations of these problems and the use of temporal data in the interpretation of Tonto Basin prehistory are presented below.

In the traditional scenario (Gladwin and Gladwin 1935; Haury 1932), the Tonto Basin was first settled during the Colonial period by Hohokam migrants from areas along the Salt and Gila rivers sometime between A.D. 500 and 900. At present the Colonial period generally is dated between A.D. 750 and 950 (Dean 1990;

Wallace and Craig 1988). Recently this theory has been modified to take into account a small indigenous population as indicated by the discovery of both Archaic period remains and Pioneer period ceramics within the Tonto Basin, although, the Colonial period expansion and Hohokam influence are still believed to be significant (Ciolek-Torrello et al. 1990; Doyel 1978; Wood 1985, 1989b). As discussed in Chapter 3, the Hohokam migration theory is based primarily on data from Haury's (1932) excavation of Roosevelt 9:6, by all appearances a Colonial period (Gila Butte and Santa Cruz phase) Hohokam pithouse village within the Lower Tonto Basin. Roosevelt 9:6 may, however, be the exception rather than the rule; the only other excavated sites from this period, Ushklish (Haas 1971a) and Deer Creek (see Chapter 7, Volume 1), while containing small quantities of Colonial period ceramics, do not exhibit an overwhelming abundance of Hohokam-like traits. Additional evidence within the Tonto Basin for a Colonial period migration is relatively scarce, consisting of a few Gila Butte and Santa Cruz red-on-buff sherds scattered over a small number of sites. Therefore, whether Roosevelt 9:6 represents a typical site of this time period is basically unknown. Alternative views, decidedly in the minority, do not posit a significant Hohokam migration. Instead, other researchers suggest that the Tonto Basin initially was occupied by an indigenous people who simply adopted Hohokam traits (Fuller et al. 1976:193) or by Mogollon-related settlers who remained culturally distinct (Pilles 1976; Whittlesey and Reid 1982a).

As a further component of the traditional Tonto Basin scenario, Gladwin and Gladwin (1935) used temporal data (specifically the perceived lack of Sacaton Red-on-buff ceramics) to argue for an occupational hiatus during the Sacaton phase, A.D. 950 to 1150. This argument was critical to the Gladwin model in which the Tonto Basin was abandoned by the Hohokam sometime prior to A.D. 900 or 950. Gladwin and Gladwin envisioned the Salado as an intrusive group unrelated to the Hohokam, who moved south from the Little Colorado River and Anasazi areas into an unoccupied Tonto Basin around A.D. 1100 or 1150. Although a Sacaton phase hiatus is no longer believed to be present in the Tonto Basin, various permutations on this theme have been proposed by other researchers. These involve some sort of population movement from the north or east into the Tonto Basin between A.D. 1100-1300, combined with the internal growth of an indigenous Mogollon or pueblo-related population (Ciolek-Torrello 1987; Haury 1945, 1976; Pilles 1976; Reid 1982b; Whittlesey and Reid 1982a).

In contrast to the Salado intrusion or Salado-as-Mogollon theories, however, the presence of material dating to the Sacaton phase (sometimes found to be stratigraphically beneath Salado material) has been alternatively used to argue for cultural and perhaps ethnic continuity between the Hohokam and Salado (Doyel 1978; Hohmann and Kelley 1988; Rice 1985; Wood 1985, 1989b; Wood and McAllister 1982). In fact, Doyel (1978:194), based on a single archaeomagetic date of A.D. 1180 ± 39 from a site containing what was perceived as a "transitional" artifact assemblage, even went so far as to define a new phase, the Miami phase, dating between A.D. 1150 and 1200. By doing this Doyel attempted to formalize (and therefore legitimize) the Hohokam-to-Salado cultural continuum by essentially bridging the gap between what had previously been considered to be two unrelated cultures. A corresponding transitional phase, the Hardt phase, similarly has been defined for the Upper Tonto Basin (Wood and McAllister 1984; Wood et al. 1981).

These are among the most pressing research issues that deal directly with chronology and temporal control in the Tonto Basin. Questions concerning local, intraregional settlement systems (in the Upper Tonto Basin or more specifically, the Rye Creek drainage area), also are dependent on chronometric data and are severely understudied. The Rye Creek data, situated in the Upper Tonto Basin and limited to the excavation of 13 sites, can only inform upon portions of these issues. The recovery of 28 absolute dates from seven sites within the Rye Creek Project area represents an increase of almost 75 percent in the number of total Tonto Basin absolute dates, and more than doubles the number of dates recovered from the Upper Tonto Basin.

CHRONOMETRIC DATABASE AND METHODOLOGICAL CONSIDERATIONS

Sixty-four absolute dates have now been recovered from 25 sites within the Tonto Basin. These are presented by project and by dating method in Table 25.1. As can be seen from this table, 70.3 percent of the recovered absolute dates are from archaeomagnetic samples, while 29.7 percent are from radiocarbon samples.

Furthermore, 43 (67.2 percent) of the dates are from sites within the Upper Tonto Basin (Ord Mine and Rye Creek projects), while only 21 (32.8 percent) are from Lower Basin sites (Ash Creek and Miami Wash projects). For purposes of this discussion, the Miami Wash Project, which is actually in the Globe-Miami area approximately 25 kilometers south of the Tonto Basin, is considered to be within the Lower Tonto Basin. A further breakdown of these data indicates that the Upper Basin contains more absolutely dated contexts; 15 sites have been dated through the analysis of 31 (72.1 percent) archaeomagnetic samples and 12 (27.9 percent) radiocarbon samples. In the Lower Basin 10 sites have been absolutely dated through the analysis of 14 (66.7 percent) archaeomagnetic samples and 7 (33.3 percent) radiocarbon samples.

None of the tree-ring samples from the Tonto Basin submitted for analysis have been datable, including seven juniper samples from the Rye Creek Project (each containing more than the 30 requisite rings needed for analysis). The lack of datable tree-ring specimens is due both to the species being dated, which in the Tonto Basin is generally juniper, and to climatic conditions within the Basin (and southern Arizona in general), which causes the annual generation of tree rings to be somewhat haphazard and dependent on localized conditions. As a result, Tonto Basin ring patterns, particularly from juniper, cannot be matched with any known dendrochronological sequence (Jeffrey Dean, personal communication 1990).

Table 25.1. Numbers and types of absolute dates recovered from sites within the Tonto Basin and Globe-Miami areas.

Project	Number of sites dated	Number of Archaeomagnetic dates	Number of Radiocarbon dates	Total number of dates (%)	Source
Miami Wash	3	5	-	5 (7.8)	Doyel 1978
Ash Creek	7	9	7	16 (25.0)	Rice 1985
Ord Mine	8	3	12	15 (23.4)	Ciolek-Torrello 1987
Rye Creek	7	28	-	28 (43.8)	See Appendix D
Total (%)	25	45 (70.3)	19 (29.7)	64 (100.0)	

Note: Does not include dates that could not be interpreted due to large Alpha-95 dispersions for archaeomagnetic samples (n=3), or large standard deviations for radiocarbon samples (n=2).

Radiocarbon Dating

Nineteen radiocarbon samples from 14 sites have been recovered. Twelve of these samples are from the Upper Basin (8 sites) and seven samples are from the Lower Basin (6 sites). Data on the radiocarbon samples, including information on the archaeological context of the sample and associated site and feature diagnostic ceramics, are presented in Tables 25.2 and 25.3. The dates presented for these samples have been standardized at one and two standard deviations using the CALIB computer program prepared by the University of Washington Isotope Laboratory (Stuiver and Reimer 1987). The CALIB program relates radiocarbon years (B.P.) to calendar years (A.D. or B.C.) through a calibration curve based on dendrochronologically dated wood specimens and their associated radiocarbon dates (Stuiver and Becker 1986).

Tables 25.2 and 25.3 indicate a general agreement (70 percent) between the radiocarbon date and the dates that can be derived from the diagnostic ceramic assemblages. This agreement, however, is much stronger on dates from the Ash Creek Project (Rice 1985) in comparison to dates from the Ord Mine Project (Ciolek-Torrello 1987). There is at least partial overlap between the radiocarbon and ceramic dates for all of the Ash Creek contexts at two standard deviations, whereas of the 10 dates with associated ceramics from Ord Mine, fully 50 percent do not agree with the ceramic dates. If one standard deviation is used, then a single Ash Creek context and six of the Ord Mine contexts are out of the ceramic range. It is important to note, however, that for the most part the ceramic ranges presented here are for the entire site and not for the specific context being dated. This is due to the fact that the Ord Mine sites contained very few decorated ceramics (less than 70 out of more than 20,000 sherds) and even fewer temporally diagnostic ceramics (around 45) spread out over 10 sites (Bruder and Ciolek-Torrello 1987:93). Data on the significantly greater number of diagnostic ceramics from the Ash Creek Project (Hohmann 1985; Woodward et al. 1985) are not presented in a manner that is easily accessible for feature-by-feature analysis. All of the buffwares are lumped together regardless of type, as are all of the whitewares. Only the Roosevelt redwares (Salado polychromes) and the reconstructible vessel assemblages are consistently broken out by type. As a result, the relationship of the diagnostic ceramics to the event being dated is unclear. This then raises the difficult question of which date is more likely to be accurate, the radiocarbon date or the ceramic date? A closer examination of the database provides at least some answers.

The discrepancies in the Ord Mine radiocarbon data appear not to be due to the "old wood problem," as Ciolek-Torrello (1987:343) attests, but instead to contextual sampling problems and the lack of attention to archaeological formation processes. This is an extremely common problem in archaeological dating, and one that significantly inhibits effective chronology building and the subsequent interpretation of chronometric data

Table 25.2. Radiocarbon dates recovered from the Ash Creek Project (Rice 1985). Standardized through CALIB calibration program (Stuiver and Reiner 1987).

Site (ASU)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Type	Sample Context	95% (63%) Date Range (A.D.)	Primary Ceramic Date (Range)	Feature Specific Ceramics
AZ U:3:44 (ASU)	2 Pithouses 1 Masonry room	Pithouse 2 (F2)	?	Roof beam?	Floor	600-990 (660-890)	850-1150	Unknown
AZ U:3:46 (ASU)	3 Pithouses	Roasting pit (F3)	?	Composite?	Fill	1030-1280 (1157-1258)	950-1150 (850-1150)	Unknown
AZ U:3:49 (ASU)	6 Masonry room pueblo	Room 3 Hearth (F22)	?	?	Fill	1280-1430 (1285-1413)	1250-1400 (1150-1450)	Floor/Floor fill: Gila Poly., Pinto Poly., Tonto Poly.
AZ U:3:50 (ASU)	3 Pithouses 5 Masonry/ Adobe rooms	Roasting pit (F19)	?	?	Fill	1297-1441 (1327-1427)	950-1400 (900-1625)	Fill: Sikyatki Poly.
		Roasting pit (F67)	?	?	Fill	1280-1420 (1284-1405)	"	Unknown
AZ U:3:51 (ASU)	3 Pithouses	Pithouse 1 (F7)	?	Burned Beam?	Floor	1000-1220 (1022-1186)	950-1150 (850-1400)	Floor: Sacaton Red-on-buff
AZ U:3:86 (ASU)	2 Pitrooms	Roasting Pit (F5)	?	?	Fill	1316-1449 (1333-1436)	1250-1400	Fill: Pinto Poly, Salado Red Corrugated

Table 25.3. Radiocarbon dates recovered from the Ord Mine Project (Ciolek-Torrello 1987). Standardized through CALIB calibration program (Stuiver and Reiner 1987).

Site (ASM)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Type	Sample Context	95% (63%) Date Range (A.D.)	Primary Ceramic Date (Range)	Feature Specific Ceramics
AZ O:15:44	4-5 room masonry compound	Room 1 Hearth (F9)	UGA4562	Composite?	Fill	434-801 (582-684)	1100-1400 (1100-Apache)	Floor/Floor fill: Salado Red Corrugated
		Extramural hearth (F3)	UGA4561	Composite	Fill	778-1160 (894-1025)	"	Unknown
		Roasting pit (F12)	UGA4563	?	Fill	1280-1450 (1299-1429)	"	Unknown
		Roasting pit (F1)	UGA4560	Charred log	Fill	1650-1955 (1672-1955)	"	Fill: St. John's Polychrome, Apache Plain
AZ O:15:45	3 room masonry compound	Roasting pit (F4)	UGA4564	Composite	Fill	1430-1955 (1446-1650)	1100-1325 (1100-Apache)	Unknown
AZ O:15:76	1 masonry room	Room 1	UGA4565	?	Floor	1329-1640 (1417-1488)	850-1400?	None
AZ O:15:84	1-2 masonry rooms	Room 1a	UGA4566	"Presumed lintel"	Fill	599-888 (646-775)	1100-1300	Fill: Pinto Polychrome
AZ O:15:86	Isolated roasting midden	--	UGA4567	Charcoal piece?	Fill	1529-1955 (1654-1955)	None	None
AZ O:15:88	3 masonry rooms	Room 1	UGA4568	Composite?	Floor	581-871 (643-771)	1250-1300	None
		Room 1	A-3152 (UA)	?	Roof fall	1280-1650 (1325-1479)	"	None
AZ U:3:49	1 masonry room	Room 1	UGA4569	Composite?	Floor	(780-1188 (899-1147)	1100-1200?	None
AZ U:3:58	1 masonry room	Roasting pit (F3)	UGA4570	?	Fill	778-1153 (893-1020)	None	None

(Dean 1978, 1990; Schiffer 1986). In cases where contextual information could be obtained, the wood samples that Ciolek-Torrello submitted for dating analysis were primarily either composite samples, comprised of many different, and possibly unrelated charcoal bits, or from fill contexts, which may easily be unrelated to the occupation and use of the feature being dated. Of the eight samples where some information on the type of sample could be obtained (or inferred from descriptions of the feature fill), six of the samples, or 75 percent, appear to be composites. Information on sample type was not available for four additional samples. Given the dominant trend, these could easily be from composite collections as well. Similarly, out of the 12 total samples, only 17 percent (2) were from defined floor contexts (and one of these was probably a composite sample), and one was from the roof fall. The remaining nine samples, or 75 percent, were from fill contexts. Although these contexts possibly date the filling of a feature, they may or may not be related to the feature use. It should be noted, however, that seven of these were from roasting pit or hearth fill, which have a higher probability of being related to the use of the feature.

Similarly, although the relationship between the radiocarbon dates and the diagnostic ceramic assemblages appears to be stronger in the Ash Creek data, this may simply be fortuitous. As with the Ord Mine samples, the majority of the Ash Creek samples were from fill contexts. Here, however, all of the samples from structures were from floor contexts, while the fill contexts were from hearths or roasting pits, which, depending on the nature of the sample and where it is taken, may accurately date the feature. Although information on the type of sample was not specifically presented, based on the feature descriptions the two floor samples are inferred to be from burned beams, while at least one of the roasting pit samples appears to be a composite.

One additional sample recovered from the Tonto Basin was not included in the above tables. This was collected by Jeter (1978) at site AZ U:3:33 on the Reno-Park Creek Project in the Lower Basin. The sample was taken from the profile of a trench cut through what was thought to be a pithouse. The analyzed date (A.D. 1480-1955 at two standard deviations) is so anomalous in regard to the associated site and feature ceramic assemblage (A.D. 850-1150: Santa Cruz and Sacaton red-on-buff) that the assigned context (a post or beam within the house) can be questioned. In fact, given the date, it appears most likely that a burned root was sampled.

As discussed by Dean (1978, 1990) and Schiffer (1986), the discrepancies in many of the above cases can be explained through two processes, both representative of major problems in chronometric sample selection and archaeological dating. First, there is a poor relationship between the event being dated (E_d) (e.g., the trash filling of a feature) and the target event (E_t) (e.g., the use of the feature) (Dean 1978:226-228). Second, the dated sample was recovered from a poor or unknown archaeological context. That is, even if the radiocarbon dates agree with the ceramic dates, as they do in most of the above cases, the dating of the use of a feature through a sample from the fill, or from a poor context, is problematic. This problem is magnified when no additional diagnostic material are recovered, such as decorated ceramics or additional absolute dates, since there is no comparative basis for accepting or rejecting the recovered date. This is particularly true for composite samples, which have been one of the most common sample types submitted for analysis within the Tonto Basin. The use of composite samples, which in effect produces an average date based on the individual dates from each charcoal piece, can significantly remove the E_d from the E_t. The same is true if "old wood" is used, either procured by prehistoric scavenging or from the sampling of a long-lived species such as juniper, pinyon pine, or mesquite. In these species if the inner, and long dead, "heartwood" is dated rather than the outer growing "sapwood" (Miksicek 1986:372-375), significant chronometric errors can occur. All of these problems may be causing the discrepancies in the dates presented in Tables 25.2 and 25.3. Therefore, it appears most likely, given the information on archaeological context and sample type, that the dates that are obviously aberrant are primarily due to imprudent sample selection by the archaeologist and not to problems with chronometric techniques or prehistoric behavioral factors, such as the scavenging of old wood.

No radiocarbon samples were submitted for analysis from the Rye Creek Project. Although potential radiocarbon samples were collected in the field, some of which were recovered from sites or features that were otherwise not dated, the samples were found through later analysis to be either in poor or ambiguous archaeological context (such as fill or composite samples), or botanically unsuitable for dating purposes. All potential radiocarbon samples were submitted to ethnobotanist Charles Miksicek for evaluation prior to submission. Miksicek found that the majority of samples, which were primarily from juniper, pinyon, or mesquite, were either composed of old wood or of inner heartwood. These samples were therefore unsuitable for radiocarbon analysis because the date would reflect an unknown time when the tree was still growing (in the case of the heartwood) or when it died, rather than when the wood was used. This is particularly true for long-lived species such as these, where the error factor can be in the magnitude of hundreds of years. Unfortunately, no short-lived or annual species (such as canotia, arrowweed, or agricultural cultigens, for example) were recovered from good archaeological contexts or in sufficient quantities for standard (non-accelerator) analysis.

Archaeomagnetic Dating

The process of archaeomagnetic dating is relatively well understood, and has been described in detail (Deaver 1989; Eighmy and Doyel 1987; Eighmy and McGuire 1989; Sternberg 1982; Wolfman 1984). Excluding the Rye Creek archaeomagnetic data, 17 archaeomagnetic dates from 11 sites have been recovered. Two sites and three samples are from the Upper Tonto Basin, while the remaining nine sites and 14 samples are from the Lower Tonto Basin and Globe-Miami area. These data are presented in Tables 25.4, 25.5, and 25.6. The

Miami Wash samples, shown in Table 25.4, were collected and dated by DuBois in 1976 based on his unpublished (and therefore unevaluated) master curve. These recently have been reanalyzed by Eighmy and Doyel (1987), who plotted their likely pole positions on an updated Southwest Master Curve (SWCV386). Both the reanalyzed dates and the original dates given by Dubois are shown in this table, although the reanalyzed dates are considered to be more accurate.

Table 25.4. Archaeomagnetic dates recovered from the Miami Wash Project (Doyel 1978). Dates are corrected by Eighmy and Doyel (1987).

Site (ASM)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Context	95% Date Range (A.D.)	Primary Ceramic Date (Range)	Feature Specific Ceramics
AZ V:9:56	1 pithouse 2 pitrooms	Pithouse 1	947	Hearth	950-1010* 1350-1425 (DuBois:1090±25)	750-1200 1250-1400	Floor: Pinto Black-on-red
		Pitroom 3	946	Hearth	950-1015* 1350-1425+ (DuBois:1350±23)	"	Unknown
		Pitroom 1	945	Hearth	935-1000* 1425+ (DuBois:1420±32)	"	Floor: Pinto Polychrome
AZ V:9:57	8 room masonry compound; 2 pithouses	Room 6	948	Hearth	1015-1310 (DuBois:1180±39)	750-1400	Floor: Snowflake Black-on-white
AZ V:9:59	2 pitrooms	Room 1	951	Hearth	1325-1375 (DuBois:1380±24)	1250-1400	Floor: Tonto Polychrome, Gila Polychrome

*Considered to be the most plausible option based on ceramic data and other information.

The Rye Creek Project has added an additional 28 samples from seven sites. All of the Rye Creek sites are within the Upper Tonto Basin, producing a total of 31 samples from 10 sites within the Upper Basin, and 45 samples from 19 sites overall. The Rye Creek data, which were collected and analyzed by William Deaver of the Arizona State Museum, are presented in Table 25.7.

As can be seen from these tables, there is a much greater concordance between the archaeomagnetic and ceramic dates than there is with the radiocarbon data. This is usually the case with archaeomagnetic data, which is considered to be a less problematic method than radiocarbon dating, and generally preferred by archaeologists when available. In fact, only two (4.4 percent) of the 45 recovered samples appear to be slightly anomalous. One is from Room 3 at site AZ O:15:88 on the Ord Mine Project. Because the A.D. 1250 to 1350 ceramic date at this site is based solely on the recovery of a single sherd (a Pinto Black-on-red sherd from the fill of Room 2), the archaeomagnetic date of A.D. 1000 to 1180 could easily be accurate for Room 3. This is particularly true given the fact that the two rooms are not contiguous and may have been built at separate times, and that the recovered diagnostic sherd was from a fill context. The other possible discrepancy is from Pithouse 2 at site AZ U:3:51 (ASU) on the Ash Creek Project. This sample from a hearth within the house produced a date of A.D. 1340 to 1450. Although the site ceramic assemblage possibly extends through A.D. 1400 (based on the presence of a few Casa Grande Red-on-buff and Salado Red Corrugated sherds, both of which are not overly well-dated types), the majority of the occupation is ceramically dated to A.D. 950 to 1150. Furthermore, a Sacaton Red-on-buff vessel was reported to be on the floor of the house. Therefore, the discrepancy in this date is difficult to explain, particularly because no additional information is given, such as the archaeomagnetic plot or the laboratory data report, which would allow for an evaluation of the sample.

As mentioned above, archaeomagnetic dating is considered to be less problematic and more accurate than radiocarbon dating, because the E_d (the last firing of the feature) is almost always related to the E_t (the use of the feature), and the overall method appears to be sound (Sternberg 1982; Wolfman 1984). Due to this, archaeomagnetic dates often are accepted uncritically by archaeologists, unless there are extreme discrepancies between the archaeomagnetic date and other chronological information, such as the ceramic date. Often these problems can be explained by the fact that the archaeomagnetic master curve is known to have looped back on itself, particularly between A.D. 700 to 900 and A.D. 1125 to 1300, and associated ceramic data or other chronological information can be used to pick the most likely date from several possibilities. There are, however, several additional and generally unrecognized potential problems with this method that need to be considered when interpreting archaeomagnetic data. These problems stem from the nature and number of the independently dated events that have been used to construct the master curve. As Eighmy and Klein (1988:i) state, in reference to the construction of the most recent Colorado State University Southwest Master Curve (SWCV588), "an archaeomagnetic date depends not only on the collected sample and curve summary, but also on the set of independently dated pole positions which go into making the curve." Furthermore, "curve building rests on the assumption that the most accurate curve is achieved by selecting only *well-dated*, *precise* pole positions" (Eighmy and Klein 1988:ii; emphasis added). Therefore, the nature of the independent dates is critical in the overall interpretation of the recovered archaeomagnetic sample.

Table 25.5. Archaeomagnetic dates recovered from the Ash Creek Project (Rice 1985).

Site (ASU)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Context	95% Date Range	Primary Ceramic Date (Range)	Feature Specific Ceramics
AZ U:3:46 (ASU)	3 Pithouses	Pithouse 1 (F1)	?	Hearth	1000-1270	950-1150 (850-1150)	Unknown
		Pithouse 2 (F7)	?	Hearth	700-960	"	Unknown
AZ U:3:49 (ASU)	6 Masonry room pueblo	Extramural hearth (F16)	?	Hearth	1000-1290	1250-1400 (1150-1450)	None
AZ U:3:50 (ASU)	3 Pithouses 5 Masonry/ adobe rooms	Pithouse 1 (F46)	?	Hearth	880-1100	950-1400 (900-1625)	Floor: Sacaton R/Bf
		Adobe Room 5 (F23)	?	Hearth	1000-1170	"	Floor: Jeddito Yellow?[1]
AZ U:3:51 (ASU)	3 Pithouses	Pithouse 1 (F7)	?	Hearth	940-1070	950-1150 (850-1400)	Floor: Sacaton R/Bf
		Pithouse 2 (F8)	?	Hearth	1340-1450	"	Floor: Sacaton R/Bf
AZ U:3:86 (ASU)	2 Pitrooms	Pitroom 2 (F2)	?	Hearth	1070-1360	1250-1400	Floor/floor fill: Gila Polychrome, Pinto Polychrome
AZ U:4:13 (ASU) Locus A	2 Pithouses	Pithouse 1 (F6)	?	Hearth	1000-1080	950-1150 (850-1150)	Unknown

[1] Two sherds of Jeddito Yellow ware on floor reported in text but not in ceramic tables.

Table 25.6. Archaeomagnetic dates recovered from the Ord Mine Project (Ciolek-Torrello 1987).

Site (ASM)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Context	95% Date Range	Primary Ceramic Date (Range)	Feature Specific Ceramics
AZ O:15:44	4-5 room masonry compound	Room 2	OM002	Hearth	970-1350	1100-1325	None
		Room 4	OM003	Hearth	1000-1200	"	Unknown
AZ O:15:88	3 masonry rooms	Room 3	OM005	Hearth	1000-1180	1250-1300	None

Table 25.7. Archaeomagnetic dates recovered from the Rye Creek Project.

Site (ASM)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Context	95% Date Range (A.D.)	Primary Ceramic Date (Range)	Feature Specific Ceramics[b]
AZ O:15:52	17 pithouses	Pithouse (F2)	DI010	Hearth	655-755	750-850 (650-1150)	None
		Pithouse (F11)	DI005	Hearth	705-865	"	Floor fill: Gila Butte Red-on-buff
		Pithouse (F13)	DI004	Hearth	650-755 900-940[a]	"	None
		Pithouse (F14)	DI002	Hearth	745-860	"	Floor fill: Snaketown Red-on-buff, Gila Butte Red-on-buff
		Pithouse (F18)	DI003	Hearth	705-860	"	Floor fill: Gila Butte Red-on-buff
		Pithouse (F21)	DI009	Hearth	700-860	"	Floor fill: Gila Butte Red-on-buff, Kana-a Black-on-white; Floor: Gila Butte Red-on-buff
		Pithouse (F22)	DI012	Hearth	705-860	"	Floor fill: Santa Cruz Red-on-buff
		Pithouse (F25)	DI008	Burned Floor	700-870	"	None
		Pithouse (F32)	DI001	Hearth	700-870	"	Floor fill: Snaketown Red-on-buff
		Pithouse (F59)	DI007	Hearth	630-695 910-1030[a] 1325-1485 1510-1645	"	Floor fill: Gila Butte Red-on-buff
		Pithouse (F65)	DI006	Hearth	655-765[a] 820-940	"	None
		Crematorium (F71)	DI011	Wall	725-855	"	Fill: Gila Butte Red-on-buff
AZ O:15:54	Masonry pueblo (disturbed)	Pitroom (F9)	DI028	Hearth	630-670 990-1130[a] 1145-1335	1125-1300 (850-1300)	Floor fill: Holbrook Black-on-white

Table 25.7. Continued.

Site (ASM)	Architecture	Feat. Type (Feature No.)	Sample No.	Sample Context	95% Date Range (A.D.)	Primary Ceramic Date (Range)	Feature Specific Ceramics[b]
AZ O:15:55	3 pithouses 2 pitrooms 2 masonry rooms	Masonry room (F1)	DI020	Hearth	630-685 920-1045 1160-1305[a]	1100-1300	None
		Pitroom (F5)	DI022	Hearth	630-680 980-1050 1060-1100 1155-1335[a]	"	Floor fill: Holbrook Black-on-white, Pinto Polychrome, St. Johns Black-on-red; Floor: St. Johns Black-on-red
		Pitroom (F6)	DI021	Hearth	630-680 925-1110 1150-1330[a]	"	None
		Pithouse (F9)	DI023	Hearth	630-690 915-1035[a] 1530-1615	"	None
		Pithouse (F11)	DI018	Hearth	630-675 980-1115 1150-1325[a]	1100-1300	Floor fill: Snowflake Black-on-white; Floor: Snowflake Black-on-white
		Pithouse (F19)	DI019	Hearth	630-685 920-1115 1150-1410[a] 1515-1560	"	None
AZ O:15:90	4 Pithouses	Pithouse (F4)	DI024	Hearth	995-1210[a] 1215-1270	1000-1150 (750-1150)	Floor fill: Holbrook Black-on-white
		Horno (F6)	DI025	Wall	630-690 925-1035[a]	"	None
AZ O:15:91	2 Pithouses	Pithouse (F5)	DI013	Hearth	630-670 995-1280[a]	1000-1150 (850-1300?)	Floor fill: Santa Cruz Red-on-buff, Kana-a Black-on-white, Black Mesa Black-on-white, Sosi Black-on-white, Holbrook Black-on-white
		Pithouse (F11)	DI014	Hearth	990-1130[a] 1145-1325	"	Floor fill: Holbrook Black-on-white; Floor: Black Mesa Black-on-white
AZ O:15:92 Locus A	Pithouses (Disturbed)	Pithouse (F14)	DI017	Hearth	630-690 920-1035[a] 1300-1485	850-1050	Floor fill: Santa Cruz Red-on-buff
AZ O:15:100	5 Pithouses	Pithouse (F1)	DI027	Hearth	1100-1150	1000-1100+ (750-1100+)	Floor fill: Sacaton Red-on-buff, Puerco Black-on-white
		Pithouse (F3)	DI015	Hearth	1000-1195	"	None
		Pithouse (F4)	DI016	Hearth	630-675 925-1125[a] 1145-1350	"	None
		Pithouse (F12)	DI026	Hearth	630-670 990-1130[a] 1145-1335	"	None

[a]Considered to be the most plausible option based on ceramic data and other information.
[b]Only the Floor fill (St. 19) and Floor (St. 20) associated sherds included. See Chapter 12 for additional fill data.

A close examination of the data on which the Southwest Master Curve is based (Eighmy and Klein 1988; Eighmy et al. 1987), however, shows that a large number of the independent dates are from contexts that are dated using less than conclusive means. That is, although it has been generally recognized that there are gaps or deficiencies in the series of independent dates (Deaver 1989; Deaver and Murphy 1990; Eighmy and Doyel 1987; Eighmy and McGuire 1989), what is generally unrecognized is that of the 166 independent dates used in curve construction (Eighmy and Klein 1988:41-44), less than 30 percent are tree-ring cutting dates in direct association with the feature being dated. These data are presented in Table 25.8. The great majority of the independent dates are from contexts that are here called "associated dates," based on Eighmy's (Eighmy et al. 1987; Eighmy and Klein 1988) definition of these contexts as being "dated by superposition, cultural content, and closely associated absolute dates within the site but not in the structure containing this feature." Data on the exact nature of these "closely associated absolute dates" are not directly presented in Eighmy et al. (1987), although some information is available if other features at the site also were dated and used as independent dates in the construction of the master curve. These data suggest that the "associated dates" were derived through a combination of many different factors, including use of cutting dates, noncutting dates, carbon-14 dates, and ceramic information. There are 64 of these dates used in the construction of the curve, comprising 38.6 percent of the independent dates. In Table 25.8 these data have been lumped with 13 dates that are termed by Eighmy either "ceramic dates" or "guess dates," meaning that there are no associated absolute dates. Of these, almost half are from the Hohokam area (DVGP Numbers 53, 73, 74, 75, 76, and 86 in Eighmy et al. 1987) and are based on estimates made between 1982 and 1984 prior to the current refinement in the Hohokam chronology (Dean 1990; Wallace and Craig 1988). An additional 24 dates (14.5 percent) are based on noncutting tree-ring dates that cannot really be considered to be an absolute date because there is no way to accurately gauge the number of missing rings. This is particularly problematic in species that decay easily, such as juniper or pinyon, because losing 50 or 100 rings to decay would not be uncommon (Dean, personal communication 1990). Although it is not directly stated, the noncutting dates are assumed to be in combination with additional ceramic information, because often the estimated date range given for the feature is sometime after the noncutting tree-ring date. This is true for the cutting dates as well, because the length of site occupation based on the cutting date generally extends from 15 to 50 years beyond the actual date. Nine dates are from radiocarbon samples, although the context and sample type of these dates are unknown, and an additional eight dates are from either historic features with known dates or experimentally constructed features.

Table 25.9 breaks these data down by 50-year time period and these are displayed graphically in Figure 25.1. As these show, there are certain periods where more confidence in the Southwest Master Curve should be placed than other periods, and this is critically important in any archaeological interpretation of archaeomagnetic data. The best dated period is between A.D. 750 and 900, particularly the A.D. 850 to 900 period. Thirty-five cutting dates (72.9 percent of all recovered cutting dates) in direct association with the sampled feature were recovered from these contexts. Therefore, there is an unspecified but relatively high degree of probability that other archaeomagnetic samples falling within this area of the master curve also date to this time period. Two other areas of relatively high confidence, although much less so than the A.D. 750 to 900 period, are between A.D. 1050 and 1150, which is anchored by four associated cutting dates, and A.D. 1250 to 1300, which is anchored by three associated cutting dates. Moderate confidence may possibly be placed in the early portion of the curve, between A.D. 575 and 750, because here there are three cutting dates, three noncutting dates, and seven associated/ceramic dates. The fact that there are only 13 samples spanning this 175-year period calls for caution in interpretation. Periods of very low confidence in the archaeomagnetic data are between A.D. 900 and 1050 (particularly the period between A.D. 925 and 1000), which is based on eight associated/ceramic dates and five noncutting dates; A.D. 1150 and 1250, based on 12 associated/ceramic dates and three radiocarbon dates; and anything post-A.D. 1300, which is based on nine associated/ceramic dates and four radiocarbon dates.

THE RYE CREEK CHRONOLOGY

In general, the Rye Creek archaeomagnetic data agree very well with the cross-dated ceramic information outlined in Chapter 12 of Volume 2. These data, presented in Table 25.7 (see also Table 12.18), suggest that

Table 25.8. Sources of independent dates used to determine Southwest Archaeomagnetic Master Curve SWC588, constructed by Colorado State University (Eighmy, et al. 1987; Eighmy and Klein 1988).

Type of Date	Number	Percent
Associated Date/ Ceramic Date[1]	77	46.4%
Tree Ring Cutting Date	48	28.9%
Tree Ring Noncutting Date	24	14.5%
Radiocarbon Date	9	5.4%
Historic/Experimental	8	4.8%
TOTAL	166[2]	100.0

[1]Associated Date means that the feature from which the archaeomagnetic sample was collected was "Dated by superposition, cultural content, and closely associated absolute dates within the site but not in the structure containing this feature" (Eighmy et al. 1987). No further information is given on these contexts.

[2]It should be noted that although Eighmy and Klein (1988:iii) state that 189 independent dates were recovered, it appears from the data they give in Table 1 (1988:41-44) that only 166 of these were used to construct Curve SWCV588, and these are the data used to compile this table.

the sites within the project area were occupied initially during the Gila Butte phase (A.D. 750-850) or slightly earlier, with the occupation extending through the early Classic period (A.D. 1150-1300).

The Deer Creek site (AZ O:15:52) was the earliest site inhabited in the project area, and to date, one of the earliest ceramic period sites occupied in the Tonto Basin. Twelve archaeomagnetic dates were recovered from the site, most within the period between A.D. 650 or 700-850. This is a well-dated period in the Southwest Master Curve, and a relatively high degree of confidence is placed in these dates. These data, combined with the presence of a few Snaketown Red-on-buff sherds (A.D. 650-750)--although unfortunately none were recovered from good or unambiguous contexts--suggest that the site may have been initially occupied sometime around A.D. 700, if not possibly earlier. Given the 100- to 150-year standard deviations of the archaeomagnetic data, it is impossible to determine which features were occupied first, although the early dates from Feature 2 (A.D. 655-755) and Feature 65 (A.D. 655-765) are suggestive. Both of these features are situated in the northern portion of the site, and Feature 65 was intruded into by a later pithouse (Feature 59). The ceramic and archaeomagnetic data indicate that the site was the most intensively occupied during the following Gila Butte phase (A.D. 750-850), at which time most of the pithouses and the cemetery area (an archaeomagnetic date of A.D. 725-855 was recovered from crematorium Feature 71) were in use. The archaeomagnetic dates for these features all end by A.D. 870, which along with the overall lack of Santa Cruz Red-on-buff ceramics (A.D. 850-950), which is present but in a very low frequency when compared to Gila Butte Red-on-buff pottery, strongly suggests that this is the approximate end date of the primary occupation. The site appears to have been reoccupied, after perhaps a brief hiatus, during the late Santa Cruz and early Sacaton phases, given the presence of low frequencies of both of these ceramic types and the archaeomagnetic dates from Features 13 and 59. Feature 59 is definitely believed to postdate the Gila Butte phase occupation, given the position of its magnetic pole plot, which is radically different than the Gila Butte phase houses, and

Table 25.9. Break-down by 50-year period of independent dates between A.D. 550-1650 (n=153) used to construct the Archaeomagnetic Master Curve SWC588 (Eighmy et al. 1987; Eighmy and Klein 1988).

Period	Number Dates[1]	Tree Ring Cutting	Tree Ring Noncutting	Carbon 14 Date	Associated/ Ceramic Date
550-600	2	2 (100%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
600-650	4	2 (50.0%)[2]	1 (25.0%)	0 (0.0%)	1 (25.5%)
650-700	6	1 (16.7%)	2 (33.3%)	0 (0.0%)	3 (50.0%)
700-750	8	0 (0.0%)	2 (25.0%)	0 (0.0%)	6 (75.0%)
750-800	18	7 (38.9%)	3 (16.7%)	0 (0.0%)	8 (44.4%)
800-850	19	6 (31.6%)[3]	2 (10.5%)	2 (10.5%)	9 (47.4%)
850-900	64	27 (42.2%)[4]	6 (9.4%)	2 (3.1%)	29 (45.3%)
900-950	25	2 (8.0%)[2]	4 (16.0%)	0 (0.0%)	19 (76.0%)
950-1000	2	0 (0.0%)	2 (100.0%)	0 (0.0%)	0 (0.0%)
1000-1050	6	1 (16.6%)	2 (33.3%)	0 (0.0%)	3 (50.0%)
1050-1100	15	3 (20.0%)[3]	4 (26.7%)	0 (0.0%)	8 (53.3%)
1100-1150	7	2 (28.6%)	1 (14.3%)	0 (0.0%)	4 (57.1%)
1150-1200	10	0 (0.0%)	0 (0.0%)	2 (20.0%)	8 (80.0%)
1200-1250	14	0 (0.0%)	0 (0.0%)	3 (21.4 %)	11 (78.6%)
1250-1300	14	3 (21.4%)	0 (0.0%)	2 (14.3%)	9 (64.3%)
1300-1350	6	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (100.0%)
1350-1400	6	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (100.0%)
1400-1450	3	0 (0.0%)	0 (0.0%)	1 (33.3%)	2 (66.7%)
1450-1500	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)
1500-1550	3[5]	0 (0.0%)	0 (0.0%)	3 (100.0%)	0 (0.0%)
1550-1600	3[5]	0 (0.0%)	0 (0.0%)	3 (100.0%)	0 (0.0%)
1600-1650	3[5]	0 (0.0%)	0 (0.0%)	3 (100.0%)	0 (0.0%)

[1]Number of dates adds up to greater than 166 because the same independent date often spans more than one 50-year period.
[2]None of the tree-ring cutting dates fall within this period, date extended by Eighmy et al. (1987) through other means.
[3]One of the six tree-ring cutting dates does not fall within this period, date extended by Eighmy et al. (1987) by other means.
[4]Ten of the 27 tree-ring cutting dates do not fall within this period, date extended by Eighmy et al. (1987) by other means.
[5]Same carbon-14 dates span all three periods.

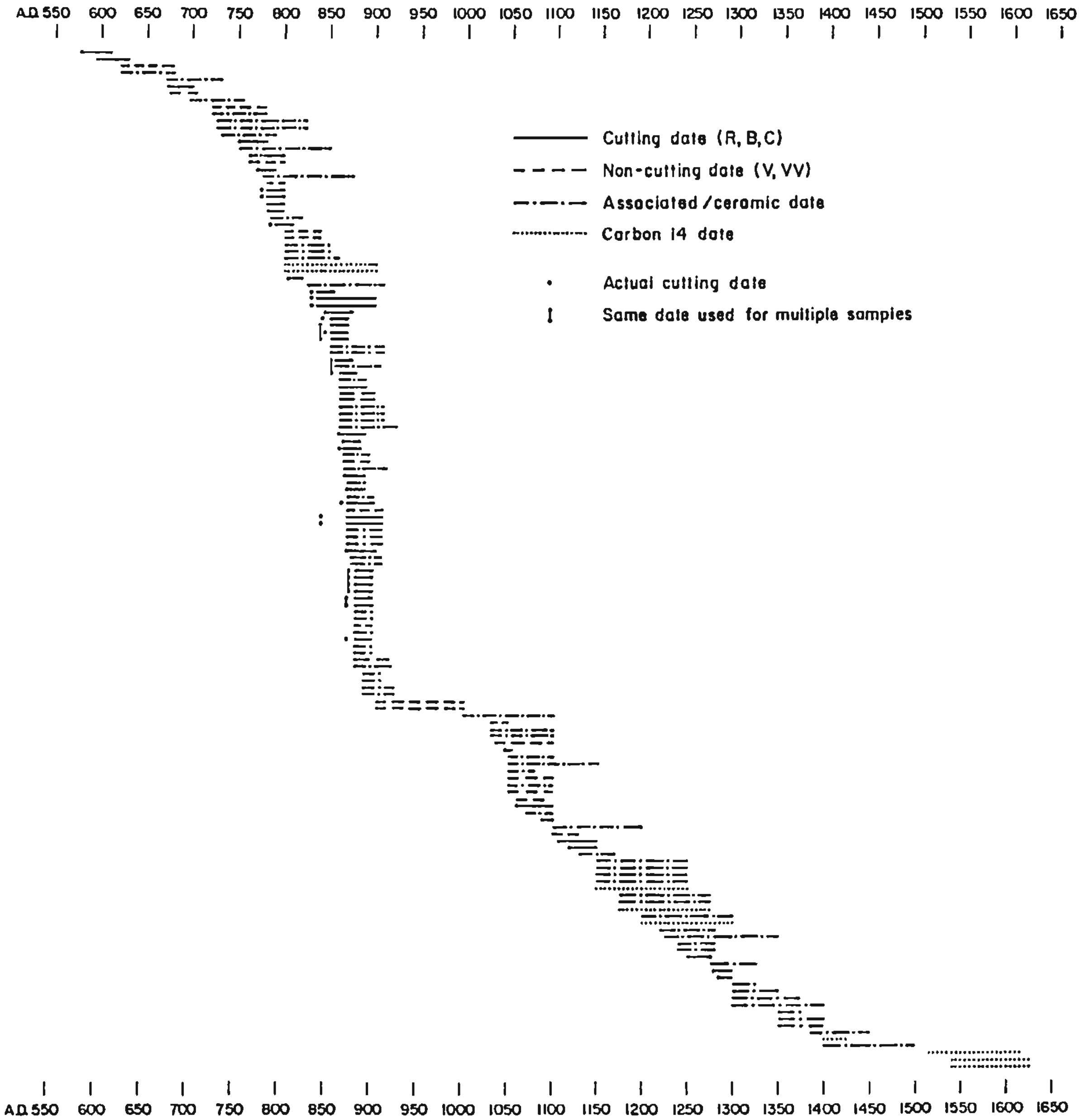


Figure 25.1. Independent dates used in the construction of the Archaeomagnetic Curve SWC588 (n=153) (Eighmy et al. 1987; Eighmy and Klein 1988).

its intrusion into Feature 65. The evidence for Feature 13 postdating the Gila Butte phase is more equivocal, and based primarily on the shallowness of the feature and its architectural style rather than any definitive factor, because both pole plot options for this feature are plausible. Given the lack of well-dated independent plots in the A.D. 900 to 1050 portion of the Southwest Master Curve, the actual dating of these features within this general period is problematic. The few recovered Kana-a Black-on-white and Santa Cruz and Sacaton red-on-buff ceramics do little to clarify this situation, except to support a placement for this later occupation sometime within the A.D. 850 to 1150 period.

The next set of sites all fall within the A.D. 900 to 1050 range, and are roughly contemporaneous with the later occupation at the Deer Creek site. Unfortunately, because this is the most poorly-defined portion of the Southwest Master Curve, the actual sequencing of sites and features within this time is uncertain. It does appear from both the archaeomagnetic data and the ceramic dates that the Rooted site (AZ O:15:92) may have been the earliest site occupied within this group. The relatively high frequencies of Santa Cruz and Sacaton red-on-buff ceramics in the fill of Feature 14 (the only excavated structure at this severely root-plow disturbed site), combined with an archaeomagnetic date of A.D. 920 to 1035, suggest a late Santa Cruz or early Sacaton phase occupation. Due to the root-plowing disturbance, however, the nature and dating of the remainder of the site is unknown. Based on the archaeomagnetic dates, pithouse Feature 9 (A.D. 915-1035) at the Boone Moore site (AZ O:15:55) and horno Feature 6 (A.D. 925-1035) at the Compact site (AZ O:15:90) may also date to this approximate time period. Because the horno is intrusive into pithouse Feature 4, which has an archaeomagnetic date of A.D. 995 to 1210, it is assumed that the pithouses at the Compact site also date to this period, perhaps at the later end post-A.D. 1000. In fact, given the proximity of Feature 9 at the Boone Moore site to the Compact site, which are separated artificially into two different sites by State Route 87 (see Chapter 9), it is possible that they are related.

The A.D. 900 to 1050 occupation either was partially contemporaneous with, or most likely shortly followed by, a roughly equivalent set of sites dating to approximately A.D. 1000 to 1150. These include the Redstone site (AZ O:15:91), Clover Wash site (AZ O:15:100), and masonry pitroom Feature 9 at the Cobble site (AZ O:15:54). Neither the ceramic data nor the archaeomagnetic dates are precise enough to separate these sites or the features within each site. There are some indications, however, based on the archaeomagnetic and ceramic data, that Features 4 and 12 at the Clover Wash site are earlier than Features 1 and 3. It is also possible, based on other lines of information (see Chapter 8), that Feature 5 at the Redstone site predates Feature 11, even though their archaeomagnetic dates are nearly identical. The primary component of the Hilltop site (AZ O:15:53) also appears to date to this general time period, although this is based solely on the ceramic assemblage since no archaeomagnetic dates were recovered.

The final group of sites can be dated to the period between A.D. 1150-1300 or 1350. These include the primary component of the Boone Moore site, which has five archaeomagnetic dates, and the Arby's (AZ O:15:99) site, which could only be ceramically dated. The five archaeomagnetic dates from the Boone Moore site are so similar that the features, comprising several different architectural styles (two pithouses, two pitrooms, and a single masonry structure), cannot be separated and sequenced from these data. In addition, based on the ceramics from the trash mound (Feature 2), it is assumed that the primary component (Feature 1) of the root-plowed Cobble site dates to this period, as do two of the three trash mounds (Features 2 and 3) tested at Rye Creek Ruin (AZ O:15:1). Feature 1, the largest trash mound tested at Rye Creek Ruin, is ceramically dated into the late Classic period (A.D. 1300-1450) and is the latest feature within the project area.

Neither absolute nor relative dating information was recovered from four sites, AZ O:15:96, AZ O:15:70, AZ O:15:71, and the Overlook site (AZ O:15:89). These are all single-room masonry fieldhouse sites situated in the southern portion of the project area. Based on the architectural and redware evidence, discussed below, these sites most likely postdate A.D. 1000 and may postdate A.D. 1150.

Plainware-to-Redware Ratios

One additional line of evidence used in dating project area sites is the plainware-to-redware ceramic ratios. Although this is certainly not the most accurate method of dating, it has proved to be moderately successful on other Tonto Basin projects (Bruder and Ciolek-Torrello 1987:105-108; Haas 1971a; Woodward et al. 1985:20). Basically, the premise is that redware ceramics (and usually corrugated wares) increase through time with a corresponding decrease in plainware ceramics (see Chapter 13). Due to a general lack of corrugated ceramics within the project area, except from the late Classic component within Feature 1 at Rye Creek Ruin, only redwares and plainwares were used in this analysis. Furthermore, because our data showed some potentially significant trends in the frequency of decorated ceramics, these were included as well. These data are presented in Table 25.10.

Table 25.10. Plainware, redware, and decorated ceramic percentages from the Rye Creek sites.

					Average by Temporal Group		
Temporal Group	Site	PW(%)	RW(%)	Dec(%)	PW(%)	RW(%)	Dec(%)
A.D. 750-850	AZ O:15:52	95.7	0.2	4.0	95.7	0.2	4.0
A.D. 900-1050	AZ O:15:92	95.2	0.1	4.7	95.2	0.1	4.7
A.D. 1000-1150	AZ O:15:53	94.8	3.0	2.2	91.9	5.3	2.8
	AZ O:15:90	91.9	4.9	3.2			
	AZ O:15:100	91.7	5.9	2.4			
	AZ O:15:91	89.1	7.5	3.4			
A.D. 1150-1300	AZ O:15:1 (F2 and 3)	57.4	41.3	1.4	54.9	44.4	0.8
	AZ O:15:99	57.1	42.3	0.5			
	AZ O:15:55	53.1	46.2	0.7			
	AZ O:15:54 (F2)	51.9	47.7	0.5			
A.D. 1300+	AZ O:15:1 (F1)	64.4	33.8	1.4	64.4	33.8	1.4

Basically, as other researchers have noted, there is a definite increase in redware ceramics through time with a corresponding decrease in both plainware and decorated ceramics. The overall change between the Preclassic (A.D. 750-1150) and Classic (A.D. 1150-1450) periods is particularly striking; redwares increase from less than 10 percent to more than 40 percent of the assemblage, while plainwares decrease from more than 90 percent to just over 50 percent, and decorated wares decrease from 3-4 percent to around 1 percent. The pattern is relatively consistent throughout, with the exception of the A.D. 900-1050 period and the post-A.D. 1300 period. The small decrease in redwares and increase in decorated wares during the A.D. 900-1050 period is possibly due to sampling problems, since these data (from the severely disturbed Rooted site) are based primarily on the excavation of only a single feature. On the other hand, it is possible that these data are accurately reflecting the trends in ceramic ware distribution and that the period between A.D. 750-1050 was relatively homogeneous, at least ceramically, since there is not really any significant change in ware distribution between these two periods. In fact, there is less variation between these two periods than between sites within the other periods. Similarly, the decrease in redwares in the post-A.D. 1300 period may also be due to sampling problems, since these data stem from a single trash mound at Rye Creek Ruin. If the data on corrugated wares are considered, which were not presented in this table, it appears possible that corrugated ceramics are replacing redwares to a certain extent, at least in terms of ware distribution (whether they are replacing redwares functionally is unknown). The small rise in decorated percentage is not considered significant and most likely due to the different nature of Rye Creek Ruin compared to the other, much smaller, sites.

Unfortunately, the results are not nearly so clear cut when applying these data to the four sites that could not be dated through other means. This appears to be due primarily to the fact that, with the possible exception of the Overlook site (AZ O:15:89), these were all the locales of very limited, and functionally specialized, activities; it is likely that very few artifacts were ever used at these sites, and what was used was not representative of a typical assemblage of that period. As a result, very few artifacts were recovered by our excavations: 6 sherds (5 plainwares and 1 redware) were recovered at AZ O:15:96; 11 sherds (all redwares) were recovered at AZ O:15:70; 37 sherds (35 plainwares and 2 redwares) were recovered at AZ O:15:71; and 152 sherds (58 plainwares and 94 redwares) were recovered at the Overlook site. In terms of redware percentages, these calculate to 16.7 percent at AZ O:15:96; 100 percent at AZ O:15:70; 5.4 percent at AZ O:15:71, and 61.8 percent at the Overlook site. Given these data, however, it is probably safe to say that the sites all postdate A.D. 1000, and that the Overlook site in particular probably postdates A.D 1150.

TONTO BASIN CHRONOLOGY

Figure 25.2 graphically displays the absolute dates recovered from the Tonto Basin that are considered to be in good archaeological context. Given the previous discussion on methodological problems in the use of radiocarbon and archaeomagnetic dates, relatively strict criteria were used for the inclusion of dates within this analysis. First of all, no composite radiocarbon samples, or radiocarbon samples from unknown contexts, were used, nor were dates from fill contexts of structures (although fill contexts from other features, such as hearths or roasting pits were used if they were not composites). Although many of these contextually poor dates were plausible in terms of the associated ceramics, they were still not included to avoid problems with circular reasoning (i.e., the date is considered to be accurate not on its own merits but only if the date falls within the expected range of the feature or site that it is supposed to be dating). Although this is a relatively common approach in archaeological use of chronometric data, there is no way to really determine whether the absolute date is accurate or fortuitous. Furthermore, only dates clearly falling within the prehistoric period were included, eliminating the possible Apachean features from the Ord Mine project. As a result, only two of the recovered radiocarbon dates were included in this analysis. And, as can be seen from Table 25.2, both of these samples (Feature 2 at AZ U:3:44 [ASU] and Feature 7 at AZ U:3:51 [ASU]) are possibly suspect because the sample type was not provided in the published report but was instead inferred from the feature descriptions. Given the fact that 19 radiocarbon samples have been analyzed in the Tonto Basin it is unfortunate that only 2 samples (10.5 percent) are amenable to analysis; incomplete published information on context or sample type caused the elimination of eight samples (including five of the seven from the Ash Creek Project), three samples were eliminated as being from possible protohistoric Apachean features, while the remaining eight samples were either composite samples or from unknown or poor contexts.

The archaeomagnetic data, on the other hand, were all included, because as noted above, there is a closer correspondence between the E_d and the E_t and contextual sampling problems are not an issue. These are discussed, however, in terms of confidence in the date based on the data given in the preceding section.

The ceramic occupation of the Tonto Basin (or, more correctly, of excavated ceramic sites containing chronometric data within the Tonto Basin) began sometime around A.D. 650 or 700. Thirteen features are dated to the period between A.D. 700 and 850. With the exception of the single radiocarbon date from AZ U:3:44 (ASU), which has a very wide standard deviation, and an archaeomagnetic date from AZ U:3:46 (ASU), both from the Ash Creek Project, all of these early dates are from archaeomagnetic samples recovered from the Deer Creek site excavated as part of this project. Furthermore, there is a relatively high degree of confidence in these archaeomagnetic dates, because they fall within the most securely dated portion of the Southwest Master Curve. These dates span the mid-to-later part of the A.D. 800s, where there is a possible hiatus in the database until around A.D. 900 or slightly later. This hiatus may be more apparent than real,

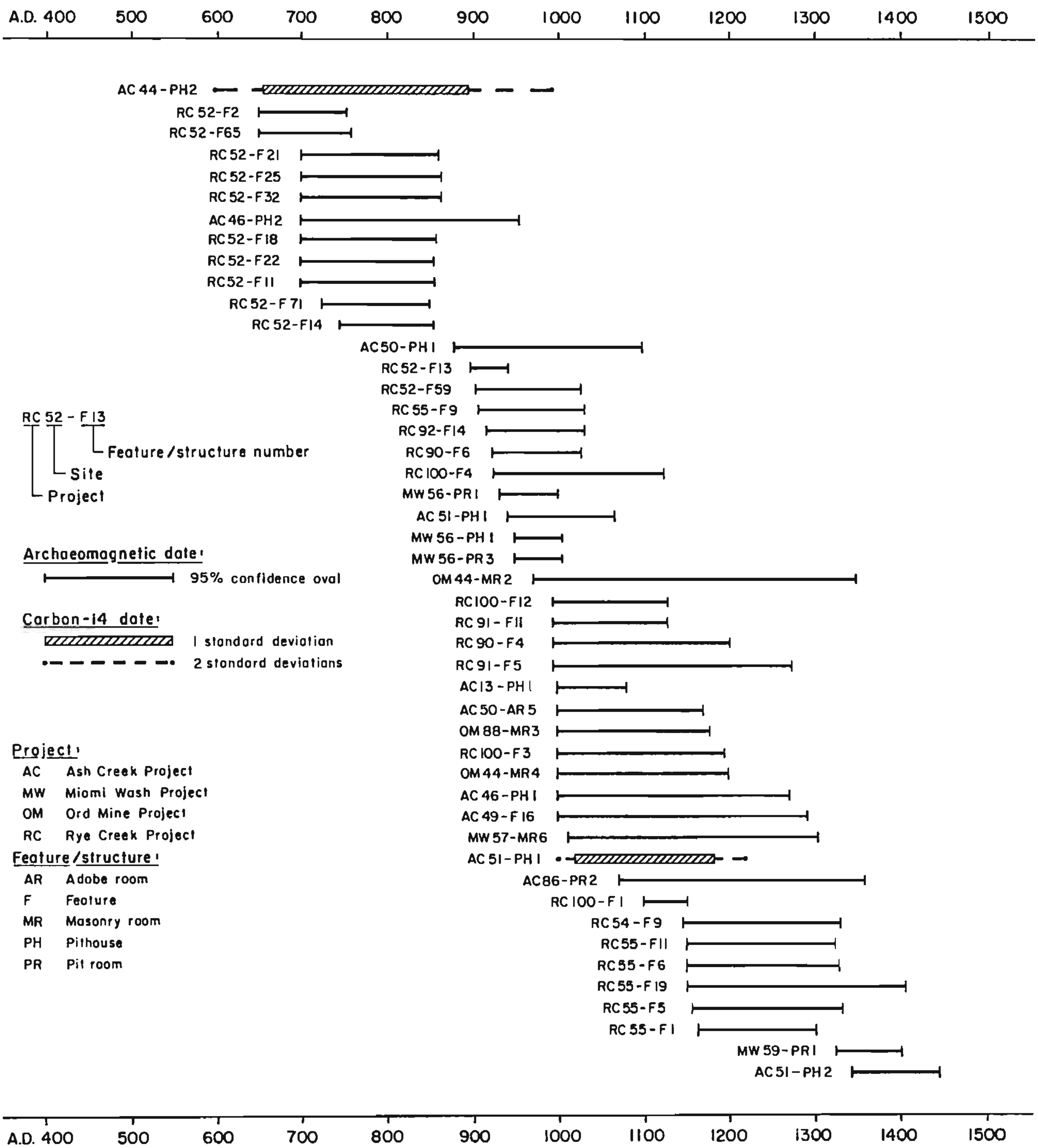


Figure 25.2. Absolute dates recovered from the Tonto Basin considered to be in good archaeological context.

however, and due primarily to the small size of the excavated sample; several of the archaeomagnetic dates and the single radiocarbon date overlap this period (as do three of the discarded radiocarbon dates).

The chronometric data indicate that during the following 400 years, from around A.D. 900 to 1300, the Tonto Basin was more-or-less continuously occupied. Given the fact that the sample is relatively small, and primarily based on sites situated along roadways slated for expansion, the fact that a good deal of chronological overlap is present suggests continuous occupation and use of this area. The period between A.D. 900 and 1000 is represented by 11 features dating primarily to this time; 5 of these are from the Lower Basin (2 from Ash Creek and 3 from Miami Wash) and 6 are from the Upper Basin. This is a very poorly dated period in the Southwest Master Curve, however, and these dates must therefore be regarded with a fair degree of suspicion, that is, their exact placement within this period is unknown. The following A.D. 1000 to 1150 period is relatively well represented; 15 features date primarily to this time. Seven of these are from the Lower Basin and eight are from the Upper Basin. Although this period is better dated on the Southwest Master Curve, due to the positioning of the curve many of the dates are lacking in precision and have wide standard deviations spanning nearly two centuries. Less data are available for the A.D. 1150 to 1300 period, represented by seven features (six from the Upper Basin and one from the Lower Basin), and only two features, both from the Lower Basin, are dated to the post-A.D. 1300 period, although a large number of discarded radiocarbon samples dated to this time. Neither of these periods, with the exception of the A.D. 1250 to 1300 time, are well dated on the Southwest Master Curve, particularly the period after A.D. 1300.

Chronometric Patterns and Tonto Basin Culture History

There are currently 47 absolute dates from 19 sites considered to be in good archaeological context. Another 20 or so sites have published ceramic information from excavated contexts. This is a very small sample from which to construct a chronologically sound culture history. This is particularly true given the current work on the Roosevelt Lake Plan 6 mitigation projects by Arizona State University (Rice 1990), Statistical Research (Ciolek-Torrello et al. 1990), and Desert Archaeology (Doelle et al. 1991), which will more than double (if not triple or quadruple), the existing corpus of absolute dates and excavated sites. There are, however, several general patterns that deserve comment.

First of all, based primarily on the use of Phoenix Basin Hohokam systematics and culture history, architecture has often been used in the absence of other datable material as a chronological indicator. Pithouses are assumed to date to the Preclassic period (pre-A.D. 1150) and above-ground masonry or adobe structures are assumed to date to the Classic period (A.D. 1150-1450). The use of this patterning to date features and sites within the Tonto Basin is particularly widespread for survey data and for dating excavated fieldhouses where there is often little temporally diagnostic material (Ciolek-Torrello 1987). Although some variation to this general schema is known to be present within the Hohokam area, the general trend appears to be well established. The chronological data suggest that this pattern may be different within the Tonto Basin. Figure 25.3 presents the chronometric information by type of architecture. As this figure shows, although pithouses certainly dominate the early portion of the occupation, masonry structures may be present as early as A.D. 1000. Masonry pitrooms, which are essentially subsurface pithouses with masonry footers or walls (argued to be a transitional type between pithouses and true masonry structures), may date as early as A.D. 935 or 950. Furthermore, pithouses and pitrooms may continue well into the Classic period, as suggested by the A.D 1050 to 1325 dates from the Boone Moore site (AZ O:15:55) and the pitroom date of A.D. 1325 to 1375 at AZ V:9:59 from Miami Wash. The date of A.D. 1340 to 1450 from a pithouse at site AZ U:3:51 (ASU) from Ash Creek is puzzling because a Sacaton Red-on-buff (A.D. 950 to 1150) vessel was recovered from the floor of the structure. This may be due to the lack of well-dated independent contexts for the A.D. 900 to 1050 and A.D. 1300-1450 portions of the master curve.

In addition, Doyel's (1978) designation of the Miami (or Hardt) phase as being a transitional Hohokam-to-Salado phase dating from A.D. 1150 to 1200 can also be called into question. As discussed earlier, the Miami phase appears to be a phase with a mission, because it serves to validate the cultural and ethnic continuity between the Hohokam and Salado by bridging the gap between what had previously been considered to be two

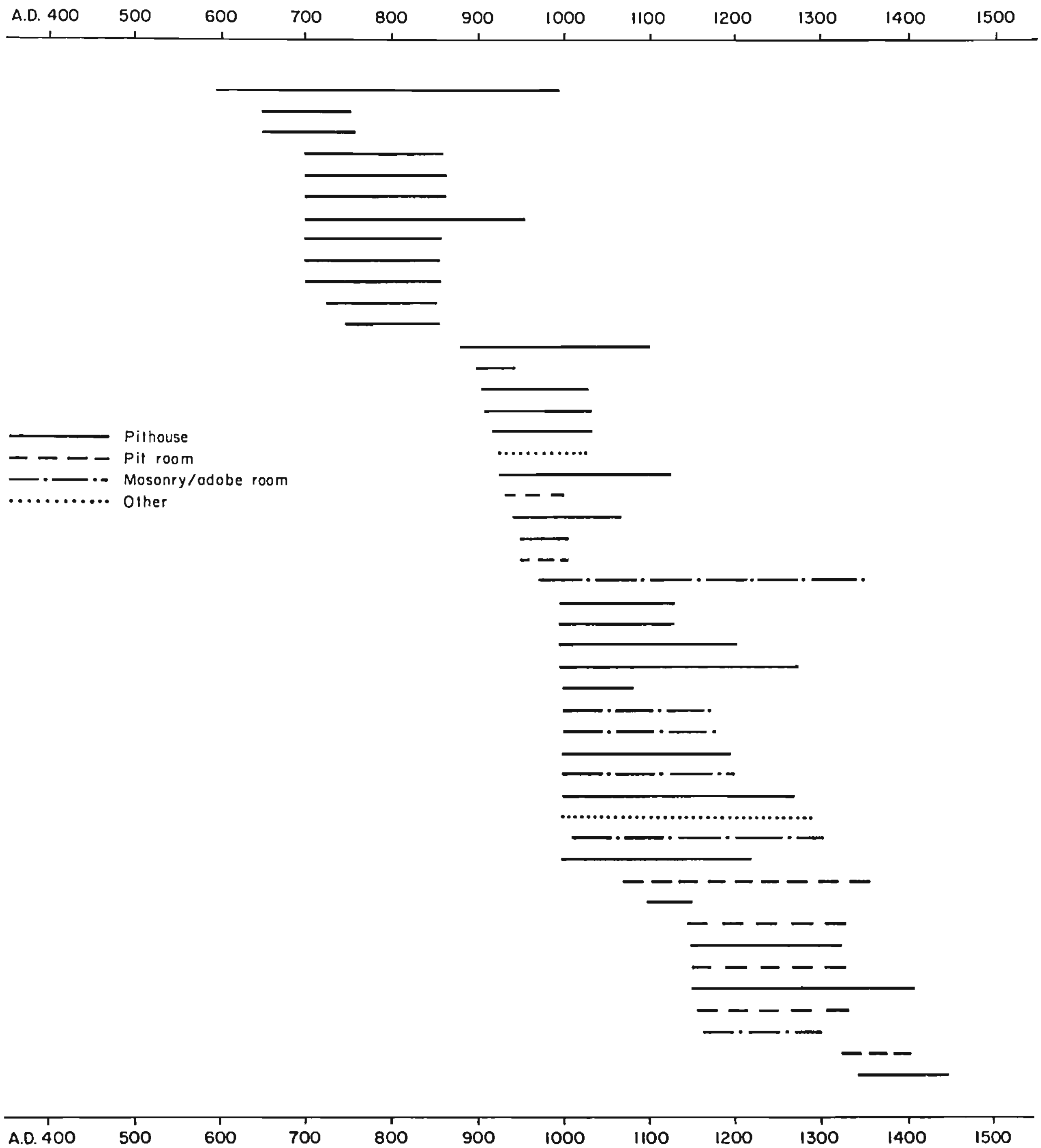


Figure 25.3. Absolute dates recovered from the Tonto Basin by architectural type.

unrelated cultures. The phase originally was based on a single archaeomagnetic date of A.D. 1180 ± 39 from Room 6 at the Columbus site (AZ V:9:57), along with additional artifactual and architectural evidence. A closer examination of the nature and context of the archaeological material, along with the recent revision by Eighmy and Doyel (1987) of DuBois's original archaeomagnetic determination from A.D. 1180 ± 39 to A.D. 1015 to 1310 (see Table 25.4), makes this phase designation far from conclusive.

The Columbus site contained at least eight masonry rooms, two pithouses, and numerous burials, within a partial compound wall. The diagnostic ceramic assemblage was mixed, both temporally and contextually, and dominated by Snowflake Black-on-white followed by Gila-Tonto polychrome. Data on the recovered decorated ceramics are presented in Table 25.11. Although some of these wares, most notably Snowflake Black-on-white and possibly Reserve-Tularosa Black-on-white, fall within the Miami phase, more recent refinements in ceramic dating suggest that most of the others are decidedly later (Gila-Tonto polychrome, San Carlos Red-on-brown, McDonald Corrugated, and St. Johns Polychrome), or earlier (Gila Butte Red-on-buff and Sacaton Red-on-buff), than the designated phase. In fact, less than half of the decorated ceramics fall within the A.D. 1100 to 1200 period. It is also likely that the 448 recovered corrugated sherds (Doyel 1978:90) postdate A.D. 1200 as well. This is based on the data from Rye Creek Ruin where corrugated sherds were only found in relative abundance within trash mound Feature 1 (ceramically dated to A.D. 1300-1450) and not within Features 2 or 3 (A.D. 1150-1300), nor were they recovered from the Boone Moore site, which also dates from A.D. 1150 to 1300.

Table 25.11. Decorated ceramics recovered from the Columbus site (AZ V:9:57 [ASM]) (after Doyel 1978:99).

Ceramic Type	Number (%)	Temporal Span
Gila Butte Red-on-buff	44 (9.8%)	A.D. 750-850
Sacaton Red-on-buff	23 (5.1%)	A.D. 950-1150
Unidentified Red-on-buff	63 (14.0%)	---
Snowflake Black-on-white	176 (39.0%)	A.D. 1100-1200
Little Colorado Whiteware	6 (1.3%)	A.D. 1050-1250
Reserve-Tularosa Black-on-white	12 (2.7%)	A.D. 1100-1300
White Mountain Redware	10 (2.2%)	---
St. Johns Polychrome	10 (2.2%)	A.D. 1175-1325
McDonald Corrugated	17 (3.8%)	A.D. 1200-1350
Salado White-on-red	1 (0.2%)	A.D. 1250-1400
San Carlos Red-on-brown	30 (6.7%)	A.D. 1250-1400
Gila-Tonto Polychrome	59 (13.1%)	A.D. 1250-1400

The only diagnostic reconstructible vessel recovered from a structure was a partial Snowflake Black-on-white jar possibly associated with Pithouse 2 (Doyel 1978:70). Although isolated Snowflake Black-on-white sherds were found on the floors of several masonry rooms (one of which also had sherds of Gila-Tonto polychrome on the floor), the recovery of a reconstructible vessel from a pithouse context suggests that Snowflake Black-on-white may be associated with the Sacaton phase ceramics and the pithouse occupation rather than the occupation of the masonry structures. In this respect, it appears more likely that the masonry structures were associated with the later ceramics. Furthermore, Doyel's (1978:88) designation of a plainware ceramic "transitional between a form of Gila Plain [Hohokam] and local Tonto Plain [Salado]," based primarily on temper inclusions (although other attributes are included), also can be questioned. Therefore, without the conclusive evidence offered by the archaeomagnetic determination of DuBois, there is at present no good basis for dating this phase to the A.D. 1150 to 1200 period and separating the phase as being distinctive from characteristics seen in later periods.

SUMMARY AND CONCLUSIONS

In summary, chronometric data recovered from the Tonto Basin suggest several interesting and potentially significant temporal patterns. First of all, the initial ceramic period settlement of the Tonto Basin appears to be during the late Snaketown or early Gila Butte phase, perhaps around A.D. 700, if not slightly earlier. These data are largely derived from the Deer Creek site in the Upper Basin, although Gila Butte phase ceramics and two absolute dates have been recovered from the Lower Basin and Globe-Miami areas as well. With the possible exception of a slight hiatus in the late A.D. 800s, thought to be primarily due to problems in the sample size and not to an actual abandonment of the area, occupation within the Basin appears to be continuous through the late Classic period. There is more than sufficient evidence to lay to rest forever the notion of a Sacaton phase hiatus.

Furthermore, temporal patterns in architectural type suggest that the settlement within the Tonto Basin may be different than that seen for the Hohokam area in the Phoenix Basin, and that the use of Phoenix Basin systematics may not be appropriate. There is probably little harm in continuing to use Phoenix Basin Preclassic period phase names because they are well established and in common use. It is, however, the borrowing of the attendant cultural implications of these phases that is problematic and possibly misleading. Although like the Phoenix Basin (and the rest of the Southwest) the initial occupation of the Tonto Basin was confined to pithouse structures, above-ground masonry and adobe structures may occur as early as A.D. 1000. This is significantly earlier than in the Hohokam area, and more similar to patterns seen in the Sinagua and Mogollon areas to the north and east. Pithouse (and masonry pitroom) architecture continues through the early Classic period, however, and possibly into the late Classic period, although the evidence for late Classic pithouses is equivocal. Finally, there appears to be no good evidence for differentiating a transitional Miami (or Hardt) phase between A.D. 1100 and 1150 as defined by Doyel (1978).

As a concluding thought, it should be clear from the above discussions that the interpretation of chronometric data is at least partially, and sometimes wholly, dependent on methodological and contextual factors. Some of these have been mentioned above, particularly as they pertain to radiocarbon and archaeomagnetic dating. A much larger issue, which is at the root of many of the problems in Southwest and Tonto Basin chronological interpretation, is the general tendency to use absolute dating methods (with the exception of dendrochronological dating) as a type of scientific "legitimizer." That is, it appears that chronometric dates are often procured for no good apparent reason than to procure absolute dates; little consideration is given to the specific type of dating method being used, the archaeological context, or the research problem. The procurement of an absolute date, then, if it agrees with other lines of chronological information, is used to legitimize the methodology and the subsequent interpretation of the data (it is an "end-all" or "be-all," so to speak). In this respect, the use of absolute dating becomes tautological. If, for example, the ceramics or architecture agree with the chronometric date, it is almost automatically accepted as accurate; if they do not agree, the absolute date is readily (and usually easily) dismissed as being somehow faulty (e.g., old wood, charcoal contamination, remnant magnetization, sampling error, etc.). Absolute dates frequently are used in this type of circular manner, and one can legitimately raise the question of why collect these dates at all if they are just being used as secondary information to back up other, usually ceramic, lines of evidence.

As a result, there are definite problems with the use of chronometric data in Southwestern archaeology, some of which are responsible for misinterpretations of the archaeological record. Although some of these problems, such as the large standard deviations of both radiocarbon and archaeomagnetic data, are currently insurmountable and related to the method itself, others can be more carefully controlled for by the careful consideration of archaeological context and the weakness or strengths of the particular dating method being used.

Even with careful contextual control, however, the lack of precision of these methods makes many analyses that call for fine-scale temporal control unfeasible. Unfortunately, dendrochronological dating, with its high accuracy and precision, is not amenable to many areas of the Southwest, including the desert Hohokam region and possibly the Tonto Basin. Tree-ring-dated ceramics are found in both of these areas, however, and Hohokam sherds occasionally are found at tree-ring-dated sites. Therefore, ceramic cross-dating may be the best and most precise method currently available in areas without dendrochronologically sensitive species. This is particularly true because recent ethnographic and ethnoarchaeological research has shown that the average use life of a ceramic vessel does not extend more than 20 years or so, and is generally less than 10 years, and therefore the lag-time for a tradeware to reach its destination is probably not significant (Arnold 1985; DeBoer and Lathrap 1979; Kramer 1985; Longacre 1985; Nelson 1991). An example of an analysis of this type attempting to date Gila Butte Red-on-buff ceramics has been presented in Chapter 24, and the results are very promising. As shown by this analysis, and as with the other dating methods, the careful consideration of the archaeological context is critical since without a consideration of context the accuracy of the derived date (and whether the E_d = the E_t) is always suspect.

CHAPTER 26

A METHODOLOGICAL APPROACH TO THE STUDY OF SEDENTISM

Mark D. Elson

This chapter deals with a complex and much debated research issue that is critical in the construction and evaluation of settlement system models. This is the degree of site sedentism. A methodological approach used to estimate sedentism is presented first followed by the application of these methods to the Rye Creek sites. These data are used to model the Rye Creek Project settlement system presented in Chapter 28.

SEDENTISM

Sedentism has been defined in a variety of ways by numerous archaeologists (e.g., Pilles and Wilcox 1978; B. Nelson 1990; Powell 1983; Rafferty 1985; Ward 1978; Young 1990). In traditional terms, sedentism generally is equated with year-round, permanent occupation, where "at least part of the population remains at the same location throughout the entire year" (Rice 1975:97 in Rafferty 1985:115). Early Southwestern anthropologists and archaeologists considered sedentism to be a signature of an advanced stage in cultural development, as mobile hunters and gatherers reached a higher plane of sociocultural complexity by adopting agriculture and moving into settled villages. In this respect sedentism was seen as "a unitary, irreversible process that occurred in a similar fashion throughout the Southwest" (B. Nelson 1990:157). Much of this was based on ethnographic analogy with historic Pueblo groups, where the large, permanently occupied pueblos of Hopi, Zuni, and Pecos, for example, were contrasted with smaller, temporarily occupied, fieldhouses and agricultural sites (Powell 1990). Sedentism generally was equated prehistorically with the Pueblo III (A.D. 1150-1300) and Pueblo IV (A.D. 1300-1450) occupations of the Anasazi region, which saw the formation of large aggregated villages in contrast to the small, scattered pueblos and pithouse sites of the earlier periods (Lekson 1990). Because most of the early archaeology in the Southwest focused on these large late sites, often in the immediate vicinity of occupied pueblos (e.g., Hewett 1906; Kidder 1924, 1958; Roberts 1929), the use of historic analogy is readily understandable. This research resulted in some very entrenched notions concerning prehistoric settlement, which also have a political and historic basis as documented by Lekson (1990). As Ben Nelson (1990:157) argues, archaeologists have long had "deeply embedded assumptions" concerning sedentism, equating small sites with "mobility, hunting and gathering, and early dates," and large sites with "sedentism, agricultural subsistence, and lateness in time."

Due to this, a simple dichotomy was established where large sedentary sites were contrasted with smaller "seasonal" sites. Seasonal sites, or those exhibiting patterns of "residential mobility" (Binford 1980), then, were defined in a basic sense as ones where the total population was absent for portions of the year (see Ward 1978). In the traditional models, seasonal sites were inhabited under two primary circumstances: 1) by early preagricultural hunters and gatherers, who occupied a series of seasonal sites as they moved from place to place to take advantage of (seasonally dependent) resource availability; and 2) by settled agriculturists where a portion of the population temporarily occupied fieldhouses and farmsteads to care for the crops during (seasonally dependent) planting, maintenance, and harvest times. Although these models are still applicable to some degree, it has now become clear that prehistoric settlement patterns are far more complex than this simple dichotomy will allow (B. Nelson 1990; M. Nelson 1990). A large body of recent research has shown that it is more constructive, and perhaps more reflective of the prehistoric situation, to view sedentism as degrees along a continuum rather than as an either/or dichotomy between seasonal and sedentary (B. Nelson 1990; Powell 1983, 1990; Schlanger 1990; Whalen and Gilman 1990; Young 1990). This is the position adopted in this chapter. As Whalen and Gilman (1990:73) note, "There is not ... a simple dichotomy between mobility and permanent residence. Instead, these concepts represent the end points of a continuum between highly mobile and fully sedentary." This of course has theoretical ramifications for settlement pattern modeling, as emphasized by Powell (1990:102), who states that, "Except at a single point in time and space, mobility and sedentism are not really mutually exclusive alternatives. The same group may have alternated uses of the landscape, or different groups may have used the same landscape in different ways."

What follows is a methodological examination of sedentism. Although this analysis is preliminary and more work remains to be done, it is believed to be a relatively successful method for measuring degrees of sedentism. Shirley Powell (1990:100-101) makes a useful distinction between archaeologists studying sedentism, dividing them into two methodological and interpretative "camps": a "complex social organization" camp and a "methodologically oriented" camp. Archaeologists involved in the complex social organization camp use sedentism (or the lack of) as a theoretical basis to construct large-scale sociocultural and settlement models (e.g., Carmichael 1990; Doelle and Wallace 1986; Elson 1986; Fish et al. 1985, 1990; F. Plog 1974; Upham 1982; Upham and F. Plog 1986; Wilcox 1978, 1991). These studies often make implicit assumptions concerning the sedentary or seasonal nature of their analyzed data set (which often consists of, or centers around, large sites), but generally present very little explicit data to back up their assumptions (outside of a subjective feel or theory of reasonableness approach). For example, in previous work I have based sedentism estimations in settlement pattern analysis on a "feel" for the site, subjectively combining variables such as site size, artifact density, formality of architecture, site structure, presence of trash mounds and botanical remains (Elson 1986, 1988:102-103). Archaeologists in the methodological camp, on the other hand, are more concerned with determining whether a particular site, or group of sites, is seasonal, sedentary, or somewhere along the continuum (e.g., Gilman 1987; Lightfoot and Jewett 1984; S. McAllister and F. Plog 1978; Pilles 1978; Powell 1983; Schlanger 1990; Young 1990). These studies, which in many ways are formation-process oriented (Schiffer 1976, 1987), are often atheoretical in terms of the larger sociocultural picture, although they may be very theoretically oriented on the level of site formation and behavioral processes. Obviously, as Powell (1990:101) states, the two different approaches are both necessary and complementary, although to date they have yet to be overly integrated. The study presented here is largely methodological, because it is believed that the first step in a settlement analysis is to determine, in as rigorous a manner as possible, the nature of the sites under examination. This is not to discount the seasonal/sedentary assumptions made by those in the theoretical school, or the value of their work, because often the data from the sites they are dealing with, many excavated a number of years ago, are not amenable to analyses of this nature. Where it can be applied, however, the use of these (or similar) methods are considered a necessary prerequisite for settlement model construction. Data gleaned from this analysis are used in Chapter 28 to discuss the nature of the overall Rye Creek settlement and social systems.

Methods and Assumptions

The underlying premise behind this analysis is the belief that there are cross-cultural regularities in prehistoric behavior and decision making that make it highly probable that sites at similar points along the sedentism continuum will exhibit similar properties, and that these properties are measurable. That is, regardless of the specific culture involved, there is a similar set of human behaviors that are applicable to the measurement of sedentism. These behaviors are believed to be related to energy expenditure. Therefore, there are two basic assumptions that structure this study. The first is that energy invested in site construction (i.e., architecture and site structure) increases as the degree of site sedentism increases. This assumption is supported in both the archaeological and ethnographic literature, although it is often implied rather than explicitly stated (Elson 1988; Lightfoot and Jewett 1984; Neitzel 1991; Rafferty 1985; Russell 1978; Ward 1978; White 1949). The second assumption, which is related to and in some ways a corollary of the first, is that in general the greater the artifact and feature diversity the more sedentary the occupation. Although Schlanger (1990:105-106) has recently criticized the use of this assumption, because she correctly states that it may be measuring site reuse or population size as well as duration of occupation, it is believed that this can be controlled for by the careful selection of the variables used as diversity measures. A model showing these relationships is presented in Figure 26.1. Although the model is overly simplistic, it schematically represents the hypothesized relationship between site occupation span, artifact and feature diversity, and energy expenditure. Note that within this

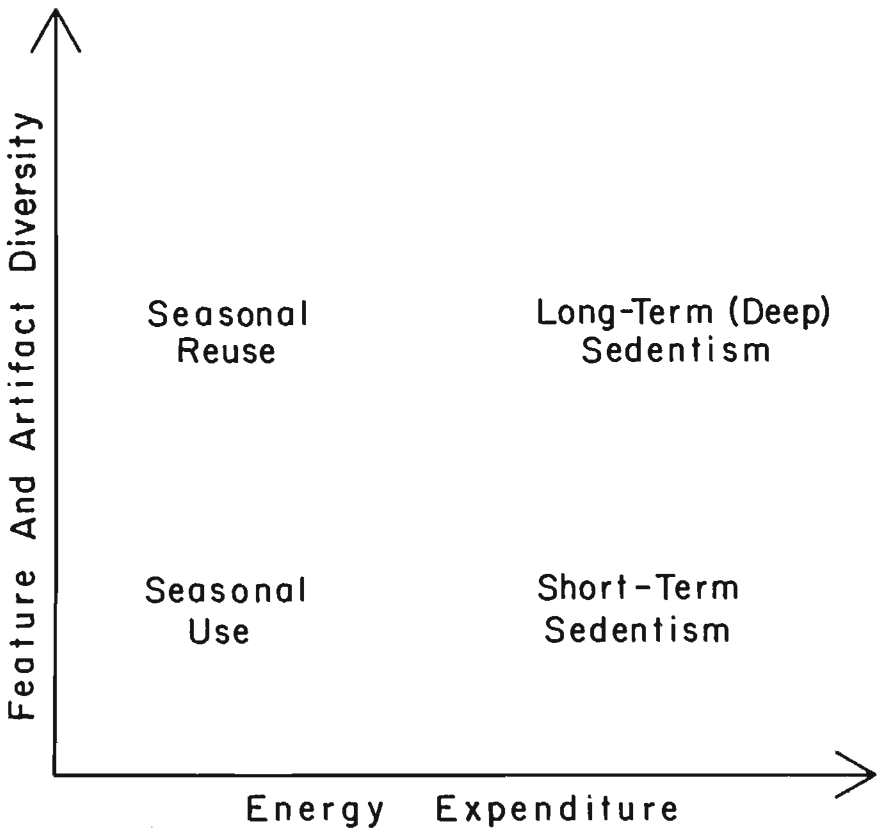


Figure 26.1. Proposed model for degree of site sedentism based on the relationship between energy expenditure and feature and artifact diversity.

model boundaries were not drawn around or among the four identified occupation types (seasonal, seasonal reuse, short-term sedentary, and long-term [deep] sedentary) because sedentism is seen as a continuum and these areas are believed to grade into each other; they are shown here primarily as reference points and not as absolute values. This is particularly true for the distinction made here between "short-term" sedentism (Nelson and LeBlanc 1986) and "deep" sedentism (Lekson 1990), which are more differences of degree than of kind (deep sedentism simply implies a greater time depth than short-term sedentism). Most important, by plotting diversity and energy expenditure against each other it can be seen that Schlanger's (1990) criticisms of the use of diversity measures may not always be appropriate; in this case, diversity is a critical measure because a site with low energy expenditure but high feature and artifact diversity may be a seasonally reused site, in contrast to a site with high energy expenditure and high artifact and feature diversity, which would be a sedentary site.

The critical question raised by an analysis of this type is how to accurately measure sedentism, particularly in terms of energy expenditure and artifact and feature diversity variables discussed above. Although one could strap a Teldyne respirometer (which indirectly measures energy expenditure through CO_2 respiration) on volunteer subjects and measure their energy levels as they go about undertaking simulated prehistoric tasks, in reality this is not an overly feasible (nor probably overly accurate) method and proxy measures must be used. Several methodological and theoretical studies have been undertaken along these lines and a large number of variables have been proposed that the authors believe to be potentially sensitive to site duration and occupation span (Gilman 1987; Lightfoot and Jewett 1984; S. McAllister and F. Plog 1978; Pilles 1978; Powell 1983; Rafferty 1985; Schlanger 1985, 1990; Young 1990; see Schlanger 1990 for a concise summary). Although most of these studies have been only partially successful, if at all, their problems may not lie in the variables themselves (although some are obviously not appropriate) but in how they have been selected, combined, and measured. These variables include site size (S. McAllister and F. Plog 1978; Powell 1983; Rafferty 1985); structure depth (Gilman 1987; Lightfoot and Jewett 1984); structure size (Lightfoot and Jewett 1984; Pilles 1978; Powell 1983); structure shape (Gilman 1987; Rafferty 1985); the number of floors per structure (Schlanger 1985); superposition of structures (Lightfoot and Jewett 1984; Schlanger 1985); various measures of artifact density and diversity (Lightfoot and Jewett 1984; S. McAllister and F. Plog 1978; Pilles 1978; Powell 1983; Rafferty 1985; Whittlesey and Reid 1982), artifact uselife (Schlanger 1990, 1991), and changes in lithic technology (Young 1990); the presence of ceramic manufacture (Rafferty 1985); measures of interior versus exterior use space, interior versus exterior hearths, and presence or absence of pits, postholes and storage features (Gilman 1987; Lightfoot and Jewett 1984; Powell 1983); the presence of burials and trash middens (Lightfoot and Jewett 1984; Rafferty 1985); and finally, estimations of botanical and faunal seasonality and diversity (Powell 1983; Young 1990). Furthermore, a relatively wide range of environmental variables have also been considered, including the distance to the nearest water source (both primary and secondary drainages), the slope of the site terrain, temperature and rainfall data, and characteristics of the immediate environmental zone, vegetation zone, and catchment area (Adams 1978; Dean and Lindsey 1978; Gilman 1987; Lightfoot and Jewett 1984; Powell 1983; Winter 1978).

Test Sites

The initial step in the analysis was to select variables considered to be the most sensitive to energy expenditure and artifact and feature diversity. The plan was to first measure these variables at a set of sites (referred to as the "test" sites) believed to represent both ends of the sedentism continuum (i.e., obvious sedentary sites, such as Walpi [ethnographically known to be permanently occupied] and Las Colinas [which contains more than 150 pithouses and a platform mound], and obvious seasonal sites, such as single-room fieldhouses). The test sites were used to represent known data points, either seasonal or sedentary, from which the selected variables could be evaluated. Although there is admittedly danger in accepting the excavators' classifications of these sites (since most were not explicitly evaluated for sedentism), care was taken to select examples that were as clear-cut as possible. Due to data needs, however, discussed below, this goal was not always met and a few of the sites are more ambiguous than desired.

After reviewing the available literature, a set of 16 test sites was selected. Eight of the test sites were believed by their excavators to represent permanent occupations, while the other eight were believed to be seasonal or temporary occupations. Four of the eight seasonal sites were believed to have been possibly seasonally reused, as were some of the sedentary sites. A listing of the selected sites is given in Table 26.1 and their locations are shown in Figure 26.2. The test sites were selected from all areas of the Southwest since it was believed that the study would have applicability across culture areas. They were selected primarily on the availability of data needed to measure the chosen variables and their representativeness as being from either end of the sedentism continuum. An attempt also was made to choose sites that were excavated in a similar manner, that is, had either a complete or relatively representative excavation sample. In this sense, the test site sample is somewhat biased, because in general only recently excavated sites contained the full range of necessary information. Furthermore, it was easier to evaluate and to get information from sites that I was most familiar with (because in some cases it involved examining unpublished data tables). As a result, Tucson Basin Hohokam sites excavated by Desert Archaeology (Institute for American Research) make up more than 30 percent of the sample and Hohokam sites in general make up more than 55 percent. Although this is certainly cause for concern, the fact that the remaining sites are spread throughout the Mogollon, Salado, Sinagua, and Anasazi areas, somewhat mitigates the Hohokam bias, although more work and an expanded sample clearly are needed. The test site sample is believed to be sufficient, however, for this preliminary analysis.

Variables

An initial set of 28 variables was selected through a review of previous sedentism studies with the addition of other variables thought to be potentially sensitive to energy expenditure. It is important to note at the outset that size and density variables, common in previous sedentism studies (Lightfoot and Jewett 1984; S. McAllister and F. Plog 1978; Powell 1983) were not included in the analysis for several reasons. For one, both of these variables are dependent on a number of factors that may not be related to occupation duration. An areal measure of site size or a count of the numbers of specific feature types (e.g., numbers of pithouses, numbers of masonry rooms, numbers of extramural pits, etc.) can also be a reflection of intensity of occupation, population size, and site reuse. Furthermore, ethnographic data suggest that substantial populations may inhabit seasonally occupied sites (Rafferty 1985). As a result, although size and feature density variables may be measuring sedentism, it is difficult to factor out what else they are measuring. Therefore in this analysis a single-room fieldhouse with a single extramural roasting pit is considered to be equivalent at the outset to a 500-room pueblo with 50 extramural roasting pits -- both of these occupations may be seasonal or sedentary, site size and feature density are not factors. The same problems hold true for artifact density, which is additionally troublesome because it is often dependent on specific disposal behaviors (i.e., trash mounds may have different densities than filled-in structures or extramural pits) that are difficult to factor out in the measurement. Like site size and feature density, artifact density may also be measuring population size, site reuse, and the intensity of the occupation. That is, although a site with a high artifact density may be a sedentary occupation, it may also be a seasonal occupation inhabited by a large number of people, or one that had been reused over a number of years. Therefore, diversity measures (simple counts of the numbers of different feature and artifact types) are believed to be more applicable. This is true even with Schlanger's (1990:106) criticisms, discussed earlier, because it is believed that in general (although not always) the greater the diversity (but not the size or density) of features and artifacts, the more sedentary the population. In this sense, diversity is believed to be primarily measuring energy expenditure (effort put into construction of site facilities and manufacture of artifacts) and to a certain extent time (the longer the occupation the more diverse the assemblage). As mentioned, the potential ambiguity in diversity measures are believed to be controlled for by the complementary use of energy-expenditure measures as shown in the model presented in Figure 26.1.

The variables also were selected to be generally cross-cultural (at least in the Southwest) and accessible from a wide range of reports put out by various institutions and archaeologists. In this sense, only the most commonly recorded and general artifact and feature categories were used. Furthermore, variables that are more-or-less specific to a region, like decorated ceramic frequency (Lightfoot and Jewett 1984; S. McAllister and F. Plog 1978; Powell 1983) or presence of intrusive ceramics (Pilles 1978), were not used, because, for

Table 26.1. Test sites selected for sedentism analysis.

Site (Site No.)	Estimated Occupation Duration	Est. Size	Date (A.D.)	Location	Reference
Permanent Sites:					
Tanque Verde Wash (AZ BB:13:68)	Permanent (short-term)	19 PH	1000-1100	Tucson Basin Hohokam	Elson 1986
Los Morteros South (AZ AA:12:57)	Permanent (deep)	300 PH	850-1100	Tucson Basin Hohokam	Wallace 1991
Los Morteros North (AZ AA:12:57)	Permanent (deep)	100 PH Compound	1150-1300	Tucson Basin Hohokam	Wallace 1991
La Lomita Pequena (AZ U:9:66)	Permanent (short term)	31 PH	900-1025	Phoenix Basin Hohokam	Mitchell 1988
Las Colinas (AZ T:12:10)	Permanent (deep)	150 PH Platfrm Md	850-1350	Phoenix Basin Hohokam	Gregory et al. 1988
Disert (AZ A:5:10)	Permanent (short term)	70 MR	1300-1350	Mimbres	Nelson and LeBlanc 1986
Walpi	Permanent (deep)	500(?) MR	1690-present	Hopi	Adams 1979
AZ I:1:17	Permanent/ Seasonal Reuse (short term)	3 PH 1 PR	1049-1064	Cohonina/ Anasazi	Sullivan 1986
Seasonal/Temporary Sites:					
Cienega (AZ BB:9:143)	Seasonal Reuse	15 PH	1000-1100	Tucson Basin Hohokam	Bernard-Shaw and Huntington 1990
Sun City Vistoso (AZ B:9:153)	Seasonal (Reuse?)	3 PH	1000-1150	Tucson Basin Hohokam	Craig 1988
AZ EE:1:152	Seasonal	1 PH	1100-1150	Tucson Basin Hohokam	Huckell et al. 1987
Carpet (AZ T:4:12)	Seasonal (Reuse?)	2 PH	1000-1100	New River Hohokam	Doyel and Elson 1985
Duncan (AZ CC:8:2)	Seasonal	13 PH	200-400	Mogollon	Lightfoot 1984
Manzanita Ridge (NA18,350)	Seasonal Reuse	3 MR	1050-1200	Mogollon	Dosh 1988
Junction House (NA16,920)	Seasonal	1 MR	1150+	Tonto Basin Salado	Ciolek-Torrello 1987
NA18,177	Seasonal	1 MR	850-1050	Mogollon	Dosh 1988

PH = Pithouse; PR = Pit room; MR = Masonry room

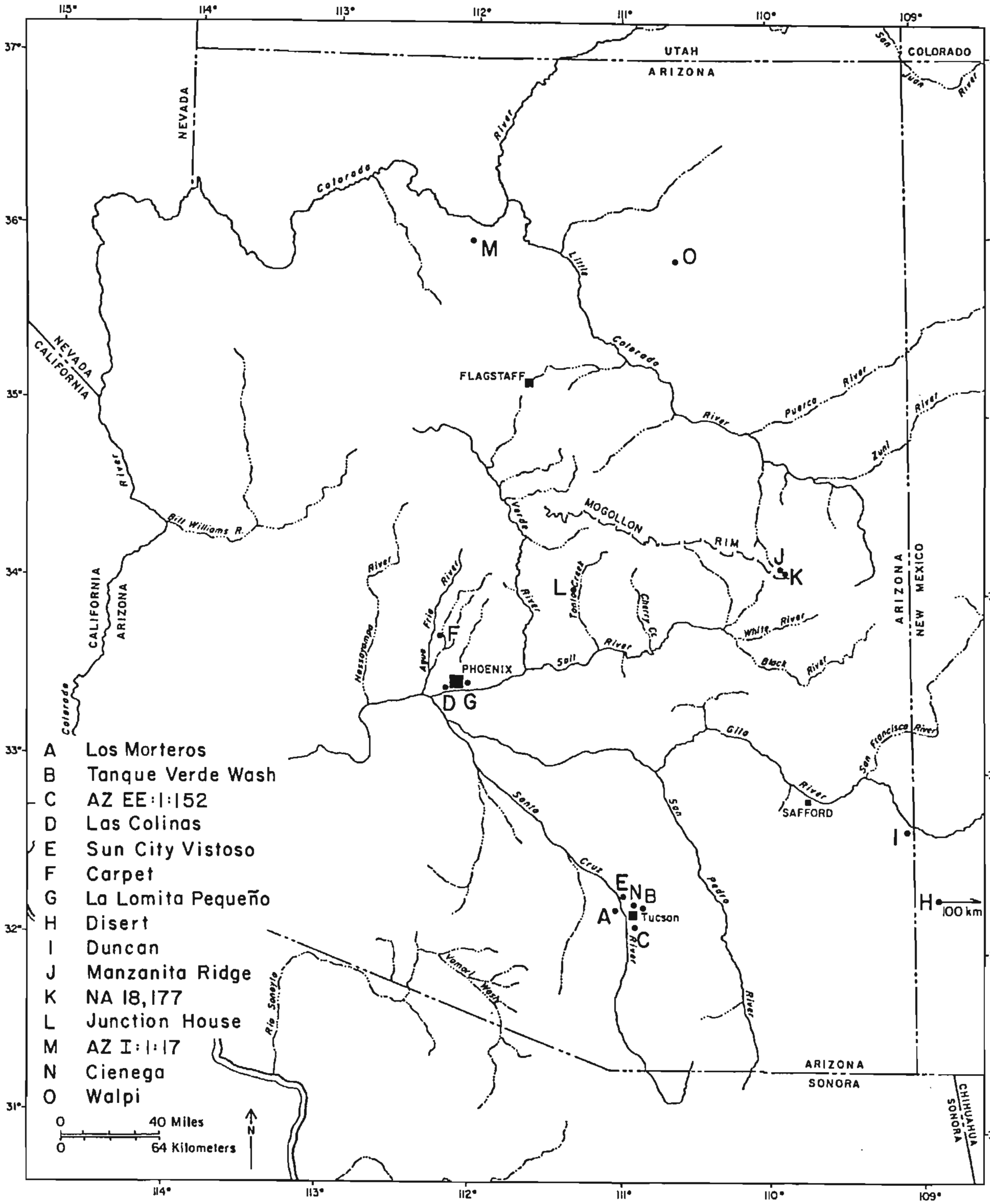


Figure 26.2. Location of test sites used in the sedentism analysis.

example, they would be drastically different among the Tonto Basin, which has no indigenous decorated tradition, and the Little Colorado and Tusayan areas, which have an extensive history of local whiteware production. This also is true for variables such as structure depth, which although hotly debated (Gilman 1987; Lightfoot and Jewett 1984; Woodbury and Zubrow 1979) and potentially significant, cannot be measured cross-culturally due to the architectural differences between pithouses and surface masonry structures.

The 28 variables coded in the initial phase of the analysis are listed next along with a brief discussion of the rationale or reason for inclusion. Not all of these variables were found to be significant -- many simply were not applicable for measuring sedentism, or were difficult to measure, and these were culled in later stages of the analysis. Furthermore, it was realized that the measure of sedentism was not absolute, nor would it be distinguished by any single variable; the analysis was purposefully multivariate, because no site will exhibit all of the characteristics thought to be associated with either sedentary or nonsedentary populations. There will always be exceptions to any rule, particularly when dealing with human behavior. Due to this it is extremely important to think of the variables as representing degrees of probability, although the actual probability cannot currently be quantified. The variables are divided into four general categories: environment, energy diversity, and other.

Environmental Variables

A. Sites that are more sedentary will be located closer to permanent water sources more often than sites that are less sedentary.

    1. PDIS -- Straight line distance (km) to permanent water.

B. Sites that are more sedentary will be constructed on a homogeneous set of similar landforms more often than sites that are less sedentary.

    2. LFRM -- Landform site is located on:
        1 = Floodplain
        2 = 1st terrace
        3 = 2nd terrace
        4 = Bajada/Lower piedmont
        5 = Mountain uplands/Higher piedmont
        6 = Plateau/Mesa top

C. Sites that are more sedentary will be located within or near to areas of arable soil more often than sites that are less sedentary.

    3. ARAB -- Straight line distance (km) to arable land.

D. Sites that are more sedentary will be situated within an area of environmental diversity more often than sites that are less sedentary. This is due to the more functionally specific nature of many of the less sedentary sites.

    4. RDIV -- Resource diversity measured 1-n by counting environmental zonation within a 3-km area of the site.

Energy Variables

A. Sites that are more sedentary will have greater energy invested into site architecture more often than sites that are less sedentary.

    5. SSIZ -- Structure size (m^2) (averaged for the site).

6. SSHP -- Structure shape (averaged for the site).
   1 = Round/oval
   2 = Between round/oval and square/rectangular
   3 = Square/rectangular

Structure shape is based on a wide body of ethnographic literature (cited in Rafferty 1985:130) that suggests that sedentary populations tend to construct square or rectangular houses while less sedentary populations construct round or oval houses.

7. PFL -- Percentage of structures with prepared floors (plaster, flagstone, other intentional preparation, etc.).
8. INH -- Percentage of structures with interior hearths.
9. PH -- Ratio of plastered or slab-lined prepared interior hearths to total interior hearths.
10. HSZ -- Size of interior hearth (cm^2)(averaged for the site).

B. Sites that are more sedentary will have greater energy invested into site artifacts more often than sites that are less sedentary.

11. SHMA -- Percentage of shaped formalized manos to total mano assemblage (excluding indeterminate manos).
12. SHMT -- Percentage of shaped formalized metates to total metate assemblage (excluding indeterminate metates).

C. Sites that are more sedentary will have greater energy invested into site structure and public facilities more often than sites that are less sedentary.

13. BRLS -- Presence (2) or absence (1) of burials.
14. CEM -- Presence (2) or absence (1) of a defined cemetery area.
15. PA -- Presence (2) or absence (1) of public architecture (mounds, ballcourts, kivas, etc.).
16. STR -- Presence (2) or absence (1) of a defined site structure (plazas, courtyard groups, etc.).

Note: these variables were combined later in the analysis into a single variable called COMBSTR (combined structure), which was tabulated through adding the scores for the individual variables for a minimum of four (absence of all four variables) and a maximum of eight (presence of all four variables).

Diversity Variables

A. Sites that are more sedentary will have a greater diversity of feature and artifact types more often than sites that are less sedentary. This is due to the limited and functionally specific nature of less sedentary sites.

17. FDIV -- Feature diversity: number of different feature types present from generalized feature list. Presence of type is scored as 1 (total scored 0-9).

   Habitation structures
   Storage structures
   Extramural pits
   Extramural hearths
   Trash mounds
   Roasting pits
   Bell-shaped pits/Granaries
   Public features (kivas, ballcourts, mounds, etc.)
   Burials/Cremations

18. ART -- Artifact diversity: number of different artifact types present from generalized artifact list. Presence of type is scored as 1 (total scored 0-13).

    Lithic tools
    Lithic debitage
    Decorated ceramics
    Plainware ceramics
    Manos
    Metates
    Bone tools
    Unmodified shell
    Shell artifacts
    Pigments
    Minerals
    Stone jewelry
    Exotica (figurines, censers, palettes, etc.)

19. LITH -- Lithic tool diversity: number of lithic tool types present from generalized lithic tool type list. Presence of type is scored as 1 (total scored 0-8).

    Projectile points
    Cores
    Core tools
    Scrapers
    Choppers
    Bifaces
    Drills
    Hammerstones

20. GND -- Ground stone diversity: number of ground stone types present from generalized ground stone type list. Presence of type is scored as 1 (total scored 0-8).

    Shaped manos
    Unshaped manos
    Shaped metates
    Unshaped metates
    Mortars
    Pestles
    Tabular knives
    Axes

B. Sites that are more sedentary will have a greater diversity of food remains and cultigens more often than sites that are less sedentary. Again this is due to the more limited and functionally specific nature of less sedentary sties.

21. FAUN -- Number of different recovered faunal species (includes only those potentially used for food resources).
22. FLOT -- Average number of botanical taxa per productive flotation sample (includes only charred remains; does not include grasses. Agave is not included because it has only recently been commonly recognized in flotation analyses).
23. CRN -- Ubiquity of corn (percentage of productive flotation samples containing corn).
24. CULT -- Ubiquity of total cultigens (percentage of productive flotation samples containing cultigens).

Other Variables

This category contained variables that were more experimental in nature in that there was some evidence that they could inform on sedentism but it was not overly clear.

A. Sites that are more sedentary should have a higher ceramic-to-lithic ratio than sites that are less sedentary due to the greater range of ceramic-related tasks.

  25. CERL -- Ratio of total ceramics to total lithics.

B. Sites that are more sedentary should have a greater ratio of manos and metates to the number of structures than sites that are less sedentary. This is based on McAllister and Plog (1978:19) who state that, ethnographically, permanently occupied habitation sites have a metate-to-structure ratio of between 2-6 to 1, whereas less sedentary sites should have fewer metates.

  26. MANS -- Ratio of manos to the number of structures (excluding defacto or abandonment refuse because the special nature of deposition can bias the counts).
  27. METS -- Ratio of metates to the number of structures (excluding defacto or abandonment refuse because the special nature of deposition can bias the counts).

C. Sites that are more sedentary should have a higher ratio of cores to bifaces. This is based on the work of Young (1990) and Parry and Kelly (1987), who argue that increasing sedentism can be correlated with an emphasis on an expedient core technology. As Young (1990:6) states, "sedentary groups are less constrained by the need to make effective use of raw materials and can use an expedient technology that is wasteful compared to other technologies such as biface reduction."

  28. CORE -- Ratio of cores to bifaces.

Analysis

The analysis proceeded as follows. The 28 variables were first coded for the 16 test sites. These were then statistically evaluated through association and significance tests to see which variables were the most successful in separating the set of eight sedentary sites from the set of eight seasonal sites. The evaluation also included four random trials, each involving the random selection and analysis of eight of the 16 sites to insure that patterning was not the result of the small sample size or one or two sites biasing the sample. A second set of variables believed to be the most significant in measuring sedentism was then culled from the first set and the 16 test sites were plotted using these variables through multidimensional scaling (MDS) analysis (discussed below). The MDS analysis correctly ordered the test sites -- sites believed to be seasonal fell at one end of the continuum and sites believed to be sedentary fell at the other end. The variables were further culled to eliminate possible redundancy in measurement and a final set of variables was used to measure the Rye Creek sites. Finally, the Rye Creek sites were plotted through MDS analysis in relation to the test sites and estimations of their degree of sedentism were made. The analytical methods are discussed more completely here.

Variable Evaluation

In most cases the published site reports (or in some cases unpublished data tables) provided information for all of the 28 initial variables. A few of the test sites were lacking data in some of the categories. Of the 16 sites, two did not contain data on plastered/prepared floors (PFL), plastered/prepared hearths (PH), and hearth size (HSZ) (Walpi and Los Morteros North); two did not contain data on frequency of shaped manos (SHMA) and shaped metates (SHMT) to the total mano and metate assemblages (Sun City Vistoso and Duncan); and single sites were missing data from the structure size (SSIZ), structure shape (SSHP), and interior hearth (INH) categories (all Los Morteros North), and flotation (FLOT), corn ubiquity (CRN), and total cultigen ubiquity (CULT) categories (all site NA18,177 from which flotation samples were not recovered). These were not considered serious deficiencies in the data set, however, because statistical evaluations of these variables could still be undertaken using 14 or 15 sites instead of the original 16. Also, at this stage three variables were eliminated and another (combined) variable was created. The variables RDIV (resource diversity within a 3 km radius of the site), ARAB (distance to arable land), and LFRM (landform) were eliminated from the analysis because it was difficult to get accurate (and therefore meaningful) data from published site descriptions. Although these variables may be significant in measuring sedentism, more refined maps and/or more detailed environmental descriptions were needed to measure these. The variable COMBSTR (combined structure) was created through combining variables BRLS (presence=2/absence=1 of burials), CEM (presence=2/absence=1 of defined cemeteries), PA (presence=2/absence=1 of public architecture) and STR (presence=2/absence=1 of site structure). COMBSTR, which replaced the four separate variables in the analysis, was measured by adding the values of the combined variables for a maximum score of 8 and a minimum score of 4. This left 22 variables for analysis.

The eight sites considered to be permanent were grouped and assigned a designation of Function = 1 and the eight sites considered to be seasonal were grouped and assigned a designation of Function = 2. Stem and leaf diagrams were then run for each variable (from the Combined, Function = 1, and Function = 2 data sets) and the median and upper and lower hinges were computed. The median values for these data are given in Table 26.2. As can be seen from this table, some of the variables appear to contain definite differences among the median scores, while others do not appear to be significantly distinct. To statistically test these differences, contingency tables were generated from the Combined data set grouping Function = 1 (sedentary) and Function = 2 (seasonal) sites as columns and the scores for the variables as the rows. The median value was used as the break point and two by two contingency tables were constructed by counting the number of sites in the Function = 1 and Function = 2 categories that were above or below the median (see example for the variable SHMT in Figure 26.3). The variables were then evaluated through Yules-Q and Fisher's exact (two-tail) statistical tests. Yules-Q is a measure of the strength of association, and therefore can rank the variables, while Fisher's exact is a test of significance designed for small sample sizes. A Yules-Q score of over 0.80 was assigned a strong association, between 0.50 and 0.80 a moderate association, and below 0.50 a weak association. The significance cut off for the Fisher's exact test was placed at $p < 0.05$. Table 26.3 ranks the variables through their Yules-Q scores and gives their level of significance as determined by Fisher's exact test. As can be seen from the table, 14 variables have a moderate to strong association and are statistically significant (with the exception of structure shape, which has a strong association but is not statistically significant), while eight variables have a weak association and are not statistically significant.

To test whether the results of the association and significance tests were being influenced by the particular selection of sites, a series of four random trials was undertaken. Each trial consisted of the random selection (through the SYSTAT program) of 8 of the 16 sites. Random Trial 1 consisted of four sedentary (Lomita Pequeña, Disert, Las Colinas, Los Morteros North) and four seasonal (Cienega, NA18,177, Manzanita Ridge, Carpet) sites; Random Trial 2 consisted of five sedentary (Walpi, AZ I:1:17, Las Colinas, Los Morteros South, Tanque Verde Wash) and three seasonal (Sun City Vistoso, Junction House, Carpet) sites; Random Trial 3 consisted of four sedentary (Disert, Las Colinas, Los Morteros South, Tanque Verde Wash) and four seasonal (Sun City Vistoso, Cienega, Manzanita Ridge, Carpet) sites; and Random Trial 4 consisted of three sedentary (Lomita Pequeña, Walpi, Los Morteros South) and five seasonal (Sun City Vistoso, Duncan, Cienega, NA18,177, Carpet) sites. Each randomly selected set was then evaluated in the same manner as the complete set of 16 sites (i.e., stem and leaf diagrams, and Yules-Q and Fisher's exact tests). The results of the random trials generally confirmed the results obtained through the evaluation of the complete data set shown in Table 26.3. The main differences were in the three variables close to the cut-off for association strength: structure size (SSIZ), shaped metates (SHMT) and shaped manos (SHMA). Two of the four random tests (Random Trials 1 and 4) indicated that structure size was only weakly associated, while shaped metates were moderately associated in two (out of three, one was not calculated due to sample size problems) and shaped manos were moderately associated in three (out of three) of the random trials. In addition, one of the random trials (Random Trial 4) suggested that the presence of interior hearths (INH) (which is negatively associated, meaning that seasonal sites contain a higher frequency), was only weakly associated, while the number of metates per structure (METS) was moderately associated in one trial, and weak to moderately associated in two others.

Table 26.2. Median values for variables in the Function = 1 (sedentary sites), Function = 2 (seasonal sites), and combined (sedentary and seasonal sites) data sets. Note presence/absence and ranked variables are not included in this table.

Variable	Sedentary (n=8)	Seasonal (N=8)	Combined (n=16)
PDIS (permanent water)	0.5 km	0.5 km	0.5 km
SSIZ (average structure size)	18.5 m^{2a}	11.25 m^2	15.1 m^{2b}
SSHP (average structure shape)	2.2[a]	1.7	2.0[b]
PFL (% plastered-prepared floor)	81.0%[c]	0.0%	31.5%[d]
INH (% interior hearth)	80.0%[a]	100.0%	88.0%[b]
PH (% plastered-slab hearth)	91.0%[c]	10.0%	75.0%[d]
HSZ (average hearth size)	1065 cm^{2c}	1085 cm^2	1085 cm^{2d}
COMBSTR (combined structure)	7.0	4.0	5.5
SHMA (% shaped manos)	83.7%	65.1%[a]	83.3%[b]
SHMT (% shaped metates)	61.3%	36.1%[a]	58.2%[b]
FDIV (feature diversity/9)	7.0	3.5	4.0
ART (artifact diversity/13)	13.0	7.5	11.0
LITH (lithic diversity/8)	7.5	4.5	6.0
GND (ground stone diversity/8)	8.0	4.0	6.0
FAUN (# of faunal species)	19.5	2.5	8.0
FLOT (# species/flotation)	3.2	1.3[a]	2.0[b]
CRN (% ubiquity of corn)	42.1%	25.0%[a]	31.8%[b]
CULT (% ubiquity of cultigens)	65.9%	33.3%[a]	43.6%[b]
CERL (ceramic to lithic ratio)	4.9	4.0	4.0
MANS (manos/structure)	3.3	3.5	3.3
METS (metates/structure)	1.05	1.7	1.15
CORE (core to biface ratio)	3.2	1.6	2.0

[a]Sample size n=7
[b]Sample size n=15
[c]Sample size n=6
[d]Sample size n=14

Table of SHMT (Rows)
by Function (Columns)
Column Percents

	1.00	2.00	TOTAL	N
0.000	.00	33.33	14.29	2.00
22.200	.00	16.67	7.14	1.00
45.800	12.50	.00	7.14	1.00
50.000	.00	16.67	7.14	1.00
55.900	12.50	.00	7.14	1.00
56.300	12.50	.00	7.14	1.00
— 58.2 (median)				
60.000	12.50	.00	7.14	1.00
62.500	12.50	.00	7.14	1.00
78.600	.00	16.67	7.14	1.00
96.000	12.50	.00	7.14	1.00
100.000	25.00	16.67	21.43	3.00
TOTAL	100.00	100.00	100.00	
N	8	6	14	

Stem and Leaf Plot
of Variable: SHMT, N=14

MINIMUM IS:	0.000
LOWER HINGE IS:	45.800
MEDIAN IS:	58.150
UPPER HINGE IS	96.000
MAXIMUM IS:	100.000

```
0   00
0
0   2
0
0 H 4
0 M 555
0   66
0   7
0
0 H 9
1   000
```

2 Cases With Missing Values Excluded From Plot.

Table of Function (Rows) by SHMT Columns

	ABOVE MEDIAN	BELOW MEDIAN	TOTAL
SEDENTARY (1)	5	3	8
SEASONAL (2)	2	4	6
TOTAL	7	7	14

FISHER EXACT TEST (TWO-TAIL) 0.103
YULE'S Q 0.5385

Figure 26.3. Example of statistical computations for variable SHMT (percentage of shaped formalized metates to total metate assemblage) used in the sedentism analysis. Function 1.00 = sedentary sites and Function 2.00 = seasonal sites.

Table 26.3. Ranking of variables by Yules-Q and Fishers exact tests.

Variable	Yules-Q	Fishers exact
FLOT (# of species/flotation)	1.0	0.000
PFL (% plastered floor)	1.0	0.000
COMBSTR (combined structure)	0.96	0.000
LITH (lithic tool diversity)	0.96	0.000
FAUN (# of faunal species)	0.96	0.000
ART (artifact diversity)	0.96	0.000
FDIV (feature diversity)	0.88	0.005
PH (% plaster/slab hearth)	0.88	0.005
INH (% interior hearth)	-0.88	0.005
SSHP (average structure shape)	0.85	0.103*
GND (ground stone diversity)	0.77	0.04
CULT (% ubiquity of cultigens)	0.72	0.03
CRN (% ubiquity of corn)	0.72	0.03
SSIZ (average structure size)	0.72	0.03
SHMT (% shaped metates)	0.54	0.103*
SHMA (% shaped manos)	0.54	0.103*
CORE (core to biface ratio)	0.47	0.13*
METS (metates/structure)	-0.47	0.13*
PDIS (distance to permanent water)	-0.25	0.32*
HSZ (average hearth size)	0.00	0.59*
CERL (ceramic to lithic ratio)	0.00	1.00*
MANS (manos/structure)	0.00	1.00*

*Not significant at the $p < 0.05$ level.

Based on the results of the testing of both the complete data set and the random trials, a second selection of variables was made. These variables were felt to be the most significant in separating the sedentary from seasonal data sets. From Table 26.3, selected variables include (in decreasing association):

1. FLOT (# of identified species per productive flotation sample);

2. PFL (percentage of structures with plastered or prepared floors);
3. COMBSTR (combined structure, including measurements of presence/absence of burials, presence/absence of a defined cemetery, presence/absence of public architecture, and presence/absence of site structure);
4. LITH (lithic diversity, measured from eight defined lithic tool types);
5. ART (artifact diversity, measured from 13 defined artifact types);
6. FDIV (feature diversity, measured from nine defined feature types);
7. PH (percentage of structures with a plastered or slab-lined prepared hearth);
8. INH (percentage of structures with an interior hearth);
9. GND (ground stone diversity, measured from eight defined ground stone tool types);
10. CRN (percentage ubiquity of corn in flotation samples);

Interestingly, several variables that had been relied upon in previous sedentism studies were found to be not significant. These include: CORE (core-to-biface ratio), METS (numbers of metates per structure), PDIS (distance to permanent water), HSZ (average hearth size), CERL (ceramic-to-lithic ratio), and MANS (numbers of manos per structure). The reasons for this are unclear, although several suggestions can be made, including the fact that the sample size may be too small or nonrepresentative (which is a consideration for all of the variables in this analysis). Other possible explanations are as follows: the distance to permanent water (PDIS) appears to be nonsignificant due to the fact that almost all of the sites, both seasonal and sedentary, were located relatively close to water sources. A preliminary analysis of the ARAB variable (distance to arable land), which was dropped from the analysis due to difficulty in obtaining accurate data, suggests a similar pattern, although there appeared to be more variability in the seasonal sites. The core-to-biface ratio (CORE) also appears not to be significant even though Young (1990) and Parry and Kelly (1987) suggest that sedentary sites will have a higher ratio due to the use of an expedient (and wasteful) lithic technology as compared to mobile populations which would utilize a less wasteful reduction strategy. Although this assumption seems reasonable, much of Young's (1990; Young and Harry 1989:276) data are based on comparisons among sedentary pueblo sites and (presumably) mobile Archaic period sites, and it is possible that temporal differences in lithic technology account for the changes that Young perceives. Further testing of these data are clearly needed. It is less clear why the other variables were not associated with either set of sites. McAllister and Plog (1978:20) state that permanently occupied structures among ethnographic groups contain two to six metates per structure, implying that seasonally inhabited structures will have fewer metates, because metates are "too heavy and unwieldy to carry around" and "too valuable to be abandoned at sites occupied for only a short duration." They are, however, lacking comparable ethnographic data from seasonal structures; the only data they give to support this assertion is archaeological data from a few small sites. In the data set used here, contrary to McAllister and Plog (1978), the number of metates per structure (METS) is weakly negatively associated, meaning that seasonal sites had slightly greater numbers of metates per structure than sedentary sites. The greater number of metates at the seasonal sites may be due to site function (seasonal resource procurement sites with few structures may have a greater number of metates per structure) or it may have to do with the excavated sample (trash areas and structures at smaller sites are more completely excavated than larger sites resulting in a more complete recovery of metates). Finally, hearth size (HSZ) and the ceramic-to-lithic ratio (CERL) appear to not be associated with the degree of site sedentism. The inclusion of hearth size as a variable in this analysis was based on more of a hunch than anything else, although Ciolek-Torrello (1978; Ciolek-Torrello and Reid 1974) uses this variable as a measurement of household size, and in turn it can be suggested that more sedentary settlements will have a greater number of large households. This variable, along with the variable for percentage of plastered or slab-lined prepared hearths (PH), was also thought to be a possible measure of architectural energy expenditure, reasoning that more sedentary sites would have larger and more carefully constructed hearths than less sedentary sites. Because the hearth size variable was averaged, however, it may not accurately reflect household size or energy expenditure. That is, patterns would be masked at the more sedentary sites with greater diversity in room function and therefore greater diversity in hearth sizes. The PH variable, however, was found to have a strong association with sedentary sites. The CERL (ceramic-to-lithic ratio), a commonly used measure in many archaeological studies, was highly nonsignificant. Both sets of sites exhibited extreme variation in this variable, suggesting that its meaning, if meaningful at all, is due to factors other than sedentism. Problems in controlling for formation processes and ceramic breakage rates can be suggested to be one problem with this variable, however.

Another interesting point that came out of the variable analysis is that the percentage of structures with interior hearths (INH) is strongly negatively associated with sedentism, meaning that less sedentary sites have more structures with internal hearths than more sedentary sites. The converse of this (i.e., the assumption that sedentary structures have more internal hearths) was relied upon strongly by Powell (1983) and Lightfoot and Jewett (1984) to separate cold-weather occupied (and more sedentary) sites from more ephemeral warm-weather occupied sites, and was partially the reason for the inclusion of the variable in this analysis. Although on the surface the negative association appears to be counterintuitive, because sedentary sites by definition should have higher frequencies of hearths, it is understandable when the diverse function of sedentary sites is considered. That is, sedentary sites have a greater number of functionally different room types, such as storage rooms, ceremonial rooms, and multipurpose rooms, which would inflate the numbers of rooms without hearths and thereby lower the overall site frequencies. This is particularly true in comparison to small sites with one or two structures, where often 100 percent of the structures contain internal hearths. At Walpi (Adams 1979:64), a large, permanently inhabited, 500+ room pueblo occupied into the historic present, only 20 percent of the rooms were classified as habitation rooms (there were approximately 3.2 storage/granary rooms for every habitation room) and hearths were found in only 33.8 percent of the structures.

Several variables that scored high in significance or association were dropped from the analysis either due to possible redundancy (measuring the same attribute twice) or difficulty in measuring. FAUN (number of recovered faunal species) was dropped because it was difficult to separate utilized faunal species from possibly intrusive faunal species in the various publications and site reports. Also, faunal diversity may be more a reflection of the surrounding environment or site function than of the degree of sedentism. SSHP (structure shape) was dropped as being too subjective a measure. Because many structures were neither completely round/oval nor square/rectangular, a subjective estimation had to be made, and an average was taken for the entire site. This probably was fine for small sites, but at a large site with hundreds of structures the error factor was felt to be potentially large and not well controlled. Although this may be a significant variable, as ethnographic data and this analysis (tentatively) suggest, more precise means of measurement need to be determined. The last significant variable dropped was the CULT cultigen ubiquity measure (percentage of flotation samples containing cultigens, including corn). This was for several reasons. Most important, it was felt to be possibly a redundant variable, because corn, which is usually the primary and often the only cultigen, was already being measured in the CRN variable. This means that the variable was being measured twice, which would weight the analysis on sites with a lot of corn. For another, it was difficult to decide what species to call cultivated, because there is evidence, for example, that *hordeum* (little barley grass), agave, and several other species may have been cultivated (see Kwiatkowski, Chapter 18). Finally, the variable was not felt to be particularly applicable to cross-cultural evaluation; different regions have different cultigens, which is often environmentally determined. Therefore, the ubiquity of corn measure (CRN) was felt to be a much better variable, because corn is found throughout the Southwest and is almost always a dietary staple.

In addition, average structure size (SSIZ) was dropped as a variable due to the fact that two of the four random trials suggested that it may not be applicable. Although it was statistically significant in the complete data set, with a moderate association, the random trials suggest that the association of structure size to sedentism is unduly influenced by the particular sample of sites being examined. This may be more due to the way it was measured, because all of the structures at a site were averaged together, than to the true significance of the variable. The percentages of shaped metates (SHMT) and shaped manos (SHMA) also were not included. Although some of the random runs suggested they may be associated with sedentism, the association was not believed to be strong enough (nor were they significant in the complete data set) to warrant inclusion in the analysis. These variables are still thought to be potentially significant as a measure of increasing energy expenditure in the site artifact assemblage but additional testing is needed before they can be fully evaluated.

Multidimensional Scaling Analysis (MDS)

Nonmetric multidimensional scaling (MDS) is a technique that has gained relatively wide acceptance in archaeological analysis (Cowgill 1972; Drennan 1976; Kendall 1971; LeBlanc 1975; Marquardt 1978; Orton 1982; see Wallace 1986a, 1986b for a review). Simply put, multidimensional scaling is a method for proximity analysis that measures the similarity among units of analysis, in this case sites, and plots them in space. For this analysis it has an important advantage over other clustering methods because units are related to each other along an ordinal scale rather than as linear distances, that is, the units are ranked and their order is known, although their exact placement within their ranked space is open to question. MDS has another advantage over other clustering methods in that it allows for the direct evaluation of results through the stress coefficient (in this case the Guttman-Lingoes coefficient of alienation).

The coded data for each variable were first converted into percentage data for comparability because the data coding included both ranked and continuous categories. This also involved a proportional standardization of the measurement scales so that each variable extended over 100 points (e.g., a variable that contained scores between 20 and 80 was converted so that the scores ran between 25 and 125). This was necessary for computing Euclidean distances, the data used by MDS to measure similarity, because variables with larger scales would have been weighted more heavily. Euclidean distances were then calculated through the SYSTAT program and these scores were input into the SYSTAT MDS program. Even though the statistical tests run on the contingency tables suggested that some variables were more significant than others in measuring sedentism, numerous MDS trials were run with different combinations of variables. As an example, Figure 26.4 shows an initial exploratory plot (with a three-dimensional solution) of 11 of the test sites (5 sites were eliminated from this initial run due to missing values) using 16 of the variables (FLOT, PFL, COMBSTR, LITH, FAUN, ART, FDIV, PH, INH, SSHP, GND, CULT, CRN, SSIZ, SHMA, SHMT). As can be seen from this figure, with the exception of AZ I:1:17 (which was one of the ambiguous sites, believed by the excavator [Sullivan 1986] to have both permanent occupation and seasonal reuse) the sites are correctly ordered -- sites believed to be more sedentary fall on the left side of the continuum and sites believed to be less sedentary fall on the right side. The plot also was encouraging in that Las Colinas, the highest ranked site, was believed to represent a site with deep sedentism, whereas Tanque Verde Wash, Lomita Pequena, and Disert, were expected to represent short-term sedentism. The intermediate rankings of Cienega, AZ I:1:17, Carpet, and Manzanita Ridge, also were encouraging in that all of these sites were believed to have been reused seasonally over a number of years.

Results

The 10 variables believed to be the most sensitive to sedentism (discussed earlier) were coded for the Rye Creek Project sites. Only seven of the sites contained appropriate data for this analysis, although these were generally the largest and most significant sites in the project area. These include the Deer Creek site (AZ O:15:52), Hilltop site (AZ O:15:53), Boone Moore site (AZ O:15:55), Compact site (AZ O:15:90), Redstone site (AZ O:15:91), Arby's site (AZ O:15:99), and Clover Wash site (AZ O:15:100). The Overlook site (AZ O:15:89) and sites AZ O:15:70, AZ O:15:71, and AZ O:15:96, all single-room masonry fieldhouses, were not analyzed because no flotation data were examined, while the Cobble (AZ O:15:54) and Rooted (AZ O:15:92) sites were too disturbed through root-plowing or road construction to evaluate. Data on the Rye Creek sites were then added to the SYSTAT file containing the test sites, Euclidean distances were computed, and these data were input into the MDS program. Two of the test sites, Los Morteros North, considered to be sedentary, and site NA18,177, considered to be seasonal, were dropped from the analysis at this stage due to lack of some data categories. Los Morteros North was missing data from 4 of the 11 categories (SSIZ, PFL, INH, and PH), while flotation samples were not recovered from site NA18,177. One other site, Walpi, was missing data in two categories (percentage of structures with plastered floors [PFL] and percentage of interior hearths that were plastered or slab-lined [PH]). Due to the significance of this site (the only one known to have been permanently inhabited ethnographically), it was retained in the analysis, using median values from the complete data set (31.5 percent for plastered floors and 75.0 percent for plastered hearths, see Table 26.2) for the missing data. By using the medians these variables are essentially unweighted and therefore the results are believed to be generally reliable. This left a total of 21 sites in the analysis, measured by 10 variables.

Figure 26.5 presents the first two dimensions of a two-dimensional solution MDS plot for the 21 sites and 10 variables. As can be seen from this figure, the relative ordering of the test sites in the trial run shown in Figure 26.4 is retained; sites considered to be sedentary cluster on the left hand side of the plot and sites considered to be seasonal cluster on the right hand side. The dimensions in MDS plots represent different

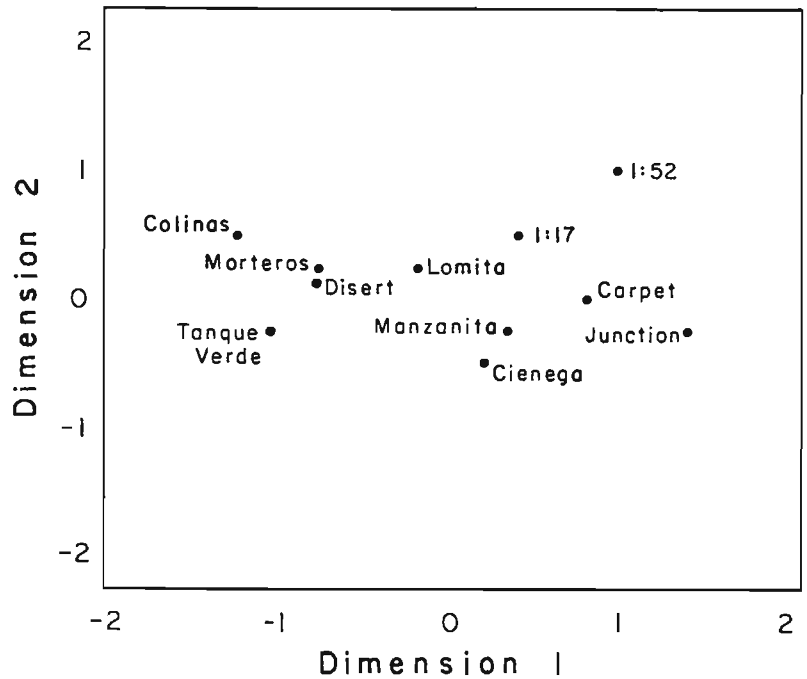


Figure 26.4. Exploratory MDS plot (with three-dimensional solution) of the first two dimensions for 11 test sites using 16 variables (FLOT, PFL, COMBSTR, LITH, FAUN, ART, FDIV, PH, INH, SSHP, GND, CULT, CRN, SSIZ, SHMA, SHMT).

factors that are influencing the array of the plotted points. Ideally, site duration would be the only dimension affecting the plot, resulting in a perfectly linear, one-dimensional array (Wallace 1986a). Two or three dimensions are often necessary to arrive at the appropriate configuration based on the stress values (Cowgill 1972; see Wallace 1986b:154 for an explanation of the method). In this case, the solution was in two dimensions (although some of the MDS trial runs using different variables produced a three-dimensional solution), meaning that some sort of noise is influencing the array of points. This is not unexpected given the nature of the database, the number of variables, and the somewhat crude proxy measures used here to measure site duration. The fact that a two-dimensional solution was obtained with 10 variables is considered quite good (Henry Wallace, personal communication 1991). Furthermore, given that Dimension 1 consistently ranked the sites in the expected order as determined through the test sites, it can be suggested that Dimension 1 represents site occupation duration. What Dimension 2 is measuring is unclear; at the suggestion of David Abbott (personal communication 1990), the rank order of the site plots on the first and second dimensions were compared using Spearman's correlation coefficient with the rank order of the sites within each variable (see also Wallace 1986a:137). A strong correlation of the variable with the second dimension ranking would indicate what variable(s) are contributing to the noise and possibly not measuring sedentism. Unfortunately, this exercise was only moderately successful because no strong correlation was obtained; Dimension 2 seems to be most affected by the percentage of structures with plastered or prepared floors (PFL), interior hearths (INH), and by the percentage of interior hearths that are plastered (PH), although why this is loading in this manner is unclear.

The narrowing of the variables to 10 and the inclusion of the Rye Creek sites makes the plot in Figure 26.5 more interpretable. Several broad groupings can be seen, which correlate relatively well with the expectations generated from the test sites, as well as from subjective estimations of the degree of sedentism of the Rye Creek sites and other Rye Creek data classes (such as the botanical and faunal remains presented in Chapters 18-21). The plot also can be correlated to a certain degree with the model presented in Figure 26.1. Although it must be realized that sedentism is seen as being on a continuum, with areas grading into each other, for clarity of interpretation and discussion several points are defined here. Walpi, Las Colinas, and Los Morteros

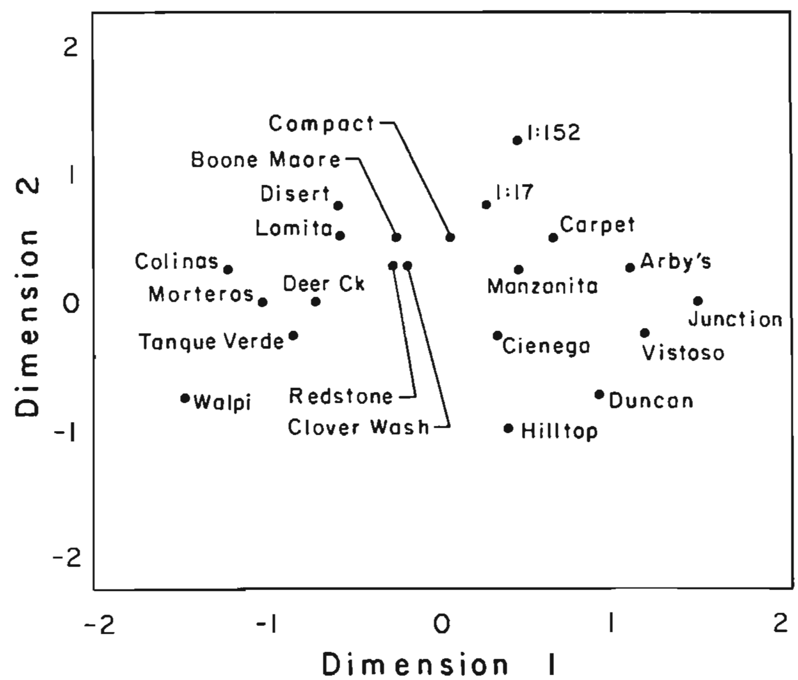


Figure 26.5. MDS plot (with a two-dimensional solution) of the first two dimensions for 21 test sites and Rye Creek Project sites using the 10 finalized variables.

South, which group at the left side of the scale, may represent deep, or relatively long-term, sedentism. Walpi is clearly the most sedentary of the sites (and Las Colinas and Los Morteros could even be considered as a separate group or part of the next group), which is encouraging because it is historically and archaeologically known to have been permanently inhabited for over 300 years (Adams 1979). A second group, consisting of the Tanque Verde Wash, Deer Creek, Lomita Pequeña, Disert, Redstone, Boone Moore, and Clover Wash sites, may represent sites that are short-term sedentary. Because these sites are somewhat dispersed along the first dimension, Tanque Verde Wash, Deer Creek, Lomita Pequeña, and Disert appear to be more sedentary than Redstone, Boone Moore, and Clover Wash. A third group of sites, composed of the Compact, AZ I:1:17, AZ EE:1:152, Manzanita Ridge, Cienega, Hilltop, and Carpet sites, all cluster together along the first dimension, although they are widely dispersed along the second dimension. These sites may represent seasonally reused occupations, inhabited on a temporary basis over a number of years. The dispersion along the second dimension suggests that there is greater variability in this group of sites than in the more sedentary sites, which may be related to their more functionally specific nature. Finally, the set of sites on the right side of the plot, Duncan, Arby's, Sun City Vistoso, and Junction House, may represent single component seasonal occupations, although short-term reuse is also a possibility given their dispersion along the first dimension (particularly for Duncan, Arby's, and Sun City Vistoso).

Modeling Energy Expenditure Versus Diversity: An Alternative Method

A simpler and perhaps more readily interpretable alternative method for measuring sedentism was devised after the completion of the MDS analysis. This involves plotting a combined measure of energy expenditure versus a combined diversity measure, similar to the model presented in Figure 26.1. In this analysis, the scores of four variables considered to be energy measures were added together and plotted against the scores of six variables considered to be diversity measures.

Energy expenditure variables include:

1) PFL -- Percentage of structures with plastered or prepared floors.
2) PH -- Percentage of hearths that are plastered, slab-lined, or prepared.
3) SSIZ -- Average structure size.
4) COMBSTR -- Combined structure (presence=2/absence=1 of burials, defined cemetery, public architecture, and site structure).

Diversity variables include:

1) FLOT -- Number of species per productive flotation sample.
2) CRN -- Percentage of productive flotation samples containing corn.
3) LITH -- Lithic tool diversity.
4) GND -- Ground stone tool diversity.
5) ART -- Artifact diversity.
6) FDIV -- Feature diversity.

Because the measurement of each variable was internally consistent, and therefore the different variables were contributing equally to the site total, the raw scores of each variable simply were added together to create a combined energy score and a combined diversity score. These are given in Table 26.4 along with their total score (energy expenditure + diversity) and are plotted in Figure 26.6. Like the MDS plot shown in Figure 26.5, several groupings are apparent which strongly correspond, with a few minor differences, to the MDS plot. The first grouping are sites that contain both a high energy expenditure and have a high artifact and feature diversity. These are situated in the upper right-hand corner of the plot and include Walpi, Las Colinas, the Deer Creek site, and Tanque Verde Wash site. These sites would be considered sedentary, and possibly long-term or deep sedentary, although the Deer Creek and Tanque Verde Wash sites are suspected to have been occupied for less than 100 years. Because time is not being directly measured here it is unclear where a cut-off point (in numbers of years) would be between deep sedentary and short-term sedentary. Alternatively, both Deer Creek and Tanque Verde Wash are known to have been reinhabited at some point after their primary occupations (see Chapter 7 and Elson 1986); both sites contain later structures and it is possible (and perhaps likely) that the diversity scores are reflecting this aspect rather than a long-term occupation. Las Colinas shows the highest energy expenditure and Walpi shows the greatest feature diversity of any of the analyzed sites. The next grouping are sites that have a similar energy expenditure to the first group but a lower feature and artifact diversity. These sites, due to their high energy expenditure levels, also are believed to represent sedentary occupations. The lower diversity levels suggest, however, that the sites may not have been occupied as long or as intensively as the deep sedentary sites. These possibly short-term sedentary sites include Disert, Lomita Pequeña, Los Morteros, Redstone, Boone Moore, and Clover Wash. It is unclear why Los Morteros plots as possibly short-term sedentary while in the MDS analysis it plots closer to the deep sedentary end of the continuum, essentially switching places with the Deer Creek and Tanque Verde Wash sites. It is possible that the primary occupation at Los Morteros was for a relatively short time, although this is essentially unknown because the total span of occupation at the site extended over at least several hundred years (Wallace 1991). Regardless, both analyses suggest a similar, sedentary-like occupation, differing in degree rather than in kind.

The remaining sites have relatively less energy expenditure and less diversity, and probably represent some form of short-term or seasonal occupations, although definite variation is apparent. The Compact site, Manzanita Ridge, AZ EE:1:152, and AZ I:1:17, given their relatively high energy levels but low diversity scores, may be very short-term sedentary occupations, much shorter than the scale implied by Nelson and LeBlanc (1986) when they defined the term. This is particularly true for the Compact site and site AZ I:1:17. An occupation of less than a generation seems reasonable, and possibly less than 15 years given estimates of structure use life (Ahlstrom 1984; Cameron 1990; Schlanger 1986) because little remodeling was noted at any

Table 26.4. Combined energy expenditure and diversity scores for analyzed sites in the sedentism study. Table arranged by value for total scores.

Site	Energy Score	Diversity Score	Total
Las Colinas	108.7	122.4	231.1
Walpi	85.4	122.6	208.0
Tanque Verde Wash	90.6	114.0	204.6
Deer Creek*	87.6	114.9	202.5
Disert	106.0	95.8	201.8
Redstone*	101.3	100.6	201.9
Lomita Pequena	106.6	89.7	196.3
Los Morteros South	98.8	94.1	192.9
Clover Wash*	93.4	90.3	183.7
Boone Moore*	90.9	92.0	182.9
Compact*	90.4	76.7	167.1
I:1:17	92.3	65.6	157.9
Manzanita Ridge	78.3	68.9	147.2
AZ EE:1:152	82.6	53.3	135.9
Carpet	63.7	65.7	129.4
Cienega	43.5	83.9	127.4
Hilltop*	48.2	76.3	124.5
Duncan	34.4	75.6	110.0
Arby's*	41.2	66.3	107.5
Sun City Vistoso	32.6	57.0	89.6
Junction House	34.0	40.5	74.5
Average Sedentary Test Sites (7)	98.3	100.6	198.9
Standard Deviation	9.1	20.6	21.9
Range of 1 Standard Deviation	89.2-107.4	80.0-121.2	177.0-220.8
Average Seasonal Test Sites (7)	52.7	63.6	116.3
Standard Deviation	21.8	14.6	26.2
Range of 1 Standard Deviation	30.9-74.5	49.0-78.2	90.1-142.5

*Rye Creek Project site

of these sites. On the other hand, these sites, along with possibly the Carpet site, may have been seasonally reoccupied on a planned basis. That is, sites that are planned to be returned to seasonally would be expected to have greater energy invested in site facilities as well as a greater feature and artifact diversity. Given the low diversity at AZ EE:1:152 it is possible that a planned return was anticipated but never undertaken, or as mentioned above, that the site was occupied on a sedentary basis for a very short period of time. The remaining sites all show very low energy investment with varying degrees of feature and artifact diversity, indicative of seasonal or seasonally reused sites. Cienega, Duncan, Hilltop, and Arby's (and possibly Sun City Vistoso), may have been reused seasonally, given their relatively high diversity. Alternatively, these sites could have been single-component seasonal sites that were occupied on a relatively more intensive level. Archaeologically, however, seasonal reuse is very clear for Cienega (Bernard-Shaw and Huntington 1990), Hilltop (see Chapter 7, Volume 1), and Arby's (see Chapter 9, Volume 1). Duncan, on the other hand, contained very little evidence for reuse, and Lightfoot (1984:113) suggests that the site was reoccupied for at most two or three seasons, if at all. Cienega contained two structures with 15 hearths and another two structures with 8 hearths, indicating continued reuse of the site, probably on a seasonal basis (Bernard-Shaw and Huntington 1990). This implies a planned reuse of the site area, although opportunistic reuse for Cienega and the other sites with low energy expenditure is also possible. Opportunistic behavior appears to be most applicable to Arby's, where portions of a partially filled-in structure were remodeled to create an ephemeral

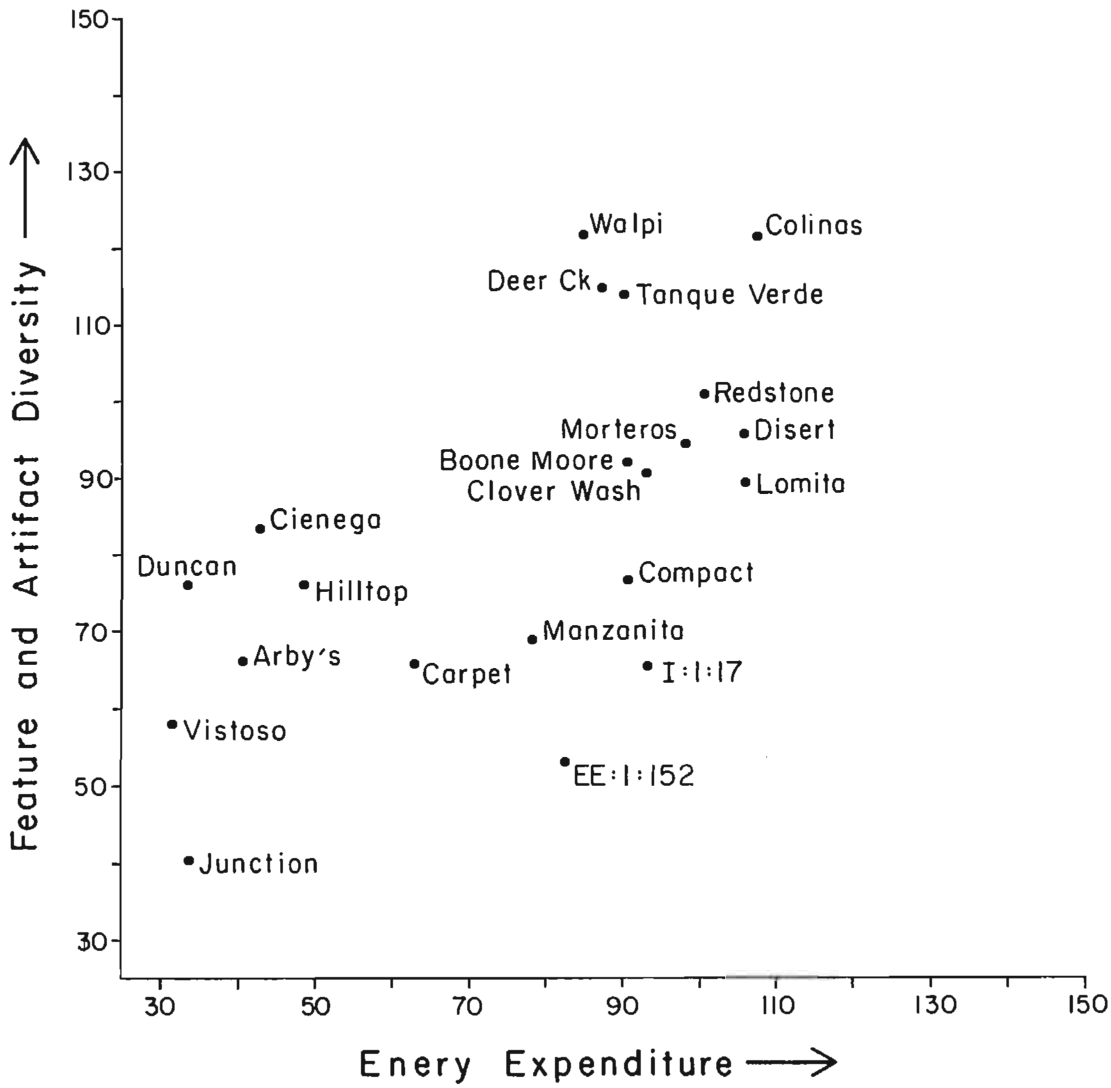


Figure 26.6. Energy expenditure scores plotted by feature and artifact diversity scores for the test sites and Rye Creek Project sites.

structure, and Hilltop, which had a series of spatially unrelated structures. Finally, Junction House (and possibly Sun City Vistoso), given its very low energy expenditure and diversity scores, may represent a single component seasonal site, although a low level of seasonal reuse is also possible.

Summary and Discussion

In summary, both methods presented suggest that sedentism is measurable and can best be perceived as being on a continuum. For the Rye Creek sites, Deer Creek (AZ O:15:52), with 17 pithouses, numerous extramural features, and a defined cemetery area, is believed to be the most sedentary site. Deer Creek is followed by a group of sites consisting of Redstone (AZ O:15:91), Boone Moore (AZ O:15:55) and Clover Wash (AZ O:15:100). Of these three sites, the Redstone site, although it only contains two structures as compared to five at Clover Wash and seven at Boone Moore, is the most substantially occupied. The occupation of these sites also is believed to be primarily sedentary, or close to sedentary, but of a different magnitude than the occupation of the Deer Creek site. The difference in magnitude may be due to a longer occupation span at Deer Creek, because the sites have roughly the same energy expenditure but different diversity levels, although population factors, site reuse, and differences in occupation intensity are also possible. All four of these sites, however, are somewhat difficult to interpret, because the archaeological data suggest that the sites were occupied at different times by both sedentary and possibly seasonal populations. This raises a potentially significant problem with these methods; because averaging data are used here for a number of variables, it is often difficult to separate out functionally different site components, and the analysis is more geared toward determining the nature of the primary occupation. As a result, the sedentary nature of a portion of the occupation may account for the high energy expenditure, while a seasonally based reoccupation may account for the relatively high diversity scores. In addition, this separation is not apparent on the MDS plots, which are based on a total score for the variables as calculated through Euclidean distances. Therefore, the use of the diversity by energy plots in conjunction with the MDS plots and the consideration of additional archaeological data, as done here, are necessary to account for potential reoccupation. Given these data, all four sites are considered to be primarily sedentary.

The Compact site (AZ O:15:90) occupies the next level down. Given its high energy expenditure it is possible that the site also represents a relatively sedentary occupation, although the lower diversity score suggests that the occupation was less intensive or of a shorter duration than the other more sedentary sites. The archaeological data (see Chapter 9) indicate, however, that a portion of the site is probably missing due to the construction of State Route 87, and that the Compact site may represent the Preclassic component of the Boone Moore site. If a portion of the site is missing, then the diversity scores would be significantly lower. This is unknown, however, and alternatively, the site may have been a very short-term sedentary occupation or a more intensive, perhaps planned, seasonally reused site. Reuse of the site is supported by the construction of a large horno (Feature 6) through one of the pithouses. The occupation of the Compact site, however, is of a much greater magnitude than the occupation of the two remaining analyzed Rye Creek sites, the Arby's (AZ O:15:99) and Hilltop (AZ O:15:53) sites, both of which are believed to have been seasonally occupied. In this respect, the Compact site is much more similar to the proposed sedentary occupations, differing only in the level of feature and artifact diversity. The Hilltop and Arby's sites, with low energy and diversity scores, are believed to have been seasonally reused. This is supported by architectural data from both sites, which show remodeling and superposition suggestive of unrelated reoccupations. The higher diversity score of the Hilltop site suggests a longer or more intensive site reuse, which accords well with the archaeological data; the ceramic assemblage indicates sporadic use of the site area over a possible 400-year period. Both sites appear to have been opportunistically reused; that is, the reuse may have been more fortuitous than planned and not related to the previous occupations.

Given these data, which as expected suggest a great deal of complexity in sedentism patterns, the original model presented in Figure 26.1 can be refined. This revised model is presented in Figure 26.7; like the original model boundaries purposefully were not drawn around the defined categories because these are perceived as being on a continuum and grade into each other. Categories are defined as reference points for ease of discussion and interpretation. Like the original model, sites with high energy expenditure and high feature and artifact diversity are considered to be deep or long-term sedentary, and sites with high energy expenditure but slightly less diversity are considered to be short-term sedentary. Likewise, sites with low energy expenditure and low diversity are considered seasonal, and sites with low energy expenditure but relatively higher diversity are considered to be reused seasonally. One additional category is defined here based on the data discussed earlier: sites with a relatively high energy expenditure but somewhat lower diversity may constitute planned seasonally reused sites -- the planning for a continued reoccupation increases the energy expended in site facilities while the reuse increases the diversity.

The new model also factors in the addition of seasonal reuse to these categories, which has the effect of increasing diversity and possibly pushing a category into the next higher level. This results in additional noise in the patterning, although as noted above, it is believed possible to factor out the reuse through additional archaeological data and a consideration of the diversity scores. In this sense, adding additional, and perhaps unrelated, reuse to a site constructed for planned reuse, for example, may push the diversity scale over a certain threshold and mimic patterns seen at the short-term sedentary sites. Adding additional seasonal reuse to a short-term sedentary site may mimic patterns seen at the deep sedentary sites. Sites that have low energy expenditure but a relatively high diversity, however, are reasonably clear as seasonally reused sites. Reuse here can be planned, but without a lot of energy put into the construction of site facilities, or opportunistic and unrelated to the previous occupations. Given the one standard deviation range for the energy and diversity scores presented in Table 26.4, most sites are readily separable on the energy level; sedentary sites from the test sample range between 89.2 and 107.4, while sites believed to be seasonal range between 30.9 and 74.5. The diversity scores, as expected, are more ambiguous, although no seasonal site has as high a diversity as sites considered to be deep or short-term sedentary.

The actual length of site duration is difficult to gauge from this analysis, because time is only being measured indirectly. Educated, but highly speculative, estimates can be made based on structure use-life studies, evidence for remodeling, and continuity in site structure. A single assumption is used here: the average life of a structure is roughly estimated at 15 years or so before remodeling may be needed (Ahlstrom 1984; Cameron 1990; Schlanger 1986). In this respect, the Deer Creek site appears to have been occupied for at least several generations, perhaps between 60 and 75 years, based on several sequences of house construction and courtyard group replacement. This is supported in part by the fact that the site plots extremely close in both analyses to the Tanque Verde Wash site, which has three courtyard group replacements and much better ceramic temporal control estimated to span around 100 years (Elson 1986). The reoccupation of the Deer Creek site, perhaps by seasonal populations, was relatively minor, occurring at some point after the primary occupation was abandoned. It is, therefore, not considered a major factor here, although it appears to have influenced the diversity scores at Deer Creek. The Redstone site, given the remodeling of one structure (Feature 11) and the subsequent construction of another, may have been occupied for 3 house replacement episodes, or around 45 years. Because the construction of the new house (Feature 5) appears to have been undertaken after Feature 11 catastrophically burned, 45 years may be a maximum estimate and the actual occupation time could be much shorter. Like the Deer Creek site, the reoccupation of the Redstone site was relatively ephemeral and occurred sometime after the main occupation (during the Classic period). The Boone Moore site and the Clover Wash site are more enigmatic, because archaeological evidence suggests that the sites may have been occupied by sedentary populations at one point in time and seasonal populations at others. At Clover Wash, one house cluster (Features 4 and 12) appears to be later, more substantial, and possibly more permanent, than the other house cluster (Features 1 and 3), which may have been seasonally occupied (see in particular Chapter 8 and the flotation, pollen, and faunal data in Chapters 18, 20, and 21). Therefore, because neither Feature 4 nor Feature 12 showed evidence for remodeling, the primary occupation of the site can be suggested to be around 15 years, with a previous period of seasonal reuse. If Features 1 and 3 represent relatively sedentary structures, however, and Features 4 and 12 are their architectural replacement, then the site could have been used for as long as a 30-year period. The occupation span of the Boone Moore sites is difficult to estimate, given the diversity of architecture (pithouse, pitroom, and masonry structures) and feature types. This is also true, because very few of the features appear to be related spatially to each other and the assignment of related house clusters or courtyard groups is difficult. That the site does contain three distinctive architectural styles, as well as a number of inhumations, roughly suggests at least a 45-year use period, but this is very speculative and the actual duration may be longer. The Compact site appears to have a single house cluster, an additional pithouse (whose relationship is unknown), and later intrusive features that

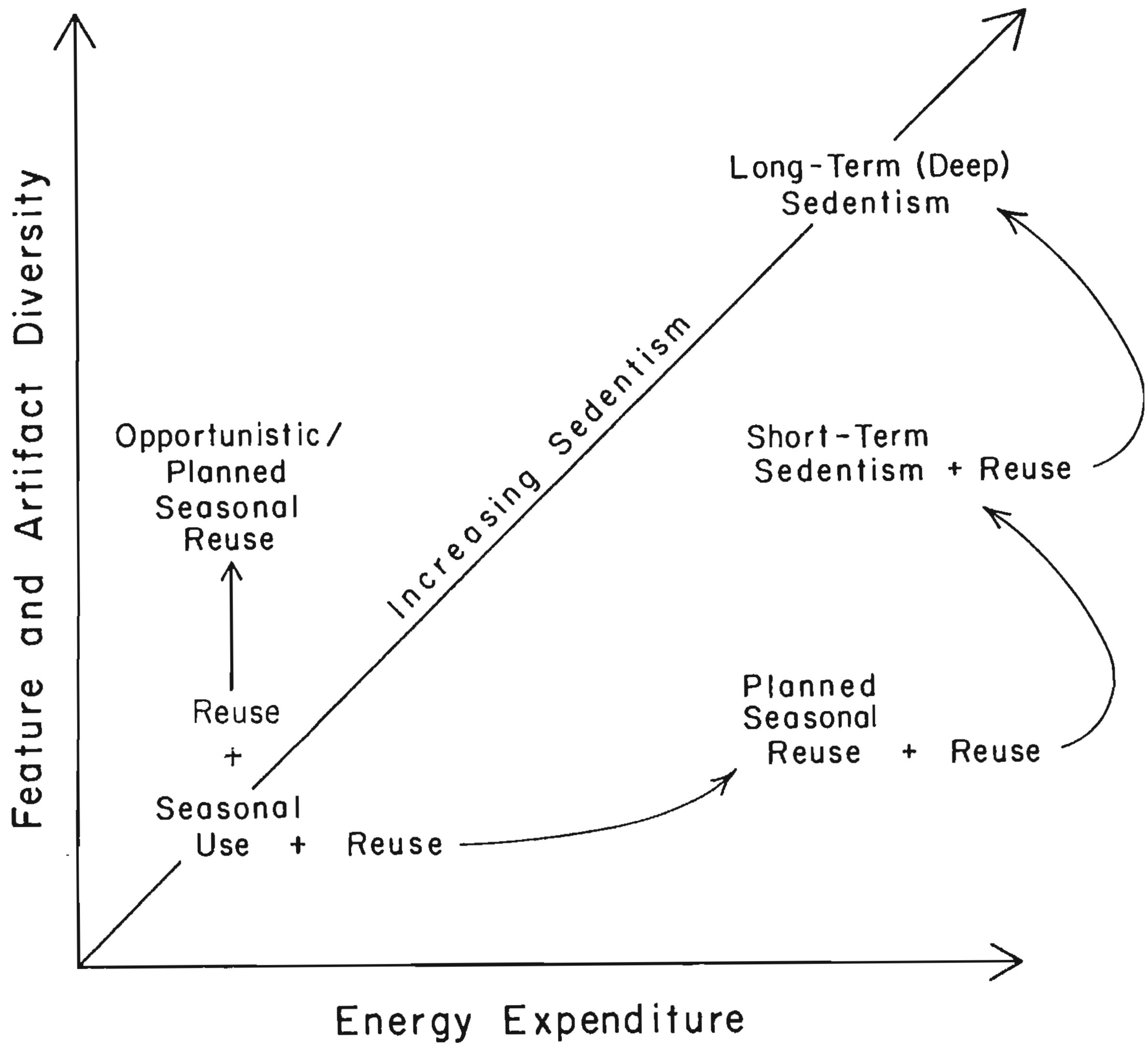


Figure 26.7. Revised model for degree of site sedentism based on the relationship between energy expenditure and feature and artifact diversity.

are either indicative of seasonal reuse or use of the site area by the inhabitants of the nearby and probably related Boone Moore site. Unfortunately, it is unknown if other portions of the site were present and removed by highway construction. Given the house cluster, it can be suggested that the site was in use for at least 15 years or so, although like the Boone Moore site, the actual duration cannot be comfortably estimated. The other Rye Creek Project sites are either believed to be seasonally occupied (Arby's, Hilltop, Overlook, AZ O:15:70, AZ O:15:71, and AZ O:15:96) and their occupation duration cannot be estimated, or they are too disturbed through root-plowing or road construction (Rooted and Cobble sites) to evaluate.

One final point needs to be made here: although it is believed that this analysis is measuring relative degrees of site sedentism and, indirectly time, it is also possible that other site attributes, such as site size, are being measured. That is, perhaps the selected variables are measuring site size and not sedentism. To investigate this the numbers of structures at the analyzed sites were plotted on both the MDS plot and the energy expenditure by diversity plot. These are shown in Figure 26.8. As can be seen from this figure, there is a general, and not surprising, correlation between site size and the degree of sedentism, because larger sites tend to be more sedentary than smaller sites. In fact, from this sample the largest nonsedentary site contained 15 structures, and although larger examples are known ethnographically, it is unclear whether large nonsedentary sites were occupied in the prehistoric Southwest during the ceramic period. The correlation between large site size and sedentism was not unexpected, and in fact, as discussed earlier, is a common assumption made in archaeological settlement pattern analysis. In both plots this pattern is far from straightforward and much variation is evident; in the MDS plot, for example, sites with fewer than 20 structures plot ahead of sites with 31 and 70 structures, while a site with only 2 structures plots ahead of sites with 3, 4, 5, 6, 7, 13, and 15 structures. The reversal is even more dramatic in the diversity versus energy expenditure plot, because sites with 2, 17, and 19 structures plot ahead of sites with 31, 70, and 300 structures. The same measurements could be made with the areal extent of each site with similar results. Therefore, it appears clear that the selected variables are not measuring site size or numbers of structures. The best explanation for the patterning seen in both plots is that the variables are measuring the relative degree of site sedentism.

CONCLUSIONS

This chapter has presented the results of a methodological study of site sedentism. Although the study of sedentism is believed to have been generally successful, questions can obviously be raised as to the sample size and the appropriateness of the sites selected for the test sample as known data points. For a preliminary analysis, which this is considered to be, it is believed that significant information on the degree of sedentism of the Rye Creek sites was obtained. Additional work is planned for the future on the Roosevelt Community Development Study (Doelle et al. 1991) to augment the site sample and refine the analysis. The data from this study are used, in conjunction with data from Rye Creek Ruin presented in Chapter 27 and data from the botanical and faunal analyses (Chapters 18-21), to model the Rye Creek settlement and subsistence systems presented in Chapter 28.

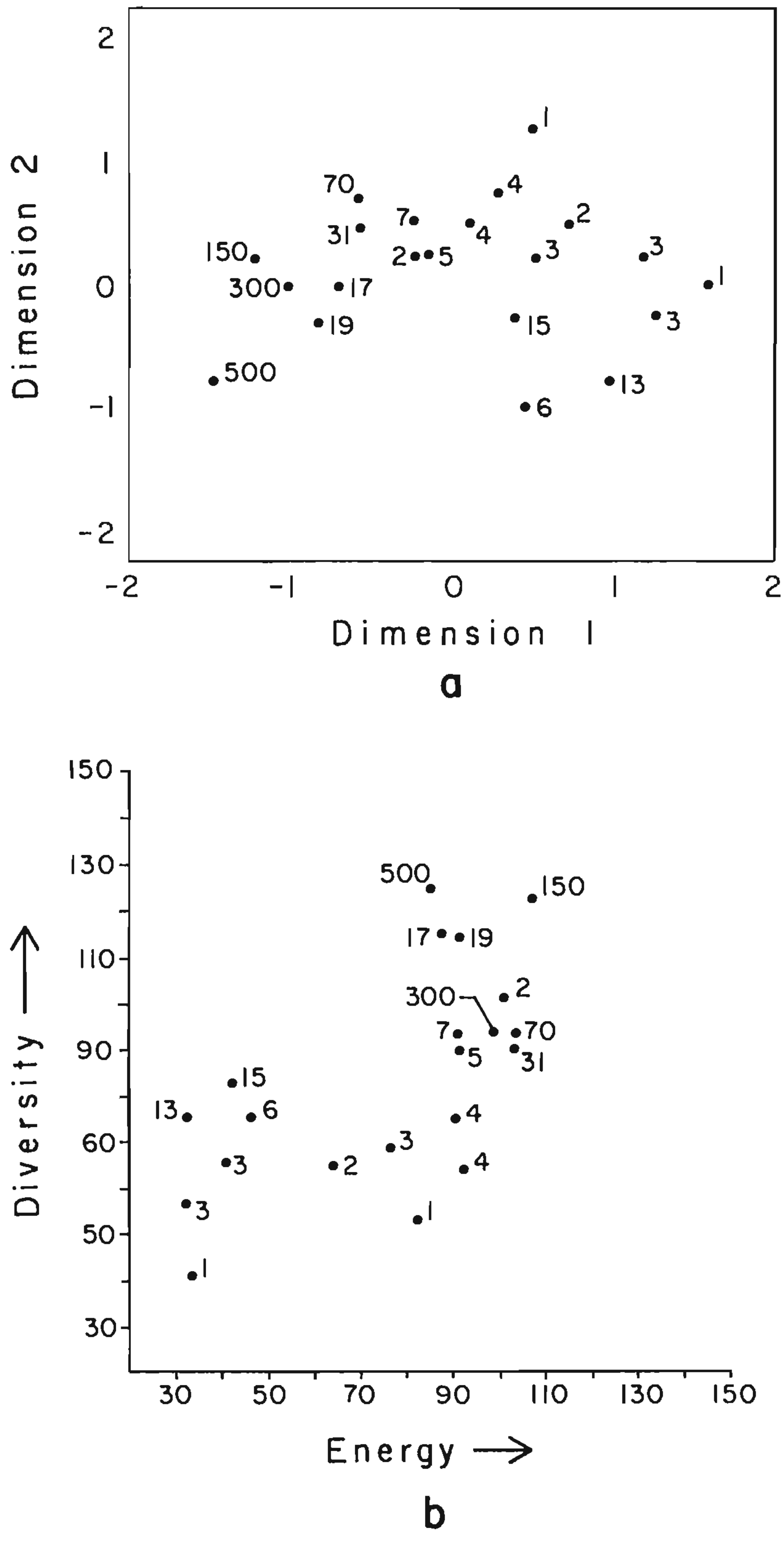


Figure 26.8. Numbers of structures at analyzed sites plotted on a) the MDS plot shown in Figure 26.5; and b) the energy expenditure by diversity plot shown in Figure 26.6.

CHAPTER 27

RYE CREEK RUIN

Douglas B. Craig

Rye Creek Ruin (AZ O:15:1 [ASM]; AR 03-12-06-54 [TNF]) contains the remains of a large Classic period village located on a terrace overlooking the confluence of Deer and Rye creeks. The site generally is considered to be the preeminent Classic period settlement in the Upper Tonto Basin, and within the basin as a whole it is second in size only to Armer Ranch Ruin (Wood 1989b). The most prominent feature at the site is the main ruin, which contains upwards of 150 masonry rooms, two platform mounds, and a large, enclosed plaza (Figure 27.1). The rooms are laid out in a semicircular arrangement around the western, southern, and eastern sides of the plaza, and a long compound wall bounds the plaza to the north. Although the rooms are contiguous from one end of the ruin to the other, they tend to be grouped into irregular clusters, many of which have enclosed courtyards attached to them. Some of the rooms may have been two stories high, although this has yet to be fully documented. Both of the platform mounds are located near the eastern edge of the plaza. The larger mound is connected to the compound wall; the smaller mound is connected to the eastern-most block of rooms. A narrow corridor separates the two platform mounds, and there is a gap in the eastern compound wall at the point where the corridor appears to end; it may be that this was the main entrance into the pueblo from the river side. Several cemeteries have been found within the plaza and courtyard areas and isolated burials are known to be scattered throughout the ruin (Haury 1930a).

Numerous trash mounds and refuse areas surround the main ruin. They serve to separate the main ruin from a group of compounds and masonry structures that extend about 1 km to the west (Figure 27.2). Several isolated masonry structures also have been recorded northeast of the main ruin, near the tip of the terrace. Although the exact relationship of these outlying compounds and structures to the main ruin is uncertain -- current indications are that many of them may predate the main ruin -- there seems little reason to doubt that they functioned together as part of a larger community system (Craig and Doelle 1990; Wood 1989b).

Rye Creek Ruin has been of interest to professional archaeologists and local residents for over half a century. This is partly due to its size and highly visible architecture and partly due to fact that the original Phoenix-to-Payson highway (the precursor of State Route 87) crossed the western edge of the site, thus providing relatively easy access. In the following chapter, the results of work carried out at Rye Creek Ruin by Desert Archaeology are summarized. This work consisted of the stratigraphic testing of three trash mounds located just north of the main ruin, updating the map of the main ruin using photogrammetric techniques, and recording the location and estimated volume of all potholes within the main ruin. The testing of trash mounds was done on a volunteer basis during the data recovery phase of the Rye Creek Project. The mapping and recording of potholes was done in cooperation with Geo-Map, Inc., as part of a separate contract with the Tonto National Forest (Craig and Doelle 1990; Holmlund 1990).

PREVIOUS RESEARCH

Although much of Rye Creek Ruin has yet to be formally investigated, over the years a number of small-scale investigations have taken place. This work has provided important baseline information and heightened awareness as to the site's importance in Tonto Basin prehistory. The following discussion reviews some of the major findings of this earlier work.

Gila Pueblo

Limited excavations were carried out at the site by archaeologists from Gila Pueblo in 1929 and 1930. This work was directed by Harold Gladwin and Emil Haury, two of the pioneers of Southwestern archaeology. A short descriptive report on the excavations was prepared by Haury (1930b), and Gladwin (1957) briefly discussed the results in *A History of the Ancient Southwest*. In addition, Haury's daily notes for the second field season (1930a) have recently become available.

According to Haury (1930b:1), the objectives of Gila Pueblo's excavations were threefold: (1) to make stratigraphic analyses of several trash mounds at the site, (2) to explore rooms in different parts of the ruin in an effort to determine if the ruin was occupied synchronously or sequentially, and (3) to examine the burial grounds.

Stratigraphic Test Pits

Three trash mounds were stratigraphically tested during the 1930 field season, two associated with the main ruin (test pits I and II), the other associated with one of the outlying compounds (test pit III). The test pits measured four square feet in area, and they were dug in 6-in (approximately 15 cm) arbitrary levels down to natural soil. The ceramics from the various levels were counted, typed, and then compared between levels and features to see if temporal differences could be discerned (see Haury 1930b:3). The recent discovery of Haury's (1930a) field notes have made the actual sherd counts from these stratigraphic test pits available for the first time; they are presented here in Table 27.1. Based on these counts, Haury (1930a) concluded that little could be done in the way of internally stratifying individual trash mounds; however, he held out much more hope for identifying broad-scale temporal differences between trash mounds. Thus, test pits I and II were viewed as evidence of both a Roosevelt and a Gila phase occupation of the main ruin, whereas the lack of Gila phase decorated wares from test pit III was viewed as evidence for the abandonment of at least some of the outlying compound by late Classic times.

Table 27.1. Ceramic frequencies from Gila Pueblo stratigraphic test pits, 1930 (after Haury 1930a).

Stratum Test Unit	Depth (cm)	Plainware	Redware	Plain Corr.	Red Corr.	Salado? Polychrome	Polychrome-on-yellow	Jeddito Black-on-yellow	Tusayan? Black-on-white	Black-on-red	Total
I	0-15	59	40	20	2	0	1	0	0	0	0
(located "about	15-30	92	53	20	0	2	0	0	0	0	0
100 feet north	30-45	80	44	5	0	0	0	1	1	1	1
of the [main]	45-60	51	41	2	0	1	0	0	0	0	0
ruin")	60-75	0	255	1	0	1	0	0	0	1	0
Total		282	433	48	2	4	1	1	2	1	774
II	0-15	106	0	14	0	1	0	3	1	0	125
(located "about	15-30	105	0	12	0	1	0	2	2	0	122
50 feet west of	30-45	75	0	7	0	0	0	0	0	0	82
the [main] ruin)	45-60	141	0	8	0	1	0	0	0	0	150
	60-75	91	0	1	0	0	0	0	0	0	92
Total		518	0	42	0	3	0	5	3	0	571
III	0-15	279	0	0	0	0	0	0	1	0	280
("a small trash	15-45	440	0	2	0	0	0	0	2	0	444
mound about 50	45-60	160	0	1	0	0	0	0	0	0	161
yards north of	60-75	175	0	0	0	1	0	0	0	0	176
the compound")											
Total		1054	0	3	0	1	0	0	3	0	1061

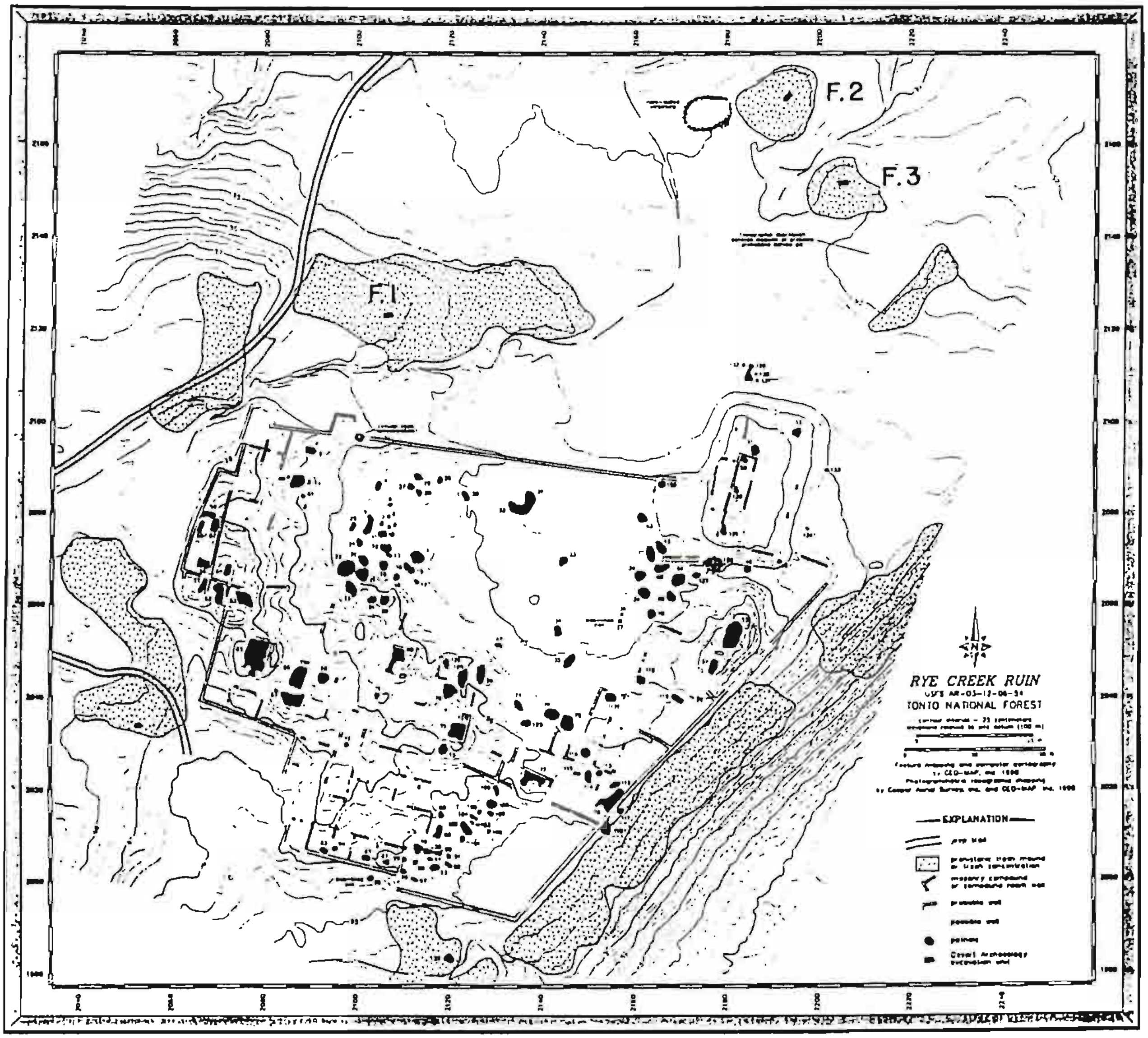


Figure 27.1. Rye Creek Ruin with potholes.

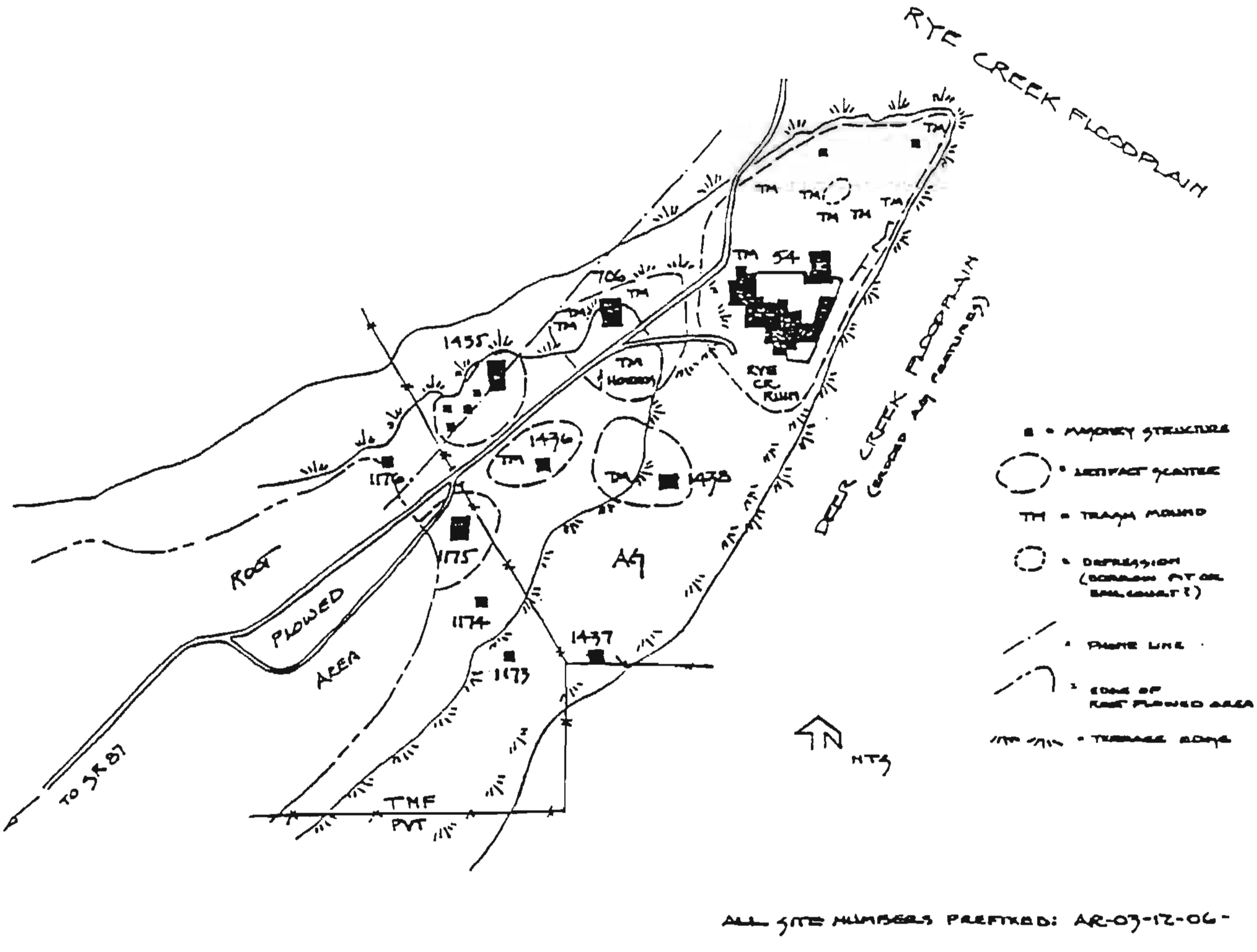


Figure 27.2. The Rye Creek Ruin settlement complex, (after Wood 1989b).

Room Excavations

Two rooms were completely excavated by Gila Pueblo and 12 others were tested. One of the tested rooms produced two clay granary platforms, similar to those reported at the VIV site (Mills and Mills 1975) and at several recently excavated sites in the Roosevelt Lake area (G. Rice, personal communication, 1991). Both of the platform mounds at the site also were tested by Gila Pueblo. One of the rooms on the southern mound produced walls that were roughly 4-m thick and a floor paved with a "mosaic" of pottery sherds. A photograph of this sherd "mosaic" floor is shown in *A History of the Ancient Southwest* (Gladwin 1957:314). Based on the decorated ceramics recovered from excavated contexts, Haury concluded (1930b:2) that all features within the main ruin were roughly contemporaneous (i.e., Gila phase). At the same time, he recognized that the nucleus of the settlement probably dated to the Roosevelt phase, based on the presence of numerous black-on-white sherds on both the surface and in the trash mounds.

Under the supervision of Monroe Amsden in 1929 and Emil Haury in 1930, test excavations also were carried out in one of the outlying compounds (AR-03-12-06-706 [TNF] on Figure 27.2). At least two rooms were tested and a sketch map was drawn. In addition, a stratigraphic test pit was excavated in a trash mound on the north side of the compound (test pit III in Table 27.1). Floor sherds in the rooms were generally scarce, consisting mainly of plainwares, a few black-on-white sherds, and a single Pinto polychrome sherd (Haury 1930a:3). In both the rooms and the trash mound, corrugated wares and Gila phase decorated wares were conspicuously absent, leading Haury to conclude that the compound predated the main occupation of the main ruin.

Burials

One hundred-sixty burials were excavated during Gila Pueblo's first field season, and 30 were excavated during the second field season. A rough sketch map of the location of the first season's burials was made by J. W. Simmons; unfortunately, it is the only provenience information available for those burials. Much more complete information is available for the burials from the second season, as a result of Emil Haury's (1930b) detailed field notes. Of note, Haury (1930a:11) comments that no black-on-white vessels were recovered from any of the burials, suggesting that most of them date to the Gila phase.

Mapping

A final accomplishment of the 1930 field season was the production of a detailed and highly accurate map of the main ruin. This map has been digitized and plotted with respect to Desert Archaeology's grid system in Figure 27.3. According to Haury (1930a:2), the map was generated by setting up a plane table and alidade on top of the large platform mound and then sighting, measuring, and projecting to the various corners of the ruin. Although, as will be discussed more shortly, there are slight discrepancies between our map and Haury's, the differences are minor, testifying to Haury's skill as a surveyor and cartographer.

Tonto National Forest

Following Gila Pueblo's work, little in the way of formal research was done at the site until the early 1980s, when archaeologists from the Tonto National Forest, under the direction of J. Scott Wood, began surveying, mapping, and recording the various types of features that make up the Rye Creek Ruin community. This work was intended mainly for inventorying purposes, since the site is located on Forest Service land. In addition, a National Register form was prepared for the site, although eligibility is still pending.

THE DESERT ARCHAEOLOGY TESTING PROGRAM

On two Saturdays in July 1989 for a total of 15 person-days, volunteers from Desert Archaeology excavated stratigraphic test pits into three of the trash mounds (Features 1, 2, and 3) on the north side of the main ruin (Figure 27.1). The test pits were 1 m by 2 m in size, and they were placed near the highest point of each mound. Each test unit was dug in 20-cm arbitrary levels until culturally sterile deposits were reached. All fill sediments were screened through 1/4-in mesh, and all artifacts except sherds smaller than a quarter dollar in size were collected. No flotation or pollen samples were collected.

Detailed analyses of the artifacts recovered from the test pits are included in the various specialist chapters of this report (see Chapters 12-17 and 21 in Volume 2). A general summary of the data is presented in Table 27.2. More detailed discussions of each of the features are provided here.

Feature 1

Feature 1 was the largest trash mound tested by Desert Archaeology. It has dimensions of roughly 50 m by 20 m. The test unit removed approximately 2.1 cubic meters of fill, producing 7097 artifacts (Table 27.2). Ceramics account for 85.6 percent of the artifact total, chipped stone for 13.3 percent, ground stone for 0.8 percent, and shell for the remaining 0.3 percent. As discussed in Chapter 12, 97 decorated sherds were recovered, spanning a broad range of time from about A.D. 1200 to 1400. Although some degree of temporal mixing was evident throughout all levels, the upper 60 cm of fill contained primarily Gila phase (A.D. 1300-1450) materials.

Table 27.2. Artifact totals from trash mounds tested by Desert Archaeology.

Site O:15:001

Feature	Plainware	Redware	Corrugated	Buffware	Black-on-white	Other Decorated	Debitage	Flake Tool	Core Tool	Mano	Metate	Other Groundstone	Shell	Total
1	3533	1856	591	4	38	55	871	47	28	9	2	44	19	7097
2	635	442	1	0	16	5	154	8	4	4	1	5	2	1277
3	477	358	0	0	5	1	120	4	1	1	0	9	1	977
Total	4645	2656	592	4	59	61	1145	59	33	14	3	58	22	9351

There are several reasons for believing that Feature 1 is one of the trash mounds tested by Gila Pueblo in 1930. First, Haury (1930a:8) describes the location of test pit I as being on a trash mound "about 100 feet north of the [main] ruin," which is also the approximate location of Feature 1. Second, signs of an old excavation unit or pothole were found about four meters southeast of the Desert Archaeology test unit (see contour anomaly on Figure 27.1). Given that many, if not most, of the "potholes" recorded in the main ruin during the mapping project were probably Gila Pueblo excavation units that had not been backfilled, it seems

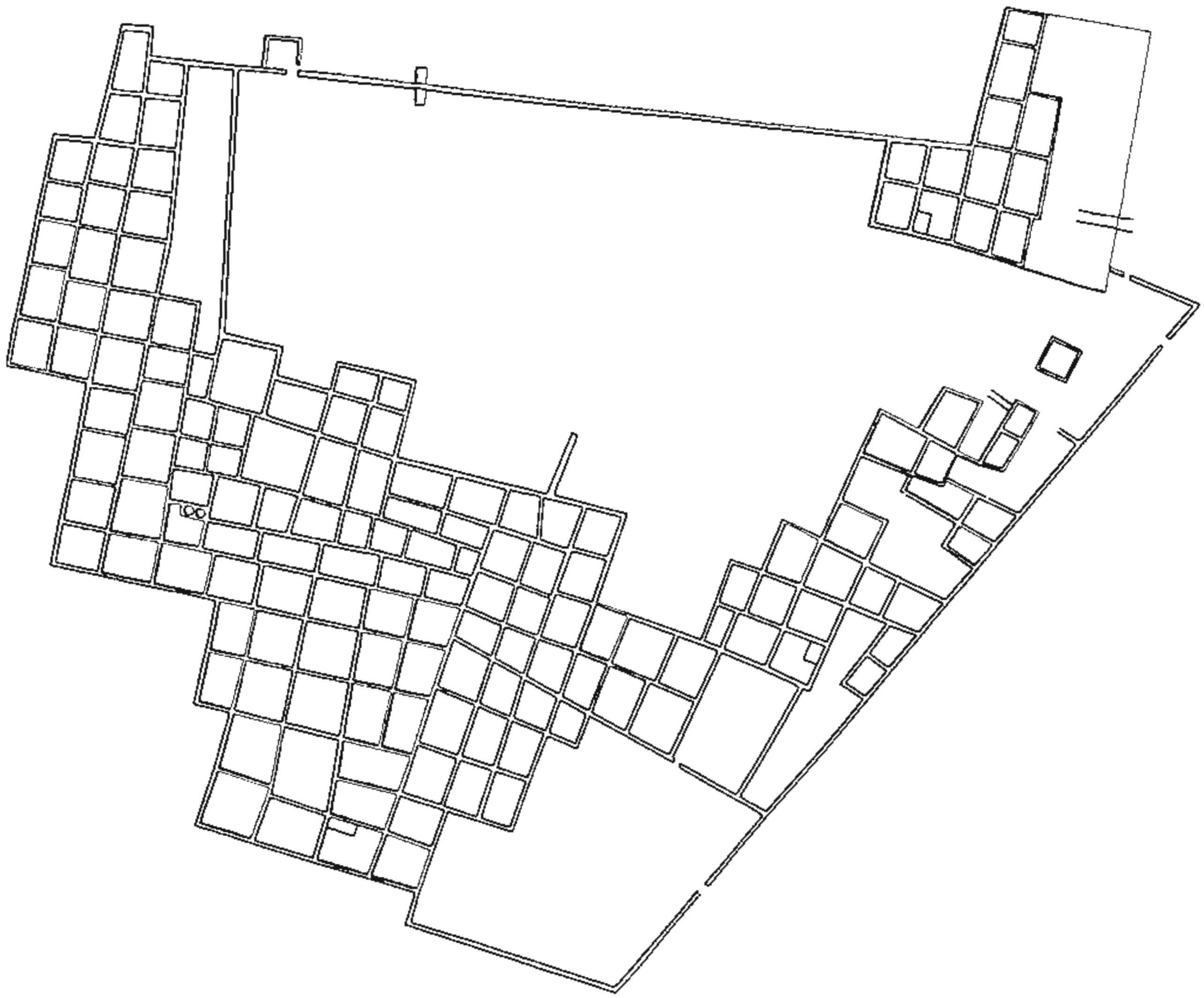


Figure 27.3. Map of Rye Creek Ruin, prepared by Emil W. Haury in 1930.

reasonable to suppose that the test units from the trash mounds also would still be visible. Third, the ceramic densities from the two test units are quite similar. The Desert Archaeology test unit produced 6,077 sherds in 2.1 cubic meters of fill, the Gila Pueblo test unit produced 516 in 0.23 cubic meters of fill (Note: The Gila Pueblo figure does not include the bottom level shown on Table 27.1 because the sherd counts from that level appear anomalous in several respects, most notably in the number of redwares represented). The averages for the two test units are 2,894 sherds per cubic meter for the Desert Archaeology test unit and 2,243 sherds per cubic meter for the Gila Pueblo test unit. These figures are believed to be well within the range of variability in artifact density for most trash mounds. Finally, the relative frequency of plainwares, redwares, corrugated wares, and decorated wares is remarkably similar for the two test units. Thus, plainwares account for 58.1 percent of the ceramic assemblage from the Desert Archaeology test unit and 54.7 percent of the ceramics from the Gila Pueblo test unit (again, not including the bottom level of the Gila Pueblo unit). Corrugated wares account for 9.7 of the Desert Archaeology sample and 9.5 percent of the Gila Pueblo sample; redwares account for 30.5 percent of the Desert Archaeology sample and 34.5 percent of the Gila Pueblo sample; and, decorated wares account for 1.6 percent of the Desert Archaeology sample and 1.4 percent of the Gila Pueblo sample.

If the inference that the two test pits are from the same trash mound is correct, then it raises an important methodological and historical point. Haury generally was disappointed in the results of the stratigraphic test pits he dug, partly because the decorated counts were low and partly because there was no clear temporal ordering among levels. He attributed (1930b:8) the poor results to the shallowness of the trash deposits and the likelihood of postdepositional disturbance. The results of the Desert Archaeology testing suggest that sampling problems may have been a more important contributing factor to the "poor" results. That is, Haury's test pit may simply have been too small. The Desert Archaeology test pit removed roughly nine times as much dirt as the Gila Pueblo test pit, and it produced 10.7 times as many decorated sherds -- 97 decorated sherds representing at least 20 temporally sensitive types, in contrast to Haury's figure of 9 decorated sherds representing five probable types. It seems reasonable to suggest that Haury's results would have approximated the Desert Archaeology results if his test unit had been larger.

Feature 2

Feature 2 was the second largest trash mound tested; it has a diameter of about 20 m. Approximately 1.1 cubic meters of fill was excavated, producing 1,277 artifacts (Table 27.2). Ceramics account for 86.1 percent of this total, chipped stone for an additional 13.0 percent, ground stone for 0.8 percent, and shell for just under 0.2 percent. Relative frequencies for the various ceramic wares are similar to those reported for Feature 1, the notable exception being that corrugated ceramics are almost completely absent; this absence, in turn, is compensated for by a correspondingly higher percentage of redwares. Twenty-one decorated sherds were recovered; 12 of these were temporally sensitive. Roughly 83 percent of the temporally sensitive types predate A.D. 1300, with the best-fit date falling somewhere between A.D. 1200 and 1250 (see Chapter 12). This suggests that the mound was associated with either an earlier occupation of the main ruin than the one currently documented, or with features that predate the main ruin. Given that the trash mound is located just outside a small rock-walled compound located north of the main ruin (see Figure 27.1), the second alternative is considered the more plausible one.

Feature 3

Feature 3 was the smallest trash mound tested; it has a diameter of about 15 m. The test pit removed roughly 1.1 cubic meters of fill, and 977 artifacts were recovered (Table 27.2). Ceramics account for 86.1 percent of this total, debitage for 12.8 percent, ground stone for 1.0 percent, and shell for 0.1 percent. Plainwares and redwares combine to account for over 99 percent of the ceramic total, with plainwares outnumbering redwares by a ratio of about 1.3:1. Similar to Feature 2, corrugated sherds were conspicuously absent, and temporally sensitive decorated sherds also tended to be quite rare. The few that were recovered suggest a probable use date for the mound of between A.D. 1100 and 1250, with a best-fit date of between A.D. 1200 and 1250 (Chapter 12, Volume 2).

Mapping Reassessment

A preliminary reassessment of Haury's map of the main ruin also was done as part of the volunteer testing program. This was accomplished by setting up a transit on top of the large platform mound and then taking a series of sideshots around the exterior and interior perimeter of the ruin. Azimuth readings were recorded to the nearest 10 minutes, and distance measurements were determined using a stadia rod. Sixty-nine points were recorded in this fashion. Plotting the points revealed a general outline of the ruin that looked very much like Haury's.

MAPPING PROJECT

Because the Tonto National Forest plans to turn Rye Creek Ruin into an interpretive site for the public, Desert Archaeology was contracted in the spring of 1991 to document the condition of the site and to prepare a general prospectus for public interpretation. As part of the documentation process, Geo-Map, Inc., was subcontracted to produce a high-resolution map of the main ruin. Geo-Map also assisted in recording and mapping the potholes at the site.

The map shown in Figure 27.1 was produced in several stages (for a full discussion see Holmlund 1990). First, electro-optical surveying equipment (a "total instrument station") was used to establish a site grid and to provide aerial control points within the project area. Coordinate information was recorded in the field on a hand-held computer (an HP-71B) and later transferred to a microcomputer database file using proprietary software. Aerial photographs were taken by Cooper Aerial Surveys of Tucson, Arizona, and photogrammetric techniques were used to produce a 25-cm contour map of the site. An enlargement of the aerial photograph served as the base map for locating most features, including all clearly exposed wall segments and most potholes associated with rooms. Because of the size and depth of most potholes in the plaza and courtyard areas, in many instances it was easier to plot them directly on to the 25-cm contour map rather than onto the aerial. For similar reasons, it was also easier to plot the trash mounds and trash concentrations on to the contour map. One slight problem that arose from using two different recording systems stemmed from the fact that the photogrammetrically-produced contour maps were rectified whereas the aerial photographs used to produce them were not. To get around this problem, end points for most of the wall segments were recorded using the electro-optical equipment, and feature positions were then manipulated and rectified using computer graphic techniques.

Figure 27.4 presents the Geo-Map, Inc. map of the main ruin superimposed on top of Haury's map. As can be seen, the fit between the two maps is close but not exact. The main discrepancy is with respect to the size and orientation of the small plaza in the southeastern corner of the ruin. There are some slight differences, too, with respect to the rooms in the southwest corner. Given that Haury's map was generated entirely from the large platform mound, it is not surprising that the rooms farthest away from that point are the most distorted. Substantial wall fall in that portion of the pueblo was undoubtedly another contributing factor; in fact, Haury (1930a:2) writes in his daily field notes, "The arrangement of rooms in the southwest section of the pueblo is very perplexing, hence the rooms as indicated on the map may not be accurate. There are probably some small courts and runways in this condensed part which are difficult to distinguish from dwellings."

In addition to mapping the site, personnel from Geo-Map, Inc., and Desert Archaeology recorded detailed information on all potholes located in and around the main ruin (Figure 27.1). A rough cut-off point of 15 cm maximum depth was used in determining which potholes to record; depressions shallower than 15 cm generally were not recorded. Each pothole was assigned a pothole number and plotted on either the aerial photograph or contour map. Additional information was then recorded for each pothole on a separate form;

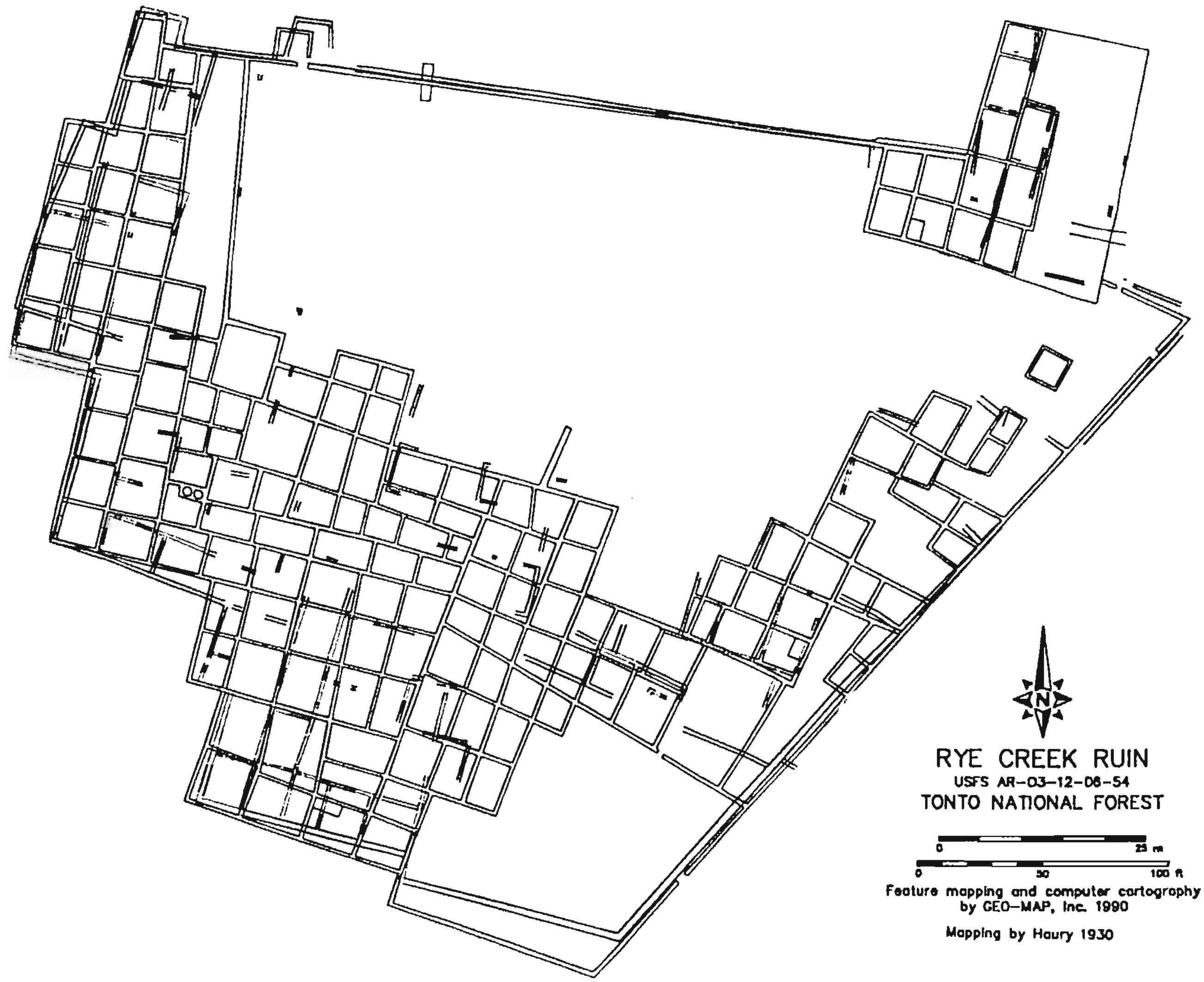


Figure 27.4. Geo-Map, Inc., map of Rye Creek Ruin superimposed over Haury's map.

information recorded included the maximum length, width, and depth of the pothole, the kind of feature it was associated with (e.g., room, burial, trash mound, platform mound), and whether any human bone or diagnostic artifacts were present. In all, 135 potholes, with a total displaced volume of almost 200 cubic meters, were recorded (Craig and Doelle 1990). Roughly 40 percent had associated human bone and are presumed to have been burials; most of these are located in one of the two large plaza areas and are believed to be associated with formal cemeteries.

DISCUSSION

The initial settlement in the area around Rye Creek Ruin appears to have occurred sometime between A.D. 700 and 800. The Deer Creek site, located less than 2 km to the west of Rye Creek Ruin, dates to the Gila Butte phase, and a Santa Cruz or Sacaton red-on-buff sherd was recovered from one of the Rye Creek Ruin trash mounds (Feature 1) tested during this project. In any case, the size of the Rye Creek settlement was probably fairly small until about A.D. 1200 or 1250, at which point a major episode of growth and construction took place. Many, if not most, of the outlying room blocks and compounds probably were occupied at that time, and construction may also have begun within the main ruin itself. It is still unclear if this growth was the result of local populations joining together in a new type of settlement arrangement or if new populations migrated into the area, although settlement aggregation is suspected to be the primary cause (see Chapter 28). Regardless, the size of the settlement appears to have peaked during the A.D. 1300s, with at least 150 rooms in the main ruin in use along with several courtyard and plaza areas and possibly two platform mounds. The formal nature of the architecture during this time period suggests that considerable planning went into laying out and building the main ruin. By the early- to mid-A.D. 1400s though, the settlement appears to have been abandoned. The causes of this abandonment are currently unknown, although it seems likely that they are related to regional factors (e.g., disease, warfare, climatic change, organizational collapse), since many other large villages in the American Southwest were also abandoned during the late A.D. 1300s and 1400s.

The issue of abandonment raises an important point that has relevance for other time periods as well. That is, the growth and development of Rye Creek Ruin is best viewed within a larger regional framework. This issue is discussed more fully by Elson in Chapter 28.

CHAPTER 28

SETTLEMENT, SUBSISTENCE, AND CULTURAL AFFILIATION WITHIN THE UPPER TONTO BASIN

Mark D. Elson

This chapter presents the conclusions of the Rye Creek Mitigation Project. A brief summary of the research design is presented first, followed by a discussion of the Rye Creek Project site typology and the settlement and subsistence systems. The final section uses these and other data to discuss the cultural affiliation of the prehistoric populations of the Rye Creek Project area and Upper Tonto Basin.

RESEARCH QUESTIONS

The Rye Creek Project research was geared towards an investment in *basic* research. This was due to several factors, the most important being the overall lack of archaeological data for the Upper Tonto Basin. This was particularly true for the Preclassic period (ca. A.D. 650-1150), a highly critical, much debated, and little known time in Tonto Basin prehistory, the nature of which has been speculated upon since the earliest days of Tonto Basin research. As noted in Chapter 3, outside of Roosevelt 9:6 (Haury 1932), Ushklish (Haas 1971a, 1971b), and a few other smaller sites (Rice 1985), very few Preclassic period sites have been investigated. Given the large Preclassic period component of Rye Creek Project sites, including some of the earliest ceramic period sites now known from the Tonto Basin, we believed that a course of basic research was not only necessary, but essential; the careful documentation of the Preclassic occupation plays a critical role in substantiating (or refuting) the numerous models proposed for the Salado occupation and the prehistory of the Tonto Basin in general. By basic research we mean the investigation of research questions that form the primary analytical building blocks needed to transform archaeological speculation into more substantive theory. This involves building a comprehensive database by emphasizing maximum control over archaeological context, stressing chronological issues, providing carefully documented descriptive data, and examining the systems present within the local prehistoric community before pushing to conclusions of regional scope. This is what we have attempted to do in this report.

The research design presented in Chapter 4 listed six interrelated historic contexts or research questions investigated as part of this project. These include contextual assessment, chronology building, subsistence and settlement systems, community organization, exchange and interaction, and cultural affiliation. As in all projects, not all planned historic contexts were ultimately amenable to the recovered database, and more data were gathered on some issues (such as chronology and subsistence/settlement systems) than on others (such as community organization). In general, however, sufficient data were recovered to address most of the research questions to some degree. The historic contexts also were organized in a hierarchical manner: contextual assessment and chronology were considered to be building blocks necessary to address the more complex issues of subsistence/settlement systems and community organization, both of which include an examination of exchange and interaction. All of these were considered necessary to address the issue of cultural affiliation.

Contextual assessment, the first historic context, is a methodological tool through which greater control can be gained over archaeological context, thereby increasing confidence in the integrity and subsequent interpretation of archaeological deposits. It also allows for the differentiation of certain refuse types, such as secondary versus transformed (or mixed) secondary versus primary trash deposits. The methods used in the contextual assessment, which were critical in sample selection and to a certain extent interpretation, have been detailed in Chapter 11 and used in the analyses of the ceramic (Chapters 12 and 13 and Appendix B), lithic (Chapter 14), and ground stone (Chapter 15) assemblages. Because it is considered to be more of a methodological tool for analytical sample selection than a specific research question it is not considered further in this chapter. The same may be said for the issue of chronology, the second historic context, which is detailed in Chapter 25. Chronological control is essential for looking at diachronic patterns in settlement and subsistence, but in and of itself is not a primary research question. Data gained from the chronological analysis are used in this chapter, but the methods and significance of chronology itself are not considered further. Therefore, this chapter deals with the last four historic contexts: subsistence-settlement systems, community organization, exchange and interaction, and cultural affiliation. After the presentation of the site typology used for this project, the historic contexts of subsistence-settlement, community organization, and exchange and interaction, are discussed under the general heading of settlement and subsistence systems. This is followed by a discussion of cultural affiliation.

SITE TYPOLOGY

The devising of a site typology went hand-in-hand with the site sedentism study presented in Chapter 26 and is the first step in the settlement analysis. A large number of site typologies for southwestern regions have been constructed and used over the years, encompassing a great deal of variation in both defined site types and terminology (e.g., Doelle and Wallace 1986; Doyel and Elson 1985; Elson 1986; Fish et al. 1985; Reher 1977; Reid 1982b; Teague and Crown 1983; Wilcox 1978; Ward 1978; Wood 1989b). Like sedentism, site typologies are seen as existing on a continuum (Flannery 1976). At one extreme are the large permanent villages, which to some extent were most likely influential in controlling and organizing the range of activities occurring at the smaller sites. At the other extreme are the small, temporary activity loci, which were functionally specific and occupied for only short periods of time. Although the sites between these two extremes are believed to be on a continuum, several stages are defined here to allow for description. As a result, a hierarchically ordered series of five site types was devised for this project, although it is important to note that there is believed to be more variation within site types than allowed for by this typology. The names for the stages used within this report, from most to least complex, are: village, hamlet, farmstead, fieldhouse, and limited activity site.

Table 28.1 presents the site type assignments of the sites investigated during the course of this project, including both testing and mitigation phase sites. The site types are briefly defined. Villages represent the focus of most settlement systems. They are considered to be year-round, sedentary habitations, often occupied for a considerable span of time (deep sedentary as defined in Chapter 26) although they do not have to be. They generally contain the following characteristics (Doelle 1985; Elson 1986); (1) Villages exhibit a greater intensity of occupation and larger site areas than other sites within the associated settlement system, including a full range of household and craft and tool manufacturing activities. This results in generally high artifact densities and high diversity of artifacts and feature types. An organized site structure with defined trash disposal areas is generally present, and villages often contain a relatively high percentage of exotic material, such as shell, stone jewelry, and intrusive ceramics. There are indications that villages controlled the flow of these materials through their respective settlement systems, (2) Villages appear to be regularly spaced along the landscape, and are often positioned at strategic locations, such as the confluences of two major drainages, or at the heads of valleys or travel routes. They are almost always located in favorable locations to meet the subsistence needs of their residents, 3) Villages are generally related to a series of smaller sedentary and seasonal satellite sites and agricultural field systems to further optimize the subsistence requirements of their inhabitants. The relationship between the village and its network of satellite sites is referred to as the community system. Rye Creek Ruin (AZ O:15:1), a large 150+ room pueblo with two platform mounds, is the only site within the general vicinity of the project area considered to represent a village site (see Chapter 27).

Hamlets represent year-round, sedentary habitations primarily geared towards agricultural subsistence, although a wide range of other subsistence goods may be collected. In a sense, hamlets are essentially small villages although they are shorter lived (short-term sedentary), have lower populations, and less occupational intensity

Table 28.1. Sites assigned to defined site types in the Rye Creek Project area (including both testing and mitigation phases).

Site Type	Site (#)	Number of Structures	Estimated Sedentism
Limited Activity	AZ O:15:93[a]	--	Seasonal
	AZ O:15:95[a]	--	Seasonal
	AZ O:15:98[a]	--	Seasonal
	AZ O:15:101[b]	--	Seasonal
Fieldhouse	AZ O:15:51[a]	2	Seasonal
	AZ O:15:70	1	Seasonal
	AZ O:15:71	2	Seasonal
	AZ O:15:89 (Overlook)	1	Seasonal
	AZ O:15:94[a]	1	Seasonal
	AZ O:15:96	1	Seasonal
	AZ O:15:97[a]	2	Seasonal
	AZ O:15:99 (Arby's)	3	Seasonal
Fieldhouse/Farmstead	AZ O:15:53 (Hilltop)	6	Seasonal
Farmstead	AZ O:15:90 (Compact)	4	Very short-term sedentary and/or seasonal reuse
	AZ O:15:100 (Clover Wash)	5	Short-term sedentary/ seasonal reuse
Farmstead/Homestead	AZ O:15:91 (Redstone)	2	Short-term sedentary/ limited seasonal reuse
	AZ O:15:55 (Boone Moore)	7	Short-term sedentary/ seasonal reuse
Hamlet	AZ O:15:52 (Deer Creek)	17	Sedentary/limited seasonal reuse
Village	AZ O:15:1 (Rye Creek Ruin)	150+	Sedentary
Unknown/Disturbed	AZ O:15:54 (Cobble)	10-15	Possible sedentary hamlet
	AZ O:15:92 (Rooted)	2+?	Possible sedentary hamlet/ agricultural field system

[a]Site only investigated during the testing phase (Elson and Swartz 1989b).
[b]Site tested during the Haught Cemetery Testing Project (Elson and Swartz 1989a).

and diversity than villages. Their site structure generally is formalized, containing defined households and trash disposal areas, although not to the same degree as villages. Organization of the hamlet is probably at the household level, although larger organizational or social units such as clan or moiety groupings may be present. Depending on the nature of the surrounding settlement system, hamlets may or may not be associated with larger village sites -- hamlets can be either independent or dependent, depending on the circumstances. Within the Rye Creek Project area the Deer Creek site (AZ O:15:52) is considered to be a hamlet. The Cobble site (AZ O:15:54) and the Rooted site (AZ O:15:92) may also represent hamlets, although they were too disturbed through root-plowing and road construction to fully evaluate.

Farmsteads encompass a wide range of site types that have been variously defined (Doyel and Elson 1985; Elson 1986; Teague and Crown 1983; Wilcox 1978). Although a definitional consensus has yet to be achieved (Crown 1985), in this typology farmsteads are considered to represent either very short-term sedentary settlements or settlements exhibiting a planned and organized reuse over a number of years. Occupation duration of farmsteads is suspected to be no more than one or two generations and probably less. Both sets of sites, whether seasonally reused or sedentary, are functionally equivalent; farmsteads generally are situated relatively close to agricultural fields and represent agriculturally oriented settlements. They are generally, but not always, functionally specific components of larger community systems. Farmsteads are divided here into two subsidiary types based on their relative degree of sedentism: farmstead-homesteads are the more sedentary, followed by farmsteads, which may be seasonal. In this sense, the seasonal farmsteads are always tied into a larger community structure, whereas the farmstead-homesteads do not necessarily need to be, although they generally are. The site structure and architecture of farmsteads (i.e., the energy expenditure levels) are more ephemeral and less formalized than hamlets, although there is usually some patterning in the site structure. It is likely that farmstead activities were organized at the household level, and that each farmstead might consist of one or two families. If the occupation of the site was long enough, or the site was reused enough, farmsteads can contain a relatively large number of structures and a fair amount of cultural trash, although well-defined trash areas may not be present. The artifact assemblage contains a lower density and diversity than hamlets, and generally reflects their more specific, agriculturally based orientation. Examples of farmstead sites from the Rye Creek Project area include the Redstone (AZ O:15:91) and Boone Moore (AZ O:15:55) sites, which are considered to be farmstead-homesteads due to their more substantial nature, and the Compact (AZ O:15:90) and Clover Wash (AZ O:15:100) sites, which are classified as just farmsteads.

Fieldhouses are seasonally occupied, functionally specific sites that are generally located in specific environmental zones to take advantage of resources, either agricultural or natural. Fieldhouse sites are well-documented ethnographically (Brugge 1978; Ellis 1978; Moore 1978; Russell 1978; Wilcox 1978) and the use of the term here is generally consistent with this documentation, although in this typology fieldhouse sites are not necessarily solely agricultural; other resource-specific activities are possible, although agricultural endeavors are considered to be the most common reason for site occupation. Fieldhouses contrast with farmsteads in the sense that while farmsteads are also somewhat functionally specific, they can operate as very small villages with a range of household and manufacture-related activities. Fieldhouse sites generally contain only one or two structures, which are often ephemeral and of low energy construction. In cases of seasonal reuse, however, several structures may be present. Due to their very functionally specific nature they generally have a very low artifact and feature density and diversity, although a limited range of activities not specifically related to their function may occur there. A distinction is made here between fieldhouses and what are called fieldhouse-farmsteads. Fieldhouse-farmsteads are more intensively occupied or reused than fieldhouses, although they are still believed to be occupied for functionally specific purposes. Excavated fieldhouse sites in the project area include the Overlook (AZ O:15:89) and Arby's (AZ O:15:99) sites, along with sites AZ O:15:70, AZ O:15:71, and AZ O:15:96. Testing phase fieldhouse sites include AZ O:15:51, AZ O:15:94, and AZ O:15:97 (Elson and Swartz 1989b; see Chapter 10). The Hilltop (AZ O:15:53) site is defined as a fieldhouse-farmstead due to the more substantial nature of its occupation (including six structures, several extramural features, and possible inhumations), although it is still believed to have functioned primarily as a single structure fieldhouse for most of its occupation.

Limited-activity sites are very short-term use areas for very specific functions. In this respect, a wide variety of functions can be subsumed under this site type, including, for example, hunting blinds, sleeping circles, quarry areas, camps along a trail, and short-term procurement camps. The common attribute of these sites is that they represent very short duration activities, measured in days or weeks instead of months and years; the inhabitants would return to the parent farmstead, hamlet, or village at the completion of the specific task. These sites are almost always within a single environmental zone, do not contain architecture (outside of ephemeral wind-breaks and brush structures), and generally have a very low artifact and feature density and diversity (except in the case of quarry sites which may have a very high artifact density but very low diversity). Limited-activity sites can be reused, although the feature and artifact assemblage will still be low in density and diversity due to the very functionally specific and short-term nature of the occupation. No limited-activity sites were investigated during the mitigation phase. Testing phase limited-activity sites include AZ O:15:93, AZ O:15:95, and AZ O:15:98 (Elson and Swartz 1989b; see Chapter 10).

THE RYE CREEK PROJECT SETTLEMENT AND SUBSISTENCE SYSTEMS

Figure 28.1 presents a map of all known sites within the general Rye Creek Project area recorded from both survey and excavation data in the Tonto National Forest and Arizona State Museum site files. This map is shown here to serve as a reference point for the following discussion.

The Rye Creek Project area and the Tonto Basin in general appear to have been settled initially by Archaic period populations, the exact nature of which are currently unknown. Although there are scattered reports of earlier Paleoindian artifacts, including a possible Clovis point from the Oxbow Hill Project (Huckell 1978) just north of the Rye Creek Project area, the first well-defined documentation for actual settlement is during the Middle and Late Archaic periods (Ciolek-Torrello 1987; Huckell 1973, 1978). Ciolek-Torrello (1987:348-349) terms the Middle Archaic portion of this occupation the Corral Creek phase, which he dates to the period between 6000 and 1500 B.C. based on projectile point styles (no absolute dates were recovered). This is currently the best defined of the Archaic period occupations, and he assigns four sites to this phase, all in the Upper Tonto Basin; two (AZ U:3:56 and AZ U:3:57) were excavated during the Ord Mine Project (Ciolek-Torrello 1987) and two (AZ O:15:32 and AZ O:15:67) were excavated by Huckell (1973, 1978) on earlier projects. Two lithic quarry sites recorded by Ciolek-Torrello (1987) may also have some Archaic period use, although this is uncertain. Scattered Archaic period remains also have been noted in the Lower Tonto Basin and Globe-Miami areas, but in lower density (Doyel 1976; MacNeider and Effland 1989). Other Archaic period sites are suspected from survey data, particularly in the Upper Basin (Scott Wood, personal communication, 1990). No Archaic period components were defined in the Rye Creek Project area, although four Middle Archaic projectile points were recovered from the Deer Creek site (AZ O:15:52) and two Late Archaic points were recovered from the Redstone site (AZ O:15:91)(see Chapter 14). Given the generally ephemeral nature of Archaic period remains, it is possible that Archaic components were present but unrecognized at both of these sites. Little is known of this initial occupation. From the scant evidence recovered by Ciolek-Torrello (1987) and Huckell (1973, 1978) sites are small and impermanent, probably representing mobile hunting stations and work camps (limited activity sites). If larger base camps were present, they have yet to be discovered, although this is not overly surprising given the relatively limited archaeological work in the Tonto Basin and the fact that most Archaic sites are deeply buried and (in the Tucson and Phoenix basins at least) generally found when trenching for remains at overlying ceramic period sites (Doelle 1985; Elson and Doelle 1987; Fish et al. 1986).

Given these data, then, the fact that several Archaic period sites are now known is believed to be significant and possibly indicative of a substantial population, although how large cannot currently be estimated. As a comparative example, however, the Tucson Basin, which is depositionally similar to the Tonto Basin, was believed to be for all practical purposes an "empty niche" with limited population during the Late Archaic period (Doyel 1984) prior to the undertaking of several large scale projects within buried floodplain zones. Research since then has shown Late Archaic sites, some quite large, to have been relatively abundant (Dart 1986; Doelle 1985; Elson and Doelle 1987; Fish et al. 1986; Huckell 1988; Huckell and Huckell 1984; Mabry 1990; Roth 1988). These data are emphasized here to suggest that the Tonto Basin, particularly the Upper Basin, may not have been an empty niche ripe for colonization by migrating populations, contrary to some of the proposed models for early Tonto Basin settlement. This will be returned to in a later section of the chapter when cultural affiliation is discussed.

Gila Butte Phase (A.D. 750-850)

Deer Creek Site (AZ O:15:52)

The first occupation of the Rye Creek Project area was during the late Snaketown (A.D. 650-750) or early Gila Butte phase (A.D. 750-850) at the Deer Creek site (AZ O:15:52) (Figure 28.1). This is one of the earliest ceramic period sites now known from the Tonto Basin. Based on the archaeomagnetic and ceramic data (see Chapter 12, Volume 2 and Chapter 25, this volume), the site may have been settled as early as A.D. 700, although this is uncertain. By the Gila Butte phase, however, the site was definitely inhabited. The Deer Creek site, the largest Preclassic period site in the project area, contained 17 pithouses, numerous extramural features, and a well-defined cemetery containing an unusual burial custom unlike practices seen at contemporaneous Hohokam, Anasazi, and Sinaguan sites. The cemetery area, discussed more completely later, contained 13 crematoriums or primary cremations within rectangular, daub-lined pits. An additional six secondary cremations and two infant inhumations were recovered from other areas of the site. The site may have been organized into several spatially discrete courtyard groups or pithouse clusters, similar to contemporaneous sites in the Hohokam areas of the Phoenix and Tucson basins (Howard 1985; Wilcox et al. 1981). Based on the sedentism study presented in Chapter 26, the site is suspected to have been occupied on a year-round basis, at least during the Gila Butte phase, serving as a small hamlet. The primary occupation of the site is estimated to have lasted approximately 60 to 75 years, based on house and courtyard group replacements (see Chapter 26). Additional, perhaps seasonal reuse of the site appears to be present during the following Santa Cruz (A.D. 850-950) and Sacaton (A.D. 950-1150) phases, although these occupations are considered to be minor and limited to one or two structures and several extramural features and surfaces.

Subsistence during the Gila Butte phase occupation was based primarily on corn agriculture; the only other definitive cultigen noted (and the only other cultigen noted besides corn from any site in the project area) was a single grain of squash (*Cucurbita*) pollen. Corn was recovered from 13 of the 17 pithouses and comprised 10.94 percent of the recovered plant parts. This is more than twice as high as the project average and is the highest of any of the habitation sites in the project area. Crops probably were grown in fields along Deer Creek, which, while presently flowing seasonally, may have had a more substantial flow during the prehistoric occupation. The nearest accessible large level field area is within half a kilometer of the site. *Hordeum* (little barley grass, which may also be cultivated [see Chapter 18]), hedgehog cactus, grasses, and agave, were the primary gathered foodstuffs. Agave accounted for 22.4 percent of the recovered plant parts and was found, along with *Hordeum* in every sampled pithouse. Overall, the site contained the greatest diversity of foodstuffs of any site within the project area, which is not surprising given its more substantial nature. Hunting apparently played a more minor role in subsistence because the number of recovered faunal remains is small. Deer were the primary focus followed by smaller game such as rabbits and hares. During the later Santa Cruz and Sacaton phase use of the site area there was a change in subsistence practices, which is probably a reflection of the more limited and functionally specific nature of these occupations. Easily collected and processed foodstuffs such as grasses and cheno-ams dominated the flotation remains, and very little corn and agave were recovered. In fact, the small amount of corn could easily have been brought into the site and agriculture may not have been a primary focus of the later occupation.

Ceramically, the Gila Butte phase occupants interacted the most intensively with Hohokam populations to the south. Although the percentage of decorated ceramics was low (4.1 percent), over 90 percent of these were Hohokam buffwares, primarily Gila Butte Red-on-buff (Table 28.2). Interaction with Hohokam groups also is suggested by the shell assemblage, which is similar in form and frequency to contemporaneous Hohokam sites. It is important to note, however, that the use of the term "interaction" in this chapter is not meant to necessarily imply *direct* contact between the inhabitants of the Rye Creek Project area and neighboring groups. Although this may have been occurring, other forms of distribution, such as down-the-line trade by middlemen or other Tonto Basin populations, may also have brought intrusive ceramics or artifacts into the area. Rather, it is meant as a descriptive term to indicate some sort of distributional network, the exact nature of which currently is unknown.

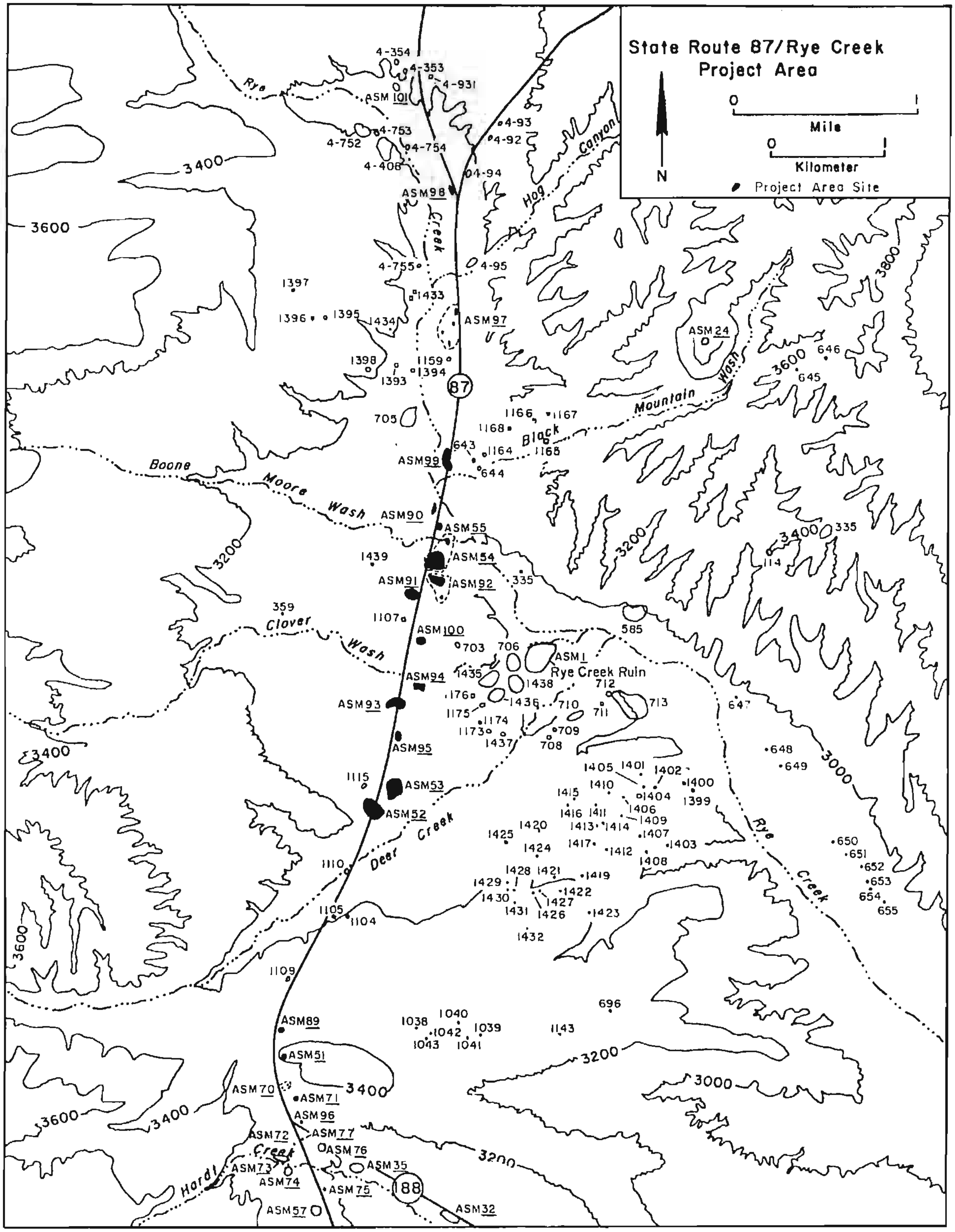


Figure 28.1. Location of known sites within the general Rye Creek Project area recorded from survey and excavation data in the Tonto National Forest and Arizona State Museum site files.

Table 28.2. Percentages of ceramic wares recovered by site from the Rye Creek Project area.

Site	Total Decorated	Buffware %	Whiteware %	Other Decorated %	Total Whiteware	Tusayan %	Little Colorado %	Cibola %
Deer Creek (AZ O:15:52)	406	90.6	9.4	0.0	38	94.7	5.3	0.0
Rooted - Locus A (AZ O:15:92)	71	64.5	35.5	0.0	25	64.0	24.0	12.0
Compact (AZ O:15:90)	35	17.1	74.3	8.6	26	50.0	38.5	11.5
Redstone (AZ O:15:91)	139	15.8	84.2	0.0	117	68.4	25.6	6.0
Clover Wash (AZ O:15:100)	76	23.7	72.4	3.9	55	83.6	3.6	12.7
Hilltop (AZ O:15:53)	42	30.9	61.9	7.1	26	50.0	23.1	26.9
Boone Moore (AZ O:15:55)	60	0.0	78.3	21.7	47	2.1	48.9	48.9
Arbys (AZ O:15:99)	10	0.0	90.0	10.0	9	11.1	44.4	44.4
Cobble (AZ O:15:54)	62	0.0	77.4	22.6	48	10.4	12.5	77.1
Rye Creek Ruin Features 2 and 3	24	0.0	79.2	20.8	19	0.0	63.2	36.8
Rye Creek Ruin Feature 1	93	4.3	38.7	57.0	36	0.0	44.4	55.6

Although there may have been some limited interaction with northern populations at this time, no definitive Lino Grayware ceramics were recovered. The few Kana-a Black-on-white sherds have been suggested to be associated with the later reoccupation during the Santa Cruz and Sacaton phases (see Chapters 12 and 24), although the possibility exists that they are associated with the later end of the Gila Butte phase occupation. The argillite assemblage, given the preponderance of local Deer Creek source material, also suggests limited interaction with northern populations; unlike later time periods only a single piece (of 33 analyzed samples) was found to have originated at the Del Rio source area in the Upper Verde Valley. The plainware ceramic assemblage suggests that at least some of the plainware vessels were "locally" (i.e., within a zone extending 3 km from the site) manufactured, although just over half appear to be nonlocal, possibly coming from relatively nearby (within 30 km) petrofacies. Local ceramic manufacture is also supported by the relatively high frequency of polishing stones (although as mentioned in Chapter 22, some of these are suspected to have been used for argillite pigment manufacture). A local red-on-brown ware (perhaps a Gila Butte Red-on-buff copy) also was manufactured, although only a few sherds of this were recovered. Given the overall paucity of tools and materials associated with ceramic manufacture, it can be suggested that production was not a specialist domain, and pots probably were produced at the household level. Perhaps most significantly, as argued below, plainware vessel form is much more similar to contemporaneous populations in the White Mountain Mogollon area than it is to Hohokam groups.

Santa Cruz (A.D. 750-850) and Sacaton (A.D. 950-1150) Phases

Occupation at the Deer Creek site continued into the Santa Cruz phase although it is likely that there was some sort of hiatus after the Gila Butte phase because most of the later occupation occurred during the late Santa Cruz and Sacaton phases, perhaps beginning around A.D. 900. Based on archaeomagnetic dates and other lines of evidence, two structures at the Deer Creek site (Feature 13, which has a date of A.D. 900-940, and Feature 59, which has a date of A.D. 910-1030) appear to date to this time. Feature 65, which Feature 59 intrudes into, may also date to the Santa Cruz phase, although this is unclear because both archaeomagnetic options are plausible (A.D. 655-765 and A.D. 820-940) and no additional dating evidence was recovered. The possible 150-year hiatus in the project area chronology is considered to be more a reflection of sampling and low intensity use of the project area than a real break in the occupation. This is supported by the fact that the site of Ushklish (Haas 1971b) was occupied during the Santa Cruz phase, although like Deer Creek its primary occupation appears to be during the Gila Butte phase (based on a retyping of the sherds in the Arizona State Museum collections presented in Chapter 24). Ushklish is similar in size to Deer Creek and is situated along Hardt Creek in the Upper Basin less than 10 km to the southeast (see Figure 3.1, Volume 1).

The next set of sites occupied within the project area fall within the A.D. 900 to 1050 range, and are roughly contemporaneous with the later reoccupation of the Deer Creek site. These include the Rooted site (AZ O:15:92), the Compact site (AZ O:15:90), and Feature 9 (a pithouse) at the primarily early Classic period Boone Moore site (AZ O:15:55). The earliest of these sites is the Rooted site, based on both the archaeomagnetic and ceramic data. The Compact site and Feature 9 at the Boone Moore site, which are probably related because they are separated by less than 50 m of the State Route 87 roadcut, appear to date slightly later.

Rooted Site (AZ O:15:92)

The Rooted site is situated along a small tributary of Rye Creek approximately 5 km north of the Deer Creek site (Figure 28.1). Unfortunately, due to massive disturbance from root-plowing, which virtually eradicated most of what is suspected to have been a significant occupation, not much is known of this site. Only a single pithouse, a possible pithouse or ramada, and parts of an agricultural field system, survived the root-plowing (all within Locus A). From the extent of the surface artifact scatter and the relatively high artifact density and diversity, a relatively substantial pithouse occupation is suspected to have been present, perhaps representing a small, sedentary hamlet similar to the Deer Creek site. There is no way to document this, however, and the site was not included in the sedentism analysis due to the lack of data. It is possible that the site represents the Preclassic period component of the Cobble site (AZ O:15:54), a Classic period hamlet (discussed later) situated across a small wash within 50 m of the site. The Rooted site was reoccupied sometime during the Classic period, when a small masonry one- or two-room fieldhouse was constructed (within Locus B). The nature of the fieldhouse is unknown due to the disturbance; only scattered cobble rubble remained within a low density artifact scatter. Nine indeterminate White Mountain Redware sherds were recovered from the surface of this scatter during the testing phase, suggesting that the structure may have been occupied during the late Classic period. Whether the occupation of the fieldhouse is related to the agricultural field system (consisting of at least 10 checkdams that survived the root-plowing) is unknown, although considered likely. The field system may also be related to the Preclassic period component.

The excavated pithouse produced a fair number of decorated ceramics along with a formalized slate palette fragment with a raised border. This is the only example of this Hohokam-related artifact type recovered from the project area. The decorated ceramics comprised around 5 percent of the ceramic assemblage, with buffwares making up 64.5 percent and whitewares (primarily Kana-a Black-on-white) making up 35.5 percent (Table 28.2). Within the whitewares, Tusayan comprised 64.0 percent, Little Colorado 24.0 percent, and Cibola 12.0 percent. Given an archaeomagnetic date of A.D. 920-1035 and the fact that the fill of the structure contained primarily Sacaton Red-on-buff with a few Santa Cruz Red-on-buff and Kana-a Black-on-white, it can be suggested that the structure was occupied during the late Santa Cruz phase and then filled in during the Sacaton phase. The dominance of Sacaton Red-on-buff, along with a few Black Mesa and Holbrook Black-on-white, suggests that the occupation of the site continued into the Sacaton phase when it was probably the most intensively inhabited. The decorated ceramic data, however, do indicate that while interaction with Hohokam groups to the south was still dominant, increasing contact was occurring with groups to the north, primarily in the Tusayan and possibly (Tusayan dominated) Flagstaff areas. Unlike the Deer Creek site, where the extremely limited northern interaction was almost exclusively with Tusayan populations, more limited interaction also is occurring at this time with both the Little Colorado and Cibola areas.

Subsistence at the Rooted site was based on corn agriculture, while agave, grasses, cheno-ams, hedgehog cactus, and *Hordeum* were collected. Similar to the Deer Creek site, agave comprised 23.5 percent of the recovered plant parts. Corn remains were significantly lower than at the Deer Creek site, making up 3.29 percent; however, because only three flotation samples were analyzed, all from pithouse Feature 14, this is not a representative sample. Faunal remains consisted primarily of small animal game (jackrabbit) and a single deer bone. Given the fact that only limited sampling was undertaken, the diverse nature of the subsistence remains suggests a relatively substantial occupation more similar to the hamlet and farmstead habitation sites than the limited-occupation fieldhouse sites.

Compact Site (AZ O:15:90)

The Compact site and pithouse Feature 9 at the Boone Moore site may be contemporaneous with the later end of the Rooted site occupation, although this is difficult to determine due to the imprecision and wide ranges of the dating methods (see Chapter 25). The Compact site contained four pithouses and an intrusive horno situated on a small ridge finger above Rye Creek. Three of the pithouses (Features 3, 4, and 5) appear to be clustered, although this is based solely on spatial evidence (which should be used with caution because it can often be fortuitous and misleading; see Elson 1986, 1988), while a fourth structure (Feature 2), which was only sampled, appears to be unrelated to the other three. Archaeomagnetic samples only were recovered from one of the structures (Feature 4) and from Feature 6, the horno (which intruded into both Features 4 and 5). Because the ceramics associated with the structures were also from poor contexts the actual contemporaneity of these features is unknown.

The sedentism study in Chapter 26 suggested that the site was either permanently occupied on a very short-term basis (relatively high energy expenditure but low feature and artifact diversity) or intensively seasonally reused, perhaps in a planned manner. A planned reuse of a site would exhibit low feature and artifact diversity because it is assumed that a similar range of activities occurred during each reoccupation. Additional lines of evidence, however, suggest that the site represents a short-term sedentary farmstead. One is the fact that the construction of State Route 87 appears to have removed a significant portion of the site, and the site may represent the Preclassic period component of the Boone Moore site, situated on the same ridge finger less than 50 m across the roadcut. This is supported by the contemporaneous dating of pithouse Feature 9 (and possible pithouse Feature 18, discussed below) at the Boone Moore site, suggesting that the two components were at one time connected. Feature 9 was very badly disturbed by an intrusive horno and possibly road construction, and not many data were recovered from it outside of the archaeomagnetic sample. Therefore if portions of the site were removed, the sedentism analysis, which is dependent on diversity scores from a representative sample, would indicate a lower level of intensity because not all feature and artifact types may have remained to be recovered. Energy scores, on the other hand, may not be drastically affected because these measures are based on the percentages of remaining features. Even with the disturbance, however, the Compact site plotted much closer to the other farmstead habitation sites than to the seasonally used (and reused) fieldhouse sites, suggesting a much more substantial, and possibly short-term sedentary occupation.

Subsistence at the Compact site was focused heavily on corn agriculture, probably grown in fields along Rye Creek. Corn made up 8.8 percent of the recovered plant parts, which is the highest percentage in the project area with the exception of the Deer Creek site. Agave, hedgehog cactus, cheno-ams, and *Hordeum* also were collected in appreciable quantities. Agave comprised 25.2 percent of the recovered plant parts. Hunting also contributed a fair amount to the subsistence, with large game (probably deer) and small game (primarily rabbits and hares) being procured in relatively equal amounts.

Interestingly, unlike the Rooted site, the Compact site appears to have increasing interaction with groups to the north at the expense of Hohokam groups. Although the artifact sample may not be representative due to the construction disturbance, this is a trend seen in later sites and suggests that the Compact site may have been occupied slightly later than the Rooted site and is perhaps more contemporaneous with the sites described next. A slightly later occupation also is supported by the occurrence of a few later whiteware types, such as Black Mesa (A.D. 1000-1135) and Holbrook (A.D. 1050-1150) black-on-white. Whitewares comprised 74.3 percent of the decorated assemblage, which contrasts strongly with the 35.5 percent at the Rooted site and the 9.4 percent at the Deer Creek site (Table 28.2). The whitewares were primarily Tusayan (50 percent), followed by Little Colorado (38.5 percent) and Cibola (11.5 percent). Increasing interaction with northern populations is partially supported by the argillite sourcing analysis presented in Chapter 22. Of the four pieces of analyzed argillite (out of eight total pieces recovered at the site) 50 percent were from the Del Rio source area in the Upper Verde Valley. Although the sample is small, this is a much higher frequency of intrusive Del Rio material than seen at either the Rooted (no Del Rio material) or Deer Creek sites (a single piece out of the 33 analyzed). As noted in Chapter 22, given the predominance of Del Rio material in the Flagstaff area it is possible that this material is stemming from there instead of directly from the Verde Valley. In addition, the presence of a few earlier buffwares, such as Gila Butte and Santa Cruz red-on-buff, suggest that the site may have also been occupied at an earlier time, although the nature of this occupation is unknown. It is possible that an earlier occupation was removed by the State Route 87 construction.

The occupations of the Rooted and Compact sites were either partially contemporaneous with, or shortly followed by, a roughly equivalent set of sites dating to approximately A.D. 1000 to 1150. These include the Redstone site (AZ O:15:91), Clover Wash site (AZ O:15:100), and Feature 9 (a masonry pit room) at the Cobble site (AZ O:15:54). All of these sites are considered to be short-term habitations (farmstead sites), although the Cobble site is suspected to be a small hamlet during the following Early Classic period. The Hilltop site (AZ O:15:53), which appears to be more functionally related to the fieldhouse sites, was also occupied at this time. With the exception of the Hilltop site, which is slightly further south along Deer Creek, the sites are situated within 5 km of each other, either on or overlooking the Rye Creek floodplain in the approximate center of the project area (Figure 28.1).

Redstone Site (AZ O:15:91)

The Redstone site is the most substantial of this set of sites, and was termed a farmstead/homestead in the site typology to differentiate it from the less sedentary farmsteads. Although the site only contained two pithouses, only one of which was occupied at any one time, the artifact assemblage, architecture, and sedentism study presented in Chapter 26 suggest that the site was permanently inhabited, probably on a short-term basis. Both pithouses are extremely large and deep, with large, alcove-like entrances; in fact, they are the two largest structures within the project area. Feature 5 appears to be the earlier of the two structures, based on the depositional nature of the fill (see Chapter 8, Volume 1) because the two structures contained statistically identical archaeomagnetic dates (Appendix D). When Feature 5 burned, it appears that Feature 11 was constructed as a replacement. This is based on the positioning of the two structures within 50 cm of each other, and their similar size, shape, and orientation, which strongly suggests that they were not contemporaneous. Feature 11 later was remodeled drastically into a much smaller structure (still with a large entrance) containing an exterior bench, although the reasons behind the remodeling are unknown. At some point after this Feature 11 catastrophically burned, leaving a large floor assemblage. As estimated in Chapter 26, the three house replacements at the site suggest a maximum site occupation span of around 45 years (based on archaeological data for a 15-year average structure use life [Ahlstrom 1984; Cameron 1990; Schlanger 1986]). Given, however, that two of the structures burned, possibly prior to the 15-year house-life span, the occupation could have been much shorter than this, perhaps around 20 to 30 years, if not less. The site was reoccupied at some point during the Classic period, based on the presence of several intrusive features and a few Salado redware sherds. The occupation at this time is considered to be relatively minor and probably seasonal. Although Stone (1986) identified three potential masonry fieldhouses at the site during the survey phase, these were all situated outside of the project right-of-way and could not be evaluated through subsurface excavation. On the surface these features are ambiguous, and it is not known whether they in fact are structures, other types of features (such as linear rock alignments), or natural cobble outcrops.

Subsistence at the Redstone site consisted of corn agriculture with a large dependence on agave collection. In fact, unlike the three earlier sites, where agave made up approximately 25 percent of the recovered relative plant parts, at the Redstone site agave comprised over 85 percent. Agave was recovered from all sampled contexts (both structures and two extramural pits) although it is unclear whether the pits date to the main site occupation or the Classic period reoccupation. The emphasis on agave suggests a change in subsistence focus, a trend continued throughout the end of the Sacaton phase and into the Classic period. Although corn pollen was recovered from both structures, as were corn remains, corn comprised only 1.7 percent of the recovered plant parts, suggesting a decreased emphasis on corn in favor of agave. Other collected foodstuffs, such as hedgehog cactus, grasses, cheno-ams, and *Hordeum*, were present in minor quantities. The site contained nowhere near the botanical diversity of the Deer Creek site, suggestive of its less intensive and more short-term occupation. Hunting appears to have played a relatively important role, with the faunal assemblage somewhat equally divided between deer and smaller game.

The Redstone site also is interesting in that it contained the highest percentage of whiteware ceramics in the decorated assemblage of any Preclassic period site in the project area (Table 28.2). The whiteware percentage was higher than most of the Classic period sites as well. While decorated ceramics comprised only 3.4 percent of the ceramic assemblage, close to 85 percent of these were whitewares. These were primarily Tusayan whitewares (68.4 percent), with some Little Colorado (25.6 percent) and a few Cibola (6.0 percent) sherds. The argillite data are also suggestive of increasing interaction with northern groups, because over 20 percent of the analyzed argillite, including a single piece of unworked raw material, was from the Del Rio source area in the Upper Verde Valley. The presence of raw material is considered to be somewhat unusual given the proximity of the Deer Creek material within 2 km of the site. A fair amount of processed argillite pigment also was found at the site, particularly on the floor of the remodeled Feature 11. In fact, the Redstone site contained more argillite (n=73 pieces) than any other site in the project area with the exception of the Deer Creek site (n=91 pieces). Given the differences in size between the two sites, it is possible that argillite procurement was a primary focus of the occupation.

Therefore, like the Compact site, the Redstone site appears to have been in relatively close interaction with groups to the north in the Tusayan and Flagstaff areas (given the dominance of Tusayan ceramics in Flagstaff at this time, as well as the Del Rio argillite, which may also be stemming from the Flagstaff area). Contact also was increasing with the Little Colorado area to the northeast. Limited interaction was still occurring with Hohokam groups to the south, but not to nearly the same degree as during the occupation of the Rooted site. Although the whitewares and Del Rio argillite may simply indicate increasing contact with northern groups, it is also possible that the Redstone site represents an actual migration into the Upper Basin by these people. This is suggested by the architectural styles of the two pithouses, which are substantially larger, including extremely large entrances, in comparison to other pithouses in the project area. They are also relatively deeper, although within the range of some of the other structures, particularly at the Deer Creek site. The construction of an exterior bench, possibly used as a sheltered extramural use area, after the remodeling of Feature 11 is also architecturally atypical for the project area, although this may be more related to the unique circumstances of the remodeling than to the cultural affiliation of the occupants.

Clover Wash Site (AZ O:15:100)

The Clover Wash site is a farmstead site in many ways similar to the Redstone site, although the occupation appears to be somewhat less substantial. The site is situated approximately 250 m southeast of the Redstone site along the same ridge overlooking the Rye Creek floodplain (Figure 28.1). Whether the two sites are actually contemporaneous is unknown. Although the archaeomagnetic dates are statistically identical (see Appendix D) and the ceramics overlap, given the imprecision and wide range of both of these dating methods, as well as the posited short use lives of the two sites, their dating can only be roughly approximated. The Clover Wash site contained five pithouses; Features 1 and 3 appear to form a related house cluster as do Features 4 and 12. Feature 6 may be related to either of these clusters or it may be isolated. As with several other sites (see Figure 2.2, Volume 1), root-plowing destroyed the upper 40 cm of the site surface, including portions of Feature 6; the other features were deep enough to be only minimally affected.

The sedentism study suggests that the site was probably permanently inhabited on a short-term basis, although there are indications of seasonal reuse as well. In this respect, based on the botanical and faunal evidence, depositional nature of the fills, and evidence for remodeled hearths, Features 1 and 3 may represent an earlier, seasonally reused component. The location of Feature 3 directly next to and with the same orientation as Feature 4, suggests house replacement rather than contemporaneity. Features 4 and 12, then, may be a slightly later replacement for Features 1 and 3, both of which were burned (although Features 4 and 12 were burned as well). Features 4 and 12 appear to be more substantial with a greater diversity of subsistence remains and artifacts, and may represent more of a short-term sedentary farmstead occupation. As with the Redstone site, subsistence was based on corn agriculture (recovered from all pithouses except for Features 4 and 6, which were not sampled, and Feature 1) with a relatively heavy emphasis on agave procurement (accounting for 54.5 percent of the recovered plant parts). Corn pollen was found in all of the structures except for Feature 6. Hedgehog and prickly pear cactus, *Hordeum*, grasses, and cheno-ams also were collected. Compared to the Redstone site, however, hunting appears to have been a very important component of the site subsistence. The faunal assemblage was dominated by large game, primarily deer; a drilled fragment of black bear (*Ursus americanus*) bone was also recovered, which is rare on prehistoric sites. Very little small game was recovered.

The ceramic assemblage was relatively diverse. Whitewares accounted for 72.4 percent of the decorated assemblage, followed by buffwares with 23.7 percent, and other decorated wares (San Juan redwares) at 3.9 percent (Table 28.2). The whiteware assemblage is somewhat similar to the Redstone site in terms of the dominance of Tusayan whitewares, which comprise 83.6 percent of the diagnostic whitewares. Unlike the Redstone site, however, Little Colorado whitewares make up only 3.6 percent of the assemblage, while Cibola whitewares comprise 12.7 percent. The significance of the difference between the two sites in Little Colorado and Cibola percentages is unclear; it may be indicative of different interaction networks or it may simply be due to sampling constraints. Continued contact with the Tusayan area is also suggested by the argillite data. Like the Redstone site, argillite from the Del Rio source area in the Upper Verde Valley makes up more than 20 percent of the analyzed argillite assemblage. Recovered whiteware types include Black Mesa, Holbrook, Puerco and Red Mesa black-on-white, which, along with the archaeomagnetic dates (Features 1 and 3 date between A.D. 1000 and 1195 and Features 4 and 12 date between A.D. 925 and 1130), place the main occupation of the site in the period around A.D. 1000-1150. In addition, the recovery of a few earlier ceramic types, such as Gila Butte red-on-buff (A.D. 750-850) and Deadman's Black-on-red (A.D. 800-1000) indicate some sort of earlier use of the site area, although the nature of this occupation is unknown. This may account for the slightly higher buffware frequency than seen at the Redstone site. A later occupation is also posited, based on the fact that every feature was intruded into by later pits. If a later occupation was present, however, it was destroyed by the root-plowing.

Hilltop Site (AZ O:15:53)

The Hilltop site also appears to be roughly contemporaneous with the Redstone and Clover Wash sites, dating sometime in the period between A.D. 1000 and 1150 based on the recovered ceramic assemblage. The site is situated on a small knoll overlooking arable areas of the Deer Creek floodplain approximately 150 m north of the Deer Creek site. The Hilltop site contained five pithouses on top of the knoll and a single masonry structure at the base. The masonry structure is thought to date to the Classic period to be unrelated to the pithouse occupation. Given the spatial layout of the site, the ephemeral nature of the pithouses, and the stratigraphic and depositional evidence, it is believed that no more than one or two structures were occupied at any one time. This is supported by the sedentism study in Chapter 26, which suggests that the site was a seasonal occupation reused over a relatively long number of years (low energy expenditure but high artifact and feature diversity). The site was typologically assigned to the fieldhouse-farmstead category, meaning that it essentially functioned as a fieldhouse site but was more intensively used (or reused). Furthermore, it is possible that the site is contemporaneous with at least part of the later reoccupation of the Deer Creek site, which may have functioned in a similar manner at this time. In this respect the two sites could represent components of a larger functional fieldhouse complex focused on cultivating the fields around Deer Creek. Alternatively, the Hilltop site could be a replacement for the Deer Creek site (or vice versa). In addition, six possible crematoriums were found at the site (although with little evidence for burning and very little cremated bone), similar in size and shape to the crematoriums associated with the Gila Butte phase occupation of the Deer Creek site. Whether these actually are crematoriums (they may be some other unidentified feature type), and whether they are related to the occupation of the Hilltop site is unknown. Burials occasionally are found at fieldhouse sites although they are relatively uncommon.

Subsistence at the site probably focused on corn agriculture based on the fact that corn pollen was recovered from all three of the sampled structures. Although corn remains were not recovered from the flotation samples, only a single pithouse sample was analyzed (the other sample was from Feature 5, the masonry structure, which only produced cheno-am seeds). Like other sites of this time period, agave dominated the flotation sample (54.5 percent of recovered plant parts), followed by cheno-ams, grasses, tansy mustard, and *Hordeum*. The virtual lack of recovered faunal remains (outside of snake vertabrae recovered from one of the possible crematoriums) supports the specialized, possibly agricultural, function of the site.

Decorated ceramics were relatively sparse, comprising around 2 percent of the ceramic assemblage. Whitewares, many from the surface of the site (which interestingly had one of the highest surface densities in the project area due primarily to the confinement of the site to the top and slopes of a small knoll) comprised 61.9 percent of the decorated assemblage, buffwares comprised 30.9 percent, and other decorated (Gila Polychrome, an indeterminate San Juan Redware, and Show Low Black-on-red) comprised 7.1 percent (Table 28.2). Like the other sites of this time, the whitewares suggest continued interaction with the Tusayan area (50.0 percent) although a fair percentage of Little Colorado (23.1 percent) and Cibola (26.9 percent) whitewares were recovered as well. The argillite data also suggest interaction with the north, since 25 percent of the analyzed sample (n=4) were from the Del Rio source area in the Upper Verde Valley. The diversity of the ceramic assemblage, and the relatively high buffware frequency relative to the Redstone and Compact sites, may be more indicative of the time depth of the site than overall patterns of interaction. Although the majority of the occupation is believed to be within the A.D. 1000 to 1150 period, the ceramic assemblage indicates use of the site area from perhaps as early as A.D. 850 to 950 (Santa Cruz Red-on-buff and Kiatuthlanna Black-on-white) and continuing into the late Classic period (A.D. 1300-1450).

Cobble Site (AZ O:15:54)

Feature 9, a D-shaped masonry pitroom at the Cobble site may also date to this general A.D. 1000 to 1150 period. This is based on the recovery of a single Holbrook Black-on-white (A.D. 1050-1150) sherd from within 5 cm of the floor (Stratum 19) and an archaeomagnetic date of either A.D. 990 to 1130 or A.D. 1145 to 1335 (see Chapter 25 and Appendix D). The earlier option for the date was chosen based on the Holbrook sherd, which the contextual assessment (Chapter 11) suggested was in relatively good context (the upper fill was contextually mixed, containing Kana-a Black-on-white [A.D. 825-1000] and Tuwiuca Black-on-orange [A.D. 1275-1350]). It is possible, however, that the presence of this sherd is also due to mixing and the later date, which is more in line with the primary site occupation, is more applicable. Several other earlier sherds were recovered from the Cobble site, including Santa Cruz or Sacaton Red-on-buff from the testing phase, and Kana-a and Black Mesa black-on-white from the data recovery phase making this date plausible.

Early Classic Period Roosevelt Phase (A.D. 1150-1300)

The next group of sites date to the early Classic period or Roosevelt phase, from roughly A.D. 1150 to 1300 or 1350. These sites include the Boone Moore site (AZ O:15:55), the Arby's site (AZ O:15:99), the primary occupation at the Cobble site (AZ O:15:54), and two of the three trash mounds tested at Rye Creek Ruin (AZ O:15:1). They are all situated in the northern portion of the project area, centering around Rye Creek (Figure 28.1). An additional group of four sites (AZ O:15:70, AZ O:15:71, AZ O:15:96, and the Overlook site [AZ O:15:89]), all single-room masonry fieldhouse sites located in the southern portion of the project area, are assumed to date to sometime during the Classic period, as is Feature 5, the masonry structure at the Hilltop site. No diagnostic ceramics or absolute dates were recovered from any of these sites (with the exception of a Show Low Black-on-red [A.D. 1050-1200] sherd from the fill of Feature 5), so their exact placement (early or late) within this period is unknown. Their assignment to the Classic period is based on the presence of masonry architecture (but note in Chapter 25 that masonry architecture may be occurring within the Tonto Basin as early as A.D. 1000) in conjunction with the presence of redware ceramics, which, although present, are relatively rare prior to around A.D. 1150. The evidence for a Classic period date is best for the Overlook site and site AZ O:15:71, and perhaps less strong at AZ O:15:70 and AZ O:15:96 from which very few artifacts were recovered.

Boone Moore Site (AZ O:15:55)

The Boone Moore site is situated on a small ridge finger overlooking the Rye Creek floodplain and contained seven structures and numerous extramural features. These include three pithouses (one of which, Feature 9, is earlier and was discussed in relation to the Compact site), two masonry/adobe pit rooms, and two surface masonry structures, as well as six inhumations, and several extramural features. The site is relatively enigmatic and difficult to interpret due to the diversity of its architecture and the apparent emphasis placed on hunting instead of agriculture. The sedentism study in Chapter 26 suggested that the site was a relatively permanent occupation, similar to the Redstone site although slightly less sedentary. Due to the averaging nature of some of the variables used in this study, however, the more sedentary nature would apply to the primary site occupation and it is possible, and suspected, that the site also functioned as a seasonal site during parts of the occupation. Also, like the Compact site, it is unknown if a portion of the site was removed through the construction of State Route 87, although it is considered likely given that several of the features are located directly next to the road-cut. Although this would potentially affect the diversity scores of the sedentism analysis, it would not necessarily affect the energy expenditure measures. In this sense, a more substantial occupation could easily have been present, which the sedentism analysis is partially measuring. The site was termed a farmstead/homestead in the site typology due to the more substantial nature of the occupation in comparison to the farmstead Clover Wash and Compact sites.

The site structure is difficult to interpret because there does not appear to be any definitive patterning. Furthermore, the archaeomagnetic options (see Chapter 25) are only clear cut for Feature 9, the earliest pithouse which probably is related to the Preclassic period occupation of the Compact site, and possibly Feature 1, a surface masonry structure (with an option of A.D. 1160-1305). The remainder of the features have two plausible options spanning the range between the mid-A.D. 950s through the early A.D. 1100s, or the mid-A.D. 1100s through the early A.D. 1300s (or in the case of pithouse Feature 19, the early A.D. 1400s). The two pithouses, Features 11 and 19, do not appear to be contemporaneous given their locations (next to each other but facing in opposite directions), although their ceramic assemblages and archaeomagnetic dates overlap. Feature 11 had a partially reconstructible Snowflake Black-on-white vessel on its floor, suggesting a date of A.D. 1100 to 1200. The masonry/adobe pitrooms (Features 5 and 6) may be contemporaneous and related because they are architecturally similar, oriented in the same direction, face onto the same extramural space, and also have overlapping archaeomagnetic dates. This same pattern could also indicate that one structure was built to replace the other. Finally, the relationship of the two surface masonry structures, Features 1 and 18, is unclear. Feature 1 opened away from the site towards the Rye Creek floodplain and in many ways appears to be an isolated fieldhouse. The archaeomagnetic date from Feature 1 overlaps with the later option for the rest of the site structures and its temporal placement within the site sequence is unclear. The orientation of Feature 18 is unknown since it was severely disturbed through road construction. It is situated behind Feature 1, however, and does not appear to be related.

Other lines of evidence, however, such as the types of deposits within the fills (i.e., primary or secondary trash, for example; see Chapters 11 and 14, Volume 2), along with the general architectural and ceramic data, suggest that the pithouses are probably earlier than the pitrooms and masonry structures. If this is the case, then pithouse Feature 11 would date to A.D. 1100-1200 (based on the partial Snowflake vessel on the floor) and Feature 19 would date to A.D. 980-1115 (based on the early option for the archaeomagnetic date). The date of Feature 19 would accord with the date for Holbrook Black-on-white (A.D. 1050-1150), which is the earliest ceramic type recovered at the site. This would also mean that Feature 19, along with Feature 9 discussed above, may be at least partially contemporaneous with the occupation of the Compact site. Feature 11, on the other hand, appears to date to the early Classic period; the archaeomagnetic option which accords best with the Snowflake ceramic date is A.D. 1150 to 1325. While pithouse architecture generally has not been associated with Classic period occupation in the past, it is now becoming clear that pithouses were a viable Classic period architectural type, and may have even persisted into the late Classic period (see Chapter 25). Feature 11 was also architecturally unusual for pithouses within the project area, being extremely deep with a short, shallow entrance and very large center posts. The implication of this is unknown, although it may be at least partially related to its late date. The structure also contained the disarticulated and jumbled remains of at least two individuals (an adult and child) on the floor, although they had been so severely disturbed through postdepositional processes that their original orientation and significance are unclear. Feature 5, a masonry/adobe pitroom, had a sherd of Pinto Black-on-red (A.D. 1250-1350) within 5 cm of the floor (Stratum 19) and a sherd of St. John's Black-on-red (A.D. 1175-1325) on the floor, which accords with the second archaeomagnetic option of A.D. 1155 to 1335. This would suggest that the similar option of A.D. 1150 to 1330 is correct for Feature 6, the other pitroom. The fill of Feature 6 also contained Pinto Black-on-red along with Padre (A.D. 1100-1250) and Walnut (A.D. 1100-1250) black-on-white, although no diagnostic ceramics were recovered from the floor. The structure was later reused, as indicated by the construction of an irregular cobble masonry wall through the approximate center of the partially filled-in house pit, although the dates of this use are unknown. The dating and sequencing of Features 1 and 18, the two masonry structures, are more difficult. Feature 1 had two Holbrook B Black-on-white (A.D. 1050-1150) sherds in the fill, suggesting that it predates this time. This implies that the A.D. 920 to 1045 archaeomagnetic option is more correct than the later A.D. 1160-1305 option. How this feature relates to Features 5 and 6, and possibly Feature 11, in terms of contemporaneity is unclear. Feature 18 is even more problematic, particularly given the severe disturbance. The structure appears to have had two floors; several partially reconstructible plainware vessels and a Walnut Black-on-white (A.D. 1100-1250) sherd were associated with the upper floor. Like Feature 1, this date overlaps with the masonry/adobe pitrooms and possibly pithouse Feature 11, and it is unclear where this structure fits into the site sequence.

Subsistence at the site was overwhelmingly dominated by agave collection and the hunting of large animals. Agave was found in every sampled feature and accounts for 91.7 percent of the recovered plant parts. This is the highest percentage for any of the sampled sites. Corn also appears to have been cultivated, at least during some of the occupations. Corn pollen was found in every sampled context (which included every structure except for Feature 18), while corn remains were recovered from four of the nine flotation samples (including Features 6, 11, and 19; Features 5 and 18 did not contain corn and Feature 1 was not sampled). Corn comprised 5.5 percent of the relative plant parts, which is close to the project average. The site contained a very low diversity of recovered botanical species; the only other identifiable species recovered from the flotation samples were hedgehog cactus and purslane seeds. Interestingly, the ground stone analysis (Chapter 15) suggests that the Boone Moore assemblage was focused more toward general plant processing than corn processing. The site had the highest percentage of general plant processing tools (47.1 percent) and the lowest percentage of corn processing tools (29.9 percent) of any habitation site in the project area. The percentage of agave processing tools was only slightly above the project average. The site also contained over 1,900 recovered faunal remains, the highest by a factor of almost 10 of any site in the project area. This suggests a primary focus on hunting by at least some of the occupations. Artiodactyls (deer and related species) and large mammal fragments dominated the assemblage, although a fair number of smaller species (such as rabbits and hares) also were recovered. Feature 5, a masonry/adobe pit room, and Feature 22, an intrusive pit within Feature 5, contained an unusually high number of mule deer mandibles. An aging analysis done on the teeth of these mandibles by Szuter in Chapter 21 of Volume 2 indicates that the deer ranged in age from several months to over four years. Their age of death suggests that they were killed during the late fall to early winter.

The ceramic assemblage shows some relatively dramatic changes in patterns of interaction from the preceding Sacaton phase. It appears that by the early Classic period interaction with Hohokam groups to the south had virtually ceased; not a single Hohokam buffware was recovered (Table 28.2). Furthermore, interaction with groups in the Tusayan and possibly Flagstaff areas was strongly curtailed, because only 2.1 percent of the whiteware assemblage consisted of Tusayan Whitewares (and these were all primarily early types and possibly related to the occupation of the Compact site). Decreasing interaction with Tusayan populations also is supported by the argillite sourcing analysis. Only a single piece of Del Rio argillite from the Upper Verde Valley was recovered out of the 13 analyzed pieces; the great majority were of locally procured Deer Creek material. This contrasts strongly with the preceding periods where Del Rio argillite comprised over 20 percent of the material at the Redstone and Clover Wash sites, and 50 percent of the material from the Compact site. Interaction with Tusayan and Hohokam groups appears to have been replaced by increasing interaction with the Little Colorado (48.9 percent) and Cibola (48.9 percent) areas. White Mountain Redwares, also possibly being made in the Cibola area (Zendeno 1991), are present for the first time, as are Roosevelt Redwares (the

Salado polychromes). It is unknown where the Roosevelt Redwares are being manufactured, because they appear to have been produced in many areas of the Southwest (Crown and Bishop 1987).

Therefore, given the large architectural diversity, the lack of obvious site structuring, and the high feature and artifact diversity, it is possible that the Boone Moore site was inhabited at different times by both seasonal and sedentary populations. The sedentary nature of the occupation is supported by the relatively high energy expenditure in site and structure construction (see Chapter 26) and by the presence of six inhumations, some of them adults with grave goods. A sedentary occupation is particularly possible if, as suspected, a portion of the site was removed through road construction. A seasonal occupation is supported by the high feature and artifact diversity suggesting continual reuse, the low botanical diversity with an emphasis on agave procurement, the incredibly high number of faunal remains, and by the presence of what appear to be isolated structures, such as Feature 1. It is also possible that different functions were occurring at different times, such as hunting during one season and agave procurement during another season. This would be similar to what Binford (1980) found for the Nunamiut Eskimo. This is supported both by the dominance of a ground stone tool kit for general plant processing (that is, repeated reoccupation for a variety of functions would mask the more specific natures of the tool kit) and by the large number of faunal remains.

Arby's Site (AZ O:15:99)

The Arby's site, a small fieldhouse site with two masonry structures, may be contemporaneous with the Boone Moore site. This is based on the recovery of a single Show Low Black-on-red (A.D. 1050-1200) sherd from the fill of one of the structures (Feature 3) and a Flagstaff-style Little Colorado whiteware (A.D. 1150-1250) sherd from the site surface. The site is situated in a relatively low area within the Rye Creek floodplain approximately half a kilometer north of the Boone Moore site (Figure 28.1).

Both structures (Feature 1 and 3) are small and relatively ephemeral, suggesting a limited occupation. This is supported by the sedentism analysis in Chapter 26, which indicates a low energy expenditure with minimal feature and artifact diversity suggestive of a seasonal occupation. It is unknown whether the two structures are contemporaneous, because they are separated by State Route 87, which effectively bisects the site. The site continued to be reoccupied after the abandonment of Feature 1, which was remodeled into Feature 5 at some point after 9 cm of fill had accumulated. That the site continued to be reused after this is indicated by a sherd match between the fills of Feature 3, on the east side of the road, and Feature 5, the remodeled structure on the west side. That both Features 3 and 5 were open and filling at the same time tentatively suggests that Feature 1 may have been the earliest structure at the site.

The subsistence data indicate a very strong agricultural function. Corn pollen was recovered from both analyzed structures (Features 1 and 3), while corn was recovered in the flotation samples from all three structures as well as from an extramural hearth (Feature 4). Corn accounted for just over 50 percent of the relative plant parts, the highest percentage of any site within the project area. Other collected foodstuffs included cheno-ams, agave, and hedgehog cactus. The relative percentage of agave was very low in comparison to the other sites (and particularly in comparison to the Classic period sites), comprising just over 10 percent of the recovered plant parts. Hunting was also limited, because only two indeterminate bone fragments were recovered. This, along with the extremely low botanical diversity further suggests the strong agricultural nature of this site.

The ceramic assemblage follows the trends in the early Classic period interaction seen at the Boone Moore site (Table 28.2). Although the sample size is very small (n=10), no buffwares were recovered, while whitewares comprised 90 percent of the decorated assemblage and other decorated wares (the single Show Low Black-on-red sherd) 10 percent. Within the whiteware assemblage, 11.1 percent were Tusayan whitewares, 44.4 percent were Little Colorado whitewares, and 44.4 percent were Cibola whitewares.

Cobble Site (AZ O:15:54)

The Cobble site is a possible hamlet situated on a terrace overlooking the Rye Creek floodplain (Figure 28.1). The primary occupation at the site appears to have been during the early Classic period, although given the presence of both Pinto Polychrome (A.D. 1250-1350), Tuwiuca Black-on-orange (A.D. 1275-1350), and Tonto Polychrome (A.D. 1250-1400) the possibility exists that the occupation extended into the following Gila phase (A.D. 1300-1450). The site was extremely disturbed by both root-plowing and the construction of State Route 87. All that remained were several isolated masonry rooms along the west side of the highway that escaped the root-plowing (but not the road construction) and large amorphous areas of undefinable rubble and an intact trash mound east of State Route 87. Given the size of the rubble scatter it is estimated that the site may have contained one or two roomblocks with as many as 10 to 15 masonry rooms. Two petroglyph boulders were also present at the site, the only examples of petroglyphs recorded in the project area. Although the site was not included in the sedentism analysis due to the lack of undisturbed data, the density and diversity of the artifact and feature assemblage and the energy expended in construction of the pueblo (the wall stones are larger than any other masonry structure within the project area) all suggest that the site was permanently inhabited.

The only structure that was found to be intact and was excavated was Feature 9, the D-shaped masonry pit-room discussed earlier that may date to the A.D. 1000 to 1150 period. As mentioned, a Holbrook Black-on-white (A.D.1050-1150) sherd from within 5 cm of the floor (Stratum 19), considered by the contextual assessment to be in relatively good context (see Appendix B), combined with an archaeomagnetic option of A.D. 990 to 1130, suggested that Feature 9 dated to the late Sedentary period. This date also is considered possible given the fact that all of the early sherds at the site (of which there were relatively few) stemmed from the west side of the highway, with the exception of a single Santa Cruz or Sacaton Red-on-buff sherd recovered from the surface of the east side during the testing phase. Given that the upper levels of this feature were extremely mixed (containing both Kana-a Black-on-white [A.D. 825-1000] and Tuwiuca Black-on-orange [A.D. 1275-1350]), however, it is possible that the Holbrook sherd is intrusive and that the feature may actually date to the other plausible archaeomagnetic option of A.D. 1145 to 1335, which would put it more in line with the majority of the site occupation. Features 5 and 8 were masonry pitrooms or surface structures, extremely disturbed through road construction. As a result, very little data were recovered from either feature. Feature 5 had a sherd of Tonto Polychrome (A.D. 1250-1400) in Stratum 19, and Pinto Polychrome (A.D. 1250-1350) and Black Mesa or Sosi Black-on-white (A.D. 1000-1150) sherds within the fill. The only diagnostic sherd associated with Feature 8 was a Black Mesa Black-on-white sherd from the fill (A.D. 1000-1135).

Feature 2 is a relatively large trash mound on the east side of the highway associated with Feature 1, the large area of amorphous rubble thought to represent one or two roomblocks. The trash mound was not disturbed by the root-plowing because it was on a cobble bar close to the terrace edge. Three 1-m by 2-m units were excavated within the mound during the testing and mitigation phases. Although the mound could not be temporally stratified by excavation level, recovered diagnostic ceramics included Reserve/Tularosa Black-on-white (A.D. 1100-1300), Tularosa Black-on-white (A.D. 1200-1300), three sherds of Pinto Black-on-red (A.D. 1250-1350), Pinto Polychrome (A.D. 1250-1350), and Tusayan Polychrome (A.D. 1125-1290). A large number of indeterminate Cibola Whiteware sherds (26) also were recovered, along with a single indeterminate Little Colorado Whiteware. No Tusayan whiteware sherds were recovered.

Subsistence at the site appears to have been based on corn agriculture with a heavy emphasis on agave collection. Corn pollen was recovered from all sampled contexts (all three masonry structures and the trash mound). Flotation samples were analyzed from Feature 9 (the fill and hearth) and Feature 2 (one sample from each of the four excavation levels within the mound). Agave and corn were recovered from every sampled context. Agave was extremely ubiquitous, comprising 85.6 percent of the relative plant parts. There was a relatively high diversity of botanical species, including purslane, cheno-ams, tansy mustard, hedgehog cactus, grasses and *Hordeum*. The faunal remains were relatively limited, although this is not surprising given the small amount excavated, and included both large and small game.

The ceramic assemblage continues the basic trends in interaction patterns seen at the other early Classic period sites with the exception of a drop in the frequency of Little Colorado Whitewares and a corresponding rise in the frequency of Cibola Whitewares. This is a pattern seen more clearly during the following Gila phase, because Little Colorado Whitewares were no longer manufactured after A.D. 1250 (Douglass 1987), suggesting that the site occupation may have extended past this time. As noted, no buffwares were recovered, while whitewares comprised 77.4 percent of the decorated assemblage and other decorated wares comprised 22.6 percent. Cibola Whitewares (77.1 percent) dominated the whiteware assemblage, followed by Little Colorado Whitewares (12.5 percent) and Tusayan Whitewares (10.4 percent).

Rye Creek Ruin (AZ O:15:1)

Rye Creek Ruin is the largest site within the Upper Tonto Basin and one of the four largest sites within the entire Tonto Basin (Wood 1989b). It is situated overlooking a wide expanse of arable land at the junction of Rye and Deer creeks within a kilometer of the project area (Figure 28.1). The site contains more than 150 masonry rooms and two platform mounds, and was almost certainly the focus of at least the Classic period settlement of the project area. The site undoubtedly was occupied on a year-round sedentary basis, and is considered to be a true village site in the site typology. Due to the significance of the site within the project area and the Tonto Basin in general, permission was granted by the Tonto National Forest to test and map the site on a volunteer basis (see Chapter 27). Although the site had been generally known to date to the Gila phase (A.D. 1300-1450), with some earlier Roosevelt phase (A.D. 1150-1300) occupation, we were especially interested to see whether there was an even earlier component, which could perhaps account for the smaller pithouse sites within the project area. To accomplish this three trash mounds (one very large one next to the northern compound wall and two smaller ones away from the wall) were selected for testing. A single 1-m by 2-m unit was excavated within each mound, and all artifacts and faunal material were recovered. Sampling was not undertaken for pollen and flotation analyses, however. The testing program was not entirely successful; an early Preclassic period component could not be defined and it is still unknown whether one is present. Significant data were still collected, however, providing us with the only comparative sample of a Gila phase assemblage.

Features 2 and 3, the two small trash mounds away from the compound wall, appear to date primarily to the Roosevelt phase, although some later mixing is present. More than 80 percent of the diagnostic ceramics predate A.D. 1300, and include Walnut A and B Black-on-white (A.D. 1100-1250), Snowflake Black-on-white (A.D. 1100-1200), and Reserve/Tularosa Black-on-white (A.D. 1100-1300). Later mixing is indicated by the recovery of a few sherds of Pinto Polychrome and Pinto Black-on-red (A.D. 1250-1350), and Bidahochi Black-on-white (A.D. 1325-1400). Even with the mixing, the percentages of whitewares to other decorated wares in Features 2 and 3 are extremely similar to the other Early Classic period sites; whitewares comprise 79.2 percent of the decorated assemblage while other decorated wares comprise 20.8 percent (Table 28.2). They are slightly different, however, in the relatively higher percentage of Little Colorado whitewares (63.2 percent) with a corresponding lower percentage of Cibola Whitewares (36.8 percent). The reason for this variation is unknown, although it may be indicative of flexibility in the interaction networks. That is, interaction networks may be more site specific and contingent on local ties than regionally dependent, although the general patterning does appear to be regionally based.

Late Classic Period Gila Phase (A.D. 1300-1450)

Rye Creek Ruin (AZ O:15:1)

As mentioned, Feature 1 at Rye Creek Ruin is the only investigated feature within the general project area that contained an unambiguous Gila phase component. Feature 1 is an extremely large trash mound that straddles the northern compound wall; deposits were found to a depth of over 1.5 m. The mound contained an extremely high artifact density and diversity, including 97 decorated sherds representing 20 temporally sensitive types and seven wares. The ceramic types clustered within the first half of the A.D. 1300s, because 76.3 percent of the recovered diagnostic ceramics postdated A.D. 1300. A number of earlier sherds, primarily

Little Colorado whitewares dating to the early A.D. 1200s were also present, as well as a single Santa Cruz or Sacaton Red-on-buff (A.D. 850-1150) and three indeterminate buffwares. Although the buffwares were all from the lower levels of the mound, stratigraphic mixing made it difficult to temporally seriate the deposits. Along with the early buffwares, the lower levels also contained Fourmile Polychrome (A.D. 1325-1375), Pinto Polychrome (A.D. 1250-1350), Chavez Pass Black-on-red (A.D. 1275-1350) and Tuwiuca Black-on-orange (A.D. 1275-1350) sherds. As noted in Chapter 12 of Volume 2, Levels 1, 2, and 3, were more purely Gila phase, with over 80 percent of the ceramics dating to the post-A.D. 1300 period, while Levels 4 and 5 were more mixed, because only 64.3 percent of the diagnostic ceramics postdated A.D. 1300.

For the mound as a whole, buffwares comprised 4.3 percent of the diagnostic decorated assemblage, whitewares comprised 38.7 percent, and other decorated wares comprised 57.0 percent (Table 28.2). The dominance of other decorated wares, primarily Roosevelt Redwares (40.7 percent of the other decorated ware category), White Mountain Redwares (37.0 percent), Hopi wares (11.1 percent), and Winslow Orangewares (9.3 percent), is a much different pattern than seen at the early Classic period sites where whitewares were still the primary decorated ceramic. This change is further illustrated by the differences among the excavation levels. Levels 1, 2, and 3, thought to basically represent a Gila phase assemblage, contained 34.5 percent whitewares versus 65.5 percent other decorated wares, while Levels 4 and 5, dating primarily to the Roosevelt phase, contained 59.3 percent whitewares versus 40.7 percent other decorated wares. This relationship is statistically significant (Pearson Chi-square=12.56, df=1, p=.0001). Furthermore, within the whiteware assemblage, no Tusayan Whitewares were recovered, Little Colorado Whitewares comprised 44.4 percent, and Cibola Whitewares comprised 55.6 percent. The percentage of Cibola Whitewares is even higher if only the upper three levels are considered, because Little Colorado whitewares were no longer manufactured after A.D. 1250 (Douglass 1987).

Finally, the four buffware sherds recovered from the lower levels of the mound do suggest that a Preclassic period component may be underlying Rye Creek Ruin. This is suspected given the ideal location of the site for settlement, particularly in terms of water resources and the potential for agriculture. Our testing was not definitive, however, as the recovery of only four sherds could represent most anything. Furthermore, previous testing of the site by Haury (1930a) and extensive surface inspections by the Tonto Forest archaeologists (J. Scott Wood, personal communication, 1990), have failed to produce much additional evidence for a Preclassic period occupation.

DIACHRONIC TRENDS IN UPPER TONTO BASIN SETTLEMENT

As the data presented above suggest, there are several very strong temporal patterns in the Rye Creek data which suggest significant changes in the settlement of the Upper Tonto Basin through time. These changes involve modifications in the nature of the settlement/subsistence systems and interaction networks and are summarized below by time period (Table 28.3).

Gila Butte Phase (A.D. 750-850)

Based on the data from the Deer Creek site (AZ O:15:52), and Ushklish (Haas 1971a) to a certain extent, settlement during the Gila Butte phase consisted of a series of small independent hamlets situated in ideal locations for agriculture. These hamlets are believed to represent sedentary sites occupied by indigenous populations (the evidence for indigenous groups is discussed below) who interacted most closely with Hohokam groups to the south, based on the dominance of buffwares in the decorated assemblage (Table 28.3). Some interaction with more northern groups is also occurring, based on the presence of Lino Graywares at Ushklish, although this is believed to have been extremely limited. It is unknown whether this interaction involved actual contact between the different populations, or whether it involved goods moving up or down the line through middlemen systems. The Hohokam buffwares and shell recovered at the Deer Creek site could have stemmed from contact with Roosevelt 9:6 (Haury 1932), which is situated in the Lower Tonto Basin approximately 30 km south of the Deer Creek site. As discussed later, Roosevelt 9:6 may represent an actual migration of a Hohokam-affiliated group into the Tonto Basin. The fact that fewer than 200 vessels are represented by the Gila Butte sherds over the estimated 60- to 75-year span of the Deer Creek site suggests that this interaction may not have been overly intensive, although it appears to have been relatively constant throughout the occupation. The limited nature of the contact with outside groups is even more apparent for the northern interaction. At Deer Creek evidence for this is limited to a few Kana-a Black-on-white vessels (which as noted appear to be more related to the reoccupation of the site during the following Santa Cruz and Sacaton phases 12 and 24) and the recovery of a single piece of Del Rio argillite from the Verde Valley. The actual number of northern goods is so limited that it can be suggested that they were procured as products of either down-the-line exchange, passing through several sites on their way to the Upper Basin, or through the actions of a few individual traders moving through the area.

Table 28.3. Percentages of ceramic wares and argillite recovered by period from the Rye Creek Project area.

	Decorated Ceramics			Whitewares				
Phase	Buff (%)	White (%)	Other Decorated (%)	Tusayan (%)	Little Colorado (%)	Cibola (%)	Del Rio Argillite (%)	Agave Parts (%)
Gila Butte	90.6	9.4	0	94.7	5.3	0	3.0	22.4
Santa Cruz	64.5	35.5	0	64.0	24.0	12.0	0	23.5
Sacaton	20.2	76.7	3.1	67.8	21.4	10.7	24.4	73.9
Early Classic	0.0	78.8	21.2	5.7	36.6	57.7	5.0	84.8
Late Classic	(4.3)[1]	38.7	57.0	0	(44.4)[2]	55.6	*	*

[1]Early buffwares recovered from Feature 1 but not related to late Classic period occupation.
[2]Little Colorado whitewares not manufactured at this time. Presence related to early Classic period use at the trash mound.
*Unknown

The plainware petrographic analysis suggests that during this time slightly less than half (43.3 percent) of the ceramics were being locally manufactured within the project area (see Chapter 13, Volume 2). In the petrographic analysis "local" was defined as temper coming from a petrofacies within a 1-km radius of the site, "possibly local" was within a 3-km radius, and "nonlocal" was anywhere outside of this range. This is based on the ethnographic work of Arnold (1985) who found in a cross-cultural analysis that ceramic temper material is generally procured close to the site area; 50 percent of potters (with the exception of those using canoe travel) procured temper within 1 km of their settlement and 75 percent within 3 km. The frequency of local temper at the Deer Creek site is slightly higher than seen in the following phases and appears to correlate with the relatively high number of recovered polishing stones. The great majority of nonlocal plainware ceramics were coming into the project area from nearby petrofacies (within 30 km) along the west side of Tonto Creek to the south in the Lower Tonto Basin (Petrofacies J: 20.1 percent) and to the north towards the Payson Basin (Petrofacies F: 28.4 percent), indicating a fair degree of intraregional interaction with neighboring groups (see Figure 13.8 for location of the petrofacies). Because the tip of Petrofacies F is within 5 km of the Deer Creek site, it is possible that these ceramics could have been locally manufactured as well, although this is unknown. If Petrofacies F is local (and due to its location it is considered to be "possibly local" for the northern sites within the project area) then there is a much higher percentage of local manufacture (71.1 percent) and intraregional interaction is occurring solely with groups in the Lower Basin. Petrofacies F covers a large area extending north towards the Payson Basin and not enough work has been done to separate this into smaller petrofacies. As a result, plainwares originating from the more northern areas towards the Payson Basin cannot presently be differentiated from plainwares that could be termed "possibly local," so the degree of intraregional interaction with groups in the Payson area is unknown.

Subsistence during this time was based on a wide diversity of cultivated, collected, and hunted foodstuffs. Corn was the primary agricultural crop, although the recovery of a single grain of squash pollen from the Deer Creek site suggests that other cultigens were grown as well. Agave was collected and used, at least in the Upper Basin where it grows naturally, but not nearly to the same extent as it was in the following phases (Table 28.3).

Mortuary practices in the Upper Basin consisted of the use of both rectangular crematoriums with associated grave goods and secondary cremations within ceramic vessels. In the Lower Basin only secondary cremations are known from this period.

Population density during this time appears to be low, since very few sites are known. Data from the site files suggests that fewer than 20 sites are currently recorded from the Tonto Basin containing either Snaketown or Gila Butte Red-on-buff ceramics. Like Deer Creek and Ushklish, these sites are relatively spread out and situated in optimal locations for agriculture. To date, there is no good evidence for the occupation of seasonal habitation sites that would suggest an organized site hierarchy. Given the recovery of a few Gila Butte Red-on-buff sherds from the Clover Wash site and the Compact site, both of which were disturbed through construction activities or root-plowing, these sites may be present but currently unrecognized. Alternatively, these sites could represent limited-activity locales for resource procurement. The fact that the intensity of survey coverage and excavation are relatively low, and that many of the earlier sites are buried within alluvial areas, the population density and site diversity during this time may easily be higher than suspected. Diagnostic ceramics from the surface of the Deer Creek site, for example, contained only Sacaton Red-on-buff and Kana-a Black-on-white sherds (Elson and Swartz 1989b:35); the Gila Butte occupation was unknown until subsurface testing was undertaken. That current survey data may be misleading as to the actual occupation intensity of this period is also suggested by the discovery of more and more sites with Snaketown and Gila Butte components with the increasing intensity of work within the Tonto Basin. Two sites with Snaketown ceramics were recorded during weekend surveys (jaunts, actually) in the Upper Basin during the course of this project, and several Gila Butte phase sites are now known from the Roosevelt Lake projects, including what appears to be a substantial component at the Meddler Platform Mound site and site AZ V:5:139 being excavated by Desert Archaeology (Doelle et al. 1991). The fact that Snaketown and Gila Butte Red-on-buff may also not have been produced in as large quantities as ceramics from the following phases also needs to be taken into account (Elson and Doelle 1986). These data all suggest that the early Preclassic period occupation of the Tonto Basin was more intensive than previously believed.

Santa Cruz Phase (A.D. 850-950)

Very little data were recovered from the Rye Creek Project area on the nature of the Santa Cruz phase occupation. As mentioned above, this is not believed to represent a significant hiatus in the occupation of the Upper Basin or Tonto Basin in general, because a fair number of sites are known with Santa Cruz phase ceramics, including both Ushklish in the Upper Basin and Roosevelt 9:6 in the Lower Basin, as well as sites currently being investigated within the Roosevelt Lake area. These data suggest that population density is increasing at this time, although the magnitude of the increase cannot be evaluated. The overall lack of Santa Cruz phase material (11 Santa Cruz Red-on-buff and 20 Kana-a Black-on-white sherds from the entire project area) is believed to represent the restricted areal nature of the sample rather than the actual use of the area.

The Rooted site (AZ O:15:92) is the only one within the project area believed to have contained an actual Santa Cruz phase occupation, although it is suspected that the primary occupation at this site was during the following Sacaton phase. Given the recovery of a few Santa Cruz Red-on-buff and Kana-a Black-on-white sherds at six other sites (Deer Creek, Hilltop, Compact, Cobble, Redstone, and AZ O:15:94), it is possible that the occupation at this time was larger than currently recognized. Unfortunately, due to the destruction of most of the Rooted site through root-plowing, the nature and true intensity of this occupation are unknown. Given the size of the site and the density and diversity of the artifact assemblage, the site is suspected to have been a sedentary hamlet, perhaps the Preclassic period component of the nearby Classic period Cobble site (AZ O:15:54), also suspected to have been a hamlet. Like the Gila Butte phase, the data suggest that some hierarchical organization may be present within the settlement. The data are better for this time period, because two of the structures at the Deer Creek site appear to date to this time, suggesting that temporarily occupied fieldhouse sites may have been present. If the Santa Cruz phase occupation of the Rooted site was in fact a hamlet, this would mean that at this time at least some settlement systems were organized into larger community networks, although the evidence for this is admittedly.

The limited data can be extrapolated somewhat to suggest that the patterns seen in the preceding phase are continuing with some modifications. This is particularly true concerning the nature of the ceramic interaction networks; while Hohokam buffwares still dominate the assemblage, there is evidence of increasing contact with northern Tusayan and Little Colorado populations, and more limited contact to the east with the Cibola region (Table 28.3). Tusayan whiteware ceramics comprise the majority of the recovered whitewares. Although these traditionally are believed to have been manufactured in the Kayenta area of the Colorado Plateau, it is possible that their source in the Tonto Basin is the Flagstaff area, which is dominated by Tusayan whitewares at this time. A Flagstaff route to the Tonto Basin is relatively straightforward and easily traveled by going down the Verde River to the East Verde River crossing a small ridge and heading down Rye Creek. The Flagstaff region is approximately 130 km (80 miles) northwest of the Upper Tonto Basin.

The limited botanical analyses suggest that corn agriculture was still the dominant subsistence focus. The procurement of agave, other collected foodstuffs and hunting also played a role in subsistence, although not much change is noted from the preceding Gila Butte phase. The only evidence for mortuary practices during this time come from the recovery of two infant inhumations at the Rooted site. Two additional infant inhumations, one with an associated Kana-a Black-on-white (A.D. 825-1000) bowl recovered from the Deer Creek site, may also date to this time period.

Sacaton Phase (A.D. 950-1150)

The Sacaton phase was a time of relatively drastic changes in both the settlement/subsistence systems and in the interaction networks. Given the number of sites in the project area occupied during this phase it is time to put forever to rest the notion of a Sacaton phase hiatus in the Tonto Basin originally proposed by the Gladwins (Gladwin and Gladwin 1935) and recently revived by Ciolek-Torrello (1987). Project area sites dating to this period include the Rooted site, which continued to be occupied, as well as the Compact site (AZ O:15:90), the Redstone site (AZ O:15:91), the Clover Wash site (AZ O:15:100), and the Hilltop site (AZ O:15:53). As noted, the occupation of the Compact site may also overlap with the end of the preceding phase, although the data suggest that it is much more similar to the sites within this chronological period.

Within the project area sites dating to this time period consist of a series of small farmsteads and fieldhouse sites, primarily focused around Rye Creek. The move to the Rye Creek area represents a switch in areal focus from the preceeding periods, and the Deer Creek area appears to be largely unoccupied except for perhaps sporadic and seasonal use of the fieldhouse sites at the Deer Creek and Hilltop sites. Most of the farmsteads are considered to have been permanently occupied for a very short duration, lasting at most one or two generations. The single fieldhouse site (the Hilltop site) is considered to be seasonal, although suspected to have been reused over a relatively large number of years. It is unclear, however, whether the lack of more permanent hamlets signifies a change in settlement strategies within the project area, or whether this is a result of the restricted sample; it is suspected that this patterning is primarily due to the sample size, particularly because the Rooted site appears to have been occupied during this period and may have been a small hamlet. In fact, going strictly by the ceramic assemblage, the primary occupation of the Rooted site is during this time. It is also possible, and in fact suspected, that an occupation was present at Rye Creek Ruin at this time, although the nature and intensity of this occupation are unknown. In this respect, an organized site hierarchy appears to be present, particularly given the seasonal nature of the Hilltop site, which necessitates a connection with a parent village. The increase in the number of sites also suggests an increase in population from the preceding period. These data must be tempered, however, by the fact that all of the sites appear to have been inhabited on a very short-term basis and it is possible, in fact perhaps likely, given the length of the phase, that no two sites were contemporaneous.

A change in the interaction networks at this time is also clearly evident (Table 28.3). Interaction with Hohokam groups to the south, the dominant pattern in the preceding periods, is drastically reduced with a corresponding rise in interaction with Tusayan groups to the north. The increase in Tusayan ceramics also is correlated with a dramatic rise in the frequency of Del Rio argillite, suggesting that both ceramics and argillite are moving through the same networks. The correlation between Del Rio argillite and Tusayan whitewares is considered to be relatively strong evidence that the Flagstaff area is the source of this interaction, since both Del Rio argillite and Tusayan ceramics are concentrated there. Interaction continued with Little Colorado populations and Cibola populations; although the percentages decrease slightly from the preceding period, the much larger number of whitewares suggests that interaction was increasing with both of these regions.

The plainware petrographic data (which include both the preceding Santa Cruz phase and the Sacaton phase) indicate changes in the intraregional interaction networks as well. During this time, 39.7 percent of the plainwares were either local or possibly local (Petrofacies F here is considered "possibly local" since it is within 3 km of the Santa Cruz and Sacaton phase sites). Although there is still contact with groups within Petrofacies J (11.6 percent), along the west side of Tonto Creek, the majority of the interaction has switched to sites within the adjoining area (Petrofacies D: 22.2 percent) on the east side of the creek (see Figure 13.8). In addition, a few plainwares also appear to be originating from the very southern portions of the basin (Petrofacies P: 4.7 percent). As mentioned, local interaction with groups to the north towards the Payson Basin is unknown, since Petrofacies F potentially encompasses this area and the fine-scale work needed to separate additional petrofacies (if possible) in this area has not yet been undertaken.

The subsistence data document additional changes. Although corn agriculture was still practiced, as was the collection and hunting of a variety of foodstuffs, there was a significant increase in the use of agave, going from around 20 percent of the recovered plant parts in the preceding periods to over 70 percent (Table 28.3). Whether this indicates actual agave cultivation, as is known ethnographically in Mexico (Pinkava and Gentry 1985) and strongly suspected prehistorically (Bernard-Shaw and Huntington 1990; Ciolek-Torrello et al. 1990; Fish et al. 1985) is unclear, although considered possible given the magnitude of the increase. Alternatively, the increase in agave use could be related to the introduction of new ideas or technological factors making procurement easier and more efficient. There are no obvious indications of a technological change in the lithic and ground stone tool assemblages, however. The figure shown in Table 28.3 for the percentage of recovered agave plant parts (73.9 percent) is an average of the Sacaton phase sites and the range is quite variable (between 25.2 percent at the Compact site to 85.8 percent at the Redstone site; the Clover Wash and Hilltop sites were both around 55 percent). Furthermore, the Redstone site figures are potentially inflated because these include two extramural pits that may be related to a Classic period reoccupation, when agave procurement and use were even more intensive. This suggests that the intensity of agave use was site specific, and that during this time sites may have more-or-less specialized in its procurement.

Data are generally lacking on mortuary practices at this time; the only definitive mortuary feature was the inhumation of a fetus at the Clover Wash site. As mentioned earlier, it is unclear whether the features identified as possible crematoriums at the Hilltop site were in fact mortuary features, or if they were, whether they were actually related to the occupation of the site. Scattered cremated bone was found at all of the sites, however, suggesting the use of some form of this practice.

As discussed earlier, it is believed that the occupation of the Redstone site may be the result of migration by populations from the north. This is based on the high whiteware frequency, the presence of raw material (and not just artifacts) from the Del Rio argillite source area, and the architectural styles of the two pithouses (extremely large with large, alcove-like entrances). Alternatively, the site occupants simply could have interacted more closely with northern populations than the other project area sites. The very low argillite-to-lithic ratio, the lowest of any site within the project area, suggests a possible specialization in argillite procurement and possibly pigment manufacture, given the presence of ground argillite pigment on house floors and artifacts. The site inhabitants may also have specialized in agave procurement and processing, as indicated by the very high frequency of agave plant parts. Both of these materials, agave and argillite, appear to occur in quantities too large for consumption by a single household, and it is likely that they were part of an exchange network, perhaps being exchanged with the Tusayan area for whiteware ceramics. Although Deer Creek argillite artifacts are not believed to have moved in significant quantities to the Flagstaff area (only two pieces were found at Flagstaff area sites), as noted in Chapter 22 only the Deer Creek argillite makes a viable red pigment (Del Rio argillite is not suitable for pigment manufacture) and perhaps argillite pigment was what was being traded.

Early Classic Period (A.D. 1150-1300)

The early Classic period was a time of additional change in the Upper Basin settlement and interaction systems. For one, there was a switch to subsurface adobe/masonry pit rooms and above-ground masonry architecture, although pithouses continued to be occupied. The exact timing of this switch is uncertain, and in fact may have occurred late in the Sacaton phase; there is evidence from other sites in the Tonto Basin that masonry structures may have appeared as early as A.D. 1000 (see Chapter 25), although the data are still equivocal. There is also a definite increase in site density and possibly population, given the numbers of known sites throughout the Basin. Unfortunately, many of these sites are either overlain by a later Gila phase occupation, so the intensity of the Roosevelt phase occupation is unknown, or are small masonry sites that do not contain diagnostic ceramics and therefore cannot be dated as to their exact placement in the Classic period. Sites within the project area that date to this time include the Cobble site (AZ O:15:54), the Boone Moore site (AZ O:15:55), and the Arby's site (AZ O:15:99). Rye Creek Ruin (AZ O:15:1) also was occupied, and may have been the focus of the project area settlement. The Cobble site is suspected to have been a permanently occupied hamlet, the Boone Moore site is a sedentary farmstead (with additional seasonal occupation), and the Arby's site is a seasonal fieldhouse. Given these data, along with the probable village status of Rye Creek Ruin at this time, the full complement of a hierarchical settlement system is present. The four additional fieldhouse sites (AZ O:15:70; AZ O:15:71; AZ O:15:96; and the Overlook site, AZ O:15:89), in the southern portion of the project area, as well as the fieldhouse in Locus B at the Rooted site and Feature 5 at the Hilltop site, may also have been occupied during the early Classic period, although this is uncertain and they could have just as easily been occupied during the following Gila phase. In fact, almost all of the sites in the high density site area on the terraces south of Deer Creek shown in Figure 28.1 are masonry fieldhouses, the great majority without diagnostic ceramics. These data do indicate, however, a much more intensive use of the landscape, primarily for agricultural purposes (if the majority of the fieldhouses can be assumed to be agriculturally specific), than in the preceding periods. This suggests an increase in population size, accompanied perhaps by aggregation into larger sedentary sites. Within the Rye Creek Project area this aggregation is perhaps somewhat exemplified by the Cobble site, which while not extremely large, appears to be larger by several factors than any of the sites in the preceding periods. Although the size of Rye Creek Ruin is unknown at this time, the fact that two of the tested trash mounds dated almost exclusively to the Roosevelt phase suggests that the site may also have been aggregated and substantially occupied, although probably not to the scale seen in the following Gila phase.

Along with the changes in architecture and increase in site density and possibly population, changes also were occurring in the interaction networks. Hohokam buffwares are completely absent (Table 28.3), suggesting that interaction with this area had ceased almost entirely at this time. This is supported by changes in the shell assemblage as documented by Vokes in Chapter 17 of Volume 2. Prior to the Classic period types and genera of shell artifacts occurred in frequencies comparable to sites in the Hohokam area, suggesting that the shell network was first moving through the Hohokam area before reaching the Tonto Basin. During the early Classic period, however, there is a marked increase in the percentage of *Conus* tinklers and beads, with a corresponding decrease in *Glycymeris* bracelet forms. Although *Conus* also increased in the Hohokam area during the Classic period, and *Glycymeris* decreased slightly, these changes were not nearly of the same magnitude as in the Rye Creek area and Tonto Basin in general, leading Vokes to suggest a change in the direction of the shell networks. That is, although some shell may still be coming from the Hohokam area, it appears that shell also was being derived from other sources. What these new sources are is unknown, and it is not out of the realm of possibilities that Tonto Basin inhabitants were making trips to the Gulf themselves to directly gather shell. Although Vokes speculates that shell was being procured from sources to the north, given the high percentage of *Conus* at some northern sites such as Wupatki and Elden Pueblo, these data are still equivocal and in need of further testing.

Perhaps the most significant change in interaction is the dramatic decrease in the frequency of Tusayan Whitewares, dropping from 67.8 percent during the Sacaton phase to 5.7 percent during the early Classic period. This can be correlated with an increase in both Little Colorado Whitewares and Cibola Whitewares, with Cibola increasing the most significantly and dominating the assemblage. The decrease in Tusayan Whitewares was accompanied by a similar decrease in the percentage of Del Rio argillite, further supporting the notion that both the argillite and Tusayan Whitewares were moving within the same networks and probably from the Flagstaff area. An increase also was present in the other decorated wares, including Roosevelt Redwares, White Mountain Redwares, Hopi Wares, and Tsegi Orangewares, indicating more widespread interaction than seen in the preceding periods. Both White Mountain Redwares and Cibola Whitewares may been coming from the Chevlon and White Mountain areas to the east (as are possibly the Roosevelt Redwares, although this is unknown), suggesting a closer interaction with this area than seen earlier.

During this time the frequency of redware ceramics also increased dramatically, going from 5.3 percent of the total ceramic assemblage during the Sacaton phase to 44.4 percent of the assemblage during the early Classic period (see Table 25.10). This was accompanied by a corresponding decrease in the percentage of plainware ceramics (from 91.9 percent to 54.9 percent). The reasons for this are unclear, although it appears to be related to a pan-Southwestern trend toward increasing redware production at that time. It is also possible that the relatively dramatic increase in redwares in the Upper Basin had to do with the use of Deer Creek argillite as a red ceramic pigment (see Chapter 22), although this is unknown.

Even more so than the preceeding periods, the petrographic analysis suggests that the majority of both plainware and redware ceramics were nonlocal; local (Petrofacies H and K) and possibly local (Petrofacies F) wares made up 32.7 percent of the plainware assemblage and 25.5 percent of the redware assemblage. As mentioned earlier, Petrofacies F (comprising 11.9 percent of the plainwares and 18.5 percent of the redwares) is included here as "possibly local" because it is within 3 km of the early Classic period sites. This petrofacies could also include potentially nonlocal ceramics coming from areas north of the project area, although this is unknown. There are only slight differences in the sources of the nonlocal plainwares and redwares. As in the preceding Sacaton phase, nonlocal plainwares stemmed primarily from Petrofacies D (28.0 percent) and J (31.0 percent) situated adjacent to each other on either side of Tonto Creek in the northern portion of the Lower Basin, as well as from Petrofacies P (6.2 percent) in the very southern portion of the basin. This suggests a degree of continuity between the Sacaton phase and early Classic period in intraregional interaction. Redware ceramics, on the other hand, came almost exclusively from Petrofacies J (63.4 percent), with a few from Petrofacies I (2.3 percent; also in the northern portion of the Lower Basin just north of J), and Petrofacies P (1.1 percent) in the very southern part of the basin (see Figure 13.8).

Subsistence during the Early Classic period, although probably based on corn agriculture, appears to be even more oriented toward agave procurement and use than in the Sacaton phase (Table 28.3); 84.8 of all recovered plant parts from these sites are agave. Both the Cobble site (85.6 percent) and Boone Moore site (91.7 percent) have very high frequencies, as compared to the agriculturally oriented fieldhouse at the Arby's site, which had a very low (10.7 percent) amount indicative of its functionally specific nature. Again, as in the Sacaton phase, it is unclear whether these amounts represent agave cultivation or simply intensive collecting.

There is also a change in mortuary practices at this time from cremation to inhumation. Although in the earlier periods infant inhumations were not uncommon, adult inhumations make their first appearance during the early Classic period. Two adult, one subadult, a child and an infant were interred at the Boone Moore site, while the Cobble site contained a single infant or fetus inhumation. No cremations were noted although scattered cremated bone was found at both of these sites, the significance of which is unclear.

Gila Phase (A.D. 1300-1450)

The Gila Phase is perhaps the best known time in all of Tonto Basin prehistory, due in part to the large and spectacular nature of its ruins and the beauty of the polychrome ceramics (see Chapter 3, Volume 1). Numerous models have been proposed for Gila phase settlement (see Hohmann and Kelley 1988; Rice 1985, 1990; Wood 1989b; Wood and McAllister 1980, 1982, 1984), most centering around population aggregation and the development of complex social systems. Given that the sample from the Rye Creek Project area consisted of the testing of three trash mounds at Rye Creek Ruin, explicit modeling of the Gila phase occupation is not overly feasible, although some suggestions can be made. This is particularly true given the ongoing work at several large Gila phase sites in the Lower Tonto Basin by Arizona State University (Rice 1990) and Desert Archaeology (Doelle et al. 1991), data from which will soon eclipse any current interpretation. It is sufficient to say that the majority of the Rye Creek Ruin occupation occurred during this phase and that the site was the center of a large community settlement system, which undoubtedly included the entire Rye Creek project area. The fact that no sites in the project area could be definitively dated to this time, with the possible exception of a few sherds from the Cobble site and the fieldhouse at the Rooted site, suggests the very aggregated nature of this settlement. As mentioned above, the four small fieldhouse sites situated in the southern portion of the project area could date to this phase, as could the large number of recorded fieldhouses on the terraces south of Deer Creek. What appears to be significant, however, is that there are very few recorded small habitation sites within the Upper Basin, suggesting that much of the population resided in Rye Creek Ruin or one of the other large Gila phase pueblos, such as the Gisela Platform Mound site situated along Tonto Creek approximately 7 km to the northeast. Although this pattern of aggregation has its roots in the preceding early Classic period, it was nowhere near the level seen at this time.

Data recovered from the testing of Feature 1, the Gila phase trash mound at Rye Creek Ruin strongly supports the importance of this site; more than 20 different diagnostic ceramic types were recovered, representing seven distinct wares (eight if the earlier buffwares are included). This indicates an extremely high level of interaction with neighboring regions. Unlike the early Classic period, there were more ceramics from the other decorated ware (57.0 percent) category than there were whitewares (38.7 percent)(Table 28.3). The other decorated category includes Roosevelt Redwares, White Mountain Redwares, Hopi Wares, Winslow Orangewares, and Mogollon Brownwares. Like the trend in the Early Classic period, Cibola Whitewares dominate the whiteware assemblage and no Tusayan Whitewares were present (the figure given in Table 28.3 for Little Colorado Whitewares is misleading since manufacture of this ware ended around A.D. 1250 and these sherds represent use of the mound during the early Classic period).

It is apparent, then, that the decorated ceramic interaction networks changed in a relatively dramatic fashion between the early and late Classic periods. The interaction with the Little Colorado area ended and was subsumed in part, but to a lesser extent, by the nearby Hopi and Winslow Orangeware areas. Cibola Whitewares, which are present in the project area throughout the occupation and begin to increase during the early Classic period, were at this time imported in even greater numbers, perhaps to make up for the lack of Little Colorado Whitewares. There is also a relatively dramatic rise in the frequency of White Mountain Redwares and Roosevelt Redwares, which are present in only limited amounts during the early Classic period. As noted, White Mountain Redwares and Cibola Whitewares are perhaps being manufactured in the Chevlon and White Mountain areas east of the Tonto Basin (Zendeno 1991), while the location of manufacture of the Roosevelt Redwares is unknown. Interestingly, White Mountain Redwares appear in approximately equal frequencies to Roosevelt Redwares (the Salado polychromes), comprising 16.1 percent of the decorated assemblage to 17.7 percent for the Roosevelt Redwares. In addition, there were slightly greater numbers of Cibola (21.8 percent) and Little Colorado (22.6 percent) Whitewares than Roosevelt Redwares. If just the data from Feature 1, the primarily Gila phase trash mound are used, then Cibola Whitewares (21.6 percent) slightly outnumber White Mountain Redwares (19.6 percent) and Roosevelt Redwares (18.6 percent). Although 16.5 percent of the decorated assemblage within the mound were Little Colorado Whitewares, these are believed to be the result of earlier mixing because they were no longer manufactured after A.D. 1250. These data suggest that Roosevelt Redwares, at least in the Upper Basin, may not be a hallmark of Salado cultural identification, and in fact occurred in frequencies comparable to what are considered to be intrusive trade wares. Whether a similar pattern is also present in the Lower Basin is currently unknown.

Why Rye Creek Ruin rose as it did to become the dominate site in the Upper Basin is unclear. It can be suggested, however, that the site is situated in a perfect location at the junction of Rye and Deer creeks for both irrigation agriculture, necessary to support an aggregated population, and to have functioned as a "gateway" community (Hirth 1978), meaning that it could easily have controlled the flow of goods and commodities between the Tonto Basin and points north. Although the Gisela Platform Mound site is slightly farther to the north, the position of Rye Creek Ruin along Rye Creek would make access from sites to the north and the Verde River area relatively easy. Gateway sites are essentially strategically located redistributive centers, which, in contrast to central places, are linked to other communities within the system through linear or dendritic networks. This is essentially the type of network, due to the drainage patterns of Rye Creek, Tonto Creek, and the East Verde River, that links Rye Creek to points north and to the Lower Tonto Basin, because the Mazatzal and Sierra Ancha mountains, and the Mogollon Rim, although certainly not impassable, would serve to impede travel. As Hirth (1978:38) states:

> The dendritic settlement pattern is the most efficient structure to connect the gateway community with the hinterland. Since the movement of goods in primitive economic systems incurs high and inflexible transportation costs, site location is important to hold transportation costs to a minimum ... Unlike central places, gateway-dendritic networks are based upon the kinds of natural irregularities found in the real world. Most important among these are the differential distribution of natural resources and population, variable agricultural productivity, and barriers to trade and communication.

Gateway communities and central places differ in several other respects, the most important being that while central places function primarily as centers for economic production, gateways generally serve as redistributive centers. This is particularly important for Rye Creek Ruin and the Upper Tonto Basin, which does not appear to have many exportable goods, outside of argillite and possibly agave. This is not to say, however, that at least some manufacture did not occur at Rye Creek Ruin; evidence recovered from the testing, including pieces of raw material that appear to have been ground for the production of pigment suggests that argillite was actively worked at the site. It may not be entirely a coincidence that the argillite float raw material source is situated within several hundred meters of the site on the Deer Creek terrace. In this respect, Rye Creek Ruin could have been involved in the manufacture of some goods, such as argillite and agave, while serving as the center of Tonto Basin redistribution for other items that were not locally manufactured, such as intrusive whiteware and polychrome ceramics. In fact, by functioning primarily in a middleman role in inter-to-intraregional exchange, Rye Creek Ruin would have a ready market for its own manufactured goods.

Summary and Discussion

In summary, through time there appear to have been relatively dramatic changes in the settlement and subsistence systems and interaction networks of Upper Tonto Basin populations. At the settlement level these changes involved increasing complexity, as largely self-sufficient hamlets moved into hierarchically structured settlement systems with a variety of site types and functions. In the later periods there appears to have been a move toward mass aggregation into single large population centers surrounded by small, seasonal sites focusing on agricultural production. At the subsistence level, although corn agriculture appears to have always been the subsistence base, there was a move toward specialization in agave procurement and use, possibly for exchange. It is unknown whether agave was actually cultivated, although given its dominance in the later time periods it is suspected to have been. Finally, at the interaction level, the earliest inhabitants interacted primarily with Hohokam populations to the south. Around A.D. 900 interaction began to occur with Tusayan populations to the north, perhaps in the Flagstaff area. For all practical purposes, interaction with Hohokam groups ended sometime around A.D. 1000 or 1050; at this time Upper Tonto Basin interaction was dominated by Tusayan populations, with an increasing emphasis on the Little Colorado area. By A.D. 1100, interaction ended with the Tusayan area, and focused instead on the Little Colorado and Cibola areas. Little Colorado whitewares were no longer manufactured after A.D. 1250; Cibola whiteware groups continued to dominate the interaction networks, joined by White Mountain and Roosevelt Redwares, and to a lesser extent groups producing Hopi Wares and Winslow Orangewares.

Several additional points need to be made concerning the nature of the interaction with neighboring populations on both a regional and interregional level. Interaction within the Tonto Basin appears to have been highly significant as shown by the plainware and redware petrographic analyses in Chapter 13 of Volume 2. Although this analysis is still preliminary, because not all of the potential petrofacies could be defined, it does appear that plainware and redware vessels were moved in relatively substantial numbers within the basin. This suggests that during the Preclassic and early Classic period the Tonto Basin was more-or-less integrated, and goods were exchanged freely between the Lower and Upper portions of the basin. As mentioned, interaction between the Upper Basin and the more northern Payson Basin is unknown due to lack of petrofacies definition within this area, although it is considered to be highly possible. Interaction within the Tonto Basin may have involved the exchange of agave and possibly argillite from the Upper Basin for ceramic vessels from the Lower Basin. Cotton, which is known to have been grown in the Lower Basin at least during the Classic period (Steen et al. 1962), could also have been exchanged. Why ceramic manufacture did not occur to a significant extent within the Upper Basin is essentially unknown, and somewhat puzzling, although it is possibly related to the nature of the intraregional interaction networks, which may be focusing within each region on the procurement and manufacture of certain goods. That is, Tonto Basin ceramics may have been manufactured largely within the Lower Basin and only to a minor degree within the Upper Basin (and the data suggest that within the Lower Basin the locale of manufacture may also have changed over time from the west side of Tonto Creek to the east side). This is similar to patterns seen in the Preclassic period in the Tucson Basin (Elson 1986; Huntington 1986; Wallace and Heidke 1986) where it appears that much of the basin-wide ceramic manufacture occurred along the Santa Cruz River in the western Tucson Basin with subsequent exchange to the eastern Basin. Alternatively, the size and representativeness of the ceramic and petrographic sample must also be considered, and it is possible that more local ceramic manufacture is occurring than the data indicate. Clearly, additional work is needed within this area, although the data are felt to be potentially significant.

On an interregional level, although the data are clear that the direction of the interaction networks changed radically through time, the exact mechanisms of this interaction are still unknown, although the intensity is believed to be relatively low. This is exemplified in Table 28.4, which gives very rough figures for the number of intrusive vessels moving through the system from four sites where the occupation span can be best estimated. As this table shows, very few vessels actually entered the system from outside areas. Although these estimates are rough, and the actual site occupation spans could be slightly different than the estimates given here, the data are believed to be accurate enough to indicate that the Upper Basin was only involved in a very low level of interaction with neighboring populations. In fact, given the number of vessels and an estimated average ceramic life-span of around 20 years (Arnold 1985; Kramer 1985; Nelson 1991), the actual movement of vessels was extremely low, and could be accounted for by periodic trips by a single trader or a number of traders, or by sporadic visits by Tonto Basin inhabitants to other areas. This is supported by the differences among the sites in intrusive ware frequencies, which suggest that individual site or trader preferences may have played a role within the general overall interaction patterns. Although the clear change in these networks over time is still believed to be significant, this may be more a reflection of what occurred within the donor areas than what occurred within the Tonto Basin. That is, the data all suggest that the inhabitants of the Upper Basin may have been largely autonomous, and perhaps indigenous, being influenced to only a minor degree by neighboring populations. This pattern apparently changed by the Classic period, and particularly the late Classic Gila phase, since significant numbers of intrusive vessels appear to be present at Rye Creek Ruin. As noted above, however, this may be due to the proposed role of Rye Creek Ruin as a redistributive gateway site and not indicative of the degree of influence that neighboring populations had in the Upper Basin. As Whittlesey and Reid (1982a) and Neitzel (1985) have noted, and as is discussed more completely in the following section, the actual numbers of ceramic vessels entering the system, particularly during the Preclassic period, suggest a low level interaction network rather than a marker of cultural affiliation.

Table 28.4. Intensity of interaction by site and number of ceramic vessels in the Rye Creek Project area.

Site	Estimated Occupation	Buff/ year	Tusayan/ year	L. Col./ year	Cibola/ year	Total vessels per year
Deer Creek (AZ O:15:52)	75 years	4.9	0.5	0.03	--	5.4
Compact (AZ O:15:90)	30 years	0.2	0.4	0.3	0.1	1.0
Redstone (AZ O:15:91)	45 years	0.5	1.8	0.7	0.2	3.2
Clover Wash (AZ O:15:100)	30 years	0.6	1.5	0.1	0.2	2.4

THE QUESTION OF CULTURAL AFFILIATION

Numerous theories abound as to the initial settlement of the Tonto Basin, the nature of the later Salado occupation, and the cultural affiliation or identity of both the initial settlers and the later Salado inhabitants. This section focuses on the initial settlement of the Upper Tonto Basin, because the majority of the data recovered from the Rye Creek Project pertains to the Preclassic period. A few thoughts on the Salado settlement are presented at the end of the chapter, although the Rye Creek data are not directly applicable to this question. The assigning of a cultural identity to a prehistoric people is a very complex process that involves the use of a large number of variables and considerations. Aspects of technology, subsistence, settlement, physical anthropology, architecture, artifact style, and artifact type, all must be considered. It is something that, unfortunately, archaeological methods are not well suited for at the present time. Although not all of these lines of evidence are present in the Rye Creek data set, there are certain data classes that are considered stronger than others, and these are used below to tentatively suggest the cultural affiliation of at least some of the Tonto Basin inhabitants.

In the traditional scenario (Gladwin and Gladwin 1935; Haury 1932), the Tonto Basin was believed to have been first settled during the Hohokam Colonial period sometime between A.D. 500 and 900 by Hohokam migrants from areas along the Salt and Gila rivers (note: the Colonial period is now generally dated between A.D. 750 and 950 [Dean 1990; Wallace and Craig 1988]). Recently this theory has been modified to take into account a small indigenous population as indicated by the discovery of both Archaic period remains and Pioneer period ceramics within the Tonto Basin. But Hohokam Colonial period expansion and influence are still believed to be significant (Hohmann and Kelley 1988; Rice 1985, 1990; Wood 1985, 1989). The Hohokam migration theory is based primarily on data from Haury's (1932) excavation of Roosevelt 9:6 in the early 1930s, by all appearances a Colonial period (Gila Butte and Santa Cruz phase) Hohokam pithouse village within the Lower Tonto Basin (see Chapter 3, Volume 1).

Alternative views, decidedly in the minority, do not posit a significant Hohokam migration. Instead, other researchers suggest that the Tonto Basin was occupied initially by an indigenous people who simply adopted Hohokam traits (Fuller et al. 1976; Neitzel 1985) or by Mogollon-related settlers who remained culturally distinct (Pilles 1976; Whittlesey and Reid 1982a).

The Initial Settlement of the Tonto Basin

Two primary lines of evidence are used to argue that the Tonto Basin was not initially settled by Hohokam colonists, but instead consisted of an indigenous population who interacted with Hohokam groups. These are mortuary patterns and plainware ceramic vessel form, both considered to be relatively conservative cultural traits. Architectural forms, other artifact types, and the frequencies of certain decorated ceramic types are used as secondary supporting evidence. These are considered to be less culturally conservative attributes, however, and more subject to a variety of external influences. As a result, these may or may not reflect cultural identity.

The Paleoindian and Archaic period occupations of the Tonto Basin are poorly known. As mentioned earlier, however, at least 20 Archaic period sites have now been recorded within the basin and a number of these have been excavated. Given the relatively limited amount of archaeological research in the Tonto Basin, coupled with the generally low visibility of Archaic period remains in alluviated areas, the recording of even a low density of Archaic period sites may be meaningful and indicative of a relatively significant occupation. Although the only excavated sites have been of the Middle Archaic period (the Corral Creek phase, ca. 6000-1500 B.C. [Ciolek-Torrello 1987]) this is believed to be the result of sampling problems and not the lack of a Late Archaic population, because isolated Late Archaic period projectile points are relatively common. This is stressed to dispel the notion that the Tonto Basin was an empty niche prior to the Pioneer or Colonial period, although the presence of Archaic peoples in and of itself does little to prove or disprove a Hohokam migration.

As presented in Chapter 25 and discussed earlier, chronometric and ceramic data indicate that the earliest ceramic period inhabitants were in the Tonto Basin by at least the Gila Butte phase (A.D. 750-850), and probably by the Snaketown phase (A.D. 650-750) or even earlier. Only three excavated sites are known from this general time, however, Roosevelt 9:6 (Haury 1932) in the lower portions of the Basin, and Ushklish (Haas 1971a) and the Deer Creek site in the Upper Basin. Most significantly, the data suggest that Roosevelt 9:6, one of the type sites for the Hohokam culture, may be the exception rather than the rule; Ushklish and Deer Creek, while containing small quantities of Colonial period ceramics, do not exhibit an overwhelming abundance of Hohokam-like traits. Furthermore, additional evidence within the Tonto Basin for a Colonial period migration is relatively scarce, consisting of a few Snaketown and Gila Butte red-on-buff sherds scattered over a small number of sites. Therefore, whether Roosevelt 9:6 represents a typical site of this time period is basically unknown, but subject to question.

Ushklish and Deer Creek are remarkably similar to each other, and to two sites, Buh Bi Laa and East Fork (Halbirt and Dosh 1991), excavated by the Museum of Northern Arizona in the White Mountains near the Apache town of White River. The White Mountains have long been considered to be the heartland of the Mogollon culture. All four sites probably contained between 15 and 25 pithouses (although East Fork may have been slightly smaller), including a mixture of what would typically be characterized as shallow Hohokam "houses-in-pits" and deeper Mogollon- or Sinagua-style "true pithouses." In fact, the architectural diversity at Ushklish led Haas (1971a) to ascribe the occupation to a mixture of Hohokam and Mogollon peoples. Although this is no longer believed to be the case, it underscores the architectural heterogeneity within the site. The same was true for the Deer Creek site as well. The ceramic assemblages from these sites were also similar, consisting primarily of plainware ceramics with a low frequency of decorated wares: Gila Butte Red-on-buff, the decorated type with the highest frequency, comprised less than 4 percent of the total ceramics, and Cibola and Tusayan whitewares comprised less than 1 percent. Roosevelt 9:6 contained 12 excavated houses but may have been slightly larger than the other three sites as the site was partially eroded and not all of the houses were excavated. Unfortunately, the frequency of Gila Butte Red-on-buff ceramics from Roosevelt 9:6 cannot be tabulated, although Haury (1986a:268) infers that it is relatively low. A few black-on-white sherds also were recovered. Buh Bi Laa and East Fork contained tree-ring cutting dates in the early to mid-A.D. 800s, which corresponds with the archaeomagnetic and ceramic dating of the Deer Creek site. The dating of Ushklish and Roosevelt 9:6 is based only on their ceramic assemblages, but both definitely contained Gila Butte Red-on-buff.

As mentioned earlier, plainware vessel form and mortuary practices suggest that the sites of Deer Creek, Ushklish, Buh Bi Laa, and East Fork are related, and may in fact be part of a sub-Mogollon Rim cultural tradition extending from the Tonto Basin through east-central Arizona and possibly New Mexico. The contention that cultural affiliation or identity is best reflected through plainware, rather than decorated ceramics, is strongly supported by cross-cultural ethnographic and ethnoarchaeological data, which indicate that most utilitarian pottery is manufactured and used at the household level (Longacre 1985; Kramer 1985; P. Rice 1987; DeBoer and Lathrap 1983). Although trade in utilitarian pottery has been documented both ethnographically and archaeologically, as is suggested by this project as well, these pots generally are exchanged within a relatively limited region, often through kin-based networks. Decorated ceramics, on the other hand, while commonly used archaeologically as indicators of cultural affiliation, are known to have been moved great distances and among disparate peoples. The use of plainwares to assess cultural identity is particularly applicable to the Tonto Basin, which is not known to have an indigenous decorated ceramic tradition until sometime after A.D. 1250, during the Salado Classic period occupation.

What is most interesting about the plainware assemblages at these four sites is their overall similarity to each other and the significant lack of flare-rim bowls, considered to be a hallmark of Colonial period Hohokam ceramic vessel forms (see Chapter 13: Table 13.41). Flare-rim bowls in both plain and decorated wares are found at Hohokam sites in appreciable quantities (as high as 30 percent of bowls in some cases [Craig 1989; Heidke 1990]) from the late Pioneer period through the early Sedentary period. Frequencies are particularly high at sites in the Hohokam areas of the Phoenix and Tucson basins, although they are found in other areas thought to have been possibly "colonized" by the Hohokam. Flare-rim bowls also appear to be missing from the Roosevelt 9:6 plainware forms as well, although given the early date of this report and the lack of some data classes, this is currently equivocal.

Although the lack of flare-rim bowls is considered significant, it is perhaps the mortuary practices, that best exemplify the distinction between these four sites and sites within the Hohokam area, including Roosevelt 9:6. Mortuary practices are generally considered to be one of the most conservative of cultural traits, and distinctions have long been drawn between the Hohokam use of cremation and the Mogollon and Anasazi use of inhumation. The Deer Creek site contained a very distinctive mortuary practice consisting of small, rectangular, daub-lined, burned pits, some with corner posts, containing small amounts of cremated human bone and charcoal within their fills (see Figures 7.21-7.31, Volume 1). Some contained burned mortuary offerings, while others did not. The features were all relatively standardized in size, shape and orientation, with a mean length of 1.3 m, a width of around 60 cm, a depth of approximately 40 cm, and a roughly east-west orientation. Thirteen of these features were recovered within a defined cemetery area at the Deer Creek site. An archaeomagnetic sample from the burned daub lining of one of these produced a date of A.D. 725 to 855, placing it securely within the main Gila Butte phase site occupation. Given the evidence for burning and the low weight of the bone and charcoal, it appears that they were used as crematoriums or primary cremations and then cleaned out. Some bone was either left in the burial or reinterred, along with a few mortuary offerings. Where the rest of the bone was placed is unclear; during extensive stripping of the Deer Creek site recovered only six other secondary pit cremations were recovered, all with small amounts of bone.

This type of "crematorium" mortuary feature, although present but uncommon in the Hohokam Classic period (Wasley and Johnson 1965), is virtually unknown from any Preclassic period Hohokam sites, where secondary pit cremations were the standard burial practice. Furthermore, this practice has been recorded at only three other sites in the Southwest, Ushklish, Buh Bi Laa, and East Fork, which all contain features essentially identical in size and orientation to those recovered from the Deer Creek site. All three of these sites contained a small number of secondary pit cremations as well. Roosevelt 9:6, on the other hand, contained only secondary pit cremations.

Additional evidence for the discrete nature of these sites as compared to Hohokam sites comes from the artifact assemblage, specifically palettes and decorated ceramics. Like flare-rim bowls, formalized carved slate palettes are considered to be a strong Hohokam cultural indicator, and were most likely part of the Hohokam ritual mortuary complex. Given the distinctive mortuary practices at Deer Creek, Ushklish, Buh Bi Laa, and East Fork, it is not surprising that formalized palettes were not recovered at any of them. Only a single formalized palette fragment was recovered from the entire Rye Creek Project area. Palettes were recovered from Roosevelt 9:6, however, which makes sense given the presence of over 20 secondary pit cremations.

Decorated ceramics also are used commonly to indicate cultural affiliation. This is particularly true for Hohokam buffwares found within the Tonto Basin. Whittlesey and Reid (1982a) have, however, made a strong argument that the frequency of buffwares in the Tonto Basin is so low (averaging less than 4 percent), in contrast to the Hohokam core areas (where they average close to 20 percent), that it is likely that the buffwares represent trade items and not the material correlates of Hohokam cultural affiliation. This view is also supported by Neitzel's (1985) analysis of the material from the Ash Creek Project in the Lower Tonto Basin. These data are particularly interesting when the lack of a Tonto Basin decorated ceramic tradition is considered. That is, the question must be asked that if an indigenous decorated ware was present, would buffware percentages averaging less than 5 percent still be considered to be strong evidence for Hohokam colonization? As a comparative example, most archaeologists no longer believe that the Tucson Basin was colonized by Phoenix Basin Hohokam groups, yet during the early phases buffware frequencies are often higher than the local red-on-brownwares and most often exceed 5 percent of the assemblage (Wallace 1988). The likelihood that the buffwares are trade goods is further supported by the data presented in the preceding section, which strongly indicates that interaction networks changed through time, and that the buffware dominance in the early periods was simply part of this process. These trends strongly suggest that trade and interaction networks were changing *rather* than the cultural affiliation or identity of the local inhabitants.

Finally, the non-Hohokam affiliation of Tonto Basin inhabitants is supported by the apparent lack of Tonto Basin ballcourts, found in all areas of the Southwest thought to have been either an actual part of the Hohokam settlement network or strongly influenced by the Hohokam (Wilcox and Sternberg 1983). Ballcourts are known from both the surrounding Verde Valley and Globe-Miami areas. Although it has been suggested by Wood (1985) that the absence of ballcourts is due more to the lack of exportable Tonto Basin trade goods during the Colonial period, this is still unresolved, because the exact role of ballcourts in exchange networks is unknown.

Summary and Discussion

These data suggest that the Tonto Basin was occupied initially by an indigenous population that participated in various exchange and interaction networks. Outside of Roosevelt 9:6, which is actually equivocal because it contains some Hohokam-like traits but not others, no good evidence currently exists to posit a Hohokam migration during the Colonial period. In this respect, Roosevelt 9:6 may be the anomaly and not the norm, although it is also possible, and perhaps likely given some of the recent data from the Roosevelt Lake excavations, that the Upper Tonto Basin, where Ushklish and Deer Creek are located, is culturally distinct from the Lower Tonto Basin. In this respect there may be other Roosevelt 9:6-like sites in the Lower Basin, essentially representing small, site-unit intrusions from the Hohokam area. It is also expected, however, that sites more like Deer Creek and Ushklish will be present in the Lower Basin as well.

Given the evidence from Buh Bi Laa and East Fork in the White Mountains it can be suggested that within the Upper Basin at least, we are dealing with a more-or-less coherent cultural area situated in the sub-Mogollon Rim transition zone between the desert and the mountains. These people did not have an indigenous decorated ceramic tradition, but rather interacted with neighboring groups. Local plainware ceramic vessel forms are more similar to Mogollon Alma Plain types than Hohokam plainware types. A variety of pithouse styles were constructed, including Hohokam-like houses-in-pits and Mogollon-like "true" pithouses. A unique mortuary ritual was practiced, consisting of the construction of rectangular daub-lined pits, some with corner posts, used as crematoriums or primary cremations. Secondary pit or vessel cremations also were used, although it is not clear whether bone from the crematoriums was reinterred within these or whether these represent separate mortuary events. It is important to note that I am not suggesting that these people were Mogollon-affiliated either. In fact, although more data are clearly needed, it can be suggested that we are dealing with a separate culture area that extends from the Upper Verde River into the Upper

Tonto Basin and over to the White Mountains and perhaps into New Mexico. J. Scott Wood (personal communication 1991) has termed this the Central Arizona Tradition.

Where the original inhabitants of the Tonto Basin came from, who they were, and who they were interacting with, are also problems central to Salado research. The term Salado has been used historically to define a Classic period (A.D. 1150-1450), cobble or adobe pueblo building people, who produced or used Roosevelt Redwares (the Salado polychromes) (Doyel and Haury 1976; Nelson and LeBlanc 1986). Based on the early work of Eric Schmidt (Hohmann and Kelley 1988), Gladwin (1957), and Haury (1932), the Tonto Basin, which was the first area with Salado polychromes and pueblo architecture investigated, has traditionally been referred to as the Salado "heartland." Through the years, as similar traits, primarily architecture and artifacts, but also mortuary practices, were recognized in different areas, the term Salado has been applied to a very heterogeneous, and often confusing, mixture of peoples, extending from Arizona to Texas and down into Chihuahua. A recent trend (which is actually the revival of an old concept) has been to confine what is called Salado culture exclusively to the Tonto Basin and Globe/Miami areas, thereby eliminating some of the heterogeneity problems inherent in previous definitions (Hohmann and Kelley 1988; Wood 1989b). Even with this narrow definition, however, it is important to note that there is still considerable cultural, architectural, and artifactual, heterogeneity within the Tonto Basin itself, as previous archaeological investigations have demonstrated (Ciolek-Torrello 1987; Doyel 1978; Haas 1971a; Hammack 1969; Haury 1932; Whittlesey and Reid 1982a; Rice 1985; Wood 1989b).

The stratigraphic and architectural differences between the later pueblo occupations and the earlier pithouse occupations led to the obvious and early inference that two distinctive cultural groups were involved, the later being an intrusion from either the Anasazi or Mogollon areas (Gladwin and Gladwin 1935; Whittlesey and Reid 1982b). This notion was challenged in later years to suggest that the Salado evolved from the earlier Hohokam occupation, representing the Classic period Hohokam manifestation in the Tonto Basin (Doyel 1978; Hohmann and Kelley 1988; Rice 1985, 1990; Wood 1989b; Wood and MacAllister 1980, 1982, 1984). Although demographic studies and our own analysis tentatively suggest that some population movement into the Tonto Basin area did occur, particularly by the Classic or Salado period, where these people were coming from is still unknown. It is suggested here that migration occurred from all areas on top of an already present indigenous population. In this respect, the patterns seen in the Preclassic period, where Roosevelt 9:6 appears to be a site-unit intrusion into the Lower Basin, in contrast to indigenous Ushklish and Deer Creek, may have occurred throughout prehistory and into the Salado period. That this may have occurred during the late Preclassic period is tentatively supported by evidence discussed earlier for the Redstone site, which may represent a small site-unit intrusion into the Upper Basin from the north. The fact that not all of these later populations are Hohokam is further supported by one of the few osteological analyses performed to date on the relatively large burial population from Togetzoge in the Globe-Miami area by Frank Ivanhoe in 1986. Ivanhoe indicated that not only were the Togetzoge inhabitants extremely healthy, unlike many Hohokam populations, but that "[the] population is unlike any contemporary Hohokam group that he [Ivanhoe] has examined" (Hohmann and Kelley 1988:71). Additional and detailed osteological analyses planned for the Roosevelt Lake Project (Rice 1990) should go far in proving or refuting these data.

The definition of the Tonto Basin Salado becomes even more problematic when actual ceramic frequencies are considered. A preliminary examination of the frequencies of Salado Polychromes at sites in both the Lower and Upper basins suggests that the Tonto Basin may not be the "heartland" of what is defined as Salado culture (whatever Salado culture may be), as it appears that frequencies of Salado ceramics may be lower in the Tonto Basin than in other regions. This analysis included a reexamination of Table 1.2 in Nelson and LeBlanc (1986) using revised and more recently collected data, and particularly not using mortuary data or whole vessel counts, which can skew the distributions. These data, while preliminary, suggest that contrary to being the "heartland," the Tonto Basin is actually situated on the extreme western edge of the Roosevelt Redware distribution and production zone; frequencies are higher in areas to the east in the White Mountains and to the southeast in the San Pedro Valley, and are virtually nonexistent in the Verde Valley area to the west.

Therefore, it is evident that there are problems with the definition of Salado as it is used today, and that there is little consensus among archaeologists working in the general area. Again, this is largely due to the overall lack of data, particularly from the early or developmental periods where almost nothing is known. The more narrow definitions, such as that used by Hohmann and Kelley (1988) and Wood (1989b), for example, fail to account for or explain the presence of similar traits and ceramics throughout central and southern Arizona, southern New Mexico, and northern Mexico, simply referring to these areas as parts of an ill-defined and unexplained Salado interaction sphere. The broader definitions, which posit Salado culture as subsuming many different traits over an extremely wide area, lose any coherent or significant meaning. An alternative view, perhaps best espoused by Wilcox (1987; Wilcox and Sternberg 1983) is that Salado may be more of an economic interaction sphere or a pan-Southwest ideological system, than a coherent culture. With the current emphasis on the Tonto Basin and the Salado, which will involve the accumulation of more data in the next 5 years than have been accumulated in the previous 100, it may be time to rethink the concept of Salado, or at least to reach some definitional consensus.

CONCLUSIONS

Much of the debate on the cultural identity of Tonto Basin inhabitants, as well as debate over the settlement, subsistence, and interaction systems, stems from the overall lack of archaeological data. This situation is now in the process of being largely alleviated through a variety of Arizona Department of Transportation highway projects, the work of the Tonto National Forest archaeological program, and the current work along the shores of Roosevelt Lake for the Bureau of Reclamation by Arizona State University (Rice 1990), Statistical Research (Ciolek-Torrello et al. 1990), and Desert Archaeology (Doelle et al. 1991). By first investigating the fundamental research issues presented in this report, we have begun to build the database necessary to explore some of the more complex questions raised in Tonto Basin research, such as those that will be addressed on the Roosevelt Lake projects. Over the next five years more than 100 sites will be investigated, ranging from small fieldhouses and artifact scatters to major habitations with compound walls and platform mounds. Although we still may not reach a consensus over who or what these people were, we will at least be on firmer interpretative ground.

PART 6: APPENDIXES

APPENDIX A

PETROGRAPHIC EVALUATION OF SAND AND SHERD SAMPLES: METHODOLOGY FOR THE QUANTITATIVE AND QUALITATIVE ANALYSES

Elizabeth Miksa

The petrographic analysis of tempering material used in potsherds was first done in the 1880s, and was advanced and expanded by the work of Anna Shepard (among others) in the 1930s and 1940s (Thompson 1991). The fundamental principle underlying such analyses is that petrographic identification of the available tempering materials in a region and of the temper used in ceramics from that region can be used to locate potential ceramic production sources (Shepard 1939). Petrographic point-count analysis is the technique used here to compare potential source sands and ceramic temper sands. It is a quantitative volumetric analysis technique that provides information on the relative amount of each mineral phase actually present in a sample (Chayes 1956).

GEOLOGIC HISTORY

In order to fully understand the premises of the petrographic analysis and how they are applied to the Rye Creek Project it is necessary to understand the geologic history of the project area. The Rye Creek Project area is located along Rye Creek, just above its confluence with Tonto Creek (see Figure 1.2, Volume 1). The sand samples collected for petrographic analysis were taken from just northwest of this area southward along Rye and Tonto creeks, and along the shores of Roosevelt Lake. This large sampling area is necessary for the characterization of available sand tempering sources in the Tonto Basin "region." The Tonto Basin is an extremely complex area geologically; its rocks and sediments span geologic time from the Early Proterozoic Eon (approximately 1.75 billion years ago) to the present. In the Early Proterozoic, the Tonto Basin was part of the newly developing continental margin (Bowring and Karlstrom 1990; Dickinson 1989; Silver 1978). As such it was subject to a variety of tectonic regimes such as subduction of oceanic crust, accretion of volcanic arcs, and volcanic arc magmatism. Rocks from this time period include igneous intrusives such as granite and diorite and extrusive rhyolite, and an extensive suite of metamorphic rocks such as quartzite, schist, and greenstone. Most of the latter rocks are the result of deformation of sedimentary rocks deposited on the continental margin. In the Middle to Late Proterozoic, deposition of sediment on the continental margin created the quartzites, shales and conglomerates of the Apache Group, a laterally extensive sedimentary unit found over much of central and south central Arizona (McConnell 1972).

The heterogeneous nature of the rocks in the Tonto Basin was well established by the beginning of the Paleozoic Era (570 million years ago [Ma]). Deposition in isolated grabens, accretion of relatively small volcanic arc terranes, and eruption of local to subregional volcanic centers began creating small scale variations in the rock record in the Precambrian. During the Paleozoic Era (570 Ma to 245 Ma), Arizona was a much "quieter" place tectonically than during previous eons (Peirce 1976). Rocks formed during this time period resulted from repeated transgression and regression of the sea across the continental margin; the rocks of the Grand Canyon typify this era. These deposits tend to be uniform over extremely large distances. Most of these sedimentary rocks have been lost from the Tonto Basin, though isolated remnants remain at the southern end of the project area.

The Mesozoic Era (245 Ma to 65 Ma) is marked by resumption of arc magmatism to the west, with a subduction zone underlying central Arizona; the rocks of this time period again display a complex regional or subregional character similar to the Precambrian suites (Coney 1978; Dickinson 1989; Drewes 1981). Rocks of the Mesozoic Era to Early Tertiary Period found in the Tonto Basin (approximately 40 to 80 Ma) are primarily igneous in nature: granites, dacite, basalt, and andesite are common. Most of the igneous rocks of this time period are found outside of the project area; however, a dacite source to the southwest of the project area along the Salt River Canyon probably contributed to the sediments now found on the southwest shore of Lake Roosevelt.

Finally, cessation of arc magmatism and uplift of the Colorado Plateau in the Miocene Epoch (4-8 Ma) led to extensive erosion along the Mogollon Rim in Central Arizona in the Late Tertiary and Quaternary Periods (5 Ma to present) (Dickinson 1989). This erosion has removed much of the post-Precambrian cover from the mountains surrounding the Tonto Basin, leaving the complex Precambrian rocks of the Sierra Ancha and Mazatzal Mountains exposed. Pliocene and Pleistocene alluvium derived from the erosion was subsequently deposited in the Tonto Basin and subjected to several soil formation episodes.

GEOLOGIC BASIS FOR PETROGRAPHIC STUDIES

The resultant bedrock geology of the Tonto Basin is one of localized deposits that change rapidly from place to place, within distances of kilometers or tens of kilometers. This situation is ideal for the identification of sand temper source zones and possibly ceramic production locations. If, as is suggested ethnographically, 75 percent of all cultures procured their temper resources within 3 km of the production location (Arnold 1985), then the bedrock geology in the Tonto Basin changes rapidly enough to be a sensitive production location indicator.

Unfortunately, bedrock geology alone does not provide the information necessary to determine ceramic production locations. Because the inhabitants of the Tonto Basin used fluvial sands as tempering material for their ceramics (see Chapter 13), it is necessary to characterize the composition not of bedrock but of the fluvial sands for comparison with ceramic temper sands. Fluvial sands are essentially the filter through which the bedrock geology is seen. Fluvial processes, in concert with complex chemical and physical weathering processes, alter the essential petrology of a rock unit (Leeder 1982). The volume of minerals with low resistance to weathering (i.e., some feldspars and pyroxenes, calcite) is reduced by fluvial processes, while the relative volume of highly resistant minerals (i.e., quartz) is increased. The composition of a sand resulting from any given type of bedrock is dependent on the climate under which erosion occurs, distance of transport, degree of weathering, position in the landscape, drainage basin size, and other factors, in addition to the composition of the parent deposit.

Characterization of sedimentary units into "petrofacies" is a technique that has recently come into prominence as a means of reconstructing geologic source areas and the sedimentary history of those units (Dickinson 1985; Dickinson and Sucek 1979; Ingersoll 1990). Petrofacies can be defined as sedimentary units characterized on the basis of their relative petrologic composition. Empirical data is used to compare sands from different locations, but the petrofacies themselves are essentially arbitrary subjective units created by the researcher. By extensively sampling the fluvial sands in the Tonto Basin and characterizing them into petrofacies, we create a detailed geologic map of the sands available to prehistoric potters. By analyzing the ceramic temper sands in the same manner as the fluvial sands, we can in theory determine the source sands for production.

SAND METHODOLOGY - DATA COLLECTION

There are essentially three phases to the characterization and use of petrofacies. The first is collection of the quantitative empirical data necessary for characterization of the petrology of the sands. The second is statistical comparison and manipulation of the data in order to establish petrofacies boundaries, both in a compositional and in a physical sense. The third is collation of the quantitative/statistical data with qualitative information so that the petrofacies concept can be extended to the ceramic identification process on a scale broader than that afforded by quantitative analysis alone. The first phase, sample collection, preparation, and point-counting, are discussed in this section.

Sand Sample Collection and Preparation

Sand samples for this project were collected along tributary drainages to Rye and Tonto creeks and on the slopes above Roosevelt Lake. Tributary drainages were chosen because it was felt that sand in the main stream courses would be compositionally too mature to distinguish petrofacies reliably. An attempt was made to space samples evenly along the petrofacies project area, but access was limited in some cases. A total of 106 sand samples was collected (Figure A.1). All sample locations were plotted on USGS 7.5' topographic maps.

At each sand sample collection site, the material in the stream bed was mixed with a shovel to avoid sampling microvariations in the sedimentary unit (Folk 1974:15-16). The sample was then sieved using standard soil separation screens so that only a sand fraction (.075 mm to 2.0 mm) remained. Thin sections were prepared for 71 of the sand samples (Figure A.1). To prepare thin sections of the sands, each sample was manually mixed, then poured into sample preparation trays to a depth of a few millimeters. Resin was then poured into the sand samples and allowed to harden. The hardened resin chip was treated subsequently as a rock and thin-sectioned using standard techniques. Thin sections were stained for potassium and calcium to allow differentiation of alkali and plagioclase feldspars from one another and from quartz (Chayes 1956).

Point-count Methodology

An attempt was made to count 400 grains from each thin-section in order to minimize point-count error. The chart published by Van der Plas and Tobi (1965) shows that a count of 400 grains ensures that the estimated percent composition by volume of all grain types will represent the true composition within 5 percent with a 95 percent confidence interval ($2\sigma = \pm 5\%$). This error estimate applies only to the counting error due to the sampling technique; it does not account for error on the part of the analyst.

Point-counting is a modal analysis, one that provides information on the relative volume of each mineral in the sample (Chayes 1956:1). To do this a grid is imposed over the sample to be counted, and the composition of the grain under each grid point is recorded. For instance, in Figure A.2, quartz is recorded for points 1, 3, and 12; potassium feldspar is recorded for point 14, and plagioclase feldspar is recorded for points 5, 6, and 10. In practice, a mechanical point-counting stage is used to produce the grid. The point-counting stage is a finely tooled instrument that can be set to move the slide in precise increments. The increments chosen for the point-count should meet two criteria. First, they must be wider than the largest grain encountered in the sample (Van der Plas and Tobi 1965:89). This prevents bias in the data set due to auto-correlation. If a grain is large enough to hit two or more points in the count, the same grain type must necessarily be counted more than once. It will be over-represented. Secondly, the point-count should cover as much of the slide as possible to minimize potential bias due to inhomogeneities in the thin-section (Friedman 1958:398). The resultant grid will be symmetrical, though it may not be isotropic, i.e., the spacing between points will be even, but the horizontal and vertical distance between points may not be the same (Chayes 1956).

For this study, the stage was set so that each vertical transect was covered in increments of 0.33 mm, the largest available spacing. It was found that 0.33 mm was too fine a scale so the vertical scale used was two increments, or 0.66 mm. Even at this increment, some grains were large enough to intersect two or more grid points. In these cases, only the first point falling on a grain was counted. This convention held true even when the grain was made up of sand size grains of various types. The example in Figure A.2 shows that point 10 is counted as Ca-plagioclase and point 11 is not counted, since both sand size grains are part of one granitic lithic fragment.

The horizontal distance between transects was chosen to ensure that the whole slide was sampled and so that, on the whole, no two transects would intercept the same grain. This interval was generally 1.0 mm, though an interval of 1.2 mm was necessary for some of the coarser sands. It is possible that an occasional grain was counted more than once, but any error thus introduced was minimal and within the counting error estimate.

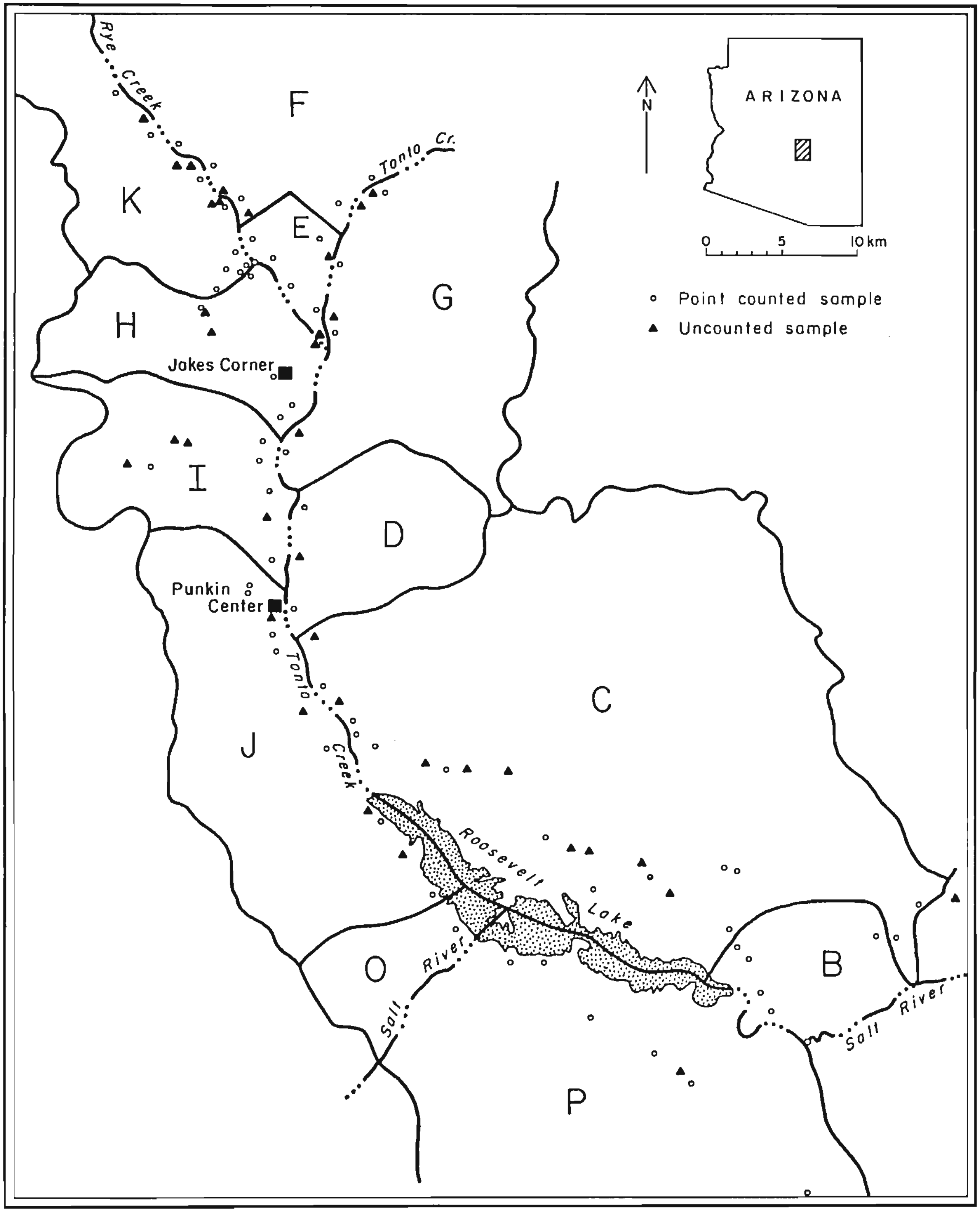


Figure A.1. Location of sand samples in project area.

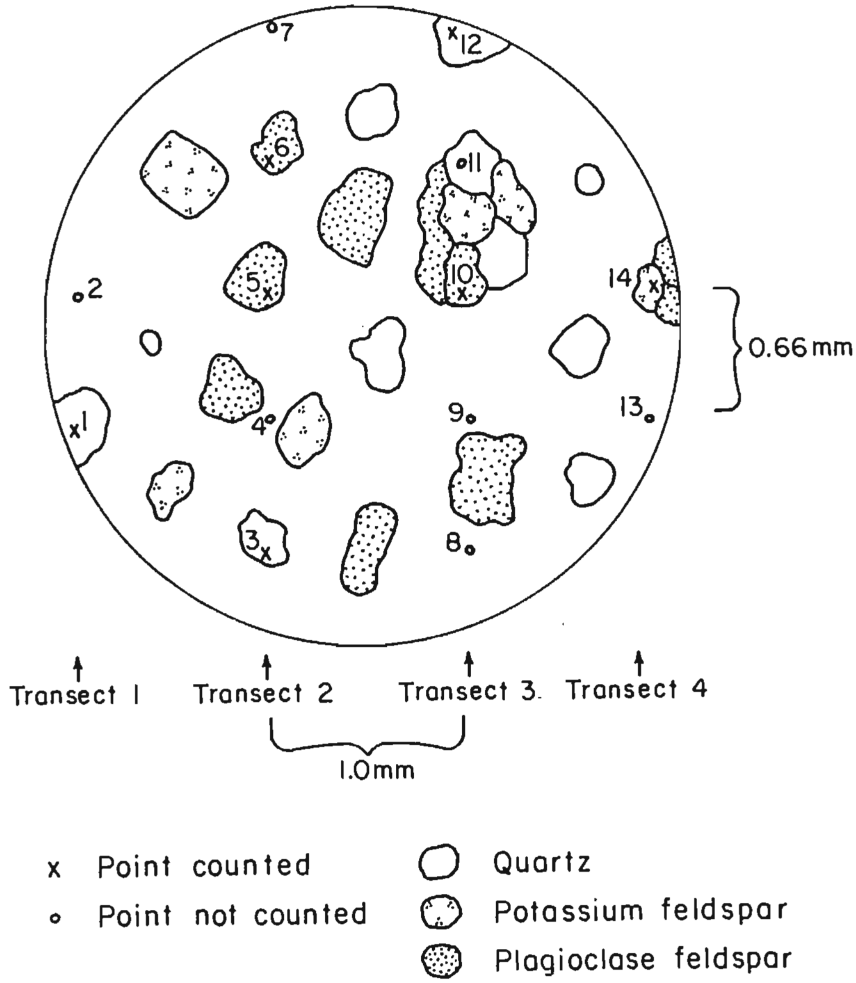


Figure A.2. Hypothetical microscope view showing how points are counted.

The technique developed by Gazzi and Dickinson (Dickinson 1970; Gazzi 1966) for point-count analysis of arkose and greywacke has been used by many researchers to define petrofacies in sandstones as a means of identifying the tectonic setting and geologic sources of those sandstones. Other researchers extended the technique to sedimentary deposits that are currently being formed. Ingersoll (1990) refers to these as *actualistic* petrofacies, or ones for which the tectonic setting and geologic sources are known, so that the strength of the relationship between source and sediment can be characterized. Using this terminology, the Rye Creek sand samples are being used to describe actualistic petrofacies.

According to the Gazzi-Dickinson technique, grains are divided into monomineralic fragments and lithic fragments. The monomineralic fragments are counted as the mineral phase to which they belong (i.e., quartz, hornblende, etc.), while the lithic fragments are further subdivided into types according to their source and texture (i.e., sedimentary-siltstone, sedimentary-chert, volcanic-felsitic, etc.). All grains that are sand size (>0.0625 mm) and larger are counted. If a single lithic grain comprises multiple grains that are sand size, then the grain that falls under the crosshair is counted as the monomineralic phase to which it belongs. For the Rye Creek analysis, 28 grain types were counted, after the divisions made by Lombard (1987:339-341) (Table A.1). Of the 28 grain types, 13 are lithic fragments and 14 are monomineralic. A 28th category, "unknown," also was counted. This was done to ensure that the counting was rigorous and that each sand sized grain that fell under the crosshairs was counted. Table A.2 is a standard igneous rock type chart that has been modified to illustrate how relevant igneous and monomineralic grain types from this analysis fit into a standard igneous classification scheme.

Some departures from Lombard's (1987a, 1987b) Tucson Basin grain type categories should be noted here. While counting the Tonto Basin materials, it was found that there was a great deal of variation in the degree of plagioclase alteration seen in the sands. It was felt that the differing degrees of plagioclase alteration should be recorded separately in case this distinction should prove to be important. Plagioclase was therefore counted as "plagioclase" if it was less than 10 percent altered; "plagioclase-altered" if it was 10 to 90 percent altered; and "plagioclase-gone" if it was more than 90 percent altered. The percent of alteration was estimated as the percent of the surface area of the grain that had been transformed to other minerals. In addition, it should be noted that the "plagioclase" category was used for Ca-plagioclase grains that took up at least some of the calcium stain. Plagioclase grains that remained unstained (Na-plagioclase) were counted as alkali feldspar (KSPAR in Table A.1).

The distinction among fine grained volcanic, sedimentary, and metamorphic lithic fragments is often difficult to make. This is especially true in the rocks of the Tonto Basin, which follow a continuum from unmetamorphosed volcanic and sedimentary rocks, through slightly metamorphosed varieties of the same, through highly metamorphosed rocks. In cases where grain sizes permitted relationships among adjacent grains to be discerned, lithic fragments were classified as sedimentary or volcanic if their original texture was still evident, and if their essential mineralogy was unchanged. Lithic fragments were classified as metamorphic if grain boundaries had become sutured (grown together), if grains exhibited strain features due to metamorphism, or if growth of minerals due to metamorphosis had occurred.

Finally, in cases where relationships among grains could not be discerned for a lithic fragment, the grain was classified on the basis of mineralogy and any other relevant features, or counted as an unknown. In addition, monomineralic grains that occurred at frequencies too low to merit recording (i.e., apatite, phosphates) were counted as unknowns.

Qualitative Data Collection: Thin-Sections

As each thin-section was point-counted, qualitative data were collected for the grain types present in the sample. It was found, for instance, that the types of lithic fragments and the characteristics of monomineralic

Table A.1. Grain types found in the Rye Creek sand and sherd thin-sections (after Lombard 1987).

Volcanic lithic fragments	
LVF	Felsic to intermediate volcanic: Microgranular nonfelted mosaics of submicroscopic quartz and feldspars, often with microphenocrysts of feldspar, quartz or rarely ferromagnesian minerals. Groundmass is fine to glassy, always has well developed potassium feldspar (yellow) stain, may have calcium plagioclase (pink) stain as well. This category represents lavas and tuffs of ryolite, rhyodacite, dacite, and latite compositions.
LVM	Intermediate to basic volcanic: Visible microlites or laths of feldspar crystals in random to parallel fabric, usually with glassy or devitrified or otherwise altered dark groundmass. Often with phenocrysts of opaque oxides, occasional quartz, olivine, or pyroxene. Rarely yellow stained, often very well developed pink stain, representing intermediate to basic lavas such as latite, andesite, quartz-andesite, basalt, or trachyte.
LVV	Glassy volcanics: Vitric or vitrophyric grains showing relict shards, pumiceous fabric, welding, or perlitic structures, sometimes with microphenoxrysts, representing pyroclastic or vitrophyric rocks.
LVH	Hypabyssal volcanics: Equigranular anhedral to subhedral feldspar-rich aggregates with no glassy or devitrified groundmass, coarser grained than LVF, generally with yellow and pink stain, representing shallow igneous intrusive rocks. Usually of granodiorite composition in the Rye Creek sand samples.
Sedimentary lithic fragments	
LSS	Siltstones: Granular aggregates of equant subangular to rounded silt-sized grains with or without interstitial cement. May be well to poorly sorted, with or without sand-sized grains. Composition varies from quartzose to lithic-arkosic, with some mafic-rich varieties.
LSA	Argillaceous: Dark, semiopaque, extremely fine grained without visible foliation, may have mass extinction, variable amounts of silt-sized inclusions, representing shales, slates, and mudstones.
LSCH	Chert: Microcrystalline aggregates of pure silica.
LSCA	Carbonate: Mosaics of very fine calcite crystals with or without interstitial clay- to sand-sized grains. Most appear to be fragments of soil carbonate and are subround to very round.
(SHERDT)	Sherd temper: (Counted only in sherd samples). Dark, semiopaque angular to subround grains, generally with discrete edges, generally including silt to sand size temper grains.
Metamorphic lithic fragments	
LMM	Microgranular quartz aggregate: Nonoriented polygonal aggregates of newly-grown strain-free quartz crystallites with sutured, planar, or curved grain boundaries.
LMF	Foliated quartz aggregate: Planar-oriented fabric developed in mostly strained quartz crystals with sutured crystallite boundaries. Quartzite.
LMA	Quartz-feldspar (mica) aggregate: Quartz, feldspars, mica, and opaque oxides in aggregates with highly sutured grain boundaries but no planar-oriented fabric; some represent schists or gneisses viewed on edge, some are undeformed metasediments or metavolcanics.
LMT	Quartz-feldspar-mica tectonite: Grains with strong planar oriented fabric in aggregates of quartz, feldspars, micas, and opaque oxides. Often display mineral segregation with alternating quartz-felsic and mica ribbons. Grains are often extremely sutured and/or elongated. These represent schists or gneisses.
LMTp	Phyllite: Quartz-feldspar-mica tectonite in which the mica grains are oriented in a planar fabric but are silt-sized or smaller, little or no mineral segregation. Also argillaceous grains that exhibit growth of planar oriented micas silt-sized or smaller.

Table A.1. Continued.

Monomineralic Grains

KSPAR	Alkali feldspars: Potassium feldspar stained yellow, unstained plagioclase feldspar, perthite, antiperthite.
MICR	Microcline: Alkali feldspar with polysynthetic (cross-hatch) twinning, stained yellow or unstained, may have zones of Calcium-plagioclase.
PLAG	Plagioclase feldspar stained pink, often with albite twinning, occasional carlsbad twinning, less than 10% altered.
PLAGal	Same as plagioclase but 10 to 90 percent altered to sericite, clay minerals or epidote.
PLAGgn	Same as plagioclase but >90 percent altered to sericite, clay minerals or epidote.
MUSC	Sand-sized muscovite mica.
BIOT	Sand-sized biotite mica.
CHLR	Undifferentiated chlorite group minerals.
QTZ	All quartz types. Unstained.
EPI	Undifferentiated members of the epidote family.
OO	Undifferentiated opaque minerals.
CACO	Undifferentiated sand-sized carbonate minerals.
PYR	Undifferentiated members of the pyroxene and amphibole groups.
GAR	Undifferentiated members of the garnet group. This category was counted, but no sand-sized garnets were observed.

Table A.2. Common igneous rock types, showing the distribution of the Rye Creek grain parameters.

	SiO_2 Na_2O, K_2O CaO, MgO, FeO Fe-Mg light — Rock Color — dark light — PLAG type — dark		
Chemical Type	Acid	Intermediate	Basic
Fine grained (extrusive, i.e. lava)	Rhyolite (LVF) (LVV)	Andesite Dacite (LVF)	Basalt (LVM)
Medium grained (hypabyssal i.e. dikes)	Microgranite (LVH)	Microdiorite Microgranodiorite (LVH)	Diabase (LVH) or (PLAG, PYR)
Coarse grained (intrusive: plutons, batholiths)	Granite (QTZ, PLAG, KSPAR, MICR, BIOT, minor PYR)	Diorite Granodiorite (PLAG, PYR, minor QTZ, KSPAR)	Gabbro (PLAG, PYR)

grains varied from sample to sample. It was felt that detailed collection of qualitative data might aid in interpretation of petrofacies boundaries and/or might help determine membership of sherds in either of two similar petrofacies.

Fluvial Sand Qualitative Data Collection: Hand Samples

Qualitative notes were collected macroscopically for each sand in hand-sample (ie., looking at the sand itself, not at a thin-section) using the binocular microscope at 10X to 15X magnification. Data collected include grain types present in the sample, as well as the size, shape, color, luster, and relative abundance of each grain type where appropriate. A list of grain types noted is given in Table A.3; Table A.4 gives a complete list of the lithic fragments observed in hand samples, while Table A.5 lists those same lithic fragments by the petrofacies in which they occur. Table A.6 is a list of the relative abundance categories used in this analysis. This information was collected to facilitate description of the sand samples at the petrofacies level. After this data was collected, the sand samples were examined by petrofacies, so that summary descriptions of each petrofacies could be written. Table A.7 presents the data on grain types and abundance collected for each petrofacies. Because it is organized by petrofacies, it gives the *range* of observed compositions for each petrofacies. Table A.8 was written as a summary for each petrofacies and represents the *average* sand found in each petrofacies. Ideally, this information will be useful in identifying ceramic temper sands to the petrofacies level on the basis of hand samples. The information then could be used to calibrate the binocular microscopic identification of sherd samples by the ceramicist. Because it is not possible to thin-section every sherd, it is necessary to develop a method for relating the heuristic petrofacies construct generated from detailed quantitative data to the less detailed but more voluminous qualitative data that can be collected quickly and easily from sherds.

SHERD METHODOLOGY - DATA COLLECTION

Sample Collection and Preparation

A sample of 52 sherds was chosen from the Rye Creek Project to represent proportionately the 12 provisional temper groups initially classified by the ceramicist (see Stark and Heidke, Chapter 13). The temper types were determined on the basis of grain size, shape, color, and composition, and were identified with reference to the sand samples collected from the project area. The ceramic sample is by no means random; approximately 5 percent of each unique temper group was chosen, rather than a percentage of all sherds. In addition, only sherds large enough to thin-section were included. Sherds were sectioned parallel to the vessel wall in order to provide an area large enough for the point-count; they were ground and stained using the same techniques as the sand samples.

Point-counting and Qualitative Data Collection in Thin-Section

Point-counting and collection of qualitative data proceeded as for the sands except that an additional grain type, sherd temper, was counted in the sherds. Sherd temper was recognized as discrete grains of sand-tempered clay found within a limited number of the sherd thin-sections examined. Sherd temper can be recognized in thin-section because it has boundaries discrete from the surrounding clay paste, as well as a different paste color and often different temper composition.

Table A.3. Grain types found in the Rye Creek sand and sherd hand samples.

Light grains	
Quartz:	Generally round to subangular, clear, gray, yellowish, rarely pinkish, translucent, anhedral.
Potassium feldspar:	Generally subangular, pink, opaque to translucent, subhedral, cleavage faces often present.
Light plagioclase:	Generally subangular, often smaller than the potassium feldspar in any given sample, white, rarely pink, opaque, subhedral to euhedral, cleavage faces often present.
Dark Grains	
Dark plagioclase:	Generally subangular to subround, green/white, translucent, subhedral.
Biotite:	Small thin plates of black- or bronze-colored mica.
"Pyriboles":	Generic term applied to pyroxenes and amphiboles which are generally not separable in these hand samples. Generally subangular, black, opaque, shiny, euhedral prisms, rarely rounded subhedral.
"Mafics":	Generic term applied to all black, dark red, or metallic iron and/or magnesium-rich minerals other than biotite, pyroxene, and amphiboles. Opaque iron oxides such as hematite most often fall into this category.
Lithic Fragments:	Rounded to subangular; sedimentary usually buff to pink or orange, volcanic generally reddish or gray, metamorphics generally red, gray, green; opaque, generally granular, metamorphic fragments may display schistosity or other planar fabric. Table 2b lists all the lithic fragments seen in hand sample.
Soil features	
Soil Carbonate:	Angular to very round, buff color, opaque, often as cement binding together very fine grains, reacts with HCl.
Soil Clay:	Round, buff color, opaque, may bind together fine sand or silt grains or coat larger grains, does not react with HCl, very soft, easy to crush.

Table A.4. Lithic fragment types seen in fluvial sand hand samples (abbreviations are used in tables A.5, A.6, and A.7).

G	Granitic fragments: quartz, potassium feldspar, and plagioclase feldspar in a primary igneous fabric.
G(m)	Granitic fragments, possibly metamorphosed.
GM	Microgranite.
D	Diabasic or dacitic fragments: plagioclase feldspar and pyribole in a primary igneous fabric.
V	Undifferentiated volcanic rock fragments.
R	Rhyolitic fragments: fine-grained pink, gray, or orange igneous rock.
R(m)	Rhyolitic fragments, possibly metamorphosed.
S	Undifferentiated sedimentary fragments.
SST	Sandstone fragments: Sand size grains bound together by cement which is generally siliceous, generally well sorted within the lithic fragments. These grains are generally round to well-round. Sandstone grains seen include: SSTgw — Gray and white sandstone SSTy — Yellow sandstone SSTbf — Buff sandstone SSTr — Red sandstone
SLST	Siltstone fragments: Silt size grains which occur in rounded lithic fragments. SLSTr — Red siltstone SLSTy — Yellow siltstone
QTZT	Quartzite: Silt to sand size sutured grains, with or without obvious planar fabric in subangular to rounded lithic fragments. Quartzite grains seen include: QTZTr — Red quartzite QTZTrp — Purplish-red quartzite QTZTro — Orangish-red quartzite QTZTbfy — Buff to yellow quartzite QTZTy — Yellow quartzite QTZTw — White quartzite QTZTg — Gray quartzite QTZTggr — Greenish-gray quartzite QTZTbr — Brown quartzite QTZTbf — Buff quartzite
SSQT	Sandstone or quartzite: Fine-grained sandstone or quartzite which cannot reliably be assigned to a more specific category. SSQTbfy — Buff to yellow sandstone or quartzite SSQTgpi — Pinkish-gray sandstone or quartzite SSQTgr — Green sandstone or quartzite SSQTgb — Gray to black sandstone or quartzite SSQTg — Gray sandstone
M	Undifferentiated metamorphic fragments, generally very fine grained and rounded. Mb — Black metamorphic My — Yellow metamorphic

Table A.4. Continued.

MI	Metamorposed igneous rock fragments which cannot reliably be assigned more specifically.	
	MIl	Light colored meta-igneous
	MIg	Gray meta-igneous
	MIgr	Green meta-igneous
MS	Undifferentiated metamorphosed sedimentary rock fragments.	
PHY	Phyllite fragments: Very fine-grained subangular fragments, generally oblate, with a mica sheen, but no visible mica grains.	
	PHYg	Gray phyllite
	PHYp	Purple phyllite
SCH	Schist fragments: fine-grained subangular fragments, generally oblate, with visible mica flakes.	
	SCHpr	Reddish purple schist
	SCHg	Gray schist
	SCHy	Yellow schist
	SCHr	Red schist
GN	Gneiss fragments: Intensely deformed and recrystallized metamorphic rocks with strong planar fabric, generally in equant to prolate rounded to subangular fragments.	
	GN	Grayish gneiss with white and black bands.
	GNmi	Micaceous gneiss
	GNam	Amphibolite gneiss
	GNgar	Gniess with visible garnet
GST	Greenstone fragments: Dark green fine-grained metamorphic fragments rich in chlorite and epidote. Generally rounded, equant to prolate, and lacking oriented fabric.	
UNID	Unidentified rock fragments.	

Table A.5. Lithic fragments grouped by the generic petrofacies in which they occur (abbreviations defined in Table A.4).

Granitic: G, D, V, S, M, UNID

Granitic-Sedimentary: G, D, R, SSTgw, SSTgy, SSTr, SLSTr, SLSTy, QTZTr, QTZTy, SSQTgpi, SSQTg

Granitic-Lithic: G, R(m), QTZTr, QTZTg, QTZTbr, SSQTgr, GN

Diabasic: G, D, S

Volcanic: GM, R

Metamorphic: G(m), R(m), SSTbf, QTZTr, QTZTrp, QTZTro, QTZTbfy, QTZTy, QTZTw, QTZTg, QTZTggr, QTZTbf, SSQTbfy, SSQTgr, SSQTg, Mb, My, MIg, MIgr, PHYg, PHYp, SCHpr, SCHg, SCHy, SCHr, GN, GNmi, GNam, GNgar, GST

Table A.6. Relative abundance classification used in hand sample analysis.

Abundance cagegory	Volume percent	Abbreviation (used in Table A.4)
Absent:	0%	-
Rare:	1-2%	R
Present:	2-20%	P
Common:	20-40%	C
Abundant:	>40%	A

Table A.7. Lithology of the petrofacies based on hand sample analysis (abbreviations defined in Table A.4).

Petrofacies	N	Quartz	Potassium Feldspar	Light Plagioclase	Dark Plagioclase	Biotite	Pyriboles	Mafics	Lithic Fragments	Lithic Fragment Types
GRANITIC										
Sand D	2	C	C	P	-	R	-/P	-/R	R/P	S, D, UNID
Sherd D	*5*	*C/A*	*-/C*	*P/A*	-	*P*	*-/P*	*-/P*	-	
Sand F	5	P/A	P/A	P/A	-/P	-/R	P	-	P	M, D, V, UNID
Sherd F	*9*	*P/A*	*-/P*	*P/A*	-	*-/C*	*-/C*	-	*-/C*	
Sand J	7	P/A	P	P/A	-/P	-/R	-	-/R	-/P	D, UNID
Sherd J	*13*	*C/A*	*-/A*	*P/A*	-	*-/P*	*-/R*	-	*-/C*	
Sand P	6	P/A	P/C	P/C	P	P	-/P	-	P	D, V, Ms, S
Sherd P	*2*	*C*	*P/C*	*P/C*	-	*P*	*P*	*-/P*	*-/R*	
GRANITIC-SEDIMENTARY										
Sand B	5	P/A	-/C	R/C	-/P	-/R	R/C	-/P	P/C	G, D, R, QTZTr, QTZTy, SSTgw, SSTy, SSTr, SLSTr, SSQTg, SSQTgpi
GRANITIC-LITHIC										
Sand E	4	C/A	P/C	-/P	-	-	-/P	-	P/C	G, R(m), QTZTbr, QTZTr, QTZTg, SSQTgr, GN
DIABASIC										
Sand C	13	-/C	-/C	-/C	-/C	-/P	-/A	-/P	-/A	D, G
Sherd C	*5*	*-/C*	*-/A*	*-/A*	-	*-/C*	*P/A*	*-/C*	*-/C*	*D, G*
VOLCANIC										
Sand O	1	P	R	P	-	-	-	R	P	GM, R, S
METAMORPHIC										
Sand G	4	P/C	-/P	R/P	-	-/R	-	-/R	C/A	QTZTw, QTZTy, QTZTbf, QTZTro, QTZTrp, SSQTg, Phyp, SCHg, SCHy, GST, GN, GNmi, GNgar, GNam, My
Sand H	5	P/A	P	R/P	-/P	-/R	-	-/R	P/A	G(m), QTZTrp, QTZTw, QTZTg, SSQTbfy, MIg, MIgr, PHYg, SCHpr, SCHg, GST
Sherd H	*7*	*-/P*	-	*-/P*	-	-	-	*-/R*	*C/A*	
Sand I	4	C/A	P	P	-	-	-/P	-	-/P	QTZTro, QTZTrp, QTZTg, QTZTggr, QTZTbfy, SSQTgr, PHYp, SCHg, Mb, AST, GN
Sherd I	*2*	*P/A*	*R/P*	*P*	-	-	-	-	*P/A*	
Sand K	8	P/A	-/P	R/P	-/P	-	-/P	-/R	P/A	G(m), R(m), SSTbf, QTZTw, QTZTr, QTZTbf, SSQTgr, SSQTgb, SCHr, GST
Sherd K	*4*	*-/C*	*-/P*	*P*	-	*-/R*	*-/R*	-	*P/A*	

Table A.8. Lithology of the petrofacies based on hand sample analysis.

Granitic

Petrofacies D (2 samples)

Quartz and potassium feldspar are common in this petrofacies, while light plagioclase is present. Biotite is rare, and pyriboles and mafics are absent to present. Lithic fragments are present. When present they tend to be sedimentary or undifferentiated fragments. The overall color of the sand in this petrofacies is light, and tends to be pinkish due to the presence of large amounts of potassium feldspar. No characteristic grains were identified in this petrofacies since the two members are very different. The modal composition obtained by the point counts indicates that both members of this petrofacies are granite.

Petrofacies F (5 samples)

Quartz is common in this petrofacies, and potassium feldspar and light plagioclase are present. Dark plagioclase and biotite are generally absent but can occur in amounts less than approximately 5 percent. Pyriboles and lithic fragments are uniformly present. Lithic fragments tend to be undifferentiated, with some diabase, some volcanic and some metamorphic identifiable. Most members of this petrofacies had lumps of soil carbonate or clay included. The overall color of the sand in this petrofacies is light; it may be pink to greenish depending on the lithic fragment content. Modal percent data obtained by the point counts indicates that four members of this group are granite; the remaining sample is granodiorite. The wide variety of feldspars present in this petrofacies, and the predominance of feldspars (potassium plus plagioclase) over quartz characterize this petrofacies.

Petrofacies J (7 samples)

Quartz is common in this petrofacies, and potassium feldspar is present. Plagioclase feldspar is common and is very conspicuous compared to quartz and potassium feldspar. Dark plagioclase is absent in all but one sample. Biotite, pyriboles, and mafics are absent to rare. Lithic fragments are present in only one sample which has some diabase and some indeterminate fragments. There is generally soil carbonate and/or clay associated with this petrofacies, which lends an overall yellowish color to the petrofacies. Modal percent data obtained from the point counts indicates that four members of this group are granite, while three are granodiorite. The large translucent light plagioclase grains, many of which are visibly altered, in association with large quartz and potassium feldspar grains, along with the lack of dark grains characterize this petrofacies.

Petrofacies P (6 samples)

Quartz is common in this petrofacies, and potassium feldspar, light plagioclase, and dark plagioclase are present. Biotite is generally present, but pyriboles are highly variable, and may be absent to present. Other mafics are absent. Lithic fragments are generally present; there is diabase or dacite present in five of the six samples. Volcanics are present in half of the samples from petrofacies P. The overall sand color of this petrofacies is usually light pinkish gray, but may be yellowish gray in samples with high volcanic lithic fragment content. Samples with a high dacite or dark plagioclase content may have a slight greenish cast. Modal percent data obtained from the point counts indicates that four of the members of Petrofacies P are granite, the remaining two are Granodiorite. However, all of the samples are high in plagioclase, so are near the granite-granodiorite division. The presence of dacite lithic fragments or dark plagioclase and pyibole grains in association with large plagioclase and quartz grains characterizes this petrofacies.

NOTE: There is no diabase source near this petrofacies, but there is a dacite source upstream. Diabase and dacite are closely related igneous rocks which are high in plagioclase and ferromagnesian minerals; diabase is medium grained and has less than 10 percent quartz while dacite is the fine grained equivalent of granodiorite and has greater than 10 percent quartz. It is difficult to distinguish between these two rock types on the basis of sand size lithic fragments.

Granitic-sedimentary

Petrofacies B: (5 samples)

This petrofacies is too variable to write a generalized description. Quartz is rare to abundant while potassium feldspar is absent to common. Light plagioclase is rare to common, while dark plagioclase is absent to present in low percentages. Biotite occurs in only one sample. Pyriboles are absent to common, but mafics are present in only one sample.

Table A.8. Continued.

Lithic fragments are present to common, and are largely sedimentary grains such as sandstone and siltstone. There is also some diabase, granite, and quartzite. Color varies from reddish pink to yellow. No characteristic grains were noted.

Granitic-lithic

Petrofacies E (four samples)
Quartz is common to abundant in this petrofacies, while potassium is present to common. Plagioclase and pyriboles are absent to present. Lithic fragments are present to common, and include metarhyolite, metagranite, gneiss, and a variety of quartzites. The characteristic grains of this petrofacies are quartz and feldspar grains in association with meta-rhyolite and red quartzite.

Diabasic

Petrofacies C (13 samples)
Quartz and potassium feldspar generally are present in this petrofacies but may vary widely; light plagioclase is common. Dark plagioclase is absent to common, while biotite is present. Pyriboles are absent to abundant. Other mafics are rarely noted. Lithic fragments are present to abundant, diabase is always present, and often is the only identifiable rock fragment type. The dark plagioclase + pyribole content seems to vary inversely with the diabasic lithic fragment content. As average grain size decreases, more lithic fragments are broken into their constituent PLAG/PYR minerals. The sands from this petrofacies tend to be strongly green; they may appear pinkish green in samples with a high granitic component. Modal percent data obtained from the point counts indicates that six of the samples in this petrofacies plot as diabase, four as granodiorite, and one each as dacite, granite, and monzodiorite. The distinctive diabase lithic fragments (or a high dark plagioclase + pyribole content) characterize this petofacies.

Metamorphic

Petrofacies G (4 samples)
Quartz is present to common in this petrofacies, while potassium feldspar is absent to present (always as a low percent). Light plagioclase is generally present, while dark plagioclase, biotite, and mafics, and pyriboles are generally absent. Metamorphic lithic fragments such as gneiss, phyllite, schist, and quartzite are common to abundant. These sands are generally gray to gray-yellow in color. Platy gray schist with a variety of gneiss grains along with greenstone, purple-red quartzite, and purple phyllite characterize this petrofacies.

Petrofacies H (5 samples)
Quartz is present to abundant in this petrofacies, while potassium feldspar is present in all samples. Light plagioclase is present, while dark plagioclase and biotite are absent in all but one sample. Mafics are rare and pyriboles are absent. Metamorphic lithic fragments are present to abundant, including greenstone, schist, meta-igneous rocks, phyllite, and several varieties of quartzite. This petrofacies tends to appear mixed green and red in hand sample. The grains which are most characteristic of this petrofacies are the quartzites in association with gray schist.

Petrofacies I (4 samples)
Quartz is common in this petrofacies. Potassium feldspar and plagioclase are both present. Biotite and mafics are absent; pyriboles are absent to present. Lithic fragments are present, and are predominantly a wide variety of metamorphic quartzites with sparse schist, phyllite, and greenstone. Hematite is present in two of the four samples in this group. The color of this petrofacies is generally reddish-pink to pinkish-gray. The wide variety of quartzites characterizes this petrofacies.

Petrofacies K (8 samples)
Quartz is present in this petrofacies. Potassium feldspar and light plagioclase generally are present. Dark plagioclase and pyriboles are absent in all but one sample. Mafics are rare to absent. Lithic fragments are present to abundant and include metamorphic grains such as quartzite, schist, meta-rhyolite and meta-granite. Greenstone and schist are also present. Diabase and granite are rare. This petrofacies is pink to yellowish in color depending on the degree of alteration by soil formation processes. Grains characteristic of this petrofacies are the greenstone in association with green and red quartzite.

Table A.8. Continued.

Volcanic

Petrofacies O (1 sample)

Quartz and light plagioclase are present in this sample and potassium and mafics are rare. Lithic fragments are present and are rhyolite, microgranite, and sedimentary. This petrofacies is pink in color, and is characterized by the microgranite.

Silt Content in Thin-Section

It has been suggested that the silt content of the clay used to make pots can be used to indicate the origin of the clay. Clays with low silt content are assumed to be redeposited, or secondary deposits, while clays with high silt content are assumed to be primary deposits (Garrett 1988). Notes were collected on the percentage of silt-size grains present in each sherd as seen in thin-section. This percentage was estimated visually with reference to a standard percentage estimation comparison chart (Harwood 1988). Several locations on each thin-section were examined, and silt content was expressed as a range rather than as a single value.

Qualitative Data Collection: Hand Samples

Qualitative notes on grain types and abundance for each sherd hand sample were collected as for the sand hand samples. Table A.7 includes information on the range of compositions seen for the sherds assigned by discriminant function analysis to each petrofacies (see Stark and Heidke, Chapter 13). Summary descriptions of the "average" ceramic temper sands seen for each petrofacies were not done.

ANALYSIS

Quantitative Analysis

The quantitative data resulting from the thin-section point-counts was analyzed as described by Heidke in Chapter 13. This analysis resulted in the definition of both generic and specific petrofacies and permitted assignment of sherds into petrofacies. Once these assignments were made, the qualitative data was examined in an attempt to relate it to the quantitative analysis.

Qualitative Analysis: Thin-Sections

The qualitative data collected on the grain types encountered in thin-section was organized into hierarchical schemes. For lithic fragments, the hierarchy classified grains according to their tectonic origin, major composition, texture, minor composition, and minor textural variations, respectively. For monomineralic grains, the classification scheme divided grains according to major mineral group, composition within the mineral group, grain size/shape, degree of alteration, and occurrence (single grains vs. sand size members of lithic fragments). The hierarchical classification was used to create and number a list of all grain types encountered in thin-section. This was done because texturally or compositionally distinct grains are often counted under one key in the point count. For instance, LVF, felsic volcanic lithic fragments, includes both rhyolitic and dacitic compositions (see Table A.2). Two petrofacies with similar high LVF counts might be distinguished from one another if the volcanic lithic fragments in one were uniformly rhyolitic in composition while the fragments in the other were uniformly dacitic. This "descriptive" phase of the thin-section petrofacies analysis is only at a preliminary stage at this time. Qualitative distinctions were not made for all grain types, and the data has yet to be analyzed adequately.

Qualitative Analysis: Fluvial Sand Hand Samples

The fluvial sand hand sample data on the range of composition for each petrofacies and the summary descriptions of petrofacies were used to create classification flow charts designed to distinguish among the petrofacies (Figures A.3 and A.4). Separate flow charts were constructed for the igneous and metamorphic petrofacies, because they are easily distinguished from one another on this broad scale. Blind tests were then conducted within the major tectonic groups, (i.e., igneous samples were classified in one test and metamorphic samples were classified in the other) to evaluate the effectiveness of the flow charts in distinguishing between petrofacies. Petrofacies B was included in both tests since it is highly variable and can appear similar to both

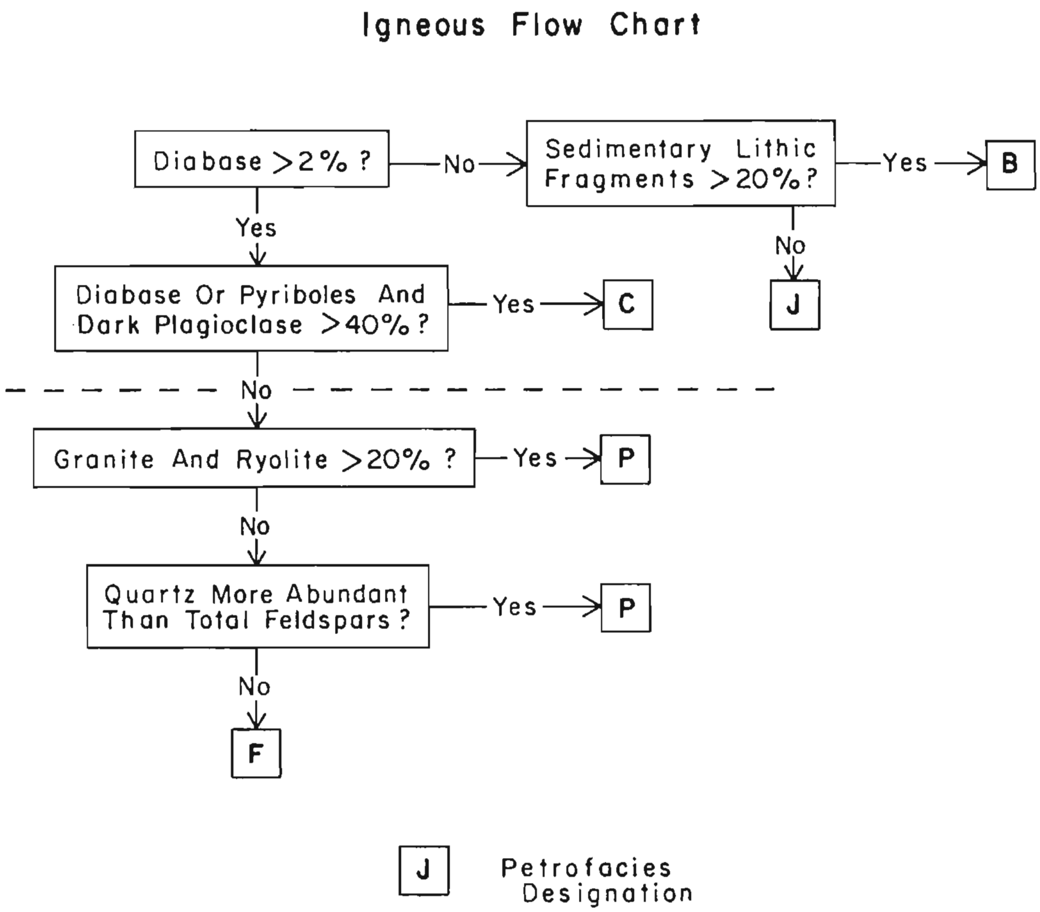


Figure A.3. Flow chart for igneous sand samples. Correct assignment can be accomplished 65 percent of the time if the chart is followed to completion, separating Petrofacies F and P. If F and P are not separated (stopping at the dotted line) then the accuracy rises to 72 percent.

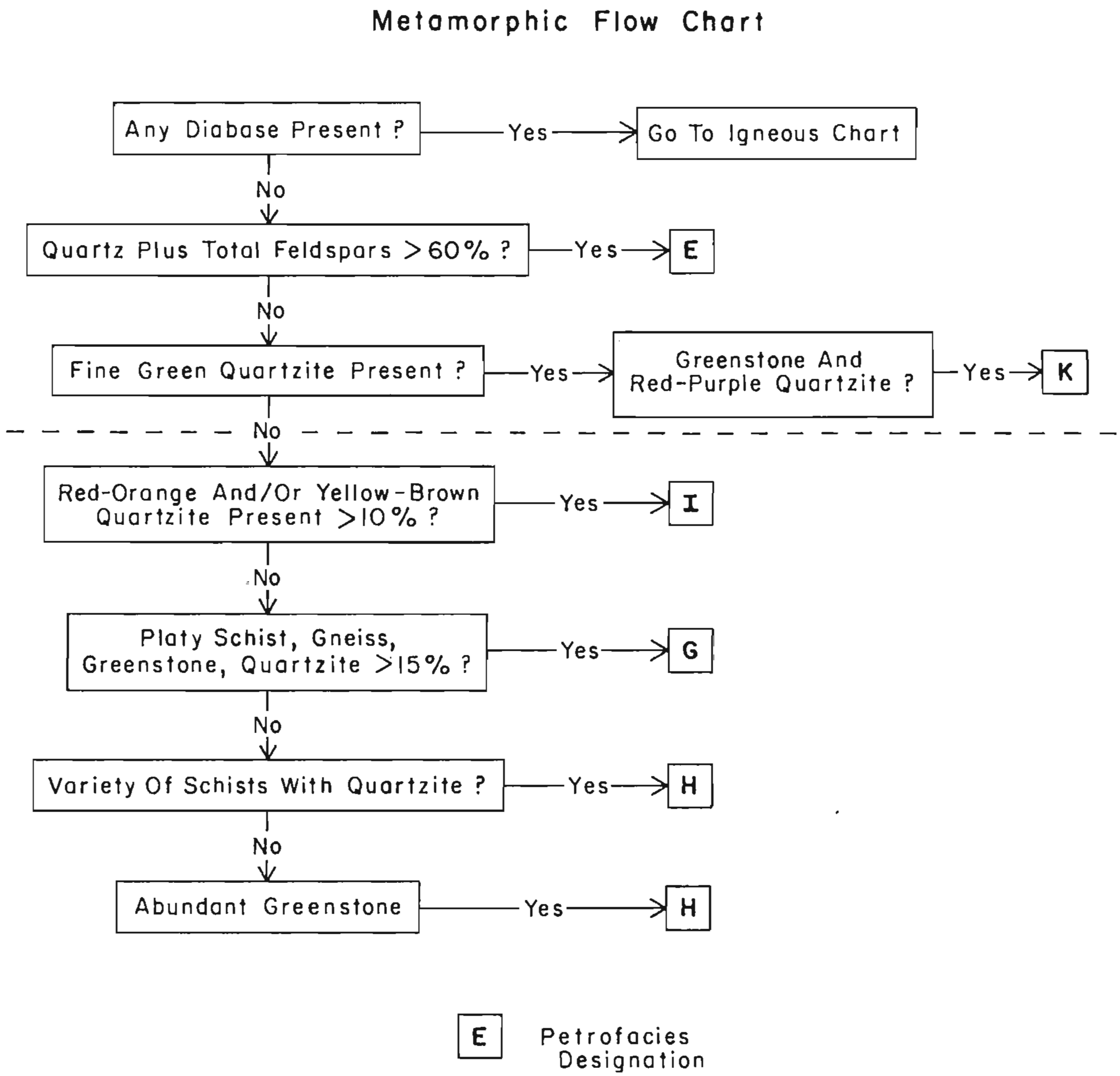


Figure A.4. Flow chart for metamorphic sand samples. Correct assignment can be accomplished 60 percent of the time if the chart is followed to completion, separating Petrofacies G, H, and I. If G, H, and I are not separated (stopping at the dotted line) then the accuracy rises to 80 percent.

igneous and metamorphic samples (see Stark and Heidke, Chapter 13). Tests were conducted by obscuring the identification number on 8 to 10 igneous or metamorphic sand samples selected for their similar appearance and then placing them randomly before the petrographer for classification.

Qualitative Analysis: Silt Content in Sherd Thin-Sections

Data collected on the percent of silt present in the paste of each sherd was reduced to an average composition for each sample. Frequency tables were generated, grouping the silt content into ranges of 0 to 5 percent, 5 to 10 percent, 10 to 15 percent, 15 to 20 percent, and 20 to 25 percent. Bar graphs were then constructed, showing the distribution of silt content by ware, phase, and predicted petrofacies (Figures A.5, A.6, and A.7 respectively).

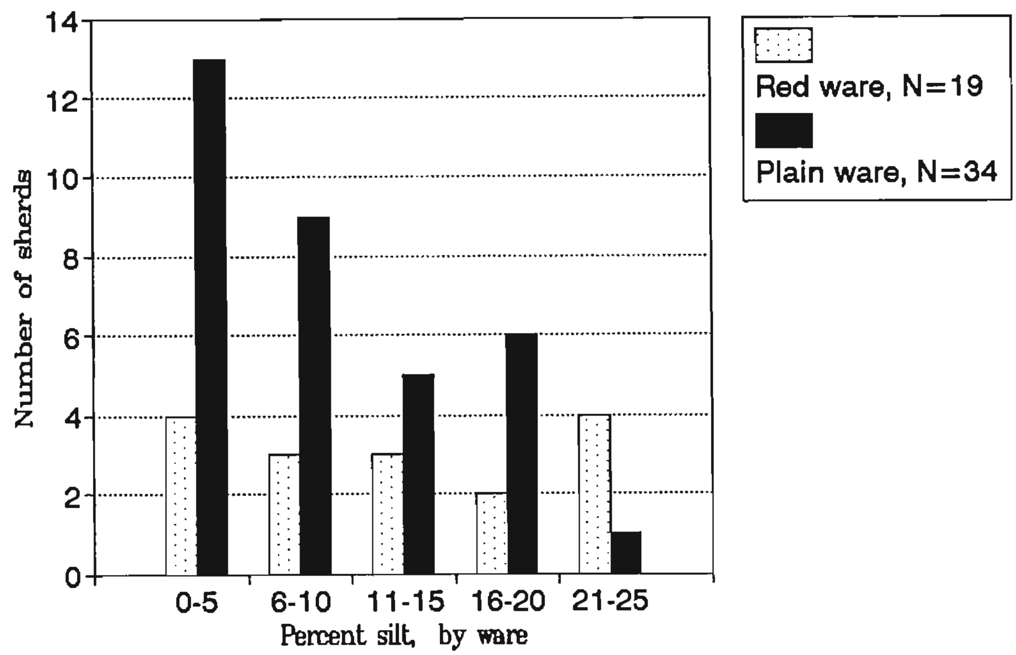


Figure A.5. Silt content of sherd thin-sections separated by ware.

RESULTS OF THE QUALITATIVE STUDIES

Qualitative Thin-section Analysis

The qualitative data collected in thin-section and organized into grain types in the course of the analysis revealed some interesting patterns in temper use by Tonto Basin potters.

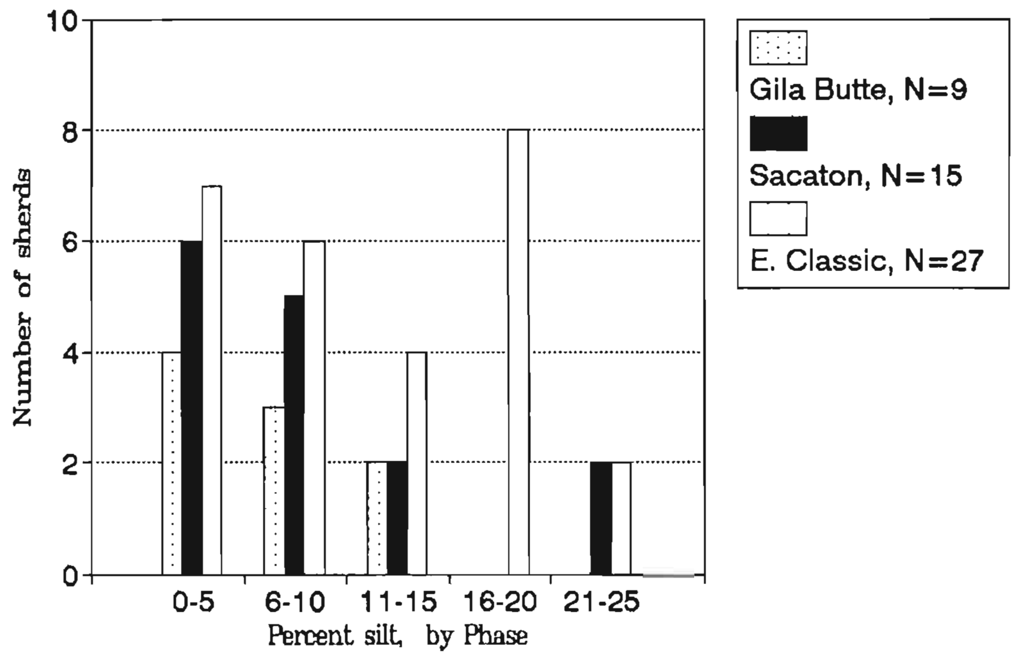


Figure A.6. Silt content of sherd thin-sections separated by phase.

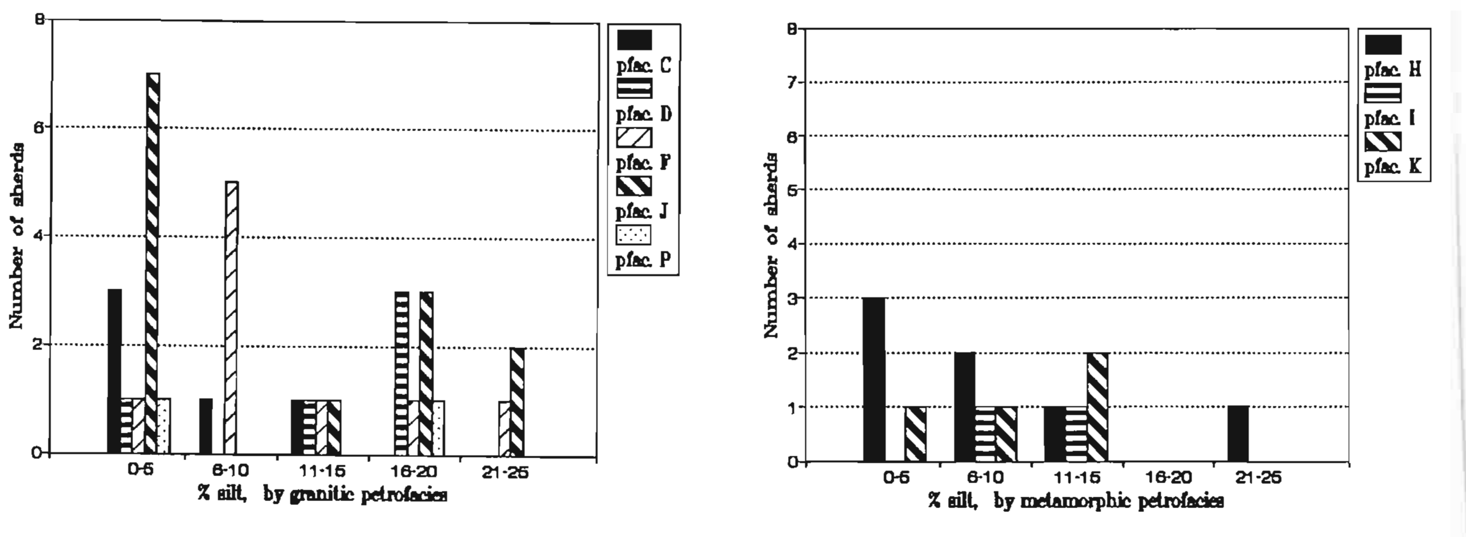


Figure A.7. Silt content of sherd thin-sections separated by petrofacies.

First, there are a number of grain types that are seen in nearly all of the petrofacies and can be seen in the majority of the sand and sherd samples. Such water-rounded grains as quartz, potassium feldspar, altered plagioclase feldspar, and pyroxene or hornblende occur throughout the Tonto Basin and were found in nearly all of the sand and sherd samples examined. This is highly significant, because it suggests that the Tonto Basin potters were using fluvial sands to temper their pots. The pervasive presence of water-rounded grains in all of the analyzed sherd samples mitigates against the possibility that the potters were using crushed rock as their sole temper source. The only difference between the fluvial sands and ceramic temper sand is that the temper tends to be finer-grained than the sieved fluvial sand samples used for this analysis (Figure A.8). Because of this, it appears likely that finer deposits may have been deliberately selected in the streambeds, or that the sands were winnowed before use. No rigorous quantitative data on grain size was collected for this preliminary study, however, so this assumption remains to be tested.

The quantitative assignment of sherds to petrofacies was notable in that no sherds were assigned to petrofacies E, which is adjacent to the sites under study and well within procurement range (see Stark and Heidke, Figure 13.7, Volume 2). The qualitative thin-section analysis supported this assessment. There is a distinctive feldspar type in the fluvial sands from petrofacies E and in TB-41, a sample taken from Rye Creek just downstream from Petrofacies E. This feldspar type, which occurs rarely or not at all in other petrofacies, is very common in E; it displays a symplectic to graphic intergrowth with quartz (Figure A.9). It would be difficult to collect a fluvial sand from petrofacies E without including this distinctive grain type, yet it was not observed in any of the sherd thin-sections. The qualitative analysis therefore strongly supports the discriminant analysis in excluding sherds from petrofacies E.

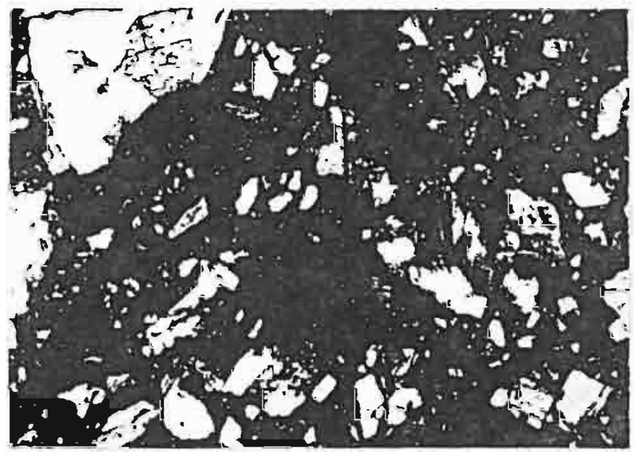
Qualitative Fluvial Sand Sample Results

Correct assignment of fluvial sands to individual petrofacies using the flow charts was achieved only 60 percent of the time for metamorphic sands Figure A.4) and 65 percent of the time for granitic sands (Figure A.3).

Among the igneous samples it was found that petrofacies C and J were easy to distinguish and were not confused with other petrofacies. This is significant because petrofacies J received the highest number of sherd assignments of all the petrofacies. There is, however, one caveat to these encouraging results: Petrofacies J is rich in soil carbonate, which lends it a distinctive yellow color in hand sample. Although the sand in Petrofacies J is probably distinctive on its own merits due to its characteristic large, single quartz and feldspar grains this remains to be tested. In the future, all sand samples should be pretreated with HCL to remove soil carbonate, because this sand attribute is postdepositional and therefore unrelated to the sand formation processes of interest to us. This is especially important because no carbonate can be seen in sherd samples. Carbonate is easily converted to oxides such as lime (CaO) or periclase (MgO) plus carbon dioxide (CO_2) over a gas flame in the laboratory. The firing temperatures associated with ceramic production undoubtedly remove all carbonates from the clay, leaving only an oxide residue, which apparently cannot be distinguished from its clay host in thin-section.

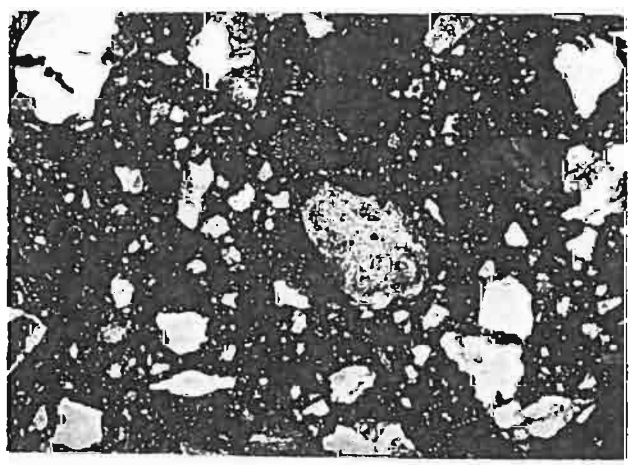
Petrofacies F and P were consistently confused with one another. Lithic grains from each of these petrofacies were compared and found to be indistinguishable. Because the igneous bedrock contributing to these petrofacies is essentially the same rock exposed in two places, it is unlikely that distinctions between these petrofacies at the hand sample level will improve significantly in the future. Petrofacies B was easily confused with most other petrofacies. Among the metamorphic samples, petrofacies E was readily distinguishable, and petrofacies K was nearly always identified correctly. Petrofacies G, H, and I were often confused with one another. At this preliminary stage it is not possible to reliably distinguish among these metamorphic sand samples due to the high intrapetrofacies variability, but future research done in conjunction with the Roosevelt Community Development Study (Doelle et al. 1991) may be able to refine the descriptions, allowing a reduction of the intra-petrofacies variability. This would increase our ability to distinguish the metamorphic petrofacies from one another.

a



b

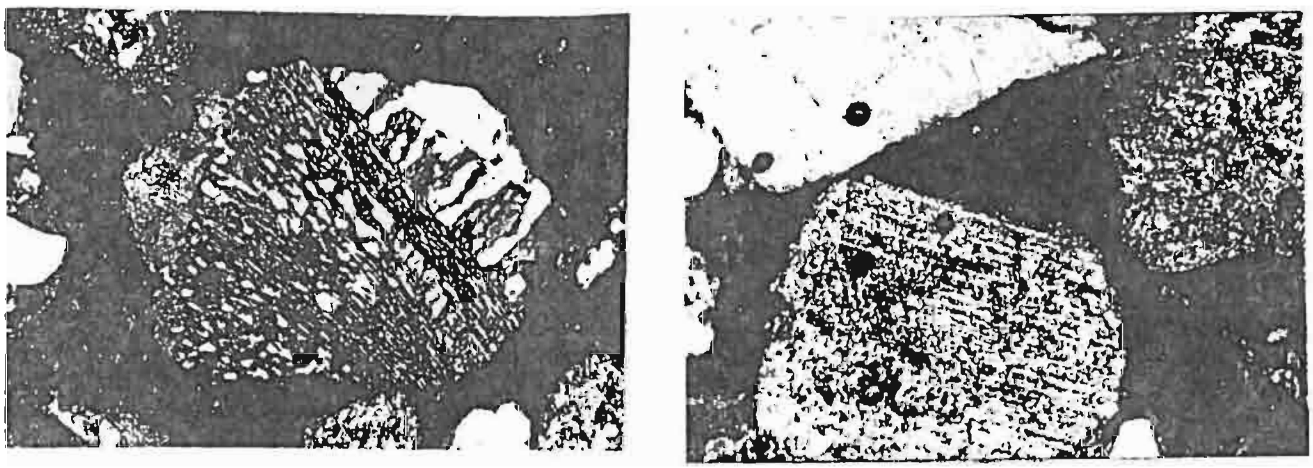
c



d

Figure A.8. Thin sections of sand samples compared with thin sections of sand-tempered sherds. Figures A.8a and A.8b are photomicrographs of a diabasic sand and a diabasic sand tempered sherd, respectively; while A.8c and d are of a granitic sand and a granitic sand tempered sherd, respectively. Note the size and shape similarities between the sherd and sand samples for each petrofacies.

At this stage, if the granitic petrofacies F and P are combined for the purpose of distinguishing fluvial sand hand samples from one another, the success rate in assigning any given granitic sample to the appropriate petrofacies (C, J, F/P, or B) climbs to 72 percent or better (one test yielded a correct assignment rate of 88 percent). Similarly, reduction of the metamorphic petrofacies to E, K, and G/H/I yields an 80 percent success rate. This effectively reduces the distinguishable petrofacies from 10 unique groups to only 7 with a corresponding decrease in our ability to identify potential ceramic production locations. It should also be noted that the petrofacies that were most difficult to identify in hand sample were for the most part the same ones that tended to be misclassified in the discriminant analysis (See Stark and Heidke, Chapter 13, Volume 2). Ideally, the planned increase in sand sample size from each petrofacies will clarify compositional boundaries.



a b

Figure A.9. Plagioclase feldspars from two petrofacies showing the difference between the symplectic intergrowth seen in Petrofacies E (A.9a) and the other Petrofacies A.9b. (Note that A.9b shows alteration of the A.9b shows alteration of the feldspar but no symplectic intergrowth.

Comparison of Fluvial Sands to Ceramic Temper Sands

As noted earlier, Table A.7 gives the summary hand sample descriptions for the sand and sherd samples by petrofacies, respectively. It is significant to note that, in general, the sands or sherds belonging to a given petrofacies are very similar to one another, though the abundance of some minerals in the sherd samples exceeds the abundance of those same minerals in fluvial sand samples. This would clearly not be the case if the fluvial sands were classified ideally. As stated above, this preliminary study has shown that on the qualitative hand sample level, sufficient detail does not always exist to distinguish between two petrofacies of similar tectonic origin. Future research must center on reducing this variability.

A discrepancy in the amount of biotite recorded in hand sample serves to illustrate this point. Examination of this data shows that biotite is generally under-reported in fluvial sand hand samples. Comparison of the quantitative point-count and qualitative data from granitic petrofacies shows that this is due primarily to a recording bias. Figure A.10 is a frequency distribution for all granitic sand and sherd samples comparing the relative biotite abundance recorded in hand sample to the modal percent of biotite determined through the point count. The distribution is arranged such that "0" means the relative abundance (Table A.6) assigned to biotite in a hand sample agrees with the point-counted modal percent, "+" means the biotite content was overestimated by one abundance category in hand sample, "++" means an overestimate by two abundance categories, and so forth. Examination of the distribution shows that the estimates for sherd hand samples form a normal distribution around "0," or a correct estimate. Abundance estimates of biotite in granitic sand samples are skewed; underestimates are more common than correct estimates plus overestimates. This may be because biotite is more conspicuous in clay paste than in a hand sample of sand.

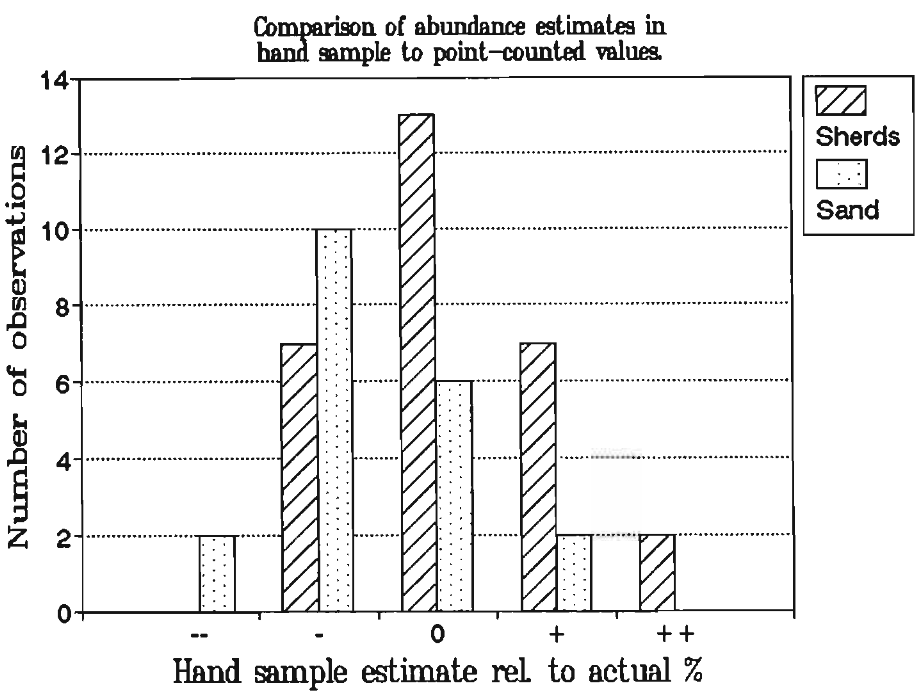


Figure A.10. Comparison of abundance estimates of biotote mica sand and sherd hand samples to modal percent data obtained by the point counts. Note that abundance estimates of sherd samples agree well with the quantitative pointcount data while the abundance estimates of sand samples tends to underestimate the quantitative value.

Silt Content Analysis

The results of the analysis of the silt data set indicate that plainwares are more likely to have low silt content (<= 10%) than a moderate (11-20%) or high (>20%) silt content. Redwares, on the other hand, are evenly distributed across the silt content spectrum. This might indicate that finer, redeposited clays relatively free of silt were valued for plainwares, while no such selection occurred for redwares.

Gila Butte phase ceramics (n=9) have predominantly low silt content with only two members in the moderate silt content range. Sacaton phase ceramics (n=15) are similarly distributed, with all but four members having low silt content. Early Classic period ceramics (n=27) are distributed across the silt content spectrum, though there are slightly more vessels with high silt content than with low or medium content. This could indicate that later potters sought siltier clays, or that they were less concerned with the size sorting characteristics of the clay source. It does seem to indicate selection of less silty clays by Gila Butte and Sacaton potters.

Examination of silt content by predicted petrofacies reveals a random pattern; this may be due in part to the small sample sizes which result from dividing the 51 samples into eight petrofacies.

CONCLUSIONS

The qualitative thin-section analysis shows that the grain type information can be used to verify and elucidate the quantitative and statistical analyses. More analysis is needed to fully realize the potential of this technique.

The qualitative hand sample analysis is not yet useful for distinguishing between samples from similar tectonic origins. Variation within the petrofacies as currently described is too high at this point to distinguish samples more than 60 percent of the time. Further work might help increase the reliability of this technique if variation within petrofacies is reduced by more intensive sampling. At this point, the goal of using hand samples as a relatively rapid way of relating heuristic petrofacies to ceramic temper types has not been reached.

APPENDIX B

CERAMIC CONTEXTUAL DATA: THE SELECTION OF ARTIFACTS FOR ANALYSIS

Henry D. Wallace

The initial selection of ceramics and other artifacts for intensive investigation requires information on the contexts involved in conjunction with a consideration of the research questions to be addressed. One set of research questions posed in the Rye Creek Project required artifacts from temporally controlled assemblages to be analyzed and compared. In many ways, the initial selection of depositional units to be used in such analyses is a "Catch-22" proposition for the archaeologist. The whole idea behind this type of sampling is that one hopes to save significant project resources by focusing on only the important contexts and yet one must somehow analyze the whole assemblage to determine which ones these are. To circumvent this dilemma at Rye Creek, several limited whole assemblage analyses were performed to arrive at preliminary conclusions of depositional integrity and temporal homogeneity, and these were utilized for the selection of artifacts for certain of the analyses. With regard to the ceramic analyses, this initial assessment involved the following: a consideration of the excavation field notes and maps, information on particular contexts supplied by project director Mark Elson, an assessment of the decorated ceramics (examined in terms of sherd size and temporal placement to assess temporal mixing), and use of the results of the plainware rim sherd size/density study discussed in Chapter 11, Volume 2. The assignment of priorities to particular classes of these data was based on the principles of conservatism and use of available data. Conservatism in this respect indicates that if the particular data available are ambiguous, or if any of the measures indicated serious problems, the context is classed as low in depositional integrity. The ratings assigned to each set of strata within a feature were labeled Class 1, Class 2, and Class 3. Class 1 contexts were those with high contextual integrity (as indicated by the analyses detailed in Chapter 11), and no evidence of serious temporal mixing. These contexts were automatically selected for detailed ceramic analyses. Class 2 contexts are those that have less overall evidence for depositional integrity but which had indications that they could be used in a limited way for certain studies. For example, in the ceramic studies, a number of the Class 2 contexts were secondary refuse deposits thought to contain some mixed-in transformed refuse. In these cases, it was believed that the large sherds in the deposit were potentially suitable for study, provided they did not significantly differ from the sherds in comparable Class 1 deposits. Similarly, to increase the sample size for functional studies, some Class 2 contexts were included (see Stark and Heidke, Chapter 13, this Volume). Class 3 contexts were all of those thought to have low depositional integrity. Ordinarily, these contexts were not considered for further study. As part of my input into the project, only structures were evaluated (with one exception). The results of this preliminary analysis and the suggestions made for the ceramic analyst are presented here. Note that the ultimate choice of contexts for various plainware and redware analyses in Chapter 13 differ somewhat from the suggestions made here for a variety of reasons, including sample size constraints.

An important point to consider when evaluating the results of this sampling strategy is that depositional integrity and temporal mixing are both relative measures that depend upon the resolution of the temporal sequence utilized and the demands of the research questions being asked. For the Rye Creek Project, the resolution required was limited to the temporal level of a phase for some aspects of the investigation and to even grosser scales for other studies. The class assignments were based on the assumption that temporal mixing was defined at the phase level. A corollary to this observation is that temporal mixing and the results of the size/density studies do not necessarily relate to one another. An example in this regard is site AZ O:15:96, a field house site with a single masonry structure (Feature 1) and a small collection of ceramics that would have been considered transformed secondary refuse using the methods outlined in Chapter 11 (i.e., small sherds in low density) and excluded from further study. Given the observation that the occupation at this locality was brief and no associated cultural activity would be expected to have affected the deposit, it is expected to be temporally very restricted and unmixed despite the fact that the deposit appears to be transformed.

What follows are the sampling recommendations for detailed ceramic studies. Only Class 1 and Class 2 contexts are considered here. The sherd plots upon which these interpretations are partially based are given in Chapter 11, Figure 11.1. Note that the temporal assignments given here for some of the features may differ from those given in the individual site descriptions in Volume One, in Chapter 13 (Decorated Ceramics) and in Chapter 25 (Chronology). This was a preliminary interpretation and not all lines of data were considered in temporal assignment.

RYE CREEK RUIN (AZ O:15:1)

A large 150+ room pueblo; three trash mounds were tested.

Feature 1: All levels are temporally mixed to some degree, but the clearest late context is Level 1. I recommend analyzing Level 1 as a Class 1 context. It should represent an A.D. 1250 to 1400 period context with the greatest percentage of the sample falling in the post 1300 range. This context contains more mixing than would ordinarily be considered acceptable for a Class 1 context but it is retained for analysis due to the need for some information on the late Classic period. The results of the analysis of this context must be utilized with the understanding that it is a partially mixed deposit. Any temporal trends observed may be diluted as a result.

Feature 2: Analyze Levels 2 and 3 as representing a good A.D. 1200 to 1250 period Class 1 context. The only mixing in the context is a late sherd in Level 1.

Feature 3: Analyze all levels (1, 2, and 3) as a good A.D. 1200 to 1275 period Class 1 context. The only possible mixing would be if Pinto Black-on-red is representing a post-A.D. 1275 time period. As the dating of this type is subject to debate, I think the pre-A.D. 1275 dating for it is still reasonable.

DEER CREEK SITE (AZ O:15:52)

Seventeen pithouses and a cemetery area.

Note that the Deer Creek site was unusual in terms of the ceramic contextual measures in that it was unknown during analysis whether the Tusayan whitewares (primarily Kana-a Black-on-white) and unidentified redwares were temporally associated with the Gila Butte occupation of the site or whether they might pre- or postdate it. As such, they are *not* taken into account here. Instead, their temporal relationships are measured against these and other contextual measures used in assessing the site's contexts. Chapters 12 and 24 deal with the Kana-a Black-on-white from this site in greater detail.

Feature 6: The fill of this structure was classed as having low contextual integrity by the sherd plot (Figure 11.1), and the presence of a Snaketown Red-on-buff sherd in with Gila Butte Red-on-buff sherds supports the possibility of temporal mixing. The large sherds from this context may be sound enough to retain this as a *Class 2* context, though it should be considered suspect. The floor and floor fill contexts are considered contextually sound based on the sherd plot. Disturbances to the structure recorded in the field notes are not thought to have seriously impaired the context.

Feature 11: The floor and floor fill strata of this feature are considered Class 1 contexts based on the sherd analysis (Figure 11.1), though the low sample size (n=2) makes this conclusion suspect. The lack of conflicting data in the form of temporal mixing leads me to leave it as a Class 1 context, provided other data support this determination.

Feature 12: One of the two rim sherds from the fill of this structure was large and no conflicting data are present to discount the possibility of this deposit having high contextual integrity. It is tentatively considered for Class 1 analysis, though it should be reevaluated with other measures.

Feature 18: The floor and floor fill of this structure are considered to have moderate contextual integrity from the sherd plot (Figure 11.1). Present in Stratum 19 is one unidentifiable Tusayan whiteware raising the question of whether the Tusayan wares are associated with the Gila Butte occupation of the site. Other contextual measures should be evaluated before placing primary significance on the ceramics in this case, given the importance of the issue. It is recommended that this be retained as a Class 1 context pending other studies that might alter this perspective.

Feature 21: The floor and floor fill strata in this structure are tentatively considered a Class 1 context via the sherd size and density analysis (Figure 11.1). Our tenuous cutoff point for the percentage of large sherds was at 25 percent and this context, with 23 rims, plots at 26.1 percent. Perhaps the most cautious approach would be to treat this as a Class 2 context and examine only the large sherds from it. Note the presence of a Kana-a Black-on-white sherd of small to moderate size in Stratum 19, and Gila Butte sherds within both Strata 19 and 20 (see Chapter 12).

Feature 34: This structure was unusual for the Deer Creek site in that no decorated ceramics were recovered from it that could assist in its dating, nor were there any absolute dates recovered. Large sherds in floor contact make the floor assemblage a Class 1 context, while the fill was definitely low in contextual integrity based on the sherd plot (Figure 11.1).

HILLTOP SITE (AZ O:15:53)

Five pithouses and one masonry structure.

This site as a whole has decorated sherds that range from Santa Cruz Red-on-buff to Gila Polychrome (A.D. 850-1450), none of which are in high enough frequencies or in the right contexts to adequately date any particular contexts. Feature 5, a masonry room, may have a redware assemblage from the lower fill that could be cross-dated if a redware seriation could be developed. Otherwise, with the exception noted below, the site does not contain contexts suited for further study.

Feature 1: The field data suggest that this feature is filled with sheetwash and the low sample size used for analysis (3 sherds in Strata 10 and 11, 2 in Strata 19 and 20) mean that the Figure 11.1 plot location may not be meaningful. The large sherds suggest more than just sheet wash, however, and this might be a context to control for potential mixing via taking only the large sherds. Arguing against this is the lack of clear dating for the feature by any means at hand. The Little Colorado whiteware in Stratum 10 would postdate A.D. 1050, but the indeterminate buffware probably predates 1050. This contradictory data lead me to conclude that we should delete this context from the analysis.

Feature 14: There were no decorated sherds from this context and no archaeomagnetic date. Although the sherd analysis plotted the floor strata from this context as potentially useful, the context as a whole is suspect given that the floor was difficult to define and portions of it were built atop the fill of pithouse Feature 15. Mixing could be a problem for these reasons. It is recommended that only large sherds be included for analysis and that this only be a Class 2 context. Note that without temporal data for the deposit, it may not be useful in many analyses.

COBBLE SITE (AZ O:15:54)

A small, heavily root-plowed disturbed pueblo with possibly 10 to 15 rooms and a trash mound.

Feature 2, Trash Mound: Three 1-m by 2-m units were placed in this mound, one during testing and two during mitigation. The testing unit should also be included in the Class 1 analysis. This is the only sizeable deposit from the site.

Feature 9: The ceramic analysis plot (Figure 11.1) placed the floor fill of this feature well into the secondary refuse portion of the plot but it should be noted that only two sherds were included in the size class analysis. The upper fill was plotted as transformed secondary refuse (four small sherds) and the decorated sherds from Strata 10 and 11 confirm the presence of mixing (Tuwiuca Polychrome and Kana-a Black-on-white). The mixing in the upper fill suggests caution in evaluating the lower fill, which includes roof/wall fall that was lying directly on the floor. Large sherds on the floor are almost certainly good, and at least pending evidence to the contrary, I would suggest we go with all rims from the floor fill strata.

Structures 5 and 8: These structures were disturbed enough from road construction that they were thought to be poor candidates for Class 1 contexts. They do contain redware rims and could be evaluated for size and abrasion as possible candidates for Class 2 consideration. Feature 5 should only be considered for Strata 19 and 20 given that the fill has some evidence of temporal mixing from the decorated sherds. I suspect that the floor dates to post-A.D. 1300 based on the presence of Tonto Polychrome. The fill contains a Black Mesa or Sosi sherd (A.D. 1000-1150) and a Pinto Black-on-red (A.D. 1250-1300?). For Feature 8, I have no basis for evaluation from the decorated data. It is probably safest to only do large sherds from lower strata for Feature 8 if the redware elsewhere can be seriated and the redware from this context can then be cross-dated. Otherwise, delete it.

BOONE MOORE SITE (AZ O:15:55)

Three pithouses, two pitrooms, two masonry structures, and several inhumations.

Features 1, 5, and 6: These features should definitely be deleted from all analyses as mixed deposits (temporal mixing may be as much as the full A.D. 1100s and 1200s or as little as the early 1200s as opposed to the late 1200s). The site as a whole lacks buffware entirely, suggesting that the earliest possible date for the site could be traced to the disappearance of the buffwares around A.D. 1050. The decorated ware support this interpretation.

Feature 9: This should also be deleted from analysis due to the field evidence of disturbance processes.

Feature 11: This assemblage deserves special attention, particularly the floor artifacts, given the unusual context that consisted of an unburned structure with several partial skeletons on the floor. Watch for anything unusual in the ceramics that could indicate ritual activity. Note that there is one pit that is possibly intrusive into the structure (Feature 11-2). The field notes on this pit need to be consulted to see if it might have introduced mixing.

Feature 18: The decorated sherds are consistent with one another and the ceramic plot (Figure 11.1) indicates that the floor fill and floor have relatively undisturbed secondary refuse. It is believed to represent a good Class 1 context.

Feature 19: The feature description for this feature describes a "mosaic" of sherds on the floor (i.e., high density). This needs to be accounted for through the ceramic analysis. The feature description and sherd analysis plot suggest that the floor strata from this feature is an outstanding Class 1 sealed context.

SITE O:15:96

Single masonry structure.

Feature 1: There were only six sherds from this context, five plainware and one redware. The isolated nature of the structure and lack of any indication of sequential occupation or reoccupation lead me to suggest that the assemblage probably relates to a limited behavioral event and can thus be considered for Class 2 analysis despite indications from the size-density analysis (Figure 11.1) that the deposit is significantly transformed. I suggest that all sherds be considered for analysis (including body sherds), trying to take conjoining sherds into account.

SITE O:15:70

A single disturbed masonry structure and rock-lined pit or pits.

Feature 1 (masonry structure): This feature was severely disturbed through road construction; no intact deposits remain for analysis.

Feature 2 (pit): All ceramics from the site came from this feature or set of features. Even though there is the possibility of reuse given the evidence of there being more than one pit, the feature is likely to have represented fairly limited behavioral events and is therefore considered a good analytical candidate in the Class 2 analysis. I suggest we look at all sherds, taking matches into account as possible.

SITE O:15:71

Two masonry structures and a slab-lined cist.

Features 1 and 2: Both of these structures are likely to represent limited behavioral events, and even though the presence of two structures raises the question of temporally discrete events and potential depositional mixing, the fact that they are essentially adjoining may suggest at least rough contemporaneity. Therefore, this is a good candidate for Class 2 analysis and I suggest we look at all sherds, taking matches into account as possible.

OVERLOOK SITE (AZ O:15:89)

Single masonry structure and rock alignment.

Feature 1: This is an unusual context that warrants some possible special consideration. It was not included as a Class 1 context due to the low (comparatively speaking) density. It is a very large, well-constructed masonry structure that had an unusually organic and artifact-rich fill (compared to other fieldhouse sites). There were two plainware rim sherds recovered from the upper fill; both small and abraded. One plainware rim was documented in the lower fill; it was large and unabraded. Overall, there is a high frequency of ceramics in the fill of the structure. See the testing unit in this regard as well. The structure is interpreted as a seasonal fieldhouse based on the lack of a hearth and full-standing walls. Given that the artifacts and trash in the fill had to have come from somewhere, there are two possible scenarios at present: 1) the occupants of the house imported cultural fill from a nearby site (there's a small pueblo atop the hill above this site that could have been robbed) in order to level out a rough rocky substrate to make a level floor. This hypothesis would mean that the lower strata should have most of the sherds, or 2) Another structure, ramada, or perhaps even a nonstructure use area, was located nearby that postdates it and was using it for a trash dump. This would mean the trash will be mainly in the fill but could go as deep as the roof-fall. The actual situation is that there are more sherds in Strata 10/11 than in 11/19 indicating the second hypothesis is more likely. Therefore, the cultural fill will probably be fine for temporal control, but may not necessarily be behaviorally synchronous with the occupation of the structure. If the first scenario were the correct one, then the fill would be worthless for most of the ceramic studies requiring temporal control as it would be a redeposited trash assemblage that would predate the house. I recommend that as part of our Class 2 analysis, all plainware and redware rims be analyzed and that the assemblage as a whole be laid out for inspection as has been suggested above for site O:15:71.

COMPACT SITE (AZ O:15:90)

Four pithouses and horno; may be an earlier portion of AZ O:15:55.

Feature 2: Insufficient field data were obtained to decide on inclusion of this feature.

Feature 3: This is most likely not a context we should consider as it appears to be filled with transformed secondary refuse and there is a long time range evident in the site ceramics. Mixing is evident in the fill decorated wares for this feature as well.

Feature 4: There is some evidence of mixing in this feature in the form of a small Santa Cruz Red-on-buff sherd in the fill and the presence of both Red Mesa and Holbrook A or B black-on-white, which have non-overlapping temporal distributions. The feature description reports that "both the fill and floor levels had been badly disturbed by rodent and root activity." I suspect that the house dates to the Sacaton phase based on sherd size considerations and the presence of Sacaton Red-on-buff and Red Mesa Black-on-white (size class 3) in the fill. I suggest that we make this a Class 2 context and analyze all large sherds within it.

REDSTONE SITE (AZ O:15:91)

Two pithouses (one remodeled), and later reoccupation with intrusive roasting pits and possible masonry structures outside of right-of-way.

As noted by Clark (Chapter 12), this is a multicomponent site with an occupation occurring in the A.D. 850 to 950 range and one in the A.D. 1000 to 1150 range. In addition, there is a later occupation in the 1100 and 1200s that is not represented by houses in the excavated area. There are only two recorded structures, one of which was remodeled and drastically altered in size, suggesting that one of the structures dates to the Santa Cruz phase or very early Sacaton or there were other, perhaps unrecognized or unrecognizable structures that date to this time period. Feature 3 is actually a good candidate in this regard, although the archaeomagnetic date does not support this possibility. Our analysis of the site is best limited to the lower fill of Feature 11 for the Class 1 analysis. There are no other contexts that appear unmixed enough to consider for Class 2 studies.

ROOTED SITE (AZ O:15:92)

Single pithouse, possible ramada, and a disturbed small masonry pueblo; site largely destroyed through root-plowing.

Only a single pithouse (Feature 14) was excavated at this site; it has the only potential Class 1 context. The ceramics in it include a consistent set of whitewares, but both Santa Cruz and Sacaton red-on-buff are present. There are, however, 13 Sacaton Red-on-buff as opposed to 3 Santa Cruz Red-on-buff sherds, and the whitewares support a Sacaton date range. One of the Santa Cruz sherds is in Stratum 19 together with five indeterminate buffware sherds. Fifty-one decorated sherds were recovered from the fill of the structure, a high density that indicates someone nearby was tossing trash into the house. The majority of the site was destroyed through root-plowing and the presence of other features and their distributions are unknown. Therefore, there are no behavioral correlates for the trash fill, though we can infer that the fill is of temporal importance. By far the majority of the trash is in Stratum 10 and this would support the idea that the house may have been abandoned in the late Santa Cruz phase and then trash-filled during the Sacaton phase. Note that this context is probably contemporaneous with Feature 59 at Deer Creek based on both the ceramic assemblage and the archaeomagnetic dates. This should remain as a Class 1 context, though the dating for it must be left as ranging from about A.D. 930 to 1050.

ARBY'S SITE (AZ O:15:99)

Two masonry structures and linear alignment.

This site has been seriously impacted and we know very little about how extensive it may have been due to Highway 87 taking out a big chunk of it. The two excavated structures do not plot in Figure 11.1 as "good" contexts; they have small sherds in low density. But there are no obvious indications of mixing and I think it would be useful to consider the analysis of the redwares and large plainwares from Feature 1 (and possibly 5 which is superimposed atop Feature 1), if it proves possible to seriate the redwares. Otherwise, there will be no basis for dating, as there are no diagnostic decorated wares from suitable contexts.

CLOVER WASH SITE (AZ O:15:100)

Five pithouses.

The biggest concern at this site is potential mixing from an early component dating to the Gila Butte phase. Note that the archaeomagnetic dates suggest two possible pairs of contemporaneous structures (Features 1 and 3, and Features 4 and 12), which are not contemporaneous between the pairs.

Feature 1: Floor strata are considered a Class 1 context based on the sherd analysis plot (Figure 11.1), but note the presence of an intrusive pit, Feature 27, that cuts into the back wall. Both the excavators and the sherd analysis support the idea that the fill represents transformed secondary refuse of dubious contextual integrity.

Feature 3: Only the fill of this structure was selected as a potential Class 1 context by the sherd analysis plot (Figure 11.1). The structure was not burned and the floor strata probably represent some sheetwash. The fill also undoubtedly contains some sheetwash, but also secondary refuse. It is temporally unmixed based on the four diagnostic decorated sherds.

Feature 4: This pithouse was not selected by the sherd plot (Figure 11.1) due to small sherd sizes and low density. Note, however, the lack of abraded sherds and the fact that the four diagnostic decorated sherds from Stratum 10 are not necessarily mixed (with Deadman's Black-on-red [A.D. 865-1067], see Chapter 24; Holbrook A Black-on-white [A.D. 1050-1150]; and Black Mesa Black-on-white [A.D. 1000-1135]). If unmixed, the context could be dated at about A.D. 1050 to 1100. Regardless, the mixing is not serious for the resolution required in this study, if present, and this would be a good context (all strata) to consider for a Class 2 large sherd analysis.

Feature 6: This seriously damaged (root-plowed) structure had one Gila Butte Red-on-buff sherd in Stratum 19 as the only diagnostic (along with another indeterminate buffware and an indeterminate Tusayan whiteware). As there are insufficient data to determine if this sherd is in good context, no further analysis is recommended.

APPENDIX C

OSTEOLOGICAL ANALYSIS

Laura C. Fulginiti, Walter H. Birkby, and Maria H. Czuzak

The skeletal remains described in this report come from nine sites in the Rye Creek Mitigation Project. The analysis on this material was performed at the Human Identification Laboratory of the Arizona State Museum by individuals not involved in excavation of the sites.

Most of the skeletal material submitted for analysis is very fragmentary and friable. Also, it is obvious from the given weights of the cremated debris that none of the features in the site, whether viewed singularly or collectively, contain enough osseous material to represent the burned remains of even a single individual. For example, an adult female with a postmortem body weight between 100 and 110 pounds should yield a mean postcremation weight of approximately 1,430 grams. Thus, a minimum number of individuals is difficult to assess for this project due to the incomplete nature of the material.

Nonhuman animal remains recovered during human analysis of the human material was forwarded to the faunal specialist for analysis. Similarly, artifactual material (bone, antler or stone), which also was encountered, was segregated and transferred to other specialists for identification.

HARDT CREEK SITES

AZ O:15:71

The total human remains represented from this site consist solely of a 2.5-cm by 3.5-cm fragment of distal humerus, side and sex not determinable. Striations consistent with rodent teeth are present on this fragment. There is an additional smaller fragment of cancellous bone of indeterminate origin.

DEER CREEK SITES

Deer Creek Site (AZ:15:52)

The submitted osseous material from this site is represented from multiple features as itemized below. Only two of the features (Features 49 and 67) actually contain noncremated interred human remains and both of these represent infants. The cremated material appears to be mature bone.

Feature 6

Cremated cranial and postcranial skeletal debris and one anterior tooth root. Total weight: 68.55g.

Feature 31

Cremated cranial, postcranial and dental remains. Total weight: 45.98g.

Feature 37

Cremated cranial, postcranial, and dental remains. Total weight: 37.02g.

Feature 46

Cremated cranial, postcranial, and dental remains. Total weight: 111.45g.

Feature 48

Cremated cranial and postcranial bone plus two tooth root fragments (one mandibular molar and one other posterior tooth). Total weight: 9.74g.

Feature 49

The remains of a noncremated child are represented by a recovered fragmentary skull, isolated teeth, and postcranial bones. Based on dental development, the child is between two and four years of age. The permanent maxillary central incisor exhibits "shovelling", a racial dental trait characteristic of Mongoloid populations. The recovered skeletal remnants consist of nearly complete cranium, portions of the mandible, 10 permanent tooth buds, 7 deciduous teeth, 3 tooth fragments, 3 vertebral fragments (two are cervical), mid-shaft of the left clavicle, pieces of the right humerus, radius and ulna, tibia and fibula fragments, rib plus indeterminate long bone fragments.

Feature 50

Cremated cranial, postcranial, and dental remains. Total weight: 12.37g.

Feature 51

Cremated cranial and postcranial remains. Total weight: 35.0g.

Feature 52

Cremated cranial, postcranial, and dental remains. Total weight: 13.84g.

Feature 53

Cremated cranial and postcranial remains. Total weight: 36.45g.

Feature 67

Two infants represented by noncremated and fragmentary cranial, dental and postcranial remains were recovered from this feature. The infants are estimated to be 9 to 15 months and 8 to 12 months respectively based on dental eruption. The permanent maxillary central incisor fragment of the 9 to 15 month-old infant exhibits "shovelling," a basically Mongoloid dental trait.

Feature 70

Cremated cranial, postcranial, and dental remains. Total weight: 95.78g.

Feature 71

Cremated cranial, postcranial, and dental remains. Total weight: 374.47g.

Feature 82

Cremated cranial remains (semicircular canals). Total weight: 2.83g.

Feature 85

Cremated cranial, postcranial, and dental remains. Total weight: 482.37g.

Feature 87

Cremated cranial, postcranial, and dental remains. Total weight: 7.69g.

Feature 88

Cremated cranial and postcranial remains. Total weight: 62.95g.

Feature 89

Cremated dental enamel fragments. Total weight: 0.62g.

Feature 117

Cremated cranial and postcranial remains. Total weight: 24.63g.

Feature 120

Cremated postcranial remains. Total weight: 4.60g.

Hilltop Site (AZ O:15:53)

The total submitted material consists solely of a burned bone fragment weighing only 0.26g. The specimen bears no morphological characteristics which would allow a determination of human or nonhuman origin.

CLOVER WASH SITES

Clover Wash Site (AZ O:15:100)

Osseous debris from this site was recovered from four features. Feature 16 yielded a single bone fragment (0.15g), which was too minute to ascertain if human or nonhuman in origin. Feature 8 bone consisted of approximately 5.4g of cremated fragments too tiny to determine if from a human or nonhuman source. Feature 21 had burned bone debris of minuscule weight (0.23g) which was also of questionable origin. Feature 25 consisted of the fragmentary and friable unburned cranial and postcranial skeletal remains of a human fetus. A single nonerupted dental bud (possible the maxillary lateral incisor) was present.

Redstone Site (AZ O:15:91)

The total array of skeletal material from this site represents nonidentifiable burned bone recovered from seven different features. The debris ranges from a single fragment up to 35+ fragments. None are morphologically diagnostic as coming from either a human or nonhuman source.

RYE CREEK SITES

Rooted Site (AZ O:15:92)

Feature 15

Human skeletal remains from Feature 15 are those of an infant, probably aged from birth to two months based on the size of the deciduous first molar tooth bud and the development of the right temporal petrous and fragmentary long bones. These are the only submitted skeletal elements from this feature.

Feature 13

The human remains from Feature 13 are those of an infant aged approximately one to two years based on the dentition and the size of the long bone diaphyses. A possible skeletal pathology is observed on the cranial elements wherein there is a noticable increase in the diploic thickness of several of the vault fragments. Diploic expansion has been associated with some forms of probable acquired anemia. The recovered human remains from this feature consist only of cranial fragments and one bud of deciduous molar.

Cobble Site (AZ O:15:54)

Feature 10

The human bones are unburned and fragmentary and represent the remains of an interred fetus aged approximately six to nine lunar months. The age determination is based on the completeness of mineralization of the deciduous anterior and posterior dentition and a left radius length of approximately 50 mm. Other preserved skeletal material consists of the following elements: cranial fragments including two malleus, one petrous portion of right temporal bone, occipital; two maxillary incisor buds, one canine bud, one first deciduous molar bud; fragments of right scapula, clavicle, and humerus; femur; rib and vertebral fragments.

Boone Moore Site (AZ O:15:55)

Feature 3

Feature 3 contains fragmentary and friable bone debris representative of a probable middle-aged adult female. The sex is based on mandibular morphology and the age is predicted on the antemortem tooth loss and second to third degree dental attrition on the two recovered anterior teeth. These two teeth (lower right lateral incisor and canine) each exhibit cervical caries (distal on the former and facial on the latter). Antemortem tooth loss is evident bilaterally for the posterior dentition with the possible exception of the left first premolar and right second premolar. Other skeletal remains from this feature are fragments of pelvis and sacrum (non-sex-diagnostic), fragments of long bones including left femur and scapula, right radius, plus fragments of femur, humerus, clavicle and ribs (side not determinable) and vertebral fragments from cervical and lumbar portions of the spinal column.

Feature 6

The human remains recovered from Feature 6 consist solely of a human proximal phalanx of an adult toe. The bone is without pathology.

Feature 7

The human material from Feature 7 consists of the incomplete fragmentary and friable bones of an adult male from a primary inhumation. The sex is based on pelvic fragments. The remains consist of the following skeletal and dental elements. Twenty-eight teeth are present representing 13 upper and 12 lower dentition plus three molars from indeterminate positions. Not recovered from the debris are one upper premolar and three other molar teeth from either dental arcade (if one assumes a full complement). Skeletal remnants consist of cranial and mandibular fragments; fragments of the right humerus, radius, ulna, femur, tibia, fibula, talus, metacarpals/tarsals, and phalanges; and fragments of the left humerus, radius, patella, femur tibia, fibula, metacarpals/tarsals, and phalanges. In addition there are identifiable fragments of the pelvic girdle, including the acetabulum, plus possible rib fragments. The anterior maxillary dentition is "shovel-shaped," especially the left lateral incisor, which is "3/4 double shoveled." Shovelling plus an observed enamel extension on the mandibular molar are basically Mongoloid racial characteristics.

Feature 8

Feature 8 contains the remains of a 6- to 12-month old infant. The age is based on dental maturation. The fragmentary remains consist of cranial elements including occipital, temporal and possible parietal bones, long bones, vertebral and rib fragments, and isolated teeth. The dentition is represented by seven deciduous incisors, two deciduous molars, one permanent premolar, and one permanent incisor.

Feature 11

Feature 11 consists of at least two adult individuals, one male and one female. Sex is based on overall robusticity of long bones and mandibular morphology. There are no pelvic or cranial elements associated with these remains. Recovered elements are primarily long bone diaphyses, carpals and tarsals, metacarpals and metatarsals, and hand and foot phalanges. There is evidence of a fracture with dislocation on one proximal hand phalanx. No other pathologies are observed. Some of the diaphyses exhibit gnaw marks consistent with the incisors of rodents. There is no evidence of perimortem cut marks on any of the bones; however, probably recent trowel cuts were noted on some diaphyses.

Two features (postholes) designated as 11-3 and 11-5 yielded respectively one adult permanent molar, and one right mandibular premolar plus a fragment of long bone diaphysis.

Feature 12

The submitted skeletal debris from Feature 12 consists of fragments of epiphyses (bone of origin not determinable), a fragment of the head of either a subadult humerus or femur, a fragment of subadult radius (side not determinable), fragments of an adult left femur, plus fragmentary humerus, long bone, and phalanx diaphyses.

Feature 17

The scanty skeletal debris submitted from Feature 17 consists of a deciduous maxillary molar, five fragments of the right parietal of a child, three occipital fragments, and a possible rib fragment.

Feature 21

The subadult skeletal remains from Feature 21 consist of portions of the frontal, right and left petrous of the temporals, fragments of the right clavicle glenoid fossa and scapula, humerus, radius, ulna, femur, tibia, and fibula; fragments of the left clavicle, humerus, radius, ulna, femur, tibia, and fibula; fragmentary ribs (eight right, seven left, 17 indeterminate), multiple vertebral fragments, and hand phalanges. Age and sex are not determinable from the available skeletal remains.

Feature 23

Feature 23 contain cranial, rib and metacarpal/metatarsal fragments from a probable neonate. Age and sex are not determinable from the submitted remains.

Rye Creek Ruin (AZ O:15:1)

Feature 1

Human skeletal remains from this feature consist of two left maxillary fragments plus an isolated deciduous upper left second molar from a child under two years of age, an adult canine tooth bud and an adult hand phalanx. Other osseous remains from this feature include burned and unburned fragments of questionable human origin. One unburned fragment appears to be worked bone.

Feature 3

The submitted material from this feature consists of a single burned fragment which is of questionable human origin. The bone appears to be worked (i.e., cut and smoothed) on its greater end.

APPENDIX D

ARCHAEOMAGNETIC DATA

William L. Deaver

Table D.1. Archaeological information on Rye Creek archaeomagnetic samples.

Site	Sample #	Feature #	Feature Type	Field Estimate of Archaeological Age
AZ O:15:52	DI001	32-1	Hearth	Sweetwater/Gila Butte
	DI002	14-3	Hearth	Gila Butte
	DI003	18-1	Hearth	Gila Butte
	DI004	13-1	Firepit	Sacaton
	DI005	11	Firepit or burned floor	Gila Butte
	DI006	65-1	Hearth	Gila Butte
	DI007	59-1	Hearth	Gila Butte
	DI008	25	Firepit or burned floor	Gila Butte
	DI009	21-3	Hearth	Gila Butte
	DI010	2-2	Firepit	Gila Butte
	DI011	71	Crematorium	Gila Butte
	DI012	22-1	Hearth	Gila Butte
AZ O:15:91	DI013	5-2	Hearth	Late Pueblo II
	DI014	11-4	Hearth	Late Pueblo II
AZ O:15:100	DI015	3-2	Hearth	Sedentary
	DI016	4-1	Hearth	Sedentary
	DI026	12-1	Hearth	Sedentary
	DI027	1-1	Hearth	Sedentary
AZ O:15:92	DI017	14-8	Firepit	Sedentary
AZ O:15:55	DI018	11-1	Hearth	Sedentary-Classic transition
	DI019	19-1	Hearth	Sedentary-Classic transition

Table D.1. Continued.

Site	Sample #	Feature #	Feature Type	Field Estimate of Archaeological Age
	DI020	1-1	Hearth	Sedentary-Classic transition
	DI021	6-1	Hearth	Sedentary-Classic transition
AZ O:15:55	DI022	5-1	Hearth	Sedentary-Classic transition
	DI023	9-1	Hearth	Sedentary-Classic transition
AZ O:15:90	DI024	4-1	Hearth	Sedentary
	DI025	6	Horno	Sedentary or Classic
AZ O:15:54	DI028	9-1	Firepit	Classic

Table D.2. Absolute archaeomagnetic dates (in years A.D.).

Sample	Curve CSU SWCV 588	Sternberg 1982
DI001	1. 700-870	No date
DI002	1. 745-860	No date
DI003	1. 705-860	1. 700-800
DI004	1. 650-755 2. 900-940	1. 700-950
DI005	1. 705-865	No date
DI006	1. 655-765 2. 820-940	1. 700-850
DI007	1. 630-695 2. 910-1030 3. 1325-1485 4. 1510-1645	1. 900-1050 2. 1300-1475
DI008	1. 700-870	No date
DI009	1. 700-860	No date
DI010	1. 655-755	1. 700-950
DI011	1. 725-855	No date
DI012	1. 705-860	No date
DI013	1. 630-670 2. 995-1280	1. 1000-1200
DI014	1. 990-1130 2. 1145-1325	1. 1000-1150
DI015	1. 630-670 2. 1000-1195	1. 1000-1150
DI016	1. 630-675 2. 925-1125 3. 1145-1350	1. 1000-1325
DI017	1. 630-690 2. 920-1035 3. 1300-1485	1. 950-1050 2. 1300-1475
DI018	1. 630-675 2. 980-1115 3. 1150-1325	1. 1100-1300
DI019	1. 630-685 2. 920-1115 3. 1150-1410 4. 1515-1565	1. 950-1400
DI020	1. 630-685 2. 920-1045 3. 1160-1305	1. 950-1050 2. 1150-1350

Table D.2. Continued.

Sample	Curve CSU SWCV 588	Sternberg 1982
DI021	1. 630-680 2. 925-1110 3. 1150-1330	1. 950-1050 2. 1100-1350
DI022	1. 630-680 2. 980-1050 3. 1060-1100 4. 1155-1335	1. 1100-1350
DI023	1. 630-690 2. 915-1035 3. 1530-1615	1. 850-1050
DI024	1. 995-1210 2. 1215-1270	1. 1000-1175
DI025	1. 630-690 2. 925-1035	1. 950-1050
DI026	1. 630-670 2. 990-1130 3. 1145-1335	1. 1000-1200
DI027	1. 1100-1150	1. 1050-1100
DI028	1. 630-695 2. 915-1030 3. 1425-1485 4. 1510-1560	1. 900-1050 2. 1300-1475

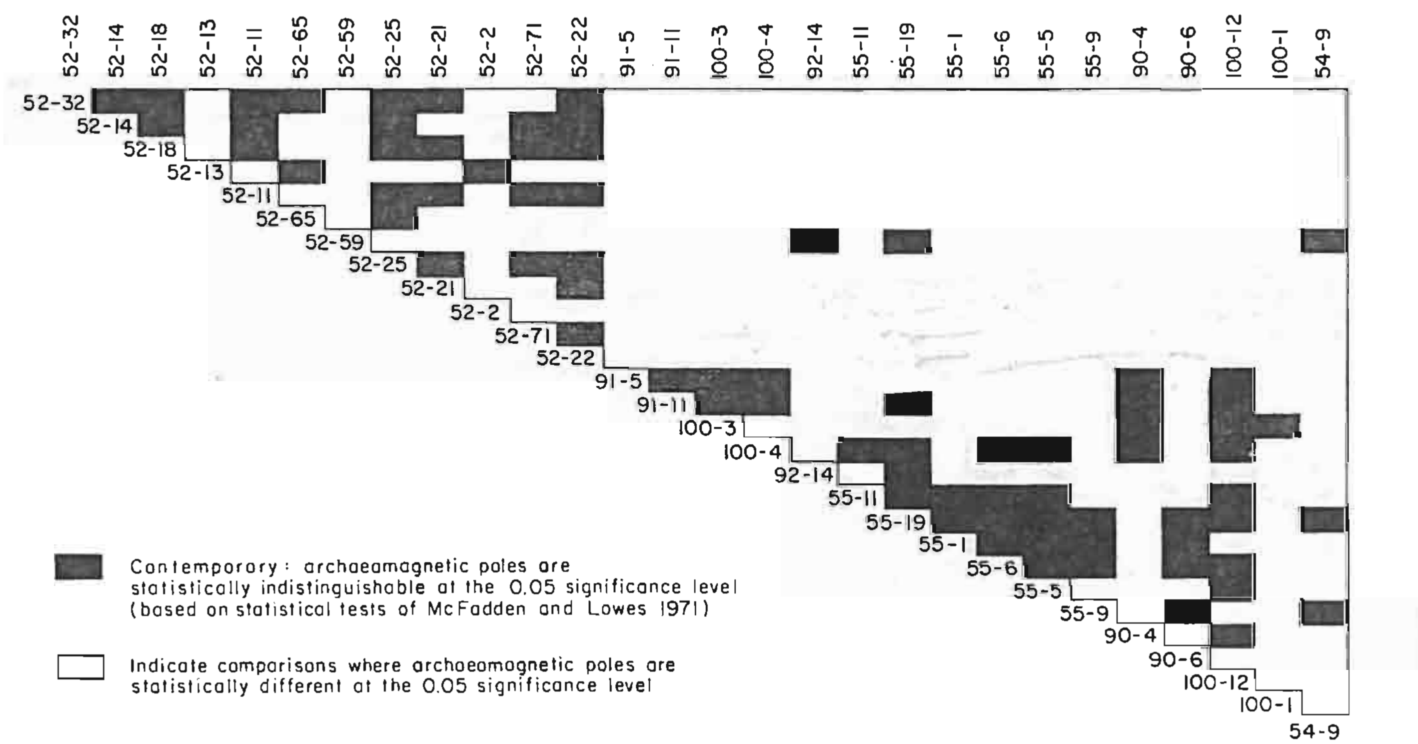


Figure D.1. Temporal relationships of archaeomagnetic samples recovered from the Rye Creek Project.

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI001 Field Number: IAR001

Provenience: AZ O:15:52 (ASM), Feature 32-1, hearth

Collector: William L. Deaver Date: 28 and 29 June 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 20 No. used for final results (N2): 19

Mean Archaeomagnetic Inclination: 45.30°

Mean Archaeomagnetic Declination: 3.47°

Mean Magnetization (JR): 4.1923E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.8°

Precision Parameter (k): 334.50

Latitude of Virtual Geomagnetic Pole (PLAT): 82.16°

Longitude of Virtual Geomagnetic Pole (PLONG): 45.29°

Semi-major axis of 95% oval of confidence around pole (DM): 2.33°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.48°

Outlier Specimens and Criteria for Deletion: H, noted as loose in field

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 700 - 870	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.

Signed: ______________ Date: 1 May '90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI002 Field Number: IAR002

Provenience: AZ O:15:52 (ASM), Feature 14-3, hearth

Collector: William L. Deaver Date: 29 June 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 14 No. used for final results (N2): 14

Mean Archaeomagnetic Inclination: 43.17°

Mean Archaeomagnetic Declination: 2.24°

Mean Magnetization (JR): 4.3339E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.1°

Precision Parameter (k): 1326.79

Latitude of Virtual Geomagnetic Pole (PLAT): 80.86°

Longitude of Virtual Geomagnetic Pole (PLONG): 55.76°

Semi-major axis of 95% oval of confidence around pole (DM): 1.36°

Semi-minor axis of 95% oval of confidence around pole (DP): 0.84°

Outlier Specimens and Criteria for Deletion: None

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 745 - 860	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI003 Field Number: IAR003

Provenience: AZ O:15:52 (ASM), Feature 18-1, hearth

Collector: William L. Deaver Date: 1 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 42.94°

Mean Archaeomagnetic Declination: 2.46°

Mean Magnetization (JR): 7.7641E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.6°

Precision Parameter (k): 269.34

Latitude of Virtual Geomagnetic Pole (PLAT): 80.64°

Longitude of Virtual Geomagnetic Pole (PLONG): 54.80°

Semi-major axis of 95% oval of confidence around pole (DM): 3.28°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.03°

Outlier Specimens and Criteria for Deletion: None

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 705 - 860	1. A.D. 700 - 800
2. A.D.	2. A.D.
3. A.D.	3. A.D.

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI004 Field Number: IAR004

Provenience: AZ O:15:52 (ASM), Feature 13-1, firepit

Collector: William L. Deaver Date: 1 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 11

Mean Archaeomagnetic Inclination: 51.04°

Mean Archaeomagnetic Declination: 1.33°

Mean Magnetization (JR): 7.7618E-02 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.4°

Precision Parameter (k): 354.43

Latitude of Virtual Geomagnetic Pole (PLAT): 87.41°

Longitude of Virtual Geomagnetic Pole (PLONG): 42.66°

Semi-major axis of 95% oval of confidence around pole (DM): 3.29°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.22°

Outlier Specimens and Criteria for Deletion: H, aberrant inclination

Remarks: Specimen H did not respond to demagnetization as did other specimens, however, by 30 mT the inclination had shallowed within the range of the other specimens.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 650 - 755	1. A.D. 700 - 950
2. A.D. 900 - 940	2. A.D.
3. A.D.	3. A.D.

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI005 Field Number: IAR005

Provenience: AZ O:15:52 (ASM), Feature 11, firepit or burned floor

Collector: William L. Deaver Date: 1 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 44.82°

Mean Archaeomagnetic Declination: 2.04°

Mean Magnetization (JR): 1.6814E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.8°

Precision Parameter (k): 587.20

Latitude of Virtual Geomagnetic Pole (PLAT): 82.16°

Longitude of Virtual Geomagnetic Pole (PLONG): 55.11°

Semi-major axis of 95% oval of confidence around pole (DM): 2.26°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.43°

Outlier Specimens and Criteria for Deletion: None

Remarks: None

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 705 - 865	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.

Signed: [signature]

Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI006 Field Number: IAR006

Provenience: AZ O:15:52 (ASM), Feature 65-1, hearth

Collector: William L. Deaver Date: 2 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 48.06°

Mean Archaeomagnetic Declination: 2.90°

Mean Magnetization (JR): 2.5628E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.0°

Precision Parameter (k): 451.41

Latitude of Virtual Geomagnetic Pole (PLAT): 84.45°

Longitude of Virtual Geomagnetic Pole (PLONG): 41.37°

Semi-major axis of 95% oval of confidence around pole (DM): 2.67°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.75°

Outlier Specimens and Criteria for Deletion: None

Remarks: This sample is stratigraphically earlier than DI007.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 655 - 765	1. A.D. 700 - 850
2. A.D. 820 - 940	2. A.D.
3. A.D.	3. A.D.

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI007 Field Number: IAR007

Provenience: AZ O:15:52 (ASM), Feature 59-1, hearth

Collector: William L. Deaver Date: 2 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 15 No. used for final results (N2): 15

Mean Archaeomagnetic Inclination: 57.05°

Mean Archaeomagnetic Declination: 357.12°

Mean Magnetization (JR): 1.8233E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.7°

Precision Parameter (k): 495.61

Latitude of Virtual Geomagnetic Pole (PLAT): 85.72°

Longitude of Virtual Geomagnetic Pole (PLONG): 216.46°

Semi-major axis of 95% oval of confidence around pole (DM): 2.50°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.82°

Outlier Specimens and Criteria for Deletion: None

Remarks: This sample was given an estimated archaeological age of Gila Butte. However, the direction and resulting VGP are inconsistent with a Gila Butte age for this sample, but are more consistent with an early Sedentary age. This sample is stratigraphically later than DI006.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 695	1. A.D. 900 - 1050
2. A.D. 910 - 1030	2. A.D. 1300 - 1475
3. A.D. 1325 - 1485	3. A.D.
4. A.D. 1510 - 1645	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI008 Field Number: IAR008

Provenience: AZ O:15:52 (ASM), Feature 25, firepit or burned floor

Collector: William L. Deaver Date: 2 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 45.36°

Mean Archaeomagnetic Declination: 2.21°

Mean Magnetization (JR): 1.3153E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.9°

Precision Parameter (k): 542.03

Latitude of Virtual Geomagnetic Pole (PLAT): 82.55°

Longitude of Virtual Geomagnetic Pole (PLONG): 53.26°

Semi-major axis of 95% oval of confidence around pole (DM): 2.37°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.50°

Outlier Specimens and Criteria for Deletion: None

Remarks: None

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 700 - 870	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI009 Field Number: IAR009

Provenience: AZ O:15:52 (ASM), Feature 21-3, hearth

Collector: William L. Deaver Date: 3 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 15 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 11

Mean Archaeomagnetic Inclination: 45.48°

Mean Archaeomagnetic Declination: 1.04°

Mean Magnetization (JR): 1.0018E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.6°

Precision Parameter (k): 810.96

Latitude of Virtual Geomagnetic Pole (PLAT): 82.84°

Longitude of Virtual Geomagnetic Pole (PLONG): 61.20°

Semi-major axis of 95% oval of confidence around pole (DM): 2.04°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.30°

Outlier Specimens and Criteria for Deletion: A, aberrant direction.

Remarks: None

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 700 - 860	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI010 Field Number: IAR010

Provenience: AZ O:15:52 (ASM), Feature 2-2, firepit

Collector: William L. Deaver Date: 3 July 1989

Magnetic Declination at Sampling Site: 12.17^{o} (sun compass measured)

Geographic Latitude: 34.06^{o} and Longitude: 248.63^{o} of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 20 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 11

Mean Archaeomagnetic Inclination: 48.45^{o}

Mean Archaeomagnetic Declination: 358.07^{o}

Mean Magnetization (JR): 4.7020E-02 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.6^{o}

Precision Parameter (k): 315.28

Latitude of Virtual Geomagnetic Pole (PLAT): 85.09^{o}

Longitude of Virtual Geomagnetic Pole (PLONG): 88.65^{o}

Semi-major axis of 95% oval of confidence around pole (DM): 3.38^{o}

Semi-minor axis of 95% oval of confidence around pole (DP): 2.22^{o}

Outlier Specimens and Criteria for Deletion: F, aberrant direction.

Remarks: None

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 655 - 755	1. A.D. 700 - 950
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI011 Field Number: IAR011

Provenience: AZ O:15:52 (ASM), Feature 71, crematiorium

Collector: William L. Deaver Date: 4 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 42.71°

Mean Archaeomagnetic Declination: 1.56°

Mean Magnetization (JR): 1.7239E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.6°

Precision Parameter (k): 762.35

Latitude of Virtual Geomagnetic Pole (PLAT): 80.61°

Longitude of Virtual Geomagnetic Pole (PLONG): 59.89°

Semi-major axis of 95% oval of confidence around pole (DM): 1.94°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.20°

Outlier Specimens and Criteria for Deletion: None.

Remarks: Contrary to field estimates, the intensity indicates a hot burning.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 725 - 855	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI012 Field Number: IAR012

Provenience: AZ O:15:52 (ASM), Feature 22-1, hearth

Collector: William L. Deaver Date: 4 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.06° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 43.92°

Mean Archaeomagnetic Declination: 1.09°

Mean Magnetization (JR): 1.1195E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.2°

Precision Parameter (k): 394.98

Latitude of Virtual Geomagnetic Pole (PLAT): 81.60°

Longitude of Virtual Geomagnetic Pole (PLONG): 61.89°

Semi-major axis of 95% oval of confidence around pole (DM): 2.74°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.71°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 705 - 860	1. A.D. NO DATE
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI013 Field Number: IAR013

Provenience: AZ O:15:91 (ASM), Feature 5-2, hearth

Collector: William L. Deaver Date: 5 July 1989

Magnetic Declination at Sampling Site: 12.17^{o} (sun compass measured)

Geographic Latitude: 34.08^{o} and Longitude: 248.63^{o} of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 60.83^{o}

Mean Archaeomagnetic Declination: 344.90^{o}

Mean Magnetization (JR): 1.0497E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 3.0^{o}

Precision Parameter (k): 206.22

Latitude of Virtual Geomagnetic Pole (PLAT): 75.81^{o}

Longitude of Virtual Geomagnetic Pole (PLONG): 196.27^{o}

Semi-major axis of 95% oval of confidence around pole (DM): 4.63^{o}

Semi-minor axis of 95% oval of confidence around pole (DP): 3.54^{o}

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 670	1. A.D. 1000 - 1200
2. A.D. 995 - 1280	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI014 Field Number: IAR014

Provenience: AZ O:15:91 (ASM), Feature 11-4, hearth

Collector: William L. Deaver Date: 5 July 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 61.29°

Mean Archaeomagnetic Declination: 347.92°

Mean Magnetization (JR): 3.1370E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.3°

Precision Parameter (k): 1047.15

Latitude of Virtual Geomagnetic Pole (PLAT): 77.41°

Longitude of Virtual Geomagnetic Pole (PLONG): 203.49°

Semi-major axis of 95% oval of confidence around pole (DM): 2.06°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.59°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 990 - 1130	1. A.D. 1000 - 1150
2. A.D. 1145 - 1325	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI015 Field Number: IAR015

Provenience: AZ O:15:100 (ASM), Feature 3-2, hearth

Collector: Barbara A. Murphy Date: 22 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.07° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 61.32°

Mean Archaeomagnetic Declination: 343.38°

Mean Magnetization (JR): 9.1229E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 3.0°

Precision Parameter (k): 210.43

Latitude of Virtual Geomagnetic Pole (PLAT): 74.54°

Longitude of Virtual Geomagnetic Pole (PLONG): 196.25°

Semi-major axis of 95% oval of confidence around pole (DM): 4.61°

Semi-minor axis of 95% oval of confidence around pole (DP): 3.55°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 670	1. A.D. 1000 - 1150
2. A.D. 1000 - 1195	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI016 Field Number: IAR016

Provenience: AZ O:15:100 (ASM), Feature 4-1, hearth

Collector: William L. Deaver Date: 22 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.07° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 60.56°

Mean Archaeomagnetic Declination: 350.14°

Mean Magnetization (JR): 9.8696E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.2°

Precision Parameter (k): 386.77

Latitude of Virtual Geomagnetic Pole (PLAT): 79.22°

Longitude of Virtual Geomagnetic Pole (PLONG): 205.37°

Semi-major axis of 95% oval of confidence around pole (DM): 3.37°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.56°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 675	1. A.D. 1000 - 1325
2. A.D. 925 - 1125	2. A.D.
3. A.D. 1145 - 1350	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI017 Field Number: IAR017

Provenience: AZ O:15:92 (ASM), Feature 14-8, firepit

Collector: William L. Deaver Date: 23 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 59.27°

Mean Archaeomagnetic Declination: 357.24°

Mean Magnetization (JR): 1.6759E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.4°

Precision Parameter (k): 901.12

Latitude of Virtual Geomagnetic Pole (PLAT): 83.62°

Longitude of Virtual Geomagnetic Pole (PLONG): 229.29°

Semi-major axis of 95% oval of confidence around pole (DM): 2.17°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.62°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 690	1. A.D. 950 - 1050
2. A.D. 920 - 1035	2. A.D. 1300 - 1475
3. A.D. 1300 - 1485	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI018 Field Number: IAR018

Provenience: AZ O:15:55 (ASM), Feature 11-1, hearth

Collector: William L. Deaver Date: 23 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 58.52°

Mean Archaeomagnetic Declination: 349.61°

Mean Magnetization (JR): 1.5302E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.2°

Precision Parameter (k): 1390.68

Latitude of Virtual Geomagnetic Pole (PLAT): 80.21°

Longitude of Virtual Geomagnetic Pole (PLONG): 193.41°

Semi-major axis of 95% oval of confidence around pole (DM): 1.73°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.28°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 675	1. A.D. 1100 - 1300
2. A.D. 980 - 1115	2. A.D.
3. A.D. 1150 - 1325	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI019 Field Number: IAR019

Provenience: AZ O:15:55 (ASM), Feature 19-1, hearth

Collector: Barbara A. Murphy Date: 23 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 11

Mean Archaeomagnetic Inclination: 59.19°

Mean Archaeomagnetic Declination: 352.66°

Mean Magnetization (JR): 9.0631E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 3.1°

Precision Parameter (k): 211.51

Latitude of Virtual Geomagnetic Pole (PLAT): 81.69°

Longitude of Virtual Geomagnetic Pole (PLONG): 205.98°

Semi-major axis of 95% oval of confidence around pole (DM): 4.71°

Semi-minor axis of 95% oval of confidence around pole (DP): 3.52°

Outlier Specimens and Criteria for Deletion: E, noted as loose in field.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 685	1. A.D. 950 - 1400
2. A.D. 920 - 1115	2. A.D.
3. A.D. 1150 - 1410	3. A.D.
4. A.D. 1515 - 1560	

Signed: Date:

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI020 Field Number: IAR020

Provenience: AZ O:15:55 (ASM), Feature 1-1, hearth

Collector: William L. Deaver Date: 23 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 56.78°

Mean Archaeomagnetic Declination: 351.49°

Mean Magnetization (JR): 8.0700E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.3°

Precision Parameter (k): 344.81

Latitude of Virtual Geomagnetic Pole (PLAT): 82.35°

Longitude of Virtual Geomagnetic Pole (PLONG): 186.49°

Semi-major axis of 95% oval of confidence around pole (DM): 3.40°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.46°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 685	1. A.D. 950 - 1050
2. A.D. 920 - 1045	2. A.D. 1150 - 1350
3. A.D. 1160 - 1305	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI021 Field Number: IAR021

Provenience: AZ O:15:55 (ASM), Feature 6-1, hearth

Collector: Barbara A. Murphy Date: 24 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 57.74°

Mean Archaeomagnetic Declination: 350.46°

Mean Magnetization (JR): 1.7089E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.3°

Precision Parameter (k): 365.62

Latitude of Virtual Geomagnetic Pole (PLAT): 81.19°

Longitude of Virtual Geomagnetic Pole (PLONG): 190.60°

Semi-major axis of 95% oval of confidence around pole (DM): 3.34°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.45°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 680	1. A.D. 950 - 1050
2. A.D. 925 - 1110	2. A.D. 1100 - 1350
3. A.D. 1150 - 1330	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI022 Field Number: IAR022

Provenience: AZ O:15:55 (ASM), Feature 5-1, hearth

Collector: William L. Deaver Date: 24 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 58.86°

Mean Archaeomagnetic Declination: 350.83°

Mean Magnetization (JR): 6.17830-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.4°

Precision Parameter (k): 963.28

Latitude of Virtual Geomagnetic Pole (PLAT): 80.82°

Longitude of Virtual Geomagnetic Pole (PLONG): 198.28°

Semi-major axis of 95% oval of confidence around pole (DM): 2.08°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.55°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 680	1. A.D. 1100 - 1350
2. A.D. 980 - 1050	2. A.D.
3. A.D. 1060 - 1100	3. A.D.
4. A.D. 1155 - 1335	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI023 Field Number: IAR023

Provenience: AZ O:15:55 (ASM), Feature 9-1, hearth

Collector: William L. Deaver Date: 24 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

<u>Archaeomagnetic Results</u>

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 54.80°

Mean Archaeomagnetic Declination: 352.96°

Mean Magnetization (JR): 4.6199E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 2.7°

Precision Parameter (k): 251.01

Latitude of Virtual Geomagnetic Pole (PLAT): 84.08°

Longitude of Virtual Geomagnetic Pole (PLONG): 172.78°

Semi-major axis of 95% oval of confidence around pole (DM): 3.88°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.75°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

<u>Date Interpretations at 95% Confidence</u>

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 690	1. A.D. 850 - 1050
2. A.D. 915 - 1035	2. A.D.
3. A.D. 1530 - 1615	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI024 Field Number: IAR024

Provenience: AZ O:15:90 (ASM), Feature 4-1, hearth

Collector: Barbara A. Murphy Date: 24 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 60.16°

Mean Archaeomagnetic Declination: 345.87°

Mean Magnetization (JR): 9.2285E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.8°

Precision Parameter (k): 571.86

Latitude of Virtual Geomagnetic Pole (PLAT): 76.82°

Longitude of Virtual Geomagnetic Pole (PLONG): 194.81°

Semi-major axis of 95% oval of confidence around pole (DM): 2.75°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.08°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 995 - 1210	1. A.D. 1000 - 1175
2. A.D. 1215 - 1270	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

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ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI025 Field Number: LAR025

Provenience: AZ O:15:90 (ASM), Feature 6, horno

Collector: William L. Deaver Date: 24 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 56.32°

Mean Archaeomagnetic Declination: 352.43°

Mean Magnetization (JR): 3.4662E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.4°

Precision Parameter (k): 917.24

Latitude of Virtual Geomagnetic Pole (PLAT): 83.23°

Longitude of Virtual Geomagnetic Pole (PLONG): 185.24°

Semi-major axis of 95% oval of confidence around pole (DM): 2.07°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.49°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 690	1. A.D. 950 - 1050
2. A.D. 925 - 1035	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI026 Field Number: IAR026

Provenience: AZ O:15:100 (ASM), Feature 12-1, hearth

Collector: William L. Deaver Date: 25 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.07° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 60.64°

Mean Archaeomagnetic Declination: 349.36°

Mean Magnetization (JR): 1.3936E+00 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.8°

Precision Parameter (k): 598.25

Latitude of Virtual Geomagnetic Pole (PLAT): 78.72°

Longitude of Virtual Geomagnetic Pole (PLONG): 203.80°

Semi-major axis of 95% oval of confidence around pole (DM): 2.71°

Semi-minor axis of 95% oval of confidence around pole (DP): 2.06°

Outlier Specimens and Criteria for Deletion: None.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 670	1. A.D. 1000 - 1200
2. A.D. 990 - 1130	2. A.D.
3. A.D. 1145 - 1335	3. A.D.
4. A.D.	

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI027 Field Number: IAR027

Provenience: AZ O:15:100 (ASM), Feature 1-1, hearth

Collector: Barbara A. Murphy Date: 25 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.07° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 12

Mean Archaeomagnetic Inclination: 60.00°

Mean Archaeomagnetic Declination: 337.47°

Mean Magnetization (JR): 1.8955E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 3.1°

Precision Parameter (k): 201.86

Latitude of Virtual Geomagnetic Pole (PLAT): 70.93°

Longitude of Virtual Geomagnetic Pole (PLONG): 186.20°

Semi-major axis of 95% oval of confidence around pole (DM): 4.63°

Semi-minor axis of 95% oval of confidence around pole (DP): 3.50°

Outlier Specimens and Criteria for Deletion: None.

Remarks: Mean VGP has a low latitude that is marginal to the curves. It does not however seem aberrant, other samples occur in the same region. Thus the curves may not reflect some feature of the secular variation represented by this sample.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 1100 - 1150	1. A.D. 1050 - 1100
2. A.D.	2. A.D.
3. A.D.	3. A.D.
4. A.D.	

Signed: [signature] Date: 1 May 90

ARCHAEOMAGNETIC PROGRAM, ARIZONA STATE MUSEUM

ARCHAEOMAGNETIC DATA REPORT

Lab Number: DI028 Field Number: IAR028

Provenience: AZ O:15:54 (ASM), Feature 9-1, firepit

Collector: Barbara A. Murphy Date: 25 August 1989

Magnetic Declination at Sampling Site: 12.17° (sun compass measured)

Geographic Latitude: 34.08° and Longitude: 248.63° of Sampling Site

Archaeomagnetic Results

Optimum Alternating Field used for Demagnetiztion (H): 10 milli Teslas

Total specimens submitted (N1): 12 No. used for final results (N2): 11

Mean Archaeomagnetic Inclination: 56.38°

Mean Archaeomagnetic Declination: 355.92°

Mean Magnetization (JR): 5.9579E-01 amperes/meter

Radius of 95% circle of confidence around mean direction (a95): 1.2°

Precision Parameter (k): 1459.60

Latitude of Virtual Geomagnetic Pole (PLAT): 85.61°

Longitude of Virtual Geomagnetic Pole (PLONG): 200.55°

Semi-major axis of 95% oval of confidence around pole (DM): 1.73°

Semi-minor axis of 95% oval of confidence around pole (DP): 1.25°

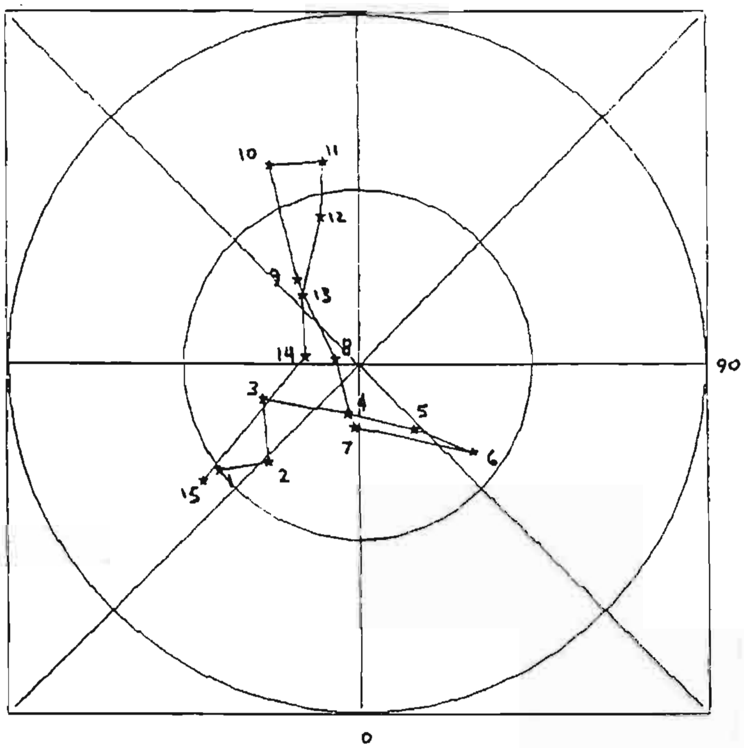
Outlier Specimens and Criteria for Deletion: B, aberrant direction.

Remarks: None.

Date Interpretations at 95% Confidence

Curve: CSU588	Curve: UA1982
1. A.D. 630 - 670	1. A.D. 1000 - 1200
2. A.D. 990 - 1130	2. A.D.
3. A.D. 1145 - 1335	3. A.D.
4. A.D.	

Signed: [signature] Date: 1 May 90



1. Red Mountain
2. Vahki
3. Estrella
4. Sweetwater
5. Snaketown
6. Gila Butte
7. Santa Cruz
8. Santa Cruz/Sacaton transition
9. Early Sedentary
10. Middle/Late Sedentary
11. Sedentary/Classic transition
12. Soho
13. Civano
14. Post Classic
15. Early Historic

Figure D.2. Relative Hohokam SWVGP Curve.

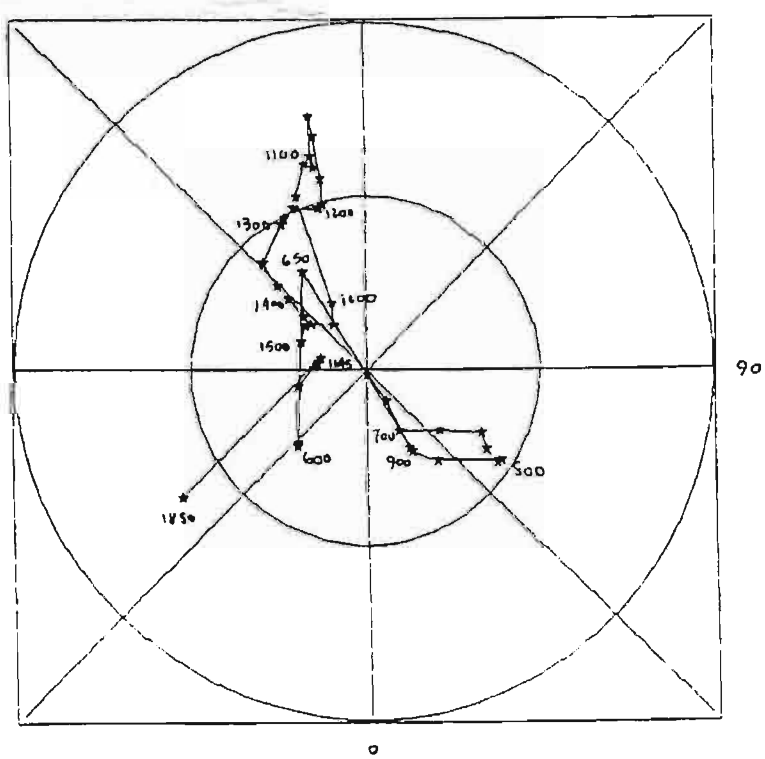


Figure D.3. CSU SWVGP Curve SWCV588.

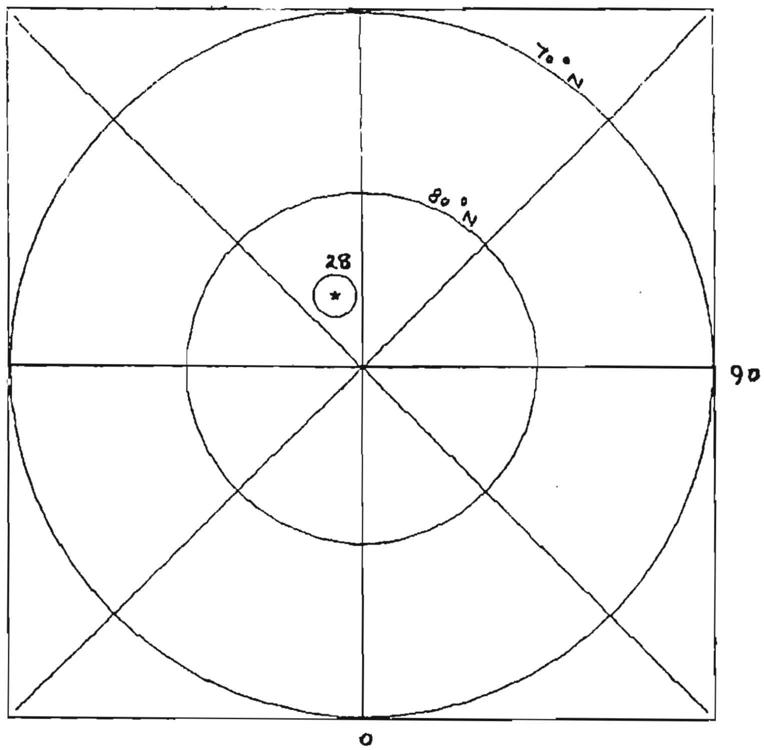


Figure D.4. VGPs for the Cobble site (AZ O:15:54 [ASM]).

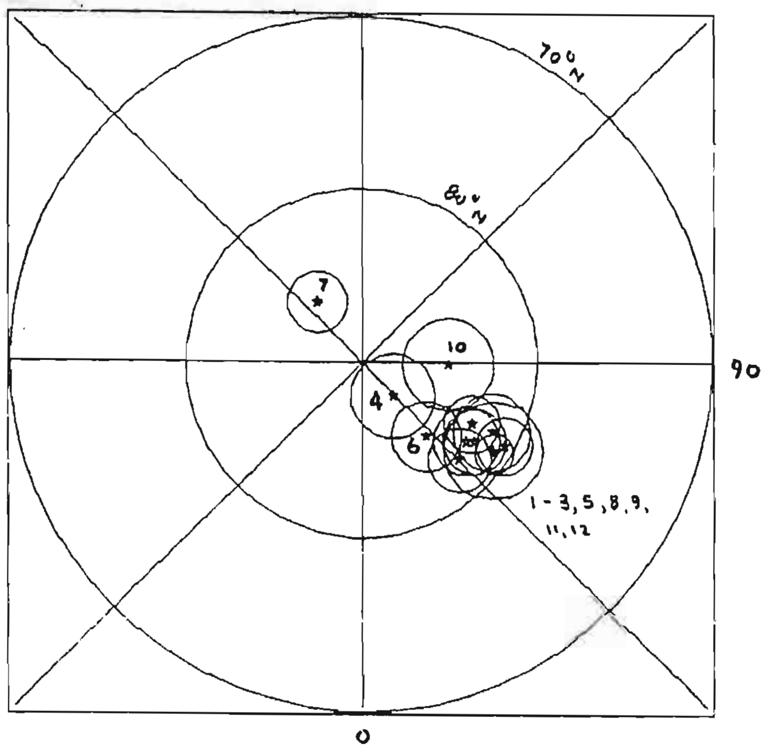


Figure D.5. VGPs for the Deer Creek site (AZ O:15:52 [ASM]).

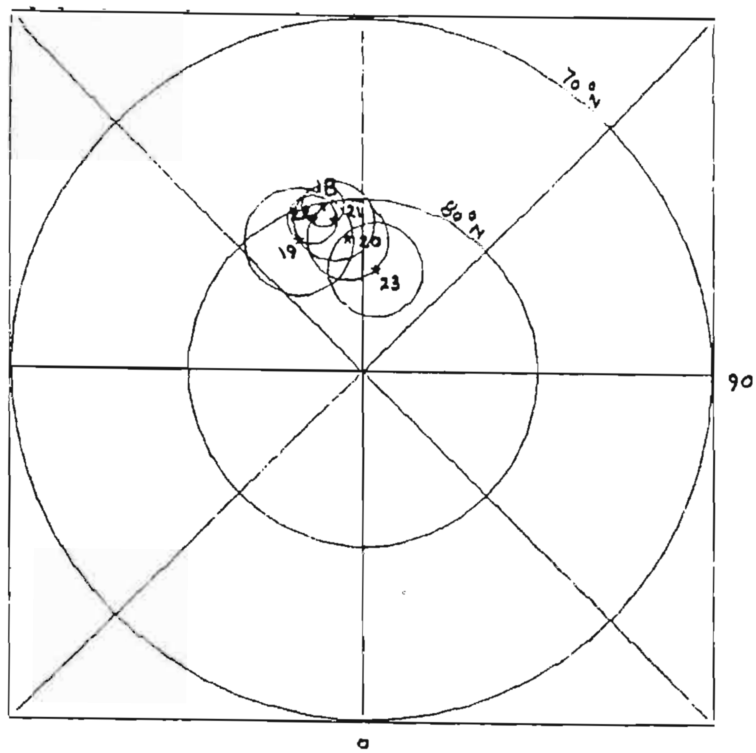


Figure D.6. VGPs for the Boone Moore site (AZ O:15:55 [ASM]).

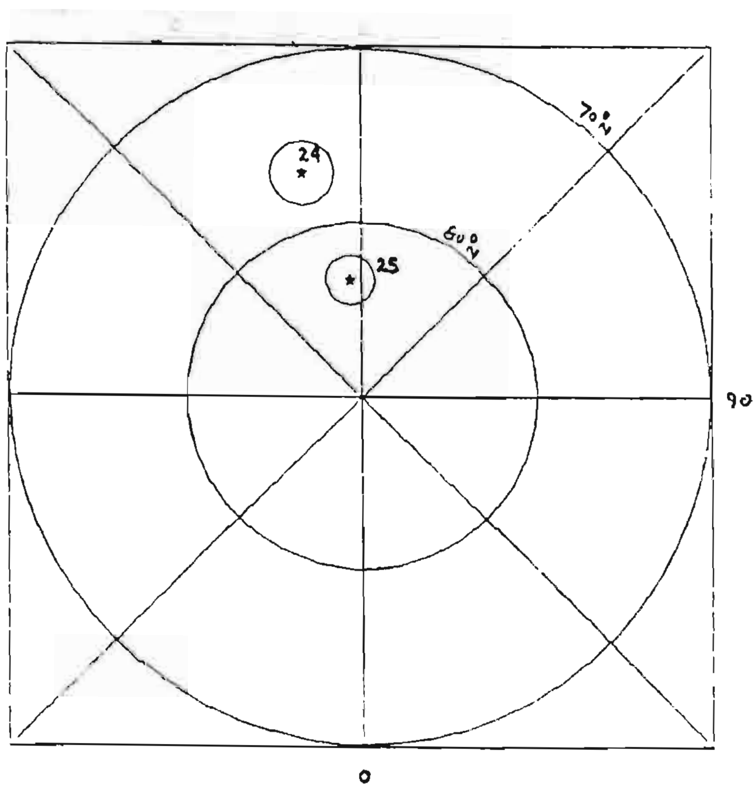


Figure D.7. VGPs for the Compact site (AZ O:15:90 [ASM]).

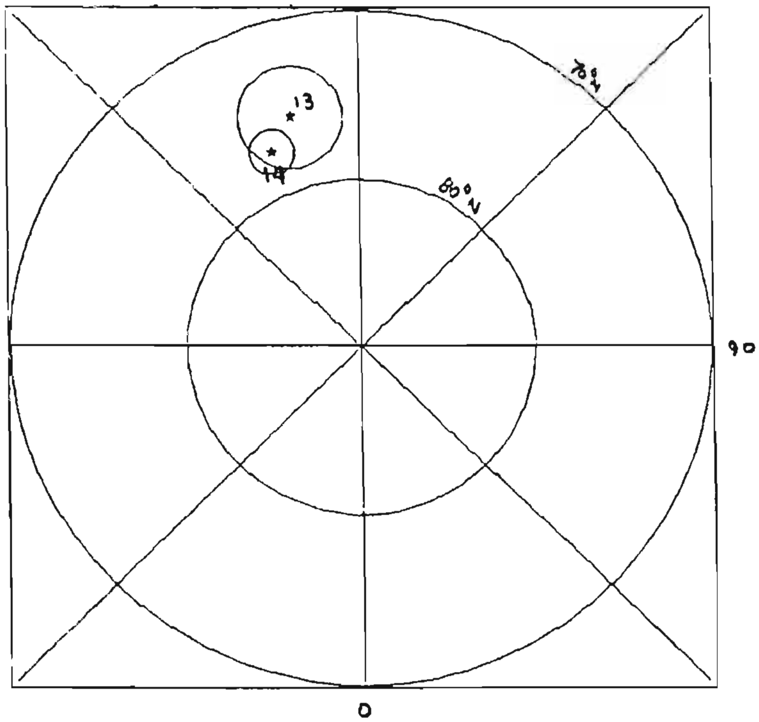


Figure D.8. VGPs for the Redstone site (AZ O:15:91 [ASM]).

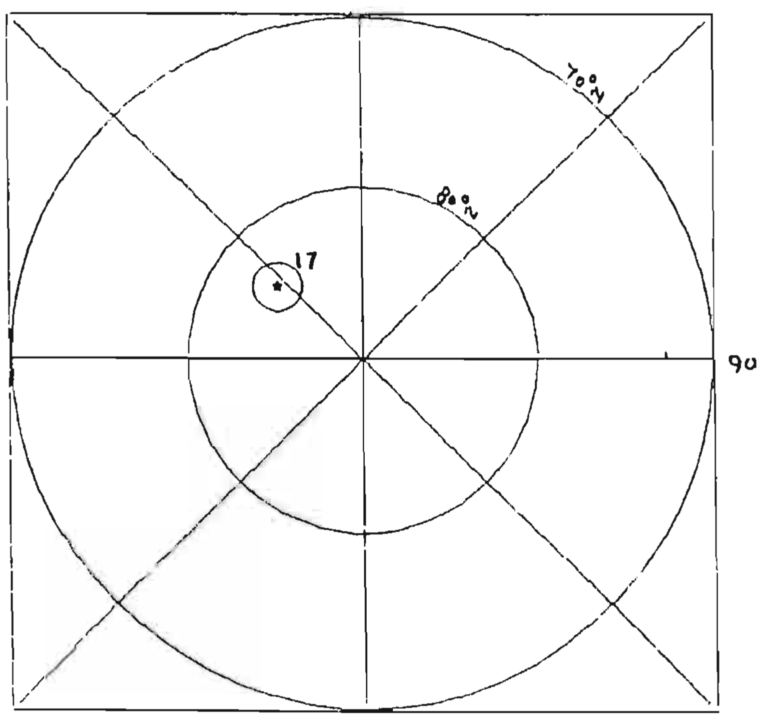


Figure D.9. VGPs for the Rooted site (AZ O:15:92 [ASM]).

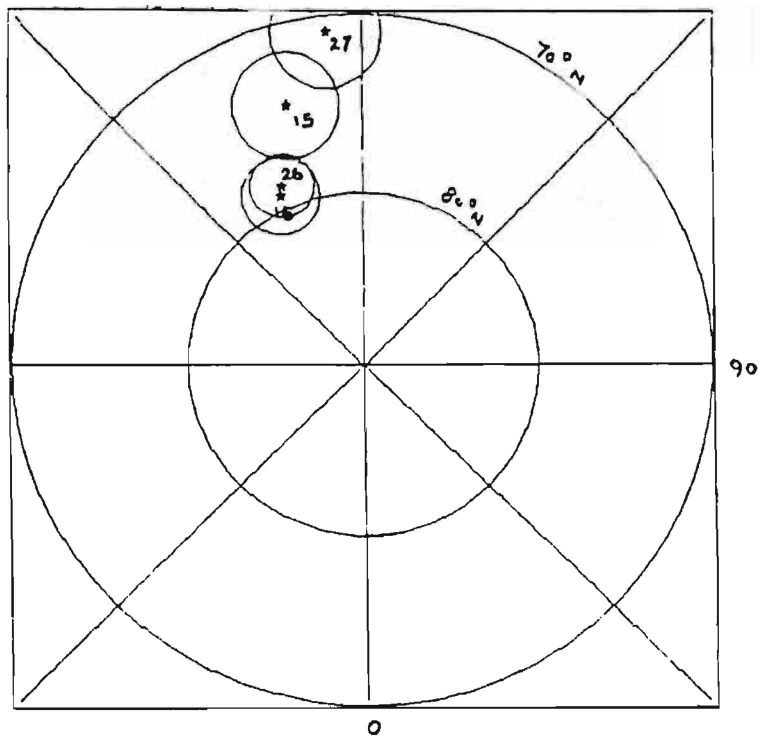


Figure D.10. VGPs for Clover Wash site (AZ O:15:100 [ASM]).

APPENDIX E

CERAMIC ANALYSES

Table E.1. Decorated ceramic coding index.

Sherd Size (Size) (Note: This variable has been used differently in earlier analyses):
1 = 2.5-5cm^2
2 = 5-16cm^2
3 = 16-49cm^2
4 = 49-100cm^2
5 = 100cm^2-RV
99 = Less than 2.5cm^2

Ceramic Class (Cerclass):
-9 = Indeterminate
1 = Red-on-brown
2 = Redware
3 = Red-on-buff
4 = Decorated Intrusive
5 = Santa Cruz Valley Polychrome
6 = Indeterminate Red-on-brown or Redware
7 = Indeterminate Red or Plain
8 = Plainware
9 = Red-on-brown or Red-on-buff
10 = Historic Aboriginal
11 = Indeterminate Red-on-brown or Plainware
12 = Tusayan Whiteware
13 = Little Colorado Whiteware
14 = Cibola Whiteware
15 = Tusayan or Little Colorado Whiteware
16 = Tusayan or Cibola Whiteware
17 = Cibola or Little Colorado Whiteware
18 = Indeterminate Whiteware
19 = Roosevelt Redware
20 = White Mountain Redware
21 = San Juan Redware
22 = Tsegi Orangeware
23 = Hopi Ware
24 = Local Red-on-plain
25 = Indeterminate Intrusivc
26 = Winslow Orangeware
27 = Tusayan Grayware
28 = Mogollon Brownware

Ceramic Type (Certype): See separate coding form

Vessel Part (Vespart):
Blank or 0 = Indeterminate
1 = Body
2 = Rim
3 = Partial RV (1/4 - 3/4)
4 = RV (3/4 or more)
5 = Gila shoulder
6 = Classic shoulder
7 = Classic indented base
8 = Partial RV (¼-½)
9 = Partial RV (½-3/4)

Vessel Shape (Shape):
Blank or 0 = Indeterminate
1 = Bowl
2 = Jar
3 = Scoop
4 = Other

Worked Sherd (Worked):
Blank or 0 = Not worked or Indeterminate
1 = Mend Hole
2.1 = One Edge Ground (Straight)
2.2 = One Edge Ground (Round)
3.1 = Two Edges Ground (Straight)
3.2 = Two Edges Ground (Round)
3.3 = Two Edges Ground (1 Straight, 1 Round)
4.1 = Unperforated Disk
4.2 = Semiperforated Disk
4.3 = Perforated Disk
5 = Rim Ground
6 = Shaped (List)
7 = Other (List)

Table E.2. Decorated ceramic types (certypes).

Buffware

304 Snaketown
306 Snaketown or Gila Butte
307 Gila Butte
308 Gila Butte/Santa Cruz
309 Gila Butte or Santa Cruz
310 Santa Cruz
312 Santa Cruz or Sacaton
313 Sacaton
318 Indeterminate Red-on-buff
319 Indeterminate Buff (no paint)

Tusayan Whiteware

1200 Indeterminate Black-on-white
1201 Indeterminate (no paint)
1204 Kana-a
1205 Kana-a or Black Mesa
1206 Black Mesa
1207 Black Mesa or Sosi
1208 Sosi

Little Colorado Whiteware

1300 Indeterminate Black-on-white
1301 Indeterminate (no paint)
1306 Holbrook A
1307 Holbrook A or B
1308 Holbrook B
1311 Walnut A
1312 Walnut A or B
1313 Walnut B
1314 Padre
1316 Leupp
1317 "Late"

Cibola Whiteware

1400 Indeterminate Black-on-white
1401 Indeterminate (no paint)
1404 Kiatuthlanna
1405 Kiatuthlanna or Red Mesa
1406 Red Mesa
1407 Snowflake
1409 Puerco
1412 Reserve
1413 Reserve or Tularosa
1414 Tularosa
1416 Pinedale

Roosevelt Redware

1902 Indeterminate B/r (bl. pt., no wh. sp.)
1903 Indeterminate (no bl. pt., no wh. sp.)
1904 Pinto Black-on-red
1905 Pinto Polychrome
1906 Pinto or Gila Polychrome
1907 Gila Polychrome
1909 Tonto Polychrome

White Mountain Redware

2000 Indeterminate Polychrome
2001 Indeterminate Black-on-red
2030 St. John's Black-on-red
2031 Pinedale Black-on-red
2032 Pinedale or Fourmile Polychrome
2033 Fourmile Polychrome
2036 Cibecue Polychrome

San Juan Redware

2100 Indeterminate Black-on-red
2105 Deadmans Black-on-red

Tsegi Orangeware

2200 Indeterminate Polychrome
2201 Indeterminate Black-on-red
2202 Indeterminate (no paint)
2220 Tusayan Polychrome variety A
2221 Cameron Polychrome

Hopi Wares

2309 Jeddito Yellow (no paint)
2310 Early Jeddito Black-on-yellow (Awatovi?)
2311 Early or late Jeddito Black-on-yellow
2313 Bidahochi Polychrome
2315 Bidahochi Black-on-white

Local Red-on-plain

2400 Local "Hohokam" design?
2401 Local indeterminate design

Winslow Orangeware

2612 Homolovi Polychrome
2613 Tuwiuca Black-on-orange
2614 Chavez Pass Black-on-red

Tusayan Grayware

2710 Tusayan Corrugated

Mogollon Brownware

2810 Show Low Black-on-red
2811 Show Low Black-on-red Corrugated
2812 Maverick Mountain Polychrome

Table E.3. Coding index for plainware ceramic attributes: Rye Creek Project.

1. Primary Feature (FEATURE1)

2. Secondary Feature (FEATURE2)

3. Provenience Number (PN)

4. Bag Number (BAG)

5. Observation Number (OBS)

6. Sherd Size (SIZE) (Note: This variable has been used differently in earlier analyses)
   - 1 = 2.5-5cm^2
   - 2 = 5-16cm^2
   - 3 = 16-49cm^2
   - 4 = 49-100cm^2
   - 5 = >100cm^2
   - 99 = less than 2.5cm^2

7. Rim Exterior Abrasion (ABRASION)
   - 0 = abrasion absent
   - 1 = >0-25% abraded
   - 2 = 26-75% abraded
   - 3 = 76-100% abraded
   - -9 = indeterminate (includes: worked sherds; burnt sherds with exfoliation; and damaged or chipped sherds)

8. Ceramic Class (CERCLASS)
   - 8 = Plainware

9. Ceramic Type (CERTYPE)
   - 800 = Unspecified Tonto/Verde Plain
   - 873 = Possible Apache Plain
   - 899 Indeterminate plain slipped or red

10. Vessel Part (VESPART)
    - 1 = Body
    - 2 = Rim
    - 3 = Partial RV (1/4 to 3/4)
    - 4 = RV (3/4 - complete)
    - 5 = Gila Shoulder
    - 6 = Transitional Gila/Classic
    - 7 = Classic shoulder
    - 8 = Classic, indented base

11. Vessel Shape (SHAPE)
    - -9 = Indeterminate
    - 1 = Bowl
    - 2 = Jar
    - 3 = Scoop
    - 4 = Other
    - 6 = Indeterminate flare-rim

12. Vessel Form (VESFORM)
    - -9 = Indeterminate form

    Bowls:
    - 0 = Indeterminate bowl
    - 1 = Flare-rim
    - 2 = Plate/platter
    - 3 = Outcurved
    - 4 = Hemispherical
    - 6 = Incurved
    - 7 = Other bowl
    - 8 = Semiflare-rim, outcurved
    - 20 = Semiflare-rim, hemispherical
    - 21 = Semiflare-rim, incurved
    - 22 = Straight-walled

    Jars:
    - 9 = Flare-rim, Indeterminate
    - 10 = Flare-rim, tall
    - 11 = Flare-rim, short
    - 12 = Returned rim
    - 13 = Straight collar, short
    - 14 = Straight collar, tall
    - 15 = Seed jar
    - 16 = Indeterminate jar
    - 17 = Neckless Jar
    - 18 = Semiflaring straight collar, tall
    - 19 = Incurved straight collar, short
    - 41 = Other jar

    Scoop:
    - 30 = Indeterminate Scoop

    Indeterminate flare-rim:
    - 40 = Indeterminate flare-rim

13. Rim Length % (RIMLENG)
    - -9 = Not a rim
    - 0 = 0-5 %
    - 1 = 5-10 %
    - 2 = 10-15 %
    - 3 = 15-20 %
    - 4 = 20-25 %
    - 5 = 25-30 %
    - 6 = 30-35 %
    - 7 = 35-40 %
    - 8 = 40-45 %
    - 9 = 45-50 %
    - 10 = 50+ %

14. Orifice Diameter [cm.] (ORIFDIA)
    - -9 = Not a rim/indeterminate

Table E.3. Continued.

15. Aperture Diameter [cm.] (APETDIA)
  -9 = Not a rim/indeterminate
16. Rim Shape (RIMSHAPE)
  -9 =Not a rim ***note**: this variable has been used differently in previous analyses
  0 = Indeterminate rim shape
  1 = Tapered
  2 = Rounded
  3 = Squared
  4 = Beveled sharp
  5 = Other/misc.
  6 = Beveled, rounded

17. Rim End consistency (RIMCON)
  -9 = Indeterminate
  0 = Consistent
  1 = Inconsistent

18. Sherd Rim Evenness (RIMEVEN)
  -9 = Indeterminate (insufficient rim length)
  0 = Undulating
  1 = Basically even

19. Rim Height [mm.] {Jars only} (HEIGHT)
  -9 = Not a jar/indeterminate

20. Vessel wall angle [Degrees] {Jars only} (ANGLE)
  -9 = Not a jar/indeterminate

21. Body Thickness [mm.] (BODTHICK)
  -9 = Indeterminate, base, adjacent to shoulder

22. Fire Cloud: 1 (FIRE)
  -9 = Indeterminate
  0 = Absent
  1 = Interior
  2 = Exterior
  3 = Interior and exterior

23. Fire Cloud: 2 (FCLOUD)
  0 = Fire clouding absent (all locations)
  1 = Fire clouding present (any location)

24. Interior Surface Treatment: 1 (INTSURF)
  -9 = Indeterminate
  1 = Polished
  2 = Wiped
  3 = Hand Smoothed
  4 = Anvil Impressed

25. Interior Surface Treatment: 2 (INTERIOR)
  0 = Not polished/burnished (i.e., wiped/hand-smoothed/anvil impressed)
  1 = Polished/Burnished

26. Exterior Surface Treatment: 1 (EXTSURF)
  -9 = Indeterminate
  1 = Polished
  2 = Wiped
  3 = Hand smoothed
  4 = Paddle Impressed

27. Exterior Surface Treatment: 2 (EXTERIOR)
  0 = Not polished/burnished (i.e., wiped/hand-smoothed/anvil impressed)
  1 = Polished/Burnished

28. Surface Treatment Pattern (PATTERN)
  -9 = Indeterminate
  1 = Interior and exterior parallel to rim
  2 = Interior parallel and exterior perpendicular to rim
  3 = Interior perpendicular and exterior parallel to rim
  4 = Interior and exterior perpendicular to rim
  5 = Other (list)

29. Smudging: 1 (SMUDGE)
  -9 = Indeterminate
  0 = Smudging not present
  1 = Bowl interior smudged
  2 = Jar interior smudged
  3 = Indeterminate form interior smudged
  4 = Bowl interior smudged, extends to exterior
  5 = Jar interior smudged, extends to exterior
  6 = Indeterminate form interior smudged, extends to exterior
  7 = Bowl or Jar, smudging on interior and exterior

30. Smudging: 2 (SMUDGE3)
  0 = Smudging absent (all surfaces)
  1 = Smudging present (at least one surface)

31. Worked Sherd (WORKED)
  Blank or 0 = Not Worked or Indeterminate
  1 = Mend Hole
  2.1 = One Edge Ground (Straight)
  2.2 = One Edge Ground (Round)
  3.1 = Two Edges Ground (Straight)
  3.2 = Two Edges Ground (Round)
  3.3 = Two Edges Ground (1 Straight, 1 Round)
  4.1 = Unperforated Disk
  4.2 = Semi-Perforated Disk
  4.3 = Perforated Disk
  5 = Rim Ground
  6 = Shaped (List)
  7 = Other (List)

Table E.3. Continued.

32. Class of Context (CLASS)
    1 = Class 1 Context
    2 = Class 2 Context

33. Evidence of Burning (BURNING)
    -9 = Indeterminate
    0 = No evidence of burning
    1 = Evidence of burning

34. Temper Source Generic (TSG)
    -9 = Indeterminate
    21 = Plutonic
    22 = Metavolcanic
    23 = Diabasic
    24 = High LMT
    25 = Indet. (Low temper %, small temper grains)
    26 = Indet. metavolcanic/plutonic
    27 = Indet. diabasic/plutonic
    28 = Possible metavolcanic
    29 = Possible diabasic
    30 = Indet. diabasic/metavolcanic
    31 = Indet. volcanic or sedimentary

35. Temper Source Specific (TSS)
    -9 = Indeterminate
    21 = White opaque
    22 = Pink opaque
    23 = Metavolcanic without metasedimentary
    24 = Metavolcanic with metasedimentary
    25 = Minor diabase
    26 = Major diabase
    27 = Schist
    28 = Phyllite

36. Temper Type (TT)
    21 = High schist
    23 = Mixed: low schist/high sand
    24 = High sand
    26 = Mica and sand
    30 = High phyllite

37. Carbon Streak (CARBON)
    -9 = Indeterminate
    0 = Absent
    1 = Present

38. Micaceous Surface (MICASURF)
    -9 = Indeterminate
    0 = No surface sheen
    1 = Micaceous surface
    2 = Surface mica from clay

Comments (intrafeature matches, etc.):

Table E.4. Coding index for redware ceramic attributes: Rye Creek Project.

1. Primary Feature (FEATURE1)

2. Secondary Feature (FEATURE2)

3. Provenience Number (PN)

4. Bag Number (BAG)

5. Observation Number (OBS)

6. Sherd Size (SIZE) (Note: This variable has been used differently in earlier analyses)
   - 1 = 2.5-5cm^2
   - 2 = 5-16cm^2
   - 3 = 16-49cm^2
   - 4 = 49-100cm^2
   - 5 = >100cm^2
   - 99 = less than 2.5cm^2

7. Rim Exterior Abrasion (ABRASION)
   - 0 = abrasion absent
   - 1 = >0-25% abraded
   - 2 = 26-75% abraded
   - 3 = 76-100% abraded
   - -9 = indeterminate (includes: worked sherds; burnt sherds with exfoliation; and damaged or chipped sherds)

8. Ceramic Class (CERCLASS)
   - 2 = Redware
   - 7 = Indeterminate Redware or Plainware

9. Ceramic Type (CERTYPE)
   - -9 = Indeterminate Red or Plain
   - 251 = Tonto Red
   - 217 = Salado Red
   - 899 = Indeterminate Slipped Plainware or Redware ("San Carlos")

10. Vessel Part (VESPART)
    - 1 = Body
    - 2 = Rim
    - 3 = Partial RV (1/4 to 3/4)
    - 4 = RV (3/4 - complete)
    - 5 = Gila Shoulder
    - 6 = Transitional Gila/Classic
    - 7 = Classic shoulder
    - 8 = Classic, indented base

11. Vessel Shape (SHAPE)
    - -9 = Indeterminate
    - 1 = Bowl
    - 2 = Jar
    - 3 = Scoop
    - 4 = Other
    - 6 = Indeterminate flare-rim

12. Vessel Form (VESFORM)
    - -9 = Indeterminate form

    Bowls:
    - 0 = Indeterminate bowl
    - 1 = Flare-rim
    - 2 = Plate/platter
    - 3 = Outcurved
    - 4 = Hemispherical
    - 6 = Incurved
    - 7 = Other bowl
    - 8 = Semiflare-rim, outcurved
    - 20 = Semiflare-rim, hemispherical
    - 21 = Semiflare-rim, incurved
    - 22 = Straight-walled

    Jars:
    - 9 = Flare-rim, Indeterminate
    - 10 = Flare-rim, tall
    - 11 = Flare-rim, short
    - 12 = Returned rim
    - 13 = Straight collar, short
    - 14 = Straight collar, tall
    - 15 = Seed jar
    - 16 = Indeterminate jar
    - 17 = Neckless Jar
    - 18 = Semiflaring straight collar, tall
    - 19 = Incurved straight collar, short
    - 41 = Other jar

    Scoop:
    - 30 = Indeterminate Scoop

    Indeterminate flare-rim:
    - 40 = Indeterminate flare-rim

13. Rim Length % (RIMLENG)
    - -9 = Not a rim
    - 0 = 0-5 %
    - 1 = 5-10 %
    - 2 = 10-15 %
    - 3 = 15-20 %
    - 4 = 20-25 %
    - 5 = 25-30 %
    - 6 = 30-35 %
    - 7 = 35-40 %
    - 8 = 40-45 %
    - 9 = 45-50 %
    - 10 = 50+ %

14. Orifice Diameter [cm.] (ORIFDIA)
    - -9 = Not a rim/indeterminate

15. Aperture Diameter [cm.] (APETDIA)
    - -9 = Not a rim/indeterminate

Table E.4. Continued.

16. Rim Shape (RIMSHAPE)
 -9 =Not a rim (<u>Note</u>: This variable has been used differently in earlier analyses)
 0 = Indeterminate rim shape
 1 = Tapered
 2 = Rounded
 3 = Squared
 4 = Beveled sharp
 5 = Other/misc.
 6 = Beveled, rounded

17. Rim End consistency (RIMCON)
 -9 = Indeterminate
 0 = Consistent
 1 = Inconsistent

18. Sherd Rim Evenness (RIMEVEN)
 -9 = Indeterminate (insufficient rim length)
 0 = Undulating
 1 = Basically even

19. Rim Height [mm.] {Jars only} (HEIGHT)
 -9 = Not a jar/indeterminate

20. Vessel wall angle [Degrees] {Jars only} (ANGLE)
 -9 = Not a jar/indeterminate

21. Body Thickness [mm.] (BODTHICK) (<u>Note</u>: This variable has been measured differently in earlier analyses)
 -9 = Indeterminate, base, adjacent to shoulder

22. Evidence of Burning (BURNING)
 -9 = Indeterminate
 0 = No evidence of burning
 1 = Evidence of burning

23. Fire Cloud: 1 (FIRE)
 -9 = Indeterminate
 0 = Absent
 1 = Interior
 2 = Exterior
 3 = Interior and exterior

24. Fire Cloud: 2 (FCLOUD)

 0 = Fire clouding absent (all locations)
 1 = Fire clouding present (any location)

25. Smudging: 1 (SMUDGE) (<u>Note</u>: This variable has included fewer variables in earlier analyses)
 -9 = Indeterminate
 0 = Smudging not present
 1 = Bowl interior smudged
 2 = Jar interior smudged
 3 = Indeterminate form interior smudging
 4 = Bowl interior smudging extends to exterior
 5 = Jar interior smudging extends to exterior
 6 = Indeterminate form interior smudge extends to exterior
 7 = Smudging on interior and exterior (may represent burning?)

26. Smudging: 2 (SMUDGE3)
 0 = Smudging absent (all surfaces)
 1 = Smudging present (at least one surface)

27. Slip Location: 1 (SLIPLOC2)
 -9 = Indeterminate
 1 = Interior only
 2 = Interior and rim
 3 = Interior, rim and exterior band
 4 = Full slip (interior, rim and exterior)
 5 = Exterior and rim
 6 = Exterior only
 7 = Other (list)

28. Slip Location: 2 (SLIP)
 -9 = Indeterminate
 1 = Interior only
 2 = Exterior only
 3 = Interior and Exterior

29. Slip Depth (DEPTH)
 -9 = Indeterminate
 1 = Thick
 2 = Thin

30. Fugitive Slip (FUGIT)
 -9 = Indeterminate (includes inadequate slip present; eroded slip surface; etc.)
 1 = Extremely fugitive (dark stain on towel)
 2 = Mildly fugitive (light stain on towel)
 3 = Not fugitive (no stain on towel)

31. Interior Surface Treatment: 1 (INTSURF)
 -9 = Indeterminate
 1 = High polish
 2 = Medium polish
 3 = Light polish
 4 = Wiped
 5 = Hand smoothed
 6 = Anvil Impressed

32. Interior Surface Treatment: 2 (INTERIOR)
 0 = Not polished/burnished (i.e., wiped/hand-smoothed/anvil impressed)
 1 = Polished/Burnished

33. Exterior Surface Treatment: 1 (EXTSURF)
 -9 = Indeterminate
 1 = High polish
 2 = Medium polish
 3 = Light polish
 4 = Wiped
 5 = Hand smoothed

Table E.4. Continued.

34. Exterior Surface Treatment: 2 (EXTERIOR)
 0 = Not polished/burnished (i.e., wiped/hand-smoothed/anvil impressed)
 1 = Polished/Burnished

35. Surface Treatment Pattern (PATTERN)
 -9 = Indeterminate
 0 = Absent
 1 = Interior and exterior parallel to rim
 2 = Interior parallel and exterior perpendicular to rim
 3 = Interior perpendicular and exterior parallel to rim
 4 = Interior and exterior perpendicular to rim
 5 = Other (list, such as pattern polish)

36. Worked Sherd (WORKED)
 Blank or 0 = Not Worked or Indeterminate
 1 = Mend Hole
 2.1 = One Edge Ground (Straight)
 2.2 = One Edge Ground (Round)
 3.1 = Two Edges Ground (Straight)
 3.2 = Two Edges Ground (Round)
 3.3 = Two Edges Ground (1 Straight, 1 Round)
 4.1 = Unperforated Disk
 4.2 = Semi-Perforated Disk
 4.3 = Perforated Disk
 5 = Rim Ground
 6 = Shaped (List)
 7 = Other (List)

37. Temper Source Generic (TSG)
 -9 = Indeterminate
 21 = Plutonic
 22 = Metavolcanic
 23 = Diabasic
 24 = High LMT
 25 = Indet. (Low temper %, small temper grains)
 26 = Indet. metavolcanic/plutonic
 27 = Indet. diabasic/plutonic
 28 = Possible metavolcanic
 29 = Possible diabasic
 30 = Indet. diabasic/metavolcanic
 31 = Indet. volcanic or sedimentary

38. Temper Source Specific (TSS)
 -9 = Indeterminate
 21 = White opaque
 22 = Pink opaque
 23 = Metavolcanic without metasedimentary
 24 = Metavolcanic with metasedimentary
 25 = Minor diabase
 26 = Major diabase
 27 = Schist
 28 = Phyllite

39. Temper Type (TT)
 21 = High schist
 23 = Mixed: low schist/high sand
 24 = High sand
 26 = Mica and sand
 30 = High phyllite

40. Carbon Streak (CARBON)
 -9 = Indeterminate
 0 = Absent
 1 = Present

41. Micaceous Surface (MICASURF)
 -9 = Indeterminate
 0 = No surface sheen
 1 = Micaceous surface
 2 = Surface mica from clay

Comments (intrafeature matches, etc.):

1. Numbers 22, 25, 27, 28, and 29 not utilized in analysis
2. Numbers 22, 25, 27, 28, and 29 not utilized in analysis

APPENDIX F

LITHIC AND GROUND STONE ANALYSES

Table F.1. Chipped stone coding sheet.

CHIPPED STONE

Artclass = 2
Color coded index card = blue

Lthclass

1 Debitage (Use Lthtype 10-13, 99)
2 Retouched pieces (Use Lthtype 20-26, 99)
3 Cores/core tools/hammerstones (Use Lthtype 30-34)
99 Unsorted chipped stone (Use Lthtype 99)

Lthtype

10 Complete flake
11 Broken flake (Proximal end)
12 Flake fragment (Distal end)
13 Shatter

20 Informal tool
21 Scraper
22 Biface
23 Projectile point
24 Plano scraper
25 Chopper
26 Miscellaneous formal tool (Specify in comments)

30 Core
31 Exhausted core
32 Core hammerstone
33 Core tool
34 Cobble hammerstone

99 Unsorted

Material

1 Basalt
2 Vesicular basalt
3 Rhyolite/andesite
4 Granite
5 Schist/gneiss
6 Welded tuff
7 Miscellaneous sedimentary
8 Quartzite
9 Quartz
10 Chert (Unspecified source)
11 Chert (Quarry AZ AA:16:187 ASM)
12 Indurated/silicified limestone, mudstone
13 Limestone
14 Miscellaneous igneous
15 Chalcedony
16 Jasper
17 Obsidian
18 Tabular knife material (Unspecified)
19 Turquoise
20 Argillite
21 Nonspecific metamorphic material (Including chlorite schist, greenstone, slate or phyllite)
30 Unknown or other

Cortex

0 Not coded
1 Absent
2 Present

Pctcort

0 Not coded
1 0-25%
2 25-50%
3 50-75%
4 75-100%

Retouch

0 Not coded
1 Unifacial
2 Bifacial
3 Utilized

Prjpoint

0 Not coded
1 Paleo
2 Archaic (Unspecified)
3 Early Archaic
4 Middle Archaic
5 Late Archaic
6 Archaic or Hohokom
7 Hohokom (Unspecified)
8 Pioneer period
9 Colonial period
10 Sedentary period
11 Classic period
12 Unknown or other
13 Nondiagnostic

Quantity

Table F.2. Ground stone coding sheet.

GROUND STONE

Artclass = 3
Color coded index card = blue

Gndclass

1 Manos (Use Gndtype 10-19, 99)
2 Metates (Use Gndtype 20-29, 99)
3 Mortar or Pestle (Use Gndtype 30,31)
4 Tabular Knife or Tabular Knife Material (Use Gndtype 40-42)
5 Polishing Stone or Polished Stone (Use Gndtype 50-52)
6 Donut Stone, Nutting Stone, or Stone Bowl (Use Gndtype 60-63)
7 Rarefind (Use Gndtype 70-79)
8 Material Sample (Use Gndtype 80,99)
9 Indeterminate Groundstone (Use Gndtype 80)
99 Unsorted Groundstone (Use Gndtype 99)

Gndtype

10 Cobble mano
11 Shaped rocker handstone
12 Unshaped rocker handstone
13 Shaped flat-faced mano
14 Unshaped flat-faced mano
15 Rectangular trough/basin mano
19 Indeterminate or other mano

20 Slab metate
21 Basin metate
22 Crude trough metate
23 Formal trough metate
24 Indeterminate slab
29 Indeterminate metate

30 Mortar
31 Pestle

40 Tabular knife
41 Tabular knife material
42 Indeterminate

50 Polishing stone
51 Polished stone
52 Indeterminate

60 Donut stone (completely perforated)
61 Nutting stone (includes possible incomplete donut stones)
62 Stone bowl (No surface decoration, not to be confused with a censer)
63 Indeterminate

70 Palette
71 Ax
72 Medicine stone
73 Jewelry
74 Censer
79 Other or unknown

80 Indeterminate

99 Unsorted

Material

1 Basalt
2 Vesicular basalt
3 Rhyolite/andesite
4 Granite
5 Schist/gneiss
6 Welded tuff
7 Miscellaneous sedimentary
8 Quartzite
9 Quartz
10 Chert (Unspecified source)
11 Chert (Quarry AZ AA:16:187 ASM)
12 Indurated/silicified limestone, mudstone
13 Limestone
14 Miscellaneous igneous
15 Chalcedony
16 Jasper
17 Obsidian
18 Tabular knife material (Unspecified)
20 Turquoise
21 Argillite
22 Nonspecific metamorphic material (Including chlorite schist, greenstone, slate or phyllite)
30 Unknown or other

Condition

0 Not appropriate
1 Less than 1/2 complete
2 1/2 or more complete but not whole
3 Complete

Quantity

APPENDIX G

FLOTATION, MACROBOTANICAL, AND WOOD CHARCOAL ANALYSES

Scott Kwiatkowski

Table G.1. Raw flotation data from the Deer Creek site, AZ O:15:52 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F2 floor fill	392-12	4	6 *Agave* fibers (CaO)[a] 3 Cheno-am seeds 2 *Descurainia* seeds 1 cf. *Descurainia* seed fragment 1 *Echinocereus* seed 4 cf. *Hordeum* spikelet fragments 12 Indeterminate seed fragments 2 *Mentzelia* seed fragments 12 Miscellaneous endosperm fragments 1 Miscellaneous fragment (CaO)[a] 8 Miscellaneous round fibers (4 CaO)[a] 1 Miscellaneous spiral twist 1 *Phacelia grandiflora* type seed fragment 1 *Sporobolus* type grain 3 cf. *Zea mays* cupule fragments	1 Caryophyllaceae cf. *Silene* seed 3 Cheno-am seeds 4 cf. Cheno-am seed fragments 3 *Cupressus-Juniperus* branchlet fragments 3 Dicotyledoneae leaves 1 *Echinocereus* seed 2 Indeterminate seed fragments 1 *Sporobolus* type grain	1 Ant 3 Charred fecal pellets 3 Charred termite pellets Numerous fecal pellets[b] 1 Insect case fragment 100 Insect exoskeleton fragments[c] 3 Snail shells 14 Termite pellets 2 Unburned bone fragments
Pithouse F6 floor fill	186-4	4	1 *Agave* fiber (CaO)[a] 1 *Bromus* type grain 1 *Bromus* type grain fragment 8 *Bromus-Elymus* type grain fragments 1 Caryophyllaceae cf. *Silene* seed 5 Cheno-am seeds 13 Cheno-am seed coat fragments 2 *Echinocereus* seed fragments 2 *Hordeum* grains 3 *Hordeum* grain fragments 2 cf. *Hordeum* grain fragments 9 cf. *Hordeum* spikelet fragments (1 caramelized) 58 Indeterminate seed fragments 32 Miscellaneous endosperm fragments 6 Miscellaneous fragments (CaO)[a] 1 Miscellaneous round fiber (CaO)[a] 2 *Zea mays* cupule fragments 1 cf. *Zea mays* cupule fragment	11 Cheno-am seeds 1 *Cupressus-Juniperus* branchlet fragment 3 Dicotyledoneae leaves 1 Gramineae grain fragment 1 *Erodium* fruit fragment 2 *Euphorbia* seeds 1 Indeterminate seed fragment 1 *Mollugo* seed 1 *Mollugo* seed fragment 1 Monocotyledoneae stem fragment	7 Charred termite pellets 1 Charred termite pellet fragment Numerous fecal pellets[b] 2 Insect cases 64 Insect exoskeleton fragments 1 Gnat 1 Snail shell 3 Termites 1 Termite exoskeleton fragment

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse hearth F9.04 fill	362-3	4	25 *Agave* fibers (24 CaO)[a] 11 Cheno-am seeds 20 Cheno-am seed fragments 13 cf. Cheno-am seed fragments 2 cf. *Descurainia* seed fragments 1 *Distichlis* type grain fragment 2 *Hordeum* grains 1 *Hordeum* grain fragment 1 cf. *Hordeum* grain fragment 1 *Hordeum* rachis joint fragment 7 cf. *Hordeum* spikelet fragments 58 Indeterminate seed fragments 3 *Leptochloa* type grains 3 *Leptochloa* type grain fragments 15 cf. *Leptochloa* type grain fragments 1 *Mentzelia* seed fragment 1 Miscellaneous D-shaped fiber 99 Miscellaneous endosperm fragments 2 Miscellaneous flat fibers (CaO)[a] 21 Miscellaneous fragments (CaO)[a] 33 Miscellaneous round fibers (25 CaO)[a] 1 Miscellaneous spine fragment 3 Miscellaneous spiral twists 6 *Portulaca* seeds 5 *Portulaca* seed fragments 3 cf. *Portulaca* seed fragments 1 *Sporobolus* type grain	2 Cheno-am seeds	1 Burned bone fragment 3 Charred fecal pellet fragments 12 Charred termite pellets 1 Charred termite pellet aggregate 3 Charred termite pellet fragments Numerous fecal pellets[b] 1 Fecal pellet aggregate 2 Insect cases 42 Insect exoskeleton fragments 1 Red resin globule 1 Termite pellet
Pithouse pit F9.06 fill	359-3	4	4 *Agave* fibers (2 CaO)[a] 10 Cheno-am seeds 26 Cheno-am seed fragments 26 cf. Cheno-am seed fragments 1 cf. Compositae achene (caramelized) 1 *Distichlis* type grain fragment 2 *Echinocereus* seeds 2 *Hordeum* grains 4 *Hordeum* grain fragments 2 cf. *Hordeum* grain fragments 2 cf. *Hordeum* spikelet fragments 36 Indeterminate seed fragments 1 *Leptochloa* type grain 1 cf. *Leptochloa* type grain fragment 1 *Mentzelia* seed fragment 1 Miscellaneous D-shaped fragment (CaO)[a] Numerous miscellaneous endosperm fragments[b] 11 Miscellaneous fragments (CaO)[a] 37 Miscellaneous round fibers (34 CaO)[a] 1 Miscellaneous spiral twist 1 *Zea mays* cupule fragment 1 cf. *Zea mays* cupule fragment	1 cf. Cheno-am seed fragment 1 Dicotyledoneae leaf fragment 1 *Sporobolus* type grain fragment	1 Charred fecal pellet aggregate 1 Charred fecal pellet fragment 4 Charred termite pellets 129 Fecal pellets[c] 1 Insect case fragment 24 Insect exoskeleton fragments 2 Unburned bone fragments

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse pit F9.08 fill	360-2	1	2 *Agave* fibers (CaO)[a] 1 Boraginaceae-like unknown seed 1 Cheno-am seed 5 Cheno-am seed fragments 7 cf. Cheno-am seed fragments 1 *Echinocereus* seed coat fragment 1 Gramineae culm fragment 1 *Hordeum* grain fragment 1 *Hordeum* rachis joint fragment 1 cf. *Hordeum* spikelet fragment 7 Indeterminate seed fragments 4 *Leptochloa* type grains 10 Miscellaneous endosperm fragments 4 Miscellaneous fragments (CaO)[a] 5 Miscellaneous round fibers (3 CaO)[a] 74 *Papaver somniferum* seeds 2 *Papaver somniferum* seed fragments 1 Teardrop-shaped unknown seed	1 Cheno-am seed 2 Dicotyledoneae leaves 2 *Sporobolus* type grains	1 Charred fecal pellet aggregate 1 Charred termite pellet Numerous fecal pellets[b] 2 Fecal pellet aggregates 27 Insect exoskeleton fragments 20 Termite pellets 1 Unburned bone
Pithouse F11 floor fill	369-5	1	8 *Agave* fibers (CaO)[a] 1 Boraginaceae-like unknown seed 1 Cheno-am seed 1 Cheno-am seed coat fragment 2 cf. Cheno-am seed fragments 9 *Echinocereus* seeds 24 *Echinocereus* seed coat fragments 2 cf. *Echinocereus* seed fragments 2 *Hordeum* grains 31 Indeterminate seed fragments 1 *Leptochloa* type grain 2 cf. *Leptochloa* type grain fragments 41 Miscellaneous endosperm fragments 18 Miscellaneous round fibers (15 CaO)[a]	1 *Euphorbia* seed 1 cf. *Sporobolus* type grain fragment	1 Charred fecal pellet 36 Charred termite pellets Numerous fecal pellets[b] 14 Insect exoskeleton fragments 14 Termite exoskeleton fragments

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F14 floor fill	172-8	4	1 cf. *Agave* caudex fragment 64 *Agave* fibers (63 CaO)[a,c] 1 *Arctostaphylos* nutlet 1 *Bromus-Elymus* type grain fragment 16 Cheno-am seeds 29 Cheno-am seed fragments 10 cf. Cheno-am seed fragments 2 cf. *Descurainia* seed fragments 3 *Echinocereus* seeds 4 *Echinocereus* seed fragments 2 *Hordeum* grain fragments 44 cf. *Hordeum* spikelet fragments[c] 278 Indeterminate seed fragments[c] 2 Indeterminate spine fragments 1 *Juniperus* seed fragment 4 cf. *Juniperus* seed fragments 3 *Leptochloa* type grains 7 *Leptochloa* type grain fragments 4 cf. *Leptochloa* type grain fragments 2 Miscellaneous D-shaped fibers Numerous miscellaneous endosperm fragments (most are probably *Prosopis* seed fragments) 17 Miscellaneous fragments (CaO)[a,c] 106 Miscellaneous round fibers (61 CaO)[a,c] 1 Miscellaneous round fiber bundle (CaO)[a] 3 Miscellaneous spiral twists 1 *Prosopis velutina* seed 1 cf. *Prosopis velutina* seed fragment 2 Teardrop-shaped unknown seeds 2 cf. *Zea mays* kernel fragments	4 Cheno-am seeds 7 *Cupressus-Juniperus* branchlet fragments 3 Dicotyledoneae leaves 2 Dicotyledoneae leaf fragments 1 *Euphorbia* seed 2 Monocotyledoneae leaf fragments 2 *Sporobolus* type grains	3 Charred fecal pellets 1 Charred fecal pellet fragment 11 Charred termite pellets 1 Charred termite pellet fragment Numerous fecal pellets[b] 2 Insect cases 44 Insect exoskeleton fragments[c] 1 Snail shell 15 Termite exoskeleton fragments
Possible Apachean roasting pit F15 fill	459-3	4	(UNPRODUCTIVE) 9 Indeterminate seed fragments 4 Miscellaneous endosperm fragments 1 Miscellaneous round fiber (CaO)[a]	1 *Agave* marginal tooth 1 Angiospermae anther 1 *Bromus rubens* type floret 2 Cheno-am seeds 3 *Cupressus-Juniperus* branchlet fragments 15 Dicotyledoneae leaves 19 Dicotyledoneae leaf fragments 4 Gramineae florets (4 different types) 11 Indeterminate seed fragments 1 Indeterminate spine fragment 1 Monocotyledoneae leaf fragment 2 cf. *Opuntia* seed fragments 1 Platyopunita seed fragment 1 *Portulaca* seed 2 *Sporobolus* type grains 1 cf. *Sporobolus* type grain fragment 3 Unknown seeds (2 may be *Euphorbia*)	14 Charred termite pellets Numerous fecal pellets[b] 2 Insect cases 1 Insect case fragment Numerous insect exoskeleton fragments[b] 3 Snail shells 1 Termite exoskeleton fragment

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Roasting pit F17 fill	117-6, 125-3	4	7 *Agave* fibers (6 CaO)[a] 1 Cheno-am seed 8 Cheno-am seed fragments 4 cf. Cheno-am seed coat fragments 1 *Descurainia* seed 1 *Echinocereus* seed coat fragment 2 cf. *Hordeum* grain fragments 1 cf. *Hordeum* spikelet fragment 24 Indeterminate seed fragments 4 *Leptochloa* type grains 1 Miscellaneous D-shaped fiber 13 Miscellaneous endosperm fragments 7 Miscellaneous fragments (CaO)[a] 8 Miscellaneous round fibers (5 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 3 *Zea mays* cupule fragments 2 cf. *Zea mays* cupule fragments 2 *Zea mays* glume fragments	8 Cheno-am seeds 2 cf. Cheno-am seed fragments 2 *Cupressus-Juniperus* branchlet fragments 1 Dicotyledoneae leaf fragment 1 *Euphorbia* seed fragment 1 cf. *Euphorbia* seed fragment 1 Indeterminate fruit fragment 2 *Sporobolus* type grains	6 Charred fecal pellets 1 Charred fecal pellet fragment 17 Charred termite pellets Numerous fecal pellets[b] 3 Insect cases 71 Insect exoskeleton fragments
Pithouse F18 fill over lower floor	275-4	4	14 *Agave* fibers (11 CaO)[a] 1 Cheno-am seed 1 Cheno-am seed fragment 2 cf. Cheno-am seed fragments 3 cf. *Hordeum* spikelet fragments 29 Indeterminate seed fragments 2 Miscellaneous D-shaped fibers (1 CaO)[a] 72 Miscellaneous endosperm fragments 11 Miscellaneous fragments (CaO)[a] 31 Miscellaneous round fibers (10 CaO)[a] 2 Miscellaneous spiral twists	2 Angiospermae anthers 4 Cheno-am seeds 110 *Cupressus-Juniperus* branchlet fragments 13 Dicotyledoneae leaves 12 Dicotyledoneae leaf fragments 1 *Euphorbia* seed 1 Gramineae, Hordeae type floret 1 Gramineae floret fragment 4 Indeterminate inflorescence fragments 11 Indeterminate seed fragments 1 Miscellaneous bract 1 Miscellaneous spiral twist 3 Monocotyledoneae leaf fragments 2 Monocotyledoneae stem fragments 1 cf. *Prosopis* pod fragment	1 Charophyceae oogonium 4 Charred termite pellets 1 Charred termite pellet fragment Numerous fecal pellets[b] 1 Insect case 1 Insect case fragment 44 Insect exoskeleton fragments 1 Termite pellet 3 Unburned bones 1 Unburned bone fragment

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F21 floor fill	291-12	4	19 *Agave* fibers (17 CaO)[a] 3 Cheno-am seeds 25 Cheno-am seed fragments 6 cf. Cheno-am seed fragments 1 *Descurainia* seed 1 *Echinocereus* seed 5 *Echinocereus* seed fragments 4 *Hordeum* grain fragments 7 cf. *Hordeum* spikelet fragments 89 Indeterminate seed fragments[c] 3 cf. *Leptochloa* type grain fragments 3 Miscellaneous D-shaped fibers 50 Miscellaneous endosperm fragments[c] 1 Miscellaneous flat fiber (CaO)[a] 13 Miscellaneous fragments (CaO)[a] 39 Miscellaneous round fibers (30 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 1 *Portulaca* seed 1 *Sporobolus* type grain 1 cf. *Zea mays* cupule fragment	3 Cheno-am seeds 1 *Cupressus-Juniperus* branchlet fragment 1 *Euphorbia* seed 1 *Sphaeralcea* seed 1 *Sporobolus* type grain	6 Charred fecal pellets 1 Charred fecal pellet fragment 4 Charred termite pellets 1 Charred termite pellet aggregate Numerous fecal pellets[b] 3 Insect cases 18 Insect exoskeleton fragments 1 Snail shell 1 Termite pellet 1 Unburned bone 3 Unburned bone fragments
Pithouse F22 floor fill	390-6	4	3 *Agave* fibers (CaO)[a] 1 *Bromus-Elymus* type grain fragment 2 Cheno-am seed fragments 1 cf. *Descurainia* seed 1 *Echinocereus* seed 1 *Echinocereus* seed fragment 1 *Elymus* type grain 2 *Elymus* type grain fragments 2 cf. *Hordeum* spikelet fragments 15 Indeterminate seed fragments 2 *Leptochloa* type grains 6 cf. *Leptochloa* type grain fragments 34 Miscellaneous endosperm fragments 2 Miscellaneous fragments (CaO)[a] 10 Miscellaneous round fibers (3 CaO)[a] 1 *Sporobolus* type grain fragment 2 *Zea mays* cupules 9 *Zea mays* cupule fragments	1 *Cupressus-Juniperus* branchlet fragment 1 *Euphorbia* seed	1 Burned bone fragment 1 Charred fecal pellet fragment 2 Charred termite pellets Numerous fecal pellets[b] 4 Insect exoskeleton fragments 1 Snail shell 29 Termite pellets 1 Unburned bone fragment

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse hearth F22.01 fill	406-2	4	4 *Agave* fibers (3 CaO)[a] 4 cf. *Bromus-Elymus* type grains 9 Cheno-am seeds 17 Cheno-am seed coat fragments 7 cf. Cheno-am seed fragments 1 *Descurainia* seed 3 cf. *Descurainia* seed fragments 1 *Echinocereus* seed 2 Globular unknown seeds 1 Gramineae culm fragment 3 *Hordeum* grain fragments 3 cf. *Hordeum* grain fragments 150 Indeterminate seed fragments 2 *Leptochloa* type grains 4 cf. *Leptochloa* type grain fragments 47 *Mentzelia* seeds 22 *Mentzelia* seed fragments 5 cf. *Mentzelia* seed fragments Numerous miscellaneous endosperm fragments[b] 1 Miscellaneous fragment (CaO)[a] 5 Miscellaneous round fibers (2 CaO)[a] 78 *Papaver somniferum* seeds 1 cf. *Prosopis* seed fragment 8 *Salvia* seed fragments 3 *Sporobolus* type grains 1 *Zea mays* cupule fragment 2 cf. *Zea mays* cupule fragments	1 Cheno-am seed 8 *Sporobolus* type grains 4 *Sporobolus* type grain fragments 4 cf. *Sporobolus* type grain fragments	1 Ant 1 Burned bone 17 Charred fecal pellets 4 Charred termite pellets Numerous fecal pellets[b] 2 Insect case fragments 27 Insect exoskeleton fragments 1 Unburned bone fragment
Pithouse F25 floor fill	413-4	4	9 *Agave* fibers (7 CaO)[a] 1 Cheno-am seed 11 Cheno-am seed coat fragments 13 cf. Cheno-am seed fragments 1 cf. *Distichlis* type grain fragment 2 *Echinocereus* seeds 1 cf. Gramineae grain 1 *Hordeum* grain fragment 1 cf. *Hordeum* grain fragment 9 Indeterminate seed fragments 1 *Mentzelia* seed 71 Miscellaneous endosperm fragments 14 Miscellaneous fragments (CaO)[a] 12 Miscellaneous round fibers (9 CaO)[a] 1 Miscellaneous spiral twist 1 *Zea mays* cupule fragment 1 cf. *Zea mays* cupule fragment	1 Cheno-am seed 1 cf. Cheno-am seed fragment 1 *Euphorbia* seed 4 cf. *Euphorbia* seed fragments	1 Charred fecal pellet Numerous fecal pellets[b] 3 Insect cases 41 Insect exoskeleton fragments 1 Snail shell

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Roasting pit F28 fill	506-1, 575-1	4	21 *Agave* fibers (CaO)[a]	1 Cheno-am seed	2 Ants
			3 Cheno-am seeds	1 cf. *Euphorbia* seed fragment	2 Charred termite pellets
			2 Cheno-am seed fragments		Numerous fecal pellets[b]
			2 cf. Cheno-am seed fragments		1 Insect case
			1 *Echinocereus* seed		54 Insect exoskeleton fragments
			1 Euphorbia seed		1 Snail shell
			1 *Hordeum* grain		
			1 *Hordeum* grain fragment		
			1 cf. *Hordeum* grain fragment		
			1 cf. *Hordeum* spikelet fragment		
			5 Indeterminate seed fragments		
			56 Miscellaneous endosperm fragments		
			2 Miscellaneous fragments (CaO)[a]		
			20 Miscellaneous round fibers (14 CaO)[a]		
			1 Miscellaneous spiral twist		
			1 *Sphaeralcea* seed fragment		
			1 *Zea mays* cupule		
			3 *Zea mays* cupule fragments		
			1 cf. *Zea mays* cupule fragment		
			2 *Zea mays* kernel fragments		
Pithouse F32 floor fill	310-6	4	5 *Agave* fibers (1 CaO)[a]	1 cf. Cheno-am seed fragment	1 Ant
			1 *Arctostaphylos* nutlet	1 Indeterminate fruit fragment	3 Charred fecal pellets
			10 Cheno-am seeds		2 Charred termite pellets
			11 Cheno-am seed fragments		53 Fecal pellets[c]
			10 cf. Cheno-am seed fragments		17 Insect exoskeleton fragments[c]
			1 *Descurainia* seed		1 Snail shell
			1 *Hordeum* grain		5 Termite exoskeleton fragments
			1 cf. *Hordeum* spikelet fragment		
			21 Indeterminate seed fragments		
			4 *Leptochloa* type grains		
			4 *Leptochloa* type grain fragments		
			8 cf. *Leptochloa* type grain fragments		
			9 Miscellaneous endosperm fragments		
			1 Miscellaneous fragment (CaO)[a]		
			112 Miscellaneous round fibers (3 CaO)[a]		
			1 cf. *Opuntia* seed fragment		
			1 *Portulaca* seed		
Pithouse F34 floor fill	143-3	4	2 *Agave* fibers (CaO)[a]	1 cf. *Cynodon dactylon* floret	2 Amber resin globules
			3 Cheno-am seeds	1 Cheno-am seed	1 Charred fecal pellet
			4 Cheno-am seed fragments	1 Cheno-am seed fragment	1 Charred termite pellet
			2 cf. Cheno-am seed fragments	1 cf. Cheno-am seed fragment	Numerous fecal pellets[b]
			1 *Hordeum* grain	1 Indeterminate seed fragment	2 Insect cases
			4 *Hordeum* grain fragments	1 *Sporobolus* type grain	39 Insect exoskeleton fragments[c]
			1 *Hordeum* rachis joint fragment		2 Snail shells
			17 cf. *Hordeum* spikelet fragments		1 Termite
			9 Indeterminate seed fragments		4 Termite exoskeleton fragments
			1 *Leptochloa* type grain		1 Unburned bone
			1 cf. *Leptochloa* type grain fragment		
			25 Miscellaneous endosperm fragments		
			1 Miscellaneous fragment (CaO)[a]		
			1 Miscellaneous spiral twist		
			3 Miscellaneous round fibers (2 CaO)[a]		

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse hearth F34.01 fill	193-1	0.5	(UNPRODUCTIVE) 2 cf. *Hordeum* spikelet fragments 1 Indeterminate seed fragment 79 *Papaver somniferum* seeds 2 *Papaver somniferum* seed fragments	1 Cheno-am seed fragment 1 cf. Cheno-am seed fragment	Numerous fecal pellets[b] 1 Insect case 1 Insect case fragment 16 Insect exoskeleton fragments 1 Snail shell
Roasting pit F43 fill	157-5, 251-5	4	4 *Bromus-Elymus* type grain fragments 9 cf. Cheno-am seed coat fragments 3 Indeterminate seed fragments 7 Miscellaneous endosperm fragments 4 Miscellaneous fragments (CaO)[a] 3 Miscellaneous round fibers (2 CaO)[a] 1 Miscellaneous spiral twist 1 *Sphaeralcea* seed	7 Cheno-am seeds 1 cf. Cheno-am seed fragment 1 *Erodium* fruit fragment 1 *Papaver somniferum* seed 2 *Sporobolus* type grains	3 Ants 2 Charred fecal pellets 1 Charred termite pellet 4 Insect cases 86 Insect exoskeleton fragments Numerous fecal pellets[b] 1 Snail shell 2 Termite pellets
Pit F45 fill ("looter pit")	239-7	4	40 *Agave* fibers (CaO)[a] 5 Cheno-am seed fragments 1 cf. Cheno-am seed fragment 1 Compositae achene 1 *Distichlis* type grain fragment 2 cf. *Hordeum* spikelet fragments 23 Indeterminate seed fragments 1 Indeterminate fruit fragment 4 *Leptochloa* type grains (2 caramelized) 8 Miscellaneous D-shaped fibers (3 CaO)[a] 12 Miscellaneous endosperm fragments 3 Miscellaneous fragments (CaO)[a] 97 Miscellaneous round fibers (75 CaO)[a] 1 Miscellaneous spiral twist 1 cf. *Phacelia ambigua* type seed fragment 1 Solanaceae seed 4 *Sporobolus* type grains 6 cf. *Sporobolus* type grain fragments 1 cf. *Zea mays* cupule fragment	5 Angiospermae anthers 1 *Bromus rubens* type floret fragment 29 Cheno-am seeds 2 Cheno-am seed fragments 2 cf. Cheno-am seed fragments 1 Compositae achene 2 cf. Compositae achenes 72 *Cupressus-Juniperus* branchlet fragments 5 *Cupressus-Juniperus* leaf scales 1 *Cynodon dactylon* floret 11 Dicotyledoneae leaves 5 Dicotyledoneae leaf fragments 1 *Echinocereus* seed fragment 1 *Erodium cicutarium* fruit 1 cf. *Erodium* fruit fragment 2 *Euphorbia* seeds 1 Indeterminate fruit fragment 21 Miscellaneous round fibers (3 CaO?) 1 Monocotyledoneae stem fragment 3 *Sporobolus* type grains	1 Ant 4 Charred termite pellets 1 Charred termite pellet fragment Numerous fecal pellets[b] 1 Insect 2 Insect cases 104 Insect exoskeleton fragments[c] 1 Snail shell 1 Spider 2 Termite exoskeleton fragments 2 Termite pellets

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Extramural surface pit F54 fill	352-3, 353-2	4	5 *Agave* fibers (CaO)[a] 1 *Astragalus Nuttallianus* type seed 3 Boraginaceae-like unknown seeds 3 Boraginaceae-like unknown seed fragments 5 Cheno-am seeds 9 Cheno-am seed fragments 8 cf. Cheno-am seed fragments 4 *Descurainia* seeds 1 *Descurainia* seed fragment 7 *Echinocereus* seeds 1 *Echinocereus* seed fragment 1 Globular unknown seed 3 Globular unknown seed fragments 10 *Hordeum* grains 29 *Hordeum* grain fragments 21 cf. *Hordeum* grain fragments 60 *Hordeum* rachis joint fragments[c] 174 cf. *Hordeum* spikelet fragments[c] 100 Indeterminate seed fragments[c] 1 *Leptochloa* type grain 3 *Mentzelia* seeds 3 *Mentzelia* seed fragments Numerous miscellaneous endosperm fragments[b] 6 Miscellaneous fragments (CaO)[a] 11 Miscellaneous round fibers (9 CaO)[a] 1 Miscellaneous spiral twist 1 *Portulaca* seed 1 *Sphaeralcea* seed 2 cf. *Sphaeralcea* seeds 4 *Zea mays* cupule fragments 4 cf. *Zea mays* cupule fragments 4 cf. *Zea mays* glume fragments 1 *Zea mays* kernel fragment 2 cf. *Zea mays* kernel fragments	11 Cheno-am seeds 1 Cheno-am seed fragment 1 cf. Cheno-am seed fragment 1 *Euphorbia* seed 25 *Sporobolus* type grains[c] 4 *Sporobolus* type grain fragments 1 cf. *Sporobolus* type grain fragment	2 Charred termite pellets 1 Charred termite pellet aggregate Numerous fecal pellets[b] 38 Insect exoskeleton fragments[c] 4 Snail shells
Pithouse F59 floor fill	438-5	4	12 *Agave* fibers (3 CaO)[a] 1 *Arctostaphylos* nutlet 1 *Arctostaphylos* nutlet fragment 5 Cheno-am seeds 2 cf. Cheno-am seed fragments 1 *Echinocereus* seed 1 *Echinocereus* seed fragment 1 cf. *Echinocereus* seed fragment 1 *Hordeum* rachis joint fragment 15 Indeterminate seed fragments 4 Miscellaneous endosperm fragments 31 Miscellaneous round fibers (5 CaO)[a] 2 Miscellaneous spiral twists 2 *Zea mays* cupule fragments	1 cf. *Euphorbia* seed fragment	1 Charred termite pellet 1 Charred termite pellet fragment Numerous fecal pellets[b] 1 Insect case 31 Insect exoskeleton fragments

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse Hearth F59.01 fill	473-3	2	5 *Agave* fibers (CaO)[a] 38 Cheno-am seeds 42 Cheno-am seed fragments 41 cf. Cheno-am seed fragments 1 Compositae achene 9 *Descurainia* seeds 1 *Descurainia* seed fragment 2 cf. *Descurainia* seed fragments 1 *Distichlis* type grain 6 Globular unknown seeds 4 Globular unknown seed fragments 1 cf. Gramineae grain 1 cf. Gramineae grain fragment 1 *Hordeum* grain fragment 1 cf. *Hordeum* grain fragment 1 *Hordeum* rachis joint fragment 6 cf. *Hordeum* spikelet fragments Numerous indeterminate seed fragments[b] 1 cf. *Lepidium* seed fragment 155 *Leptochloa* type grains[c] 96 *Leptochloa* type grain fragments[c] 198 cf. *Leptochloa* type grain fragments[c] 2 Miscellaneous D-shaped fibers (CaO)[a] 1 *Mentzelia* seed 2 *Mentzelia* seed fragments Numerous miscellaneous endosperm fragments[b] 3 Miscellaneous fragments (CaO)[a] 3 Miscellaneous round fibers (CaO)[a] 1 Miscellaneous spiral twist 80 *Papaver somniferum* seeds 1 cf. *Phalaris* grain 1 *Portulaca* seed fragment 2 *Zea mays* cupules 2 *Zea mays* cupule fragments 1 cf. *Zea mays* cupule fragment	40 Cheno-am seeds 11 Cheno-am seed fragments 18 cf. Cheno-am seed fragments 1 *Erodium* fruit fragment 1 cf. *Erodium* seed fragment 5 *Euphorbia* seeds 1 Indeterminate seed fragment 15 *Portulaca* seeds	1 Charred fecal pellet 1 Charred fecal pellet aggregate 5 Charred termite pellets Numerous fecal pellets[b] 1 Insect case 16 Insect exoskeleton fragments 4 Termite pellets
Roasting pit F60 fill	376-1	4	3 *Agave* fibers (CaO)[a] 2 Cheno-am seeds 2 Cheno-am seed fragments 3 cf. Cheno-am seed fragments 2 cf. *Descurainia* seed fragments 1 *Echinocereus* seed 1 *Echinocereus* seed fragment 1 *Elymus* type grain fragment 1 Globular unknown seed fragment 10 Indeterminate seed fragments 1 *Leptochloa* type grain 27 Miscellaneous endosperm fragments 1 Miscellaneous fragment (CaO)[a] 1 Miscellaneous spiral twist 1 *Zea mays* cupule fragment	4 *Cupressus-Juniperus* branchlet fragments 1 *Euphorbia* seed	1 Charred termite pellet 1 Charred termite pellet aggregate Numerous fecal pellets[b] 4 Insect cases 10 Insect exoskeleton fragments 2 Snail shells 1 Unburned bone fragment

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pit F63 fill	435-7	4	18 *Agave* fibers (16 CaO)[a] 5 Cheno-am seeds (1 caramelized) 8 Cheno-am seed fragments 1 *Descurainia* seed 1 *Hordeum* grain fragment 1 cf. *Hordeum* spikelet fragment 67 Indeterminate seed fragments[c] 1 *Leptochloa* type grain 44 Miscellaneous endosperm fragments[c] 4 Miscellaneous flat fibers (3 CaO)[a] 3 Miscellaneous fragments (CaO)[a] 10 Miscellaneous round fibers (7 CaO)[a] 2 cf. *Opuntia* seed fragments 1 *Zea mays* cupule 28 *Zea mays* cupule fragments 13 cf. *Zea mays* cupule fragments 1 *Zea mays* glume 2 *Zea mays* glume fragments 2 cf. *Zea mays* glume fragments 1 *Zea mays* kernel fragment 2 cf. *Zea mays* kernel fragments	1 *Cupressus-Juniperus* branchlet fragment 3 Dictyledoneae leaves 2 *Euphorbia* seeds 1 cf. *Sporobolus* type grain fragment	1 Charred fecal pellet 2 Charred termite pellets Numerous fecal pellets[b] 1 Insect case Numerous insect exoskeleton fragments[b] 2 Snail shells 2 Termite exoskeleton fragments 1 Unburned bone fragment
Crematorium F71 fill	499-5	4	4 Cheno-am seeds 14 Cheno-am seed fragments 21 cf. Cheno-am seed fragments 2 *Hordeum* grains 4 *Hordeum* grain fragments 1 *Hordeum* rachis joint fragment 5 cf. *Hordeum* spikelet fragments 21 Indeterminate seed fragments 2 *Leptochloa* type grains 97 Miscellaneous endosperm fragments 2 Miscellaneous fragments (CaO)[a] 4 Miscellaneous round fibers (2 CaO)[a] 3 Platyopuntia seed fragments 11 cf. Platyopuntia seed fragments 1 *Zea mays* cupule fragment	1 cf. *Celtis* seed fragment 1 Cheno-am seed 3 *Cupressus-Juniperus* branchlet fragments 3 *Euphorbia* seeds 1 *Euphorbia* seed fragment 1 Miscellaneous spiral twist	1 Ant 63 Charred termite pellets 2 Charred termite pellet aggregates Numerous fecal pellets[b] 2 Insect case fragments 14 Insect exoskeleton fragments
Pit F75 fill (associated with surface F72)	485-2	1	(UNPRODUCTIVE) 2 Indeterminate seed fragments	1 Cheno-am seed 1 *Cupressus-Juniperus* branchlet fragment 3 *Sporobolus* type grains 3 cf. *Sporobolus* type grains 1 Unknown fruit fragment with stellate hairs	Numerous fecal pellets[b] 43 Insect exoskeleton fragments Numerous termite pellets[b] 10 Termite pellet aggregates 2 Snail shells

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pit F76 fill (burned)	467-6	4	1 *Echinocereus* seed 2 *Hordeum* grains 1 *Hordeum* grain fragment 3 cf. *Hordeum* grain fragments 1 cf. *Hordeum* spikelet fragment 8 Indeterminate seed fragments 35 Miscellaneous endosperm fragments 2 Miscellaneous fragments (CaO)[a] 4 Miscellaneous round fibers (CaO)[a] 1 cf. *Phacelia* seed fragment 12 *Zea mays* cupules 51 *Zea mays* cupule fragments 31 cf. *Zea mays* cupule fragments 8 *Zea mays* glume fragments 7 cf. *Zea mays* glume fragments 2 cf. *Zea mays* kernel fragments	2 Cheno-am seeds 1 cf. Cheno-am seed fragment 7 *Cupressus-Juniperus* branchlet fragments 2 Dicotyledoneae leaves 4 *Euphorbia* seeds 2 *Euphorbia* seed fragments 1 cf. *Euphorbia* seed fragment 1 *Portulaca* seed 2 *Sporobolus* type grains 3 cf. *Sporobolus* type grain fragments	1 Charred fecal pellet 2 Charred termite pellets Numerous fecal pellets[b] 5 Insects Numerous insect exoskeleton fragments[b] 1 Snail shell 2 Termite pellets
Crematorium F82 fill	488-2	4	1 *Arctostaphylos* nutlet aggregate 1 Cheno-am seed fragment 1 cf. Gramineae grain fragment 1 *Hordeum* grain fragment 8 Miscellaneous endosperm fragments 1 Miscellaneous round fiber 1 cf. *Sporobolus* type grain fragment	4 *Euphorbia* seeds 1 *Euphorbia* seed fragment	1 Charred termite pellet 152 Fecal pellets 8 Insect exoskeleton fragments 2 Snail shells 1 Unburned bone fragment
Crematorium F85 fill	501-6	4	1 *Agave* fiber (CaO)[a] 3 Cheno-am seeds 2 cf. Cheno-am seed fragments 1 *Hordeum* grain 13 Indeterminate seed fragments 3 *Leptochloa* type grains 6 Miscellaneous endosperm fragments 1 Miscellaneous flat fiber (CaO)[a] 3 Miscellaneous fragments (CaO)[a] 9 Miscellaneous round fibers (7 CaO)[a]	1 Cheno-am seed 2 cf. Cheno-am seed fragments 1 *Cupressus-Juniperus* branchlet fragment 1 *Daucus* fruit 4 Dicotyledoneae leaves 1 *Opuntia* seed interior fragment 3 *Sporobolus* type grains 1 cf. *Sporobolus* type grain	1 Charred termite pellet Numerous fecal pellets[b] 69 Insect exoskeleton fragments 1 Snail shell
Roasting pit F86 fill	507-2	4	6 *Agave* fibers (4 CaO)[a] 2 Boraginaceae-like unknown seeds 5 Cheno-am seeds 1 Cheno-am seed fragment 9 cf. Cheno-am seed coat fragments 3 *Descurainia* seeds 1 cf. *Descurainia* seed fragment 3 *Echinocereus* seeds 1 *Hordeum* grain fragment 1 cf. *Hordeum* grain fragment 8 Indeterminate seed fragments 4 *Leptochloa* type grains 19 Miscellaneous endosperm fragments 2 Miscellaneous flat fibers (CaO)[a] 3 Miscellaneous fragments (CaO)[a] 8 Miscellaneous round fibers (7 CaO)[a] 1 *Zea mays* cupule fragment 4 cf. *Zea mays* cupule fragments	1 Dicotyledoneae leaf 1 *Echinocereus* seed 1 *Euphorbia* seed	26 Charred fecal pellets 1 Charred fecal pellet aggregate 4 Charred fecal pellet fragments 183 Charred termite pellets 5 Charred termite pellet aggregates 19 Charred termite pellet fragments Numerous fecal pellets[b] 123 Insect exoskeleton fragments 1 Ostracode shell (whole) 2 Snail shells

Table G.1. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Crematorium F117 fill	524-5	4	1 Cheno-am seed 2 cf. *Hordeum* spikelet fragments 24 Indeterminate seed fragments 1 *Leptochloa* type grain 25 Miscellaneous endosperm fragments 1 Miscellaneous round fiber 1 *Sporobolus* type grain	9 Cheno-am seeds 8 *Euphorbia* seeds 4 *Euphorbia* seed fragments 2 cf. *Sporobolus* type grain fragments	2 Charred termite pellets 3 charred termite pellet fragments Numerous fecal pellets[b] 18 Insect exoskeleton fragments 1 Unburned bone fragment
Roasting pit F118 fill	508-4, 516-1, 517-1	4	1 Cheno-am seed 2 Cheno-am seed coat fragments 11 cf. Cheno-am seed coat fragments 1 *Descurainia* seed fragment 1 *Echinocereus* seed 1 *Echinocereus* seed fragment 1 Indeterminate seed fragment 4 *Leptochloa* type grains 8 Miscellaneous endosperm fragment 1 Miscellaneous flat fiber (CaO)[a] 1 Miscellaneous fragment (CaO)[a] 1 Miscellaneous round fiber (CaO)[a] 1 *Portulaca* seed	13 Cheno-am seeds 2 Cheno-am seed fragments 1 *Erodium* seed fragment	3 Charred fecal pellets 3 Charred termite pellets 2 Charred termite pellet fragments Numerous fecal pellets[b] 69 Insect exoskeleton fragments 9 Termites 16 Termite exoskeleton fragments 2 Unburned bone fragments

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.2. Raw flotation data from the Hilltop site, AZ O:15:53 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F1 floor fill	139-3	4.0	6 *Agave* fibers (CaO)[a] 2 Cheno-am seed coat fragments 1 *Descurainia* seed 1 *Hordeum* grain fragment 4 cf. *Hordeum* spikelet fragments 7 Indeterminate seed fragments 1 *Leptochloa* type grain 6 Miscellaneous D-shaped fibers (5 CaO)[a] 8 Miscellaneous endosperm fragments 1 Miscellaneous flat fiber (CaO)[a] 4 Miscellaneous fragments (CaO)[a] 21 Miscellaneous round fibers (17 CaO)[a]	1 cf. *Sporobolus* type grain fragment	3 Charred fecal pellets Numerous fecal pellets[b] 2 Insect cases 40 Insect exoskeleton fragments 41 Termite pellets
Masonry pitroom F5 floor fill	186-3	4.0	3 Cheno-am seeds 8 Cheno-am seed fragments 2 cf. Cheno-am seed fragments 2 Miscellaneous endosperm fragments 1 Miscellaneous round fiber	1 cf. Cactaceae seed coat fragment 1 cf. *Daucus* fruit 1 *Euphorbia* seed 1 *Euphorbia* seed fragment 2 Indeterminate seed fragments 1 Miscellaneous fragment (CaO)[a] 1 *Sporobolus* type grain 1 Unknown fruit fragment with stellate hairs	Numerous fecal pellets[b] Numerous insect exoskeleton fragments[b] 1 Snail shell

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.

Table G.3. Raw flotation data from the Cobble site, AZ O:15:54 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Trash mound F2, level 1	107-5	4.0	40 *Agave* fibers (39 CaO)[a] 1 Cheno-am seed fragment 6 Indeterminate seed fragments 5 Miscellaneous endosperm fragments 4 Miscellaneous flat fibers (CaO)[a] 21 Miscellaneous fragments (CaO)[a] 16 Miscellaneous round fibers (CaO)[a] 2 Miscellaneous round fiber bundles (CaO)[a] 1 cf. *Zea mays* cupule fragment 1 cf. *Zea mays* kernel fragment	1 *Astragalus Nuttallianus* type seed 41 Cheno-am seeds 4 Cheno-am seed fragments 3 cf. Cheno-am seed fragments 1 Dicotyledoneae leaf 2 *Echinocereus* seeds 2 *Echinocereus* seed fragments 1 cf. *Echinocereus* seed fragment 1 *Erodium* fruit fragment 5 cf. *Erodium* fruit fragments 4 *Erodium cicutarium* seeds 27 *Euphorbia* seeds 3 *Euphorbia* seed fragments 1 cf. *Euphorbia* seed fragment 2 Indeterminate fruit fragments 12 Indeterminate seed fragments 1 Miscellaneous spiral twist 8 *Opuntia* seed coat fragments 3 *Portulaca* seeds 3 cf. *Portulaca* seed fragments 2 *Schismus* type grains 7 cf. *Schismus* type grain fragments 1 *Sporobolus* type grain	Numerous fecal pellets[b] 1 Insect case Numerous insect exoskeleton fragments[b] 1 Unburned bone
Trash mound F2, level 2	108-5	4.0	27 *Agave* fibers (CaO)[a] 1 *Elymus* type grain 4 Indeterminate seed fragments (1 caramelized) 17 Miscellaneous fragments (CaO)[a] 15 Miscellaneous round fibers (12 CaO)[a]	28 Cheno-am seeds 7 Cheno-am seed fragments 1 *Erodium cicutarium* fruit 4 *Euphorbia* seeds 1 *Euphorbia* seed fragment 6 Indeterminate seed fragments 55 *Opuntia* seed coat fragments 10 *Portulaca* seeds 1 *Portulaca* seed fragment 2 cf. *Schismus* type grain fragments 1 *Sporobolus* type grain	1 Charred termite pellet Numerous fecal pellets[b] 2 Insect cases Numerous insect exoskeleton fragments[b] 5 Termite pellets 1 Unburned bone fragment

Table G.3. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Trash mound F2, level 3	109-5	4.0	101 *Agave* fibers (95 CaO)[a] 1 Cheno-am seed 1 Cheno-am seed fragment 2 *Hordeum* grain fragments 1 cf. *Hordeum* grain fragment 7 Indeterminate seed fragments 2 Miscellaneous D-shaped fibers (CaO)[a] 22 Miscellaneous endosperm fragments 6 Miscellaneous flat fibers (CaO)[a] 98 Miscellaneous fragments (CaO)[a] 2 Miscellaneous fragments of round fibers scattered in parenchyma (CaO)[a] 73 Miscellaneous round fibers (66 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 4 *Zea mays* cupule fragments 4 cf. *Zea mays* cupule fragments 1 *Zea mays* kernel fragment 2 cf. *Zea mays* kernel fragments	7 Cheno-am seeds 1 Dicotyledoneae leaf 1 *Erodium* fruit fragment 9 *Euphorbia* seeds 5 *Euphorbia* seed fragments 9 Indeterminate seed fragments 41 *Opuntia* seed coat fragments 7 *Portulaca* seeds 1 *Portulaca* seed fragment 2 *Sporobolus* type grains 2 cf. *Sporobolus* type grain fragments	Numerous fecal pellets[b] 1 Insect case Numerous insect exoskeleton fragments[b] 1 Unburned bone 3 Unburned bone fragments
Trash mound F2, level 4	110-4	4.0	265 *Agave* fibers (264 CaO) [a,c] 1 *Agave* round and trough-shaped fiber bundle (CaO)[a] 1 Cheno-am seed coat fragment 5 cf. Cheno-am seed fragments 1 *Descurainia* seed 1 *Echinocereus* seed 1 cf. Gramineae grain fragment 4 Indeterminate seed fragments 11 Miscellaneous D-shaped fibers (CaO)[a,c] 25 Miscellaneous endosperm fragments 20 Miscellaneous flat fibers (CaO)[a,c] Numerous miscellaneous fragments (CaO)[a,b] 158 Miscellaneous round fibers (156 CaO)[a,c] 5 Miscellaneous round fiber bundles (CaO)[a] 3 Miscellaneous spiral twists 1 cf. *Portulaca* seed coat fragment 1 *Zea mays* cupule 1 cf. *Zea mays* cupule fragment	4 Cheno-am seeds 2 Cheno-am seed fragments 3 *Echinocereus* seed fragments 4 cf. *Erodium* fruit fragments 6 *Euphorbia* seeds 3 *Euphorbia* seed fragments 30 *Opuntia* seed coat fragments 2 cf. *Plantago* fruit fragments 1 *Plantago* seed 1 cf. *Plantago* seed fragment 1 cf. *Sporobolus* type grain fragment	Numerous fecal pellets[b] 1 Insect case Numerous insect exoskeleton fragments[b] 1 Snail shell 1 Unburned bone fragment

Table G.3. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
D-shaped masonry pitroom F9 floor fill	117-5	4.0	1 cf. *Agave* caudex fragment (CaO)[a] 39 *Agave* fibers (36 CaO)[a] 1 cf. Cheno-am seed fragment 1 *Hordeum* grain fragment 9 Indeterminate seed fragments (1 caramelized) 2 Miscellaneous D-shaped fibers (CaO)[a] Numerous miscellaneous endosperm or *Agave* caudex fragments[b] 230 Miscellaneous fragments (CaO)[a] 14 Miscellaneous fragments of round fibers scattered in parenchyma (CaO)[a] 67 Miscellaneous round fibers (60 CaO)[a] 11 Miscellaneous round fiber bundles (CaO)[a] 3 *Portulaca* seeds 1 cf. *Portulaca* seed fragment 1 cf. *Zea mays* cupule fragment 1 cf. *Zea mays* kernel fragment	3 Indeterminate seeds 5 Miscellaneous fragments (CaO)[a]	77 Fecal pellets 3 Insect cases 78 Insect exoskeleton fragments 1 Termite
Hearth F9.01 fill in D-shaped masonry pitroom	123-3	4.0	5 cf. *Agave* caudex fragments (CaO)[a] 259 *Agave* fibers (251 CaO)[a] 5 *Agave* fragments of round and trough-shaped fibers scattered in parenchyma (CaO)[a] 1 cf. *Agave* marginal tooth fragment (CaO)[a] 1 *Arctostaphylos* nutlet 1 Boraginaceae-like unknown seed 3 Cheno-am seeds 39 cf. Cheno-am seed fragments (3 caramelized) 20 Indeterminate seed fragments 4 Miscellaneous D-shaped fibers (CaO)[a] Numerous miscellaneous endosperm fragments[b] Numerous fragments (CaO)[a,b] 7 Miscellaneous flat fibers (CaO)[a] 20 Miscellaneous fragments of round fibers scattered in parenchyma (CaO)[a] 182 Miscellaneous round fibers (168 CaO)[a] 27 Miscellaneous round fiber bundles (CaO)[a] 28 *Portulaca* seeds (2 caramelized) 22 *Portulaca* seed fragments (2 caramelized) 8 cf. *Portulaca* seed fragments (3 caramelized) 4 *Sporobolus* type grains (1 caramelized) 1 *Zea mays* cupule 2 *Zea mays* cupule fragments 11 cf. *Zea mays* cupule fragments 11 cf. *Zea mays* kernel fragments	1 Gramineae floret 2 *Portulaca* seeds	2 Ants 1 Charred fecal pellet fragment Numerous fecal pellets[b] 85 Insect exoskeleton fragments[c] 1 Termite pellet

Table G.3. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.4. Raw flotation data from the Boone Moore site, AZ O:15:55 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Cobble-lined adobe pitroom F5 (composite sample above upper floor)	185-13	4.0	11 *Agave* fibers (CaO)[a] 1 cf. Cactaceae prickle 10 Miscellaneous fragments (CaO)[a] 7 Miscellaneous round fibers (5 CaO)[a]	1 Gramineae, cf. Hordeae type floret fragment	Numerous fecal pellets[b] 157 Insect exoskeleton fragments
Cobble-lined adobe pitroom F6 floor fill	207-8	4.0	1 cf. *Agave* caudex fragment (CaO)[a] 19 *Agave* fibers (18 CaO)[a] 1 *Echinocereus* seed 19 Miscellaneous endosperm fragments 11 Miscellaneous fragments (CaO)[a] 16 Miscellaneous round fibers (12 CaO)[a] 3 *Zea mays* cupule fragments	1 *Euphorbia* seed 2 Indeterminate seed fragments	122 Fecal pellets[c] 31 Insect exoskeleton fragments[c] 1 Snail shell 1 Termite pellet
Pithouse F11 floor fill	170-13	4.0	13 *Agave* fibers (12 CaO)[a] 5 Miscellaneous endosperm fragments 3 Miscellaneous fragments (CaO)[a] 8 Miscellaneous round fibers (CaO)[a] 1 cf. *Zea mays* cupule fragment 1 cf. *Zea mays* kernel fragment	2 *Euphorbia* seeds 3 *Euphorbia* seed fragments 4 cf. *Euphorbia* seed fragments 14 *Portulaca* seeds 1 *Portulaca* seed fragment	186 Fecal pellets[c] 88 Insect exoskeleton fragments[c] 2 Snail shells
Pithouse hearth F11.01 fill	199-1	2.0	6 *Agave* fibers (CaO)[a] 1 Globular unknown seed 3 Miscellaneous endosperm fragments 9 Miscellaneous fragments (CaO; 1 caramelized) 2 Miscellaneous round fibers (CaO)[a]	2 Cheno-am seeds 1 Dicotyledoneae leaf fragment 2 *Euphorbia* seeds	77 Fecal pellets 14 Insect exoskeleton fragments
Masonry pitroom F18 upper floor fill	151-11	4.0	2 *Agave* fibers (CaO)[a] 1 Miscellaneous endosperm fragment 3 Miscellaneous round fibers (1 CaO)[a]	1 Cheno-am seed 2 *Daucus* fruit fragments 2 Dicotyledoneae leaves 3 Dicotyledoneae leaf fragments 1 *Echinocereus* seed 4 *Echinocereus* seed fragments 58 *Euphorbia* seeds 12 *Euphorbia* seed fragments 5 cf. *Euphorbia* seed fragments 2 Gramineae, Hordeae type grain fragments 2 Indeterminate seed fragments 1 *Mollugo* seed 11 cf. *Opuntia* seed coat fragments 1 *Physalis* seed 4 *Portulaca* seeds 3 *Sporobolus* type grains 23 Unknown fruits with stellate hairs 20 Unknown fruit fragments with stellate hairs	1 Beetle Numerous fecal pellets[b] 2 Insect cases Numerous insect exoskeleton fragments[b] 1 Unburned bone

Table G.4. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Masonry pitroom F18 lower floor fill	219-8	4.0	7 *Agave* fibers (CaO)[a] 2 Miscellaneous endosperm fragments 6 Miscellaneous fragments (CaO)[a] 2 Miscellaneous round fibers (CaO)[a]	2 Cheno-am seeds 1 Dicotyledoneae leaf 1 *Echinocereus* seed fragment 4 *Euphorbia* seeds 6 *Euphorbia* seed fragments 1 cf. *Euphorbia* seed fragment 2 *Portulaca* seeds 1 cf. *Portulaca* seed fragment	1 Burned bone fragment Numerous fecal pellets[b] 1 Fecal pellet aggregate 3 Insect cases Numerous insect exoskeleton fragments[b]
Pithouse hearth F19.01 fill	174-4	4.0	23 *Agave* fibers (22 CaO)[a] 2 Miscellaneous endosperm fragments 5 Miscellaneous fragments (CaO)[a] 8 Miscellaneous round fibers (7 CaO)[a] 1 Miscellaneous spiral twist 1 *Zea mays* cupule fragment 1 cf. *Zea mays* cupule fragment 1 cf. *Zea mays* glume fragment	9 Cheno-am seeds 2 *Euphorbia* seeds 1 *Leptochloa* type grain 7 *Portulaca* seeds 1 cf. *Portulaca* seed coat fragment	Numerous fecal pellets[b] 17 Insect exoskeleton fragments 2 Unburned bones 2 Unburned bone fragments
Roasting pit F20 fill	257-5	4.0	4 *Agave* fibers (3 CaO)[a] 1 Miscellaneous endosperm fragment 2 Miscellaneous flat fibers (1 CaO)[a] 3 Miscellaneous fragments (CaO)[a] 19 Miscellaneous round fibers	4 Cheno-am seeds 1 *Daucus* fruit fragment 62 *Euphorbia* seeds 21 *Euphorbia* seed fragments 7 cf. *Euphorbia* seed fragments 3 Indeterminate seed fragments 1 cf. *Opuntia* seed coat fragment 1 *Portulaca* seed 1 *Portulaca* seed fragment 1 cf. *Schismus* type grain 1 *Sphaeralcea* seed 5 *Sporobolus* type grains 2 Unknown fruits with stellate hairs 1 Unknown fruit fragment with stellate hairs	1 Charred fecal pellet 1 Charred fecal pellet fragment Numerous fecal pellets[b] 1 Insect case fragment Numerous insect exoskeleton fragments[b]
Pit F22 fill (trash pit)	216-3	4.0	9 *Agave* fibers (CaO)[a] 1 Miscellaneous D-shaped fibers (CaO)[a] 3 Miscellaneous endosperm fragments 1 Miscellaneous flat fibers (CaO)[a] 9 Miscellaneous fragments (CaO)[a] 11 Miscellaneous round fibers (9 CaO)[a] 2 *Zea mays* cupule fragments	1 Cheno-am seed fragment 1 *Euphorbia* seed 1 cf. *Sporobolus* type grain fragment	1 Ant Numerous fecal pellets[b] 17 Insect exoskeleton fragments 1 Snail shell

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.5. Raw flotation data from the Compact site, AZ O:15:90 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F3 floor fill	141-5	4.0	6 *Agave* fibers (CaO)[a] 4 Cheno-am seeds 7 Cheno-am seed fragments 4 *Echinocereus* seeds 1 *Echinocereus* seed coat fragment 2 cf. *Elymus* type grain fragments 1 *Hordeum* grain fragment 2 Indeterminate seed fragments 52 Miscellaneous endosperm fragments 9 Miscellaneous fragments (CaO; 2 caramelized) 4 Miscellaneous round fibers (1 CaO)[a] 1 Miscellaneous spiral twist 1 *Sporobolus* type grain 3 *Zea mays* cupule fragments 1 cf. *Zea mays* kernel fragment	1 *Baccharis* achene 7 Dicotyledoneae leaves 1 cf. *Euphorbia* seed fragment 2 Indeterminate fruit fragments	5 Fecal pellets 8 Insect exoskeleton fragments
Pithouse hearth F4.01 fill	127-2	4.0	6 *Agave* fibers (CaO)[a] 1 Cheno-am seed 1 Cheno-am seed fragment 7 Indeterminate seed fragments 16 Miscellaneous endosperm fragments 7 Miscellaneous fragments (CaO)[a] 9 Miscellaneous round fibers (4 CaO)[a] 2 Monocotyledoneae stem fragments 1 *Portulaca* seed	1 *Echinocereus* seed fragment	12 Fecal pellets 2 Fecal pellet aggregates 4 Insect exoskeleton fragments 2 Unburned bones
Pithouse F5 floor fill	137-4	3.5	2 *Agave* fibers (1 CaO)[a] 1 Cheno-am seed 2 *Echinocereus* seeds 2 *Echinocereus* seed fragments 1 *Hordeum* grain fragment 1 cf. *Hordeum* grain fragment 27 Indeterminate seed fragments (1 caramelized) 37 Miscellaneous endosperm fragments 5 Miscellaneous fragments (CaO)[a] 1 Miscellaneous round fiber 1 Monocotyledoneae stem fragment 1 *Portulaca* seed 1 *Portulaca* seed fragment 1 *Sporobolus* type grain 1 cf. *Zea mays* kernel fragment	2 *Baccharis* achenes 12 *Echinocereus* seed fragments 1 Indeterminate seed fragment 2 *Portulaca* seeds	1 Ant 20 Fecal pellets 1 Insect case 7 Insect exoskeleton fragments 16 Macrospore clusters 1 Unburned bone fragment
Roasting pit F8 fill	126-3	4.0	2 Cheno-am seeds 3 cf. Cheno-am seed coat fragments 1 Indeterminate seed fragment 10 Miscellaneous endosperm fragments 6 Miscellaneous fragments (CaO)[a] 2 Miscellaneous round fibers (1 CaO)[a]	2 *Baccharis* achenes 4 *Echinocereus* seed coat fragments 2 *Euphorbia* seeds	5 Charred fecal pellets Numerous fecal pellets[b] 25 Insect exoskeleton fragments

Table G.5. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Roasting pit F9 fill	131-2	4.0	1 Cheno-am seed 1 cf. Cheno-am seed fragment 3 Indeterminate seed fragments 1 Miscellaneous endosperm fragment 1 Miscellaneous round fiber 1 Miscellaneous spine fragment 2 *Zea mays* cupule fragments 1 cf. *Zea mays* cupule fragment	1 Angiospermae anther 1 *Baccharis* achene 2 Dicotyledoneae leaves 4 *Euphorbia* seeds 1 cf. *Euphorbia* seed fragment 2 Indeterminate seed fragments 1 cf. *Opuntia* seed coat fragment	4 Ants 73 Charred fecal pellets 151 Fecal pellets[c] Numerous insect exoskeleton fragments[b]

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.6. Raw flotation data from the Redstone site, AZ O:15:91 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F5 floor fill	193-8	4.0	11 *Agave* fibers (8 CaO)[a] 1 Boraginaceae-like unknown seed 5 Cheno-am seeds 5 Cheno-am seed fragments 5 cf. Cheno-am seed fragments 14 cf. *Distichlis* type grains 1 cf. *Distichlis* type grain fragment 1 cf. *Echinocereus* seed fragment 3 *Hordeum* grains 2 cf. *Hordeum* grain fragments 18 Indeterminate seed fragments 1 *Leptochloa* type grain 11 Miscellaneous endosperm fragments 7 Miscellaneous fragments (CaO)[a] 2 Miscellaneous fragments of round fibers and epidermis 45 Miscellaneous round fibers (13 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 2 Miscellaneous spiral twists 1 *Phalaris* grain 3 *Portulaca* seeds 1 *Sporobolus* type grain 2 *Zea mays* cupules 2 *Zea mays* cupule fragments 2 cf. *Zea mays* cupule fragments 1 *Zea mays* glume	1 Angiospermae anther 8 Cheno-am seeds 2 Cheno-am seed fragments 5 cf. Cheno-am seed fragments 3 Dicotyledoneae leaves 1 Dicotyledoneae leaf fragment 2 *Euphorbia* seeds 1 cf. *Euphorbia* seed fragment 13 cf. *Ferrocactus* seed fragments 3 cf. Gramineae grain fragments 3 Indeterminate seed fragments 1 Miscellaneous round fiber (CaO)[a] 1 Miscellaneous spiral twist 215 *Opuntia* seed interior fragments[c] 14 *Portulaca* seeds 1 *Sphaeralcea* seed 3 *Sporobolus* type grains	3 Charred fecal pellets Numerous fecal pellets[b] 2 Insect cases 1 Insect case fragment 189 Insect exoskeleton fragments 42 Termite pellets
Pithouse F11 floor fill	189-14	4.0	22 *Agave* fibers (13 CaO)[a] 3 Cheno-am seeds (1 caramelized) 12 Cheno-am seed fragments 7 cf. Cheno-am seed fragments 3 *Echinocereus* seeds 2 *Echinocereus* seed fragments 6 Indeterminate seed fragments 1 Miscellaneous D-shaped fiber (CaO)[a] 1 Miscellaneous flat fiber (CaO)[a] 8 Miscellaneous fragments (CaO)[a] 41 Miscellaneous round fibers (21 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 1 *Sporobolus* type grain 1 *Zea mays* cupule fragment 1 cf. *Zea mays* cupule fragment 1 *Zea mays* kernel fragment	4 Cheno-am seeds 1 Dicotyledoneae leaf 4 *Euphorbia* seeds 1 *Euphorbia* seed fragment 1 cf. *Euphorbia* seed fragment 2 Indeterminate seed fragments 5 Miscellaneous fragments (CaO)[a] 1 *Portulaca* seed fragment 1 *Sporobolus* type grain	1 Ant Numerous fecal pellets[b] 113 Insect exoskeleton fragments 87 Termite pellets

Table G.6. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Roasting pit F17 fill	207-3	4.0	19 *Agave* fibers (9 CaO)[a] 1 *Arctostaphylos* nutlet fragment 3 Cheno-am seeds 2 Cheno-am seed fragments 1 cf. Cheno-am seed fragment 1 *Echinocereus* seed 2 *Elymus* type grains 1 cf. *Hordeum* grain fragment 2 cf. *Hordeum* spikelet fragments 10 Indeterminate seed fragments 3 Miscellaneous endosperm fragments 4 Miscellaneous fragments (CaO)[a] 28 Miscellaneous round fibers (13 CaO)[a] 1 Monocotyledoneae stem fragment 1 *Plantago* seed fragment 1 cf. *Zea mays* cupule fragment 1 cf. *Zea mays* kernel fragment	9 Cheno-am seeds 1 Cheno-am seed fragment 1 *Echinocereus* seed fragment 3 *Euphorbia* seeds 4 *Euphorbia* seed fragments 1 cf. *Euphorbia* seed fragment 4 Indeterminate seed fragments 1 cf. *Lotus* seed 75 cf. *Opuntia* seed coat fragments 1 *Portulaca* seed 1 cf. *Portulaca* seed fragment 3 *Sporobolus* type grains	2 Charred termite pellets Numerous fecal pellets[b] 2 Insect cases Numerous insect exoskeleton fragments[b] 1 Termite pellet 1 Unburned bone fragment
Pit F25 fill	209-3	4.0	300 *Agave* fibers (286 CaO)[a] 5 *Agave* marginal teeth 1 cf. *Agave* marginal tooth fragment 1 cf. Cheno-am seed fragment 1 cf. Globular unknown seed fragment 2 Indeterminate seed fragments 3 Miscellaneous endosperm fragments 1 Miscellaneous flat fiber (CaO)[a] 102 Miscellaneous fragments (CaO)[a] 137 Miscellaneous round fibers (124 CaO)[a] 6 Miscellaneous round fiber bundles (CaO)[a]	12 Cheno-am seeds 1 Cheno-am seed coat fragment 1 *Erodium cicutarium* seed 1 cf. *Erodium* fruit fragment 1 Indeterminate seed coat fragment 1 *Portulaca* seed 1 *Sporobolus* type grain	Numerous fecal pellets[b] 2 Insect cases 127 Insect exoskeleton fragments 1 Macrospore cluster 1 Termite pellet 1 Unburned bone

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.7. Raw flotation data from AZ O:15:92 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F14 floor fill	127-9	4.0	8 *Agave* fibers (CaO)[a] 9 Cheno-am seeds 17 Cheno-am seed fragments 11 cf. Cheno-am seed fragments 2 *Descurainia* seeds 1 *Echinocereus* seed 1 *Echinocereus* seed fragment 1 *Hordeum* grain 1 *Hordeum* grain fragment 13 cf. *Hordeum* spikelet fragments 6 Indeterminate seed fragments 1 Miscellaneous D-shaped fiber (CaO)[a] 18 Miscellaneous endosperm fragments 1 Miscellaneous flat fiber (CaO)[a] 10 Miscellaneous fragments (CaO)[a] 11 Miscellaneous round fibers (7 CaO)[a] 5 *Zea mays* cupules 1 *Zea mays* cupule fragment	1 *Baccharis* achene	124 Fecal pellets 1 Insect case 8 Insect exoskeleton fragments
Pithouse hearth F14.05 fill	139-3	4.0	28 *Agave* fibers (25 CaO)[a] 1 cf. *Agave* marginal tooth fragment 12 Cheno-am seeds 13 Cheno-am seed fragments 1 cf. Cheno-am seed fragment 1 *Descurainia* seed 8 *Hordeum* grain fragments 12 cf. *Hordeum* grain fragments 1 *Hordeum* rachis joint fragment 26 cf. *Hordeum* spikelet fragments 84 Indeterminate seed fragments 10 *Leptochloa* type grains 58 Miscellaneous endosperm fragments 2 Miscellaneous flat fibers (CaO)[a] 26 Miscellaneous fragments (CaO)[a] 29 Miscellaneous round fibers (21 CaO)[a] 29 *Sporobolus* type grains 3 *Sporobolus* type grain fragments (caramelized)	1 cf. *Celtis* seed coat fragment 2 Cheno-am seeds	2 Burned bone fragments 5 Charred fecal pellets 2 Charred fecal pellet fragments 2 Charred fecal pellet aggregates 5 Charred termite pellets Numerous fecal pellets[b] 49 Insect cases 7 Insect exoskeleton fragments 2 Termite pellets 3 Unburned bone fragments

Table G.7. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse hearth F14.08 fill	143-2	4.0	14 *Agave* fibers (13 CaO)[a]	4 Cheno-am seeds	1 Charred termite pellet
			3 Boraginaceae-like unknown seeds	1 *Daucus* fruit	Numerous fecal pellets[b]
			5 Cheno-am seeds	13 Dicotyledoneae leaves	3 Insect cases
			15 Cheno-am seed fragments	12 Dicotyledoneae leaf fragments	23 Insect exoskeleton fragments
			15 cf. Cheno-am seed fragments	1 *Erodium cicutarium* fruit	1 Termite pellet
			3 *Descurainia* seeds	1 Indeterminate fruit fragment	1 Termite pellet fragment
			1 cf. *Descurainia* seed fragment	6 *Sporobolus* type grains	
			6 *Echinocereus* seeds	1 Unknown fruit fragment with stellate hairs	
			9 *Echinocereus* seed fragments		
			1 cf. *Echinocereus* seed fragment		
			1 *Hordeum* grain		
			1 *Hordeum* grain fragment		
			1 cf. *Hordeum* grain fragment		
			1 *Hordeum* rachis joint fragment		
			1 cf. *Hordeum* spikelet fragment		
			90 Indeterminate seed fragments		
			1 Miscellaneous D-shaped fiber		
			3 Miscellaneous flat fibers (CaO)[a]		
			71 Miscellaneous endosperm fragments		
			7 Miscellaneous fragments (CaO)[a]		
			20 Miscellaneous round fibers (11 CaO)[a]		
			1 *Portulaca* seed		
			2 *Sphaeralcea* seeds		
			1 *Zea mays* cupule fragment		
			1 cf. *Zea mays* cupule fragment		

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.

Table G.8. Raw flotation data from the Arby's site, AZ O:15:99 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Masonry structure F1 floor fill	111-3	4.0	15 Miscellaneous endosperm fragments 1 Miscellaneous fragment (CaO)[a] 1 *Zea mays* cupule 1 *Zea mays* kernel fragment	2 Cheno-am seeds 12 Dicotyledoneae leaves 6 Dicotyledoneae leaf fragments 2 cf. *Euphorbia* seed fragments 2 cf. *Schismus* type grains 1 *Sporobolus* type grain	1 Beetle Numerous fecal pellets[b] 2 Insect cases 1 Insect case fragment Numerous insect exoskeleton fragments[b] 1 Snail shell
Slab-lined pitroom F3 floor fill	125-6	4.0	1 *Echinocereus* seed 9 Indeterminate seed fragments (1 caramelized) 31 Miscellaneous endosperm fragments 4 Miscellaneous round fibers (3 CaO)[a] 1 Miscellaneous round fiber bundle (CaO)[a] 1 *Zea mays* cupule 2 *Zea mays* cupule fragments 5 cf. *Zea mays* cupule fragments 1 *Zea mays* kernel fragment 4 cf. *Zea mays* kernel fragments	1 *Celtis* seed 1 *Erodium cicutarium* fruit 1 *Euphorbia* seed 1 *Euphorbia* seed fragment 2 cf. *Euphorbia* seed fragments 2 Indeterminate seed fragments 1 Miscellaneous round fiber (CaO)[a] 1 *Physalis* seed 1 *Schismus* type grain 13 cf. *Schismus* type grains 6 cf. *Schismus* type grain fragments	1 Beetle Numerous fecal pellets[b] 1 Insect Numerous insect exoskeleton fragments[b] 1 Macrospore cluster 1 Unburned boned fragment
Extramural hearth F4 fill	107-3	2.0	(UNPRODUCTIVE) 1 Indeterminate seed fragment 5 Miscellaneous endosperm fragments 1 cf. *Zea mays* cupule fragment	1 Cheno-am seed 4 Indeterminate seed coat fragments 1 Miscellaneous spiral twist	40 Fecal pellets 37 Insect exoskeleton fragments 1 Macrospore cluster 1 Snail shell
Cobble brush structure hearth F5.01 fill	108-2	2.5	1 *Agave* fiber (CaO)[a] 2 Cheno-am seeds 1 Cheno-am seed fragment 6 Indeterminate seed fragments 15 Miscellaneous endosperm fragments 1 *Zea mays* kernel fragment	1 *Bromus rubens* type floret 10 Dicotyledoneae leaves 10 Dicotyledoneae leaf fragments 1 cf. *Euphorbia* seed fragment 1 Indeterminate seed fragment 1 *Portulaca* seed 1 *Sporobolus* type grain	1 Ant 1 Charred fecal pellet Numerous fecal pellets[b] 3 Insect cases 2 Insect case fragments Numerous insect exoskeleton fragments[b] 11 Snail shells

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.

Table G.9. Raw flotation data from the Clover Wash site, AZ O:15:100 (ASM).

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Pithouse F1 floor fill	145-5	4.0	7 *Agave* fibers (5 CaO)[a] 1 Cheno-am seed 2 Cheno-am seed fragments 3 cf. Cheno-am seed fragments 1 Globular unknown seed 2 cf. *Hordeum* grain fragments 1 cf. *Hordeum* spikelet fragment 7 Indeterminate seed fragments 1 *Leptochloa* type grain 2 *Leptochloa* type grain fragments 17 Miscellaneous endosperm fragments 4 Miscellaneous fragments (CaO)[a] 8 Miscellaneous round fibers (5 CaO)[a]	18 Cheno-am seeds 1 *Echinocereus* seed 6 cf. *Opuntia* seed fragments 2 *Sporobolus* type grains	54 Fecal pellets[c] 69 Insect exoskeleton fragments 4 Termite pellets
Pithouse F3 floor fill	142-5	4.0	24 *Agave* fibers (15 CaO)[a] 3 Cheno-am seeds 5 Cheno-am seed fragments 22 cf. Cheno-am seed fragments 1 *Echinocereus* seed 1 cf. *Echinocereus* seed fragment 1 Globular unknown seed 28 Indeterminate seed fragments 1 *Leptochloa* type grain 21 Miscellaneous endosperm fragments 1 Miscellaneous epidermis fragment 19 Miscellaneous fragments (CaO)[a] 157 Miscellaneous round fibers (38 CaO)[c] 1 Miscellaneous spiral twist 3 *Sporobolus* type grains 4 *Sporobolus* type grain fragments	7 Cheno-am seeds 1 Cheno-am seed fragment 1 cf. *Euphorbia* seed fragment	121 Fecal pellets[c] 1 Insect case 115 Insect exoskeleton fragments[c]
Pithouse F12 floor fill	127-6	4.0	15 *Agave* fibers (12 CaO)[a] 3 Cheno-am seeds 1 Cheno-am seed fragment 2 cf. Cheno-am seed fragments 2 *Distichlis* type grains 2 *Echinocereus* seeds 19 Indeterminate seed fragments 1 Miscellaneous D-shaped fiber (CaO)[a] 4 Miscellaneous endosperm fragments 17 Miscellaneous fragments (CaO)[a] 52 Miscellaneous round fibers (33 CaO)[a] 1 Miscellaneous spiral twist 1 *Portulaca* seed 1 *Sporobolus* type grain 1 cf. *Sporobolus* type grain fragment 1 *Zea mays* cupule fragment	41 *Euphorbia* seeds 27 *Euphorbia* seed fragments 3 cf. *Euphorbia* seed fragments 1 Indeterminate seed fragment 1 *Leptochloa* type grain	118 Fecal pellets 1 Gnat 183 Insect exoskeleton fragments 1 Spider 5 Termite pellets

Table G.9. Continued.

Context and Provenience	Prov. No.	Size (L)	Carbonized Plant Taxa	Uncarbonized Plant Taxa	Other
Roasting pit F17 fill	205-2	4.0	2 cf. *Agave* caudex fragments (CaO)[a] 8 *Agave* fibers (6 CaO)[a] 1 *Agave* marginal tooth 4 Cheno-am seeds 2 Cheno-am seed fragments 1 cf. Cheno-am seed fragment 10 Indeterminate seed fragments 66 Miscellaneous endosperm fragments 33 Miscellaneous fragments (CaO)[a] 15 Miscellaneous round fibers (6 CaO)[a] 1 *Opuntia* seed interior fragment 2 *Zea mays* cupule fragments 1 *Zea mays* kernel fragment	12 Cheno-am seeds 1 Dicotyledoneae leaf 2 *Echinocereus* seeds 1 cf. *Erodium* fruit fragment 2 *Euphorbia* seeds 1 *Euphorbia* seed fragment 2 Indeterminate seed coat fragments 6 Miscellaneous fragments (CaO)[a] 1 *Portulaca* seed 2 Unknown fruits (cf. Bohrer [1984:Fig. 8.2C])	Numerous fecal pellets[b] Numerous insect exoskeleton fragments[b] 1 Termite pellet

Notes:
[a]CaO - white styloid and/or raphide crystals present.
[b]"Numerous" - more than 50 parts per liter.
[c]Estimated number; all others are actual counts.

Table G.10. Taxonomic distribution of the actual numbers of charred plant remains recovered from the Deer Creek site and project totals.

Taxon	Deer Creek Gila Butte Phase (n=26 samples; 98.0 L) Actual Number of Parts			Deer Creek Indeterminate Preclassic (n=6; 15.5 L) Actual Number of Parts			Project Totals (n=70; 259.5 L) Actual Number of Parts		
	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.	Whole	Frag.	cf.Frag.
Agave									
caudexes	--	--	1	--	--	--	--	--	10
fibers	--	259	--	--	25	--	--	1,586	--
leaves	--	--	--	--	--	--	--	6	--
marginal teeth	--	--	--	--	--	--	6	--	3
Arctostaphylos									
nutlet	2	--	--	1	1	--	4	2	--
nutlet aggregate	--	1	--	--	--	--	--	1	--
Astragalus Nuttallianus type seed	1	--	--	--	--	--	1	--	--
Boraginaceae-like unknown seed	6	3	--	1	--	--	12	3	--
Cactaceae prickle	--	--	--	--	--	--	--	--	1
Caryophyllaceae cf. *Silene* seed	1	--	--	--	--	--	1	--	--
Cheno-am seed	90	182	133	57	77	78	213	355	331
Compositae achene	1	--	--	1	--	1	2	--	1
Descurainia seed	14	2	12	9	1	2	31	3	15
Echinocereus seed	32	40	2	3	2	1	58	57	6
Euphorbia seeds	1	--	--	--	--	--	1	--	--
Globular unknown seeds	3	4	--	6	4	1	12	8	1
Gramineae (except *Hordeum* and *Zea mays*)									
Bromus type grains	1	1	--	--	--	--	1	1	--
Bromus-Elymus type grains	--	14	4	--	--	--	--	14	4
Distichlis type grains	--	2	1	1	1	--	3	3	16
Elymus type grains	1	3	--	--	--	--	4	3	2
indeterminate culms	--	1	--	--	1	--	--	2	--
indeterminate type grains	--	--	2	--	--	2	--	--	5
Leptochloa type grains	40	14	42	161	96	200	215	112	242
Phalaris grains	--	--	--	--	--	1	1	--	1
Sporobolus type grains	11	1	7	--	--	--	52	8	8

Table G.10. Continued.

Taxon	Deer Creek Gila Butte Phase (n=26 samples; 98.0 L) Actual Number of Parts			Deer Creek Indeterminate Preclassic (n=6; 15.5 L) Actual Number of Parts			Project Totals (n=70; 259.5 L) Actual Number of Parts		
	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.	Whole	Frag.	cf.Frag.
Hordeum									
grains	27	48	35	4	10	3	36	74	58
rachis joints	--	62	--	--	4	--	--	68	--
spikelets	--	--	264	--	--	28	--	--	339
Juniperus seeds	--	1	4	--	--	--	--	1	4
Lepidium seeds	--	--	--	--	--	1	--	--	1
Mentzelia seeds	51	28	5	1	3	--	52	31	5
Monocotyledoneae stems	--	--	--	--	--	--	--	4	--
Opuntia seeds	--	--	3	--	--	--	--	1	3
Phacelia seeds									
ambigua type	--	--	1	--	--	--	--	--	1
grandiflora type	--	1	--	--	--	--	--	1	--
indeterminate type	--	--	1	--	--	--	--	--	1
Plantago seeds	--	--	--	--	--	--	--	1	--
Platyopuntia seeds	--	3	11	--	--	--	--	3	11
Portulaca seeds	10	5	3	--	1	--	48	29	13
Prosopis seeds	1	--	2	--	--	--	1	--	2
Salvia seeds	--	8	--	--	--	--	--	8	--
Solanaceae seeds	1	--	--	--	--	--	1	--	--
Sphaeralcea seeds	2	1	2	--	--	--	4	1	2
Teardrop-shaped unknown seed	2	--	--	--	--	--	3	--	--
Zea mays									
cupules	16	105	64	2	5	2	29	137	98
glumes	1	12	13	--	--	--	2	12	14
kernels	--	4	8	--	--	--	10	31	41
Totals:	316	804	620	248	231	319	793	2,545	1,229

Table G.11. Taxonomic distribution of the actual numbers of charred plant remains recovered from the Compact, Redstone, and AZ O:15:92 (ASM) sites.

Taxon	Compact (n=5 samples; 19.5 L) Actual Number of Parts			Redstone (n=4; 16.0 L) Actual Number of Parts			AZ O:15:92 (ASM) (n=3; 12.0 L) Actual Number of Parts		
	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.
Agave									
fibers	--	14	--	--	352	--	--	50	--
marginal teeth	--	--	--	5	--	1	--	--	1
Arctostaphylos nutlet	--	--	--	--	1	--	--	--	--
Boraginaceae-like unknown seed	--	--	--	1	--	--	3	--	--
Cheno-am seed	9	8	4	11	19	14	26	45	27
Descurainia seed	--	--	--	--	--	--	6	--	1
Echinocereus seed	6	3	--	4	2	1	7	10	1
Globular unknown seeds	--	--	--	--	--	1	--	--	--
Gramineae (except *Hordeum* and *Zea mays*)									
Distichlis type grains	--	--	--	--	--	15	--	--	--
Elymus type grains	--	--	2	2	--	--	--	--	--
Leptochloa type grains	--	--	--	1	--	--	10	--	--
Phalaris grains	--	--	--	1	--	--	--	--	--
Sporobolus type grains	2	--	--	2	--	--	29	3	-
Hordeum									
grains	--	2	1	3	--	3	2	10	13
rachis joints	--	--	--	--	--	--	--	2	--
spikelets	--	--	--	--	--	2	--	--	40
Monocotyledoneae stems	--	3	--	--	1	--	--	--	--
Plantago seeds	--	--	--	--	1	--	--	--	--
Portulaca seeds	2	1	--	3	--	--	1	--	--
Sphaeralcea seeds	--	--	--	--	--	--	2	--	--
Zea mays									
cupules	--	5	1	2	3	4	5	2	1
glumes	--	--	--	1	--	--	--	--	--
kernels	--	--	2	--	1	1	--	--	--
Totals:	19	36	10	36	380	42	91	122	84

Table G.12. Taxonomic distribution of the actual numbers of charred plant remains recovered from the Clover Wash site, the Sedentary Period sample from the Hilltop site, and the Cobble site.

Taxon	Clover Wash (n=4 samples; 16.0 L) Actual Number of Parts			Hilltop, Sacaton Phase (n=1; 4.0 L) Actual Number of Parts			Cobble (n=6; 24.0 L) Actual Number of Parts		
	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.
Agave									
caudexes	--	--	2	--	--	--	--	--	6
fibers	--	54	--	--	6	--	--	731	--
leaves	--	--	--	--	--	--	--	6	--
marginal teeth	1	--	--	--	--	--	--	--	1
Arctostaphylos nutlet	--	--	--	--	--	--	1	--	--
Boraginaceae-like unknown seed	--	--	--	--	--	--	1	--	--
Cheno-am seed	11	10	28	--	2	--	4	3	45
Descurainia seed	--	--	--	1	--	--	1	--	--
Echinocereus seed	3	--	1	--	--	--	1	--	--
Globular unknown seeds	2	--	--	--	--	--	--	--	--
Gramineae (except *Hordeum* and *Zea mays*)									
Distichlis type grains	2	--	--	--	--	--	--	--	--
Elymus type grains	--	--	--	--	--	--	1	--	--
indeterminate type grains	--	--	--	--	--	--	--	--	1
Leptochloa type grains	2	2	--	1	--	--	--	--	--
Sporobolus type grains	4	4	1	--	--	--	4	--	--
Hordeum									
grains	--	--	2	--	1	--	--	3	1
spikelets	--	--	1	--	--	4	--	--	--
Opuntia seeds	--	1	--	--	--	--	--	--	--
Portulaca seeds	1	--	--	--	--	--	31	22	10
Zea mays									
cupules	--	3	--	--	--	--	2	6	18
kernels	--	1	--	--	--	--	--	1	15
Totals:	26	75	35	2	9	4	46	772	97

Table G.13. Taxonomic distribution of the actual numbers of charred plant remains recovered from the Boone Moore and Arby's sites, and the Indeterminate Classic period sample from the Hilltop site.

Taxon	Boone Moore (n=9 samples; 34.0 L) Actual Number of Parts			Arby's (n=4; 12.5 L) Actual Number of Parts			Hilltop, Classic period (n=1; 4.0 L) Actual Number of Parts		
	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.	Whole	Frag.	cf. Frag.
Agave									
caudexes	--	--	1	--	--	--	--	--	--
fibers	--	94	--	--	1	--	--	--	--
Cactaceae prickle	--	--	1	--	--	--	--	--	--
Cheno-am seed	--	--	--	2	1	--	3	8	2
Echinocereus seed	1	--	--	1	--	--	--	--	--
Globular unknown seeds	1	--	--	--	--	--	--	--	--
Zea mays									
cupules	--	6	2	2	2	6	--	--	--
glumes	--	--	1	--	--	--	--	--	--
kernels	--	--	1	--	3	4	--	--	--
Totals:	2	100	6	5	7	10	3	8	2

Table G.14. Results of the scan analysis except for possible Apachean roasting pit F15 at the Deer Creek site.

	Agave	*Argemone*	Cheno-am	*Descurainia*	*Distichlis* Type	*Echinocereus*	Globular Unknown	Gramineae	*Hordeum*	*Leptochloa* Type	*Mentzelia*	*Opuntia*	*Phalaris*	Platyopuntia	*Portulaca*	*Sporobolus* Type	Teardrop Unknown	*Zea mays*
DEER CREEK																		
Pithouse pit F9.07 fill	1fi	--	Xs Xsf	1s 1sf	--	1s 1sf	--	--	1gf[a]	--	--	--	--	--	--	--	--	1cf
Pithouse F12 floor fill	Xfi	--	Xs	--	--	--	--	--	1gf[a]	Xg Xgf	--	Xsif	--	1sf	--	--	--	1c
Pithouse trivet F12.01 fill	Xfi	--	Xsf	--	--	--	--	--	--[a]	Xg	Xs	--	--	--	--	--	--	--
Pithouse F13 floor fill	1fi	--	1s	--	--	--	--	Xstf[b]	--	--	--	--	--	--	--	--	--	--
Hearth F14.03 fill (under pithouse)[c]	Xfi	1s	Xs	Xs	--	Xs	--	--	Xg[a] Xgf	--	--	--	--	--	--	--	--	Xc
Pithouse hearth F14.04 fill	Xfi	--	Xs Xsf	--	--	Xs	Xs	--	Xg[a]	--	--	1sf	--	--	--	--	--	--
Pithouse F18 upper floor fill	Xfi	--	1s 1s[d]	--	--	1s	--	--	--	1g	--	--	--	--	--	--	--	--
Pithouse F36 floor fll	--	--	1s 1sf	--	--	1s	--	--	--	--	--	--	--	--	--	--	1s	--
Crematorium F46 fill	1fi	--	--	--	--	--	--	--	1g	--	--	--	--	--	--	--	--	1c
Pit F56 fill	Xfi	--	1s Xsf	1s	--	Xs 1sf	--	--	--	--	--	--	--	--	--	--	--	Xcf
Pithouse F62 floor fill	1fi	--	Xs	--	--	Xs	--	--	--	--	1s	--	--	--	--	--	--	1c
Pithouse F65 floor fill	Xfi	--	1s	--	--	--	--	Xstf[e]	--	--	--	--	--	--	--	--	--	--
Pit F81 fill (burned)	--	--	Xs Xsf	--	--	Xs	--	--	1g 1gf	--	--	--	--	--	--	--	--	--
HILLTOP																		
Pithouse F6 floor fill	--	--	Xs	--	--	--	--	--	1gf[a]	--	--	--	--	--	--	--	--	--
Pithouse F14 floor fill	--	--	Xs Xsf	--	--	Xsf	--	--	1gf[a]	--	--	--	--	--	--	--	--	--
Pithouse F15 floor fill	--	--	--	--	--	Xsf	--	--	--[a]	--	--	--	--	--	--	--	--	--

Table G.14. Continued.

	Agave	*Argemone*	Cheno-am	*Descurainia*	*Distichlis* Type	*Echinocereus*	Globular Unknown	Gramineae	*Hordeum*	*Leptochloa* Type	*Mentzelia*	*Opuntia*	*Phalaris*	Platyopuntia	*Portulaca*	*Sporobolus* Type	Teardrop Unknown	*Zea mays*
BOONE MOORE																		
Masonry pitroom F1 floor fill	1fi	--	--	--	--	--	--	--	--	--	--	--	--	--	1s	--	--	1cf
Hearth F1.01 fill in masonry pitroom	Xfi	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pithouse F19 floor fill	1fi	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
COMPACT																		
Pithouse ash pit F4.02 fill	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Horno F6 fill	Xfb XXfi	--	Xs	--	--	--	--	Xstf	--	--	--	--	--	--	--	--	--	1c
REDSTONE																		
Roasting pit F20 fill	--	--	Xs	--	--	1sf	--	--	--	--	--	--	--	--	1s	--	--	--
CLOVER WASH																		
Pithouse F4 floor fill	Xfi	--	1s	--	--	--	1s	--	--	1g	--	1sif	--	--	--	Xg 1gf	--	--
Pithouse remnant F6 floor fill	Xfi	--	--	--	Xg	Xs Xsf	--	--	--	--	--	--	1g	--	1s	Xg Xgf	--	--
Roasting pit F13 fill	1mt	--	--	--	--	--	--	--	--	--	--	--	--	--	1s	--	--	--
Ash pit F22 fill	1fi	--	Xs 1sf	--	--	Xs Xsf	1s 1sf	--	1g 1gf	--	--	--	--	Xsf	Xs 1sf	--	--	--

Notes: c - cupule; cf - cupule fragment; fb - fragments of round and trough-shaped fibers embedded in parenchyma; fi - fiber; g - grain; gf - grain fragment; mt - marginal tooth; s - seed; sif - seed interior fragment; sf - seed fragment; stf - culm fragment; X - between 2 and 100 parts present; XX - more than 100 present.

[a]cf. *Hordeum* spikelet fragments also present.

[b]cf. *Phragmites*

[c]Sample also contains charred *Papaver somniferum* seeds introduced into the sample to test the recovery rate of the flotation processing technique.

[d]caramelized

[e]Includes small grass culm fragments as well as cf. *Zea mays* stalk fragments.

Table G.15. Wood charcoal recovered from sites in the Rye Creek area.

Feat #	Sample #	Sycamore	Pinyon	Juniper	Oak	Trans.	Palo Verde	Creosote	Other
AZ O:15:52									
1	451-5	-	-	1	-	-	-	-	-
2	355-5	-	5	21	-	-	-	-	-
2	356-3	-	-	1*	-	-	-	-	-
2	392-10	-	-	1	-	-	-	-	-
2	392-11	-	-	1	-	-	-	-	-
9	329-12	-	-	-	-	-	-	-	Agave heart 1, Canotia 1
9.7	364-2	-	-	-	-	-	-	-	Hackberry 1
12	212-6	-	-	1	-	-	-	-	-
13	115-4	-	-	14	-	-	13	-	-
13	131-3	-	-	1	-	-	-	-	-
14.2	173-1	1	-	-	-	-	-	-	-
18	227-9	1	-	-	-	-	-	-	-
18.2	220-2	-	-	1	-	-	-	-	-
18.2	220-3	-	-	1	-	-	-	-	-
18.3	231-3	-	-	1	-	-	-	-	-
20	382-3	-	-	2	-	-	2	-	-
21	215-9	-	9	9	-	-	-	-	Catclaw 1
21	222-7	1	1	21	-	-	-	-	Catclaw 3
21	225-6	-	-	1	-	-	-	-	-
21	233-5	-	8	7	-	-	1	-	Unk. Vesicular material 1
21	279-6	-	2	19	3	-	-	-	Hackberry 1, Catclaw 3
21	291-2	-	-	25	-	-	-	3	-
21	291-3	-	-	1	-	-	-	-	Grass stems ++
21	291-11	-	-	8	-	-	-	1	-
21.1	285-1	-	1	-	-	-	-	-	-
21.1	285-2	-	1	-	-	-	-	-	-
22	390-5	-	-	-	-	-	-	-	Agave stalk 1
28	506-2	-	-	1	-	-	-	-	-
32	274-4	-	-	1	-	-	-	-	-
32	310-7	1	-	-	-	-	-	-	-
36	217-2	-	-	-	-	-	-	-	Saltbush 1

Table G.15. Continued.

Feat #	Sample #	Sycamore	Pinyon	Juniper	Oak	Trans.	Palo Verde	Creosote	Other
43	157-6	-	-	1	-	-	-	-	Mesquite sapwood 1, Mesquite heart 2, Arrow weed 3
44	240-1	-	-	-	-	-	-	-	Mesquite heartwood 1*
46	315-5	2	-	22	-	-	-	-	Hackberry 1, Desert Broom 1
46	324-8	-	-	1	-	-	-	-	-
48	311-8	-	-	22	2	2	-	-	-
50	317-5	-	-	-	-	-	-	-	Hackberry 1, Agave heart 4
53	346-3	-	-	1	-	-	-	-	-
56	347-5	-	-	-	-	-	-	-	Catclaw 1
59	335-5	-	-	1	-	-	-	-	-
59	422-6	-	-	1	-	-	-	-	-
59	458-3	-	-	1	-	-	-	-	-
59	458-4	-	-	1	-	-	-	-	-
61	377-5	-	-	-	-	-	-	-	Saltbush 1
65	486-3	-	-	1	-	-	-	-	-
65	489-3	-	-	1	-	-	-	-	-
65	491-3	-	-	1	-	-	-	-	-
71	478-6	-	-	1	-	-	-	-	-
71	499-4	1	-	-	-	-	-	-	-
76	467-4	-	-	2	-	-	-	-	Catclaw 1
82	488-3	-	-	1	-	-	-	-	-
85	493-4	-	12	5	-	-	-	-	-
86	507-3	-	1	9	-	-	-	-	Saltbush 3
118	508-2	1	2	11	-	-	-	-	Canotia 1
AZ O:15:53									
6	110-2	-	-	-	-	-	-	1	-
6	121-1	1	-	-	-	-	4	14	Saltbush 2
6	144-3	-	-	-	-	-	-	1	-
AZ O:15:55									
5	185-12	-	-	1*	-	-	-	-	-
5	186-5	-	-	1*	-	-	-	-	-
6	131-5	-	-	-	-	1	-	-	-
6	165-5	-	-	-	-	-	-	-	Mesquite heartwood 1
17	241-4	-	-	-	-	1	-	-	-

Table G.15. Continued.

Feat #	Sample #	Sycamore	Pinyon	Juniper	Oak	Trans.	Palo Verde	Creosote	Other
18	184-30	-	-	-	-	-	-	-	Mesquite heartwood 1
18	184-31	-	-	-	-	-	-	-	Canotia 1
18	220-13	-	-	-	-	-	-	-	Mesquite root
AZ O:15:90									
1	107-1	-	-	1	-	-	-	-	-
3	114-5	-	-	1*	-	-	-	-	-
3	116-6	-	-	1	-	-	-	-	-
3	140-3	-	-	1	-	-	-	-	-
3.2	143-4	-	-	1	-	-	-	-	-
3.2	143-5	-	-	1	-	-	-	-	-
4	113-6	-	-	7	1	-	1	-	-
4	115-7	-	-	1	-	-	-	-	-
4	120-3	-	-	-	-	-	1	-	-
5	112-3	-	-	1	-	-	-	-	-
5	137-3	-	-	1	-	-	-	-	-
5	138-3	-	-	1	-	-	-	-	-
AZ O:15:91									
5	193-6	4	-	12	-	-	3	-	Arrowwood 7
5	193-7	-	-	1*	-	-	-	-	-
5.6	200-1	-	-	1*	-	-	-	-	-
5.7	213-1	-	-	1*	-	-	-	-	-
11	112-5	-	-	1*	-	-	-	-	-
11	136-9	-	-	-	-	-	-	-	Arrowwood 1
11	136-10	1	-	-	-	-	-	-	-
11	140-9	-	-	1	-	-	-	-	-
11	147-4	-	-	1	-	-	-	-	-
11	165-2	-	-	1*	-	-	-	-	-
11	189-12	-	-	1*	-	-	-	-	-
11	217-13	-	-	1*	-	-	-	-	-
11.1	183-3	-	-	1*	-	-	-	-	-
11.2	184-4	-	-	1*	-	-	-	-	-
11.8	221-1	-	-	1*	-	-	-	-	-
11.9	222-1	-	-	1*	-	-	-	-	-
AZ O:15:92									

Table G.15. Continued.

Feat #	Sample #	Sycamore	Pinyon	Juniper	Oak	Trans.	Palo Verde	Creosote	Other
14	107-8	-	-	1	-	-	-	-	Agave heart 6
14	114-8	-	-	-	-	-	-	-	Agave heart 1
14	119-5	-	-	1	-	-	-	-	-
14	130-9	-	-	-	-	1	-	-	Brm 3, Agave heart 1
14	140-3	-	-	-	-	-	-	1	-
15.1	115-3	-	-	-	-	1	-	-	-
AZ O:15:99									
1	103-2	-	-	-	-	1	-	-	-
1	103-3	-	-	-	-	14	1	-	Catclaw 4, Brm 3, Mesquite branch 4, Mesquite root 1, Maize kernal 1
1	115-3	-	-	-	1	1	-	-	Brm 1
3	121-5	-	-	1	-	-	-	-	-
3	121-6	1	-	-	-	-	-	-	-
3	125-5	-	-	-	1	-	-	-	Mesquite branch 7, Brm 1
AZ O:15:100									
1	184-2	1	-	-	-	-	-	-	-
1	184-3	-	-	-	-	-	-	-	Hackberry 1
2	245-6	1	-	-	-	-	-	6	-
2	245-7	-	-	1	-	-	-	-	Sedge stems ++
2	246-1	-	-	-	-	-	-	-	Arrowwood 1, Sedge stems ++
3	125-5	-	-	1	-	-	-	-	-
3	130-6	3	-	7	-	-	-	-	-
3	130-7	1	-	-	-	-	-	-	-
3	137-3	-	-	1	-	-	-	-	-
3	142-4	-	-	-	-	-	-	-	Arrowwood 1
3	172-1	-	-	1	-	-	-	-	-
4	117-1	10	-	-	-	-	-	-	Willow 17
5	161-5	1	-	-	-	-	-	-	-
6	180-5	-	-	1	-	-	-	-	-
6	180-7	-	-	1	-	-	-	-	-
6	180-8	-	-	-	-	-	-	-	Sedge stems ++
6	198-6	-	-	-	-	-	-	-	Sedge stems ++
12	116-4	-	-	-	-	-	-	-	Sedge stems ++

Table G.15. Continued.

Feat #	Sample #	Sycamore	Pinyon	Juniper	Oak	Trans.	Palo Verde	Creosote	Other
12	128-2	-	-	1	-	-	-	-	Sedge stems ++
12	191-4	1	-	-	-	-	-	-	-
12	201-3	1	-	-	-	-	-	-	-
13	236-3	-	-	-	-	-	-	-	Unknown bark
17	205-4	-	-	-	2	5	-	-	-

Table G.16. Flotation sample volume information and wood charcoal identifications.

Context and Provenience	Prov. No.	Sample Size (L)[a]	Total Vol. (ml)[b]	Vol. Wood (ml)[c]	Wood Charcoal Identifications
			The Deer Creek Site, AZ O:15:52 (ASM)		
Pithouse F2 floor fill	392-12	4	35	10	20 *Cupressus/Juniperus* type
Pithouse F6 floor fill	186-4	4	34	9	2 *Cupressus/Juniperus* type 1 cf. *Larrea tridentata*
Pithouse hearth F9.04 fill	362-3	4	36	9	1 cf. *Larrea tridentata*
Pithouse pit F9.06 fill	359-3	4	21	9	1 Arboreal legume cf. *Prosopis* sp. 2 *Atriplex/Suaeda* type 1 cf. *Larrea tridentata*
Pithouse pit F9.07[d]	364-3	4	21	5	(NONE IDENTIFIABLE)
Pithouse pit F9.08	360-2	1	10	5	(NONE IDENTIFIABLE)
Pithouse F11 floor fill	369-5	1	13	5	2 Arboreal legume cf. *Prosopis* sp.
Pithouse F12 floor fill[d]	243-5	4	54	50	20 *Cupressus/Juniperus* type
Pithouse trivet F12.01 fill[d]	250-3	4	33	16	1 cf. *Celtis* sp. 2 *Cupressus/Juniperus* 1 Unknown
Pithouse F13 floor fill[d]	115-3	4	95	90	4 *Cupressus/Juniperus* type 16 cf. *Plantanus Wrightii*
Pithouse F14 floor fill	172-8	4	25	20	1 *Atriplex/Suaeda* type 1 *Pinus* type 3 cf. *Plantanus Wrightii*
Pithouse hearth F14.03 fill[d]	178-1	2	11	6	2 *Cupressus/Juniperus* type
Pithouse hearth F14.04 fill[d]	174-4	4	24	18	3 cf. *Plantanus Wrightii*
Possible Apachean roasting pit F15 fill[d]	456-2	4	42	1	1 *Cupressus/Juniperus* type
Possible Apachean roasting pit F15 fill	459-3	4	33	4	2 *Cupressus/Juniperus* type
Roasting pit F17 fill	117-6, 125-3	4	27	9	1 Arboreal legume cf. *Acacia* sp. 2 *Pinus* type
Pithouse F18 floor fill[d]	227-11	4	239	239	15 cf. *Plantanus Wrightii* 5 *Cupressus/Juniperus* type
Pithouse F18 fill over lower floor	275-4	4	20	9	4 *Cupressus/Juniperus* type (3 caramelized) 5 cf. *Plantanus Wrightii*
Pithouse F21 floor fill	291-12	4	26	13	19 *Cupressus/Juniperus* type
Pithouse F22 floor fill	390-6	4	16	13	5 Arboreal legume cf. *Prosopis* sp. 1 *Cupressus/Juniperus* type 1 cf. *Tessaria sericea*
Pithouse hearth F22.01 fill	406-2	4	24	7	1 *Cupressus/Juniperus* type 1 cf. *Larrea tridentata*

Table G.16. Continued.

Context and Provenience	Prov. No.	Sample Size (L)[a]	Total Vol. (ml)[b]	Vol. Wood (ml)[c]	Wood Charcoal Identifications
Pithouse F25 floor fill	413-4	4	17	7	2 *Cupressus/Juniperus* type 1 cf. *Plantanus Wrightii*
Rosting pit F28 fill	506-1, 575-1	4	23	5	16 *Cupressus/Juniperus* type (6 caramelized) 3 cf. *Quercus* sp.
Pithouse F32 floor fill	310-6	4	35	27	13 *Cupressus/Juniperus* type 1 cf. *Quercus* sp.
Pithouse F34 floor fill	143-3	4	22	2	1 Arboreal legume cf. *Prosopis* sp. 1 cf. *Larrea tridentata*
Pithouse hearth F34.01 fill	193-1	0.5	3	0.5	(NONE IDENTIFIABLE)
Pithouse F36 floor fill[d]	147-4	4	30	7	14 Cupressus /Juniperus type (13 caramelized)
Roasting pit F43 fill	157-5, 251-5	4	21	1	(NONE IDENTIFIABLE)
Pit F45 fill ("looter pit")	239-7	4	45	35	12 cf. *Plantanus Wrightii*
Crematorium F46 fill[d]	324-9	4	15	4	3 *Cupressus/Juniperus* type 1 *Pinus* type 1 cf. *Plantanus Wrightii*
Extramural surface pit F54 fill	352-3, 353-2	4	27	8	2 Arboreal legume cf. *Cercidium* sp. 5 *Cupressus/Juniperus* type (1 caramelized)
Pit F56 fill[d]	347-4	4	40	35	7 Arboreal legume cf. *Acacia* sp. 2 cf. *Larrea tridentata*
Pithouse F59 floor fill	438-5	4	30	28	14 *Cupressus/Juniperus* type 6 cf. *Plantanus Wrightii*
Pithouse hearth F59.01	473-3	2	16	4	(NONE IDENTIFIABLE)
Roasting pit F60 fill	376-1	4	25	6	1 *Cupressus/Juniperus* type 4 cf. *Plantanus Wrightii*
Pithouse F62 floor fill[d]	408-3	4	31	3	7 *Cupressus/Juniperus* type (6 caramelized) 1 *Pinus* type
Pit F63 fill	435-7	4	32	23	10 cf. *Larrea tridentata* 1 cf. *Plantanus Wrightii*
Pithouse F65 floor fill[d]	491-2	4	147	147	20 *Cupressus/Juniperus* type
Crematorium F71 fill	499-5	4	19	9	1 cf. *Celtis* sp. 7 *Cupressus/Juniperus* type 1 cf. *Plantanus Wrightii*
Pit F75 fill (associated with surface F72)	485-2	1	5	0.5	(NONE IDENTIFIABLE)
Pit F76 fill (burned pit)	467-6	4	31	7	2 Arboreal legume cf. *Prosopis* sp. 1 cf. *Celtis* sp. 5 *Cupressus/Juniperus* type 1 cf. *Larrea tridentata*

Table G.16. Continued.

Context and Provenience	Prov. No.	Sample Size (L)[a]	Total Vol. (ml)[b]	Vol. Wood (ml)[c]	Wood Charcoal Identifications
Pit F81 fill (burned pit)[d]	497-2	4	97	97	3 Arboreal legume cf. *Acacia* sp. 5 Arboreal legume cf. *Prosopis* sp. 4 cf. *Quercus* sp.
Crematorium F82 fill	488-2	4	129	127	11 *Cupressus/Juniperus* type 9 *Pinus* type
Crematorium F85 fill	501-6	4	29	14	15 *Cupressus/Juniperus* type 3 *Pinus* type
Roasting pit F86 fill	507-2	4	31	15	2 Arboreal legume cf. *Prosopis* sp. 4 *Atriplex/Suaeda* type 14 *Cupressus/Juniperus* type
Crematorium F117 fill	524-5	4	12	5	5 *Cupressus/Juniperus* type 1 cf. *Larrea tridentata*
Roasting pit F118	508-4, 516-1, 517-1	4	29	14	1 Arboreal legume cf. *Acacia* sp. 1 Arboreal legume cf. *Prosopis* sp. 3 *Cupressus/Juniperus* type 3 cf. *Larrea tridentata*
			The Hilltop Site, AZ O:15:53 (ASM)		
Pithouse F1 floor fill	139-3	4	23	7	2 cf. *Plantanus Wrightii*
Masonry pitroom F5 floor fill	186-3	4	65	16	5 Arboreal legume cf. *Cercidium* sp. 8 cf. *Larrea tridentata*
Pithouse F6 floor fill[d]	141-4	4	27	14	4 cf. *Larrea tridentata*
Pithouse F14 floor fill[d]	192-5	4	22	1	(NONE IDENTIFIABLE)
Pithouse F15 floor fill[d]	193-4	4	14	2	2 Arboreal legume cf. *Acacia* sp.
			The Cobble Site, AZ O:15:54 (ASM)		
Trash mound F2 fill, level 1	107-5	4	58	3	(NONE IDENTIFIABLE)
Trash mound F2 fill, level 2	108-5	4	35	3	(NONE IDENTIFIABLE)
Trash mound F2 fill, level 3	109-5	4	31	5	(NONE IDENTIFIABLE)
Trash mound F2 fill, level 4	110-4	4	36	5	(NONE IDENTIFIABLE)
D-shaped, slab-lined pitroom F9 floor fill	117-5	4	14	7	(NONE IDENTIFIABLE)
D-shaped, slab-lined pitroom hearth F9.01 fill	123-3	4	30	14	(NONE IDENTIFIABLE)
			The Boone Moore Site, AZ O:15:55 (ASM)		
Masonry pitroom F1 floor fill[d]	196-5	4	13	3	2 Arboreal legume cf. *Acacia* sp. 1 cf. *Quercus* sp.
Masonry pitroom hearth F1.01 fill[d]	218-1	4	23	15	6 Arboreal legume cf. *Acacia* sp.
Cobble-lined adobe pitroom F5 fill above upper floor	185-13	4	26	3	(NONE IDENTIFIABLE)

Table G.16. Continued.

Context and Provenience	Prov. No.	Sample Size (L)[a]	Total Vol. (ml)[b]	Vol. Wood (ml)[c]	Wood Charcoal Identifications	
Cobble-lined adobe pitroom F6 floor fill	207-8	4	16	7		(NONE IDENTIFIABLE)
Pithouse F11 floor fill	170-13	4	16	3	6	cf. *Quercus* sp.
Pithouse hearth F11.01 fill	199-1	2	8	1		(NONE IDENTIFIABLE)
Masonry pitroom F18 fill over upper floor	151-11	4	29	3	1	*Cupressus/Juniperus* type
Masonry pitroom F18 fill over lower floor	219-8	4	27	3		(NONE IDENTIFIABLE)
Pithouse F19 floor fill[d]	158-4	4	12	1		(NONE IDENTIFIABLE)
Pithouse hearth F19.01 fill	174-4	4	7	3		(NONE IDENTIFIABLE)
Roasting pit F20 fill	257-5	4	98	50	20	Arboreal legume cf. *Prosopis* sp.
Pit F22 fill (trash filled)	216-3	4	15	3	1	*Cupressus/Juniperus* type
The Compact Site, AZ O:15:90 (ASM)						
Pithouse F3 floor fill	141-5	4	21	8	2	*Cupressus/Juniperus* type
Pithouse hearth F4.01 fill	127-2	4	25	17	1 7	Arboreal legume cf. *Cercidium* sp. *Cupressus/Juniperus* type
Pithouse ash pit F4.02 fill[d]	128-1	1.5	22	11		(NONE IDENTIFIABLE)
Pithouse F5 floor fill	137-4	3.5	17	6	5 1 1	*Cupressus/Juniperus* type *Pinus* type cf. *Quercus* sp.
Horno F6 fill[d]	144-6	4	238	232	4 3 6 6	Arboreal legume cf. *Acacia* sp. cf. *Celtis* sp. *Cupressus/Juniperus* type cf. *Fouquieria splendens*
Roasting pit F8 fill	126-3	4	61	58	16 4	Arboreal legume cf. *Prosopis* sp. cf. *Quercus* sp.
Roasting pit F9 fill	131-2	4	67	60	1 19	Arboreal legume cf. *Cercidium* sp. Arboreal legume cf. *Prosopis* sp.
The Redstone Site, AZ O:15:91 (ASM)						
Pithouse F5 floor fill	193-8	4	48	30	6	*Cupressus/Juniperus* type
Pithouse F11 floor fill	189-14	4	45	40	1 19	*Cupressus/Juniperus* type cf. *Plantanus Wrightii*
Roasting pit F17 fill	207-3	4	55	28	17 3	cf. *Celtis* sp. *Cupressus/Juniperus* type
Roasting pit F20 fill[d]	208-2	4	783	783	19 1	Arboreal legume cf *Prosopis* sp. cf. *Canotia holacantha*
Pit F25 fill	209-3	4	16	0.5		(NONE IDENTIFIABLE)
AZ O:15:92 (ASM)						

Table G.16. Continued.

Context and Provenience	Prov. No.	Sample Size (L)[a]	Total Vol. (ml)[b]	Vol. Wood (ml)[c]	Wood Charcoal Identifications
Pithouse F14 floor fill	127-9	4	14	5	3 *Cupressus/Juniperus* type
Pithouse hearth F14.05 fill	139-3	4	14	10	4 *Cupressus/Juniperus* type 2 cf. *Larrea tridentata*
Pithouse hearth F14.08 fill	143-2	4	33	8	3 *Cupressus/Juniperus* type 1 *Pinus* type
The Arby's Site, AZ O:15:99 (ASM)					
Masonry structure F1 floor fill	111-3	4	24	1	2 Arboreal legume cf. *Acacia* sp. 2 cf. *Plantanus Wrightii*
Slab-lined pitroom F3 floor fill	125-6	4	28	3	9 *Cupressus/Juniperus* type
Extramural hearth F4 fill	107-3	2	3	0.5	2 Arboreal legume cf. *Prosopis* sp.
Cobble brush structure hearth F5.01 fill	108-2	2.5	22	4	8 Arboreal legume cf. *Prosopis* sp.
AZ O:15:100 (ASM)					
Pithouse F1 floor fill	145-5	4	16	5	2 *Cupressus/Juniperus* type
Pithouse F3 floor fill	142-5	4	18	9	3 Arboreal legume cf. *Prosopis* sp. 1 *Cupressus/Juniperus* type 2 cf. *Plantanus Wrightii*
Pithouse F4 floor fill[d]	115-3	4	26	26	9 cf. *Plantanus Wrightii*
Pithouse remnant F6 floor fill[d]	180-4	4	22	4	2 *Cupressus/Juniperus* type
Pithouse F12 floor fill	127-6	4	18	17	1 Arboreal legume cf. *Prosopis* sp. 1 *Atriplex/Suaeda* type 2 *Cupressus/Juniperus* type 1 cf. *Larrea tridentata* 2 cf. *Plantanus Wrightii*
Roasting pit F13 fill[d]	234-1, 235-1, 236-2	4	281	281	19 *Cupressus/Juniperus* type 1 *Pinus* type
Roasting pit F17 fill	205-2	4	38	18	12 Arboreal legume cf. *Prosopis* sp. 1 *Cupressus/Juniperus* type 1 *Pinus* type
Ash pit F22 fill[d]	141-3	4	36	14	1 Arboreal legume cf. *Acacia* sp. 2 *Cupressus/Juniperus* type 2 cf. *Larrea tridentata* 1 Unknown

[a]Sediment volume before processing
[b]Total light fraction volume
[c]Approximate volume of wood charcoal in the light fraction
[d]Intensively scanned sample

APPENDIX H

FAUNAL ANALYSIS

Table H.1. Rye Creek faunal coding format (adapted from Hatch et al. 1987, and Szuter 1989).

Variable	Values
Site Number	Last two digits of ASM site number
Case Number	1 through 9999 (acts as a record number)
Class	0-Unknown 1-Fish 2-Amphibian 3-Reptile 4-Bird 5-Mammal
Taxon	See Appendix H2A
Size	1-Very small (rodent size) 2-Very small/small (rodent or lagomorph size) 3-Small (lagomorph size) 4-Small/medium (lagomorph or coyote size) 5-Medium (coyote size) 6-Medium/Large (coyote or artiodactyl size) 7-Large (artiodactyl size)
Side	0-Unknown 1-Right 2-Left 3-Axial 4-Fused right and left (i.e. sides of a cranium)
Body Part	See Appendix H2B
Portion	0-Unknown 1-Complete 2-Proximal 3-Distal 4-Shaft 5-Anterior 6-Posterior 7-Middle/Medial 8-Lateral 9-Fragment
Percentage	1 to 100 percent (no smaller than 5% increments)

Table H.1. Continued.

Variable	Values
Fusion	0-Unknown or not applicable 1-Fused 2-Epiphyseal lines present 3-Unfused or immature
Burning	0-Not burned 1-Brown-black scorched 2-Calcined, taupe/grey
Butchering Marks	0-Absent 1-Present
Spiral Fracture	0-Absent 1-Present
Weathering	0-Good condition 1-Slightly weathered 2-Heavily weathered 9-Not recorded
Rodent Gnawing	0-Absent 1-Present
Carnivore Gnawing	0-Absent 1-Present
Breakage	0-No breaks 1-Old breaks 2-Fresh breaks 3-Old and fresh breaks 9-Not recorded
Worked	Blank-Not worked 1-Worked
Number of Fragments	Count recorded
Weight	Number of grams
Faunal Bag #	Consecutive number given to each bag as analysis was completed

Table H.2A. Numeric values for recovered taxon.

Code	Scientific Name	Common Name
100	Testudinata	Turtle/Tortoise
138	*Phrynosoma* sp.	Horned lizard
300	Serpentes	Snake
307	Colubridae	Nonpoisonous snake
351	Crotalidae	Poisonous snake
1405	*Buteo* sp.	Hawk
1800	Phasianidae	Quail
2800	Columbidae	Doves
3801	*Colaptes* sp.	Flicker
401	Leporidae	Rabbit and hare
402	*Lepus* sp.	Jackrabbit
403	*L. alleni*	Antelope jackrabbit
404	*L. californicus*	Black-tailed jackrabbit
405	*Sylvilagus* sp.	Cottontail rabbit
500	Rodentia	Rodent
501	Sciuridae, small	Squirrel and allies
501	Sciuridae, large	Squirrel and allies
516	*Spermophilus variegatus*	Rock squirrel
525	*Thomomys* sp.	Pocket gopher
531	*Perognathus* sp.	Pocket mouse
549	*Dipodomys* sp., small	Kangaroo rat
570	cf. *Sigmodon* sp.	Cotton rat
579	*Neotoma* sp.	Wood rat
600	Carnivora	Carnivore
606	*Canis latrans/C. familiaris*	Coyote/Domestic dog
608	*Urocyon cinereoargenteus*	Gray fox
621	cf. *Taxidea taxus*	Badger
640	*Ursus americanus*	Bear
700	Artiodactyla	Artiodactyla
703	Cervidae	Elk and deer
705	*Odocoileus* sp.	Deer
706	*O. hemionus*	Mule deer
710	*O. hemionus/Ovis canadensis*	Mule deer/Bighorn sheep
716	*Bos/Bison*	Cattle/Bison

Table H.2B. Numeric values for body part variable.

Code	Body Part
00	Indeterminate
01	Antler/horn core
02	Cranium
03	Mandible
04	Tooth indeterminate
05	Incisor
06	Canine
07	Premolar
08	Molar/Cheektooth
09	Vertebra Indeterminate
10	Atlas
11	Axis
12	Cervical
13	Thoracic
14	Lumbar
15	Sacrum
16	Caudal
17	Ribs-Carapace
18	Sternum
19	Pectoral girdle-coracoid
20	Scapula
21	Innominate (complete)
22	Ilium
23	Ischium
24	Pubis
25	Acetabulum
26	Longbone Indeterminate
27	Humerus (shaft or complete)
28	Proximal humerus
29	Distal humerus
30	Radius (shaft or complete)
31	Proximal radius
32	Distal radius
33	Ulna (shaft or complete)
34	Proximal ulna
35	Distal ulna
36	Metacarpal-carpometacarpus
37	Proximal metacarpal
38	Distal metacarpal
39	Carpals
40	Femur (shaft or complete)
41	Proximal femur
42	Distal femur
43	Tibia-Tibiotarsus (shaft or complete)
44	Proximal tibia
45	Distal tibia
46	Fibula (shaft or complete)
47	Proximal fibula
48	Distal fibula
49	Metatarsal-tarsometarsus (shaft or complete)
50	Proximal metatarsal
51	Distal metatarsal
52	Patella

Table H.2B. Continued.

53	Tarsals
54	Astragulus
55	Calcaneus
56	Metapodial (shaft or complete)
57	Proximal metapodial
58	Distal metapodial
59	Podial-Sesamoid indeterminate
60	Phalanx indeterminate
61	Phalanx I
62	Phalanx II
63	Phalanx III
64	Dermal layer
65	Hyoid
66	Clavicle
67	Costal cartilage
68	Baculum
69	Furculum
70	Urostyle
71	Opercular
72	Quadrate
73	Articular
74	Hyomandibular
75	Preopercular

Table H.3A. Quantity (Qty) and weight in grams (Wt) of faunal remains recovered from the Rye Creek Project by site, feature and stratum. Quantity of worked bone (Wk) is also included.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
Hilltop Site - AZ O:15:53							
0	2/9	Non-Feature	Sheet Trash	Human/Nonhuman	1		0.54
4	50	Crematorium	Fill	Serpentes	22		0.54
14	20	Pithouse	Floor	Unidentified Mammal size 6		1	0.56
Site Total					23	1	1.64
AZ O:15:71							
1	10	Masonry Structure	Fill	Unidentified class & size indet	1		-
				L. californicus	1		-
Site Total					2		-
The Compact Site - AZ O:15:90							
3	9	Burnt Pithouse	Sheet Trash	Unidentified Mammal size 6	1		-
3	19		Floor	Unidentified Mammal size indet	2		-
				Unidentified Mammal size 6	3		-
				Serpentes	2		-
				Lepus sp.	1		-
				Neotoma sp.	1		-
4	10	Pithouse	Fill	Unidentified class/size indet	1		-
				Unidentified Mammal size indet	1		-
				Unidentified Mammal size 3	2		-
				Unidentified Mammal size 6	1		-
				L. californicus	3		-
				Rodentia	4		-
				Small Sciuridae	1		-
				Thomomys sp.	1		-

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
5	9/10	Burnt Pithouse	Sheet Trash/	Unidentified Mammal size 6	16		-
			Fill	Unidentified Mammal size indet	1		-
				Artiodactyla	1		-
5	10		Fill	Unidentified Mammal size 7	12		-
				Unidentified Mammal size indet	2		-
				Sylvilagus	1		-
				Small Sciuridae	1		-
5	19		Floor Fill	Unidentified Mammal size indet	6		-
6	50	Horno	Fill	Unidentified Mammal size ?	1		-
8	50	Roasting Pit	Fill	Unidentified Mammal size indet	5		-
Site Total					70		-
The Arby's Site - AZ O:15:99							
3	10B	Slab Pitroom	Fill	Unidentified class/size indet	1		-
5	10	Brush Structure	Fill	Unidentified Mammal size indet	1		-
Site Total					2		-
The Cobble Site - AZ O:15:54							
2	50	Trash Mound	Fill	Unidentified Mammal size 3	1		0.22
				Unidentified Mammal size 4	1		0.29
				Unidentified Mammal size 6	1		0.75
				L. californicus	2		2.16
5	11	Masonry Structure	Roof Fall	Unidentified Mammal size 3	2		0.54
				Unidentified Mammal size 6	3		0.77
				Unidentified Mammal size 7	1		0.43

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Artiodactyla	1		0.47
				Odocoileus sp.	1		0.49
5	12		Roof-Floor	Unidentified class/size indet	1		0.14
				Unidentified Mammal size 6	6		0.76
				Unidentified Mammal size 7	1		0.72
				Testudinata	3		1.90
9	10	Slab Pitroom	Fill	Unidentified Mammal size indet	1		0.09
				Unidentified Mammal size 3	3		0.50
				Leporidae	2		0.20
				L. californicus	4		2.57
				Thomomys sp.	1		0.21
9	11		Roof Fall	Unidentified Mammal size 3	1		0.19
				Unidentified Mammal size 6	1		0.38
			Floor Fill	Unidentified size & class indet	1		0.14
				Unidentified Mammal size indet	2		0.45
9	19			Unidentified Mammal size 2	2		0.10
				Unidentified Mammal size 3	2		0.12
				Unidentified Mammal size 6	2		0.35
				Lepus sp.	3		0.48
				L. californicus	3		1.16
				Sylvilagus sp.	1		0.20
Site Total					53		16.78
Clover Wash Site - AZ O:15:100							
1	10	Pithouse	Fill	Unidentified Mammal size 4	1		0.28
				Unidentified Mammal size 6	1		0.31

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
1	19		Floor Fill	Unidentified Mammal size 3	1		0.18
3	10	Pithouse	Fill	Unidentified Mammal size 6	12		0.88
				Unidentified Mammal size 7	4		6.30
				Artiodactyla	1		10.13
3	11		Roof Fall	Unidentified Mammal size 6	1		0.87
				Unidentified Mammal size 7	2		2.60
3	19		Floor Fill	Unidentified Mammal size 6	27		1.72
				Unidentified Mammal size 7	8		1.45
				Artiodactyla	36		14.92
5	50	?	Fill	*Lepus* sp.	1		0.06
12	1	Pithouse	Plowzone	Unidentified Mammal size 7		1	12.45
12	9		Sheet Trash	Unidentified Mammal size 5	1		0.57
				Unidentified Mammal size 6	1		0.05
				C. latrans/C. familiaris	23		17.79
12	10		Fill	Unidentified Mammal size 6		1	0.50
				C. latrans/C. familiaris	2		16.22
12	10B		Fill	*L. californicus*	1		1.40
12	11		Roof Fall	*L. californicus*	2		6.48
12	19		Floor Fill	Unidentified Mammal size indet	4		0.25
				Unidentified Mammal size 6	5		1.29
				Unidentified Mammal size 7		2	1.17
				Leporidae	1		0.03
				Lepus sp.	1		0.15
				L. californicus	1		2.37
				Sylvilagus sp.	1		0.90

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Ursus americanus		1	2.08
				Human/Nonhuman	4		1.56
12	30	Internal Feature	Fill	Unidentified Mammal size 6	1		0.22
20	50	Pit	Fill	Unidentified Mammal size 6	1		0.35
21	50	Ash Pit	Fill	Unidentified Mammal size 5	1		4.15
28	50	Pit	Fill	Unidentified Mammal size 6	2		0.08
				Unidentified Mammal size 7	5		1.68
Site Total					152	5	111.44
The Rooted Site - AZ O:15:92							
14	10	Pithouse	Fill	Unidentified Mammal size indet	15	1	-
				Artiodactyla	1		-
14	19		Floor Fill	Unidentified Mammal size 3	1		-
				Unidentified Mammal size 6	1		-
				Unidentified Mammal size indet	30		-
				Leporidae	1		-
				L. californicus	19		-
				Sylvilagus sp.	1		-
14	20		Floor	Unidentified Mammal size 7		1	-
Site Total					69	2	-
The Deer Creek Site - AZ O:15:52							
2	10	Pithouse	Fill	Unidentified Mammal size 3	1		0.19
				Unidentified Mammal size 6	1		0.57
				Unidentified Mammal size 7		1	11.75
				Artiodactyla	1		2.65

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
5	9	Extramural Area	Sheet Trash	Unidentified Mammal size 3	2		0.69
6	10	Pithouse	Fill	Artiodactyla	2		7.67
6-3	30	Internal Feature	Fill	Unknown	1		0.10
9	10	Pithouse	Fill	*Sylvilagus* sp.	1		0.79
9	19		Floor Fill	Unidentified Mammal size 3	1		0.14
				Small Sciuridae	1		0.14
9	9		Sheet Trash	Human/Nonhuman	1		0.98
11	10	Pithouse	Fill	Unidentified Mammal size 3	1		0.19
				Unidentified Mammal size 7	2		6.81
				Spermophilus variegatus	1		0.15
				Artiodactyla	1		2.51
11	11		Roof Fall	Artiodactyla	1		3.87
11	11A		Roof Fall	Unidentified Mammal size indet	1		0.08
				Unknown	1		0.26
11	19	Pithouse	Floor Fill	Unidentified Mammal size 7	9		3.71
				Artiodactyla	2		4.48
13	9-11	Pithouse	Mixed	*C. latrans/C. familiaris*	1		25.98
14	11	Pithouse	Roof Fall	Unidentified Mammal size 7	1		0.66
				Artiodactyla	1		1.70
14	30	Internal Feature	Fill	Unidentified Mammal size indet	2		0.12
				Unidentified Mammal size 3	1		0.13
17	50	Roasting Pit	Fill	Unidentified Mammal size 7	1		0.74
18	19	Pithouse	Floor Fill	Unidentified Mammal size 7	1		0.36
				Artiodactyla	1		0.92
21	10	Pithouse	Fill	Unidentified Mammal size 3	13		2.17

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 6	1		0.31
				Unidentified Mammal size 7	5	2	5.04
				Lepus sp.	2		0.39
				L. californicus	5		1.33
				Sylvilagus sp.	2		0.46
				Carnivora	1		0.33
				Artiodactyla	4		54.27
				O. hemionus/O. canadensis	1		4.70
				Unknown-Mammal size 7	1		4.99
21	11		Roof Fall	Unidentified Mammal size 3	6		0.52
				Unidentified Mammal size 7		1	0.77
				L. californicus	1		0.52
21	19		Floor Fill	Unidentified Mammal size indet	7		0.53
				Unidentified Mammal size 3	7		1.17
				Unidentified Mammal size 6	3		0.91
				Unidentified Mammal size 7	1	1	1.26
				Lepus sp.	2		0.38
				L. californicus	4		1.92
				Sylvilagus sp.	1		0.14
				Carnivora	1		0.13
				O. hemionus/O. canadensis	1		3.90
21	9		Sheet Trash	Unidentified Mammal size 7		1	1.02
38	9	Trash Area	Sheet Trash	Unidentified Mammal size 6	1		0.36
50	50	Crematorium	Fill	Unidentified Mammal size 3	1		0.07
				Lepus sp.	1		0.33

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Sylvilagus sp.	1		0.21
62	9	Pithouse	Sheet Trash	Unidentified Mammal size 7	3		0.45
				Human/Nonhuman	1		12.41
63	50	Trash pit	Fill	Unidentified Mammal size indet	3		0.27
				Unidentified Mammal size 6	3		0.30
				Unidentified Mammal size 7	3		6.72
				L. californicus	1		0.46
				Artiodactyla	1		2.58
70	50	Crematorium	Fill	Artiodactyla	4		1.46
121	50	Roasting Pit	Fill	Human/Nonhuman	1		2.40
Site Total					133	6	193.52
The Redstone Site - AZ O:15:91							
0	9	Non-feature	Sheet Trash	Unidentified Mammal size 2	1		0.02
				Unidentified Mammal size 3	13		0.63
				Unidentified Mammal size 6	1		0.46
				Unidentified Mammal size 7		3	5.82
				Leporidae	5		0.33
				Rodentia	1		0.02
3	19	Extramural Area	Floor Fill	Unidentified Mammal size indet	3		0.25
				Lepus sp.	1		0.23
5	10/11	Pithouse	Fill	*Odocoileus* sp.	1		3.22
5	19		Floor Fill	Unidentified Mammal size 3	2		0.14
				Unidentified Mammal size 6	1		0.16
				Unidentified Mammal size 7	2	2	14.61
				L. californicus	1		1.38
				Sylvilagus sp.	1		0.63

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Odocoileus sp.	1		0.22
				Bos/Bison	1		8.47
				Unknown	2		1.98
5	9/10		Sheet Trash/	Unidentified Mammal size 3	1		0.21
			Fill	Unidentified Mammal size 6	1		0.34
				Unidentified Mammal size 7		1	0.78
5	9/80		Sheet Trash/	Unidentified Mammal size 3	1		0.42
			Disturbed	*L. alleni*	1		0.18
				L. californicus	2		0.58
5. 1	30	Internal Feature	Fill	Artiodactyla	1		0.48
11	10	Pithouse	Fill	Unidentified Mammal size 6	3		0.94
				Unidentified Mammal size 7	6	1	8.76
				Unknown	1		3.01
11	10/11		Roof Fall/	Unidentified Mammal size 6	1		0.07
			Fill	Unidentified Mammal size 7	1		0.54
11	11		Fill	Unidentified Mammal size 7	3	2	2.63
11	19		Floor Fill	Unidentified Mammal size indet	1		0.04
				Unidentified Mammal size 3	2		0.24
				Unidentified Mammal size 6	3		0.36
				Unidentified Mammal size 7	4		3.29
				Leporidae	1		0.11
				L. californicus	1		0.71
				Sylvilagus sp.	2		0.50
				Odocoileus sp.	1		1.37
				Unknown Mammal size 3	1		0.22

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unknown Mammal size 7	1		1.86
11	20		Floor	Unknown Mammal size 7	1		0.58
11	40	Sealed Pithse	Fill	Unidentified Mammal size 3	4		0.20
				Unidentified Mammal size 6	1	2	7.24
				Unidentified Mammal size 7	2	4	8.81
				Leporidae	1		0.15
				Lepus	1		0.08
				L. californicus	2		0.52
				Sylvilagus sp.	2		0.34
				C. latrans/C. familiaris	1		6.28
				Artiodactyla	3	1	8.18
				Unknown size 3	1		0.61
				Unknown Mammal size 3	1		0.46
11	9		Sheet Trash	Unidentified Mammal size 3	4		0.31
				L. californicus	2		0.37
16	9	Rock Alignment	Sheet Trash	Unidentified Mammal size 4	1		0.80
				Leporidae	1		0.01
Site Total					104	16	101.15
Rye Creek Ruin - AZ O:15:1							
1	50		Fill	Unidentified class/size indet	2		0.28
				Unidentified Aves	3		0.46
				Unidentified Mammal size indet	2		0.40
				Unidentified Mammal size 1	2		0.28
				Unidentified Mammal size 2	1		0.07
				Unidentified Mammal size 3	23		6.91

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 4	4		1.12
				Unidentified Mammal size 6	11		3.39
				Unidentified Mammal size 7	31	7	82.88
				Lepus sp.	10		2.33
				L. californicus	9		8.21
				Sylvilagus sp.	11		3.78
				Rodentia	2		0.11
				Small Sciuridae	1		0.20
				Thomomys sp.	1		0.53
				Perognathus sp.	1		0.00
				Dipodomys sp. (small)	1		0.15
				Neotoma sp.	2		0.54
				C. latrans/C. familiaris	3		7.04
				Urocyon cinereoargenteus	1		0.97
				Artiodactyla	3		13.78
				O. hemionus	2		43.85
				Buteo sp.	1		0.41
				Phasianidae	2		0.21
				Colaptes sp.	2		0.34
				UNK	2		0.74
				Fish	3		0.39
				Human/Nonhuman	2		12.91
2	50		Fill	Unidentified Mammal size indet	4		1.08
				Unidentified Mammal size 3	3		1.22
				Unidentified Mammal size 6	4		1.49
				Unidentified Mammal size 7	3		11.18
				Lepus sp.	2		0.26
				Sylvilagus sp.	1		0.19
				Artiodactyla	1		0.40

Table H.3A. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Odocoileus sp.	2		1.41
				Human/Nonhuman	2		8.55
3	50		Fill	*Phrynosoma* sp.	1		0.08
				Colubridae	24		5.66
				L. californicus	1		0.42
				Sylvilagus sp.	1		0.10
				Rodentia	1		0.02
				Neotoma sp.	3		0.30
				UNK	1		1.64
5	50		Fill	Unidentified Mammal size 3	3		1.10
				Unidentified Mammal size 6	1		0.25
				Unidentified Mammal size 7	3		4.71
				L. californicus	2		0.82
Site Total					201	7	233.16

Table H.3B. Quantity (Qty) and weight in grams (Wt) of faunal remains recovered from the Boone Moore site (AZ O:15:55) by feature and stratum. Quantity of worked bone (Wk) is also included.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
The Boone Moore Site - AZ O:15:55							
0	9	Nonfeature	Sheet trash	Unidentified Mammal size indet.	2		0.13
				Unidentified Mammal size 6	31		4.12
				Unidentified Mammal size 7	6		4.05
1	10	Cobble masonry structure	Fill	Unidentified Mammal size 1	3		-
				Unidentified Mammal size 3	5		-
				Unidentified Mammal size 4	5		-
				L. californicus	6		-
				Sylvilagus sp.	1		1.64
				S. variegatus	1		-
1	19	Floor	Fill	Unidentified size & class indet.	1		-
				Unidentified Mammal size indet.	1		-
				Unidentified Mammal size 4	1		-
				Unidentified Mammal size 6	3		-
				Lepus sp.	1		-
				L. californicus	4		-
5	9	Cobble lined adobe pitroom	Sheet trash	Unknown	1		0.91
				Phasianidae	2		0.29
				Unidentified class & size indet.	1		0.05
				Unidentified Mammal size 3	9		2.51
				Unidentified Mammal size 6	74		5.91

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 7	57		33.51
				Lepus sp.	2		0.48
				L. alleni	1		1.32
				L. californicus	12		11.17
				Sylvilagus	4		1.12
				Artiodactyla	7		16.07
				Cervidae	1		0.67
				Odocoileus sp.	11		11.51
				O. hemionus	3		68.28
5	10		Fill	Unidentified class & size indet.	5		0.62
				Unidentified Mammal size 3	32		9.93
				Unidentified Mammal size 6	11		2.85
				Unidentified Mammal size 7	42		24.12
				Leporidae	3		0.36
				Lepus	2		0.20
				L. alleni	1		0.14
				L. californicus	24		28.40
				Sylvilagus	10		3.89
				cf. *Taxidea taxus*	1		1.99
				Artiodactyla	14		28.40
				Odocoileus sp.	6		4.29
				O. hemionus	2		37.34
				Phasianidae	3		0.42
				Unknown	2		2.99
5	11	Roof fall		Unidentified. Mammal size3	1		0.57
				Unidentified Mammal size 6	22		3.49
				L. californicus	3		5.59
5	19	Floor	Fill	Unidentified class & size indet	3		0.14

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 2	1		0.02
				Unidentified Mammal size 3	21		5.15
				Unidentified Mammal size 4	3		1.08
				Unidentified Mammal size 6	15		3.00
				Unidentified Mammal size 7	254		97.30
				Leporidae	3		0.41
				Lepus sp.	3		5.38
				L. californicus	33		35.93
				Sylvilagus sp.	14		7.63
				Rodentia	1		0.15
				Sigmodon sp.	1		0.11
				Artiodactyla	53		93.27
				Odocoileus sp.	36		34.49
				O. hemionus	11		123.34
				O. hemionus/O. canadensis	2		14.29
				Phasianidae	8		1.16
				Unknown	2		1.11
				Unknown Mammal size 7	1		7.68
5-11S	30	Internal feature	Fill	Unidentified Mammal size 3	1		0.43
				Unidentified Mammal size 6	2		0.45
				Lepus sp.	1		0.45
				L. californicus	3		2.75
				Artiodactyla	3		9.59
5	49		Sealed sheet trash	Unidentified Mammal size indet	2		0.34
				Unidentified Mammal size 3	10		2.29
				Unidentified Mammal size 7	204	3	65.03

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Leporidae	2		0.36
				Lepus sp.	4		5.13
				L. californicus	12		11.19
				Sylvilagus sp.	5		1.70
				Rodentia	1		0.09
				Thomomys sp.	1		0.24
				Artiodactyla	20		54.80
				Odocoileus sp.	42		71.86
				O. hemionus	1		4.34
				Phasianidae	1		0.15
				Unknown	2		1.20
				Unknown Mammal size indet	1		2.78
6	10	Cobble-lined	Fill	Unidentified class & size indet.	1		0.01
		Adobe pitroom		Unidentified class indet. size 2	1		0.04
				Unidentified Mammal size indet	26		0.98
				Unidentified Mammal size 1	1		0.12
				Unidentified Mammal size 3	16		2.95
				Unidentified Mammal size 4	6		1.00
				Unidentified Mammal size 6	43		7.90
				Unidentified Mammal size 7	44	1	31.42
				Leporidae	9		0.65
				Lepus sp.	6		0.84
				L. californicus	23		11.35
				Sylvilagus sp.	14		4.24
				Neotoma sp.	1		0.20
				Artiodactyla	2		4.69
				O. hemionus/O. canadensis	2		28.43
				Phasianidae	2		0.18

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unknown Mammal size indet.	1		0.19
				Unknown Mammal size 3	1		0.13
				Unknown Mammal size 7	2		3.24
6	10/11		Fill/Roof fall	Unidentified Mammal size 3	5		0.73
				Unidentified Mammal size 6	3		0.17
				Unidentified Mammal size 7	10	2	12.36
				L. californicus	6		2.93
				Sylvilagus sp.	3		2.71
				Sciuridae	1		0.69
				Artiodactyla	1		1.46
				Unknown large bird	1		0.64
6	11		Roof fall	Unidentified Mammal size indet.	2		0.33
				Unidentified Mammal size 3	7		1.55
				Unidentified Mammal size 4	1		0.30
				Unidentified Mammal size 6	1		0.42
				Leporidae	1		0.07
				L. californicus	10		3.68
				Sylvilagus sp.	3		1.79
				Rodentia	1		0.06
				Thomomys sp.	1		0.29
				Neotoma sp.	1		0.08
				Artiodactyla	2		1.09
				Odocoileus sp.	1		0.41
				Phasianidae	1		0.17
6	19		Floor fill	Unidentified Mammal size indet.	1		0.30
				Unidentified Mammal size 6	3		0.75

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 7	2		7.41
				Lepus sp.	1		0.10
				L. californicus	3		1.86
				Sylvilagus sp.	2		0.38
				Rodentia	1		0.02
				Thomomys sp.	1		0.22
				Dipodomys sp. small	1		0.13
				Artiodactyla	1		0.62
				Odocoileus sp.	1		23.38
7	50	Inhumation	Fill	Unidentified Mammal size 1	1		0.04
				Rodentia	1		0.01
8	50	Inhumation	Fill	Unidentified Mammal size 7	8		10.68
				L. californicus	1		0.70
9	10	Pithouse	Fill	Unidentified Mammal size 3	6		0.27
				Unidentified Mammal size 4	2		0.22
				Unidentified Mammal size 6	2		0.08
				Unidentified Mammal size 7	1		1.02
				Lepus sp.	2		0.17
				Buteo sp.	1		1.70
9	50		Fill	Unknown Mammal size 6	1		3.37
9	80		Disturbed	Unidentified Mammal size indet.	4		0.11
				Unidentified Mammal size 6	9		1.82
10	50	Pit	Fill	Unidentified Mammal size 2	3		0.24
				Leporidae	1		0.07
11	10	Pithouse	Fill	Unidentified Mammal size indet.	6		0.18
				Lepus sp.	1		0.05

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				Unidentified Mammal size 3	6		0.60
				Unidentified Mammal size 6	9		1.61
				Unidentified Mammal size 7	1		-
				L. californicus	3		0.45 +
				Sylvilagus sp.	2		0.41
11	19		Floor fill	Unidentified Mammal size indet.	10		0.67
				Unidentified Mammal size 3	4		1.33
				Unidentified Mammal size 6	15	1	4.47
				Unidentified Mammal size 7	4	1	5.12
				Crotalidae	1		0.36
				Leporidae	1		0.08
				Lepus sp.	3		1.99
				L. californicus	12		8.25
				Sylvilagus sp.	3		1.41
				Rodentia	2		0.01 +
				C. latrans/C. familiaris	1		13.13
				Artiodactyla	1		0.23
				Odocoileus sp.	2		1.24
				Phasianidae	1		0.08
				Unknown small bird	1		0.06
11	30	Internal feature	Fill	Unidentified Mammal size indet.	10		-
				Unidentified Mammal size 3	1		-
				Unidentified Mammal size 4	1		0.10
				Unidentified Mammal size 6	4		-
				Lepus sp.	1		-

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				L. californicus	2		0.27 +
				Unknown	2		0.20
18	19	Masonry structure or extramural activity area	Floor fill	Unidentified Mammal size 3	2		0.26
				Unidentified Mammal size 6	50		8.08
				Unidentified Mammal size 7	11		13.33
				Crotalidae	1		0.27
				L. californicus	3		1.21
				Rodentia	2		0.11
				Neotoma sp.	1		0.22
				Artiodactyla	3		0.58
				Unknown Mammal size 6	1		0.39
18	19a		Floor fill	Unidentified Mammal size 6	8		0.76
				Unidentified Mammal size 7	2		2.50
				Sylvilagus sp.	1		0.05
18	20A		Floor	*O. hemionus/O. canadensis*	1		10.28
18	MA-20A		Floor	*Odocoileus* sp.	1		2.45
19	10	Pithouse	Fill	*L. californicus*	1		0.21
	19		Floor fill	Unidentified Mammal size 6	1		0.48
				Unidentified class & size indet.	7		2.06
				L. californicus	3		4.70
				Carnivora	1		0.77
				Phasianidae	1		0.09
				Unknown Mammal size 3	1		0.39
				Unknown size 4	1		1.14
	20		Floor	Unidentified Mammal size 3	1		0.46

Table H.3B. Continued.

Feature Number	Stratum Number	Feature Type	Stratum Type	Taxon	Qty	Wk	Wt
				L. alleni	1		0.10
				Unidentified class & size indet	6		0.53
				Unidentified Mammal size 7	10		6.32
				L. californicus	2		3.31
				Odocoileus sp.	1		0.42
				O. hemionus	1		22.95
				Unknown Mammal size 7	1		1.05
				Unknown med-lg bird	2		2.87
20	50B	Roasting pit		Unidentified Mammal size 7	1		1.67
22	50	Trash pit	Fill	Unidentified Mammal size 7	27		14.59
				L. californicus	1		0.51
				Artiodactyla	31		18.81
				Odocoileus sp.	6		22.61
				O. hemionus	16		452.08
23	50	Burial	Fill	*Phrynosoma* sp.	1		0.09
				Cervidae	64		77.04
Site Total					1932	8	1890.38

APPENDIX I

ARGILLITE DATA

Table I.1. Argillite artifact samples from sites within the Rye Creek Project area analyzed through X-ray diffraction analysis.

Site/Sample #	Source	Artifact Type	Weight (gm)
Clover Wash Site - AZ O:15:100			
1001	Deer Creek	Polishing stone	
1002	Deer Creek	Polishing stone	
1003	Deer Creek	Indeterminate cobble	
1004	Del Rio	Indeterminate cobble	
1005	Del Rio	Worked piece	
1006	Deer Creek	Worked (?) piece	
1007	Unknown E	Polishing stone	
1008	Deer Creek	Polished stone	
1009	Deer Creek	Polishing stone	
The Arbys Site - AZ O:15:99			
1010	Unknown C	Polishing stone	
1011	Unknown E	Polished pebble	
The Rooted Site - AZ O:15:92			
1012	Unknown D	Flake	
1013	Deer Creek	Polishing stone	
1014	Deer Creek	Ring fragment	1.3
The Redstone Site - AZ O:15:91			
1015	Not Argillite	Indeterminate tabular piece	
1016	Del Rio	Ground piece	
1017	Unknown D	Polished pebble	
1018	Del Rio	Polishing stone	
1019	Deer Creek	Indeterminate tabular piece	
1020	Deer Creek	Disk or bead blank	0.3
1021	Deer Creek	Worked piece	
1022	Del Rio	Unworked fragment (quarry sample)	
1023	Del Rio	Pendant (perforated)	0.7
1024	Unknown D	Polished cobble fragment	
1025	Deer Creek	Pendant blank	
1026	Deer Creek	Tubular bead blank	
1027	Deer Creek	Hexagonal disk blank	1.8

Table I.1. Continued.

Site/Sample #	Source	Artifact Type	Weight (gm)
The Redstone Site - AZ O:15:91 (continued)			
1028	Deer Creek	Heptagonal disk blank	0.5
1029	Deer Creek	Polishing stone	
1030	Deer Creek	Worked polished pebble	
1031	Deer Creek	Disk or bead blank	0.3
1032	Del Rio	Hexagonal disk	0.5
1033	Deer Creek	Pendant blank	
1034	Deer Creek	Elongated bead	0.4
1035	Deer Creek	Indeterminate cobble	
1036	Deer Creek	Bead fragment	0.2
1037	Deer Creek	Tubular bead (short)	0.8
1038	Deer Creek	Tubular bead (long)	0.8
1039	Deer Creek	Heptagonal disk	0.7
1040	Del Rio	Round bead	0.9
1041	Deer Creek	Octagonal disk bead	1.0
1136	Deer Creek	Ground piece	
1137	Deer Creek	Imitation copper bell	
The Compact Site - AZ O:15:90			
1042	Del Rio	Pendant fragment	0.7
1043	Deer Creek	Heptagonal disk	0.3
1044	Del Rio	Rectangular pendant	1.5
1046	Deer Creek	Heptagonal (?) disk	1.1
The Overlook Site - AZ O:15:89			
1047	Deer Creek	Polished (?) cobble	
1048	Deer Creek	Ring fragment	1.1
1049	Deer Creek	Polishing stone	
1050	Del Rio	Flaked polished pebble	
1051	Deer Creek	Polishing stone	
1052	Deer Creek	Polishing stone	
1053	Deer Creek	Ring fragment	0.9
AZ O:15:71			
1054	Deer Creek	Polishing stone	
1055	Deer Creek	Worked (?) cobble	
AZ O:15:70			
1056	Deer Creek	Polished stone	

Table I.1. Continued.

Site/Sample #	Source	Artifact Type	Weight (gm)
The Boone Moore Site - AZ O:15:55			
1057	Deer Creek	Polished cobble	
1058	Unknown E	Polished cobble	
1059	Deer Creek	Disk blank	0.8
1060	Deer Creek	Fetish (?)/pendant	1.7
1061	Deer Creek	Ring fragment	0.7
1062	Deer Creek	Polishing stone	
1063	Deer Creek/Oak S	Polishing stone	
1064	Deer Creek	Ornament	2.3
1065	Deer Creek	Polished cobble	
1066	Deer Creek	Polished pebble	
1067	Del Rio	Tabular piece	
1134	Unknown E	Ground piece	
1135	Deer Creek	Perforated disk	132.8
The Cobble Site - AZ O:15:54			
1068	Unknown E	Polishing stone	
1069	Tucson Mountain	Polished pebble	
1070	Deer Creek	Polishing stone	
1071	Deer Creek	Incised tabular fragment	
1133	Deer Creek	Imitation shell bracelet fragment	
Hilltop Site - AZ O:15:53			
1072	Deer Creek	Ornament/fetish	3.4
1073	Unknown C	Polishing stone	
1074	Deer Creek	Polishing stone	
1132	Del Rio	Ornament/tool	10.8
The Deer Creek Site - AZ O:15:52			
1075	Deer Creek	Polished pebble	
1076	Del Rio	Pendant (unfinished)	3.5
1077	Deer Creek	Polished pebble	
1078	Deer Creek	Polishing stone	
1079	Deer Creek	Polishing stone	
1080	Deer Creek	Pendant/effigy	6.1
1081	Deer Creek	Polishing stone	
1082	Deer Creek	Indeterminate cobble	
1083	Deer Creek	Polished pebble (worked?)	
1084	Deer Creek	Indeterminate cobble	
1085	Deer Creek	Polishing stone	
1086	Deer Creek	Polishing stone	
1087	Deer Creek	Polished pebble	
1088	Deer Creek	Polished pebble (?)	
1089	Unknown D	Polished pebble	
1090	Unknown E	Disk fragment (?)	

Table I.1. Continued.

Site/Sample #	Source	Artifact Type	Weight (gm)
The Deer Creek Site - AZ O:15:52 (continued)			
1091	Unknown E	Worked (?) piece	
1092	Deer Creek	Polishing stone	
1093	Deer Creek	Indeterminate cobble	
1094	Deer Creek	Polishing stone	
1095	Deer Creek	Polishing stone	
1096	Deer Creek	Indeterminate cobble	
1097	Deer Creek	Indeterminate cobble	
1098	Deer Creek	Polished cobble	
1099	Deer Creek	Polishing stone	
1100	Deer Creek	Polishing stone	
1101	Unknown E	Polishing stone	
1102	Deer Creek	Polishing stone	
1103	Deer Creek	Polishing stone	
1104	Deer Creek	Polishing stone	
1105	Deer Creek	Polishing stone	
1130	Deer Creek	Nose plug (?)	4.4
1131	Deer Creek	Awl	3.8
Rye Creek Ruin - AZ O:15:1			
1106	Deer Creek	Polished cobble	
1107	Deer Creek	Polished cobble	
1108	Deer Creek	Polished cobble	
1109	Deer Creek	Polishing stone	
1110	Deer Creek	Polishing stone	
1111	Deer Creek	Polishing stone	
1112	Del Rio	Polished cobble	
1113	Deer Creek	Polished cobble	
1114	Deer Creek	Indeterminate cobble	
1115	Deer Creek	Indeterminate cobble	
1117	Deer Creek	Polishing stone	
1118	Unknown E	Polishing stone	
1119	Deer Creek	Polishing stone	
1120	Del Rio	Pendant blank	
1122	Deer Creek	Polishing stone	
1123	Unknown E	Polished cobble	
1124	Deer Creek	Polishing stone	
1125	Deer Creek	Polishing stone	
1126	Deer Creek	Worked piece	
1129	Deer Creek	Pendant or fetish	

Table I.2. Argillite artifact samples from sites outside of the Rye Creek Project area analyzed through X-ray diffraction analysis.

Site/Sample #	Source	Artifact Type	Weight (gm)
Tuzigoot:			
1138	Del Rio		
1139	Del Rio		
1140	Del Rio		
1141	Del Rio		
1142	Del Rio		
Shoofly Village: AZ O:11:6			
1143	Deer Creek	Ring fragment	
1144	Del Rio	Worked piece (mosaic?)	
1145	Unkown E	Ground piece	
1147	Deer Creek	Ground piece	
1149	Deer Creek	Ground piece	
1151	Unknown E	Ground piece	
AZ O:11:1144			
1153	Deer Creek	Ground piece	
1154	Deer Creek	Ground piece	
AZ O:15:12			
1155	Deer Creek	Polishing stone	
Lizard Man: NA 17957			
1157	Del Rio	Unworked flake	2.8
1158	Del Rio	Worked flake	0.9
1159	Del Rio	Ground piece	4.3
1160	Tucson Mountain	Round bead	0.3
1161	Del Rio	Ground piece	11.4
1162	Del Rio	Unworked flake	0.7
Pueblo Grande: AZ U:9:7			
1163	Deer Creek	Bead fragment	
1164	Deer Creek	Nose plug (?) fragment	2.1
1165	Tucson Mountain	Bead	
1166	Del Rio	Ground piece	3.6
1167	Del Rio	Bead	
1168	Not Argillite	Beads	

Table I.2. Continued.

Site/Sample #	Source	Artifact Type	Weight (gm)
Los Morteros: AZ AA:12:57			
1169	Tucson Mountain	Pendant	
1171	Tucson Mountain	Informal palette/worked slab	
1173	Unknown B	Ring	
1174	Tucson Mountain	Ring	
Winona-Ridge Ruin:			
1175	Del Rio	Bracelet fragment	
1176	Deer Creek	Pendant blank	1.7
1177	Del Rio	Bead	0.5
1178	Del Rio	Pendant fragment	
1179	Del Rio	Tubular bead	
1180	Unknown A	Pendant	
1181	Del Rio	Ring	
1182	Del Rio	Ground piece	9.8
1183	Deer Creek	Ground piece	5.4
Marana Platform Mound: AZ AA:12:251			
1184	Del Rio	Tubular pipe fragment	
1185	Tucson Mountain	Ground piece	
1186	Tucson Mountain	Ground piece	
1187	Tucson Mountain	Flake debitage	
1188	Tucson Mountain	Flake debitage	
Grasshopper Ruin: AZ P:14:1			
1189	Del Rio	Pendant	
1190	Deer Creek	Fetish (?)	
1191	Deer Creek	Perforated disk fragment	
1192	Del Rio	Pendant	

Note: Samples A29,322 and 74:13:283 are Hematite.

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