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IN
STORAGE

CONTRIBUTIONS TO THE ARCHEOLOGY OF PETRIFIED FOREST NATIONAL PARK, 1985-1986

by
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Contributions by:

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Publications in Anthropology 45

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Contributions to Petrified Forest Archeology

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Western Archeological and Conservation Center
Tucson, Arizona
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ABSTRACT

Archeological work conducted during the summers of 1985 and 1986 produced much new data which was badly needed to update our perceptions of Petrified Forest prehistory. A total of 120 sites along the park boundaries and in the developed areas were recorded, many of them for the first time. Surveys to fulfill compliance requirements prior to installation of a new water system (NPS Package No. 111) and developed area surveys provided data on prehistoric land use and settlement patterns in large blocks or quadrats. A privately funded survey of a 1/4-mile wide corridor around the 91-mile park perimeter, half of which was completed, provided transect-type data in a variety of environmental zones. Also included in this report are the results of limited excavation at AZ K:13:60 (ASM), an Archaic campsite inhabited in the first millennium B.C. The site was recorded first in the summer of 1985, and testing was undertaken in 1986 to determine its condition and National Register significance.

ACKNOWLEDGEMENTS

We are indebted to the many people whose contributions helped produce the results in this volume. We are grateful that Project Director George A. Teague gave us the opportunity to direct the projects. Many thanks go to Park Superintendent Ed Gastellum and his staff for logistical support and for making our stays in the park enjoyable and productive. Limited funding for the boundary survey was provided by the Petrified Forest Museum Association. The slack was picked up by members of the American Rock Art Research Association (ARARA) who paid their own bills and volunteered many hours of their time. Pat and Jack McCreery were prime movers from the start, fund raisers, recruiters of crew members and all-around cheerleaders. Other "regulars" from ARARA were Bob Cooper, Don Christensen, Jim and Kitty Stoddart, Merry Austin, Paul Hughes, Sandy McCreery, and A. J. and Frank Bock. Park staff who joined us include Dewey Garner, Jim Ireland, Karen Finley, Denise Dumouchel, Ed and Carolyn Gastellum, Amy Ward, Katie Fenn, Pam Obernesser and Bill Collup; Bill's wife, Vicki, was a regular the second year. In addition to the authors, Western Archeological and Conservation Center (WACC) archeologists Lynne D'Ascenzo and Suzanne Crawford were diligent in their "pursuit of science." Holbrook teachers, Mary Brace and Ferrell Knight, also volunteered the second year. Without each of them, we never could have covered so much territory.

A number of individuals contributed time and effort in the completion of the work on AZ K:13:60. WACC archeologists Susan Wells, and Richard Ervin, and Assistant State Lands Archeologist John Madsen worked hard to complete the field work quickly; it was a pleasure to work with this group of professionals. Bob Cooper, Don Christensen and Petrified Forest Park Ranger Clyde Stonaker added muscle during excavation and backfilling. Fred Nials, Eastern New Mexico University geomorphologist, consulted on-site on the stratigraphy. We appreciate their labors.

During writeup and analysis in Tucson, we relied on the expertise of many people. Suzanne Fish analyzed the pollen. Lisa Huckell analyzed flotation and shell samples. Both produced concise and professional reports. Alan Ferg helped identify the historical artifact

and fossil. Chuck Adams and Rich Lange identified many of the atypical sherds. Rob Serface and Miki Tagg washed the artifacts. Washington State University processed the radiocarbon samples, and Austin Long, University of Arizona, graciously ran a C-14 date on the corn. Ken Rozen gave some useful insights on the projectile points and illustrated the points in Chapter 9. Lisa Huckell illustrated the ornaments. Lynn D'Ascenzo drew the first drafts of the site maps and rock art in Chapter 7. Ron Beckwith drafted all other maps and artifacts. Bruce Huckell and Gwinn Vivian, ASM, provided many references. Bruce also contributed insights on the flaked stone assemblage. Editors Sally Adams and Linda Gregonis labored to rid the manuscript of errors. Although each of the administrative staff at WACC was tremendously helpful, Beverly Mohler, ex-division secretary (now administrative officer), Sandra Elliot, current secretary, and Vonna Lou Mason, typist, deserve special mention. Donna Fesselmeyer cheerfully helped with report production. Trink also wishes to commend her husband, T. J. Priehs, for his advice and endurance on these projects.

Finally, thanks go to Apache-Sitgreaves Forest Archeologist Bruce Donaldson for giving Marty time out from his new job to complete his manuscript, and for his comments on the draft. Susan Wells took over Marty's responsibilities on the water system project, and in general helped with quality control on the report. We could not have completed this project without the help of all these people. Thank you.

Chapter 1

INTRODUCTION

During the summers of 1985 and 1986, archeologists from the Western Archeological and Conservation Center (WACC) surveyed large areas of Petrified Forest National Park (Fig. 1.1) and test excavated a preceramic site. The surveys covered (1) the developed area at the Rainbow Forest headquarters in the south end of the park; (2) four alternative parcels for the proposed Denver Service Center project to construct a water treatment facility and waterlines (National Park Service Package No. 111); (3) the environs of PEFO Site 236 on the east boundary of the park; and (4) a 400-m wide corridor along 63 km of the park boundary fence. The excavation was undertaken to determine the condition and research potential of a preceramic site that was first recorded in 1985. The first two surveys and the test excavation were directed in the field by Martyn D. Tagg. The second two surveys, privately funded at the request of the superintendent, were accomplished by the author and a minimal WACC staff with the aid of volunteers.

The fieldwork was conducted from July 18 to August 7, 1985 and from June 16 to July 17, 1986. Survey field methods and the research topics were essentially the same for all surveys. A total of 120 sites were recorded; the testing of one of these was considered an extension of the survey function--to evaluate site significance, condition and research potential. As a body, these new data make a substantial contribution to our knowledge of the archeology of the Petrified Forest and the surrounding region. Thus, the results are presented together in this report.

In the remainder of this chapter, the projects are described individually in more detail. Previous archeological work is summarized, and the research topics addressed by the fieldwork are discussed. In chapters 2 and 3, the culture history and the environmental setting of the park are characterized. In Chapter 4, the field methods are described, and in Chapter 5, the artifact analyses are enumerated. New site data are classified by site types and are presented in chapters 6 and 7. In Chapter 8, Wells presents management recommendations for the

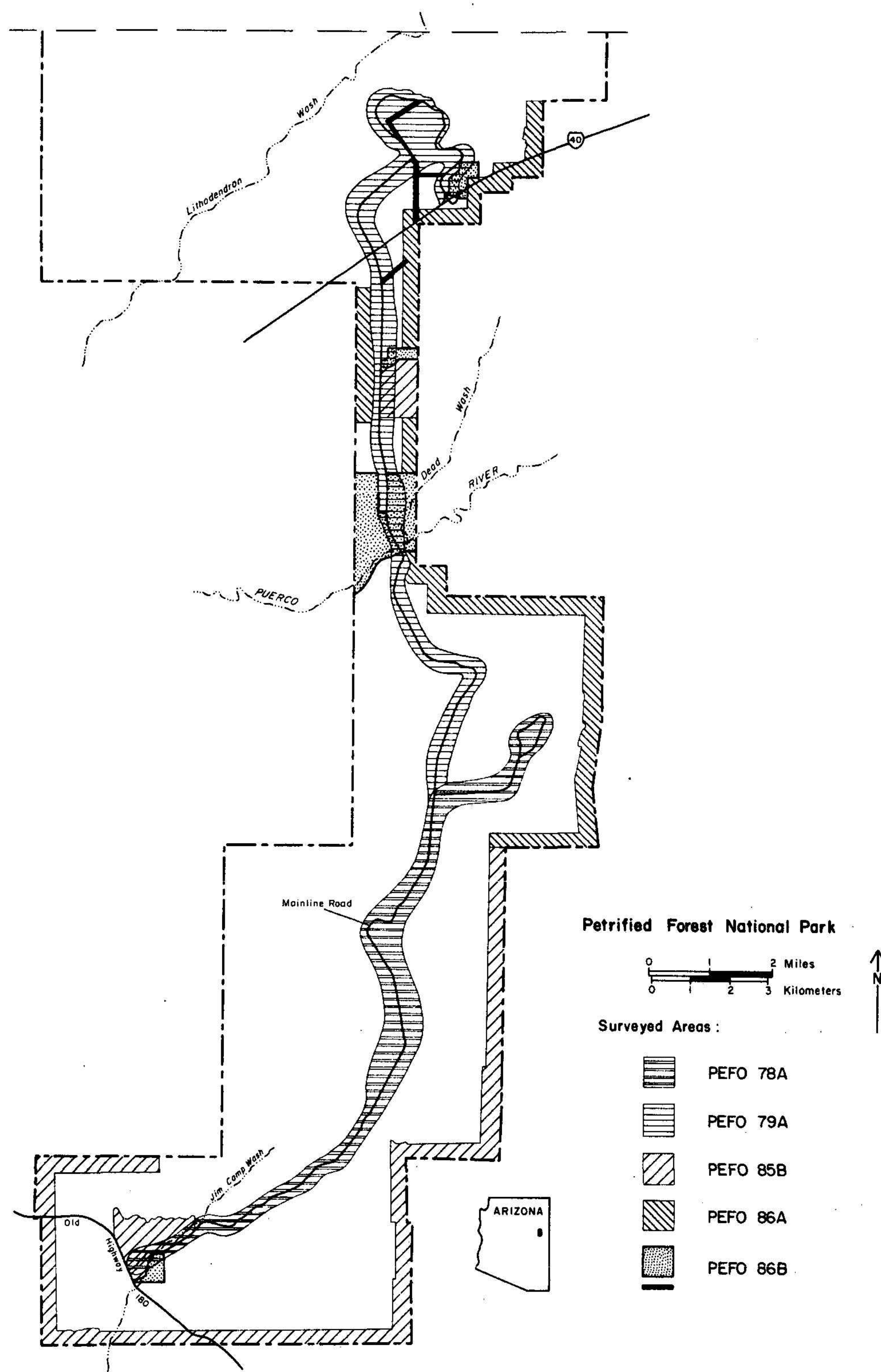


Figure 1.1 Map of Petrified Forest National Park showing project areas.

treatment of the sites recorded during the water system survey. In Chapter 9, Tagg introduces the results of the test excavations; those findings are further considered in the research summary in Chapter 10, along with all survey data generated in the park since 1978. The research summary highlights some of the questions raised by the analyses and makes comparisons with earlier works. Finally, recommendations for future research are proposed in Chapter 11. The recommendations include various archeological proposals that address both management and research concerns.

Fieldwork for two other projects was conducted concurrently. The results of the mitigation of the impacts of road reconstruction (Pkg. No. 140, Phase III) on three Pueblo period sites, and the surface reconnaissance of McCreery Pueblo (AZ K:13:41 [ASM]) are presented in a separate volume (Jones 1986).

Project Descriptions

Survey of the Rainbow Forest Developed Area

(WACC Project Nos. PEFO 85B, in part, and PEFO 86B, in part)

Over the years, most archeological clearance work in the park has centered on the Painted Desert Headquarters and Rainbow Forest Museum areas. Responding to individual construction projects has been relatively expensive and time consuming. Blanket coverage of selected developed areas with suitably large buffer zones will allow clearance requests to be handled more rapidly and cost effectively. New requests can now be processed without additional survey, using the data base produced previously.

The survey of the Rainbow Forest Developed Area was completed in conjunction with other projects (Pkg. No. 140 and Phase I of Pkg. No. 111) funded by the Denver Service Center. The survey in 1985 (Proj. No. PEFO 85B) expanded on work done earlier by Nancy Hammack (1979; Proj. No. PEFO 78A). An additional parcel (Proj. No. PEFO 86B) was surveyed to aid in planning the new water system. The entire area is considered in the management recommendations for the water system (see Chapter 8).

A total of 9 sites was recorded in an area containing approximately 581 acres (see Fig. 1.1). The survey area is roughly triangular in shape and is bounded on the north by a high badlands scarp, on the southeast by the park Mainline Road and project boundaries for the Water System Project, and on the southwest by Old Highway 180.

Survey for the Water System Project

(Proj. No. PEF0 86B, in part)

Currently, water for domestic uses is supplied to Petrified Forest National Park staff and visitors by pipelines from Puerco Well #2, which is located between the Puerco River and the Santa Fe railroad tracks. Concentrations of iron, manganese and total dissolved solids (TDS) in the water exceed the recommended maximum levels established by the Environmental Protection Agency (National Park Service 1986:5-12). Serious corrosion is occurring at some joints of the steel and cast iron water and sewerlines and in appliances such as water heaters. In addition, the sewerlines at the Painted Desert headquarters are clogged with grout used to stabilize wall footings.

The National Park Service wishes to reduce potential health hazards while providing a water and sewer system that is cost effective, easily maintained, and has minimum impact on park resources. Three alternatives have been proposed. Alternative A, the installation of one treatment plant north of the Puerco River (with two location options) and the repair of approximately 7.1 km (4.4 miles) of the trans-park waterline, is preferred. Alternative B entails the construction of two treatment plants, one at the Rainbow Forest and one at the Painted Desert headquarters. The water at Rainbow Forest would be provided by the Rainbow Forest well (not currently developed for domestic use) and at Painted Desert by Puerco Well #2 and pipeline. Alternative C calls for the construction of two small treatment plants, one at the Rainbow Forest and one at the Painted Desert headquarters. The plants would only process water for drinking. Water to both plants would be transported by a repaired trans-park waterline.

The most extensive alternative (Alternative A) would require the replacement of approximately 7,070 m (23,200 feet) of pipeline extending

north from the Puerco Well, and of 915 m (3,000 feet) connecting the Painted Desert reservoir and Kachina Point (NPS 1986:9). Included in all plans is the replacement of 1,125 m (3,700 feet) of sewerlines at the Painted Desert Headquarters, and of 275 m (900 feet) of sewerlines at Rainbow Forest (NPS 1986:31-32).

The boundaries of the archeological surveys conducted for the proposed plant and pipeline locations included a buffer zone around the areas specified by the planning team (see Fig. 1.1 and Chapter 8). The total area surveyed was 1,200 acres; 33 sites were recorded or rerecorded. Additional details are presented in chapters 7 and 8.

Survey of the Environs of PEF0 Site 236

(Proj. No. PEF0 85B)

Following surface reconnaissance and mapping at PEF0 Site 236, also known as McCreery Pueblo, the area in the immediate vicinity of the site was surveyed. One objective of the survey was to provide good training for the volunteer survey crews. We also hoped to locate contemporaneous sites, because the habitation structure at Site 236 indicated a site population that seemed too small to support activities associated with a Great Kiva. In a total of 430 acres (0.67 square miles), (see Fig. 1.1), 6 sites were located and recorded. Later, this area was subsumed by survey needs for Alternative A of the proposed water system. Thus, the sites are discussed in some detail in both chapters 6 and 8.

Survey of the Park Boundary

(Proj. Nos. PEF0 85B, in part, and PEF0 86A)

In 1983, pothunters crossed the south boundary fence of the park and dug several deep holes in a large site. Because of the threat of pothunters park staff realized the need to update baseline data on archeological sites along the 146 km (91-mile) boundary so they could upgrade resource protection efforts. In 1985, limited private funding was obtained by the superintendent and chief ranger, and a long-term project to survey a corridor 400 m (0.25 mi) wide along the entire boundary began under the direction of the author and with the help of

volunteers, mainly from the American Rock Art Research Association (ARARA).

From July 20 to August 7, 1985, 33 km (20.5 miles) of fence line were surveyed (Proj. No. PEF0 85B) (see Fig. 1.1). Forty-three sites were recorded in a total area of 3,280 acres. From June 24 to July 3, 1986, 30.2 km (18.75 miles) of fence line survey were completed (Proj. No. PEF0 86A) (see Fig. 1.1). Thirty-three sites were recorded in a total area of 3,000 acres. In summary, during the first two years of the survey, 76 sites were recorded along 63.2 km of the boundary, an area of 6,280 acres (approximately 10 square miles).

Previous Archeological Work

Previous archeological work in Petrified Forest National Park forms the foundation upon which current research and management objectives are based. Past work has been sporadic and uneven. However, more than 600 site forms from three major surveys and numerous small-scale projects are archived at the Western Archeological and Conservation Center. Only 11 sites have been excavated.

The earliest work in the park was done in the summer of 1896 by Jesse W. Fewkes and Walter Hough for the Bureau of American Ethnology (Fewkes 1904). This expedition was based in Holbrook for the purpose of regional reconnaissance and artifact collection for the Smithsonian Institution. Some artifacts were recovered from Puerco Ruin. In 1901, as leader of the Smithsonian Museum-Gates Expedition, Hough (1903) inspected Puerco Ruin (NA6302, called Adamana by Hough) and nearby petroglyphs, and test excavated and collected surface samples at the Twin Butte Site (NA5065, called Metate by Hough). During the 1930s, C. B. Cosgrove (1951) worked at Puerco Ruin and the Flattop Site, and completely excavated Agate House (LA470). Albert H. Schroeder (1961) and Calvin H. Jennings (1967, 1980) continued excavations at Puerco Ruin for the National Park Service during the 1960s. Although Puerco Ruin has been excavated four times, only Jennings (1980) produced a full report, which unfortunately, was severely limited in distribution. Erik K. Reed supervised Bennet T. Gale (1941) and some Civilian Conservation Corps (CCC) workers in the excavation of a small rockshelter (PEF0 Site

171) located near and contemporaneous with Puerco Ruin. In 1970, in conjunction with a road realignment project at the south end of the park, Bruce G. Harrill (1971) excavated a small field house (NA10,808) inhabited at some time between A.D. 1150 and A.D. 1300. In 1983, the author (Jones 1983) test excavated AZ Q:1:42(ASM), an Anasazi site located on the Mainline Road south of Blue Mesa Road. The site had loci dating to the Basketmaker III/Pueblo I and Pueblo II/Pueblo III Anasazi periods. Analysis focused on an extensive and systematic examination of the flaked stone debitage from the temporally discrete loci.

The most extensive excavations in the park were made by Fred Wendorf (1953) in 1949. To test his hypotheses on early pottery horizons, Wendorf dug large sections of the Flattop Site, a Basketmaker II period village, and the Twin Butte Site, a Basketmaker III/Pueblo I period village.

Numerous surveys have been undertaken in the park for research and management purposes. Site records for 609 sites from four institutions are on file at the Western Archeological and Conservation Center. The actual number of sites represented by the records is only about 500 sites because a number of sites have been recorded more than once by different projects. Survey data need to be better correlated. Of the 109 sites H. P. Mera (1934) recorded in the 1930s, 87 are within the park boundaries. New Mexico Laboratory of Anthropology numbers were assigned, and collections, largely of ceramics, were made. As a reflection of the unevenness of the data, it should be noted that all of Mera's sites had ceramics and ranged in age from the Basketmaker III through the Pueblo IV periods (Hammack 1979). Apparently PEF0 Site 236, a Great Kiva site adjacent to the park that was transferred from private ownership to the Park Service in December 1986, was also overlooked by Mera. In 1940 and 1941, Reed (1940) and Carl Jepson, a park naturalist, revisited Mera's sites where possible and marked them with long 2-inch by 4-inch wood stakes. They also recorded other sites located mainly in the southern section of the park. The more than 300 sites recorded ranged in age from Basketmaker III through Pueblo IV and were given Museum of Northern Arizona site numbers. The large ceramic collections from 280 of these sites were used by Reed to define pottery types and horizons for the park. Reed's work was published in the park overview

(Stewart 1980:192-221). Wendorf (1948) based his pottery horizons for early sites at Petrified Forest on Reed's work. In 1942, L. F. Keller, a park naturalist, and Gale mapped the locations of 74 sites north of the river; no report was written. Barrie M. Thornton (1977) recorded only two lithic sites during a survey of 100 ha (40 acres) near the stables on the west boundary in the southern end of the park. During a survey along the Mainline Road, Nancy S. Hammack (1979) recorded 74 sites. R. J. Martynec (1985) recorded 11 sites and produced an analysis of rock art styles as they relate to the interaction between prehistoric cultural groups. For the work reported here, A. T. Jones (1985, 1986) conducted several small surveys during the summers of 1985 and 1986 and recorded 87 sites, some of which had been recorded previously. Also in the summer of 1986, Tagg recorded the 33 sites discussed in Chapter 7 of this report.

Many other studies have been done in areas surrounding the park. W. W. Wasley (1960), George J. Gumerman (1969), Alan P. Olson (Gumerman and Olson 1968), and Alan Ferg (1978) completed survey and excavation projects prior to construction of Interstate 40. These studies, along with a synthesis by Gumerman and S. Alan Skinner (1968), established summaries of the culture history of the Puerco and Little Colorado river valleys. Currently, E. Charles Adams (1985) is conducting a large-scale survey and excavations in the Little Colorado River Valley as part of the Homol'ovi Project near Winslow. Gumerman and Sutton (1968, Gumerman 1969) documented occupations in the Hopi Buttes area. Major excavations at Whitewater and Kiatuthlanna (Roberts 1931, 1939 and 1940) and at White Mound Village (Gladwin 1945) helped formulate hypotheses on Anasazi occupation east and northeast of the park. In the Forestdale region to the south, Emil W. Haury (1940, 1985; Haury and Sayles 1947) excavated two early sites, the Bear and Bluff ruins, as well as Tla Kii Ruin (Forestdale Ruin) which dates to A. D. 900 to 1200. This work is pertinent to Petrified Forest archeology because the Forestdale series of Mogollon Brown Ware is considered to be synonymous with the Woodruff series found throughout the park (Breternitz 1966:104). Edward B. Danson (1957) surveyed the area south of St. Johns for the Peabody Museum. By far the most extensive projects were sponsored by the Field Museum of Natural History and directed by Paul S. Martin in the Pine

Lawn, Tularosa and Hay Hollow valleys (see Stewart [1980] for a complete list).

Research Topics

Management needs, as well as the results of prior archeological research, influenced the research topics to be addressed with the data from these projects. The archeological work for the projects under consideration was conducted in compliance with the National Historic Preservation Act, as amended in 1980, and through consultation with the Arizona State Historic Preservation Officer (SHPO). The boundaries of the survey areas were defined by management needs and project specifications. Also, the survey and site recording procedures for all but the water system survey were devised to accommodate the skills of volunteer crews. Because the excavation was for evaluation only, sample size and the size of excavation units were limited. Given these conditions, the analyses were planned to address the following research problems.

Culture History

The park is at the boundary of several archeological culture areas and contains archeological remains whose occupation dates do not correspond well to existing chronologies. Refinement of local chronologies and classifications has been possible with additional analyses of artifacts, features, and non-artifactual specimens such as radiocarbon samples. Accurate dating would allow an assessment of the role of each site in regional prehistory.

Economic Orientation

Few recent excavations have been done in the Petrified Forest, so palynological, floral, and faunal data are limited. Collections of macrofossils, fossil pollen and flotation samples from the preceramic site have helped to reconstruct the past environment and interpret human adaptation during that period. The nature of settlement away from the

river is largely unknown; whether sites represent the remains of dry farming, gathering, or hunting activities can be determined. From the survey data, studies of site size and differentiation give insight into changes in site use and location through time, as well as into site variability during a particular period.

Regional Interaction and Trade

Because boundaries are often intangible, determination of prehistoric cultural boundaries is difficult. In the past, this problem was addressed by studying the range of traits found in a given area or at a site. Studies were refined by using ethnographic analogy (in this case, among the Hopi and Zuni) and by referring to social anthropological studies regarding boundaries, cultural intermingling, and assimilation. The study of prehistoric trade goods, both imports and exports, is also important. Procurement and dispersal of the abundant petrified wood and the production of pottery from localized clay and temper sources are important topics. Data from small sites, isolated from the more densely populated drainages, are significant in refining the definitions of trade and interaction networks.

Technological Change

Although Mera (1934) and Wendorf (1953) noted unusually large lithic scatters and quarries in the park, intensive research into lithic technology has just begun. Further inquiry into patterns of stone procurement, processing, and use, and patterns of dispersal of raw materials and finished products are needed. Variability within and between assemblages and changes in lithic technology through time have been investigated. This aspect of the research is particularly important because of the growing number of recorded preceramic sites.

The above topics have been rather broadly outlined to serve as guidelines for the research. The research summary (Chapter 10) incorporates all data collected since 1978 and addresses specifically

the knowledge gained about culture history, economic orientation, technological change, and interaction and trade for the Petrified Forest National Park region.

Chapter 2

PREHISTORIC CULTURE HISTORY

The oldest of more than 500 prehistoric sites in the park dates to before 1000 B.C. The most recent site dates to as late as A.D. 1450. Historic Period occupation began with the influx of Navajos around A.D. 1550, just 10 years after the first visits into the northern Southwest by the Spanish. Other Euro-Americans arrived in the latter half of the 19th century.

A regional archeological overview (Plog 1981) of the middle and upper Little Colorado River valley places Petrified Forest in perspective to the surrounding area. Stewart (1980:62-120) presents an excellent and detailed review of the culture history of the park and surrounding areas. The brief outline below incorporates recent changes.

Because too few chronometric dates are available from sites at Petrified Forest, the standard Pecos Classification is used. Devised in 1927 by A. V. Kidder and his colleagues as a taxonomy of sequential stages, by the mid-1930s, dates had been assigned to each stage. At Petrified Forest, dating of sites is based on projectile point and architectural styles and on ceramic cross-dating. Differences with the standard dates used for the Pecos Classification (McGregor 1965:Fig. 11) point out what many archeologists have noted--that time-lags in development and cultural diffusion from one geographic area to another often occur. As used here, the periods of the classification are best viewed as developmental stages for which the dates may change with future work.

Paleo-Indian

The Paleo-Indians, known for their game hunting, created at least two types of sites in the Southwest between about 10,000 and 8,000 B.C. Both kill sites and campsites have been studied extensively in southeast Arizona (Haury, Antevs and Lance 1953; Haury, Sayles and Wasley 1959; Hemmings 1970). However, in northeast Arizona, finds have been limited to isolated artifacts or surface scatters. Near the park, these occur along the Puerco River (Danson 1961; Olson 1964a) and at Concho (Thomas

1952; Wendorf and Thomas 1951). Although no Paleo-Indian sites are known in the park, at least three projectile points diagnostic of this period have been found. Wendorf (1953:69-70) found a reworked Folsom point made of petrified wood in the backfill of a pithouse on Flattop Butte. Jones and Tagg (see Chapter 9) recorded a site with hundreds of small retouched flakes and five bifaces on the surface, including the base of a Folsom point broken in manufacture (prior to fluting). Two rock features appeared to be resting on the Pleistocene surface, but could not be unequivocally assigned to this period. They also found the base of a Cody point on a site dated to the Pueblo II/Pueblo III period (see Chapter 5).

Archaic

Hammack (1979) recorded six possible Archaic (6000 B.C. to A.D. 300) lithic scatters. No diagnostic points were found on the sites; however, several Jay-style projectile points (Irwin-Williams 1967:Fig. 7) found nearby may indicate more precise dates of 5500 to 4800 B.C. Based on my inspection, only one of Hammack's sites has distinct potential for dating to the preceramic period. In 1985, surveyors recorded two Archaic sites. Locus A of AZ K:13:59 featured a San Jose-style point (Irwin-Williams 1967:Fig. 7) made of fine-grained basalt and dating from the third millennium B.C. The numerous cores, retouched flakes and bifaces found on the site were made of the local petrified wood. In addition to lithics, sandstone slabs and hearths were noted. The second site was AZ K:13:60 (see Chapter 8). The Archaic sites are located on bluffs or ridges. Most are the remains of small hunting and plant-gathering camps, but evidence from testing at AZ K:13:60 suggests that agriculture had its beginnings by the end of this period.

Before 1978, Archaic period sites had not been recorded in the park. The low number of recorded early sites is the result of several factors--of low population during the Archaic Period and of sampling biases because earlier archeologists were preoccupied with ceramic sites.

Basketmaker II

Twenty-six sites are known from the Late Basketmaker II/Early Basketmaker III period (about A.D. 300 to 500). The sites are located primarily on mesa tops and on the edges of badlands scarps. Most have from 1 to 25 pithouses. Pithouses excavated at the Flattop Site (AZ Q:1:2) are small, shallow, slab-lined structures with no interior hearths, although dividing walls are known. Exterior slab-lined hearths were found. The sole pottery is the distinctive type, Adamana Brown, the only paddle-and-anvil pottery in this area. It is tempered with selenite that is available locally in veins in the Chinle formation. Recovered corncobs, manos, and metates indicate that domesticates were cultivated widely by this time.

Wendorf (1953:51-57) placed the Flattop Site in the Basketmaker II period on the basis of cross-dating with the Bluff Site (AZ P:16:20), which had been tree-ring dated to A.D. 300 (Haurly 1985:360-361). These dates should be re-examined; probably on the basis of architectural and ceramic attributes, the site is best dated to the Early Basketmaker III.

Basketmaker III

During the Basketmaker III period (about A.D. 500 to 800) architecture becomes more differentiated and formalized. Villages are composed of pithouses, deep proto-kivas, storerooms, and trash areas arranged in a crescent. Agricultural features are evident at the partially excavated site of Twin Butte. Sites are no longer located on mesa tops. Most of the 57 sites dating to this period are found closer to arable land, at the base of the bluffs, and on slopes. However, a few were recorded in the low-lying valleys. Ceramics are mixed and include brown, gray, and black-on-white wares. Petrified wood core hammerstones are common and diagnostic; however, chert cobbles were also used. Few tools, mostly scrapers and projectile points, were recorded during survey. Unretouched flakes seemed to have sufficed for various jobs. Shell artifacts are rare.

Pueblo I

Only one single component Pueblo I site (A.D. 800 to 950) has been recorded in the park (AZ Q:1:95). Five others (AZ Q:1:57, 64, 65, 86, 89) may be Pueblo I, but also have ceramics from the Basketmaker III and Pueblo II periods. AZ Q:1:81 has a Pueblo I component (Locus 5). N. Hammack (1979:44) recorded five sites from this period, but only four of those dates were substantiated by our research. The sites cluster on the first terrace north of the Puerco River and overlooking Dead Wash, and have eroded clusters of slab-lined features.

Why are there so few sites from this period? Euler and others (1979) maintain that environmental data for many of the drier areas, including nearby Hay Hollow Valley, show a major drought from A.D. 850 to 900. In a later work, the period between A.D. 750 and 1000 is designated a stress epoch (Dean, Euler, Gumerman, Plog, Hevly, and Karlstrom 1985). At that time, prehistoric inhabitants either moved closer to major drainages (like the Puerco River) or out of the area completely. At Petrified Forest, the people may have done both. There would have been a relatively low population. Sites that were in the flood plain may be buried or washed away. The few known sites that were occupied during the Pueblo I period occur on the terrace, an area that was inhabited for hundreds of years before and after the Pueblo I period, so the archeological record is unclear. Additional detailed surface and subsurface archeological work may be able to sort out the components.

Pueblo II

A total of 247 sites date to the Pueblo II period, between about A.D. 950 and 1100. These sites are located closer to major drainages than are those from previous periods. Pithouses and kivas are still present but are usually associated with small pueblos. There are shell artifacts on several sites. There is greater variety in the raw material of stone artifacts, including quartzite and basalt. Quartzite hammerstones are common. Pottery wares are still as variable as in previous periods. Many of these sites seem to have been inhabited through the Pueblo III period. Two Pueblo II sites have been excavated

in the park (Jones 1986). PEF0 Site 236, which has a small, coursed masonry structure and a Great Kiva, 18 m in diameter, was constructed at the end of this period (Jones 1986).

Pueblo III

In other areas, the Pueblo III period is usually characterized by centralization and aggregation. However, at Petrified Forest from about A.D. 1100 to 1300, 73 dispersed small and large pueblos with kivas are found. Agate House, NA 10,808, and AZ K:13:19 (ASM) are the only excavated sites from this period.

Gray wares, brown wares, and black-on-whites, as well as polychromes, are evident. Reed (1980:211-212) divided the period into early (Holbrook horizon) and late (Walnut horizon) phases based on pottery. The few flake tools observed from this period are made of basalt and petrified wood (Hammack 1979:49).

Pueblo IV

During the Pueblo IV period, about A.D. 1300 to 1450, most of the population in the Southwest was aggregating into large pueblos in relatively few areas, including Petrified Forest. Numerous small Pueblo IV sites, such as those found in the Homol'ovi area (Adams 1985; Lange, Young and Fratt 1986:15-16), are lacking at Petrified Forest. Five sites in the park, including NA 10,808 and Puerco Ruin, were occupied during the early part of this period. Puerco Ruin and PEF0 Site 171, have been excavated. Pottery is complex and resembles that found at the nearby population centers of Homol'ovi, Zuni, and Hopi (Stewart 1980).

Historic Period

The only documented ethnographic use of the park is one Navajo site near the Flattop Buttes that appears to date to around A.D. 1750 (Sudderth and others 1976). The lone sandstone slab structure has a long, narrow entryway and is associated with a possible cist, a rock

alignment and several bedrock mortars. Some of the corrals and rock art in the park also may evidence limited Navajo occupation.

The Little Colorado River Valley was colonized towards the end of the 19th century by small groups of Mormon farmers and ranchers. Before the park was fenced, several stock tanks with windmills provided water to livestock. Modern stock tanks and new windmills can be seen across the boundary fence from at least two of the abandoned tanks.

During the 1930s, the Civilian Conservation Corps constructed the Rainbow Forest Headquarters and residences, the Painted Desert Inn, the water line from the Puerco River to Rainbow Forest and many other park improvements that are still in use today. The sparse remains of their work camp near Puerco Ruin were noted during the 1986 fieldwork. Other historical sites and artifacts found throughout the park are concentrated along the Mainline Road and demonstrate heavy visitation to the park in the last 75 years.

Much of the data necessary to build a detailed culture history for the park is nonexistent or incomplete. The sequence described here may not seem to fit the classic Pecos Classification (Stewart 1980:117), possibly due to strong Mogollon influence from the southeast. A regional sequence, such as the one recently completed by Gumerman and Dean (1985) for the Kayenta Anasazi, needs to be developed.

Chapter 3

ENVIRONMENTAL SETTING

Present Environment

Petrified Forest National Park is part of the Colorado Plateaus, a series of elevated plains dissected by dry washes and canyons. At an average elevation of about 1,645 m (5,400 feet), the park is slightly lower than the surrounding terrain where the relief varies between 1,676 m (5,500 feet) and 1,830 m (6,000 feet) (Green and Sellers 1974:340).

The main drainage in the park is the Puerco River, which flows into the Little Colorado River at Holbrook, Arizona. The park is divided by the Puerco River into two sections (see Fig. 1.1). The southern section has small areas of badlands and is characterized by grassy plains and mesas dissected by washes. Most of the spectacular petrified wood deposits outcrop there. In the northern section, distinctive multicolored badlands, known as the Painted Desert, are eroding into the edges of broad rolling and grassy mesas.

Dead Wash and Nine Mile Wash drain into the Puerco River in the vicinity of Puerco Ruin. Dry Wash, another major tributary, flows through the park farther south. In the park, Puerco Ridge and the Flattops area constitute the divide in the park between the Puerco and Little Colorado river valleys. Jim Camp Wash drains directly into the Little Colorado about 8 km (5 mi) south of the park.

All streams in the park are intermittent, flowing only after heavy rains. No springs are flowing at present either. These occur most frequently at the contact between the base of a sandstone and the clay strata. Two springs, Zuni Well on Lithodendron Wash and Agate Bridge about 8.8 km (5.5 mi) south of the Puerco River, were active as recently as the 1940s (Wendorf 1953). The availability of water for domestic uses during prehistoric times is uncertain and is discussed further under the heading of Past Environments.

One of the characteristics of the Colorado Plateaus province is the horizontal aspect of the underlying sedimentary rock layers. The principal rock formation exposed in the park is the Petrified Forest

member of the Chinle formation. The rock unit is composed of reddish-brown to bluish mudstone, siltstone, and sandstone lenses deposited during Triassic times, about 200 million years ago. The undisturbed deposits are over 335 m (1,100 feet) thick, but differential erosion of the various layers accounts for the park's topography and exposure of the famous petrified wood beds. The harder sandstones cap the mesas and form cliffs; most of the rock art sites are located there. Erosion of softer mud- and siltstones produces the spectacular banded slopes and badlands capped with petrified trees, which were the sources of lithic raw material for thousands of years.

Many areas are covered by an uneven sand mantle with occasional "blowouts" and eroded gullies. Higher knolls appear to be stabilized dunes, interspersed with a sandy desert pavement of small chert cobbles resulting from deflation. The fossiliferous cobbles were redeposited from Permian age sediments and make up about 10 percent of the raw material for flaked stone tools (Jones 1983:Table 3). The alluvial soil found in the washes, which is similar to that encountered below the surface in the test excavations, is a very dense tan to medium brown silty clay. Wendorf (1953:13) found the alluvial soils derived from the Chinle formation to be alkaline clays, generally unsuitable for agriculture.

There are three plant communities in the park. On the basis of natural color aerial photographs and field inspection, vegetation has been classified into the computer-compatible Poulton system (Miller 1976). Much of the park has been designated as barren land, which supports less than 5 percent vegetative growth (Fig. 3.1). Major natural vegetation classes (as opposed to those altered by man) are (1) herbaceous, (2) shrub-scrub and (3) riparian or floodplain associations. The herbaceous community includes tall grass prairies, short grass prairies, desert grasslands, palouse grasslands, bunch grass, and steppe grasslands. Shrub-scrub includes halophytic (salt tolerant) communities dominated by saltbush, greasewood, and winterfat, and other communities dominated by sage, snakeweed, cliffrose, and other shrubs. Riparian or floodplain associations are characterized by cottonwoods and tamarisks



Figure 3.1. Badlands formation near the south end of Petrified Forest National Park.



Figure 3.2. View of Petrified Forest landscape; herbaceous vegetation class in foreground; riparian and floodplain vegetation along Dead Wash near horizon. View looking northeast.

or by small salt grasses (Fig. 3.2). Also included in the shrub-scrub association is an open Juniper woodland which occurs on volcanic mesa tops and rims around the Painted Desert. An occasional lone juniper was noted during these surveys. (Pinyon occurs along with juniper only on Chinde Mesa on the northern boundary of the park).

Numerous snakes, lizards and rabbits were seen during the fieldwork. Other small mammals such as coyotes, bobcats and skunks, and reptiles such as toads and salamanders are common (Stewart 1980:7). An occasional bear, mountain lion or deer is sighted by the park staff, but the most impressive and frequent large mammals are a small herd of pronghorn antelope that ranges south of the Puerco River.

The present climate at the park is windy and arid. The Mogollon Plateau to the south creates a rain shadow effect, so that annual precipitation is only 22 cm (8.64 inches). Most precipitation falls in July, August and September, and less than half falls as snow.

Temperatures are those of the high desert. Winter temperatures are normally between -7° and $+9^{\circ}$ C, with the subfreezing range reached infrequently. Summer temperatures have never exceeded 40° C (104° F) (Green and Sellers 1974:370) and usually vary from 15° C to 35° C.

The average length of the growing season is 180 days (Smith 1945), more than long enough for maize cultivation. However, incessant driving winds from the southeast in the spring may have been a problem for young seedings. As noted above, alluvial soils derived from the Chinle formation and the lack of surface water were not conducive to agriculture.

Past Environment

The suitability of the Petrified Forest region for agriculture was discussed above in terms of present-day environmental variables. There obviously are problems with assuming that the climate was similar during times of prehistoric occupation. The amount of precipitation and the rainfall patterns are known to be highly variable, causing subsequent changes in vegetation and soil deposition. The demise of springs at Agate Bridge and Zuni Well since the 1940s and the invasion of pinyon and juniper into former range grassland (Stewart 1980:6) are good

examples of modern environmental flux in the park. Stewart (1980:21) describes a chronology of climatic change from 500 B.C. to A.D. 1600 based on palynological data (Schoenwetter and Dittert 1968:46). More recent work by Dean and others (1985) employs archeological, geological and dendrochronological data as well. Stress epochs were characterized by low effective moisture or high temporal variability in effective moisture, depressed water tables and stream entrenchment. Major stress epochs (Dean and others 1985:542-544) correlate well with periods of low site density. For example, stress epochs occurred at (1) A.D. 200 to 375; (2) A.D. 750 to 900 (Pueblo I period); and (3) A.D. 1275 to 1475. Only the sites in the park date earlier than the first epoch, and the park was virtually abandoned after the third epoch. The stress epoch from A.D. 750 to 900 may account for the apparent hiatus in the use of many multicomponent sites that have Late Basketmaker III and Pueblo II/Pueblo III components, but no apparent Pueblo I occupation. Both Stewart (1980:118) and Dean and others (1985:547) suggest that during this dry period the people relocated nearer to large drainages, such as Dead Wash, Dry Wash or the Puerco River.

In summary, during the times that Anasazi sites were occupied, roughly between A.D. 950 and 1300, effective moisture seems to have been substantially higher than today. Springs found at the base of the sandstone outcrops, such as at Agate Bridge, probably were flowing in sufficient volume for domestic uses, and surface water probably was adequate for agriculture. Examination of site features and artifacts in the following chapters helps define the changing land-use patterns and social structures of the local inhabitants.

Chapter 4

SURVEY METHODS

The field methods for the surveys conducted in 1985 and 1986 were essentially the same although crew size varied. The Rainbow Forest Developed Area and Water System surveys were completed by WACC crews. At the Rainbow Forest, Marty Tagg was accompanied by Susan Crawford from July 9 to 13, 1985 (7 person-days). A total of 4 sites was recorded in an area of 581 acres (72 acres/person-day). In 1986, Marty Tagg conducted the Water System Project from July 8 to 17 with the help of Krista Deal, Lynne D'Ascenzo and Trinkle Jones, and from October 28 to November 11, with the help of Susan Wells. In a total of 35 person-days, 33 sites were recorded in 1,200 acres (35 acres/person-day).

On July 18 and 19, 1985, one crew surveyed the environs of PEFO Site 236. Directed by Trinkle Jones, the survey covered 430 acres and resulted in the recording (by two crews) of six sites. The crews included Crew Chief Marty Tagg and Assistant Crew Chief Susan Crawford, as well as volunteers Jack and Pat McCreery, Jim and Kitty Stoddart, Sandy McCreery, Bob Cooper, Don Christensen, and Frank and A. J. Bock. A total of 24 person-days (18 acres/person-day) was used. Volunteers had one day of classroom orientation that covered project logistics and goals and summarized previous research, park prehistory, and the rudiments of artifact identification. Survey and recording methods were explained in the field.

From July 20 to August 7, 1985, and from June 24 to July 3, 1986, Jones conducted survey of 63.2 km of the park boundary fence. A total of 76 sites were recorded. The first year, Crew Chief Marty Tagg and Assistant Crew Chief Susan Crawford assisted Jones during the two 10-day sessions with different volunteer crews. Volunteers Jack and Pat McCreery, Jim and Kitty Stoddart, Sandy McCreery, Bob Cooper, and Don Christensen worked the first session. Volunteers Jack and Pat McCreery, Jim and Kitty Stoddart, Sandy McCreery, Merry Austin, Paul Hughes, and Dewey Garner worked the second. Park staff Jim Ireland, Denise Dumuchel, Pam Obernesser and Karen Finley occasionally helped. On most days, each of two crews of five (minimum) covered a corridor 400 m

(0.25 mile) wide along 1.6 km (1 mile) of fence line, recording sites concurrently. Two to five sites were located daily by each crew. Three sites per crew were the maximum number that could be recorded in one day. A total of 123 person-days (WACC-42; ARARA-68; park staff-13) was used. Forty-three sites were recorded in a total area of 3280 acres (5.12 square miles) for an average of 26.7 acres/person-day.

During the 1986 Boundary Survey, 30.2 km (18.75 miles) were completed. The one-day orientation for the session also included a flint-knapping demonstration and explanation by Tagg. Directed by Jones, Crew Chief Marty Tagg and Assistant Crew Chiefs Krista Deal and Lynne D'Ascenzo were assisted by ARARA volunteers Pat and Jack McCreery, Kitty and Jim Stoddart, Bob Cooper, and Don Christensen, Holbrook school teachers Ferrell Knight and Mary Brace, as well as park resident Vicki Collup. Occasionally, park staff Caroline and Ed Gastellum, Bill Collup, and Jim Ireland helped. Each of the two crews (minimum of four people on each) averaged 1.8 km (1.1 miles) of fence line and recorded as many as four sites daily. A total of 114 person-days (WACC-36; ARARA-53; park staff-11; local volunteers-14) was used. Thirty-three sites were recorded in a total area of 3000 acres (4.7 square miles) for an average of 26.3 acres per person-day.

The areas were completely covered on foot in transects that paralleled the boundary fence line or features such as roads and washes. Flagging tape was used to mark the edges of transects, to ensure that no terrain was overlooked. Because vegetation was low and sparse, we assumed that a crew member could clearly see site features and artifact concentrations at a distance of about 8 m. The survey interval of 14 to 25 m between surveyors varied and was based on the numbers of crew members each day. In occasional areas of dense shrubbery and along rock outcrops where rock art was likely, crews halted for more intensive scrutiny.

The archeological remains at Petrified Forest were recorded as either sites or isolated finds. Sites were defined as those areas with definite features, such as rubble mounds, hearths or slab-lined features, or more than about 75 artifacts. Isolated finds most often isolated individual artifacts, but could be clusters of up to

75 artifacts. Isolated features such as small, amorphous slab spall clusters (without artifacts) were recorded as isolated finds.

These seem rather broad definitions. However, during the first weeks of survey in 1985 it was noted that isolated artifacts and small clusters of artifacts were ubiquitous throughout the park. Extensive erosional channels in many areas of the park, such as along the numerous badlands scarps, had displaced artifacts as much as 400 m downslope from the original proveniences on sites. Individually recording each artifact or cluster would have been time-consuming. Thus, isolated artifacts, other than projectile points, were not individually recorded or plotted, but instead were noted in survey logs.

At the other extreme, vast areas of the park are characterized by petrified wood outcrops surrounded by hundreds of thousands of flakes and much debitage. Three lithic quarries have been recorded: Jasper Forest and Crystal Forest by Hammack (1979) and Giant Logs by Jones (1985, and Tagg, Wells and Deal this volume). Site areas correspond more or less to the geologic units containing petrified wood and have few diagnostic artifacts. Survey methods need to be devised for this type of site as a class. Thus, no further recording of quarries, other than marking the boundaries of high density areas on field maps, was attempted.

In general, sites were recorded by the entire crew at the time of discovery. Field site numbers included the project number as a prefix and were assigned consecutively within each project. The WACC project number consists of three parts: the park acronym, the year the fieldwork was begun, and a letter unique to each project (in this case, PEF0 85B, PEF0 86A or PEF0 86B). Within each project, isolated finds (sometimes called isolated artifacts in the field) were numbered consecutively, but the prefixes included a designation of IA- or IF-, e.g. PEF0 85B-IA-1.

With one exception, sites were plotted on USGS 7.5' quadrangle maps using triangulation, where possible, to ensure accuracy. In 1985, the USGS 7.5' Adamana quadrangle was not available; thus sites PEF0 85B-47 through 51 were plotted in the field on the USGS 15' Petrified Forest, Arizona map.

Site boundaries reflect areas of relatively low artifact densities. However, because erosion is extensive in the park, the boundaries do not encompass every artifact. Had boundaries been established by marking the most remote artifacts, erosional patterns, rather than activity areas, would have been recorded.

After locating site boundaries, features and higher density core areas were defined and numbered. A pace-and-compass map was made using the site stake (3/8-inch rebar stake with stamped aluminum tag appended) as a datum and showing the locations of features, ground stone and collected artifacts, rough topographic features and disturbed areas. Previously placed site stakes were also plotted. Black-and-white photographs and color slides were taken of features and of the general location to aid in relocating each site.

Procedures for assessing the artifact assemblage of each site evolved during these projects. The primary goals were to place each site chronologically, to discern relative artifact densities (useful for management as well as research purposes), and to describe major classes of artifacts (useful for defining site types and functions). A balance must always be found between on-site and laboratory analysis, because field time is relatively expensive. In this respect, the volunteers were especially valuable. Larger crews could spend more time analyzing artifacts in the field. Their sharp eyes missed little, so at the beginning of the first year of the boundary survey, the total number of artifacts on each site was counted. However, on large sites, counting the total assemblage was so time-consuming for the small return of information, that estimates for ceramics and flaked stone classes were used after several weeks. At that time, the crews began to inventory one or two 1 square meter units in order to obtain a rough measure of the maximum artifact density. These "density units" were placed nonrandomly, where artifact density seemed highest. The second year, a minimum of two units were nonrandomly placed in two different parts of each site to produce a more representative sample, one that showed variation in density within the site.

Collection strategies varied little between individual surveys. Because no ground-disturbing projects were planned, large surface collections were not needed. We collected only artifacts diagnostic of

site chronology, such as projectile points and ceramics with distinct designs or unusual ceramics needing lab identification. Shell artifacts and other ornaments also were collected. The provenience of each was plotted on the sketch maps.

Because field methods did vary slightly between surveys, researchers may wish to consult the original field notes for specific projects. Journals, as well as original and final site forms, maps, photographs and artifacts are curated at the Western Archeological and Conservation Center. Abbreviated site forms and map plots also can be inspected at the Arizona State Museum (University of Arizona, Tucson).

Chapter 5

ARTIFACT ANALYSIS AND DATING

Ceramic Analysis

by

Anne Trinkle Jones

For these projects, all sherds were analyzed by the author with consultation on unusual sherds with other ceramic experts. Methods of collection are described in Chapter 4. Plain ware, red ware and black-on-white sherds were analyzed separately, using different analytical schemes, all of which relied heavily on the Southwestern Ceramic System (Colton 1965). The taxonomy is based on the type-variety concept (Colton and Hargrave 1937; and Wheat, Gifford and Wasley 1958), and organizes ceramic variability with standardized observations and procedures. The system has been criticized in recent years (Dulaney and Swarthout 1978; Reid 1984 and Washburn 1984). While the classification process obviously is not foolproof, I feel it is a good alternative to time consuming, computer intensive, multivariate analyses and to expensive sourcing analysis. The procedure is a statistical proposition; while a certain number of individual sherds will probably be misclassified, archeologists seem to agree on the great majority of definitions. Along with Doyel (1984), Windes (1984) and Sullivan (1984b), I believe that the structure of the system is viable as long as specific definitions and descriptions are updated following new technological, stylistic and distributional studies. General trends in ware and design styles are defined reliably. Use of this typology is expected to make the current analysis comparable to others done in the region through the decades.

During analysis, no attempt was made to piece together any of the sherds, although some obviously matched. After washing the sherds in water, a fresh break made on each was examined for paste and temper characteristics with a 14-power hand lens.

In addition to sorting the sherds by type and ware, sherds were classified by vessel form. These included jars, bowls, ladle fragments, handles and unidentifiable. In most cases, decorated sherds were easily

classified; the painted decoration was assumed to be on the interior in bowls and on the exterior on jars. Determination of the vessel form of utility sherds was more difficult. Whether corrugated or not, sherds which were well polished or smoothed on the interior were labeled bowl sherds; those which were rough or exhibited wiping striations were labeled jar sherds. This information is available on the analysis forms archived at the Western Archeological and Conservation Center.

Plain Ware

The few plain ware sherds that were collected for lab analysis were sorted on the basis of temper, core color and surface treatment. Tusayan Gray Ware sherds were easily distinguished by the white-to-light gray paste and pure quartz sand temper. The local Basketmaker III Lino Gray type is surprisingly white in core and surface colors; Reed (1980:198) recommended the variety be labeled Lino White. We have reverted back to the standard type name. Little Colorado Gray Ware was more variable. The sherds have dark gray-to-muddy gray-brown paste and tempers ranging from pure sherd, to mixed sand and sherd, to an almost complete lack of temper. Both wares are considered intrusive, although a variety of Little Colorado Gray Ware may have been locally made (Reinhard 1979:61).

The remainder of the sherds were not given type names, but were separated on the basis of paste color and surface treatment. Colors ranged from gray to gray/brown to brown. In addition to plain scraped pottery, surface manipulation created differences in coiling and indenting and produced four main corrugated types:

1. Plain Corrugated, which had clapboard coils with no indentations;
2. Indented Corrugated, which had finger indentations on each coil;
3. Zoned Corrugated, which had alternating bands of unindented and indented coils;
4. Patterned Indented Corrugated, characterized by areas of indentation and nonindentation on each coil to form

patterns, usually triangular or polygonal in shape, over the entire vessel (Crown 1981); and

5. Obliterated Corrugated, characterized by the rough smoothing of either plain or indented corrugated sherds.

Several other forms of surface manipulation were noted. A few sherds were incised corrugated, produced by scoring several coils, perpendicular to their length, with a pointed tool. This treatment is analogous to Honani Tooled in Tusayan Gray Ware. The percentage of smudged sherds was recorded at each site. This was identified not only by the presence of blackening, which may result from other causes besides smudging, but also by the presence of polishing marks.

As with the Tusayan and Little Colorado River gray wares, other plain types were consistent with those described for other projects in the region (Crown 1981; Doyel 1980; and Martin and Rinaldo 1960). The sherds were typical of those described in previous research in the park (Mera 1934:10; Reed 1980:194-198; Reinhard 1979). Gray ware sherds have light gray to very dark gray paste with occasional carbon streaks; temper is coarse and variable, usually a high proportion of quartz sand or crushed sherd with varying amounts of crushed rock; surface finish is usually poor with wiping and smoothing striations visible. Most of the brown ware sherds were similarly finished, and the temper was as variable, the major difference occurring in the paste color which ranged from light or pinkish brown to tan to a dark gray-brown. Except in color, those brown sherds resembled Little Colorado Gray Ware in all other attributes, and were subsumed by Reed (1980:196) under the name of Holbrook Corrugated.

A few of the brown sherds fit the general description of Mogollon Brown Ware sherds. The plain sherds, with fine sand temper and smooth, light brown or reddish tan surfaces, resembled those described as Woodruff Brown or Woodruff Smudged (Mera 1934:6-7), and synonymous with Forestdale Plain or Forestdale Smudged (Breternitz 1966:104; Wendorf 1953:115). The latter probably includes two types defined by Haury, those of Alma Plain: Forestdale Variety and of Forestdale Plain (Wendorf 1953). The plain corrugated is similar to Reserve Plain Corrugated and

the indented corrugated is similar to Reserve Indented Corrugated (Rinaldo and Bluhm 1956:155-161).

Decorated Ware

Methods of analysis, references and thereby the author's biases, and results (Table 5.1) are discussed below. For the purposes of dating using such small ceramic samples, exact counts of each type are unimportant; these are on record at WACC. However, sample size is indicated, so the precision of the analysis may be judged.

Black-on-red Sherds

Collected red ware sherds that were stylistically and technologically similar to White Mountain Red Wares were found on 38 sites. These were sorted on the basis of paint combinations and design styles (Carlson 1970). Showlow Black-on-red was nearly as abundant; it was collected from 28 sites. Showlow Black-on-red, a fine textured gray to reddish pottery with a mixed temper of fairly fine quartz sand and fine angular fragments, is decorated with a thin, sometimes powdery, red slip and dull black paint in broad-line and geometric designs (Colton and Hargrave 1937:79; Haury 1931:27). The bowls may be corrugated on the exteriors. Mera (1934:7) considered the Showlow types descendants of Woodruff Brown. Whether this is the case or not, they should be included in Mogollon Brown Ware (Museum of Northern Arizona 1964). Several other types were found in small quantities. Pinto Polychrome, a Late Pueblo III development from Showlow Black-on-red (MNA 1964), was found at AZ Q:1:97 and 106A. Tuwiuca Orange Wares (Colton 1956), including Homol'ovi Black-on-red, were found at AZ K:13:53, Q:1:118 and 141. Kintiel Black-on-orange, a Tsegi Orange Ware (Colton 1956), also was found at AZ Q:1:118. (The Kintiel does not show on Table 5.1; it was originally placed with unidentified sherds.) Jeddito Yellow Wares (Colton 1956) were found at AZ K:13:10 and Q:1:94.

Table 5.1

DIAGNOSTIC CERAMIC TYPES FOR WACC PROJECT NOS. PEFO 85B, 86A, AND 86B

CERAMIC TYPE	ASM Site Number AZ K:13: _____																						
	10	11	12	15	17	43	44	45	46	47	49	50	51	52	53	54	55	56	57	59	60	61	62
TUSAYAN WHITE/GRAY WARE				x		x								x								x	
Lino B/G																							
Kana-a B/W																							
Black Mesa B/W									x										x				
Sosi B/W	x	x				x						x					x						
Flagstaff B/W																							
Dogoszhi B/W																							
Shato B/W																							
LITTLE COLORADO WHITE WARE						x	x		x			x	x										
St. Joseph B/W																							
Holbrook A B/W	x			x				x				x											
Holbrook B B/W	x		x	x	x	x	x	x			x		x		x		x	x	x		x	x	
Padre B/W						x																	
Walnut B/W	x			x	x				x			x	x		x			x		x			
Chevelon B/W																			x				
CIBOLA WHITE WARE Design Style	x			x				x	x	x				x									
Lino																							
White Mound	x						x																
Kana-a																	x						
Kiatuthlanna									x														
Red Mesa		x				x				x													
Black Mesa																							
Snowflake				x			x																
Puerco:Escavada		x		x				x							x	x							
Puerco:Puerco	x	x		x		x							x				x		x	x			x
Reserve (Wingate)	x	x							x														x
Tularosa				x	x	x														x			
Walnut																							
Dogoszhi						x			x			x			x								
WHITE MOUNTAIN RED WARE					x		x	x											x				
Puerco B/R	x						x											x					
Wingate B/R					x																		
Wingate Polychrome					x																		
St. Johns Polychrome					x																		
St. Johns B/R					x																	x	
Springerville Polychrome																							
Pinedale B/R																							
Pinedale Polychrome																							
OTHER RED/ORANGE/YELLOW WARES																							
Showlow B/R (includes Corrugated)	x			x				x	x		x		x		x								
Pinto Polychrome																							
TUWIUCA ORANGE WARE (Unidentified)																x							
Hono'ovi B/R																							
JEDDITO YELLOW WARE (Unidentified)	x																						
Jeddito B/Y																							
SAMPLE SIZE	23	14	3	30	13	16	14	18	17	9	4	8	9	6	21	1	7	7	11	4	3	7	2

Table 5.1 (continued)

AZ K:13:_____		AZ Q:1:_____																						
CERAMIC TYPE	63	28	56	57	60	61	63	64	65	79	80	81						83	84	85	86	87	88	89
	A	B	C	D	E	F																		
TUSAYAN WHITE/GRAY WARE			x		x	x	x			x					x									
Lino B/G						x																x		
Kana-a B/W				x	x			x	x			x			x				x			x		
Black Mesa B/W								x				x		x					x					
Sosi B/W					x							x		x						x				
Flagstaff B/W																								
Dogoszhi B/W																								
Shato B/W																	x							
LITTLE COLORADO WHITE WARE			x															x		x	x			
St. Joseph B/W			x																					
Holbrook A B/W	x	x										x			x									
Holbrook B B/W	x	x	x		x							x					x			x	x			
Padre B/W																								
Walnut B/W																								
Chevelon B/W												x												
CIBOLA WHITE WARE Design Style			x		x						x			x	x									
Lino																x								
White Mound					x			x														x		
Kana-a			x		x																			
Kiatuthlanna								x				x		x		x			x					
Red Mesa									x				x		x	x								
Black Mesa																								
Snowflake		x															x		x					
Puerco:Escavada						x						x						x	x			x		
Puerco:Puerco								x			x	x	x		x	x		x		x				
Reserve (Wingate)										x			x		x	x	x							
Tularosa																								
Walnut																								
Dogoszhi										x		x	x	x	x		x							
WHITE MOUNTAIN RED WARE					x																			
Puerco B/R																								
Wingate B/R	x																							
Wingate Polychrome																								
St. Johns Polychrome																								
St. Johns B/R																								
Springerville Polychrome																								
Pinedale B/R																								
Pinedale Polychrome																								
OTHER RED/ORANGE/YELLOW WARES																								
Showlow B/R (includes Corrugated)	x											x					x					x		
Pinto Polychrome																								
TUWIUCA ORANGE WARE (Unidentified)																								
Homol'ovi B/R																								
JEDITO YELLOW WARE (Unidentified)																								
Jedito B/Y																								
SAMPLE SIZE	8	5	10	3	25	6	3	9	5	10	2	29	6	11	3	7	15	11	3	4	9	4	8	3

Table 5.1 (continued)

CERAMIC TYPE	AZ Q:1:—																			
	90	91	92	93	94	95	96	97	98	99	102	104	105	106A	106B	107	108	109	110	111
TUSAYAN WHITE/GRAY WARE				x		x														
Lino B/G																				
Kana-a B/W					x	x														
Black Mesa B/W	x				x				x											
Sosi B/W					x															
Flagstaff B/W		x																		
Dogoszhi B/W					x															
Shato B/W					x															
LITTLE COLORADO WHITE WARE	x							x												x
St. Joseph B/W																				
Holbrook A B/W	x	x																		x
Holbrook B B/W			x		x															x
Padre B/W																			x	
Walnut B/W			x																x	
Chevelon B/W																				x
CIBOLA WHITE WARE Design Style					x		x				x									x
Lino																				x
White Mound					x	x								x						
Kana-a																				
Kiatuthlanna	x			x	x	x														
Red Mesa	x																			
Black Mesa														x				x		x
Snowflake		x						x	x	x		x	x		x					
Puerco:Escavada												x	x					x	x	x
Puerco:Puerco								x		x		x	x							
Reserve (Wingate)		x			x					x			x		x	x		x	x	x
Tularosa											x			x			x		x	
Walnut														x					x	
Dogoszhi	x				x									x		x				
WHITE MOUNTAIN RED WARE							x			x										x
Puerco B/R														x						x
Wingate B/R		x																		
Wingate Polychrome																				
St. Johns Polychrome								x		x								x		
St. Johns B/R			x					x	x											
Springerville Polychrome																			x	
Pinedale B/R																				
Pinedale Polychrome																				
OTHER RED/ORANGE/YELLOW WARES																				
Showlow B/R (includes Corrugated)		x		x							x							x	x	
Pinto Polychrome								x						x						
TUWUICA ORANGE WARE (Unidentified)																				
Homol'ovi B/R																				
JEDDITO YELLOW WARE (Unidentified)																				
Jeddito B/Y					x															
SAMPLE SIZE	12	7	4	6	27	7	6	9	3	9	3	5	8	8	3	1	3	10	24	36

Table 5.1 (continued)

	AZ Q:1:_____																129			
CERAMIC TYPE	113	114	115	116	117	118	120	121A	121B	122	123	125	126	127	128	A	C	D	130	
TUJAYAN WHITE/GRAY WARE												x								
Lino B/G																				
Kana-a B/W																				
Black Mesa B/W																				
Sosi B/W																x				
Flagstaff B/W																				
Dogoszhi B/W						x														
Shato B/W																				
LITTLE COLORADO WHITE WARE					x			x												
St. Joseph B/W																				
Holbrook A B/W	x			x																
Holbrook B B/W	x																	x		
Padre B/W											x									
Walnut B/W					x										x	x				
Chevelon B/W									x											
CIBOLA WHITE WARE Design Style			x																	
Lino																				
White Mound		x																		
Kana-a																				
Kiatuthlanna																		x		
Red Mesa				x																
Black Mesa							x				x									
Snowflake			x	x	x	x				x	x			x	x	x			x	
Puerco:Escavada			x												x		x			
Puerco:Puerco	x	x	x	x		x	x	x		x	x				x	x	x	x	x	
Reserve (Wingate)				x	x		x			x			x		x	x		x		
Tularosa						x					x				x					
Walnut											x									
Dogoszhi				x	x		x	x		x	x				x					
WHITE MOUNTAIN RED WARE						x														
Puerco B/R						x										x				
Wingate B/R	x		x								x				x				x	
Wingate Polychrome																				
St. Johns Polychrome						x					x				x				x	
St. Johns B/R						x					x				x				x	
Springerville Polychrome																				
Pinedale B/R																				
Pinedale Polychrome																				
OTHER RED/ORANGE/YELLOW WARES																				
Showlow B/R (includes Corrugated)			x		x		x	x		x				x	x					
Pinto Polychrome																				
TUWICUA ORANGE WARE (Unidentified)																				
Homol'ovi B/R						x														
JEDDITO YELLOW WARE (Unidentified)																				
Jeddito B/Y																				
SAMPLE SIZE	6	2	11	8	8	11	6	9	1	7	23	6	1	2	28	10	2	6	5	

Table 5.1 (continued)

CERAMIC TYPE	AZ Q:1:—																AZ Q:2:		
	131	132	133A	133B	134	135	136	137	140	141	143	144	146	147	148	149	24	26	27
TUSAYAN WHITE/GRAY WARE	x											x	x						
Lino B/G															x				
Kana-a B/W															x	x			
Black Mesa B/W														x					
Sosi B/W								x				x					x		
Flagstaff B/W																			
Dogoszhi B/W																x			
Shato B/W																			
LITTLE COLORADO WHITE WARE																			
St. Joseph B/W																			
Holbrook A B/W												x		x					x
Holbrook B B/W		x	x										x		x		x		
Padre B/W																			
Walnut B/W		x				x		x		x	x		x						x
Chevelon B/W																			
CIBOLA WHITE WARE Design Style				x						x									
Lino																			
White Mound																			
Kana-a												x			x				
Kiatuthlanna								x											
Red Mesa																			
Black Mesa													x						x
Snowflake	x	x		x	x		x				x								x
Puerco:Escavada								x					x				x		x
Puerco:Puerco		x					x	x	x		x	x	x			x	x		
Reserve (Wingate)		x		x	x		x	x	x				x						
Tularosa	x	x		x		x		x			x								
Walnut																			
Dogoszhi		x														x			x
WHITE MOUNTAIN RED WARE		x		x	x								x						
Puerco B/R		x																	
Wingate B/R						x													x
Wingate Polychrome		x				x		x			x								
St. Johns Polychrome		x									x								
St. Johns B/W																			
Springerville Polychrome																			
Pinedale B/R																			
Pinedale Polychrome										x									
OTHER RED/ORANGE/YELLOW WARES																			
Showlow B/R (includes Corrugated)		x						x					x						x
Pinto Polychrome																			
TUWIUCA ORANGE WARE (Unidentified)										x									
Homol'ovi B/R																			
JEDDITO YELLOW WARE (Unidentified)																			
Jeddito B/Y																			
SAMPLE SIZE	3	24	2	11	7	14	5	13	4	4	13	6	19	3	9	5	11	3	14

Table 5.1 (continued)

CEFAMIC TYPE	AZ Q:2:—				
	28	29	30	32	33
TUSAYAN WHITE/GRAY WARE					
Lino B/G					
Kana-a B/W					
Black Mesa B/W		x			
Sosi B/W					x
Flagstaff B/W					
Dogoszhi B/W					
Shato B/W					
LITTLE COLORADO WHITE WARE					
St. Joseph B/W					
Holbrook A B/W					x
Holbrook B B/W		x			
Padre B/W					
Walnut B/W					x
Chevelon B/W					
CIBOLA WHITE WARE Design Style					x
Lino					
White Mound					
Kana-a					
Kiatuthlanna		x			
Red Mesa				x	
Black Mesa					
Snowflake	x	x		x	
Puerco:Escavada					x
Puerco:Puerco	x				x
Reserve (Wingate)		x		x	x
Tularosa					
Walnut					
Dogoszhi		x	x		
WHITE MOUNTAIN RED WARE					x
Puerco B/R		x			x
Wingate B/R	x				x
Wingate Polychrome					
St. Johns Polychrome					
St. Johns B/W					
Springerville Polychrome					
Pinedale B/R					
Pinedale Polychrome					
OTHER RED/ORANGE/YELLOW WARES					
Showlow B/R (includes Corrugated)		x			x
Pinto Polychrome					
TUWUICA ORANGE WARE (Unidentified)					
Homol'ovi B/R					
JEDDITO YELLOW WARE (Unidentified)					
Jeddito B/Y					
SAMPLE SIZE	4	14	3	5	22

Black-on-white Sherds

Analysis of the black-on-white ceramics was not so straightforward. If possible, unpainted sherds that were well smoothed and had a definite slip were placed in a ware on the basis of paste color, texture and temper. These probably represent the base or body sherds of jars. Tusayan White Ware sherds exhibited pure quartz sand temper in a light gray-to-white fine-textured paste (Colton and Hargrave 1937:203-204). These were collected from 34 percent of the sites. Little Colorado River White Ware sherds, collected from 47 percent of the sites, had crushed white sherd, sand and occasionally crushed rock temper in a dark gray-to-muddy gray-brown, fine-to-medium textured paste (Colton 1955). Cibola White Ware, collected from 72 percent of the sites, had varying amounts and proportions of sherd, quartz and crushed rock temper in a light or dark colored paste (Colton 1965). This definition obviously is not as clearcut, and some of the unidentifiable white ware sherds may actually belong to this category.

Sherds with painted decoration were sorted first by paint type. Both Tusayan and Little Colorado white wares normally had carbon paints, although a few of the sherds had a mixed carbon/mineral paint. Secondary attributes of temper and paste color were as described above for the unpainted white ware sherds. Sherds fitting those descriptions were then placed into types defined by Colton (1955).

Sherds with mineral paints or carbon/mineral paints generally fit descriptions for the Puerco/Chaco or White Mountain Series of Cibola White Wares (Colton 1941, 1965; Mera 1935). However, because of the complexities of the traditional type definitions and the difficulty of assigning series and type names (Dulaney and Swarthout 1978; Sullivan 1984b), further analysis concentrated on defining design styles. With the exception of two additions, Sullivan's (1984a:Fig. 5.2) design style taxonomy was used as illustrated. The hierarchical taxonomy is based on line width, design layout, element execution and line elaboration, which are used to define 11 styles (Sullivan 1984a:79-82). All but two (White Mound and Kiatuthlanna styles) had been previously defined in other works.

Several small changes were made to clarify the sorting and further refine the taxonomy. Since the collections consist entirely of smaller

sherds, the design layout variable was not useful in differentiating styles. However, two other variables, quality of hatching and types of elements, were added. The Sosi style, as defined by Sullivan (1984a:81), was divided into two styles on the basis of the type of elements present. The mineral paint version of the classic Sosi (Sosi B in Colton's [1955] terminology), where interlocking barbed elements predominate in a bold, broad line design, was termed the Puerco Style: Escavada Variety (Crown 1981:238). The Snowflake style was used to label designs characterized by bold, broad line elements and interlocking rectilinear scrolls, where stepped edges, rather than the barbed edges of the Sosi style, predominate (Crown 1981:238; Colton 1955). There is much disagreement over the validity of the Snowflake style, which was designated by Longacre (1964) but was not well described. In this study, the style is used to help differentiate between the Snowflake and the Puerco: Escavada styles.

The Sullivan taxonomy does not include design styles which developed during late Pueblo times. The type of element, stepped or barbed, and the quality of hatching were used to discriminate between the Reserve (called Wingate by Sullivan [1984a] and defined by Carlson [1970]) and Tularosa styles (after Crown 1981:238). The Reserve style is characterized by interlocking solid and diagonally hatched elements where the hatched element is larger, by a predominance of barbed edges on the elements, by frets and scrolls (Crown 1981:234). Tularosa style is also characterized by interlocking solid and hatched elements but the hatched element is the same size or slightly smaller. Stepped elements, as in scrolls and terraces, are abundant and generally smaller and more repetitious than in the Reserve Style.

Ceramic Dating

Ceramic cross-dating was used to date the sites. The dates (Breternitz 1966) are based largely on tree-ring dates from the Flagstaff area and include specimens from a number of multicomponent sites (thereby extending the length of proposed dates for the individual types). However, they are the best available for the Petrified Forest area. The range of accuracy is between 100 and 200 years.

In all cases, dates for traded pottery types (Breternitz 1966:67) were used, since it is uncertain which of the pottery was locally made. Because the collection from each site was small and non-random, it was not feasible to weight the dates on the basis of sherd count of any one type.

Recent work done in the upper Little Colorado is pertinent as well. That the use of corrugated wares began after about A.D. 950 is generally accepted. Thereafter, the proportions of plain sherds decreased. Doyel (1980:176) analyzed ceramics from three sequentially occupied Pueblo II sites, one of which was tree-ring dated to the first half of the 1100s. Proportions of plain gray ware sherds within the utility assemblage decreased from 43 percent to 16 percent around A.D. 1150.

Percentages of plain versus corrugated wares, as well as the architectural and projectile point styles from each site, were considered before assigning each site to a Pecos Classification stage (refer to Tables 6.1, 6.2 and 7.2). Use of the Pecos Classification, as opposed to chronological dates, does not connote greater dating precision than could be derived from such small diagnostic collections.

Lithic Analysis

by

Martyn D. Tagg

Stone artifacts were noted at all of the recorded sites. These consisted mainly of flaked stone, but also included ground stone and other worked stone, such as jewelry. In most cases these artifacts were not collected and are discussed in the site descriptions. The collections consisted of ornaments as well as temporally diagnostic artifacts such as projectile points. A total of 58 stone artifacts were collected from the various projects described in this report.

Flaked Stone

Flaked stone artifacts were most common, (n = 49) including projectile points, bifaces, scrapers, and drills. Artifact type, material type, dimensions (or maximum dimension if fragmentary), and

condition (complete, or if fragmentary--the types of damage) were recorded.

Projectile Points

Projectile points are small triangular or lanceolate bifaces that show some specialization for hafting, such as stems or notches (Rozen 1981:191). They represent the only temporally diagnostic stone artifact collected, with 24 recovered from 17 sites.

The projectile points were identified with the help of Ken Rozen, Arizona State Museum. The earliest point recovered was the base of a Folsom point, which belonged to the Paleo-Indian Tradition (ca. 10,000-8000 B.C.). This point is described in more detail in Chapter 9.

A base fragment of a Cody point was found on a rubble mound at AZ Q:1:129, a PII/PIII site. The point has a parallel-sided stem with a flat base that was ground, and very slight shoulders, marking the juncture with the blade (Fig. 5.1a). It is made of petrified wood and has a diagonal break across the blade just above the shoulders. The point is well-thinned and uniformly flaked. It is 0.6 cm thick and 3.2 cm in maximum dimension. It seems likely that this point once had a blade four or five times longer than its base. Points of this style are associated with the Southern Cody Complex as described by Judge (1973) which belonged to the Plains-based Paleo-Indian tradition of big game hunters. The Cody culture is considered late Paleo-Indian, dating around 6600 to 6000 B.C. (Irwin-Williams 1973:4). Similar points are described by Irwin-Williams (1973:4, Fig. 7) from the Arroyo Cuervo region of northwestern New Mexico and the complex is well represented in the Middle Rio Grande Valley (Tainter and Gillio 1980:29). Schreiber and Sullivan (1984:28-29, 55-57, Fig. 4.2g-i and 5.2f) recovered Cody-style points from two preceramic sites on Voight Mesa, northeast of Springerville, Arizona. Wendorf and Thomas (1951:109, Fig. 48b-f) also describe similar points collected from various contexts near Concho, Arizona.

Two points with parallel-sided stems, basal notches, and pronounced shoulders marking the juncture of the stem with blade (Fig. 5.1b-c) were identified as Pinto points. Both points have shallowly serrated blades, are made of cobble chert and have uniform-sized and regularly-spaced

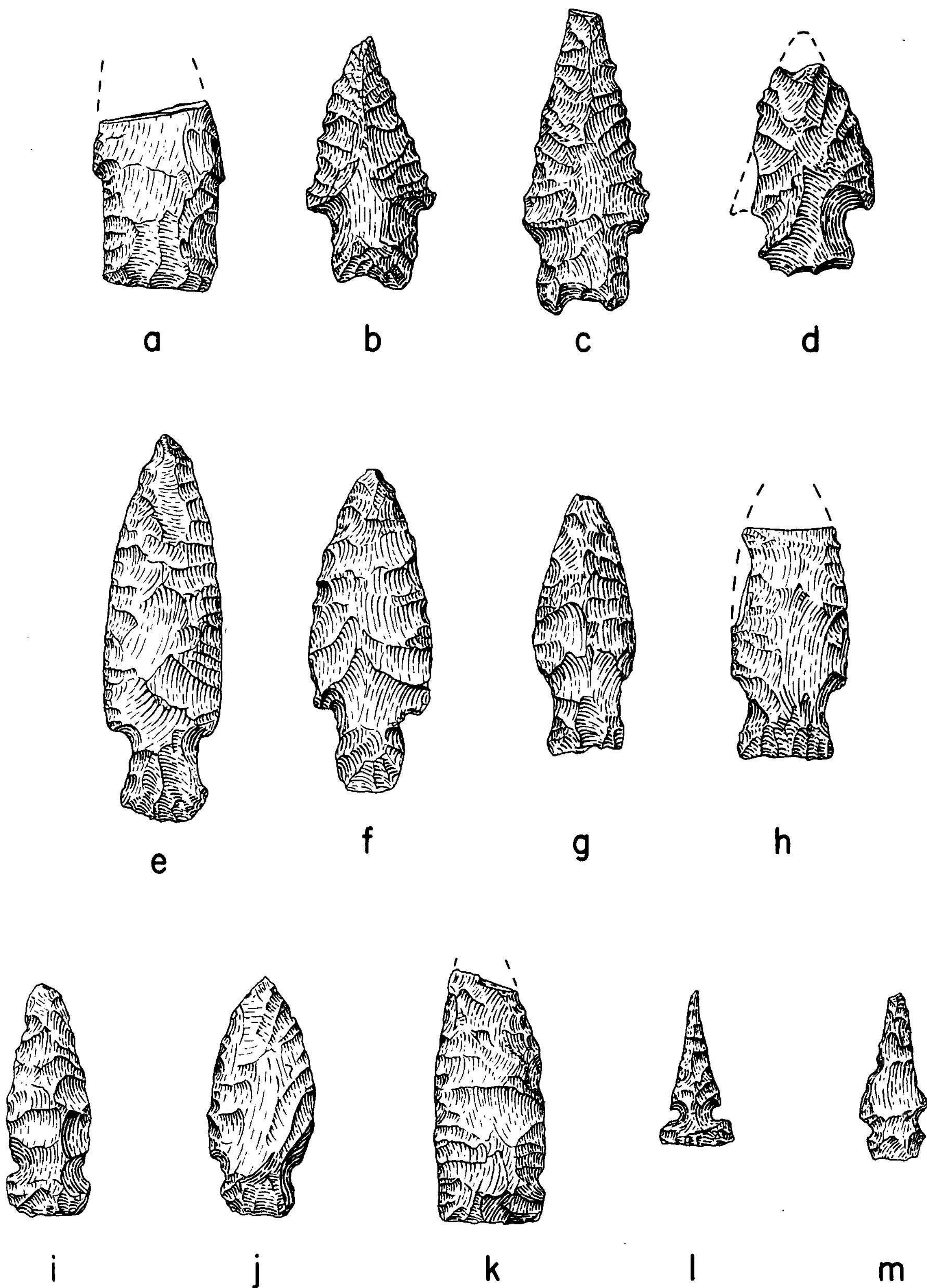


Figure 5.1. Projectile points. (a) Paleo-Indian Cody point; (b-c) Middle Archaic Pinto points; (d) Late Archaic San Pedro Point; (e-j) Basketmaker points; (l-m) Pueblo II and Pueblo III points. Length of (e) is 6.1 cm.

flake scars. One of the points was recovered from AZ Q:2:29, a Late PI through PIII site. It is 4.2 cm long, 2.1 cm wide, 0.6 cm thick, and has a very slightly damaged tip. The second point is from AZ K:13:48, a Basketmaker II site. The point is 5 cm long, 2.1 cm wide, and 0.5 cm thick, and also has a slightly damaged tip. Points of this style were originally described by Campbell and Campbell (1935) from the Pinto Basin site in southern California, and are considered diagnostic of the middle Archaic period in Arizona (ca. 500-1500 B.C.) (Huckell 1984:192-196). This type of point has been described by Wendorf and Thomas (1951:109-110, Fig. 49a-h) as belonging to the Concho Complex, a preceramic sequence identified in northeastern Arizona. Rozen (1981:191, Fig. 69g-k) also described similar "Type 2" points from St. Johns. Irwin-Williams (1973:Fig. 4a-f) attributes this style of point, with serrated blades and well-defined shoulders, to the San Jose Complex of the Oshara Tradition (ca. 3000-2000 B.C.).

A single side-notched point with a slightly convex base and triangular blade was identified as a San Pedro Point (Fig. 5.1d). The well-flaked obsidian specimen has a damaged tip and is missing one tang; the point has a maximum dimension of 3.4 cm and is 0.6 cm wide. The point was recovered from AZ K:13:49, a Late Pueblo II/Early Pueblo III site. In southern Arizona, this point style has been called San Pedro and is characteristic of the Late Archaic period (1500 B.C. to A.D. 1) (Sayles and Antevs 1941). In northeastern Arizona, similar points are described by Wendorf and Thomas (1951:111, Fig. 50), Martin and Rinaldo (1960:28, Fig. 10e), Rozen (1981:191-194, Fig. 69a-f), Chapman (1977:402-403), and Bradford (1980:98, Fig. 48o). Wendorf and Thomas, Chapman, and Bradford associated this point style to the preceramic Basketmaker period, and both Chapman and Bradford suggest that the style persisted into ceramic period times. Irwin-Williams (1973:Fig. 5d and Fig. 6d) associates this point style with the Late Archaic Armijo phase, and the later En Medio phase which includes Basketmaker II (1800 to 800 B.C., and 800 B.C. to A.D. 400, respectively).

Three different styles of side-notched dart points have been identified as Basketmaker points. The first style, represented by three specimens, consists of long, lanceolate-shaped points with slight shoulders, shallow side-notches, and long stems with a convex base (Fig.

5.1e-f). The three points all vary slightly in form, but appear to represent the same style. One of the points was recovered below the Flattop Site (AZ Q:1:2), a Basketmaker II site excavated by Wendorf (1953). The point is made of petrified wood and is 6.1 cm long, 2 cm wide, and 0.5 cm thick (Fig. 5.1e). It has an expanded base and long, straight side notches. The second point came from AZ Q:2:32, a Pueblo II/Pueblo III site. It is made of chert and is 5.3 cm by 2 cm by 0.4 cm. It varies just slightly from the previously described point with a much less expanded base (Fig. 5.1f). The final point of this style came from AZ Q:1:125, a Basketmaker II site. It is made of cobble chert and is 5.4 cm long, 1.9 cm wide, and 0.7 cm thick. It has very shallow side notches, and is missing most of the base.

The second style of Basketmaker point varies slightly from the first style, with expanded stems and concave bases (Fig. 5.1g-h). Two points of this style were recovered. One of the points was recovered from AZ Q:2:32, a Pueblo II/Pueblo III site. The point is made of petrified wood and is 4.3 cm long, 1.7 cm wide, and 0.4 cm thick (Fig. 5.1g). The margins of the blade have been ground flat down to the shoulders, indicating that the point was reused as a tool other than a projectile. The second point came from AZ Q:1:81, a Late Pueblo I/Pueblo III site. The point is made of petrified wood. It is missing its tip and has damage along one margin of the blade. Ken Rozen suggested that the margin damage may have been done intentionally, with a blow to the broken surface of the tip, to make a burin break to isolate a projection and create a tool other than a projectile. This reworking would have been done while the broken point was still hafted to the shaft.

The third style of Basketmaker point is represented by three side-notched specimens. The points are smaller than the previous two styles, and have shorter and more expanded bases (Fig. 5.1i-j). The first point is made of basalt and is 4 cm long, 1.8 cm wide, and 0.4 cm thick (Fig. 5.1j). It is lanceolate-shaped. The point was found on AZ K:13:59, a possible Archaic site. The second point was recovered from AZ Q:1:81, a Late Pueblo I/Pueblo III site. It is made of petrified wood and is 3.8 cm long, 1.4 cm wide, and 0.4 cm thick (Fig. 5.1i). Its base is wider than the blade, although the margins of the blade have

been ground flat from use as another tool type. The final point is a chert isolated find. It was recovered near AZ K:13:60, a Late Archaic site (see Chapter 9). The point has a small portion of its tip and base damaged. It is 3.3 cm long, 1.5 cm wide, and 0.5 cm thick.

Points similar to the three styles of Basketmaker points have been described by Wendorf and Thomas (1951:111, Fig. 50) and Wendorf (1953:139-140, Fig. 84). In both cases the points are associated with the Basketmaker period. As illustrated, the points are variable in size and shape, but the general morphology is the same. Wendorf (1953:140) suggests that the major difference between Basketmaker II and Basketmaker III sites may be point size, with larger points on Basketmaker II sites and smaller ones on Basketmaker III sites.

The final two identifiable points have been identified as Pueblo period points. They are small, side-notched, triangular specimens. One was recovered from AZ K:13:53, a Pueblo II/Early Pueblo III site. It is made of chert and is 2.6 cm long, 1.2 cm wide, and 0.3 cm thick. The point has a convex base, which is the widest part of the artifact (Fig. 5.11). The second point came from AZ Q:1:133, a late Pueblo II/Pueblo III site with a possible Basketmaker III component. It is made of chalcedony and is 2.8 cm long, 1.3 cm wide, and 0.3 cm thick. The point has damage to both margins, and the ends of the base appear to be broken (Fig. 5.1m). Although the shoulders are the widest part of the specimen, when complete this point was probably very similar to the point from AZ K:13:53. Points similar to those recovered at Petrified Forest are described by Martin and Rinaldo (1960:263, Fig. 143a-c, f) from Table Rock Pueblo near St. Johns which was dated to around A.D. 1350 (Pueblo III/Pueblo IV). Reid (1982:224-233, Figs. A.1.5a, e, Fig. A.1.8b, Fig. A.1.9g-l, Fig. A.1.12h) illustrates similar points from the Q Ranch region near Cibecue, Arizona, that were from Pueblo III and Pueblo IV sites. It seems likely from the context of the two points recovered at Petrified Forest National Park, that they date in the Pueblo II/Pueblo III periods.

Four point bases were recovered that could not be temporally placed with certainty and may represent point preforms. All are made of petrified wood. They are triangular-shaped with no modifications for hafting. One was recovered from AZ Q:1:125, a Basketmaker II site. It

is a well-made piece with a flat base (Fig. 5.1k). It has a broken tip and has a maximum dimension of 4.2 cm. The second artifact is from AZ Q:1:81, a Late Pueblo I/Pueblo III site. It is similar to the previously described artifact, but has a more rounded base. It also is missing its tip, and has a maximum dimension of 3.7 cm. The third artifact is a complete specimen from AZ Q:1:133, a Late Pueblo II/Pueblo III site. It is 2.2 cm long, 1.2 cm wide, and 0.3 cm thick and is damaged at one corner of the base. The fourth preform was recovered from AZ Q:1:60, a Basketmaker III site also occupied in the late Pueblo II and early Pueblo III periods. The preform is triangular-shaped with a rounded base. It is 3.5 cm long, 1.7 cm wide, and 0.8 cm thick. It is well-flaked but may have been too thick to complete, although it is still usable as a bifacial tool. These artifacts may represent point preforms rather than finished tools--the presence of pressure flaking in their production separates them from bifaces. The specimen from AZ Q:1:125 is undoubtedly Basketmaker II, since that site has only one component. The specimen from AZ Q:1:133 is probably from the pueblo period due to its small size.

Two point fragments were recovered. A chert midsection came from AZ Q:1:103, a possible Archaic site. The fragment is from a dart-sized projectile point, and is probably Archaic or Basketmaker. The second fragment was found at AZ Q:2:30, a late Pueblo II/Pueblo III site. The tip fragment is made of petrified wood, and was probably broken during manufacture as indicated by the diagonal break. It came from a dart-sized point and is probably preceramic.

The final four artifacts have been classified as projectile points due to their shapes, but are in reality no more than worked flakes. A small triangular piece was recovered from AZ K:13:44, a late Pueblo II/Pueblo III site. It is made of petrified wood and is 1.7 cm long, 1 cm wide, and 0.3 cm thick. It appears to be a flake fragment that has been unifacially flaked to produce a triangular "point" with a concave base. It is probably in context at the Pueblo II/Pueblo III site. A second pressure-flaked piece came from AZ Q:1:133, a late Pueblo II/Pueblo III site. It is a petrified wood flake fragment that has been bifacially flaked into a triangular form. The flake scars are concentrated along the margins, and do not carry into the body of the

piece. One corner notch has been formed. The artifact is 2.9 cm long, 1.5 cm wide, and 0.3 cm thick. It is probably in context on the pueblo period site from which it came. The third specimen was recovered at AZ Q:1:91, a late Pueblo II/Pueblo III site. It is a petrified wood proximal flake that was unifacially flaked to create the point shape--it is side-notched with an expanded base. The specimen has a damaged margin and tip. It is 2.6 cm long, 1.5 cm wide, and 0.3 cm thick. It probably represents a pueblo period arrow point. The final piece came from AZ Q:1:29, recorded by Hammack (1979) during the mainline road site. The site was an aceramic site identified as a probable Late Archaic due to this point, which was identified as San Jose style. A later field check of the site by the author suggested it was no more than one of the many undatable petrified wood scatters found throughout the park. The "point" is a petrified wood proximal flake fragment with unifacial microflaking along both margins to produce a triangular shape. It has been corner-notched, and the base is missing. It appears to be the result of child's play or practice rather than an attempt to make a usable point.

Bifaces

Bifaces were the next most common flaked stone artifact type collected, with 17 recovered. Bifaces are described as pieces exhibiting continuous bifacial retouch along 50 percent or more of their edges, with no evidence of pressure flaking or no formal specialization for hafting (Rozen 1981:195). Two types were defined by Rozen (1981), small and large bifaces.

Of the nine small bifaces recovered, only two were complete and seven were fragmentary. These bifaces ranged from refined pieces with relatively regular flaking and regular edges ($n = 6$), to those that were relatively wide with large, irregular flake scars and irregular edges ($n = 3$). Rozen (1981:195) describes this variability as a probable reflection of different stages in biface manufacture, and the cruder types are often called preforms, or unfinished tools (Tagg and Huckell 1984:85). The two complete specimens and one fragment could both be termed preforms--both are relatively well-flaked, but are fat with irregular edges. They are made of petrified wood, including one of the

black variety. The latter specimen is lanceolate-shaped and is 4.9 cm long, 1.7 cm wide, and 1 cm thick. The second specimen is oval-shaped, 3.9 cm long, 3.1 cm wide, and 1.8 cm thick. The final preform is a cobble chert base fragment with a rounded base similar to a contracting stemmed projectile point. It has a maximum dimension of 3.3 cm. This specimen and the completed black petrified wood artifact were recovered from AZ K:13:59, a possible Archaic site. The other complete preform came from AZ Q:2:30, a Late Pueblo II/Early Pueblo III site.

The remaining, better made small bifaces are all fragmentary, including three tips and three bases. The tips have been worked to a point and the bases are round or square--the pieces were probably triangular or oval when complete. Four fragments are made of petrified wood with one each of cobble chert and basalt. They range in maximum dimension from 3.4 cm to 4.4 cm. All of the fragments have straight or diagonal breaks across their midsection, indicative of breakage from end shock during manufacture. These artifacts were probably discarded prior to use. Three of the bifaces were recovered from two possible Archaic sites (AZ K:13:39 and AZ Q:1:103); one was recovered from AZ Q:1:129, and two were isolated artifacts.

The biface base recovered from AZ Q:1:129 was an extremely well-made specimen and deserves special mention. The obvious skill of manufacture of the artifact is similar to that of the Late Paleo-Indian Cody point recovered from the same site, and Ken Rozen suggested that it could be the base of a Cody knife, an artifact diagnostic of the Southern Cody complex. The petrified wood specimen has a diagonal break across its midsection, and was probably broken during manufacture. The piece has a square base, and has evenly spaced and uniform sized flake scars. It has a maximum dimension of 3.7 cm and is 0.3 cm thick.

The eight large bifaces include one complete piece and seven fragments. As with small bifaces, they ranged from crude preforms ($n = 2$) to more refined pieces ($n = 6$). The one complete artifact is a preform, made on a large black petrified wood flake that still retains its striking platform and bulb of percussion. The preform is roughly oval-shaped, and is 8.2 cm long, 4.9 cm wide, and 2 cm thick. The remaining preform is a base fragment made of an unidentifiable igneous rock. A diagonal fracture runs across the center of the piece. It has

a maximum dimension of 6.9 cm. Both preforms were isolated artifacts, recovered near petrified wood outcrops.

All of the well flaked large bifaces are fragmentary, including four bases and two tips. One base is square, two are round, and one is oval. All of the fragments have breaks that indicate end shock during manufacture. Breaks are generally across the center of the piece, but two bases were broken very near the bottom, and little remains. The pieces were made of petrified wood ($n = 5$), and chalcedony ($n = 1$), and range in maximum dimension from 5.6 cm to 8.2 cm. Four of the fragments came from possible Archaic sites (three from AZ Q:1:103 and one from AZ K:13:59), two were isolated artifacts, and one came from AZ K:13:46, a Pueblo II/early Pueblo III site.

Scrapers

Two scrapers were collected, one complete and one fragmentary specimen. The complete scraper was manufactured on a cobble chert flake. It measures 4.9 cm by 3.7 cm by 0.8 cm and is an end scraper, with flakes removed from the exterior surface. It also has been flaked on the interior surface along a noncontiguous edge to the working edge, technically making it a bifacial implement. The scraper fragment is well-flaked along about 50 percent of its remaining edge. It was made on a piece of chalcedony, and has a maximum dimension of 6.1 cm. It is too incomplete to identify as to type. The scrapers were recovered from two possible Archaic sites, AZ Q:1:103 and K:13:59.

Drills

Two drill fragments, a base and a tip, were collected. The chert base fragment has a slightly expanded, rounded base, which angles slightly into the bifacially worked tip. The tip is truncated just above the base. The fragment has a maximum dimension of 2.4 cm. It was recovered from AZ K:13:61, a late Pueblo II/Pueblo III site. The second fragment is a well-worked tip. The chert piece is bifacial and 3.6 cm long. It was recovered from AZ Q:1:79, a late Pueblo II/early Pueblo III site.

Flakes

Four unusual flakes that were recorded together as an isolated feature (IF) were collected. The flakes are of clear glass and are probably off of a bottle base or insulator. A mold line is visible just below the striking platform on the exterior surface of three of the pieces. Each piece is teardrop-shaped, 4.1 cm long, 3.1 cm wide, and 1.1 cm thick. The flakes are unique in that they are almost identical in size and shape; they are so similar that they appear to have been made from a mold. Whoever created these flakes historically had a fine sense of knapping. There was no evidence remaining to indicate the purpose behind the artifacts.

Discussion

The analysis of flaked stone recovered during the various projects at Petrified Forest National Park has helped to illustrate the utilization of tools made of locally available petrified wood and cobble chert by the prehistoric inhabitants of the area. The occurrence of one projectile point made of obsidian would indicate use of materials obtained nonlocally. The nearest source for obsidian is near Flagstaff, 190 km to the west.

Of special interest in this section are the projectile points, since they represent temporally diagnostic artifacts. They reveal a long utilization of the area, ranging from the Late Paleo-Indian period (ca. 6000 B.C.) to Pueblo II/Pueblo III times (ca. A.D. 1300). Only the Early Archaic Period (ca. 7500 to 5000 B.C.) is not represented. Many of these points were found on later sites and were undoubtedly curated. This includes the Pinto points, the San Pedro point, and four Basketmaker points, three of which have been reworked or used for other tasks. The Late Paleo-Indian point was also found out of context on a later site, along with what has been identified as a Cody knife fragment. The fragmentary nature of both of these artifacts would make them unlikely items for curation because their small size would make them impossible to rework. This might suggest a Paleo-Indian occupation of AZ Q:1:129, covered over by the later Pueblo II/Pueblo III occupation. The fact that both the point and knife were made of petrified wood suggests that they were made in the vicinity, and along

with Folsom points recovered from the Flattop Site (Wendorf 1953) and AZ K:13:60 (Chapter 9, this report), indicate Paleo-Indian use of the region.

Many of the points were found in context, including the remainder of the Basketmaker points and the Pueblo period points. Two predominately aceramic sites, AZ K:13:59 and AZ Q:1:103, were identified as possibly Archaic. The flaked stone assemblage indicates that this is probably the case. Both sites yielded a number of bifaces and scrapers, and each had one point. The point from AZ K:13:59 is either a Late Archaic or Basketmaker style and would suggest a late preceramic date for the site. The Late Archaic site, AZ K:13:60, is just upslope from this site. Only a point midsection came from AZ Q:1:103, but from the size of the fragment, it was undoubtedly Archaic, and probably Late Archaic according to Ken Rozen.

Ground Stone

Ground stone artifacts were noted at many of the recorded sites. These consisted mainly of utilitarian objects such as metates or manos that were used for food production. These artifacts were noted and not collected.

One class of ground stone that was not collected deserves special mention. A number of sandstone rings were noted on or nearby sites dating to the Basketmaker II and Basketmaker III periods. Percussion chipping was used to shape the edges of the local light gray-brown fine-grained sandstone. There are two classes: (1) large discs of tabular sandstone with biconical perforations chipped into the center, and (2) smaller doughnut-shaped sandstone rings. Often the edges of the discs were ground smooth after the rough shaping, and in several cases, natural irregularities on the faces of the slabs were also ground, so that the raised areas were somewhat polished. One complete disc and many semicircular fragments were found east of the Basketmaker site, AZ Q:1:114. The complete specimen was 96 cm in diameter with a biconical perforation 33 cm in diameter in the center. The slab was only 3.1 cm thick, and had been chipped to shape but was not ground. When the

underlying sandy deposits eroded away, the slab had broken into five sections. Most often only sections of these discs are discovered.

The same is the case with the stone rings. However, the edges and the faces of relatively thick slabs or of nontabular sandstone blocks were chipped and pecked to shape. A fragment found at AZ Q:1:114 was 3.5 cm thick, and although incomplete, was probably only about 12 cm in diameter. There was a biconical perforation about 4 cm in diameter in the center. DiPeso, Rinaldo and Fenner (1974:219) list a number of references for both types of stone rings used as ventilator openings, hatchway frames, niches and passageways in prehistoric sites in east central Arizona and western New Mexico. For example, one of the large discs was found in situ in a kiva at Guardian Pueblo in northeastern Arizona (Jennings 1978:Fig. 110).

A light gray-brown fine-grained sandstone bowl found in the remains of a pithouse at AZ Q:1:114 (see the inset of Fig. 6.8) had been shaped in the same way as the stone rings. The oval bowl was 24 cm by 18 cm with an overall thickness of 12 cm. An oval basin 12 cm long by 5 cm deep was pecked and ground into the center. The specimen was not collected. Stone bowls were found at the Basketmaker Flattop and Twin Butte sites at Petrified Forest (Wendorf 1953:62-63, 137). They are common on Hohokam sites (Haury 1976:289-290) and on numerous other sites throughout the Southwest (DiPeso and others 1974:219).

Only unusual utilitarian ground stone artifacts, and all nonutilitarian stone artifacts such as jewelry, were collected for further analysis. This consisted of nine artifacts.

The only two utilitarian pieces of ground stone that were collected include a full grooved maul and hoe. The maul was recovered from AZ Q:1:94, a Basketmaker III/early Pueblo III site. The maul is made of sandstone. It is cylindrical in shape with a broader, flat end tapering down to a more pointed, rounded end. A shallow, 2.4 cm wide groove has been pecked around the center of the artifacts. The maul is 26 cm long, 8.8 cm wide, and 7 cm wide. One side is flat, and exhibits evidence of pecking; the opposite side is too exfoliated and weathered to determine its original shape.

The hoe blade was recovered from AZ K:13:11, a Pueblo II/Pueblo III site. It is a tabular piece of fine-grained sandstone that has been

worked into shape. The working edge of the tool is slightly convex, and has been ground to a point. This is the widest part of the artifact at 6.8 cm. The remaining three edges have been pecked and ground to shape and still exhibit battered and spalled margins. Both sides exhibit striations, and have been ground smooth. From the blade edge, the piece tapers back to a squared end that is 4.3 cm wide. This gives the hoe a shape similar to a modern axe head. The tool is 14.8 cm long and 1.1 cm thick.

Seven nonutilitarian ground stone artifacts were collected, including three pieces of jewelry, a bird effigy, a piece of incised slate, and two shaped pieces of sandstone. Three beads or pendants were recovered from three sites. A petrified wood bead came from AZ Q:1:123, a late Pueblo II/early Pueblo III site. The round specimen is 1.1 cm in diameter and 0.4 cm thick and has a suspension hole drilled in the center of the piece (Fig. 5.2d). Two pendants were recovered, one each from AZ Q:1:113 and AZ Q:1:123, both late Pueblo II/early Pueblo III sites. Both pendants are made of a soft, white siltstone. The pendant from AZ Q:1:113 is round, 1.6 cm in diameter and 0.3 cm thick, and has a suspension hole drilled 0.3 cm from one edge of the piece (see Fig. 5.2c). Striations from grinding are still visible on both sides and the margins. The second pendant is a fragment from what was probably a subrectangular or trapezoidal-shaped piece. The piece has a suspension hole drilled 0.3 cm from its top edge, and has a diagonal break across its midsection (Fig. 5.2e). Striations from manufacture are still visible on both faces and margin.

A complete bird effigy was found at PEF0 Site 21, a Pueblo II/Pueblo III site. The effigy is made of green claystone. It is roughly triangular-shaped with a groove around one tip to create the head (Fig. 5.2b). The base and top of the effigy are flat, and there are many other flat facets on the sides and front of the artifact. The effigy is relatively crude and has several small gouges taken out of it. Manufacturing striations are visible on all surfaces of the artifact.

Two shaped sandstone "balls" were recovered, one from AZ Q:2:25, a Basketmaker II site, and one from AZ Q:2:28, a late Pueblo II/Pueblo III site. These artifacts are cylindrical with flat ends. The artifact from AZ Q:2:25 has slightly convex sides and ends. It is 6 cm long and

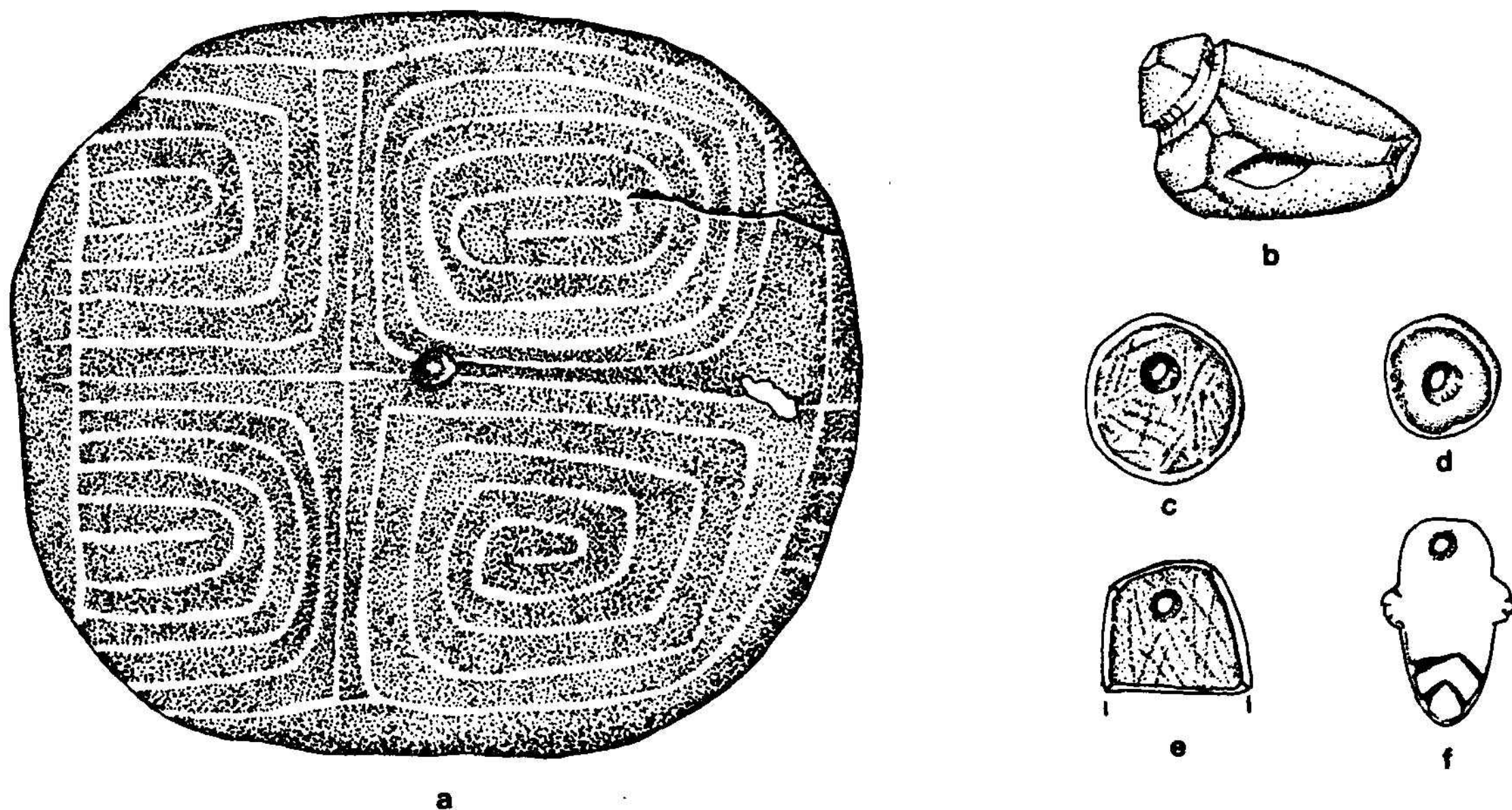


Figure 5.2 Ground stone and shell artifacts. (a) Incised slate object; (b) stone figurine; (c-e) stone beads and pendants; (f) shell pendant. Length of e is 8.4 cm.

5.7 cm wide. The artifact from AZ Q:2:25 has flat ends and flatter sides than the other specimen. It is 5.5 cm long and 4.5 cm wide, and has several spalls out of the sides and one end. One spherical sandstone ball, about 4 cm in diameter, was found on AZ Q:1:114, a Basketmaker II site, but was not collected. Wendorf (1953:62; Fig. 30) illustrates similar artifacts from the Flattop Site, which are called stone balls. Their use is unknown.

The final stone artifact, and by far the most unusual specimen recovered, was an incised slate object from AZ Q:1:123, a late Pueblo II/Pueblo III site. The tabular piece of slate-like material has had its margins ground to give it a rectangular shape with rounded corners (Fig. 5.2a). One face is heavily striated from grinding, and the other face has an incised design. A concavity has been drilled in the center,

and two lines have been incised, offcenter, to divide the design into four panels. The design area is bordered on all four sides by another incised line. The two larger panels have elongated, curvilinear scroll designs. One of the scrolls tie in to the border line, and its outer line is cut by the drilled center hole. The second scroll has more squared corners and does not tie into the border line. The remaining two panels are smaller than the first two, and contain a design with concentric U's anchored to the base line. The artifact is 8.4 cm long, 7.1 cm wide, and 0.7 cm thick. No artifacts similar to this one could be found in the literature, and its function is unknown.

Shell Analysis

by

Martyn D. Tagg

Three shell artifacts were collected from three separate sites. The shell was identified by Lisa Huckell, Arizona State Museum. Two fragments of Glycymeris sp. were recovered, one from AZ K:13:57, a late Pueblo II/early Pueblo III site, and one from AZ Q:1:56, a Basketmaker III/Pueblo II site. Both pieces are from the side margin of the valve, and were so extensively shaped by grinding that they could not be identified beyond the genus. The artifact from AZ K:13:57 is from a narrow-banded bracelet (0.5 cm in width), while the piece from AZ Q:1:56 is larger and wider (1.1 cm in width). Glycymeris is a marine shell with species found along the California coast and in the Gulf of California (Sea of Cortez) (Vokes 1985:91); however Lisa Huckell indicated that the fragment from AZ Q:1:56 may be G. gigantea or G. immaculata which are from the gulf only. Glycymeris bracelets and fragments are common to prehistoric sites throughout the Southwest. Doyel and Debowski (1980:341-347, Fig. 157) identified many fragments from the sites in the nearby Dead Valley, near Springerville.

The third shell artifact is a complete ornament from AZ Q:1:81, a late Pueblo I/Pueblo III site. It is a medial piece of Laevicardium elatum that has been shaped into what appears to be a zoomorphic form. The artifact is oval-shaped with one round end, and the other end curving to more of a point (Fig. 5.2f). A suspension hole has been

drilled in the rounded end, and two chevron-shaped designs have been incised in the pointed end. Two small protrusions are present on both sides of the artifact about a third of the way down from the rounded end. Each has been incised with three or four lines. The artifact is 2 cm long, 1.3 cm wide, and 0.2 cm thick. Laevicardium elatum is a marine shell common in waters of the Gulf of California and along the Pacific coast. This shell type was commonly made into zoomorphic figures and circular pendants (see Doyel and Debowski 1980:342, 347, Fig. 157a) (Urban 1978:301).

Chapter 6

RESULTS OF THE BOUNDARY AND RAINBOW FOREST SURVEYS

Site Types

A total of 87 sites was located in 1985 and 1986 in a variety of environmental situations throughout the park (Figs. 6.1-6.3). On the basis of the morphological characteristics of the sites, eight site types were defined, including a single masonry room, two or more masonry rooms, pithouse/slab features, artifact scatters, rockshelter, rock art, agricultural site, and historical site (Tables 6.1-6.2). All features, including structures or rubble mounds, trash or rock concentrations, rock art panels and extramural hearths or storage cists, were labeled numerically. Occasionally sites consisted of more than one set of features or artifact concentrations that were spatially discrete. These discrete areas were individually mapped and described and labeled alphabetically (or occasionally numerically) as loci.

The greatest problem encountered in the field was differentiating between the sites with structural remains. Because of significant erosion and both alluvial and eolian deposition at Petrified Forest, it was difficult to discern the type of construction or to accurately determine room count. Structures are usually mounded or covered with dunes. Rarely were wall outlines or alignments visible, and it was difficult to determine the number of room blocks or total rooms. For this reason, the large class "masonry rooms (2+)" was not subdivided. Room counts were estimated only as a rough indicator of structure size and to allow later examination of the possible functional differences, such as those described throughout Southwest literature, between sites and structures.

Structures were constructed of chunks and blocks of petrified wood, of a very crumbly light brown to reddish-brown sandstone, or of a combination of the two. The sandstone, obtained locally from the Petrified Forest member of the Chinle formation, was occasionally shaped into blocks, but occurs most often in relatively thin, naturally weathered and rounded slabs. The degree of weathering often makes it difficult to discern whether the rocks were intentionally shaped. With

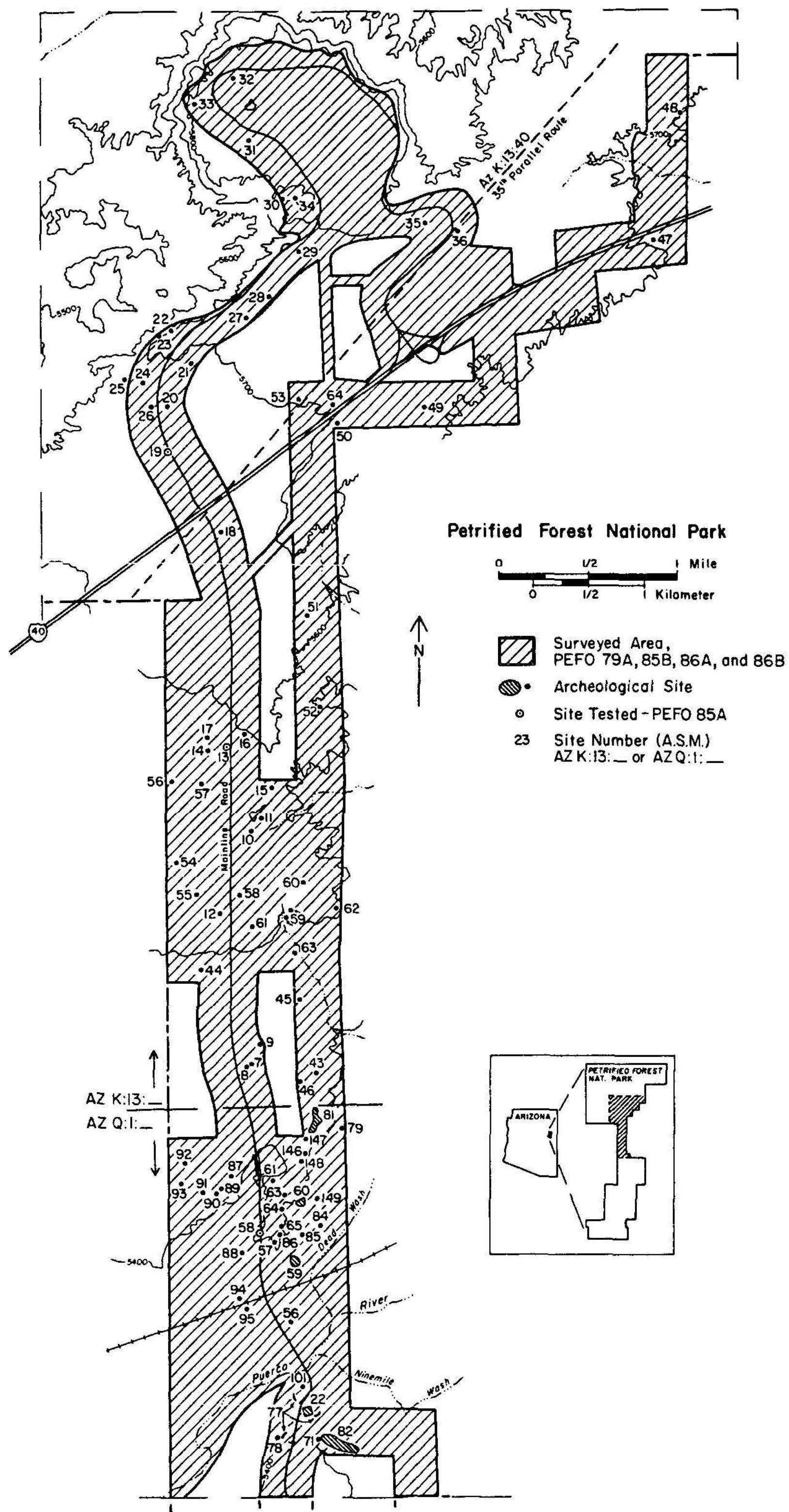


Figure 6.1 North section of part showing survey areas and site locations.

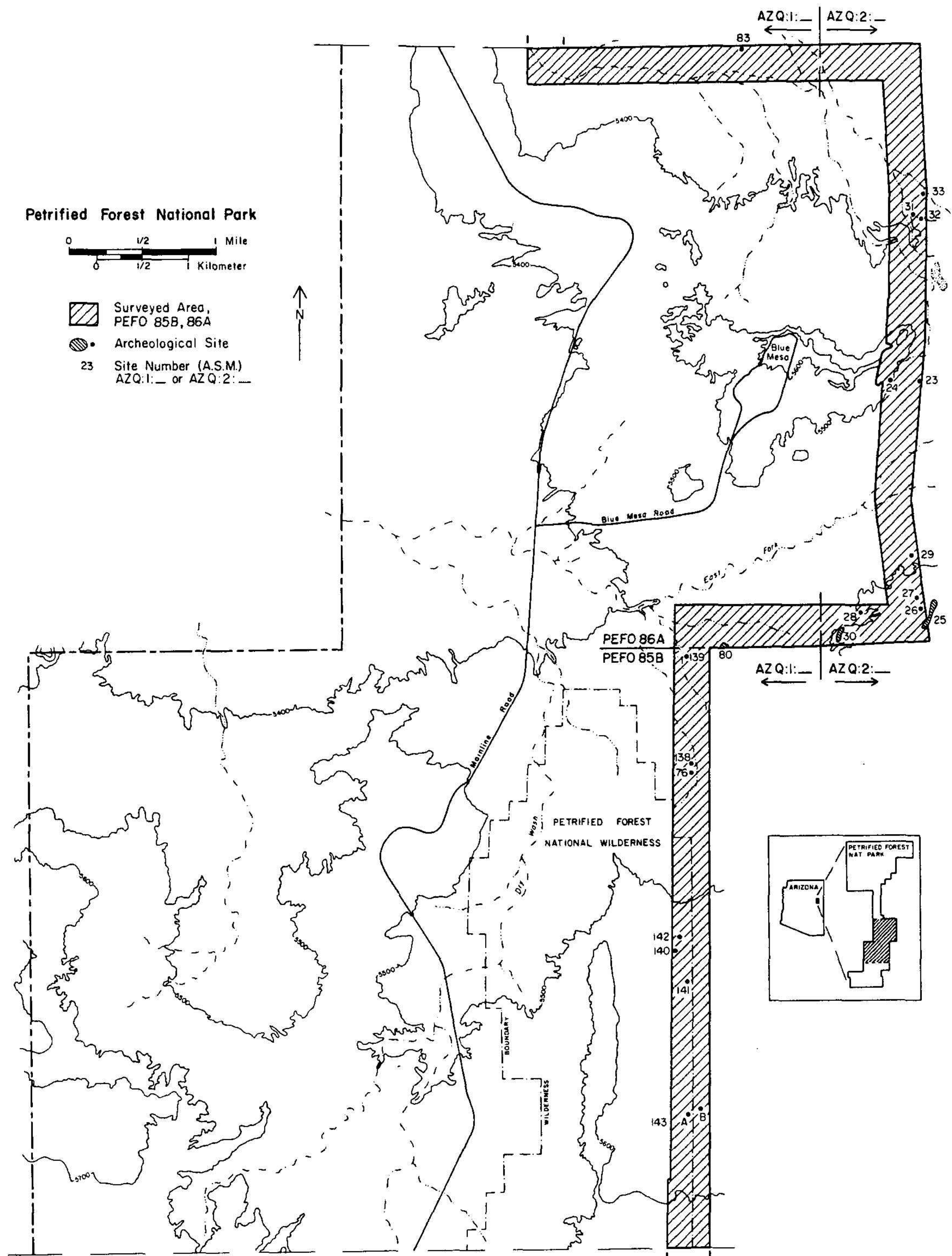


Figure 6.2 Central section of park showing survey areas and site locations.

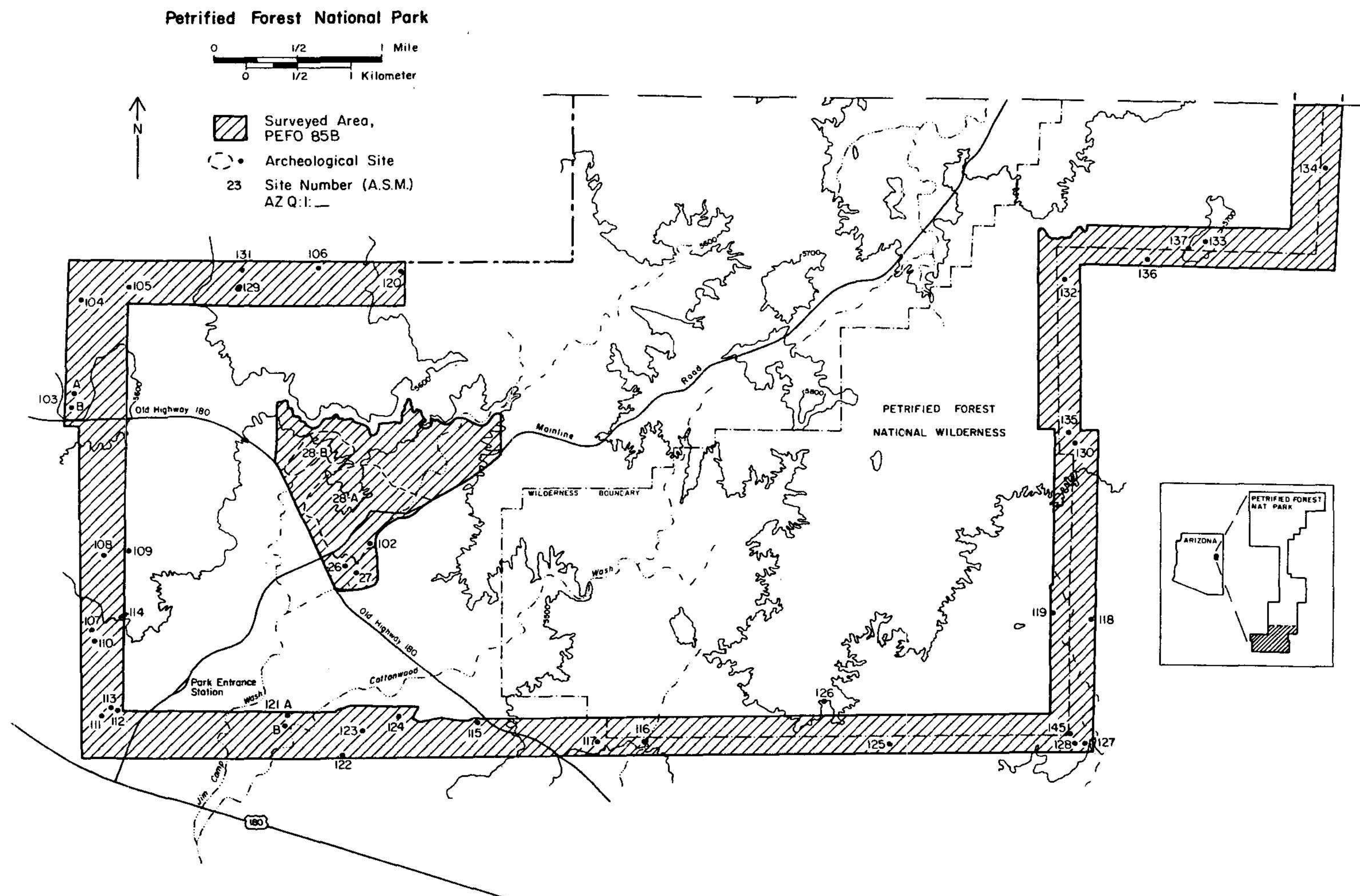


Figure 6.3 South section of park showing survey areas and site locations.

Table 6.1
SITES RECORDED FOR PROJECT PEFO 85B
(Listed by ASM Site Number)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:			MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS	
PEFO 85B-6 AZ K:13:58	PII/PIII	25x55 (1,375)	None noted	37	36	0		NC** ARTIFACT SCATTER
PEFO 85B-7 AZ K:13:59	Archaic(?); LPII/PIII	(see p. 84) (3,302)	3 loci: none noted	10	200	1	4 bifaces; 1 projectile point	NC ARTIFACT SCATTER
*PEFO 85B-8 AZ K:13:60	Late Archaic	38x35 (1,330)	2 rock piles; 1 hearth; 2-3 pit features	1	267	1	1 point base; 4 bifaces	NC ARTIFACT SCATTER
PEFO 85B-9 AZ K:13:61	LPII/PIII	42x40 (1,680)	None noted	38	44	0		NC ARTIFACT SCATTER
PEFO 85B-10 AZ K:13:62	LPII/PIII	115x35 (4,025)	Rubble mound; small rubble mound	34	87	0		NC MASONRY ROOM
PEFO 85B-11 AZ K:13:63	LPII/EPIII	36x40 (1,440)	Large rubble mound; small rubble mound	218	115	1		NC MASONRY ROOMS (2+)
PEFO 85B-3 AZ Q:1:26	PII/PIII	32x24 (768)	Rubble mound; trash area; lithic concentration	30	200	0		NC MASONRY ROOMS (2+)
PEFO 85B-4 AZ Q:1:27	PII/PIII	33x22 (726)	Rubble mound with wall section	20	100	3		NC MASONRY ROOMS (2+)
PEFO 85B-1 AZ Q:1:28	LPII/PIII?	2,000x1,300 (2,600,000)	2 loci: none noted	8	1,000,000	0	Cans; glass	100-200 ARTIFACT SCATTER (QUARRY)
PEFO 85B-2 AZ Q:1:101	Unknown	45x25 (1,125)	None noted	0	10,000	0		53 ARTIFACT SCATTER
PEFO 85B-5 AZ Q:1:102	LPII/EPIII	20x15 (300)	Eroded rubble mound	75	50-100	3		26 MASONRY ROOM (1?)
PEFO 85B-12 AZ Q:1:103	Archaic(?)	(see p. 84) (11,200)	2 loci: none noted	1 (Locus B)	700	2	1 point frag- ment; 6 bifaces	NC ARTIFACT SCATTER
PEFO 85B-13 AZ Q:1:104	LPII/PIII	58x38 (2,204)	None noted, but few scattered sandstone slabs	40	300	0		NC ARTIFACT SCATTER
PEFO 85B-14 AZ Q:1:105	LPII/PIII	44x26 (1,144)	Rubble mound and trash area	150	300	2	1 biface	NC MASONRY ROOMS (2+)
PEFO 85B-15 AZ Q:1:106	PI, PII/PIII	(see p. 84) (1,162)	None noted	145	180	0	1 biface tip	12 ARTIFACT SCATTER
PEFO 85B-16 AZ Q:1:107	LPII/PIII	31x22 (682)	Rubble mound	70	150	0		NC MASONRY ROOM

* See also Chapter 9.

** = No Count.

Table 6.1 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS		
PEFO 85B-17 AZ Q:1:108	PIII	140x98 (13,720)	None noted	13	750	3	2 bifaces	NC	ARTIFACT SCATTER
PEFO 85B-18 AZ Q:1:109	PII/PIII	50x40 (2,000)	Rubble mound and trash area	300	250	3		0	MASONRY ROOM
PEFO 85B-19 AZ Q:1:110	LPII/PIII	32x12 (384)	Large rubble mound and trash area	500	300	9		NC	MASONRY ROOMS (2+)
PEFO 85B-20 AZ Q:1:111	PII/PIII	28x24 (672)	Rubble mound and trash area			1	1 worked sherd	100	MASONRY ROOM
PEFO 85B-21 AZ Q:1:112	PII/PIII	33x22 (726)	3 petroglyph panels; boulder room; trash area	15	100	0	Corncob (Modern?)	14	ROCK ART
PEFO 85B-22 AZ Q:1:113	LPII/PIII	29x11 (319)	2 rubble mounds (1 w/daub and upright slabs)	200	50	3	Siltstone bead	20	MASONRY ROOMS (2+)
PEFO 85B-23 AZ Q:1:114	BMII; (LPII/PIII?)	105x15 (1,575)	6 slab rubble concentra- tions; 1 bin or pithouse; 1 pithouse	100	500	27	1 sandstone ball and 1 bowl; 3 shaped slabs; 1 worked sherd	NC	PITHOUSE/SLAB FEATURE
PEFO 85B-24 AZ Q:1:115	LPII/PIII	38x20 (760)	Rubble concentration			6		18	MASONRY ROOM
PEFO 85B-25 AZ Q:1:116	PII/PIII	26x23 (598)	Rubble concentration			0		36	MASONRY ROOM
PEFO 85B-26 AZ Q:1:117	LPII/PIII	19x15 (285)	Rubble mound	100	25	4	1 sherd scraper	23	MASONRY ROOMS (2+)
PEFO 85B-27 AZ Q:1:118	LPII/PIII	17x13 (221)	Rubble mound with few upright slabs	125	50	1		14	MASONRY ROOM
PEFO 85B-28 AZ Q:1:119	PII/PIII?	14x9 (126)	Rubble mound	21	10	0		1	MASONRY ROOM
PEFO 85B-29 AZ Q:1:120	PII/PIII	30x22 (660)	2 rubble mounds			1		21	MASONRY ROOMS (2+)
PEFO 85B-30 AZ Q:1:121	LPII/PIII	(see p. 79) (1,276)	2 loci: rubble mound and artifact scatter	521	400	5	4 worked sherds	NC	MASONRY ROOMS (2+)
PEFO 85B-31 AZ Q:1:122	LPII/PIII	120x160 (7,200)	2 rubble mounds (one with daub); black stain and trash area	551	372	10		NC	MASONRY ROOMS (2+)

- Table 6.1 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS		
PEFO 85B-32 AZ Q:1:123	LPII/PIII	50x30 (1,500)	Rubble concentration	936	1,030	9	Bead; pendant; incised slate disc	NC	MASONRY ROOM
PEFO 85B-33 AZ Q:1:124	EPIII	17x14 (238)	None noted	216	223	1		NC	ARTIFACT SCATTER
PEFO 85B-34 AZ Q:1:125	BMII	123x12 (1,476)	2 slab-lined features			2	Glass	11	PITHOUSE/SLAB FEATURE
PEFO 85B-35 AZ Q:1:126	LPII/EPIII	15x11 (165)	Wall alignment and rubble concentration	150	50	1		12	MASONRY ROOM (1?)
PEFO 85B-36 AZ Q:1:127	LPII/PIII	16x14 (224)	Rubble mound with wall alignment			1		10	MASONRY ROOM (1?)
PEFO 85B-37 AZ Q:1:128	LPII/PIII	38x34 (1,292)	2 large rubble mounds; 3 small rubble piles; trash area	870	600	7	1 polishing stone; 2 worked sherds	33	MASONRY ROOMS (2+)
PEFO 85B-38 AZ Q:1:129	BMII/BMIII? PII/PIII	260x170 (44,200)	4 loci: 1 large rubble mound; 2 smaller rubble piles; 2 trash areas; 2 artifact scatters			9	3 bifaces; 1 point; 1 worked sherd	61	MASONRY ROOMS (2+)
PEFO 85B-39 AZ Q:1:130	LPII/PIII	50x18 (900)	Eroded rubble concentra- tion with wall alignment; trash area			1		230	MASONRY ROOM (1?)
PEFO 85B-40 AZ Q:1:131	BMIII?	200x150 (30,000)	14 amorphous slab concen- trations (possible structures)	500	1,500	3	1 perforated sherd disk; 1 shaped slab	12	ARTIFACT SCATTER
PEFO 85B-41 AZ Q:1:132	LPII/PIII	45x32 (1,440)	Rubble mound			2	1 point base	47	MASONRY ROOMS (2+)
PEFO 85B-42 AZ Q:1:133	BMIII; LPII/PIII	140x70 (9,800)	2 loci: rock alignment (possible buried structures)			2	2 bifaces; 5 points	23	ARTIFACT SCATTER
PEFO 85B-43 AZ Q:1:134	LPII/PIII	33x27 (891)	None noted, but few small sandstone slabs	100	50	3	1 worked sherd	31	ARTIFACT SCATTER
PEFO 85B-44 AZ Q:1:135	LPII/PIII	49x40 (1,960)	Rubble mound			1		35	MASONRY ROOMS (2+)
PEFO 85B-45 AZ Q:1:136	PI?; LPII/PIII	45x45 (2,025)	None noted; one area has higher artifact density	27		0		22	ARTIFACT SCATTER
PEFO 85B-46 AZ Q:1:137	LPII/PIII	70x65 (4,550)	Small rubble mound and trash area			0	1 biface	75	MASONRY ROOM

Table 6.1 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:			MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE		
PEFO 85B-47 AZ Q:1:138	PII(?)	21x11 (231)	Rubble mound	50	150	0	36	MASONRY ROOM
PEFO 85B-48 AZ Q:1:139	BMIII	160x50 (8,000)	1 upright slab; 3 small rubble piles	10	1,000	1	29	PITHOUSE/SLAB FEATURE
PEFO 85B-49 AZ Q:1:140	LPII/PIII	43x26 (1,118)	Rubble mound			3	20	MASONRY ROOMS (2+?)
PEFO 85B-50 AZ Q:1:141	BMIII; LPII/PIV	130x120 (15,600)	Small rubble pile; site buried(?)	75	425	4	10	MASONRY ROOM (1?)
PEFO 85B-51 AZ Q:1:142	BMII/BMIII	45x35 (1,575)	2 rubble mounds			0	33	MASONRY ROOMS (2+)
PEFO 85B-52 AZ Q:1:143	LPII/PIII	75x50 (3,750)	4 rubble mounds		2,000+	7	139	MASONRY ROOMS (2+)
PEFO 85B-53 AZ Q:1:144	BMIII/PI?; LPII/PIII	(see pp. 78-79) (1,900)	2 loci: 1 rubble mound and trash area; 1 slab concentration			0	15	MASONRY ROOMS (2+)
PEFO 85B-54 AZ Q:1:145	BMIII?; PII/EPIII	12x8 (96)	Eroded rubble mound	6	20	0	2	MASONRY ROOM

Table 6.2
SITES RECORDED FOR PROJECT PEFO 86A
(Listed by ASM Site Number)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS		
PEFO 86A-30 AZ K:13:17	LPII/PIII	30x22 (660)	None noted	70	30	0		26	ARTIFACT SCATTER
PEFO 86A-27 AZ K:13:43	LPII/EPIII	44x32 (1,408)	Rubble mound and trash area	112	121	4		9	MASONRY ROOM (1?)
PEFO 86A-19 AZ K:13:44	LPII/PIII	37x32 (1,184)	1 large rubble mound; 3 small rubble piles; 1 dark stain and trash area	75	75	0		5	MASONRY ROOMS (2+)
PEFO 86A-17 AZ K:13:45	PII/EPIII	(see p. 79) (3,184)	2 loci; 3 large rubble mounds and trash area	600	400	2	1 worked sherd	51	MASONRY ROOMS (2+)
PEFO 86A-16 AZ K:13:46	PII/EPIII	56x43 (2,408)	2 large rubble mounds; 1 small rubble area; trash area; chipping station	114	182	4		26	MASONRY ROOMS (2+)
PEFO 86A-18 AZ K:13:47	PII/PIII	40x30 (1,200)	2 dispersed scatters of sandstone blocks	56	24	0		11	MASONRY ROOMS (2+)
PEFO 86A-14 AZ K:13:48	BMII	36x22 (792)	Charcoal stain; 3 possible pithouses; 2 small slab scatters	10	30	1		9	PITHOUSE/SLAB FEATURE
PEFO 86A-13 AZ K:13:49	LPII/EPIII	42x22 (924)	4 small slab scatters	35	20	1		3	ARTIFACT SCATTER
PEFO 86A-12 AZ K:13:50	LPII/EPIII	41x29 (1,189)	2 small slab scatters	25	15	0		8	ARTIFACT SCATTER
PEFO 86A-11 AZ K:13:51	LPII/PIII	32x30 (960)	Rubble mound and trash area	150	50	1		6	MASONRY ROOMS (2+)
PEFO 86A-10 AZ K:13:52	LPII/PIII	42x16 (672)	3 panels of petroglyphs	6	0	0		1	ROCK ART
PEFO 86A-29 AZ K:13:53	PII/EPIII	28x28 (784)	Rubble mound and trash area	400	200	1	6 worked sherds	27	MASONRY ROOM
PEFO 86A-31 AZ K:13:54	PII	32x18 (576)	Rubble mound	4	10	0		1	MASONRY ROOM
PEFO 86A-20 AZ K:13:55	PI(?); LPII/PIII	20x24 (480)	Rubble mound w/visible wing wall	30	50	6	1 worked sherd	5	MASONRY ROOM
PEFO 86A-15 AZ K:13:56	LPII/EPIII	15x15 (225)	None noted	109	100	0		8	ARTIFACT SCATTER
PEFO 86A-32 AZ K:13:57	LPII/EPIII	26x24 (624)	Rubble mound and trash area	200	250	6	Many shell fragments	22	MASONRY ROOM

Table 6.2 (continued)

Table 6.2 (continued)									
FIELD NUMBER ASH NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS		
PEFO 86A-25 AZ Q:1:71	BMIII(?)/ PIV	136x112 (15,232)	9 petroglyph panels; 3-walled masonry structure and trash area	2	100			8	ROCK ART
PEFO 86A-26 AZ Q:1:79	LPII/EPIII	60x45 (2,700)	Wall alignment	45	50	0		13	MASONRY ROOM
PEFO 86A-21 AZ Q:1:80	LPII/PIII	(see pp. 84-85) (2,812)	2 loci; none noted	2	1,500	1		24	ARTIFACT SCATTER
PEFO 86A-28 AZ Q:1:81	LPI/PII	(see pp. 79-81) (35,640)	6 loci, each w/trash area; 3 masonry structure (1 room); artifact scatter; 1 black stain	2,500	1,500	20	1 shell pendant; 2 worked sherds	23	MASONRY ROOMS (2+)
PEFO 86A-33 AZ Q:1:82	1930s-1950s	(see pp. 98-99) (88,000)	Raised roadbed; debris of 5 storage and 1 residential structures structural debris; historic ceramics	100	0	0	Tool fragments; cans; bottles; car parts;	NC*	HISTORICAL SITE
PEFO 86A-5 AZ Q:1:83	LPII/PIII	25x18 (450)	Rubble mound and trash area	82	217	1	4 pcs. daub	59	MASONRY ROOM
PEFO 86A-23 AZ Q:2:23	BMIII/PI?	19x16 (304)	Wall alignment	6	150	1		14	MASONRY ROOM
PEFO 86A-24 AZ Q:2:24	PII/EPIII	18x18 (324)	2-3 adjacent coursed rooms	50	100	2		20	MASONRY ROOMS (2+)
PEFO 86A-1 AZ Q:2:25	BMII	670x30 (20,100)	13 slab-lined pithouses; small charcoal stain	500	4,500	10		13	PITHOUSE/SLAB FEATURE
PEFO 86A-2 AZ Q:2:26	PII/PIII	25x7 (175)	None noted	29	7	4		14	ARTIFACT SCATTER
PEFO 86A-3 AZ Q:2:27	PII/EPIII	38x20 (760)	Rubble mound	150	400	4	1 portable mortar	34	MASONRY ROOM
PEFO 86A-4 AZ Q:2:28	LPII/PIII	36x25 (900)	1-room rubble mound; 2 small rubble areas	30	300	5		45	MASONRY ROOM
PEFO 86A-6 AZ Q:2:29	LPI/PIII	38x24 (912)	Rubble mound and trash area	290	120	10	1 pc. daub; 2 worked sherds	36	MASONRY ROOM
PEFO 86A-22 AZ Q:2:30	LPII/EPIII	150x50 (7,500)	Rockshelter with rock alignment and trash; 22 checkdam sections	30	750	2		79	AGRICULTURAL SITE
PEFO 86A-8 AZ Q:2:31	PII(?)	65x10 (650)	4 panels of petroglyphs	12	5	1		1	ROCK ART

* = NO Count.

Table 6.2 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ m ²	SITE TYPE
				CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS		
PEFO 86A-7 AZ Q:2:32	PII/PIII	50x26 (1,300)	Rubble mound	24	115	2	3 worked sherds	9	MASONRY ROOM
PEFO 86A-9 AZ Q:2:33	PII/PIII	44x28 (1,232)	Rubble mound and trash area; 1 slab-lined cist	685	800	6	Many pcs. daub; tin cans	68	MASONRY ROOMS (2+)

these cautionary words, the characteristics of each site type are discussed below.

Masonry Room

This class includes 29 sites (Table 6.3), each with the remains of a coursed masonry room. The room may appear as a rock rubble mound (21 or 72 percent) or rubble concentration. The room does not appear as a mound if the entire site area is buried by sand or is eroded. Also some walls may have been less than full height. Similar sites in the Southwest have been called field houses (Pilles 1978), although as defined here, the type does not include structures with two to four rooms.

Of the 29 sites, none has more than one locus. The average site size is 1,512 square meters (range = 126 to 15,600 square meters); without the largest site, which is multicomponent, average size is 974 square meters. Trash is widely scattered on these sites, although the features are relatively small. Twenty-one have rubble mounds (two with visible wall alignments); five have rubble concentrations (Fig. 6.4a, for example); and two have wall alignments with little other rubble (see Fig. 6.4b, for example). Nine of the sites have definable trash areas (although none has trash mounds), east (67 percent) and southeast (33 percent) of the structures (see Fig. 6.4c, for example). Burned daub, which may have been used for mortar in masonry or jacal structures, was evident on two sites.

The artifact assemblages consist mostly of ceramics and flaked stone, but ground stone occurs on 20 sites (69 percent). The artifact totals for all classes range from 14 to 1,966. Each site had less than 400 sherds and less than 1,030 flakes. As many as 10 ground stone objects, mostly manos and occasionally metate fragments, were found on these sites, but the average was less than 3. A portable mortar was found on AZ Q:2:27. Worked sherds were found on five sites and shell fragments on one. A bead, pendant and incised stone disc were found at AZ Q:1:123. Maximum artifact density averages 34 per square meter, but 45 percent of the sites have less than 25 artifacts visible on the surface.

Table 6.3
SITES FROM PROJECTS PEFO 85B AND 86A GROUPED BY SITE TYPE

MASONRY ROOM (n=29)

ASM NUMBERS	FIELD NUMBERS
AZ K:13:043	PEFO 86A-27
AZ K:13:053	PEFO 86A-29
AZ K:13:054	PEFO 86A-31
AZ K:13:055	PEFO 86A-20
AZ K:13:057	PEFO 86A-32
AZ K:13:062	PEFO 85B-10
AZ Q:1:079	PEFO 86A-26
AZ Q:1:083	PEFO 86A-05
AZ Q:1:102	PEFO 85B-05
AZ Q:1:107	PEFO 85B-16
AZ Q:1:109	PEFO 85B-18
AZ Q:1:111	PEFO 85B-20
AZ Q:1:115	PEFO 85B-24
AZ Q:1:116	PEFO 85B-25
AZ Q:1:118	PEFO 85B-27
AZ Q:1:119	PEFO 85B-28
AZ Q:1:123	PEFO 85B-32
AZ Q:1:126	PEFO 85B-35
AZ Q:1:127	PEFO 85B-36
AZ Q:1:130	PEFO 85B-39
AZ Q:1:137	PEFO 85B-46
AZ Q:1:138	PEFO 85B-47
AZ Q:1:141	PEFO 85B-50
AZ Q:1:145	PEFO 85B-54
AZ Q:2:023	PEFO 86A-23
AZ Q:2:027	PEFO 86A-03
AZ Q:2:028	PEFO 86A-04
AZ Q:2:029	PEFO 86A-06
AZ Q:2:032	PEFO 86A-07

MASONRY ROOMS (2+) (n=26)

AZ K:13:044	PEFO 86A-19
AZ K:13:045	PEFO 86A-17
AZ K:13:046	PEFO 86A-16
AZ K:13:047	PEFO 86A-18
AZ K:13:051	PEFO 86A-11
AZ K:13:063	PEFO 85B-11
AZ Q:1:026	PEFO 85B-03
AZ Q:1:027	PEFO 85B-04
AZ Q:1:081	PEFO 86A-28
AZ Q:1:105	PEFO 85B-14
AZ Q:1:110	PEFO 85B-19
AZ Q:1:113	PEFO 85B-22
AZ Q:1:117	PEFO 85B-26
AZ Q:1:120	PEFO 85B-29
AZ Q:1:121	PEFO 85B-30
AZ Q:1:122	PEFO 85B-31
AZ Q:1:128	PEFO 85B-37
AZ Q:1:129	PEFO 85B-38
AZ Q:1:132	PEFO 85B-41
AZ Q:1:135	PEFO 85B-44
AZ Q:1:140	PEFO 85B-49
AZ Q:1:142	PEFO 85B-51
AZ Q:1:143	PEFO 85B-52
AZ Q:1:144	PEFO 85B-53
AZ Q:2:024	PEFO 86A-24
AZ Q:2:033	PEFO 86A-09

PITHOUSE/SLAB FEATURES (n=5)

ASM NUMBERS	FIELD NUMBERS
AZ K:13:048	PEFO 86A-14
AZ Q:1:114	PEFO 85B-23
AZ Q:1:125	PEFO 85B-34
AZ Q:1:139	PEFO 85B-48
AZ Q:2:025	PEFO 86A-01

ARTIFACT SCATTER (n=21)

AZ K:13:017	PEFO 86A-30
AZ K:13:049	PEFO 86A-13
AZ K:13:050	PEFO 86A-12
AZ K:13:056	PEFO 86A-15
AZ K:13:058	PEFO 85B-06
AZ K:13:059	PEFO 85B-07
AZ K:13:060	PEFO 85B-08
AZ K:13:061	PEFO 85B-09
AZ Q:1:028	PEFO 85B-01
AZ Q:1:080	PEFO 86A-21
AZ Q:1:101	PEFO 85B-02
AZ Q:1:103	PEFO 85B-12
AZ Q:1:104	PEFO 85B-13
AZ Q:1:106	PEFO 85B-15
AZ Q:1:108	PEFO 85B-17
AZ Q:1:124	PEFO 85B-33
AZ Q:1:131	PEFO 85B-40
AZ Q:1:133	PEFO 85B-42
AZ Q:1:134	PEFO 85B-43
AZ Q:1:136	PEFO 85B-45
AZ Q:2:026	PEFO 86A-02

ROCK ART (n=4)

AZ K:13:052	PEFO 86A-10
AZ Q:1:071	PEFO 86A-25
AZ Q:1:112	PEFO 85B-21
AZ Q:2:031	PEFO 86A-08

AGRICULTURAL SITE (n=1)

AZ Q:2:030	PEFO 86A-22
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HISTORIC SITE (n=1)

AZ Q:1:082	PEFO 86A-33
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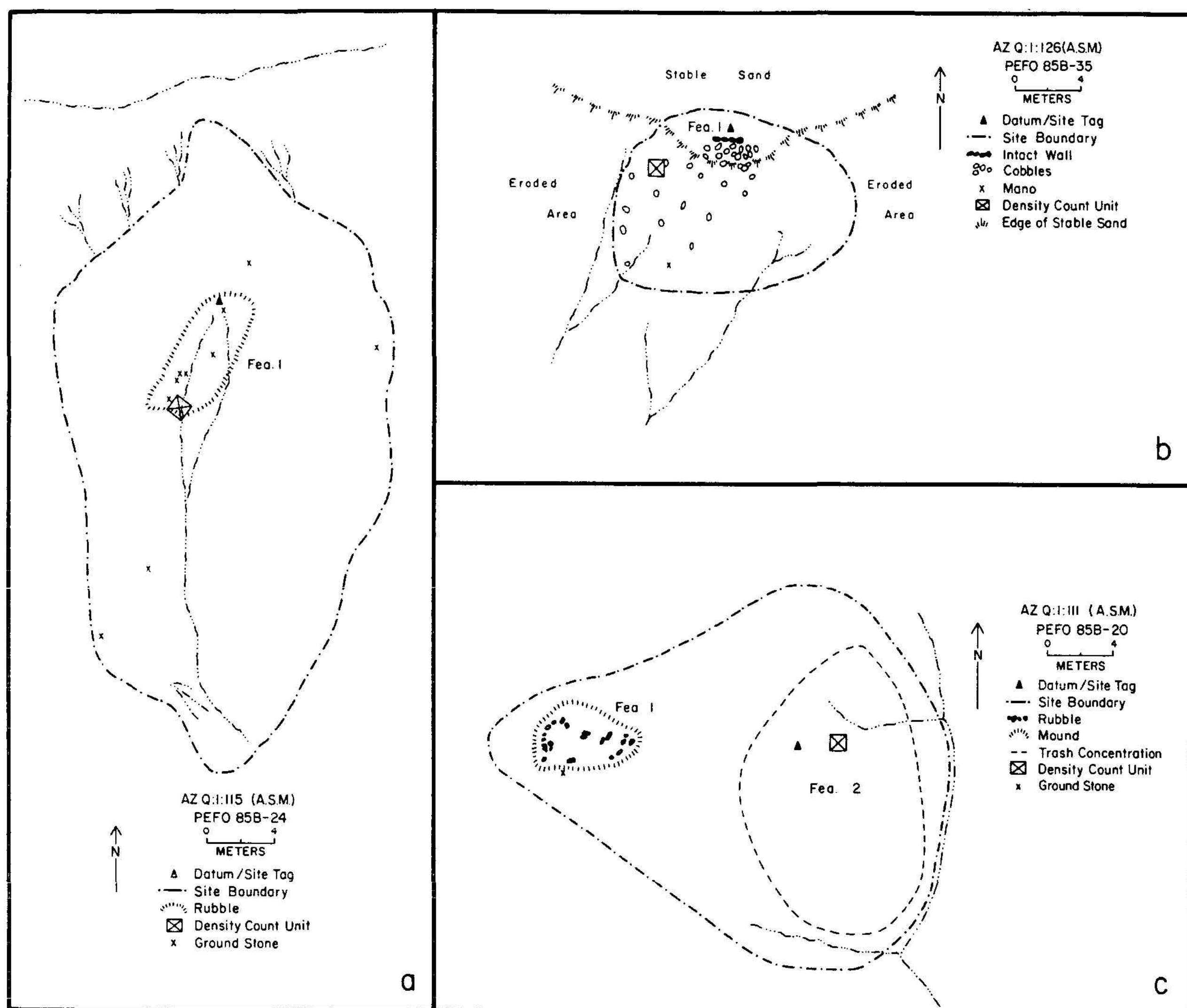


Figure 6.4 AZ Q:1:115, AZ Q:1:126 and AZ Q:1:111. Single room masonry sites.

Although AZ Q:2:23 may have been occupied only during the Basketmaker III/Pueblo I transition, the remainder of the sites were occupied during the Pueblo II/Pueblo III periods. Eighteen of those (62 percent) were inhabited only during the Late Pueblo II/Pueblo III transition. Two of the sites are multicomponent. AZ K:13:55 may have a Pueblo I component. AZ Q:1:141 certainly has a Basketmaker III component. AZ Q:1:102 also may have been occupied during the Pueblo IV period, but possibly the late sherds came from the nearby Wallace Tanks Ruin.

Three sites differ rather markedly from the patterns described above. AZ Q:1:141 is much larger than other sites, 15,600 square meters compared to 4,025 square meters for the next largest site. The small rubble pile may indicate a one-room structure on the site, but the site size and large numbers of flaked and ground stone, as well as the extensive dunes on the site, suggest that other structures may be buried (Fig. 6.5a). Ceramics on the site indicate that AZ Q:1:141 is one of only two multicomponent sites in this group; sherds represented all periods from Basketmaker III to Pueblo IV except for Pueblo I. The extremely high artifact counts (more than 2,000) on AZ Q:1:123 suggest that this site is more than a limited activity site. The artifacts are concentrated in a relatively small area, 40 m by 30 m, and include a bead, pendant and small incised stone disc. The location of the site between sandy knolls near the floodplain of Cottonwood Wash, as well as the large blowouts, indicates that either part of a larger site remains buried or that a larger site was deflated completely (see Fig. 6.5b). The third anomaly in this group of small masonry sites, is AZ Q:1:130; the artifact density (230 per square meter) is more than twice that of any other site. A higher frequency of polychromes, along with the earlier black-on-white ceramic types, may indicate a longer occupation than at most Pueblo II/Pueblo III sites, in which case the high artifact density would be expected.

Masonry Rooms (2+)

Twenty-six sites appear to have the remains of more than one masonry room (see Table 6.3) in one or more coursed masonry room blocks. The room blocks are usually mounded or covered with dunes. Only one of the sites (AZ K:13:47) did not have at least one mound; there were two dispersed scatters of sandstone blocks instead. Fourteen of the sites (54 percent) have one visible rubble mound; 8 (31 percent) had two mounds; and 3 (12 percent) had more than two.

As far as the crews could tell, the largest sites have 5 to 10 rooms. When possible, the layout of a structure (for example, L-shaped or U-shaped) or of multiple structures (around a courtyard/plaza or central work area) was described. Definable trash

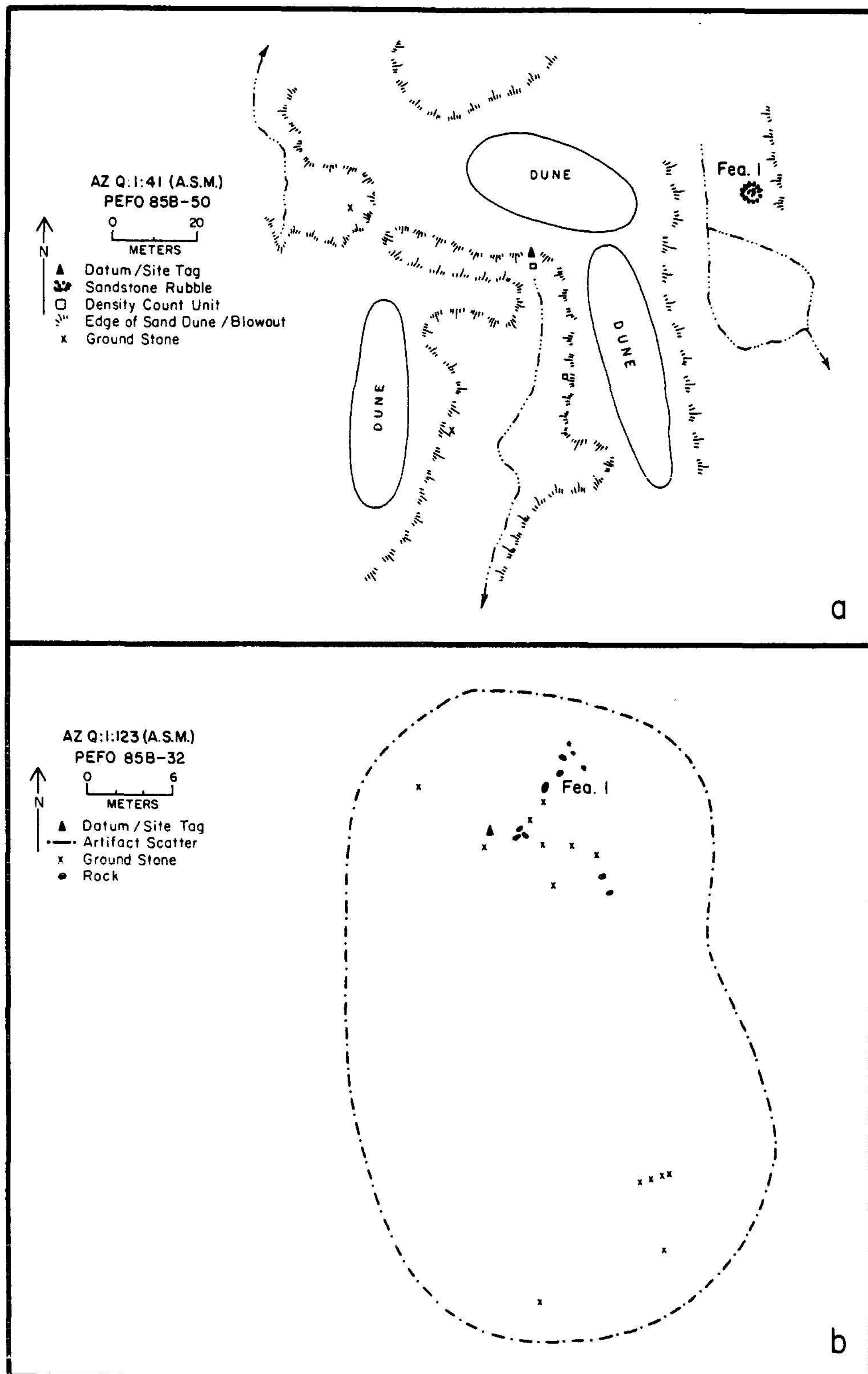


Figure 6.5 AZ Q:1:41 and AZ Q:1:123. Unusual single masonry rooms.

concentrations occurred at 13 sites (50 percent). Nine of the sites (35 percent) had other features, including ash or charcoal stains, discontinuous artifact scatters, and small rubble piles. This contrasts with the one-room sites only two (7 percent) of which had small associated features.

The average site size was 4,522 square meters. Four sites (15 percent) were less than 500 square meters, but only two (8 percent) were greater in size than 10,000 square meters.

The types of artifacts found on the sites were varied and abundant. The maximum average artifact density per square meter was 34. The average total number of artifacts for all classes was 728 (range 80 to 4,020). The average total number of sherds was 410 (range = 20 to 2,500); of flaked stone, it was 314 (range = 24 to 1,500); of ground stone, it was 4 (range = 0 to 20). Worked sherds were found on six sites (23 percent); polishing stones on three (11 percent); projectile points on two (8 percent); bifaces on four (16 percent), and a siltstone bead and an incised shell pendant on one site each.

Only one of the 26 sites was not occupied during the Pueblo II/Pueblo III periods. Ceramics from AZ Q:1:142 indicate a Basketmaker II and Basketmaker III occupation. Two distinct concentrations of petrified wood and sandstone blocks were located in the deflated area of a sand dune. Although the structures appeared mounded, the type of structure could not be discerned. The mounding is probably the result of eolian processes; the structures probably represent eroded shallow pithouses, rather than masonry rooms.

Two other sites, AZ Q:1:129 and AZ Q:1:144, were multicomponent; that is, they were inhabited at other times in addition to the Pueblo II/Pueblo III transition. Of the four loci at AZ Q:1:129 (Fig. 6.6a), Locus A has a large rubble mound of from four to six rooms. Loci C (20 square meters) and D (30 square meters) were small artifact scatters, both of which had ground stone; these probably were work areas associated with Locus A. However, Locus B (75 square meters) has two small rubble concentrations; in one of these a wall alignment can be seen. The ceramics found there were almost entirely of the Basketmaker II type, Adamana Brown. AZ Q:1:144 has two loci, which are visible in deflated areas around sand dunes. Locus A, 50 m by 35 m, has a rubble

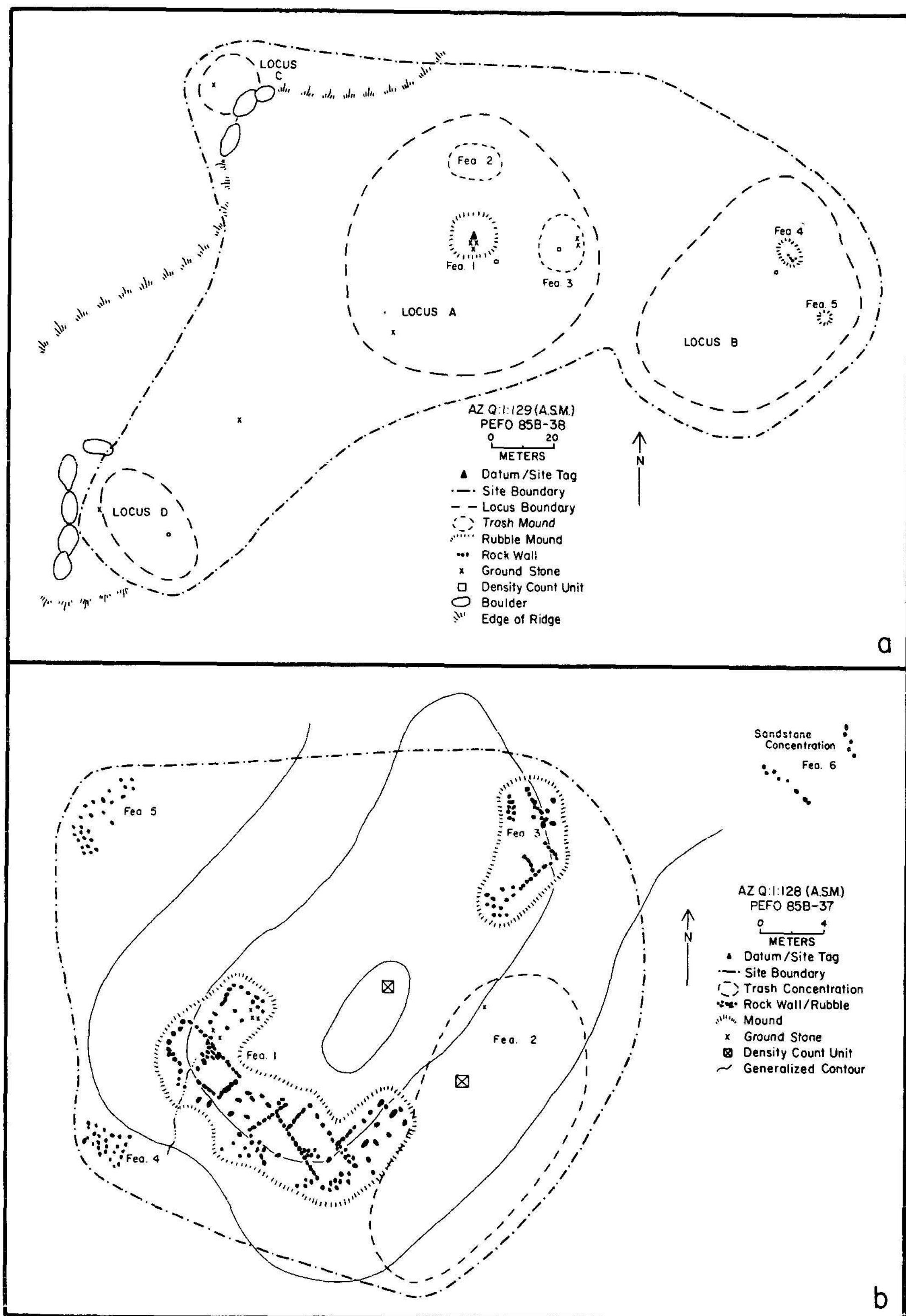


Figure 6.6 AZ Q:1:129 and AZ Q:1:128. Multiple masonry room sites.

concentration, 9 m by 5 m, and ceramics to indicate a Late Pueblo II/Pueblo III occupation. Locus B, 15 m by 10 m, is about 40 m north of the Locus A datum. There is a rubble pile, 3 m in diameter, with primarily Lino Gray and Woodruff Brown ceramics, indicative of the Basketmaker III/Pueblo I transition. There may be buried structures.

Five sites have more than one locus. Where loci boundaries were easily definable, site size was determined by adding the area of each locus, rather than by multiplying the overall site dimensions. AZ Q:1:129 and AZ Q:1:142 are described above because they are multicomponent. At AZ Q:1:121, Locus A, 45 m by 24 m, is a two- to three-room pueblo. An artifact scatter, 14 m in diameter, 90 m southwest of the Locus A datum, was designated Locus B. The ceramics from both loci are similar and date to Late Pueblo II and Early Pueblo III. At AZ K:13:45, Locus A, 56 m by 50 m, has three rubble mounds of one to two rooms each, as well as a definable trash area. Locus B, 24 m by 16 m, is a dense artifact scatter located 88 m east of Locus A. A grassy mounded area with several sandstone rocks may indicate a buried rubble mound. AZ Q:1:81 is a large site that covers the highest point on the north-south trending lower Pleistocene terrace of the Puerco River. Previously recorded by Reed (1940) as six separate sites, intrasite boundaries were difficult to delineate, so the site was recorded as one site with six loci (Fig. 6.7). Locus 1, 81 m by 67 m, had a small rubble mound, 7 m by 10 m, a black stain, 2 m by 1 m, and a trash scatter which was distributed primarily to the southeast of the rubble. Locus 2, 63 m by 43 m, had no structural remains, but four mano fragments and an incised shell pendant were found in the artifact scatter. Locus 3, 28 m by 26 m, had a small rubble mound, probably one room; a definable trash area with two manos and four mano fragments was located to the east of the rubble mound. Locus 4, 36 m by 30 m, had a buried rubble mound, metate fragment and very little trash; the area appears to have been buried by recent eolian deposits. (On loci 3 and 4 were found tin cans with crimped seams.) Locus 5, 55 m by 65 m, is a light scatter of artifacts with some sandstone slabs that appear to have eroded mostly downslope to the southeast. At Locus 6, 70 m by 50 m, the dark soil and highly dispersed sandstone rubble at the ridge edge are the remains of a structure. A second stain, about 30 cm in diameter, is

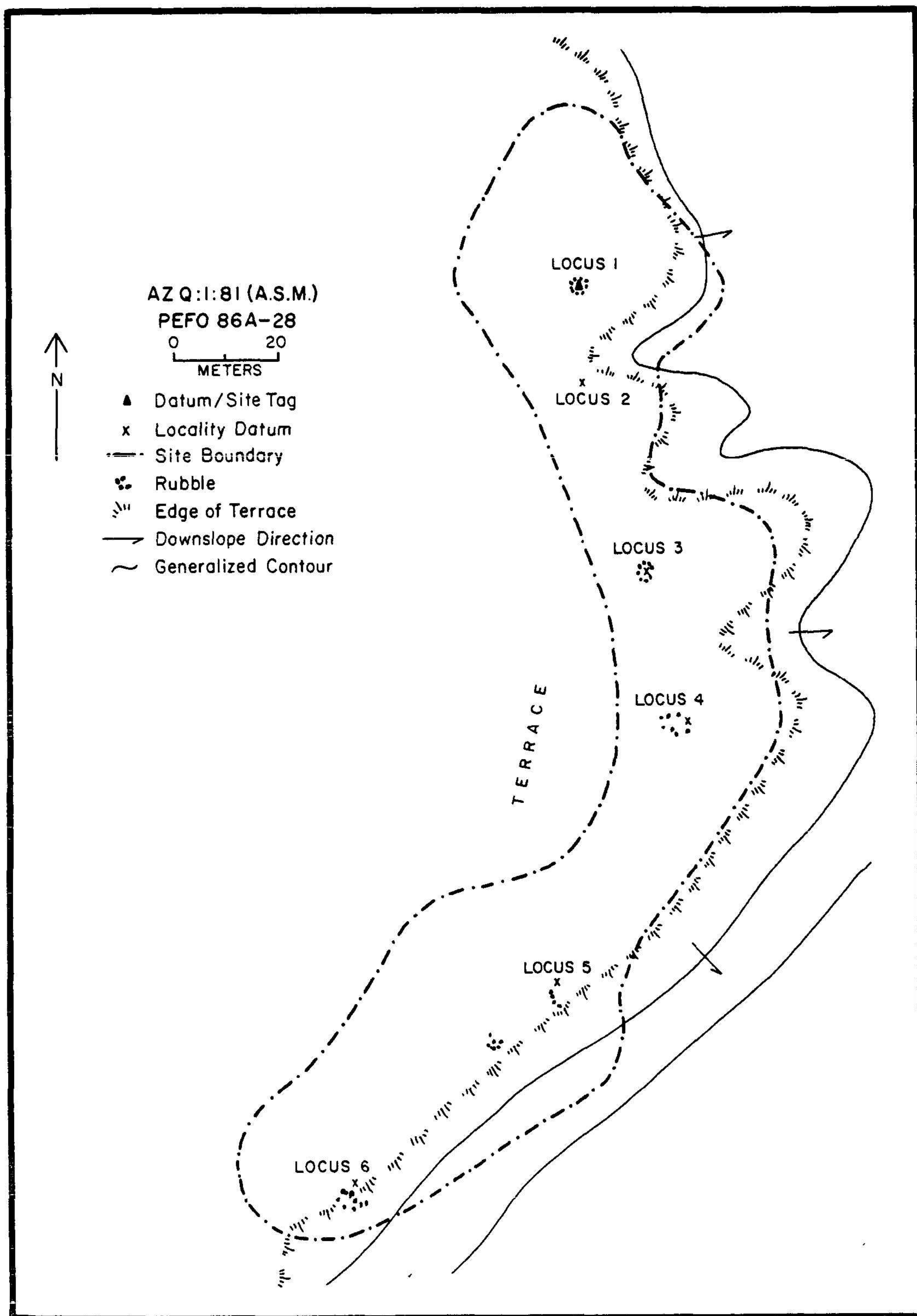


Figure 6.7 AZ Q:1:81. Multicomponent site.

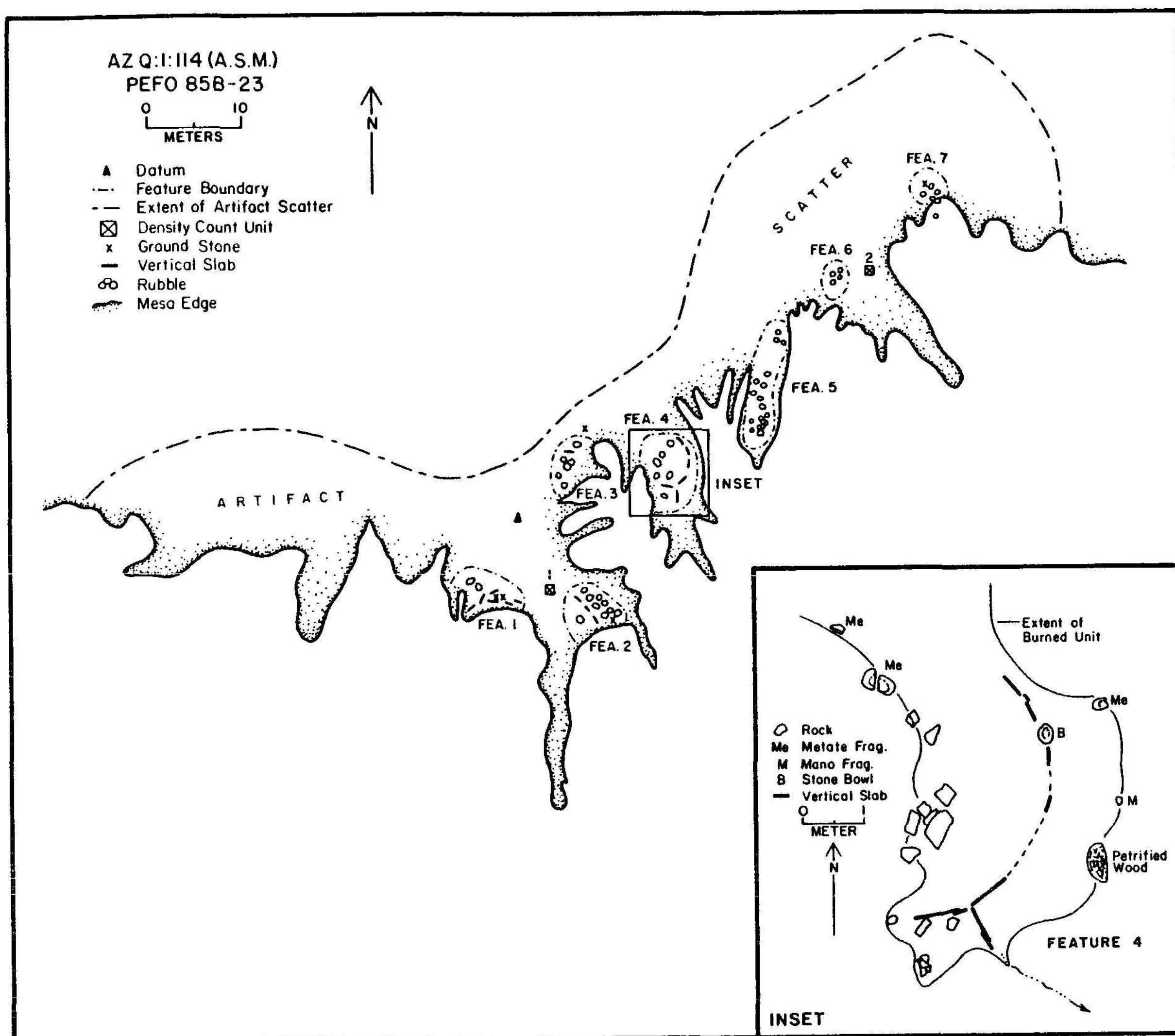
about 20 m northwest of the structure. Most of the artifacts are displaced southeast at the bottom of the slope. Loci 1, 3, 5, and 6 have numerous sherds from the Pueblo I period as well as the Pueblo II/Pueblo III transition. This site may be one of the earliest pueblo sites in the northern part of the park.

Several of the sites described seem rather large. The large site areas and the number of loci are misleading. The greatest number of rooms visible on any site described is about 10 rooms at AZ Q:1:128 (see Fig. 6.6b). AZ Q:1:129 and AZ Q:1:81 follow with five to six rooms each; the latter is nothing more than a number of discontinuous 1-room structures. Four sites have three to five rooms, and the rest have less.

Pithouse/Slab Feature

Five sites have numerous slab-lined pithouses and storage features (see Table 6.3). The average site size in this category is 6,389 square meters. These sites have the remains of one or more subterranean or semisubterranean structures constructed of upright shaped sandstone slabs (Fig. 6.8, for example). AZ Q:2:25 has at least 13 pithouses. The building material is the same crumbly sandstone found at many of the masonry room sites, so the structures do not preserve well. These slab features could often be differentiated from coursed masonry structures, because there is less rock rubble, fewer blocky rocks, rubble in a ring shape, and frequently a dark circular stain within the ring. Where these architectural characteristics were not obvious, the presence or absence of an early ceramic assemblage (including Adamana Brown, Lino Gray, Woodruff Brown, and White Mound Black-on-white ceramic types) was used to help determine the correct site type. Also, sites of this type usually have multiple features, such as small slab-lined bins or cists, charcoal stains and rubble concentrations.

Maximum artifact density per square meter is only 16, but the average total number of artifacts is 1,670 (range = 600 to 5,000). This total represents an average of 155 sherds (range = 10 to 500), 1,507 flakes (range = 30 to 4,500) and 8 ground stone items (range = 1 to 27). Ground stone objects such as a siltstone ball, stone bowl, and



large, thin, sandstone slabs shaped into discs and sometimes perforated, are found along with numerous metates and manos. Basketmaker II sites were differentiated on the basis of the lack of any ceramics except Adamana Brown. Descriptions of the Flattop and Twin Butte sites (Wendorf 1953) fit these remains well. In general, these sites are badly eroded. Near sites located on the edge of badlands scarps, artifacts are found densely distributed along washes as far as 400 m down slope.

Artifact Scatters

These 21 sites are concentrations of ceramic and/or lithic artifacts that have no structural remains. The proportions of each artifact class may vary. No site had 100 percent lithics. Five others had ceramics on only one locus (AZ Q:1:28, AZ K:13:59, AZ Q:1:103, AZ Q:1:80) or had 1 percent or less ceramics (AZ K:13:60 and AZ Q:1:101). Lithic scatters occur frequently at Petrified Forest, especially near or in the exposures of petrified wood. AZ Q:1:28, which is at least 2,000 m by 1,300 m in size, is the Giant Logs Petrified Forest quarry near the Rainbow Forest Museum. Only eight sherds (dating to the Late Pueblo II and Pueblo III periods) were found in this area along with historical cans and glass; how they relate to the quarry is unknown. Due to the distinctive nature of a quarry, the characteristics of this site are not used to define typical artifact scatters at Petrified Forest. Other lithic scatters like it were not recorded during these surveys, but are intended for later study.

Scatters with 100 percent ceramics are rare. "Potbreaks" (where clustered sherds appear to represent only one vessel) were recorded as Isolated Features (IFs) if not associated with other artifacts or features. Eight of the sites (42 percent) had greater numbers of ceramics than lithics. On the average, though, only 39 sherds (5 percent of the assemblage) were found on each site compared to 801 lithics. (If AZ Q:1:101, the lithic activity locus associated with Puerco Ruins, is not included in the calculation of the average lithics per site, the mean drops to 260 and ceramics become 13 percent of the total assemblage.) An average of less than one ground stone item was found on each site. Only one site had a worked sherd, and no ornaments were found on any artifact scatter. Most of the variety in artifacts was found in the flaked stone class; four sites (19 percent) had projectile points, and a total of six (28 percent) had stone tools of some sort. For artifact scatters, the maximum total artifact density per square meter was 20.

Seven sites had nonarchitectural features such as hearths, small rock piles and concentrations, or storage cists. Four of those (57 percent) had scatters of small sandstone slabs, which may represent

buried or deflated structures and features; those same four represent half of the sites where ceramics are more abundant than lithics.

All but 3 of the 21 sites were occupied during the Pueblo II or Pueblo III periods. One of those is the Late Archaic site, AZ K:13:60 (see Chapter 9 of this report). AZ Q:1:131 is a Basketmaker III site. The remaining site (AZ Q:1:101) was tested in early 1987 prior to road reconstruction (Wells 1987). The limited ceramic assemblage points to a late Pueblo III/Pueblo IV occupation. Due to its proximity, one can assume it is associated with Puerco Ruins.

Five (24 percent) of the sites may be multicomponent. Loci at AZ K:13:59 and AZ Q:1:103 seem to be chipping stations for biface manufacture, with flaked stone diagnostic of the Archaic period. AZ Q:1:106 and AZ Q:1:136 may have Pueblo I components as well. AZ Q:1:133 has a Basketmaker III loci as well as the expected Pueblo II/Pueblo III remains.

The average site size (not including the quarry) was 2,949 square meters. Four of the sites had more than one locus. Locus A at AZ K:13:59 was 34 m by 38 m in size. The lithic scatter had a light brown fine-grained sandstone grinding slab with a pecked surface, many small secondary flakes, bifaces, and a basalt projectile point that is probably Late Archaic in style (see Figure 5.1j). Locus B, 70 m by 28 m, and Locus C, 5 m by 10 m, were small artifact scatters with numerous small flakes and one snub-nosed end scraper, but only about 10 sherds total. No features were noted. At AZ Q:1:103, similar flaking debris was distributed at two loci on either side of a natural tank. Locus A was 80 m by 70 m in size. Locus B, 100 m by 55 m, is 150 m south of Locus A. One corrugated sherd was found there. At AZ Q:1:106, both sherds and lithics, with many small sandstone spalls and two to five larger light brown sandstone slabs occur both at Locus A, 22 m by 25 m, and Locus B, 34 m by 18 m. Locus A has a few Pueblo I sherds and may have been occupied slightly earlier than Locus B. AZ Q:1:80 consists of two loci on a small hill of the Chinle formation in the floodplain of the East Fork of Dry Wash. Only two sherds were found on Locus A, 48 m by 44 m, along with a light brown sandstone mano. Locus B, 35 m by 20 m, was a lithic scatter. A few small logs of petrified wood found on

the hill support the premise that the site was used for lithic processing.

Rock Art Sites

Rock art has long been known as an important part of the archeological record at Petrified Forest (Hough 1903:318). For this project, a rock art site is defined as a site where the major focus appears to be the petroglyph or pictograph panels. These sites have sparse trash (an average of six artifacts per square meter). The average total number of artifacts per site was 60 (9 sherds and 51 flakes). Occasionally there is a room or windbreak of boulders or coursed masonry, but these tend to be overshadowed by the rock art. Sites with only a few isolated glyphs were classified according to their other characteristics, for example masonry room. Special care was taken by the crews to thoroughly inspect all likely locations within the survey areas (having along the "pros" from the American Rock Art Research Association was a bonus). Four petroglyph sites were recorded (see Table 6.3). All sites except one were south of the Puerco River. The average size was 4,320 square meters. (Excluding the extensive multicomponent site near Puerco Ruin [AZ Q:1:71], average site size was only 683 square meters.)

Two sites had features other than rock art. AZ Q:1:112 had a circular enclosure, 4.5 m by 5.0 m, made of large unshaped sandstone blocks (Fea. 2). About five of the largest blocks are probably in their original location; smaller rocks were piled between those, as much as three courses high. A light trash scatter, 20 m by 13 m, located 15 m northwest of the enclosure, had about 100 chunks and flakes of petrified wood and 15 sherds. Although no collections were made, in-field analysis indicates that the site was occupied during Late Pueblo II and Pueblo III times. A large corncob found on the site surface probably is modern. Three small panels (Fea. 1a-c) of very faint glyphs pecked into the desert varnish of the sandstone boulders were located within 10 m of each other (Fig. 6.9a). Panel 1 has about 20 glyphs filling the south-facing side of a boulder, 1.9 m long and 1.1 m high (Fig. 6.10). Zoomorphic elements included two bear-paw symbols, about 14 cm long by

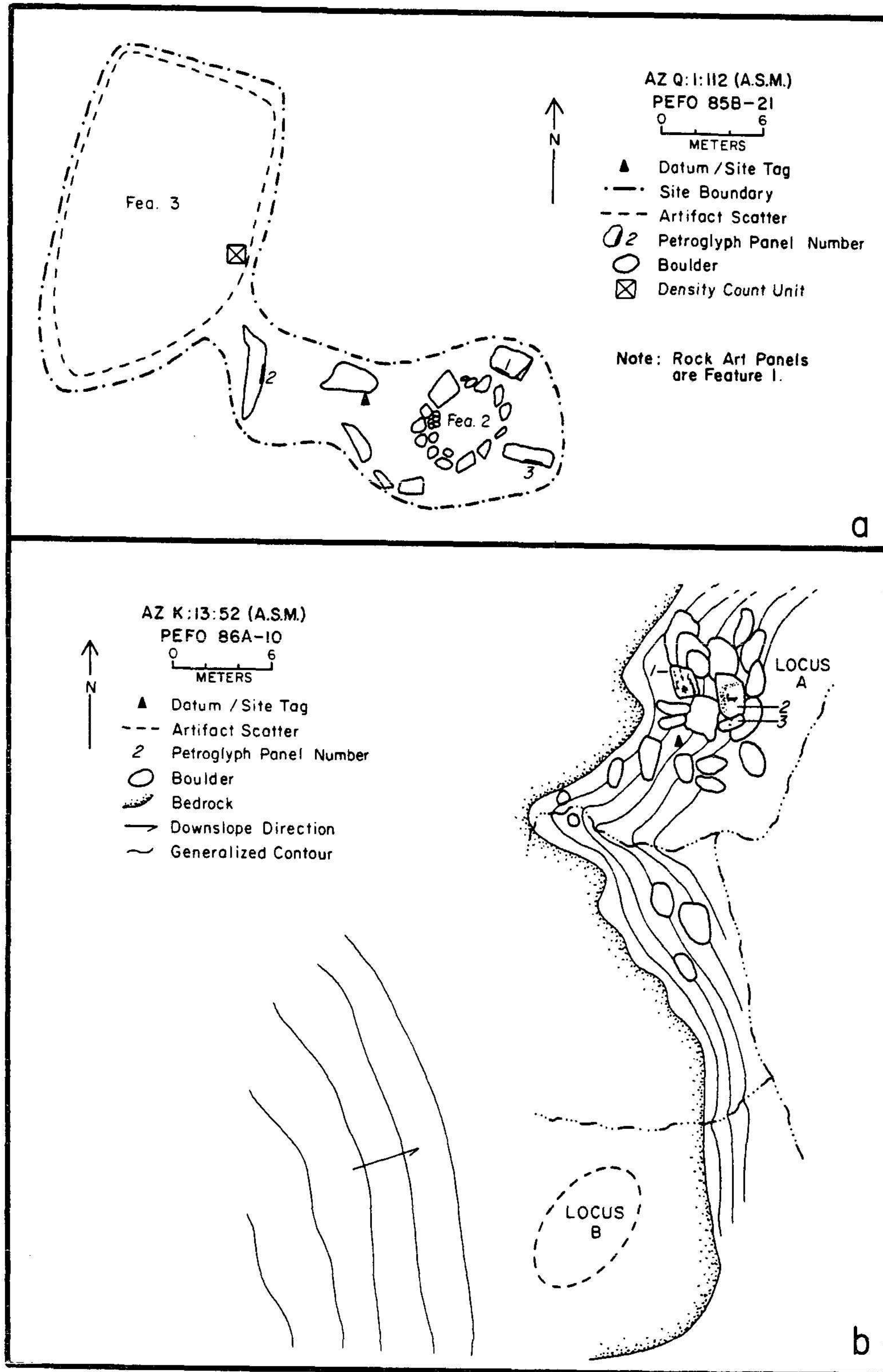


Figure 6.9 AZ Q:1:112 and AZ K:13:52. Rock art sites.

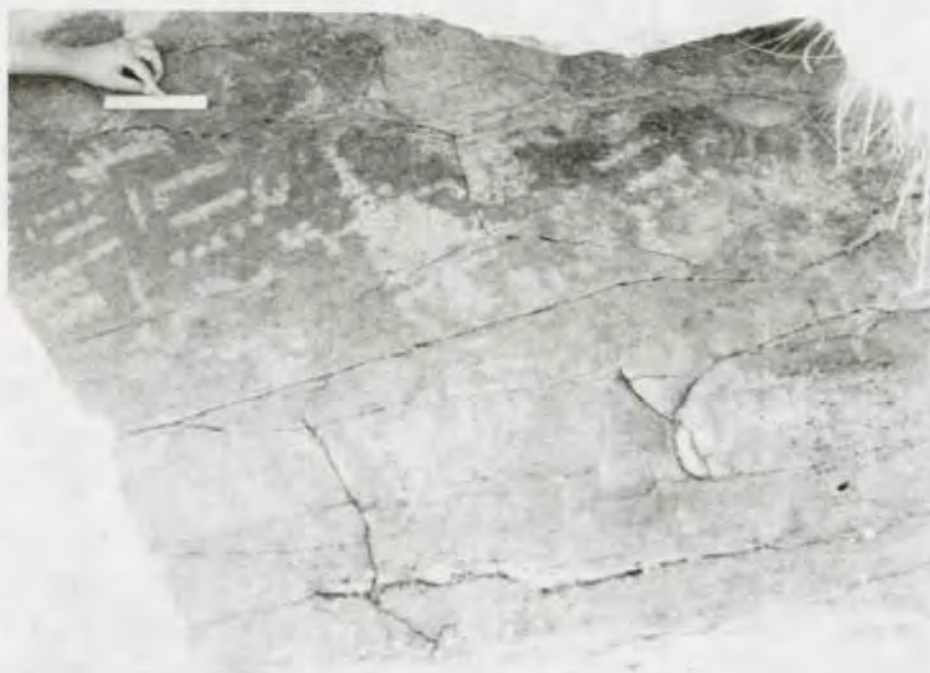


Figure 6.10 AZ Q:1:112. Petroglyph Panel 1. Scale = 6 inches.

8 cm high, and four quadrupeds (possibly two coyotes or antelope, about 16 cm long by 8 cm high, and two horned toads, about 41 cm long by 21 cm wide). One geometric element resembles a "bull's eye." Other glyphs are faint or exfoliated and are difficult to interpret. Panel 2 has only three elements, including one zoomorph (an antelope, 14 cm high by 12.5 cm tall), one anthropomorph, 10 cm wide by 15 m tall, with male genitals, and one element with four curvilinear solids. Panel 3 has three human footprints, between 13 and 20 cm long and 24 and 34 cm wide; two have toes (one of those has six toes). These petroglyphs most closely agree with those described for the Middle Pueblo Period (A.D. 1000 to 1300) (Martyneec 1985:72).

AZ Q:1:71 had a structure (Fea. 1) similar to the one found at AZ Q:1:112. The three-sided rectangular masonry room, three courses high, was positioned against a boulder. A light density trash area is associated with the enclosure. Nearby, on boulders and on the overshadowing sandstone cliffs upon which Puerco Ruin sits, are nine

petroglyph panels (Fig. 6.11). Ceramics date the site to the Pueblo III/Pueblo IV periods, but Martynec (1985) feels the glyphs may date back to the Basketmaker III period. The site's ground surface is extensively disturbed by the historical site, AZ Q:1:82; but although additional modern glyphs have been added to the panels, none of the older elements has been defaced. Panel 1 is immediately adjacent to and west of a tall, dense thicket of saltbush (Atriplex canescens), a sign that a water source, perhaps a seep, is not far below. In a land where water is scarce, a long occupation of this site would not be surprising.

Panels 1, 2, 3, and 9 are on large patinated boulders in the Puerco River floodplain east of the cliffs. Panel 1 (originally recorded by Martynec as AZ Q:1:72 [ASM]) consists of about 139 elements. The art almost entirely covers a large slab that is tilted against a sandstone outcrop. The southeast-facing section, 80 by 45 cm, has 9 "cat" paw prints. The main northeast-facing section, 6 m long by 0.65 m high, has a serpentine line parallel to and over which six to eight human footprints and a linear series of paw prints and cloven-hoof prints are pecked (Fig. 6.12a-c). Other elements include about 10 quadrupeds (possibly pronghorn antelope and lizards), 2 anthropomorphs, at least 3 crosses, 4 zigzags (snakes), a spiral, 3 geometrical patterns of dots, about 7 rectilinear and circular polygons, and 1 botanical element. Two glyphs above the main panel include a curved line and an anthropomorph. Martynec (1985:71) asserts that the panel was produced prior to Pueblo IV times.

Panel 2 has three elements in an area 60 cm by 40 cm, on a south-facing boulder (Fig. 6.13a). The serpentine glyph is less patinated than the other two elements, one of which is a curvilinear element, possibly an open-face mask. Martynec (1985:17) placed the Mask/Kachina tradition in the Early Pueblo Period (A.D. 650 to 1000), but others (Adams 1985) ascribe the tradition to the Pueblo IV period, which would better fit the dates derived from the nearby Puerco Ruins.

Panel 3, 120 by 90 cm, consists of 20 elements on an east-facing boulder. The nine anthropomorphs include three flute players and two figures holding logs(?) over their heads. Martynec (1985:72) dates flute player elements to between A.D. 1000 and 1300. There also are seven zoomorphs and four geometric elements (Fig. 6.14a).

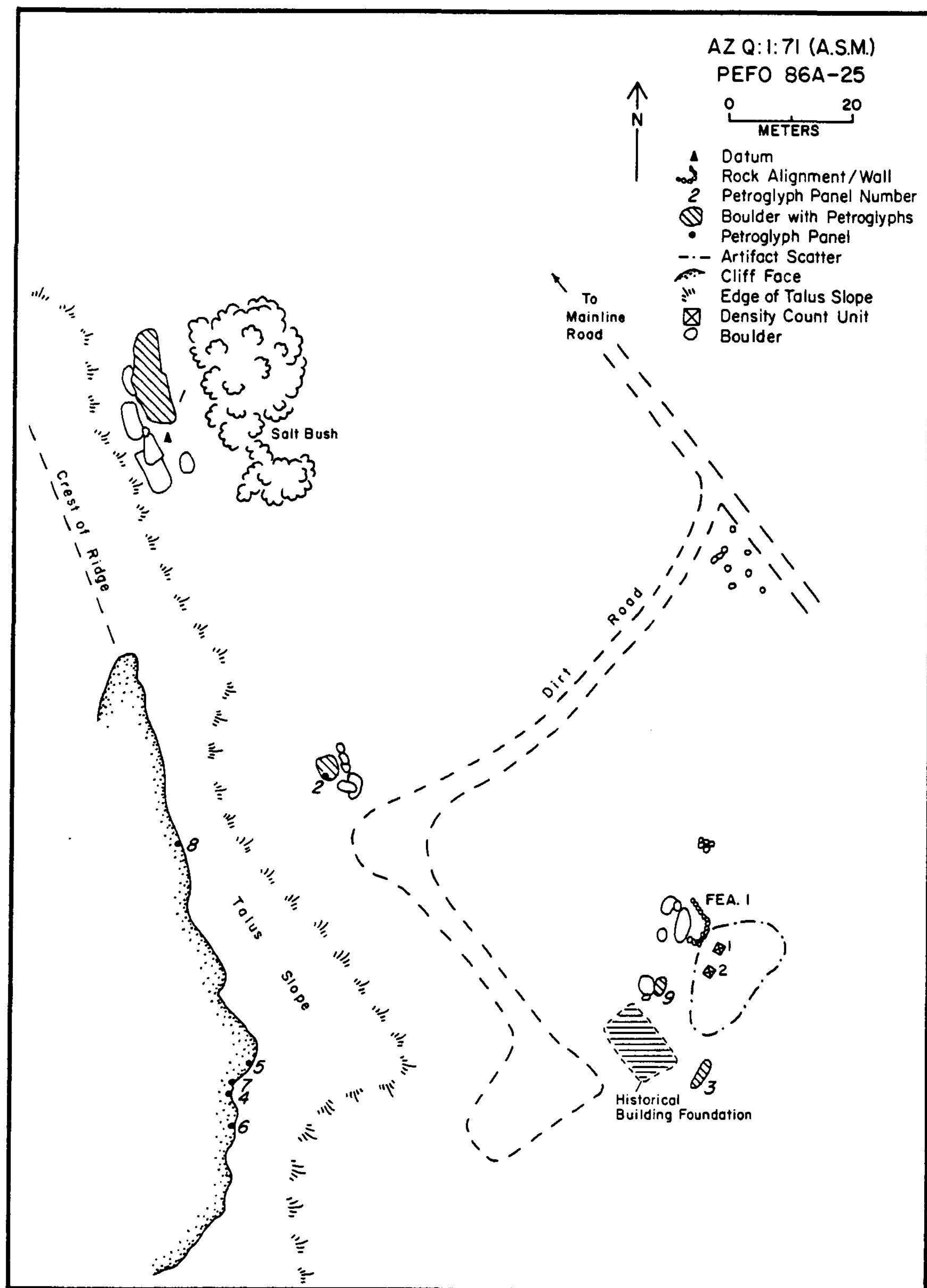


Figure 6.11 AZ Q:1:71. Petroglyph rock art site (overlain by historical site [AZ Q:1:82]).

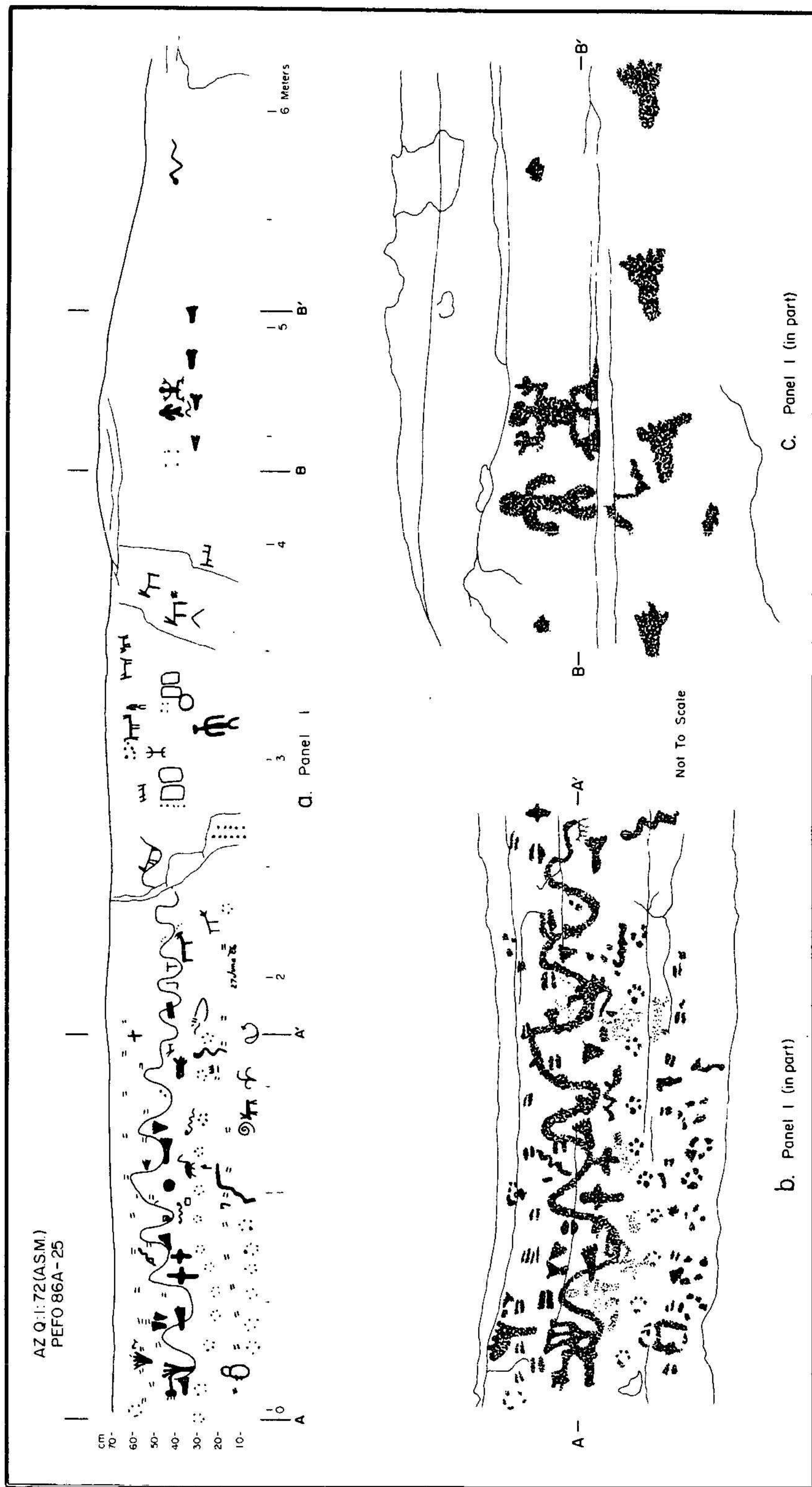


Figure 6.12 AZ Q:1:72. Petroglyph panel 1.

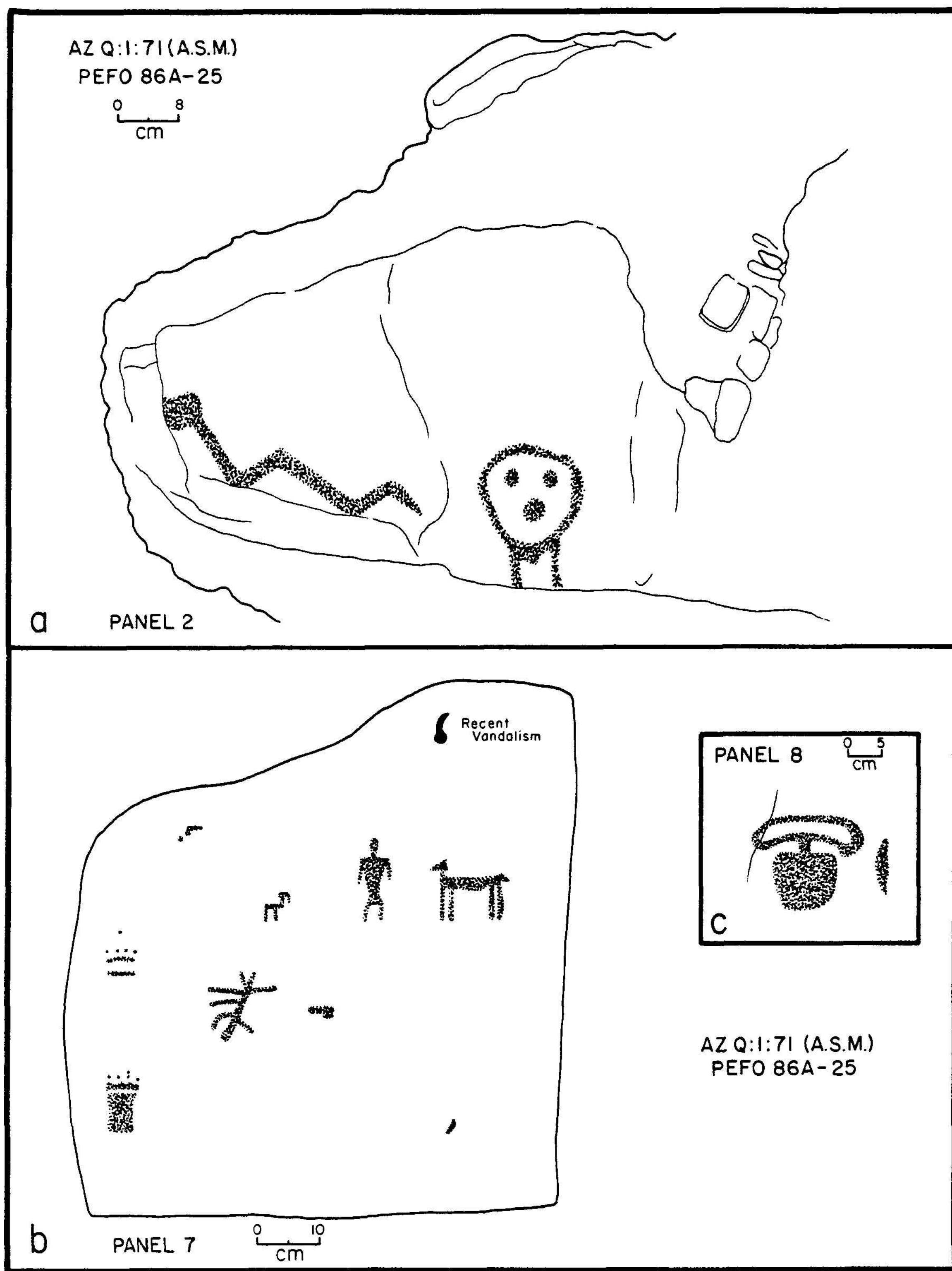


Figure 6.13 AZ Q:1:71. Petroglyph rock panels 2, 7 and 8.

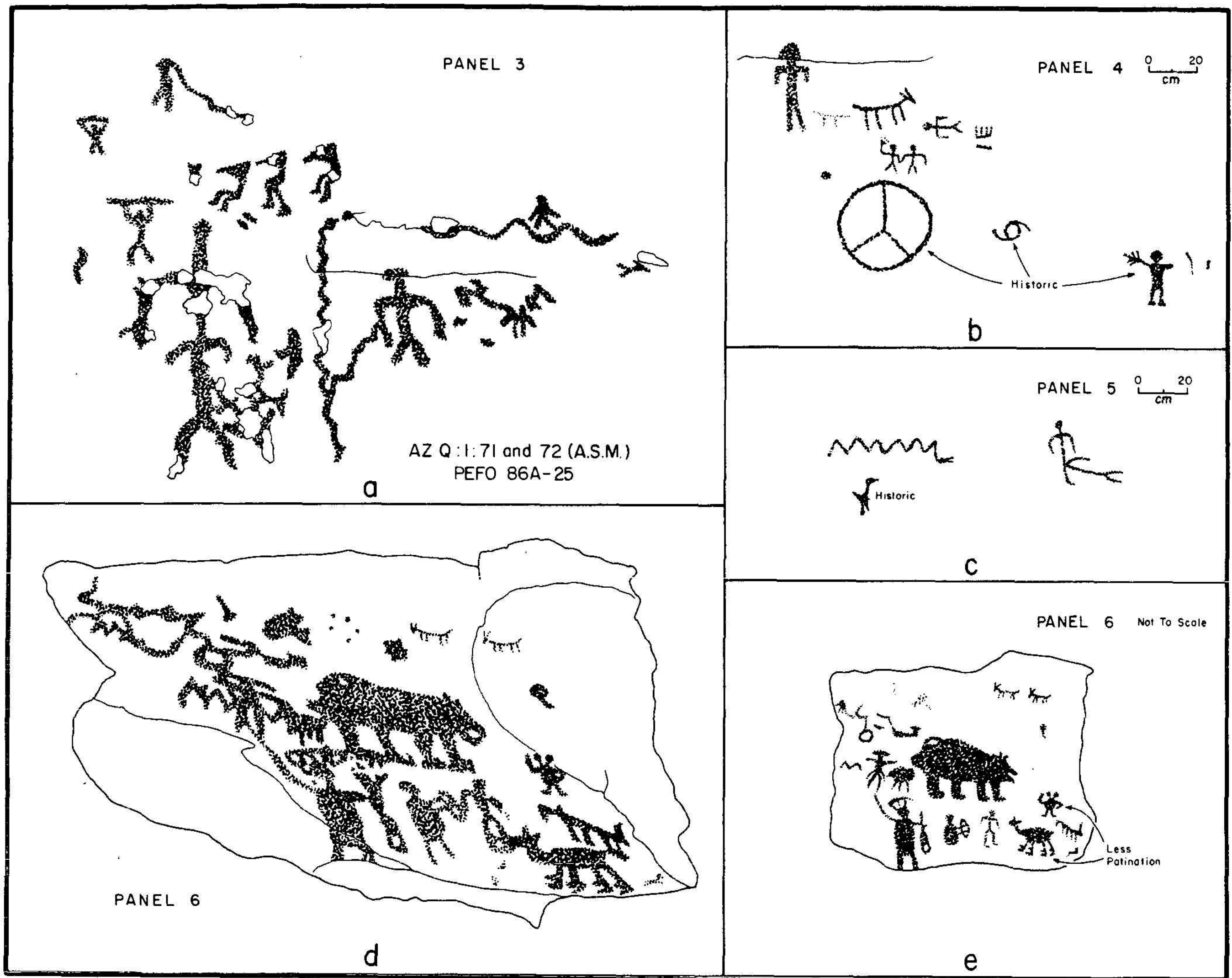


Figure 6.14 AZ Q:1:71. Petroglyph panels 3, 4, 5 and 6. Panel 6 (d) and (e) were inaccessible to make a scale drawing. The glyphs are distorted when traced from a photograph (d).

Panels 4 through 8 are located on the east-facing talus-top cliff that towers 20 m above the floodplain in this location, or on boulders at the cliff base. The north-facing Panel 4, 106 cm by 181 cm, has a total of 8 glyphs, including 4 anthropomorphs, 1 quadruped (possibly antelope), 1 zoomorph, 1 rectilinear geometric element and 1 small orb (see Fig. 6.14b). Three historical elements (one anthropomorph, one peace symbol and a curvilinear element) were added not more than 4 cm below the prehistoric glyphs.

Panel 5, 122 cm by 40 cm, has three elements. A serpentine element and historical zoomorph (possibly a bird) occur on the left. On the right (see Fig. 6.14c) is an anthropomorph with a horizontal appendage, almost identical to one illustrated from Newspaper Rock (AZ Q:1:21 [ASM]) and suggested by Martynec (1985:Fig. 6) to be a birthing scene. A few scratches above and below the glyphs appear to be names or dates; one reads "1933" or "1938." The CCC constructed a number of buildings at the base of the cliff in 1938 (AZ Q:1:82).

Panel 6, 80 cm by 180 cm (estimated), exhibits a total of 20 elements on a southeast-facing section of the cliff that is now inaccessible. These include five anthropomorphs, five quadrupeds (possibly including three pronghorn antelope and one bear), one botanical? (floral) and one rectilinear element (see Fig. 6.14d-e). Two of the glyphs in the lower right are less patinated.

Panel 7, 80 cm by 60 cm, is on a northeast-facing boulder at the base of the cliff. The 10 glyphs include 2 footprints (1 bear-paw print), an insect, an open-figure triangular-bodied anthropomorph, a quadruped (pronghorn?), and another zoomorph (bird?) (see Fig. 6.13b). The insect resembles a spider clan symbol that is visible along the trail to the Homolovi II Ruin near Winslow.

Panel 8, 22 cm by 16 cm, is the northernmost panel. On a northeast-facing boulder at the cliff base, the two elements are both curvilinear (see Fig. 6.13c).

Panel 9, 3.1 m by 1.9 m, is on a badly weathered east-facing boulder in the floodplain. Varying degrees of patination indicate that elements were made at different times. These were too faint to be sketched, but include a quadruped, lizards or lizard men, and a bear-paw print.

At AZ Q:2:31, there are 5 petroglyph panels, less than 45 cm by 60 cm each, along a 30-m long, east-facing section of a sandstone outcrop. The total of 10 elements includes 6 zoomorphs (5 snakes and 1 possible bear paw), 1 complex geometric glyph (bisymmetrical curvilinear), and 1 botanical element (perhaps floral) (Fig. 6.15a-d). There is some variation in the degree of patination, but few lichens and minimal weathering have left the designs in good shape.

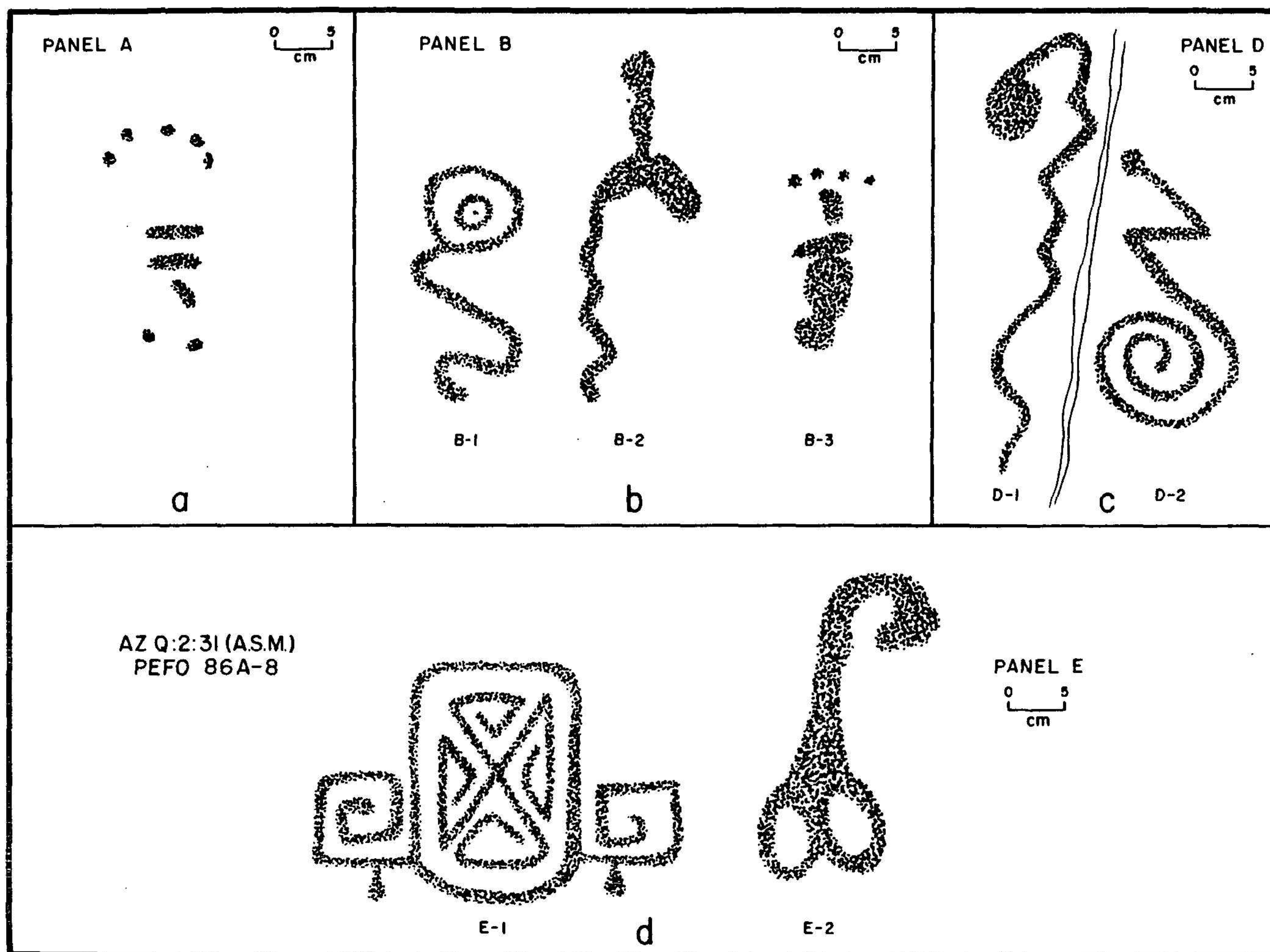


Figure 6.15 AZ Q:2:31. Petroglyph rock art panels A, B, D and E.

At AZ K:13:52, there are 3 panels and a 5 m by 4 m trash scatter that is 34 m southwest of the panels. The panels, which are badly exfoliating around the edges, are on three boulders in an area 7 m by 6 m, near the base of a sandstone cliff. Panel 1 has 22 elements, including 11 zoomorphs (2 snakes, 2 quadrupeds [lizards?], 7 quadruped footprints [carnivore?]), a pair of human footprints, and 1 anthropomorph with facial features (Fig. 6.16a). Panels 2 and 3, which are adjacent to each other, have numerous zoomorphic elements (more than 100 cat-like paw prints) and some recent scratches and incised designs. In the center of Panel 2 is a puma glyph, 40 cm long by 25 cm high (see Fig. 6.16b). At least two similar elements are known from Petrified Forest; one was collected by the CCC during the late

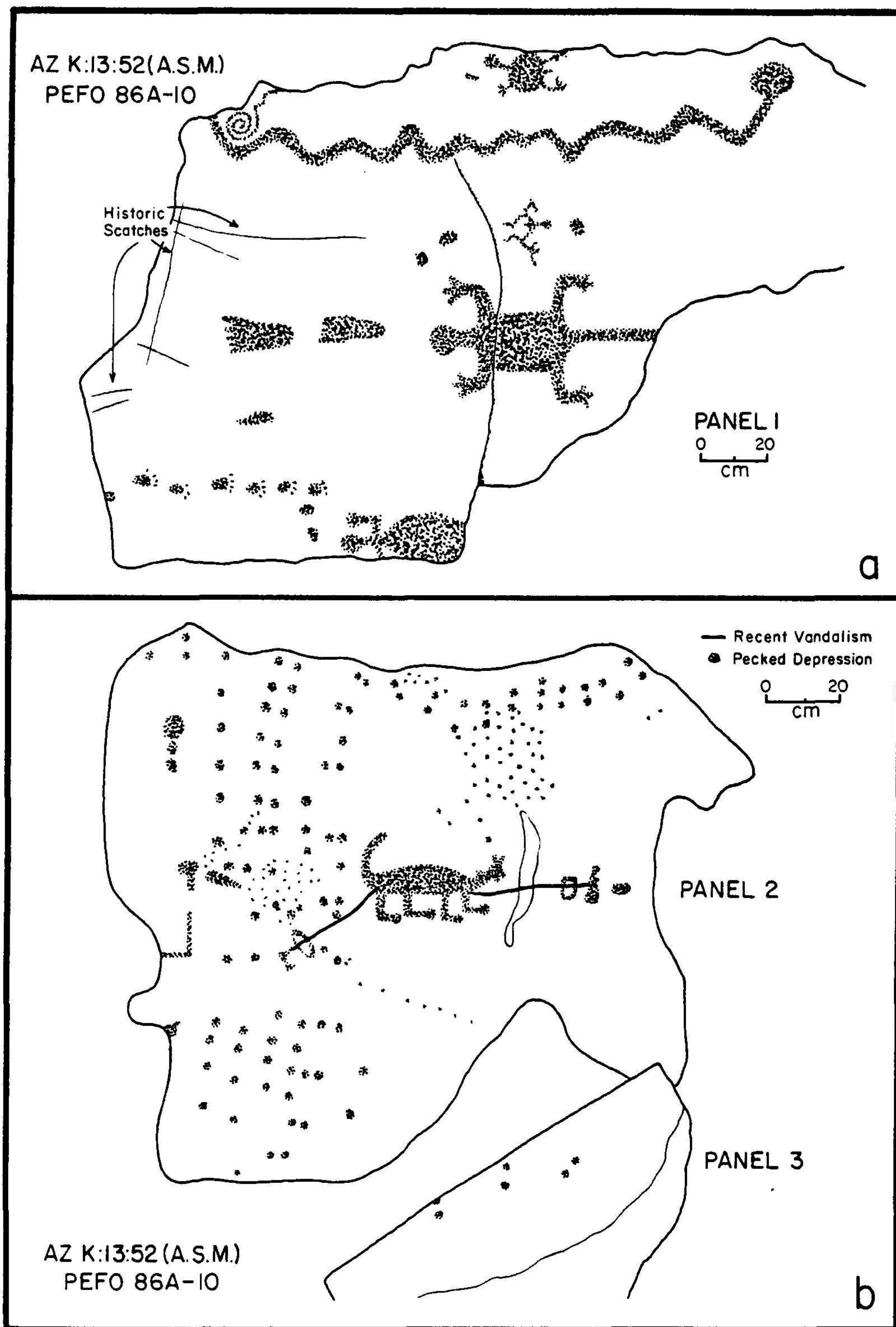


Figure 6.16 AZ K:13:52. Petroglyph rock art panels 1, 2 and 3.

1930s and is currently on display at the Rainbow Forest Museum and Visitor Center. The other was found in the Flattops section of the park. These styles resemble those from the Early and Middle Pueblo periods (A.D. 650 to 1300) (Martyneec 1985:71-72). Ceramic analysis supports an occupation during the Late Pueblo II/Pueblo III periods (A.D. 1080 to 1280).

Agricultural Site

One agricultural site (AZ Q:2:30) was discovered in 1986. Two sandstone ridges define a narrow north-northeast/south-southwest trending alluvial valley in which 22 masonry alignments, from 1.5 m to 24 m long, represent at least 20 checkdams (Fig. 6.17). The alignments are constructed of coarse, light brown sandstone and appear to be only one course high; some of the stones appear upright (Fig. 6.18).

A small rockshelter (Fea. 1) located on the southeast side of a sandstone ridge, 3 m high, provided a slight overhang and shelter for a room or work area, 4.5 m long by 2.1 m deep, formed by a curved alignment of sandstone blocks and small boulders (see inset Fig. 6.17). All artifacts, including one projectile point and one biface of petrified wood and the fragments of two manos were clustered around the rockshelter and ridge. The densest artifact concentration was 8 m east of the shelter. The total number of artifacts was estimated at 780 with a maximum artifact density of 79 per square meter.

Domestic water for the Late Pueblo II/Early Pueblo III site may have come from potholes in the nearby sandstone, some of which still contained water in late June 1986. However, this probably was not sufficient to water plants, and the diversion of rainfall and runoff would have been aided by the checkdams.

The only other agricultural site known from the park is Twin Butte, a Basketmaker III site (Wendorf 1953). The parallel alignments do not crosscut drainages but follow the dip of the slopes, which is unusual for water/soil control features except waffle or grid gardens. However, no cross walls are visible at Twin Butte.

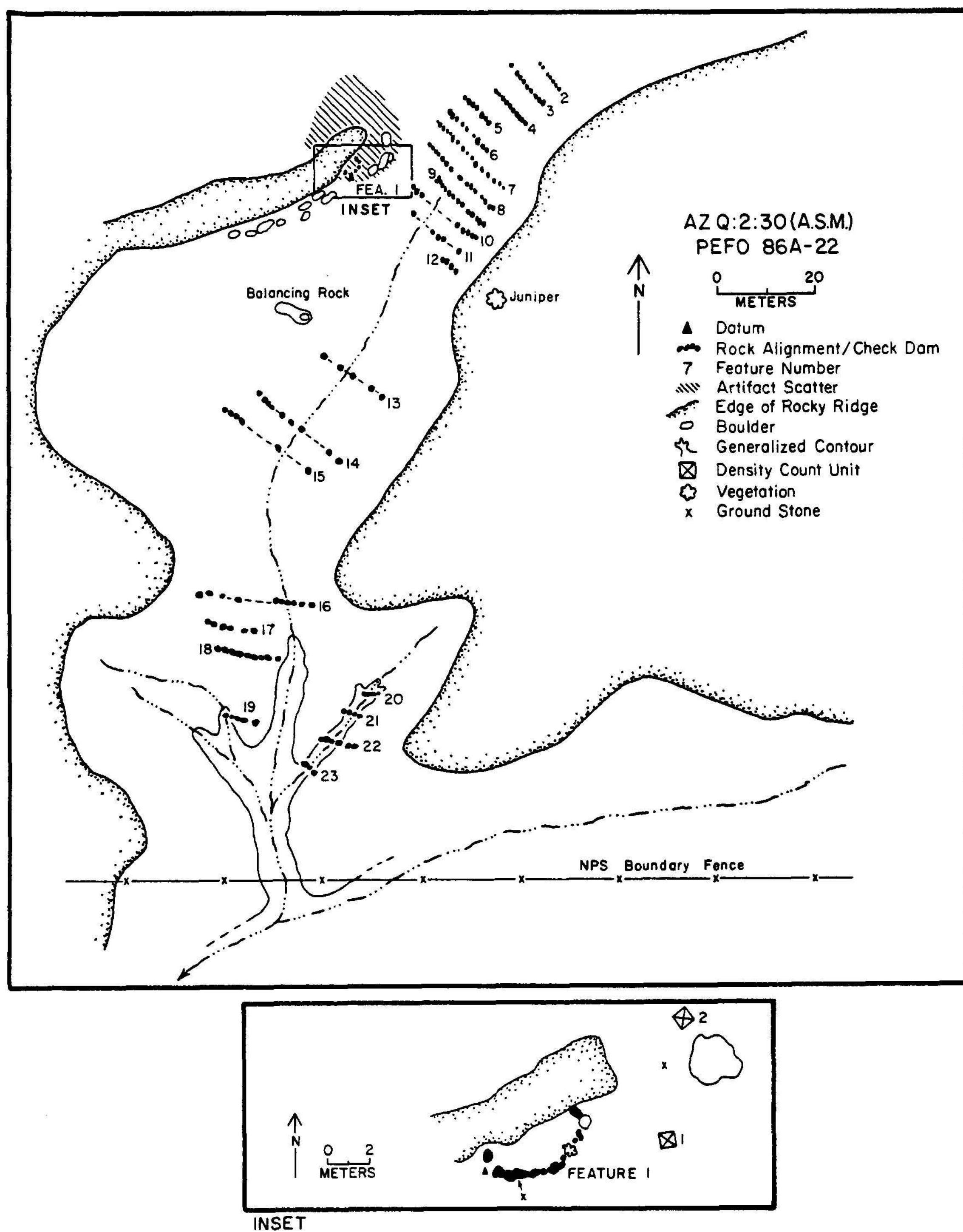


Figure 6.17 AZ Q:2:30. Checkdams and rockshelter (inset) at agricultural site.

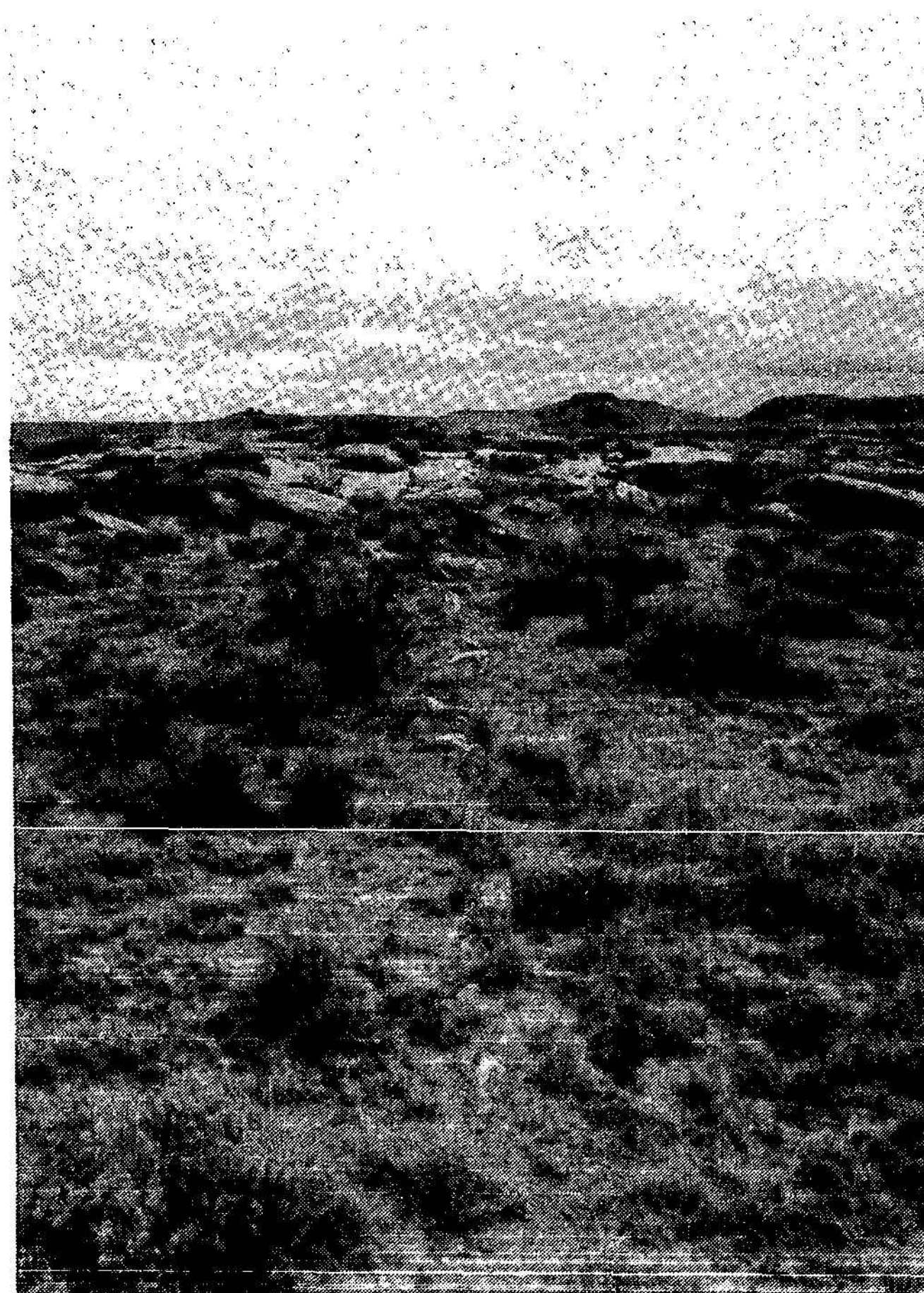


Figure 6.18 AZ Q:2:30. Rock alignment trending from center foreground to background at agriculture site.

Historical Site

Only one historical site (AZ Q:1:82) was recorded. In the Puerco River valley southeast of Puerco Ruins, trash dating from the 1930s to the 1950s was noted over an area 400 m east-west by 220 m north-south. Park Chief of Maintenance, Marion Clark, gave us a park file with pertinent historical data, including building photographs, plans and construction details. The Civilian Conservation Corps constructed five storage and work buildings there in 1938. A sixth wooden structure built before 1930 as a ranger residence was razed in 1953. All that remains of the structure are structural debris, glass and historical ceramics, auto and tool fragments, wire nails, and cans with crimped seams. Trash concentrations in bladed areas probably represent old

building locations. Due to time constraints and the large site size, the site was not rigorously recorded. Further study of the documentation and detailed mapping and inventory may provide more information about specific building locations, and on the CCC period work area.

Site Description Summary

By combining the data generated from two years of boundary survey, we can examine the characteristics of the sites within each site type with some rigor. The sample size is greater than 20 for three types; artifact scatter, masonry room, and masonry rooms (2+). Also, a number of additional pithouse/slab feature sites were visited during the course of the fieldwork; the five sites that were recorded seem representative of the variation, so they will also be used in this comparison. Mean values (\bar{X}) were calculated for each type for site size, maximum artifact density, and the estimated total numbers of ceramics, chipped stone, ground stone, and total artifacts (Table 6.4). The quarry was not included in the calculations.

Table 6.4

STATISTICS FOR PREHISTORIC SITES
RECORDED BY THE BOUNDARY AND RAINBOW FOREST SURVEYS
(PEFO 85B AND 86A)

(Mean [\bar{X}] Values Shown)

SITE TYPES	n	SITE SIZE (m ²)	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY/ (m ²)
			CERAMICS	CHIPPED STONE	GROUND STONE	TOTAL ARTIFACTS	
ARTIFACT SCATTER	21	2,949	39	14,422	<1	14,461	20
PITHOUSE/SLAB FEATURES	5	6,389	155	1,507	8	1,670	16
MASONRY ROOM	29	1,512 (*974)	140	186	2	328	34
MASONRY ROOMS (2+)	26	4,522	410	314	4	728	34
ROCK ART	4	4,320	9	51	<1	66	6
AGRICULTURAL	1	7,500	30	750	2	782	79
TOTAL	86						

* Size without multicomponent site included.

The evident differences are intuitive, and unquestionably support previous hypotheses about variation in site types. Examination of the artifact counts may elucidate the range and importance of activities on different site types. One would expect fewer activities to be conducted at sites most often labeled limited activity sites. The processing and use of flaked stone was relatively more important on artifact scatters (95 percent of the assemblage). This also seems to be the case on pithouse sites, and indeed, ceramics comprise only 9 percent of the assemblage; however, this difference is probably temporal, as well. At the earliest ceramic sites, pottery likely was not abundant. Further, the first ceramic type, Adamana Brown, is very soft, friable, and earth-colored and may either disintegrate or escape the eye of the surveyor. Ground stone is more abundant on the early sites, too, but if one were to divide the numbers of ground stone by the number of dwelling units on the structural sites, this difference might not be significant.

The pithouse sites are largest, yet have a very low artifact density. As described above, many features are widely dispersed over those sites, and no definable trash areas are evident. The high artifact densities for both types of masonry room sites confirm the presence of very dense and discrete trash areas on both. Yet one might wonder why the artifact densities are the same. Research (Baldwin and Bremer 1985:102; Pilles 1978) has shown trash to be lacking or very sparse on the smaller so-called field houses. To further compare the large and small masonry sites, note that, as expected, site size for the one-room sites is much less, a quarter of that for the larger sites. Yet intrasite layout is the same: the coursed masonry structure has trash scattered overall, but more densely concentrated within an area that is most often to the east or southeast. In fact, the layout of sites with two or more rooms, may not include a multiroom structure, but may instead be a combination of two or more one-room modules, where a module consists of a one-room structure and its associated trash (for example, see Jones 1985:74; Fig. 12). In these respects, Petrified Forest pueblo sites seem to differ from those in Anasazi and Sinagua areas to the north and west.

Chapter 7

RESULTS OF THE WATER SYSTEM SURVEY

by

Martyn D. Tagg, Susan J. Wells, and Krista Deal

A total of 33 sites was recorded during the water system survey, including 15 previously unrecorded sites and 18 sites originally located by Reed (1940) or Hammack (1979). In many cases a single site recorded during PEF0 86B may include more than one of Reed's sites, and many of Hammack's sites were replotted on the topographic maps. Sites recorded during the PEF0 Site 236 survey (PEF0 85B), the Rainbow Forest residential area survey (PEF0 85B), and the 1986 boundary survey (PEF0 86A) that lie within the boundaries of the water system project area are discussed elsewhere in the report. Data for two sites recorded by Hammack (AZ K:13:13 and AZ Q:1:58) and excavated by Jones in conjunction with the Mainline Road rehabilitation are presented in Jones' 1986 report.

This chapter presents site descriptions for the 33 sites recorded during the water system survey. Figure 7.1 shows site locations within the four surveyed areas. For convenience the areas were numbered from 1 to 4 going from north to south. Area 1 is at the Painted Desert development, Area 2 is the vicinity of the borrow pit, Area 3 is north of the Puerco River and Area 4 is south of the Rainbow Forest developed area. A summary of all sites recorded in the proposed project area and management recommendations are presented in Chapter 8 of this volume.

The 33 sites included here fall into five site types based on the presence or absence of observable surface features. These include sites with one masonry room, sites with two or more masonry rooms, pithouse/slab feature sites, artifact scatters and a historical site. Rock art was also recorded at one of the masonry room sites. Site type definitions presented in Chapter 6 of this volume are the same as those used in this chapter. Those sites with two or more components were classified according to their most prominent features. Due to the number of sites recorded, the sites are discussed by type rather than by individual site. Table 7.1 shows a breakdown of sites by type.

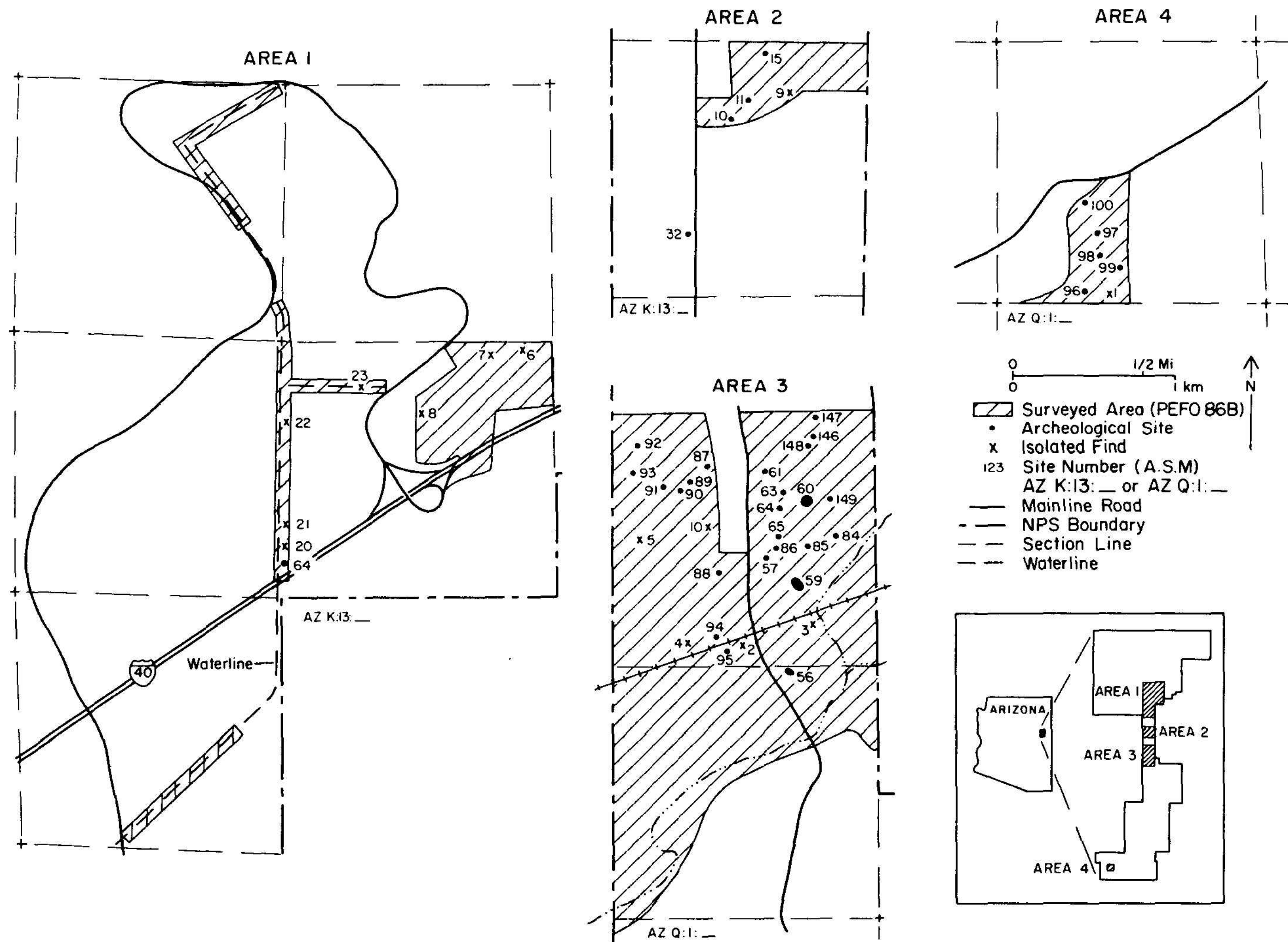


Figure 7.1 Locations of sites recorded by the water system survey (PEFO 86B).

Table 7.1
TYPES OF SITES RECORDED BY THE WATER SYSTEM SURVEY (PEFO 86B)

<u>SITE TYPE</u>	<u>NO.</u>	<u>PERCENT</u>
Masonry Room	11	33.3%
Masonry Rooms (2+)	7	21.2%
Pithouse/Slab Features	7	21.2%
Artifact Scatter	7	21.2%
Historical	1	3.1%
TOTAL	33	100.0%

Masonry Room

This is the largest class of sites (11; or 33.3 percent) and is characterized by rubble mounds that represent what appear to be single-room masonry structures in association with artifact scatters (AZ Q:1:61, 84, 87, 88, 91, 92, 96, 98, 99, 147 and 149) (Table 7.2). These sites date to the PII and PIII periods. Only two sites (AZ Q:1:96 and 98) had well-defined wall alignments, while the rest were either concentrations or mounds of structural rubble. The two well-defined structures were constructed of petrified wood log segments and were either square or rectangular. The square structure (AZ Q:1:98) measures 4 m by 4 m (Fig. 7.2), and the rectangular structure (AZ Q:1:96) is 3 m by 2 m. Both structures have enough rubble to indicate that the walls were more than one course high. These two sites were located in the Rainbow Forest area where petrified wood is abundant.

The features at the remaining nine sites consist primarily of sandstone slab rubble; they are located in areas where petrified wood is not readily available. Two sites (AZ Q:1:61 and 149) have well-defined low mounds of rubble, 2 m by 6 m and 3 m by 3 m, respectively; there are no defined walls. The remaining sites have a dozen or more sandstone slabs concentrated in areas from 3 m by 2 m to 6 m by 3 m. One site,

Table 7.2
SITES RECORDED BY PROJECT PEFO 86B
(Listed by ASM Site Number)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS	SITE TYPE
PEFO 86B-10 AZ K:13:10	LPII/EPIV	55x70 (3,850)	1 large rubble mound; trash area	400	600	2	Historical artifacts	MASONRY ROOMS (2+)
PEFO 86B-11 AZ K:13:11	PII/PIII	30x36 (1,080)	2 rubble mounds	600	800		1 ground stone hoe	MASONRY ROOMS (2+)
PEFO 86B-32 AZ K:13:12	LPII	50x17 (850)	2 trash areas; sandstone slabs	60	140	1	1 point; 1 biface	ARTIFACT SCATTER
PEFO 86B-12 AZ K:13:15	PII/PIII	44x36 (1,584)	2 rubble mounds	1,500	3,000	6		MASONRY ROOMS (2+)
PEFO 86B-33 AZ K:13:64	PII	32x25 (800)	Sandstone slabs; modern disturbance	15	50			ARTIFACT SCATTER
PEFO 86B-7 AZ Q:1:56	BMIII/PII	50x60 (3,000)	1 rubble mound; 5 rubble concentrations with stains	200	300	12	Shell bracelet; corncob	MASONRY ROOMS (2+)
PEFO 86B-19 AZ Q:1:57	PI/EPII	24x12 (288)	Sandstone slabs around dark charcoal stain; trash area; possible historical grave	30	49	2	1 projectile point base	PITHOUSE/SLAB FEATURES; HISTORICAL GRAVE
PEFO 86B-30 AZ Q:1:60	BMIII; LPII/EPIII	200x175 (35,000)	Pithouse village with 8 slab features, dark stain and ground stone cluster; 2 of these slab features possibly later component	3,000	2,000	22	Bone; stone bowl fragment; shaped sandstone slab; 1 projectile point	PITHOUSE/SLAB FEATURES
PEFO 86B-22 AZ Q:1:61	BMIII/EPIII?	27x30 (810)	1 rubble mound; trash area	100	250			MASONRY ROOM
PEFO 86B-31 AZ Q:1:63	BMIII; Historical	44x11 (484)	1 slab concentration; historical boards and trash	4	4	7	Historical artifacts	PITHOUSE/SLAB FEATURES
PEFO 86B-23 AZ Q:1:64	BMIII/PII	48x36 (1,728)	3 slab concentrations; trash area	75	150	1		PITHOUSE/SLAB FEATURES
PEFO 86B-21 AZ Q:1:65	BMIII/PI	56x36 (2,016)	Dispersed sandstone slabs; dark soil stain; trash area	150	200	4		PITHOUSE/SLAB FEATURES
PEFO 86B-25 AZ Q:1:84	PII/PIII	22x40 (880)	1 rubble mound; 3 rubble concentrations; 1 slab-lined storage cist	75	130	1		MASONRY ROOM
PEFO 86B-24 AZ Q:1:85	PII/PIII	20x14 (280)	2 rubble concentrations with wall alignments	60	100	5		MASONRY ROOMS (2+)

Table 7.2 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS	SITE TYPE
PEFO 86B-20 AZ Q:1:86	BMIII/PI; (PII?)	120x65 (7,800)	2 loci: 4 slab concentrations; 1 circular depression; 1 rectangular depression with milled boards; trash area; dark soil stain	400	600	5	Milled lumber	PITHOUSE/SLAB FEATURES
PEFO 86B-18 AZ Q:1:87	LPII/EPIII	33x30 (990)	1 rubble mound	100	100			MASONRY ROOM
PEFO 86B-17 AZ Q:1:88	PII/EPIII	35x34 (1,190)	1 rubble mound	100	150			MASONRY ROOM
PEFO 86B-16 AZ Q:1:89	BMIII/EPII	34x28 (952)	1 slab concentration	90	60	1		PITHOUSE/SLAB FEATURES
PEFO 86B-15 AZ Q:1:90	PII/III	28x20 (560)	Possible sandstone feature; trash area	400	600			ARTIFACT SCATTER
PEFO 86B-14 AZ Q:1:91	LPII/PIII	29x24 (696)	1 rubble mound with upright slabs; trash area	350	500		1 projectile point	MASONRY ROOM
PEFO 86B-13 AZ Q:1:92	PII/PIII	30x20 (600)	1 rubble mound	50	30			MASONRY ROOM
PEFO 86B-9 AZ Q:1:93	PII/PIII?	16x22 (352)	Possible sandstone feature; trash area	50	100	1		ARTIFACT SCATTER
PEFO 86B-8 AZ Q:1:94	BMIII/EPIII; EPIV	74x60 (4,440)	6 rubble concentrations	500	1,000	11	Grooved maul; 2 worked sherds	MASONRY ROOMS (2+)
PEFO 86B-6 AZ Q:1:95	PI/EPII	33x27 (891)	Possible sandstone feature	40	40			ARTIFACT SCATTER
PEFO 86B-5 AZ Q:1:96	PIII?	24x27 (648)	1 petrified wood rubble mound with wall alignments; lithic concentration	20	2,000			MASONRY ROOM
PEFO 86B-4 AZ Q:1:97	LPII/EPIV	55x40 (2,200)	Possible sandstone and petrified wood features; trash area	150	1,500		Historical artifacts	ARTIFACT SCATTER
PEFO 86B-3 AZ Q:1:98	PII/PIII	80x80 (6,400)	1 petrified wood rubble mound with wall alignments; lithic concentration	20	1,500	1		MASONRY ROOM
PEFO 86B-2 AZ Q:1:99	PII/PIII	48x24 (1,152)	1 rubble mound; petroglyphs	150	850		Historical artifacts	MASONRY ROOM; ROCK ART

Table 7.2 (continued)

FIELD NUMBER ASM NUMBER	TIME PERIOD	SITE SIZE (SQ. METERS)	FEATURES	CERAMICS	CHIPPED STONE	GROUND STONE	OTHER ARTIFACTS	SITE TYPE
PEFO 86B-1 AZ Q:1:100	Historical (1880-1920)	51x44 (2,244)	Petrified wood foundation; old road; trash				500 Historical artifacts	HISTORICAL SITE
PEFO 86B-26 AZ Q:1:146	PII/PIII	78x70 (5,460)	2 rubble mounds; 2 trash areas; 2 slab concentrations	2,500	2,500	5		MASONRY ROOMS (2+)
PEFO 86B-27 AZ Q:1:147	PII/EPIII	35x20 (700)	1 rubble mound	35	15	3		MASONRY ROOM
PEFO 86B-28 AZ Q:1:148	BMIII/EPII	40x35 (1,400)	1 sandstone slab	350	150			ARTIFACT SCATTER
PEFO 86B-29 AZ Q:1:149	LP11/PIII	30x25 (750)	1 rubble mound	125	125	4	1 point tip; historical artifacts	MASONRY ROOM

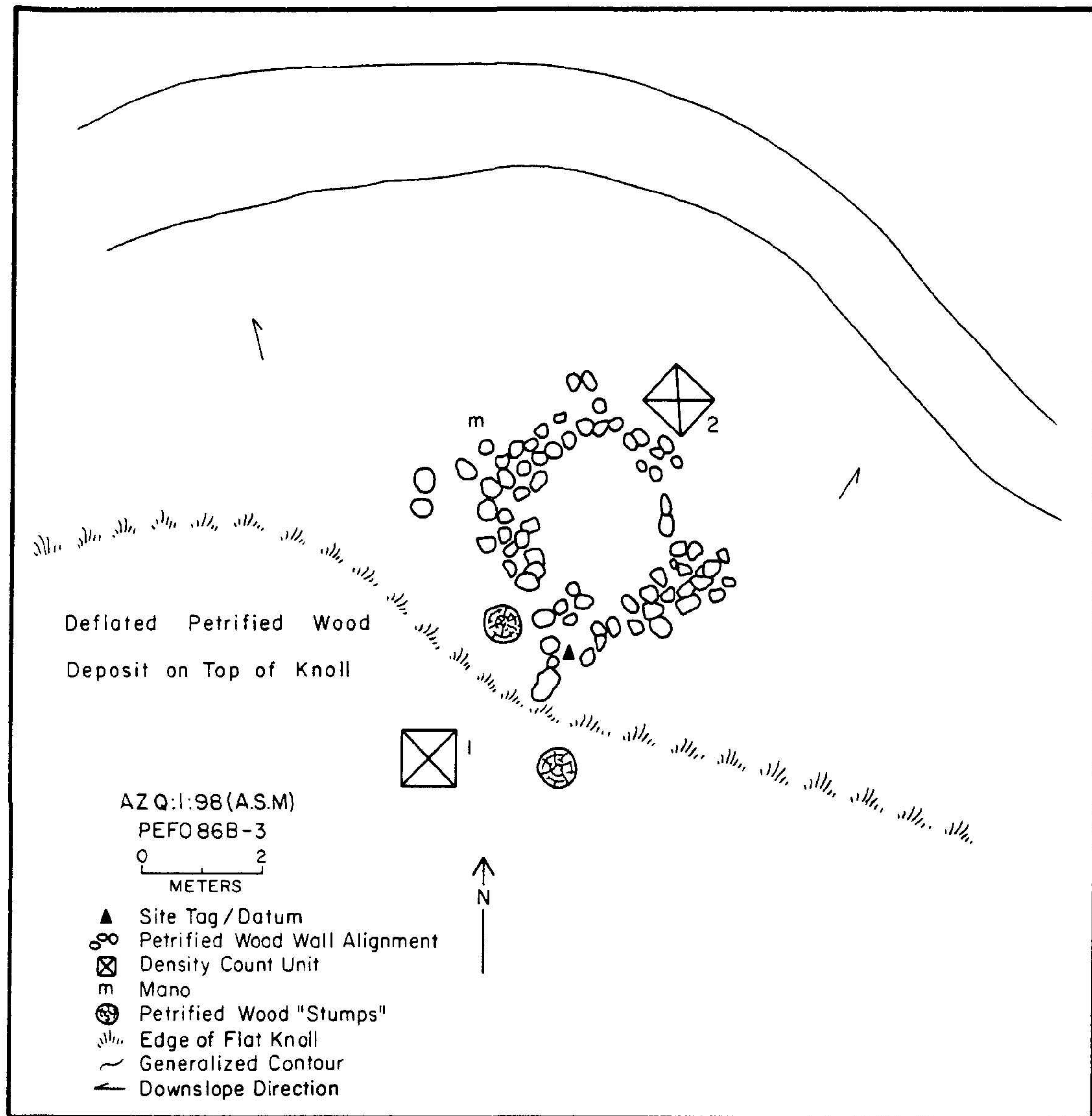


Figure 7.2 AZ Q:1:98. Masonry room site.

AZ Q:1:91, still has two upright slabs standing side-by-side as the remains of a wall. Another site, AZ Q:1:84, has two upright slabs indicating a slab-lined cist (40 cm diameter) lying 20 m from the structural debris. All of these sites have the potential for subsurface structural remains.

One masonry room site has rock art associated with it (AZ Q:1:99). The site consists of a 6 m by 5 m concentration of petrified wood log segments against the north face of a large sandstone outcrop, representing a one- or two-room structure. The rock art is located on the south face of the outcrop. A small dark stain lies 8 m northeast of the structure. A 48 m by 24 m scatter of about 1,000 artifacts is

concentrated downslope from the structure. Flaked stone outnumbers ceramics, being 85 percent of the assemblage, and a few historical artifacts (bottle glass and tin cans) were noted. The rock art elements are described later.

Artifact scatters of various sizes and densities are associated with all of the structures. The scatters range in area from 600 square meters (AZ Q:1:92) to 6,400 square meters (AZ Q:1:98), with a mean area of 1,347 square meters and median of 810 square meters (Table 7.3).

Table 7.3
STATISTICS FOR PREHISTORIC SITES
RECORDED BY THE WATER SYSTEM SURVEY (PEFO 868)

TYPE	n		SITE SIZE (m ²)	ESTIMATED NUMBER OF:				MAXIMUM ARTIFACT DENSITY (Artifacts/m ²)
				CERAMICS	CHIPPED STONE	GROUND STONE	TOTAL ARTIFACTS	
MASONRY ROOM	11	Mean Range Median	1,347 600- 6,400 810	102 20- 350 100	495 15-2,000 150	0.8 0- 3 0	616 53-2,020 254	20 3-47 21
MASONRY ROOMS (2+)	7	Mean Range Median	2,813 280- 5,460 1,584	823 60-2,500 500	1,184 100-3,000 800	3.5 1-12 5	2,015 165-5,005 1,401	31 3-66 24
PITHOUSE/SLAB FEATURE	7	Mean Range Median	6,900 288-35,000 952	528 4-3,000 90	444 4-2,000 150	5.2 0-22 2	978 15-5,022 225	19 12-30 16.5
ARTIFACT SCATTER	7	Mean Range Median	1,007 352- 2,200 850	152 15- 400 60	368 40-1,500 140	0.3 0- 1 0	521 65-1,650 201	23 5-74 11
TOTAL	32							

Maximum artifact density ranges from 3 to 47 artifacts per square meter, with a mean of 20 and median of 21. Two sites (AZ Q:1:61 and 91) have discrete trash concentrations lying southeast of the structures. The trash at AZ Q:1:91 is in a 7 m by 8 m area, 16 m from the structure, whereas that at AZ Q:1:61 is in a 10 m by 6 m concentration 14 m from the structure. A third site, AZ Q:1:84, has a dense scatter of artifacts directly around the structure. Artifacts at the remaining sites are lightly scattered throughout the site areas.

Flaked stone and ceramics are the dominant artifact types present at all sites, ranging from 53 artifacts (AZ Q:1:147) to 2,020 (AZ Q:1:96), with a mean of 616 and median of 254 artifacts. Flaked stone artifacts outnumber ceramics at 7 of the 11 masonry room sites, particularly at AZ Q:1:96 and 98 where flaked stone represents almost 99 percent of the assemblages. Both of these sites lie within the Rainbow Forest petrified wood quarry, where there is abundant material in the immediate vicinity, and may represent discrete quarry areas. Flaked stone at the other sites is predominantly petrified wood, with lesser amounts of cobble chert, chalcedony, quartzite and rhyolite. Artifacts other than flaked stone debitage include hammerstones (AZ Q:1:61, 84, 87, 91 and 98), cores (AZ Q:1:88 and 98), and retouched pieces such as projectile points (AZ Q:1:91 and 149), scrapers (AZ Q:1:61) and unifacial knives (AZ Q:1:61).

Ground stone was noted at five sites and includes manos (AZ Q:1:84, 98, 147 and 149) and metate fragments (AZ Q:1:147). All ground stone is sandstone. Historical trash was noted at AZ Q:1:99 and 149.

The high percentages of brown and gray corrugated sherds, along with identified black-on-white, redware and orange ware sherds, are strong indications of Pueblo II to Pueblo III occupation at all of the masonry room sites. A few Basketmaker III ceramics at AZ Q:1:61 may indicate the presence of an earlier component at this site. AZ Q:1:88 deserves special notice because of the unusually high percentage of Mogollon ceramics; Mogollon ceramics were also found at AZ Q:1:61 and 91.

Masonry Rooms (2+)

Seven sites have substantial amounts of rubble or more than one distinct rubble area, indicating the presence of multiple masonry rooms (AZ K:13:10, 11, 15; AZ Q:1:56, 85, 94 and 146) (see Table 7.2). These Pueblo II and Pueblo III sites are extremely variable. The features at three sites (AZ K:13:11; AZ Q:1:85 and 146) clearly represent two noncontiguous rooms or room blocks. AZ K:13:11 (Fig. 7.3) has two rubble mounds with dimensions of 14 m by 9 m and 16 m by 16 m, which are 6 m apart. AZ Q:1:85 has two distinct rooms with wall alignments still

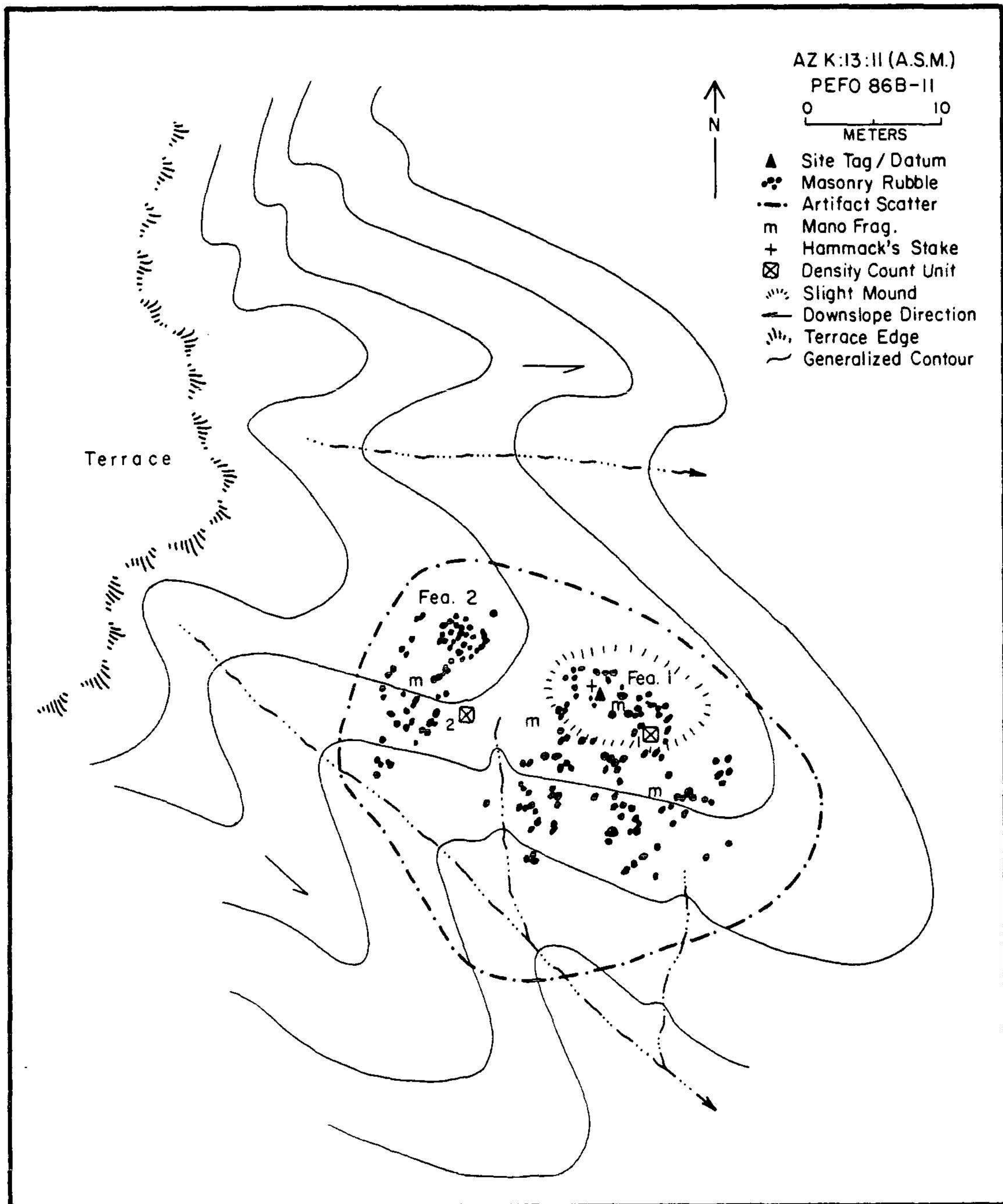


Figure 7.3 AZ K:13:11. Multiple masonry room site.

visible. The rooms, 2.5 m apart, are constructed of sandstone slabs and are both approximately 8 square meters in size. AZ Q:1:46 has one distinct wall 5 m long. The rubble mounds at AZ Q:1:46 are both approximately 10 m by 8 m in size and are 30 m apart.

Two sites appear to have single room blocks (AZ K:13:10 and 15). AZ K:13:10 has a large rubble mound 20 m by 17 m in area with a single upright sandstone slab. Several small scatters of rubble may indicate noncontiguous rooms, trash deposits or disturbance. Although badly eroded, AZ K:13:15 appears to be a room block with multiple rooms. Rubble is concentrated in a 22 m by 10 m area and is eroding down both sides of an erosional finger.

The final two sites (AZ Q:1:56 and 94) appear to have a number of noncontiguous structures, but are both too heavily silted and/or eroded to determine the exact layout. Each site has one distinct structure consisting of a 5 m by 5 m rubble mound at AZ Q:1:56 and an 8.5 m by 8.5 m rubble scatter at AZ Q:1:94, as well as numerous amorphous rubble scatters or dark soil areas that represent other structures or extramural features. At all seven of these multiple structure sites, sandstone slabs were the dominant building material, although petrified wood was used secondarily at AZ K:13:15.

Artifact scatters were associated with all of the structures, ranging from 280 square meters (AZ Q:1:85) to 5,460 square meters (AZ Q:1:146) (mean = 2,813 square meters; median = 1,584 square meters). Distinct trash areas were noted at two sites (AZ K:13:10 and AZ Q:1:146). The trash area at AZ K:13:10 lies 20 m east of the house mound, covering an area approximately 15 m by 15 m. AZ Q:1:146 has two distinct trash areas, one associated with each of the rubble mounds. The trash areas, each southeast of a structure, cover areas 450 square meters and 750 square meters. Artifacts at the remaining sites are concentrated around the structures or features.

Ceramics, flaked stone and ground stone are present at all sites and range from 165 (AZ Q:1:85) to 5,005 artifacts (AZ Q:1:146) (mean = 2,015; median = 1,401). The average maximum artifact density is 31 artifacts per square meter, which is considerably higher than at single-room masonry sites (see Table 7.3). Flaked stone, mainly petrified wood with lesser amounts of cobble chert, chalcedony and

quartzite, outnumbers ceramics at all but one site (ceramics: mean = 823, median = 500; lithics: mean = 1184, median = 800). Chipped stone artifacts include hammerstones (AZ K:13:11 and 15; AZ Q:85 and 94), cores (AZ K:13:11; AZ Q:1:85 and 94), a chopper (AZ K:13:11) and a scraper (AZ Q:1:56).

Ground stone was present at all sites including manos (AZ K:13:11 and 15; AZ Q:1:56, 85, 94 and 146), metate fragments (AZ K:13:10 and 15; AZ Q:1:56, 85, 94 and 146) and a grooved maul (AZ Q:1:94). A complete trough metate was found beside the house mound at AZ Q:1:56. Red sandstone was the dominant ground stone material. A shell bracelet fragment and a corncob were noted at AZ Q:1:56. There are a few historical tin cans and bottle glass at AZ K:13:10, as well as a recent rock cairn on the house mound.

Although these sites are larger than single-room masonry sites and have a few more exotic artifact types, they do not otherwise differ much from the smaller sites. These sites generally date to the Pueblo II and Pueblo III periods, but AZ Q:1:56 and 94 also have Basketmaker III and early Pueblo period ceramics. There appears to be a substantial Basketmaker III component in addition to the Pueblo II component at AZ Q:1:56, and although the Basketmaker III component at AZ Q:1:94, is relatively minor, this site also has a minor Pueblo IV component making it the longest occupied masonry room site for the waterline project. There is also a minor Pueblo IV component at AZ K:13:10.

Pithouse/Slab Features

Seven sites (AZ Q:1:57, 60, 63, 64, 65, 86 and 89) were defined as pithouse/slab feature sites, based on the presence of concentrations of sandstone slabs thought to represent slab-lined pithouses, hearths or storage cists, associated with Basketmaker III and early Pueblo period ceramics (see Table 7.2). The number of features varies from one eroded structure (AZ Q:1:57, 63, 65 and 89) to 10 possible structures (AZ Q:1:60). AZ Q:1:65, with a single structure, is illustrated in Figure 7.4. AZ Q:1:64 and 86 have three and four eroded structures, respectively. The structures generally consist of large, shaped, sandstone slabs ranging in area from 2 m by 3 m to 5 m by 10 m and

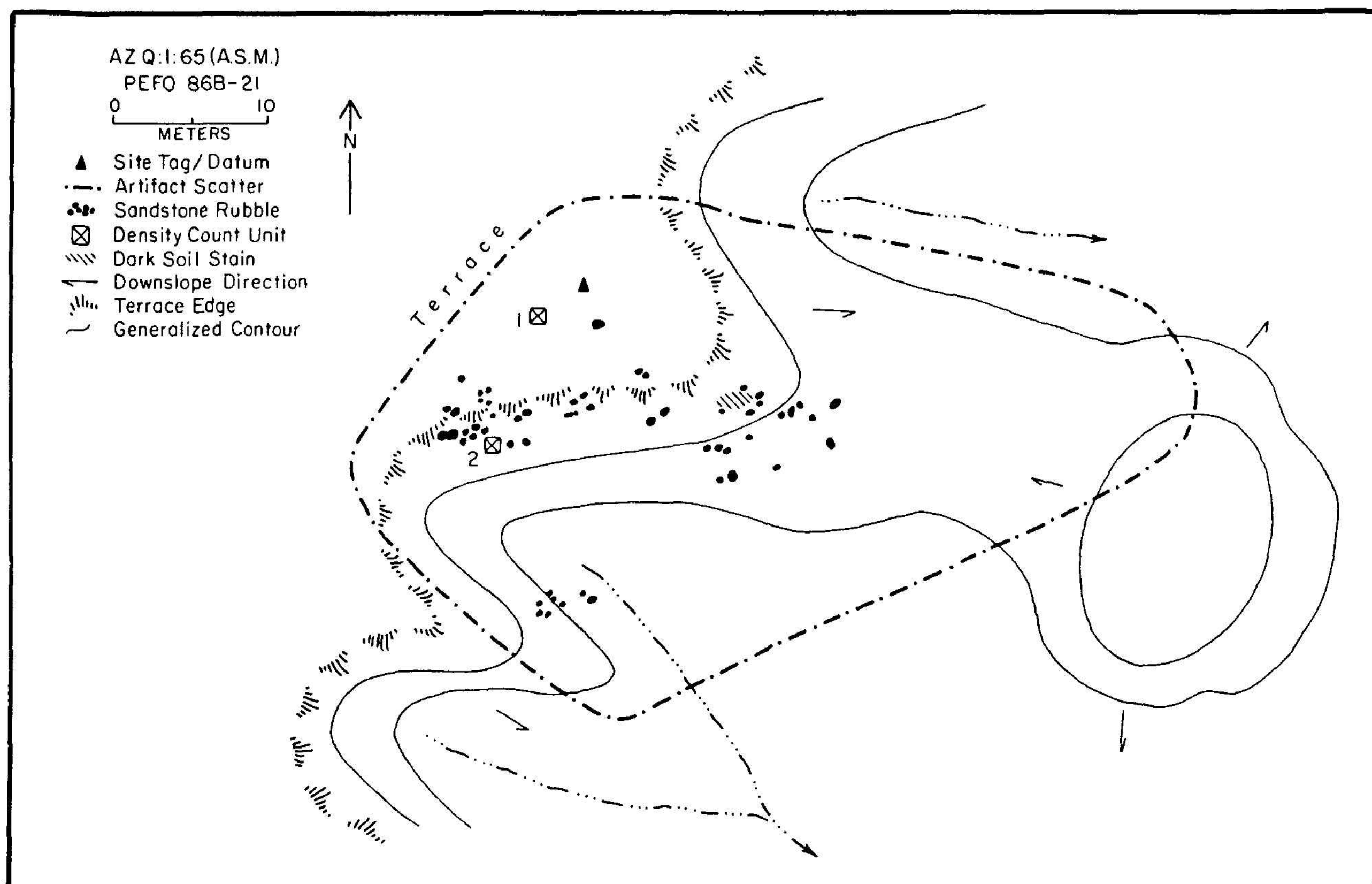


Figure 7.4 AZ Q:1:65. Pithouse/slab feature site.

averaging 5 m by 5 m in area. Many of the features also have black soil stains associated with them. The feature at AZ Q:1:57 has a 75 cm diameter black stain that may represent a hearth or pit.

AZ Q:1:60 is a large pithouse village site with a distinct feature area (40 m by 30 m) with eight slab features, a dark soil stain, a ground stone cluster and a dense artifact scatter. One feature has five upright slabs. AZ Q:1:86 has two distinct localities, one with all the structures and one containing artifacts and a few isolated slabs. There are undoubtedly buried features at most or all of the sites.

Artifact scatters are associated with all the slab concentrations, ranging in size from 288 square meters (AZ Q:1:57) to 35,000 square meters (AZ Q:1:60) (mean = 6,900 square meters; median = 952 square meters). Artifacts are usually evenly dispersed; however, they are

concentrated around the slab features at AZ Q:1:60 and 86. Ceramics, flaked stone and ground stone are present on all sites, ranging from 15 (AZ Q:1:63) to 5,022 artifacts (AZ Q:1:60) (mean = 978; median = 225 artifacts). A variety of ceramic types were identified, with a mean of 528 and median of 90 sherds. Bone was noted at AZ Q:1:60.

Flaked stone is predominantly petrified wood, with some cobble chert and quartzite (lithics: range = 4 to 2,000; mean = 444; median = 150). The flaked stone assemblage includes hammerstones (AZ Q:1:60, 65 and 89), cores (AZ Q:1:60 and 65), projectile points (AZ Q:1:57 and 60) and a scraper (AZ Q:1:86).

Ground stone tools include manos (AZ Q:1:60, 64, 65, 86 and 89) and metate fragments (AZ Q:1:57, 60, 63, 65 and 86). A stone bowl fragment and a perforated shaped sandstone slab were found AZ Q:1:60, which has 22 pieces of ground stone, more than any other site in the survey. Sandstone is the most commonly used ground stone material, but quartzite was also noted.

Although the range and mean values (see Table 7.3) are skewed because of AZ Q:1:60, the median values for ceramics, lithics and total artifacts are quite similar to those for single-room masonry sites. However, pithouse/slab feature sites have more ground stone and a lower median artifact density. The maximum artifact density ranges from 12 to 30 artifacts per square meter, with an average of 19 and median of 16.5 (see Table 7.3).

The pithouse/slab feature sites are generally earlier than the masonry sites. All of them have Basketmaker III or Pueblo I ceramics, which include Lino Gray and Woodruff Brown, as well as White Mound, Kiatuthlanna and Kana'a black-on-white types. Other decorated ceramics and corrugated plainwares dating to the Pueblo II period occur on five sites. Some Pueblo III sherds were identified at AZ Q:1:60, making it the site with the longest occupation in this class.

Three sites have evidence of historical use or disturbance. AZ Q:1:57 has an oblong depression covered by a sheet of corrugated tin with sandstone slabs at both ends. This feature is believed to be the grave of a Mr. Rennecker, who died circa 1940, according to Ranger George Johnson (Hammack 1979:56). One of the slabs at the head of the grave is a metate, indicating that the slabs probably came from the

prehistoric slab feature. AZ Q:1:86 has an oblong depression with milled timber lying in it and a second round depression with no artifacts. Historical trash was also noted at AZ Q:1:63.

Artifact Scatters

Seven sites were classified as artifact scatters (AZ K:13:12 and 64; AZ Q:1:90, 93, 95, 97 and 148) (see Table 7.2). Although sandstone slabs or large petrified wood chunks are present at all of these sites, there are too few pieces to place the sites in one of the surface feature categories. However, structures or features probably existed at one time. These sites may have pithouses, slab storage bins, or one- or two-room masonry structures that have been buried or eroded. The ceramic dates for these sites may provide a clue to the types of features to expect.

The sherds indicate Pueblo II occupation at all sites. Earlier Basketmaker III sherds are found at AZ Q:1:48. The ceramic assemblage at AZ Q:1:95 is almost entirely Pueblo I, which is highly unusual for Petrified Forest sites. Pueblo III ceramics were collected at AZ Q:1:90, 93 and 97, and early Pueblo IV sherds were recovered from AZ Q:1:97.

Two of the sites (AZ Q:1:95 and 97) have petrified wood and/or sandstone rubble features, but natural outcrops of the material within the site boundaries make verification impossible without excavation (Fig. 7.5). However, artifacts are concentrated around the rubble in two places at AZ Q:1:97. The remaining five sites have from one to three small sandstone slabs in areas where there are no natural outcrops. At three of these sites (AZ K:13:12 and 64; AZ Q:1:93) the few pieces of sandstone are in a line, as if part of a wall; at two sites (AZ Q:1:90 and 93) artifacts are heavily concentrated around the rubble. Excavation would be necessary to determine the nature of these possible features.

The artifact scatters range in size from 352 square meters (AZ Q:1:93) to 2,200 square meters (AZ Q:1:97) with 65 (AZ K:13:64) to over 1,650 artifacts (AZ Q:1:97) (mean = 521, median 201) (see Table 7.3). Ceramics and lithics are present at all sites, with flaked stone

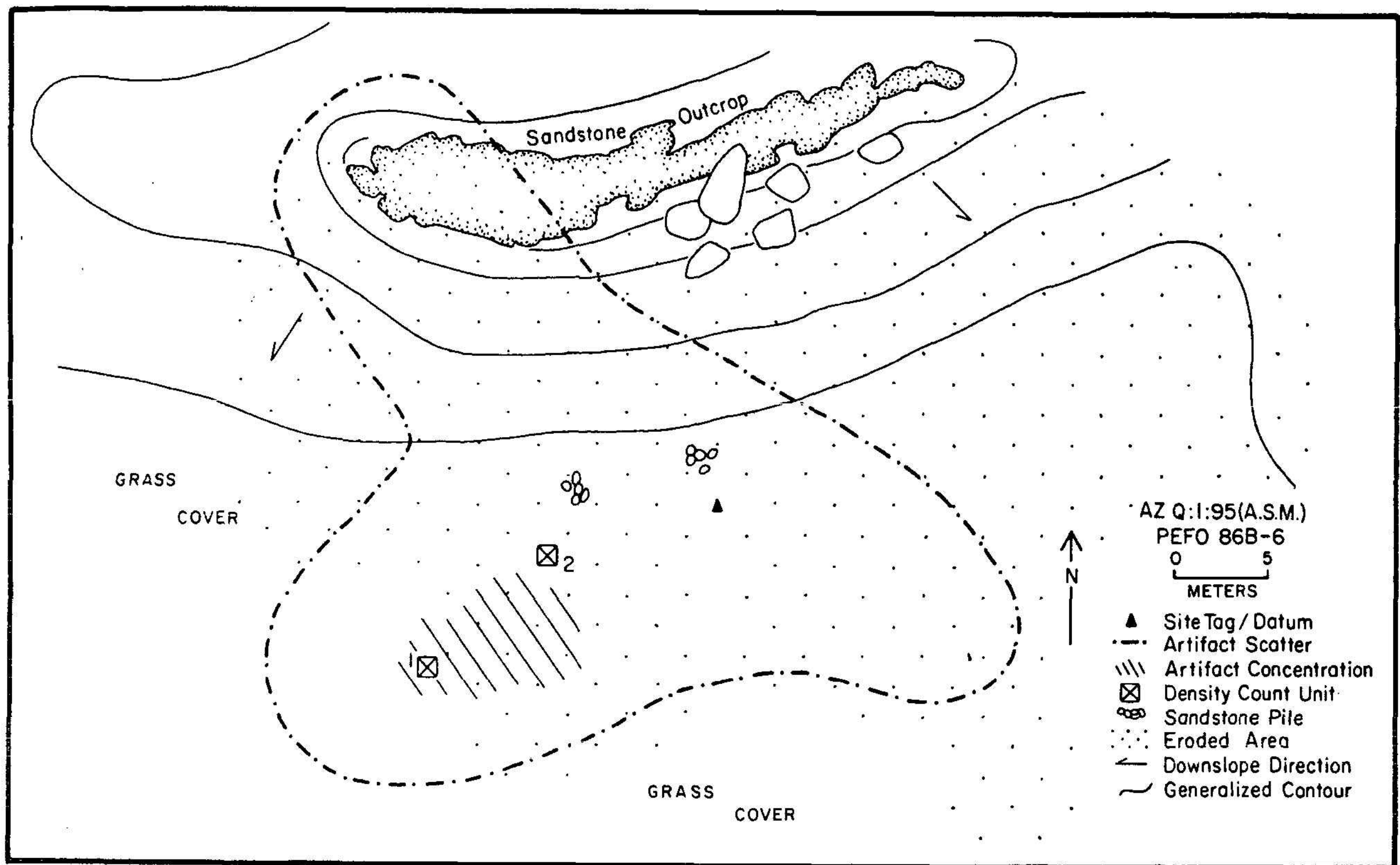


Figure 7.5. AZ Q:1:95. Artifact scatter.

generally more plentiful. This is especially true at AZ Q:1:97, because of its proximity to the Rainbow Forest quarry site.

Ground stone, a mano (AZ K:13:12) and an unidentified fragment (AZ Q:1:93), was present at only two sites. Other artifacts noted include hammerstones (AZ Q:1:97), cores (AZ Q:1:95 and 97) and scrapers (AZ Q:1:90). Hammack (1979) collected a point and biface from AZ K:13:12.

This class of sites has the lowest mean values for site size, chipped stone, ground stone and total number of artifacts, and the lowest median values for all artifact classes (see Table 7.3). The

maximum artifact density for artifact scatters ranges from 5 to 74 artifacts per square meter, with a mean of 23 and median of 11. The mean artifact density is higher than that for single-room masonry sites and pithouse/slab feature sites, but the median value is lowest for this class of sites. The overlap of the statistics for artifact scatters with the statistics for sites with masonry features suggests that at least some of the artifact scatters may have buried structures.

Historical trash was noted at AZ Q:1:97, which is near a historical site (AZ Q:1:100). Modern trash and telephone line debris were found on AZ K:13:64, which is located at the edge of the Interstate-40 right-of-way.

Rock Art

On the south face of the rock outcrop at AZ Q:1:99, 5 m south of the rubble pile, is a single petroglyph panel with two prehistoric elements and a modern element (Figs. 7.6 and 7.7). The prehistoric elements consist of a human figure and a geometric design. The anthropomorph has an elongated body; it is standing with one hand raised and the other holding a staff. There are noticeable protrusions on either side of its head, perhaps ears or some type of headwear. To the right of the figure is an oval geometric design that looks like a shield. The design style of the petroglyphs and the ceramics onsite date to the Pueblo II and Pueblo III periods (Martyneec 1985:72).

On the left side of the panel there is a modern pecked design that has a face in profile (with an eye and ear) and the name "A. H. Zamora" beneath it. It was undoubtedly placed there by a visitor. The recent vandalism does not disturb the prehistoric design, but the older petroglyphs are starting to fade and weather.

Historical Site

A single historical site, AZ Q:1:100, was recorded on the floodplain of Jim Camp Wash near the Rainbow Forest residential area. The site lies 150 m southeast of the present Fred Harvey concession operation and may represent early National Park Service or Fred Harvey

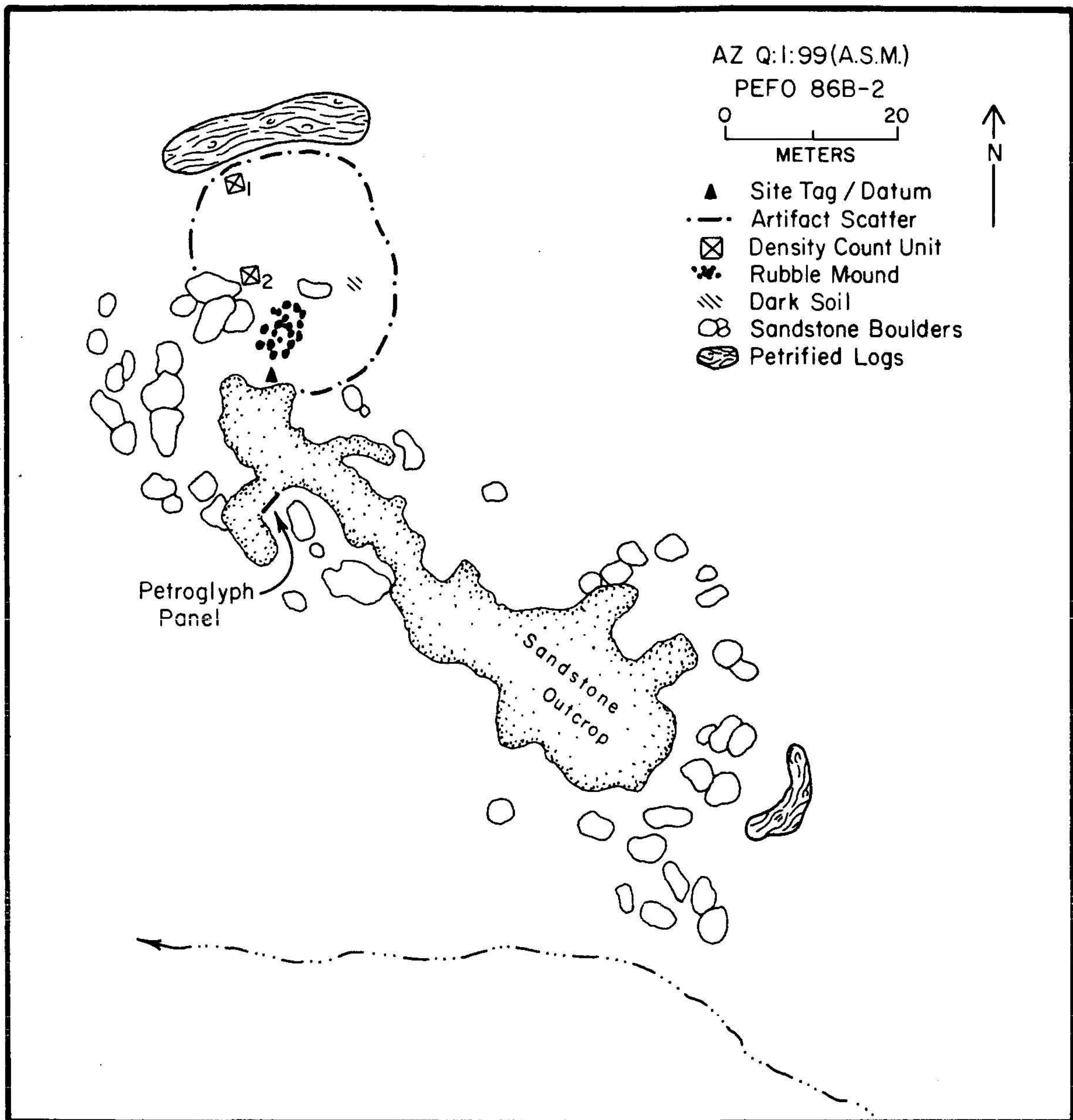


Figure 7.6. AZ Q:1:99. Masonry room site with rock art.

use of the park, or perhaps an early homestead or way station. The site consists of a petrified wood foundation surrounded by a very light scatter of artifacts 55 m north-south by 45 m east-west. A road bisects the scatter, running just west of the structure. A recent erosional channel runs down the road (Fig. 7.8)

The foundation consists of a single course of upright petrified wood log segments placed side by side. It is rectangular, approximately 6 m by 4 m, aligned roughly east-west, and open to the east. A pile of disturbed log segments in the southeast corner of the structure suggests

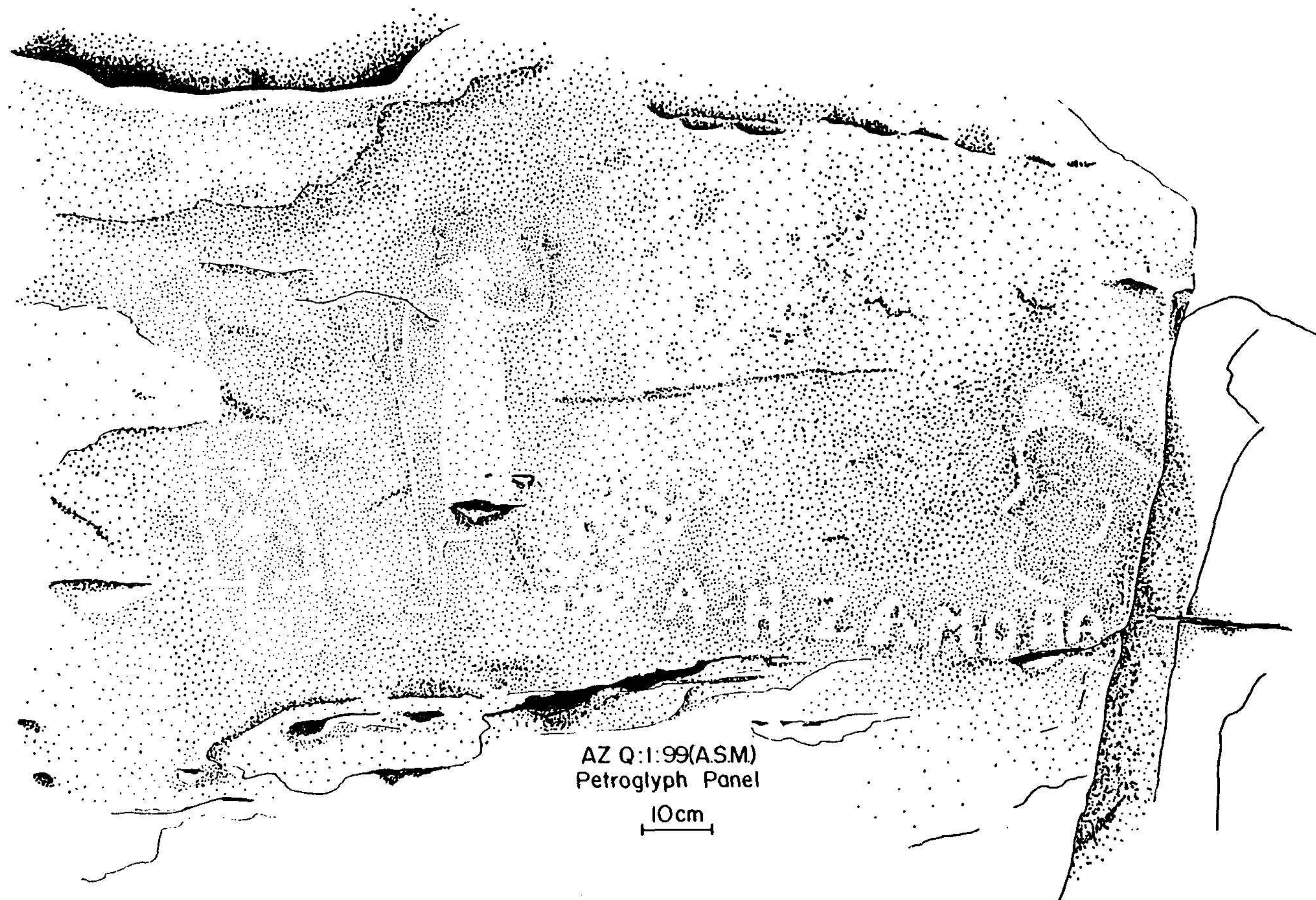


Figure 7.7 AZ Q:1:99. Rock art panel with two prehistoric elements, anthropomorph and geometric design, as well as historic profile and name.

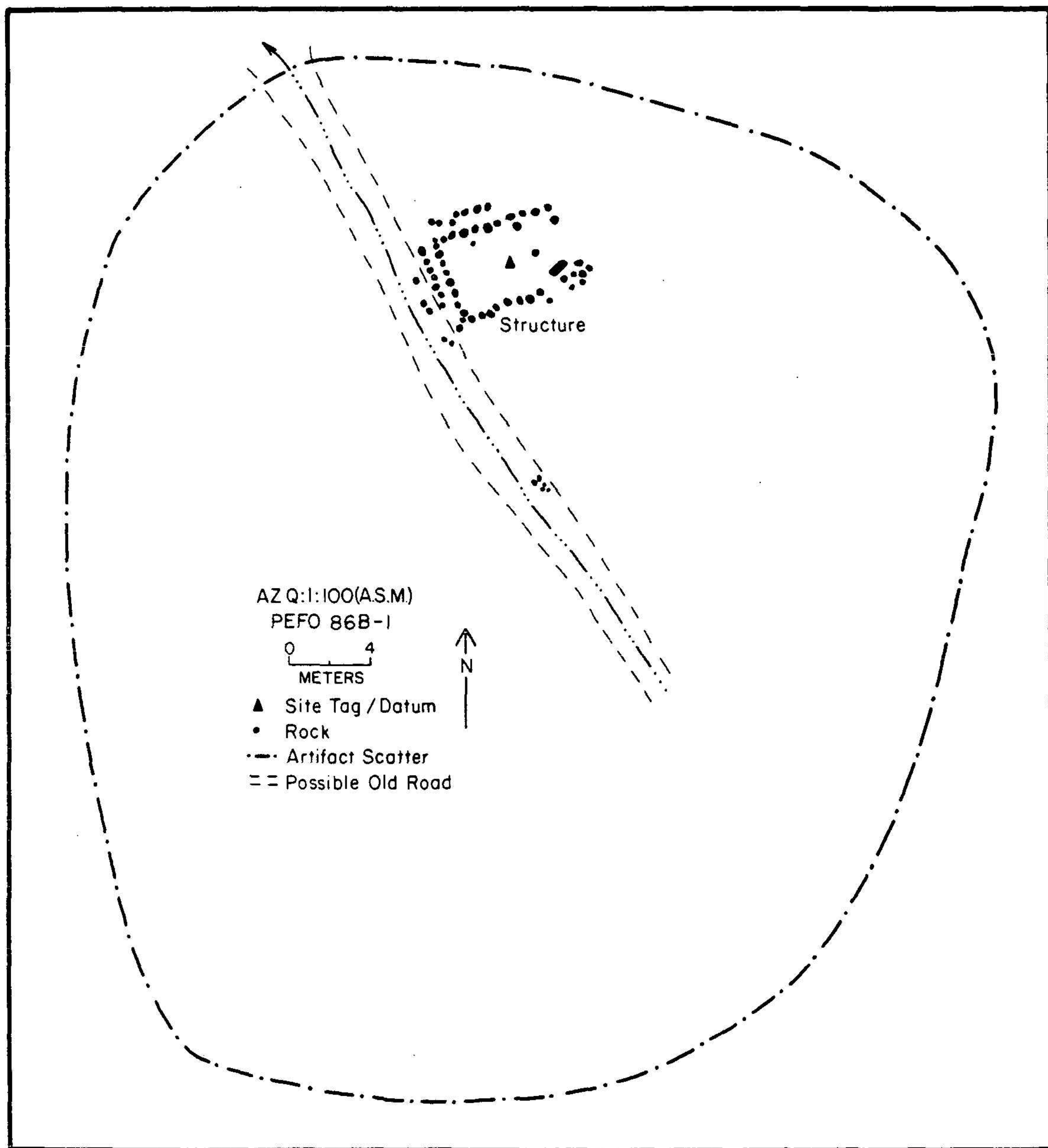


Figure 7.8. AZ Q:1:100. Historical site.

that part of the east side may have been closed at one time. Two partial walls also lie 50 cm outside the foundation along the north and west walls of the northwest corner. The function of these walls is unknown; they may represent remodeling or stabilization events, or may even be small benches. A cluster of petrified wood chunks, 50 cm in diameter, lies 8 m south of the structure in the old road. Milled timber in and around the foundation suggests a wooden superstructure.

A diverse assortment of cultural material was found, primarily to the south of the structure. There were ceramic fragments; glass from culinary, household, liquor and patent medicine bottles; various metal objects, including horseshoe fragments, wire fasteners, baling wire, cast iron stove parts and miscellaneous hardware fragments; five calibers of cartridges, including .45, .38, .44, .38-55 and .22; square and wire nails; solder-seam and a few crimped-seam cans (including meat tins); clothing items such as buttons, buckles and shoe leather; and milled timber. Glass dominates the assemblage (approximately 75 percent); it is mostly sun-colored amethyst (SCA) with lesser amounts of brown, light green, aqua and clear glass present. Tin food cans were the most abundant metal artifact present, suggesting a domestic use for the structure. The number and different styles of large-caliber cartridges might also indicate a homestead where weapons would have been needed for hunting or defense. The artifacts point to site use between 1880 and 1950, but the predominance of sun-colored amethyst glass, solder-seam cans, square-cut nails, and the early dates of the cartridges suggest a primarily late 19th century use of the site.

Historical artifacts were also present at seven prehistoric sites (AZ K:13:10; AZ Q:1:57, 63, 86, 97, 99 and 149). These occurrences include the historical grave at AZ Q:1:57, milled boards at AZ Q:1:63 and 86, and the historical or modern rock art at AZ Q:1:99. Modern disturbance due to telephone line construction and the Interstate-40 right-of-way was noted at AZ K:13:64.

Isolated Finds

Fourteen isolated finds or nonsite artifact scatters were located during the survey (Table 7.4). It should be noted that these scatters

Table 7.4
PEFO 86B WATER SYSTEM SURVEY

ISOLATED FINDS

<u>IF NUMBER</u>	<u>INVENTORY</u>	<u>SURVEY AREA</u>
PEFO 86B-IF-1	4 or 5 corrugated sherds	Area 4
PEFO 86B-IF-2	Single sherd disk	Area 3
PEFO 86B-IF-3	Potbreak--20 sherds	Area 3
PEFO 86B-IF-4	Sandstone, sherds, flakes	Area 3
PEFO 86B-IF-5	Sherds, flakes, mano	Area 3
PEFO 86B-IF-6	Sandstone slabs, sherds	Area 1
PEFO 86B-IF-7	Sandstone, sherds, flakes	Area 1
*PEFO 86B-IF-8	Sandstone slabs, artifacts	Area 1
PEFO 86B-IF-9	Sandstone slab checkdam	Area 2
PEFO 86B-IF-10	Sandstone, flakes, sherds	Area 3
PEFO 86B-IF-20	Sandstone, flakes, sherds	Area 1
PEFO 86B-IF-21	Sandstone, flakes, sherds	Area 1
PEFO 86B-IF-22	Core and hammerstone	Area 1
PEFO 86B-IF-23	Sandstone, sherds, flakes	Area 1

* This isolated find may be the same locus as PEFO 79A-44, which was assigned the ASM site number AZ K:13:37. According to our definition of sites, it was recorded here as an IF, not a site.

are numbered from 1 to 10 and 20 to 23. Ten of these small scatters have a few small sandstone slabs in association with a few artifacts (PEFO 86B-IF-4 to 10, 20, 21 and 23); because these finds occur in areas of sand dunes, it is possible that the small sandstone fragments represent buried features. In fact, a similar scatter, identified as a site by Hammack (1979), was tested by Jones (1986). A hearth and a number of artifacts were recovered. Although not accorded site status, it is recommended that these loci be tested if they are to be impacted by construction activities.

The other finds are true isolates: PEFO 86B-IF-1 and 3 are small clusters of ceramics, PEFO 86B-IF-2 is a single sherd disk and PEFO 86B-IF-22 is the location of a core and a hammerstone in disturbed context.

Chapter 8

MANAGEMENT RECOMMENDATIONS FOR THE WATER SYSTEM ALTERNATIVES AND FUTURE PROJECTS IN SELECTED AREAS

by

Susan J. Wells

This chapter is designed to stand alone as a management document for the proposed Water System Project. In addition, it is hoped that by summarizing the archeology of four previously developed areas where considerable archeological survey has been done, this chapter will be useful to planners of future projects.

It is important to establish the two frames of reference used throughout this chapter; these are the four archeologically surveyed areas versus the four potential construction zones. The four surveyed areas, 1 to 6 square miles in size, are arbitrarily defined areas that surround each of these potential construction zones; Figure 8.1 shows the location of these areas in the park. Three of these areas (Areas 1, 2, and 3) are north of the Puerco River and the fourth (Area 4) is in the vicinity of the Rainbow Forest headquarters area. Arizona State Museum site numbers are used to refer to sites.

The four potential construction areas are small, bounded parcels specified by the Denver Service Center (DSC). The three construction alternatives for the Petrified Forest water system improvements take place in one or more of these parcels. In addition to construction of one or more water treatment plants, parts of the water pipeline and sewer system are scheduled for replacement.

The organization of this chapter is as follows: the locations of the four surveyed areas and the four proposed construction zones within those areas are presented first. The three construction alternatives and proposed work on the water- and sewerlines are then discussed. Archeological data for each of the surveyed areas are presented and potential impacts of the various construction alternatives discussed. The final section of this chapter is a summary of potential impacts to archeological sites of the construction alternatives, and the waterline and sewer system improvements.

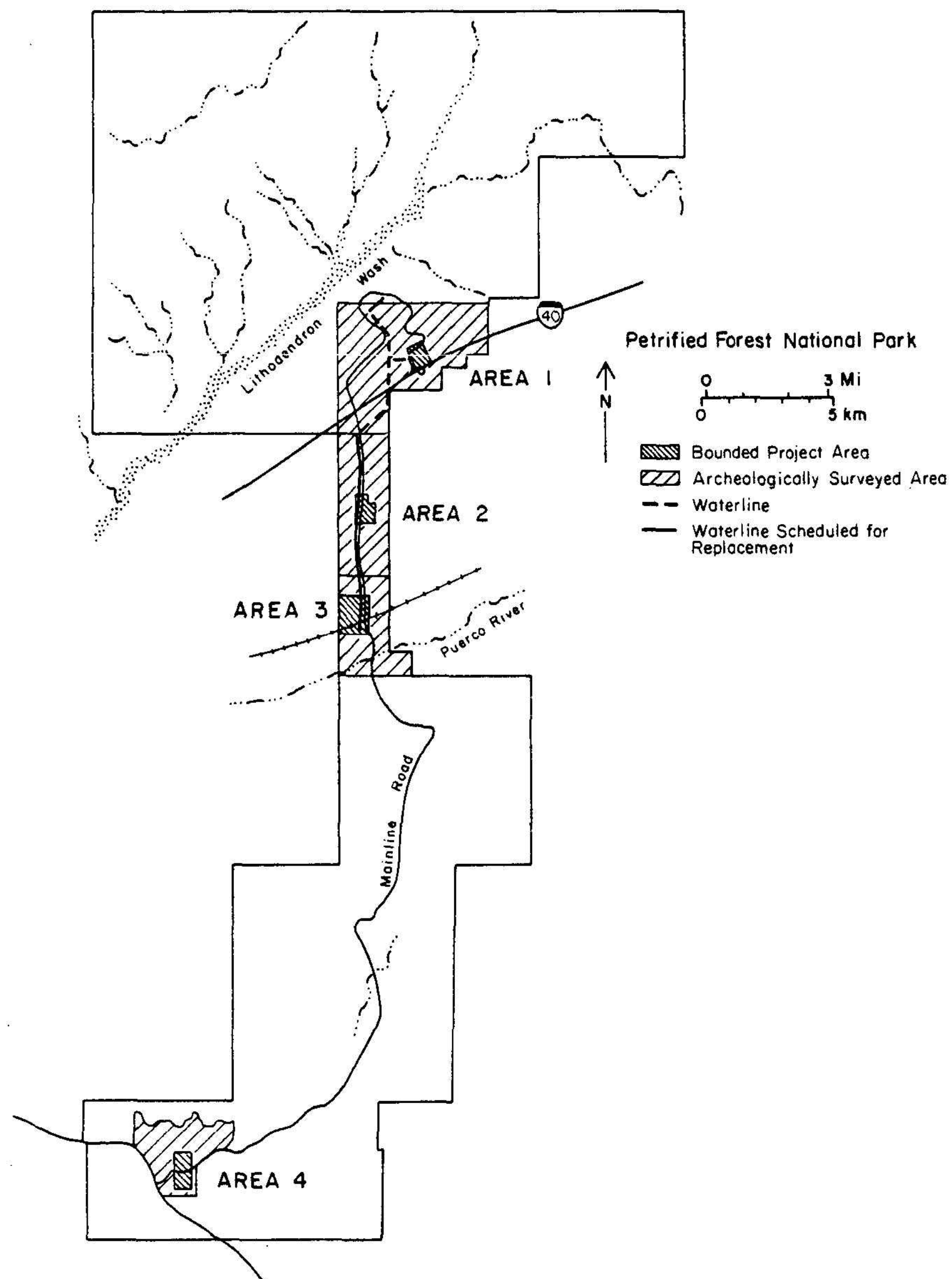


Figure 8.1 Four proposed water system project areas under discussion.

Surveyed Areas

There are maps in this chapter for each of the four survey areas showing survey coverage and indicating which survey project covered the terrain. The construction zones outlined by DSC area also shown on these maps.

Area 1

Area 1 includes approximately 6.5 square miles at the north end of the Mainline Road loop (Fig. 8.2). The road and the area inside the upper loop were surveyed by Hammack in 1979 (PEFO 79A: Hammack 1979). The Boundary Fence Survey (PEFO 86A) follows a quarter-mile corridor along the eastern park boundary. An irregularly shaped block on the east side of the Painted Desert developed area and parts of the waterline were surveyed by the PEFO 86B crew. Figure 8.2 shows where survey boundaries overlap in some places. The proposed project area for construction alternatives B and C is in and around the headquarters and residential area.

Area 2

Located directly south of Area 1, Area 2 is in a narrow section of the park that is only 1 mile wide. Survey coverage of the three 1-square-mile sections is shown in Figure 8.3. Four different survey projects have been conducted in Area 2: PEFO 79A, PEFO 85B, PEFO 86A and PEFO 86B. The construction zone is in the vicinity of the borrow pit.

Area 3

Just to the south of Area 2, the 2.25 square miles of Area 3 include the Puerco River, Puerco Well No. 2, the railroad right-of-way and Puerco Ruin. Figure 8.4 shows the area that has been surveyed by crews from PEFO 79A, PEFO 86A and PEFO 86B. The project area extends north and west of the well.

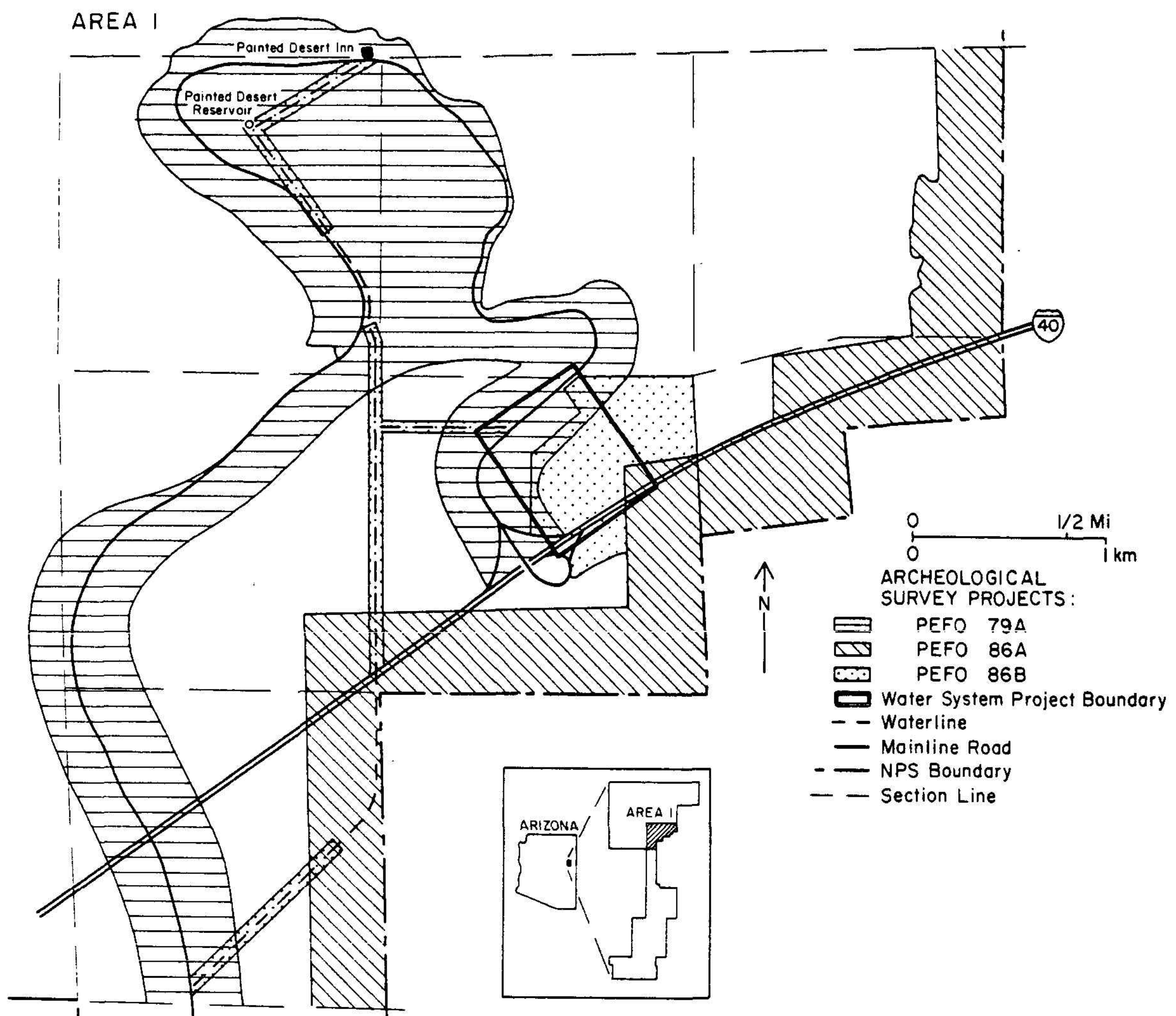


Figure 8.2 Survey coverage of Area 1 and waterline.

Area 4

Approximately 1 square mile has been surveyed in and around the Rainbow Forest developed area. Figure 8.5 shows the extent of surveys done by PEFO 78A, PEFO 85B and PEFO 86B. The project area includes the residential area and the sewage lagoons.

Construction Alternatives

The construction alternatives for improving the water system at Petrified Forest National Park involve four discrete locations in the

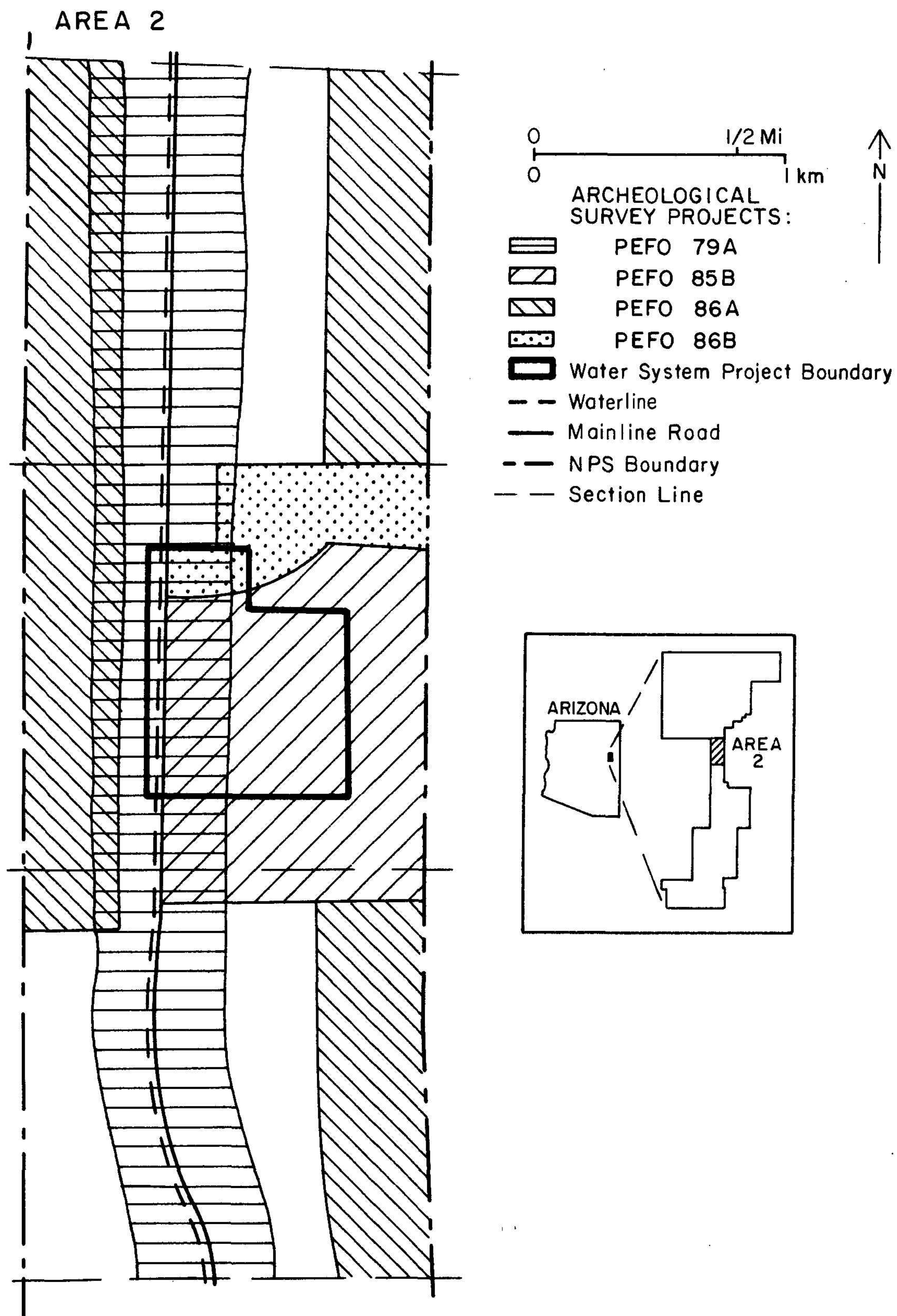


Figure 8.3 Survey coverage of Area 2 and waterline.

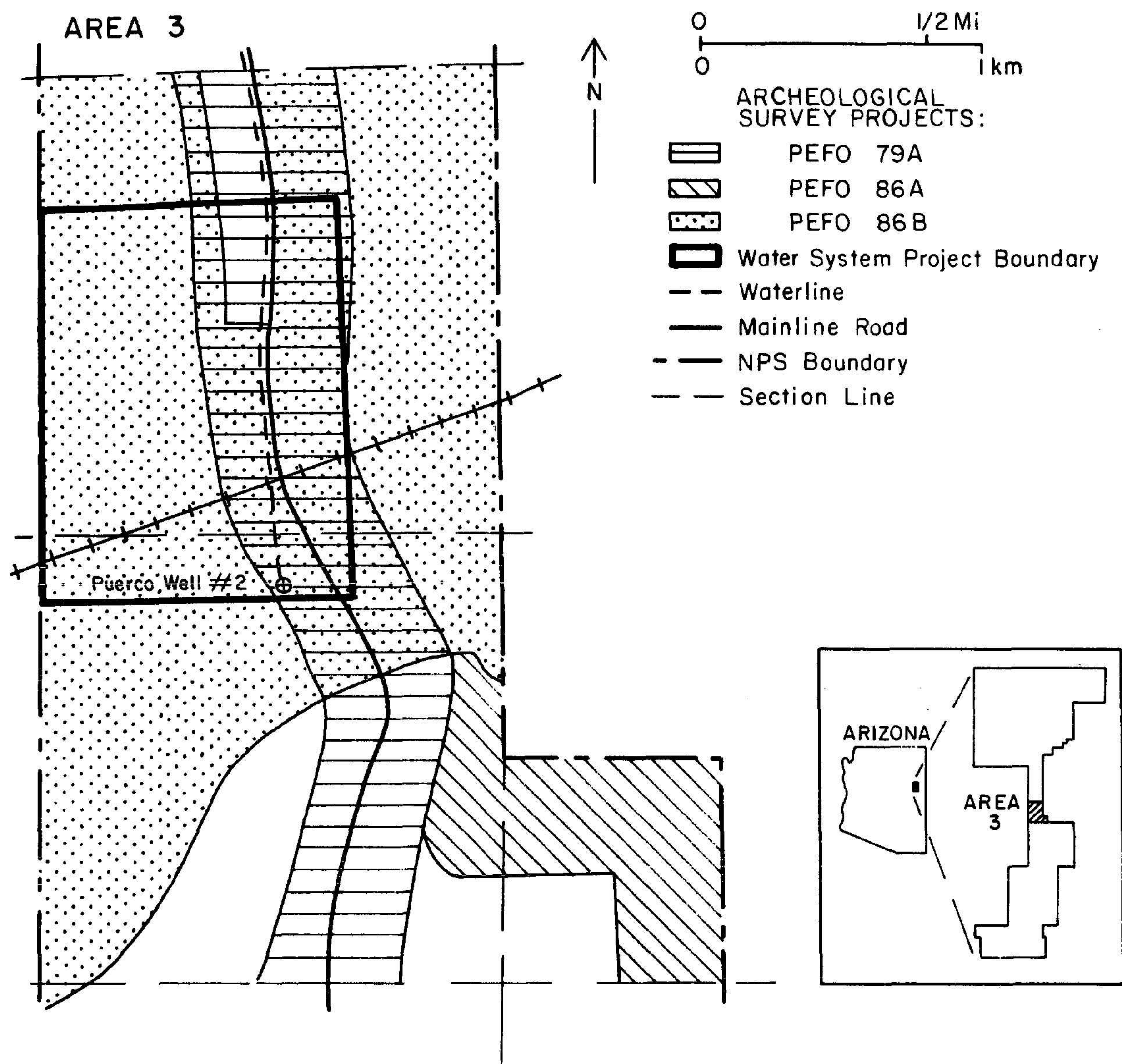


Figure 8.4 Survey coverage of Area 3 and waterline.

park. Replacement of several segments of pipeline and upgrading the sewer systems at the Painted Desert and Rainbow Forest developed areas are also planned. All acreage within the proposed project areas was surveyed by the Water System Project (PEFO 86B) or by earlier archeological surveys (PEFO 78A and 79A: Hammack 1979; PEFO 85A, 85B and 86A: this volume).

Buffer zones adjacent to the project areas were also surveyed, their boundaries determined by natural features such as drainages or by

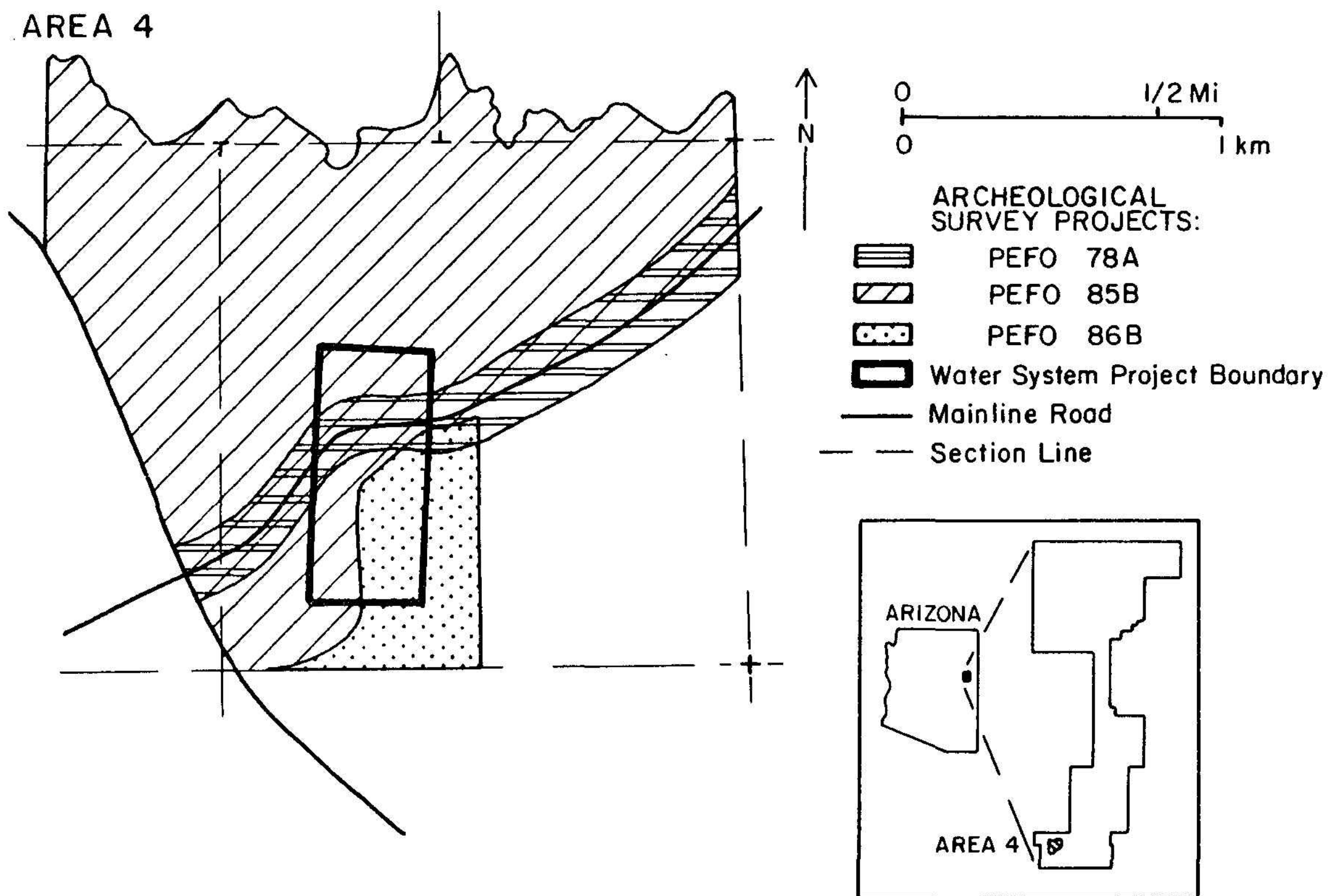


Figure 8.5 Survey coverage of Area 4.

manmade features such as roads and fences. This has already proven useful because the most recent plans submitted to WACC for the water treatment plant have the access road lying outside the original parcel specified by DSC for Area 3 but within the buffer zone surveyed by PEFO 86B.

Water System Project Areas

There are three alternatives for the proposed Water System Project at Petrified Forest. Construction Alternative A involves surveyed areas 2 and 3. Alternatives B and C would impact both the Painted Desert and Rainbow Forest developed areas, archeological survey areas 1 and 4. Pipeline work will occur in survey areas 1, 2 and 3. Improvement of the sewer system will be in survey areas 1 and 2.

Alternative A

Alternative A, the installation of one water treatment plant north of Puerco Well No. 2 and the repair of approximately 7.1 km (4.4 miles) of the trans-park waterline, is the preferred alternative.

Option 1

Option 1 of this alternative is to place the plant 1.3 km (0.8 mile) northwest of Puerco Well No. 2 (Figs. 8.6 and 8.7), within the project boundaries shown for Area 3 in Figure 8.4. Two routes for the access road are being considered for Option 1. The east-west route (see Fig. 8.6) entails construction of a new road 965 m (0.6 mile) long and 3.6 m (12 feet) wide connecting the plant and the Mainline Road. The railroad access option (see Fig. 8.7) has a segment 1.1 km (0.7 mile) long north of and parallel to the Santa Fe railroad tracks, which then turns north for 965 m (0.6 mile) following the boundary fence. Waterlines and powerlines would follow the access roads within a 6 m (20 foot) wide corridor.

Option 2

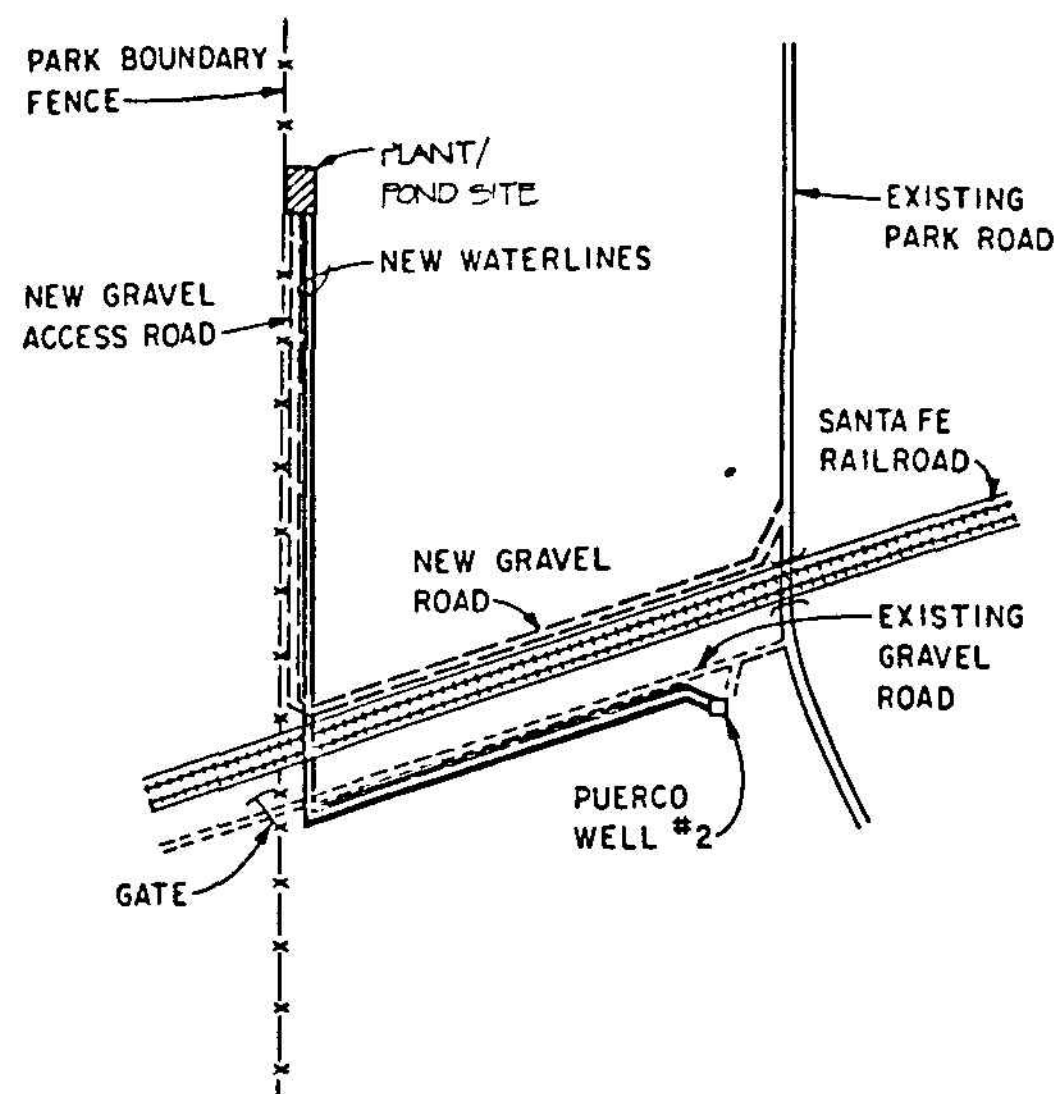
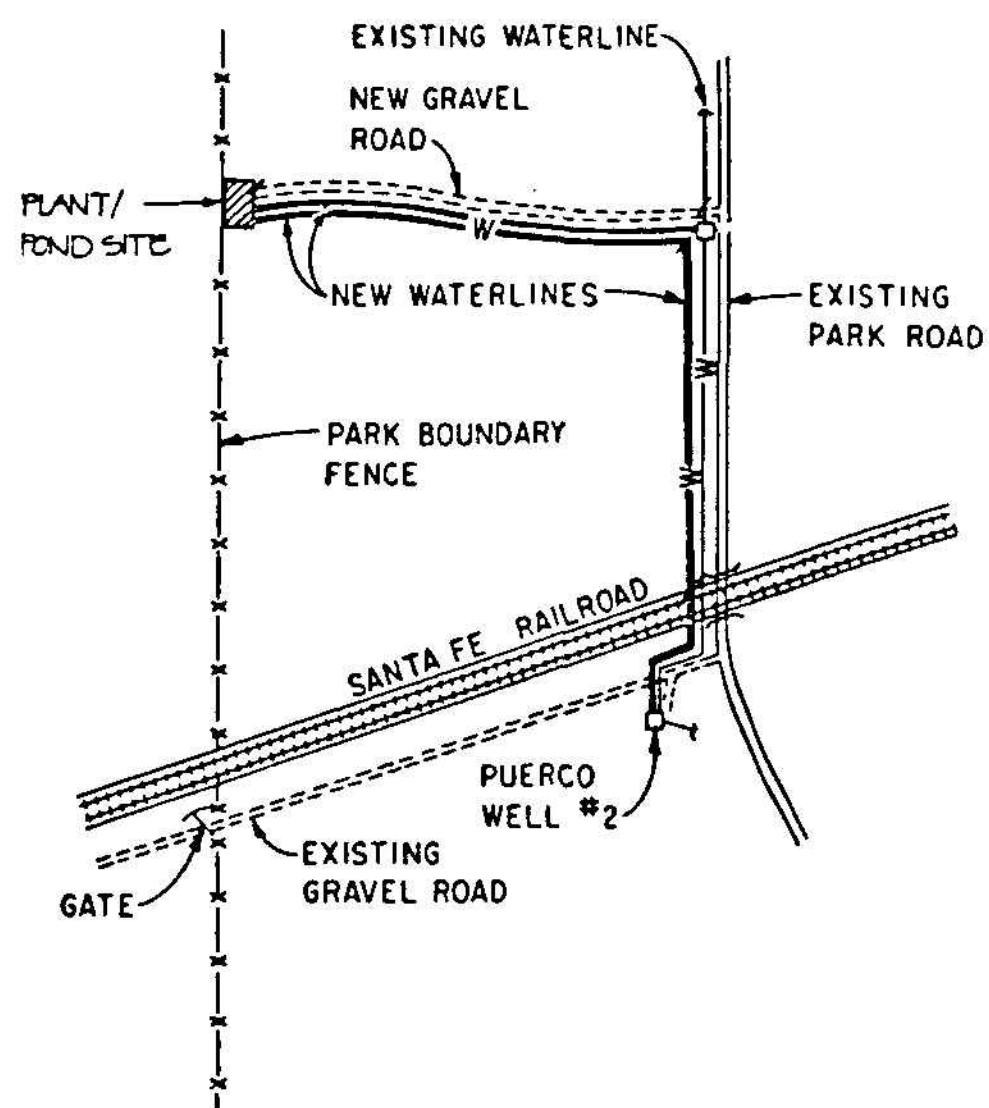
Option 2 is to put the plant 4.3 km (2.7 miles) northeast of Puerco Well No. 2 in the vicinity of the borrow pit (see Figs. 8.3, 8.8). A pipeline from the well to the plant (5 km; 3.1 miles) would be installed on the west side of the road and a powerline placed on the east side of road.

Alternative B

Alternative B is the construction of two treatment plants, one at the Painted Desert and the other at the Rainbow Forest. Water would be provided to Painted Desert headquarters by Puerco Well No. 2 and the repaired pipeline. Water at Rainbow Forest headquarters would be provided by the Rainbow Forest well which is not currently developed for domestic use.

Alternative C

Alternative C involves treatment of drinking water only by constructing two small treatment plants, one at Rainbow Forest and the



ALTERNATIVE A, OPTION 1
(EAST-WEST ACCESS)

1000 0 1000 2000
SCALE OF FEET

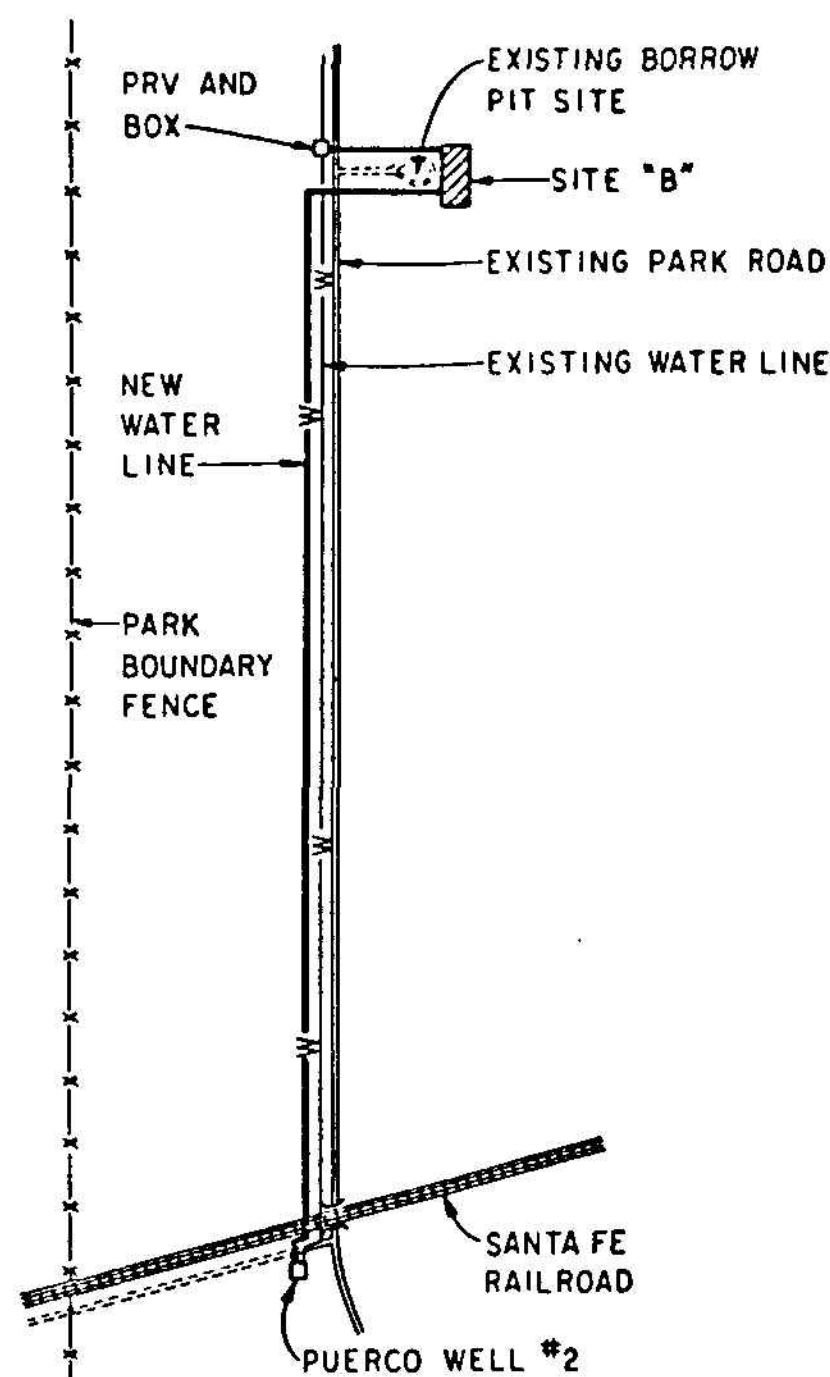


ALTERNATIVE A, OPTION 1
(RAILROAD ACCESS)

1000 0 1000 2000
SCALE OF FEET



Figure 8.6 Construction Alternative A, Option 1, east-west access.
Figure 8.7 Construction Alternative A, Option 1, railroad access.



ALTERNATIVE A, OPTION 2

2000 0 2000 4000
SCALE OF FEET



Figure 8.8 Construction Alternative A, Option 2.

other at Painted Desert. Water to both plants would be provided by a repaired trans-park pipeline. No other access or construction would be required for this alternative.

Waterlines

Repair of the trans-park pipeline is necessary for all construction alternatives. The two segments of pipeline scheduled for replacement are the 7-km (4.4-mile) long segment that goes north from Puerco Well No. 2 along the west shoulder of the Mainline Road and the 1.1-km (0.7-mile) long segment from the Painted Desert Reservoir to the Painted Desert developed area.

If alternatives A or B are chosen, upgrading the water system will require that a second waterline 1.9 km (1.2 mile) long be installed along the route of the existing line between the Painted Desert Reservoir and Painted Desert headquarters.

Sewerlines

All three construction alternatives require the replacement of 1.1 km (0.70 mile) of sewerlines at the Painted Desert Headquarters and 275 m (0.17 mile) of sewerlines at Rainbow Forest (National Park Service 1986:31-32).

Cultural Resources

There have been a number of archeological survey projects conducted in the vicinity of the proposed construction areas for the water system. Rather than just presenting the archeological data for the small parcels specified by the Denver Service Center (DSC), we will present the data for all the surveyed territory north of the Puerco River (surveyed areas 1, 2 and 3) and for the Rainbow Forest developed area (Area 4). Management recommendations for archeological resources in the vicinity of the water system alternatives, the pipeline and sewerlines will be addressed for each surveyed area.

There are several reasons for presenting archeological data for areas larger than the proposed project areas. The first is to show the entire length of the water pipeline scheduled for replacement, which extends from Puerco Well No. 2, located just north of the river, to both Painted Desert headquarters and the Painted Desert Inn. The second reason is to allow some flexibility if redesigned project plans extend outside the parcels originally outlined by DSC. The final reason is that all four proposed plant locations have been disturbed by previous construction and are the areas, particularly the Painted Desert and Rainbow Forest developed areas, most likely to see future construction projects.

The archeological data in this chapter are presented in a series of maps and tables for each of the four project areas. The maps show the location of archeological sites relative to the proposed construction areas. It is hoped that these maps will be useful not only for planners of the new water system, but also for planners of future construction projects.

The tables present archeological data for all sites in the four areas including those recorded by older projects. When available, information on each site includes site area, estimated number of surface artifacts, maximum artifact density per square meter, site type and features present.

These variables provide the means to assess the sites in a qualitative way. For instance, if planners cannot avoid disturbing a site but have the choice of paying for mitigation of impact to (data recovery for) an artifact scatter of 100 square meters with 48 artifacts on the surface versus a masonry room site of 3,800 square meters with 1,000 artifacts on the surface, up to 24 artifacts per square meter, 4 rubble mounds and a trash area the choice seems clear; the smaller site with no features would be less expensive to test or excavate.

Although the tables are designed to be used by planners working in cooperation with archeologists, the archeological staff at the Western Archeological and Conservation Center has access to complete site records and can best determine the site's significance as well as data recovery potential and costs. In all cases, avoidance of sites is the preferred alternative from an archeological point of view.

Isolated finds (IFs) are also included in the tables for each area. They have already been discussed in Chapter 7. It appears that the small artifact scatters with sandstone fragments labeled IFs by the PEF0 86B crew were called sites by Hammack (1979). These sites, or IFs, occur in sand dunes and may have been buried by dune action. One of Hammack's small sites, AZ K:13:13, had 16 artifacts and a few pieces of sandstone on the surface. Limited testing by Jones (1986) consisted of surface collection and excavation of a single 2 m by 1 m test unit, revealing the presence of a hearth and recovering a total of 51 artifacts. Therefore, these sites, although small, may be significant and have the potential to yield information about the past.

The important thing to note in the IF tables for each survey area is whether or not the IF is to be tested. For sparse artifact scatters with a few pieces of sandstone we generally recommend testing to determine the extent of buried deposits. In the case of these IFs, as in the case of archeological sites, avoidance is the preferred treatment.

Area 1

This area is under consideration for construction alternatives B and C, replacement of waterline segments and replacement of sewerlines. The three surveys conducted in Area 1 recorded 26 archeological sites and 7 IFs (Tables 8.1 and 8.2). The sites include 17 artifact scatters; 10 of these have sandstone slabs indicating the potential for buried features. One of the artifact scatters, AZ K:13:19, located within the Mainline Road right-of-way was tested by Jones (1986). There is one pithouse village, one site with a single masonry room and four sites with more than one masonry room. The three remaining sites are historical, one with rock alignments, one with a three-sided foundation and the 35th Parallel Route. The Painted Desert Inn, which is not listed in the site table, is a historical structure listed on the National Register; it is being renovated into a museum for park visitors. Testing is recommended for all but one of the IFs in this survey area (see Table 8.2) because of the presence of artifacts and sandstone slabs in the sand dunes.

Table 8.1
AREA 1: SITES (26)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ K:13:18 PEFO 79A-25	250	--	--	ARTIFACT SCATTER/ Lithic Concentration
AZ K:13:19 PEFO 79A-26	264	20	3	ARTIFACT SCATTER/ Tested PEF0 85A
AZ K:13:20 PEFO 79A-27	100	5	--	ARTIFACT SCATTER
AZ K:13:21 PEFO 79A-28	250	6	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:22 PEFO 79A-29	2,500	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:23 PEFO 79A-30	750	--	--	MASONRY ROOMS (2+)/ Rubble Mounds, Trash Area
AZ K:13:24 PEFO 79A-31	100	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:25 PEFO 79A-32	1,000	--	--	MASONRY ROOMS (2+)/3 Room Outlines, 2 Trash Areas
AZ K:13:26 PEFO 79A-33	48	--	--	ARTIFACT SCATTER
AZ K:13:27 PEFO 79A-34	125	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:28 PEFO 79A-35	80	--	--	ARTIFACT SCATTER
AZ K:13:29 PEFO 79A-36	750	--	--	MASONRY ROOMS (2+)/Rubble Mounds, 3 Trash Areas
AZ K:13:30 PEFO 79A-37	600	--	--	ARTIFACT SCATTER/ Sandstone Fragments
AZ K:13:31 PEFO 79A-38	1,200	--	--	ARTIFACT SCATTER
AZ K:13:32 PEFO 79A-39	275	--	--	ARTIFACT SCATTER

Table 8.1 (continued)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ K:13:33 PEFO 79A-40	8	None	--	HISTORICAL SITE/Rock Alignments-Circle, Cross
AZ K:13:34 PEFO 79A-41	9	--	--	HISTORICAL SITE/ 3-Sided Basalt Foundation
AZ K:13:35 PEFO 79A-42	50	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:36 PEFO 79A-43	75	--	--	ARTIFACT SCATTER/ Sandstone Slabs
*AZ K:13:40 35th Parallel Route	--	--	--	HISTORICAL SITE/ On National Register
AZ K:13:47 PEFO 86A-18	1,200	80	11	MASONRY ROOMS (2+)
AZ K:13:48 PEFO 86A-14	792	41	9	PITHOUSE/SLAB FEATURES/ 3 Pithouses, Slabs, Stain
AZ K:13:49 PEFO 86A-13	924	56	3	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:50 PEFO 86A-12	1,189	40	8	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:53 PEFO 86A-29	784	601	27	MASONRY ROOM/ Rubble Mound, Trash Area
AZ K:13:64 PEFO 86B-33	800	65	5	ARTIFACT SCATTER/ Sandstone Slabs

* = Site in proposed project area
 -- = Data not available

Table 8.2
AREA 1: ISOLATED FINDS (7)

PEFO 86-B IF NO.	INVENTORY	NECESSARY TO TEST?
IF-6	Sandstone slabs, sherds	Yes
IF-7	Sandstone slabs, artifacts	Yes
*IF-8	Sandstone slabs, artifacts	Yes
IF-20	Sandstone, flakes, sherds	Yes
IF-21	Sandstone, flakes, sherds	Yes
IF-22	Core and hammerstone	No
IF-23	Sandstone, sherds, flakes	Yes

* = IF in proposed project area.

Area 1: Alternatives B and C

The proposed project boundaries in Area 1 enclose 116 acres surrounding the Painted Desert developed area (Figure 8.9). There are only two archeological occurrences within the area specified by DSC. These are the 35th Parallel Route, also known as the Beale Camel Trail (AZ K:13:40 [ASM]), and PEF0 86B-IF-8. Neither appear to be located in areas that will be directly impacted by water treatment plant construction.

A 6-mile-long segment of the 35th Parallel Route passes through Petrified Forest National Park. The old wagon road was first surveyed in 1853-1854 by First Lieutenant Amiel Weeks Whipple under contract to the Congress of the United States. The route was one of six transcontinental railroad surveys funded by Congress. The road was later cleared for wagon travel by Edward Fitzgerald Beale's 1857-1858 expedition, which employed camels imported by the U.S. Army (Chappell 1976). The 35th Parallel Route is listed on the National Register of Historic Places (12/6/77). Any action impacting this property will

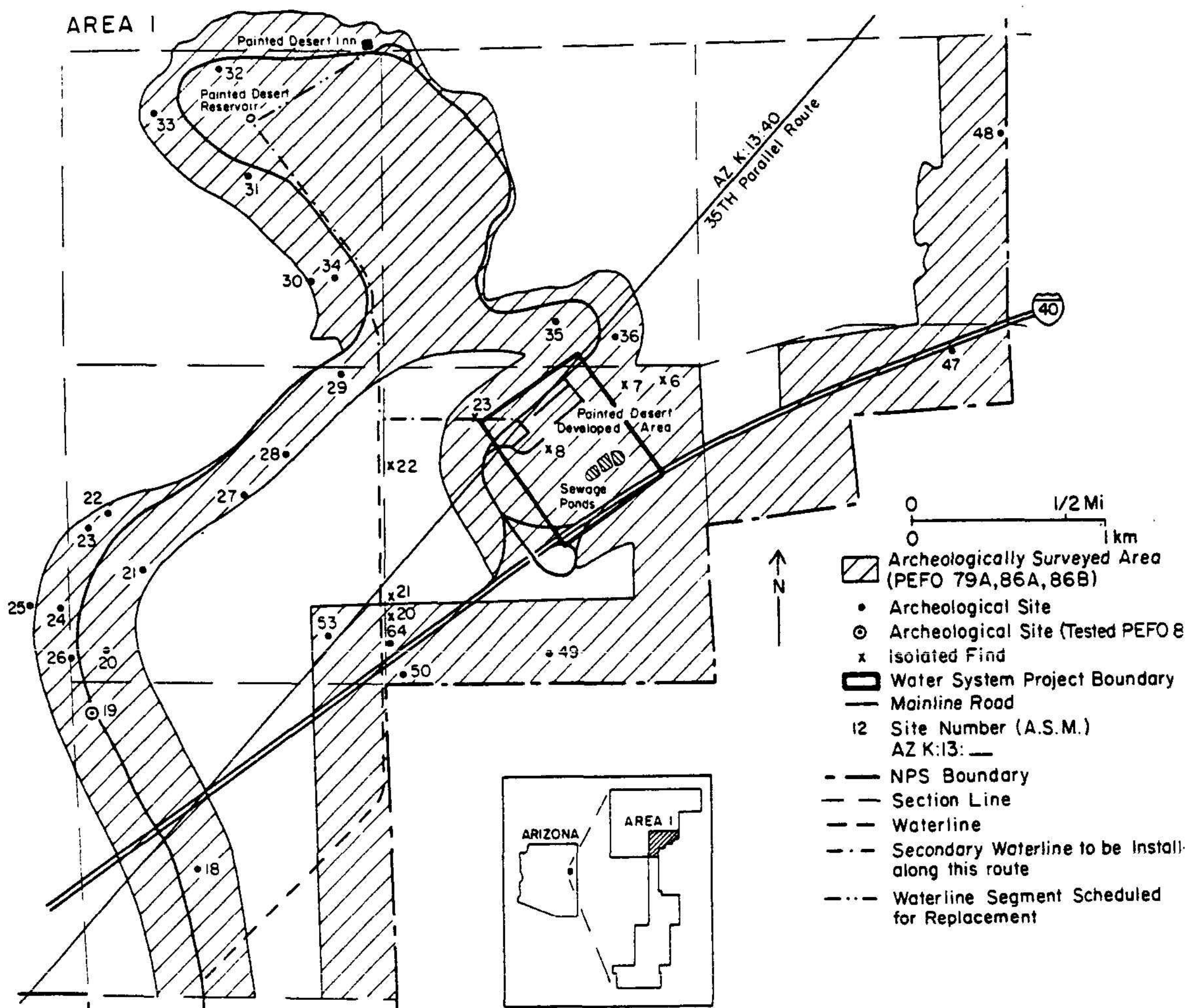


Figure 8.9 Area 1. Location of archeological sites relative to water system project boundaries.

require compliance with Section 106 of the National Historic Preservation Act, as amended in 1980.

PEFO 86B-IF-8 was originally recorded by Hammack (1979) as an archeological site. Different definitions of sites versus isolated finds led the PEFO 86B crew to designate the artifacts and sandstone slabs as an IF, but testing is recommended if there is to be impact to IF-8.

Area 1: Waterline

The 1.1-km (0.7-mile) long pipeline from the Painted Desert Reservoir to the Painted Desert Inn is scheduled for replacement. No

archeological sites occur along the pipeline; however, because the Painted Desert Inn is on the National Register, the planning document for the water system includes recommendations to ensure compliance with NPS-28 guidelines restricting activities at NPS properties on the Register (National Park Service 1986:34).

A second pipeline 1.9 km (1.2 miles) long from the Painted Desert Reservoir to the Painted Desert headquarters will be installed if construction alternatives A or B are chosen. PEF0 86B-IF-23, a light scatter of sandstone slabs and artifacts, occurs within the 50-m-wide, east-west corridor surveyed between the main pipeline and headquarters. This IF should be avoided when the pipe is installed; if avoidance is not possible, testing is recommended. Archeologists from WACC can relocate this IF relative to the pipeline once plans are finalized.

Area 1: Sewerlines

The plans for the sewerline repair at the Painted Desert developed area involve paved and previously disturbed areas. By comparing figures 8.9 and 8.10 it appears that no cultural resources will be impacted by this activity.

Area 1: Notes on Future Projects

It should be noted that two sites and several IFs were recorded in the vicinity of the pipeline south of the east-west line to headquarters. Any future work on the waterline that might impact the 35th Parallel Route (AZ K:13:40) will have to comply with the Section 106 process. AZ K:13:64 is located along the waterline route, just north of Interstate-40. Although already impacted by I-40, a power pole, the access road and possibly the waterline itself, avoidance or testing should be considered. Only two of the IFs along this part of the pipeline will require testing; however, if activities associated with the waterline are restricted to the west side of the access road these IFs will be avoided.

Any future projects that will occur in areas already surveyed, as indicated by the shaded areas in Figure 8.9, can be planned using that figure and Tables 8.1 and 8.2.

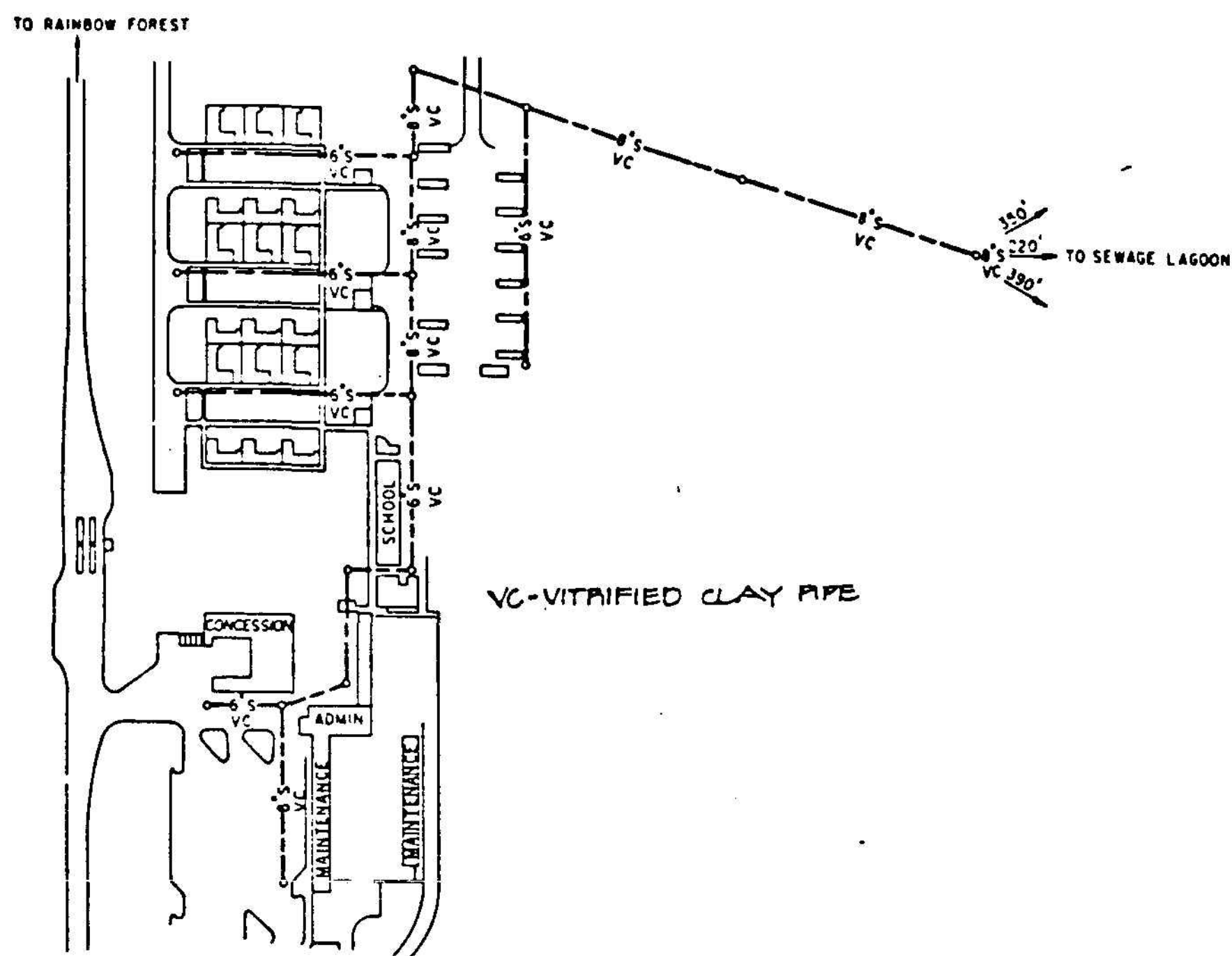


Figure 8.10 Painted Desert sewer system.

Area 2

Thirty sites and an IF were recorded by four archeological survey projects in Area 2 (Fig. 8.11, Tables 8.3 and 8.4). There are nine artifact scatters, one of which, AZ K:13:13, revealed the presence of a hearth when tested by Jones (1986). Only three of the remaining scatters have sandstone slabs on the surface. AZ K:13:60 is a Late Archaic period lithic scatter tested by Tagg (Chapter 9: this volume). There are seven sites with at least one masonry room and nine with two or more masonry structures. PEF0 Site 236 is a great kiva site and there is one rock art site. The single IF has a sandstone slab check dam and testing is recommended.

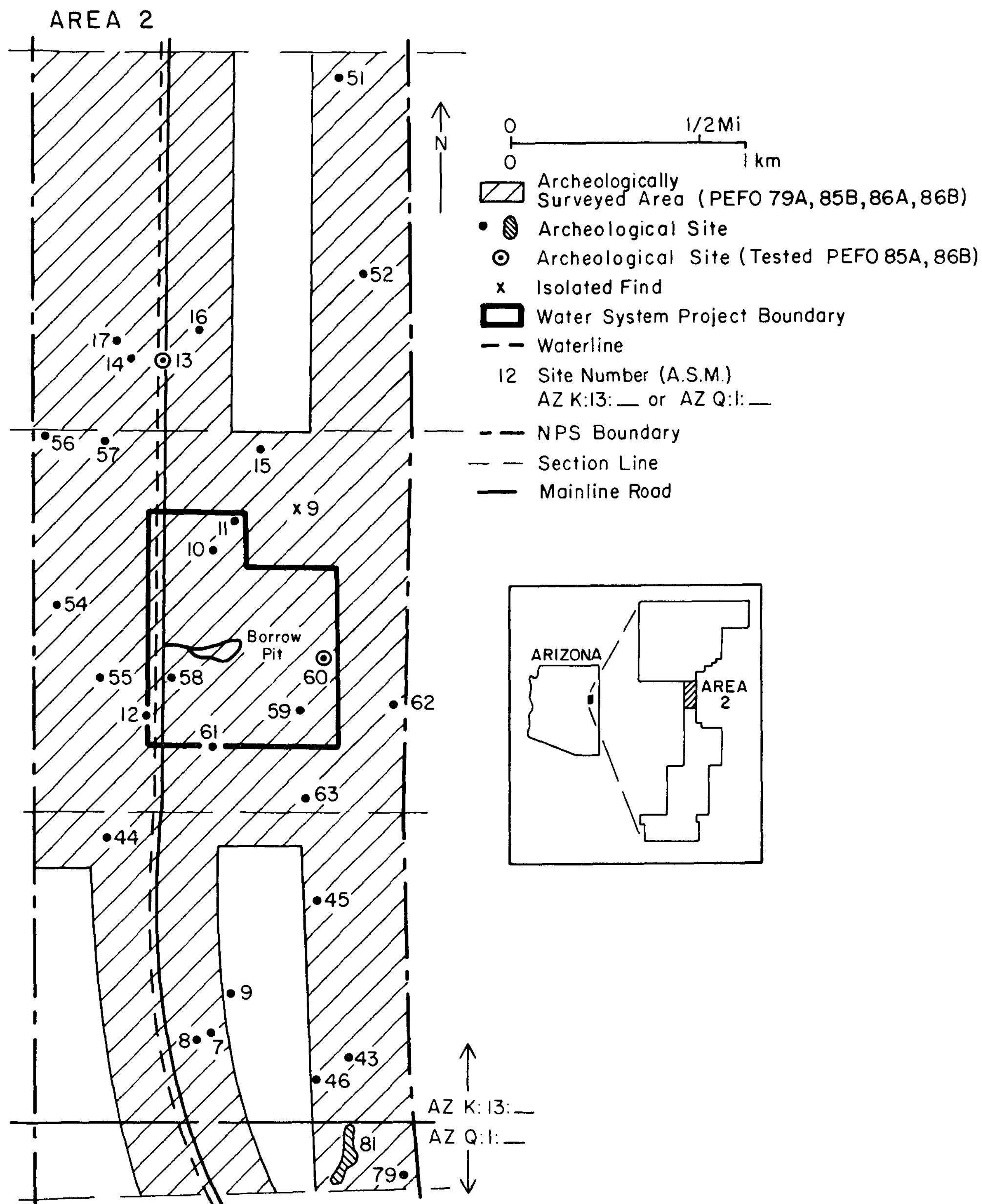


Figure 8.11 Area 2. Location of archeological sites relative to water system project boundaries.

Table 8.3
AREA 2: SITES (30)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ K:13:7 PEFO 79A-14	5	--	--	MASONRY ROOM
AZ K:13:8 PEFO 79A-15	160	--	--	HISTORICAL CORRAL
AZ K:13:9 PEFO 79A-16	3,000	--	--	MASONRY ROOMS (2+)/ Rubble Mounds, Trash Areas
*AZ K:13:10 PEFO 79A-17 PEFO 86B-10	3,850	1,000	24	MASONRY ROOMS (2+)/ Large Rubble Mound, Trash Mound
*AZ K:13:11 PEFO 79A-18 PEFO 86B-11	1,080	1,400	44	MASONRY ROOMS (2+)/ 2 Rubble Mounds
*AZ K:13:12 PEFO 79A-19 PEFO 86B-32	850	200	7	ARTIFACT SCATTER/ Sandstone Slabs
*AZ K:13:13 PEFO 79A-20	72	--	--	ARTIFACT SCATTER/Hearth/ Tested PEFO 85A
AZ K:13:14 PEFO 79A-21	40	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:15 PEFO 79A-22 PEFO 86B-12	1,584	4,500	66	MASONRY ROOMS (2+)/ 2 Rubble Mounds
AZ K:13:16 PEFO 79A-23	400	--	--	ARTIFACT SCATTER/ Sandstone Slabs
AZ K:13:17 PEFO 79A-24 PEFO 86A-30	660	100	26	ARTIFACT SCATTER
AZ K:13:41 PEFO Site 236	5,600	1,625	20	GREAT KIVA SITE/Great Kiva, Room Block, 10 Features
AZ K:13:43 PEFO 86A-27	1,408	235	9	MASONRY ROOM/ Rubble Mound, Trash Area

Table 8.3 (continued)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ K:13:44 PEFO 86A-19	1,184	150	5	MASONRY ROOMS (2+)/Rubble Mounds, Stain, Trash Area
AZ K:13:45 PEFO 86A-17	3,184	1,000	51	MASONRY ROOMS (2+)/3 Rubble Mounds, Trash Area
AZ K:13:46 PEFO 86A-16	2,408	300	26	MASONRY ROOMS (2+)/3 Rubble Mounds, Trash Area
AZ K:13:51 PEFO 86A-11	960	250	6	MASONRY ROOMS (2+)/Rubble Mound, Trash Area
AZ K:13:52 PEFO 86A-10	672	6	1	ROCK ART/3 Petroglyph Panels
AZ K:13:54 PEFO 86A-31	576	14	1	MASONRY ROOM/Rubble Mound
AZ K:13:55 PEFO 86A-20	480	86	5	MASONRY ROOM/Rubble Mound with Wing Wall
AZ K:13:56 PEFO 86A-15	225	209	8	ARTIFACT SCATTER
AZ K:13:57 PEFO 86A-32	624	456	22	MASONRY ROOM/ Rubble Mound, Trash Area
*AZ K:13:58 PEFO 85B-6	1,375	73	--	ARTIFACT SCATTER
*AZ K:13:59 PEFO 85B-7	3,302	210	--	ARTIFACT SCATTER
*AZ K:13:60 PEFO 85B-8	1,330	267	--	ARTIFACT SCATTER/Hearth, Rock Piles, Pits/Tested PEFO 86B
*AZ K:13:61 PEFO 85B-9	1,680	82	--	ARTIFACT SCATTER
AZ K:13:62 PEFO 85B-10	4,025	121	--	MASONRY ROOM/2 Rubble Mounds
AZ K:13:63 PEFO 85B-11	1,440	333	--	MASONRY ROOMS (2+)/ 2 Rubble Mounds

Table 8.3 (continued)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ Q:1:79 PEFO 86A-26	2,700	95	13	MASONRY ROOM/Wall Alignment
AZ Q:1:81 PEFO 86A-28	35,640	4,020	23	MASONRY ROOM (2+)/3 Structures, Stain, 6 Trash Areas

* = Site in proposed project area.
 -- = Data not available.

* * * * *

Table 8.4

AREA 2: ISOLATED FIND (1)

PEFO 86B- IF NO.	INVENTORY	NECESSARY TO TEST?
IF-9	Sandstone Slab Checkdam	Yes

Area 2: Alternative A, Option 2

There are seven sites in the 175-acre parcel under consideration for this construction option--AZ K:13:10, 11, 12, 58, 59, 60 and 61. These sites are denoted by asterisks in Tables 8.3 and 8.4. Although there are no sites within 100 meters of the existing access road and borrow pit, care should be taken when using earth moving equipment to avoid all sites. The closest site is AZ K:13:58, an artifact scatter located 140 m south of the access road. AZ K:13:59, an artifact scatter, and AZ K:13:60, the Late Archaic site tested by Tagg, are 375 m southeast and 350 m east of the borrow pit, respectively.

Area 2: Waterline and Powerline

Three miles of waterline in Area 2 are scheduled for replacement. At present the waterline is within 6 m of the west shoulder of the Mainline Road. The only site within the 6-m (20-foot) wide corridor proposed for the waterline is AZ K:13:13 a small artifact scatter tested for archeological significance prior to Mainline Road construction by Jones (1986).

If Alternative A, Option 2 is chosen, a powerline will be installed on the east shoulder of the Mainline Road, extending from the well to the treatment plant. Two sites appear to be close to the Mainline Road on the map (Fig. 8.11); however, AZ K:13:12, an artifact scatter with sandstone slabs, is 50 m west of the road and AZ K:13:58, an artifact scatter, is 20 m east of the road. These sites will not be disturbed by either the pipeline or the powerline if construction is restricted to a corridor 6 m (20 feet) from the road shoulder.

Area 3

Twenty-nine sites and 5 IFs are located in Area 3 (Fig. 8.12, Tables 8.5 and 8.6). Five artifact scatters, including a lithic scatter, are among the sites recorded. Prior to realigning the Mainline Road the lithic scatter, AZ Q:1:101, will be tested in the spring of 1987. There are 6 sites with pithouse or slab features, 9 sites with one masonry room and 6 sites with two or more masonry rooms; Puerco Ruin is one of the multiple-room sites. A rock art site with nine petroglyph panels and 2 historical sites were also recorded.

The IFs listed in Table 8.6 include three with the potential for buried deposits and two that do not need to be tested.

Area 3: Alternative A, Option 1

There are 11 sites and 4 isolated finds in the 365-acre parcel under consideration for Alternative A, Option 1. These are denoted by asterisks (*) in Tables 8.5 and 8.6. All but one of the sites have evidence of features on the surface. Two clusters of sites occur in areas likely to be chosen for construction.

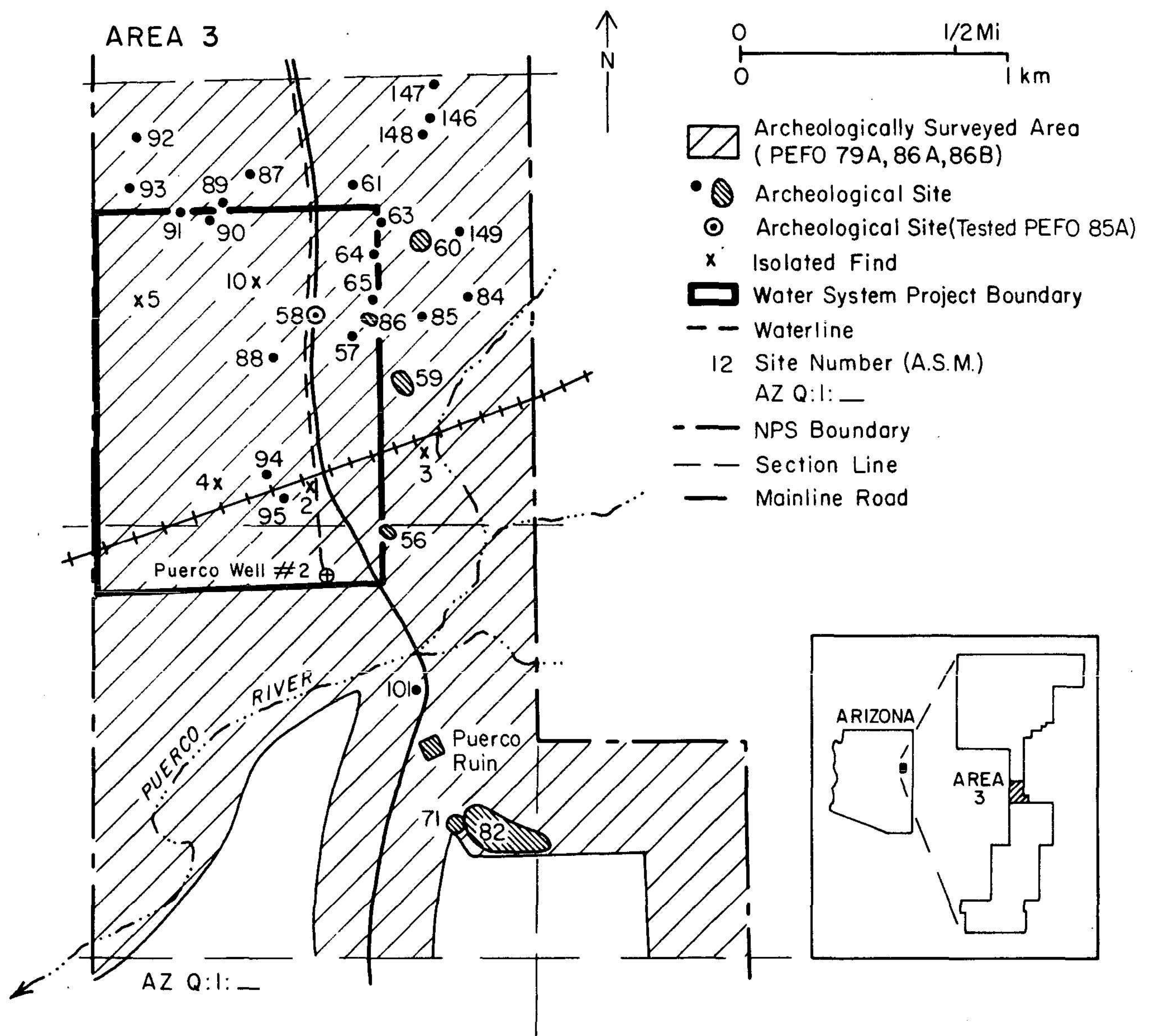


Table 8.5

AREA 3: SITES (29)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ Q:1:22 PUERCO RUIN	--	--	--	PUEBLO
AZ Q:1:56 PEFO 79A-4 PEFO 86B-7	3,000	512	6	MASONRY ROOMS (2+)/Rubble Mound, 5 Rubble Concentrations with Stains
*AZ Q:1:57 PEFO 79A-5 PEFO 86B-19	288	80	18	PITHOUSE/SLAB FEATURES/ Sandstone Slabs with Stain, Trash Area, Historical Grave
*AZ Q:1:58 PEFO 79A-6	5,848	--	--	MASONRY ROOM/Masonry Structure, Midden, Burial/ Tested PEF0 85B
AZ Q:1:59 PEFO 79A-7	18,750	--	--	HISTORICAL SITE/Structures, Trash, Water Tank
AZ Q:1:60 PEFO 79A-8, 10 PEFO 86B-30	35,000	5,022	29	PITHOUSE/SLAB FEATURES/ 8 Slab Features, Stain, Ground Stone Cluster
AZ Q:1:61 PEFO 79A-9 PEFO 86B-22	810	350	23	MASONRY ROOM/Rubble Mound, Trash Area
*AZ Q:1:63 PEFO 79A-11 PEFO 86B-31	484	20	--	PITHOUSE/SLAB FEATURES/Rubble Mound; Historical Boards and Trash
*AZ Q:1:64 PEFO 79A-12 PEFO 86B-23	1,728	225	30	PITHOUSE/SLAB FEATURES/3 Slab Concentrations, Trash Area
*AZ Q:1:65 PEFO 79A-13 PEFO 86B-21	2,016	350	12	PITHOUSE/SLAB FEATURES/ Sandstone Slabs, Stain, Trash Area
AZ Q:1:71 PEFO 86A-25	15,232	100	8	ROCK ART/9 Petroglyph Panels, Masonry Structure
AZ Q:1:82 PEFO 86A-33	88,000	--	--	HISTORICAL SITE/Road, 6 Structures

Table 8.5 (continued)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ Q:1:84 PEFO 86B-25	880	205	21	MASONRY ROOM/Rubble Mound, 3 Rubble Concentrations, Cist
AZ Q:1:85 PEFO 86B-24	280	165	3	MASONRY ROOMS (2+)/2 Rubble Concentrations with Wall Alignments
*AZ Q:1:86 PEFO 86B-20	7,800	1,000	12	PITHOUSE/SLAB FEATURES/ 4 Slab Concentrations, 2 Depressions, Trash Area
AZ Q:1:87 PEFO 86B-18	990	200	4	MASONRY ROOM/Rubble Mound
*AZ Q:1:88 PEFO 86B-17	1,190	250	3	MASONRY ROOM/Rubble Mound
AZ Q:1:89 PEFO 86B-16	952	150	15	PITHOUSE/SLAB FEATURES/ Slab Concentrations
*AZ Q:1:90 PEFO 86B-15	560	1,000	74	ARTIFACT SCATTER/Sandstone Feature(?), Trash Area
*AZ Q:1:91 PEFO 86B-14	696	850	47	MASONRY ROOM/Rubble Mound, Trash Area
AZ Q:1:92 PEFO 86B-13	600	80	5	MASONRY ROOM/Rubble Mound
AZ Q:1:93 PEFO 86B-9	352	150	27	ARTIFACT SCATTER/Sandstone Feature(?), Trash Area
*AZ Q:1:94 PEFO 86B-8	4,440	1,500	16	MASONRY ROOMS (2+)/ 6 Rubble Concentrations
*AZ Q:1:95 PEFO 86B-6	891	80	6	ARTIFACT SCATTER/ Sandstone Feature(?)
AZ Q:1:101 PEFO 85B-2	1,125	10,000	--	ARTIFACT SCATTER/ To be Tested PEFO 87A
AZ Q:1:146 PEFO 86B-26	5,460	5,000	57	MASONRY ROOMS (2+)/2 Rubble Mounds, 2 Trash Areas, 2 Slab Concentrations

Table 8.5 (continued)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ Q:1:147 PEFO 86B-27	700	50	6	MASONRY ROOM/Rubble Mound
AZ Q:1:148 PEFO 86B-28	1,400	500	11	ARTIFACT SCATTER/ Sandstone Slab
AZ Q:1:149 PEFO 86B-29	750	250	8	MASONRY ROOM/Rubble Mound

* = Site in proposed project area.
 -- = Data not available.

* * * * *

Table 8.6

AREA 3: ISOLATED FINDS (5)

PEFO 86B- IF NO.	INVENTORY	NECESSARY TO TEST?
*IF-2	Single sherd disk	No
IF-3	Potbreak, 20 sherds	No
*IF-4	Sandstone, sherds, flakes	Yes
*IF-5	Sherds, flakes, mano	Yes
*IF-10	Sandstone, flakes, sherds	Yes

* = IF in proposed project area.

The first cluster of sites is on the north edge of the project area. AZ Q:13:90 and 91 as well as two sites outside the bounded area, AZ Q:13:87 and 88, could be impacted by the proposed east-west access road if the treatment plant is placed in the northwest corner of the project area. AZ Q:1:90 is an artifact scatter with sandstone slabs, AZ Q:1:87 and 91 are single-room masonry sites, and AZ Q:1:89 is a pithouse/slab feature site. (The inclusion of the two sites north of the bounded project parcel is based on the most recent set of plans sent to WACC by DSC.) Both PEF0 86B-IF-5 and 10 require testing but appear to be south of the area to be impacted. Both the pipeline replacement and proposed railroad access are scheduled to occur in the vicinity of a second cluster of sites that includes AZ Q:1:94, a multiple-room masonry site, AZ Q:1:95, an artifact scatter with sandstone slabs, as well as PEF0 86B-IF-2, a single sherd disk, and PEF0 86B-IF-4, a small scatter of artifacts and sandstone slabs.

When final plans are submitted, WACC archeologists will be able to refine the list of threatened sites. It may be necessary for WACC personnel to relocate and flag the sites and IFs determined to be in the path of construction. Planners can then decide whether to avoid or mitigate impacts to sites. Although we are not familiar with all the intricacies of the planning process, we believe that if the preferred alternative is chosen, the plant and access road can be located in areas without sites.

Area 3: Waterline and Powerline

There are only two archeological occurrences that might be impacted by replacing the pipeline segment that goes north from Puerco Well No. 2 for 400 m and then follows along the west side of the Mainline Road for 6.4 km (4 miles).

The first is AZ Q:1:58, a site previously tested by Jones (1986) prior to Mainline Road construction. Sample data recovery and site structure delineation have been completed and no further assessment work is necessary. However, a burial was recovered from the east side of the road; if Alternative A, Option 2, the borrow pit location, is chosen, the powerline to be placed on the east side of the road may uncover

additional burials. This is considered unlikely but monitoring of trenching operations in the site vicinity is recommended.

The second is PEF0 86B-IF-2, a single sherd disk that does not have the potential to yield further information.

Area 4

Nine sites and an IF were recorded in Area 4 by three survey projects (Fig. 8.13, Tables 8.7 and 8.8). These include an artifact scatter with possible features and a huge quarry site. There are four sites with one masonry room in evidence and two sites with two or more masonry rooms. The single historical site has a foundation. PEF0 86B-IF-1, a small scatter of sherds, does not need to be tested.

The 73-acre project area has four sites. One of these sites, AZ Q:1:28, is a large lithic quarry that covers much of the developed area. The others are an artifact scatter, a site with one masonry room and a historical foundation.

Area 4: Alternatives B and C

Construction activities associated with these alternatives involve previously disturbed areas within the Rainbow Forest developed area as well as areas in the vicinity of the well and sewage lagoons. The lithic quarry, AZ Q:1:28, extends north from Jim Camp Wash and covers almost half of the bounded project area. Any construction within the boundaries of AZ Q:1:28 that is not in previously disturbed areas will require archeological evaluation prior to construction. Because the site is made up of innumerable chipping stations, each centered around individual petrified wood logs, it may be possible to avoid cultural loci. Otherwise, data recovery can be performed using methods tested in the spring of 1987 at AZ Q:1:101, a large lithic scatter northwest of Puerco Ruin.

The three sites located south of Jim Camp Wash are discrete sites that can probably be avoided by construction. Final plans will be checked by WACC before final clearance can be issued.

If any construction associated with the water system is to occur in the vicinity of the Rainbow Forest Reservoir, which is located on top of

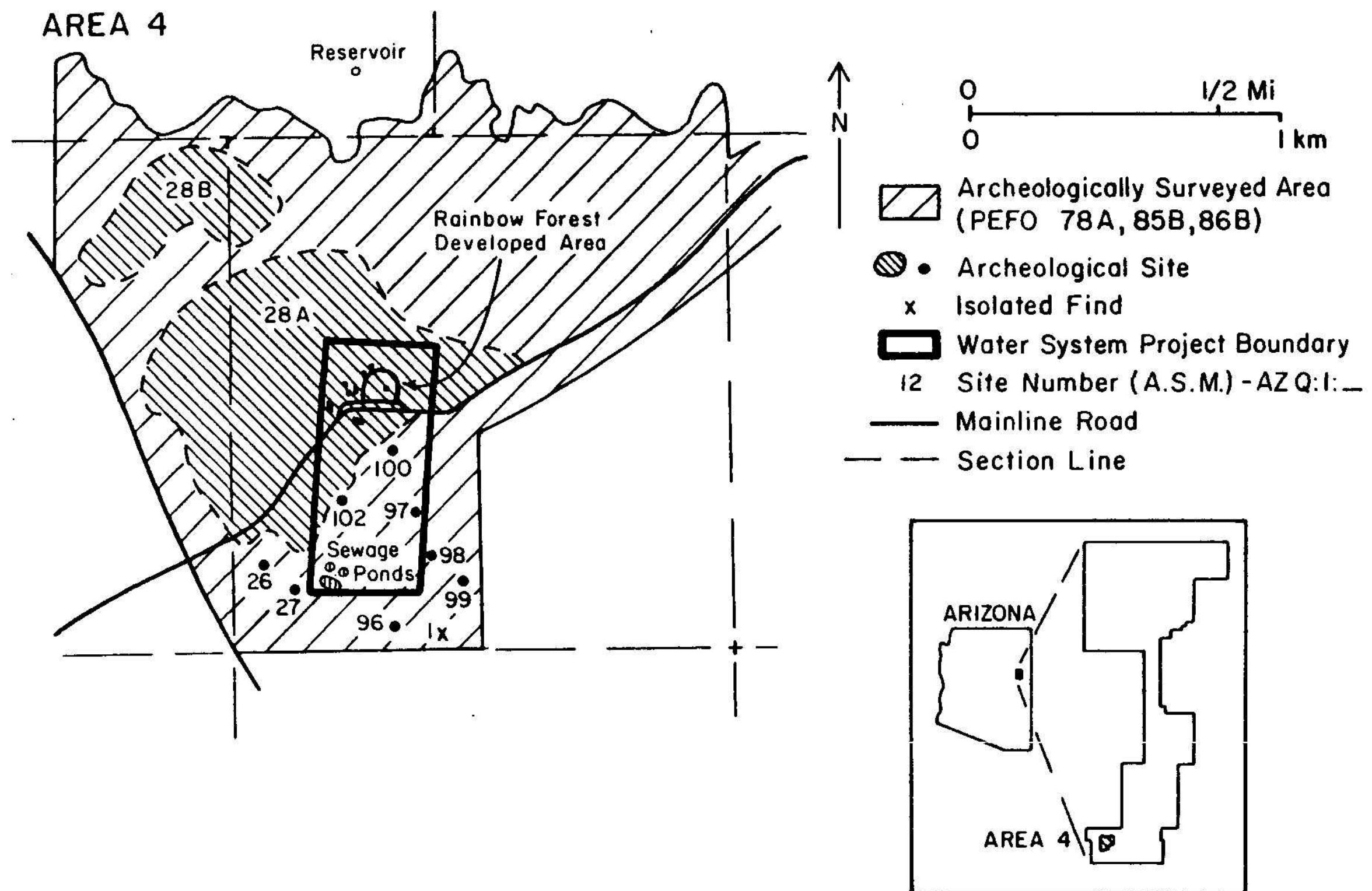


Figure 8.13 Area 4. Location of archeological sites relative to Water System Project boundaries.

the escarpment 1 km north of the developed area, further archeological investigations including survey will be necessary.

Area 4: Sewerlines

The improvement to the Rainbow Forest sewer system will occur in previously disturbed areas. The plans, shown in Figure 8.14, do not appear to threaten known sites. However, any variation from the present path of the sewerlines, particularly within AZ Q:1:28, the lithic scatter north of Jim Camp Wash, should be field checked by WACC archeologists.

Management Summary

The management recommendations are briefly summarized for each of the construction alternatives, repair to the waterline and sewer system

Table 8.7

AREA 4: SITES (9)

ASM NUMBER FIELD NUMBER	SITE AREA (sq. m)	ESTIMATED NUMBER ARTIFACTS	MAXIMUM ARTIFACT DENSITY (art/sq.m)	SITE TYPE/FEATURES/NOTES
AZ Q:1:26 PEFO 78A-1 PEFO 85B-3	768	230	--	MASONRY ROOMS (2+)/Rubble Mound, Trash Area, Lithic Concentration
AZ Q:1:27 PEFO 78A-2 PEFO 85B-4	726	120	--	MASONRY ROOMS (2+)/Rubble Mound with Wall Section
*AZ Q:1:28 PEFO 78A-3 PEFO 85B-1	2,600,000	1,000,000	--	ARTIFACT SCATTER (QUARRY)
AZ Q:1:96 PEFO 86B-5	648	2,020	37	MASONRY ROOM/Rubble Mound, Lithic Concentration
*AZ Q:1:97 PEFO 86B-4	2,200	1,650	34	ARTIFACT SCATTER/Possible Features, Trash Area
AZ Q:1:98 PEFO 86B-3	6,400	1,520	26	MASONRY ROOM/Rubble Mound, Lithic Concentration
AZ Q:1:99 PEFO 86B-2	1,152	1,000	42	MASONRY ROOM; ROCK ART/ Rubble Mound; Petroglyphs
*AZ Q:1:100 PEFO 86B-1	2,244	500	--	HISTORICAL SITE/Foundation, Road, Trash
*AZ Q:1:102 PEFO 85B-5	300	175	26	MASONRY ROOM/Rubble Mound

* = Site in proposed project area.
 -- = Data not available.

Table 8.8

AREA 4: ISOLATED FIND (1)

PEFO 86B- NO.	INVENTORY	NECESSARY TO TEST?
IF-1	4 or 5 corrugated sherds	No

* * * * *

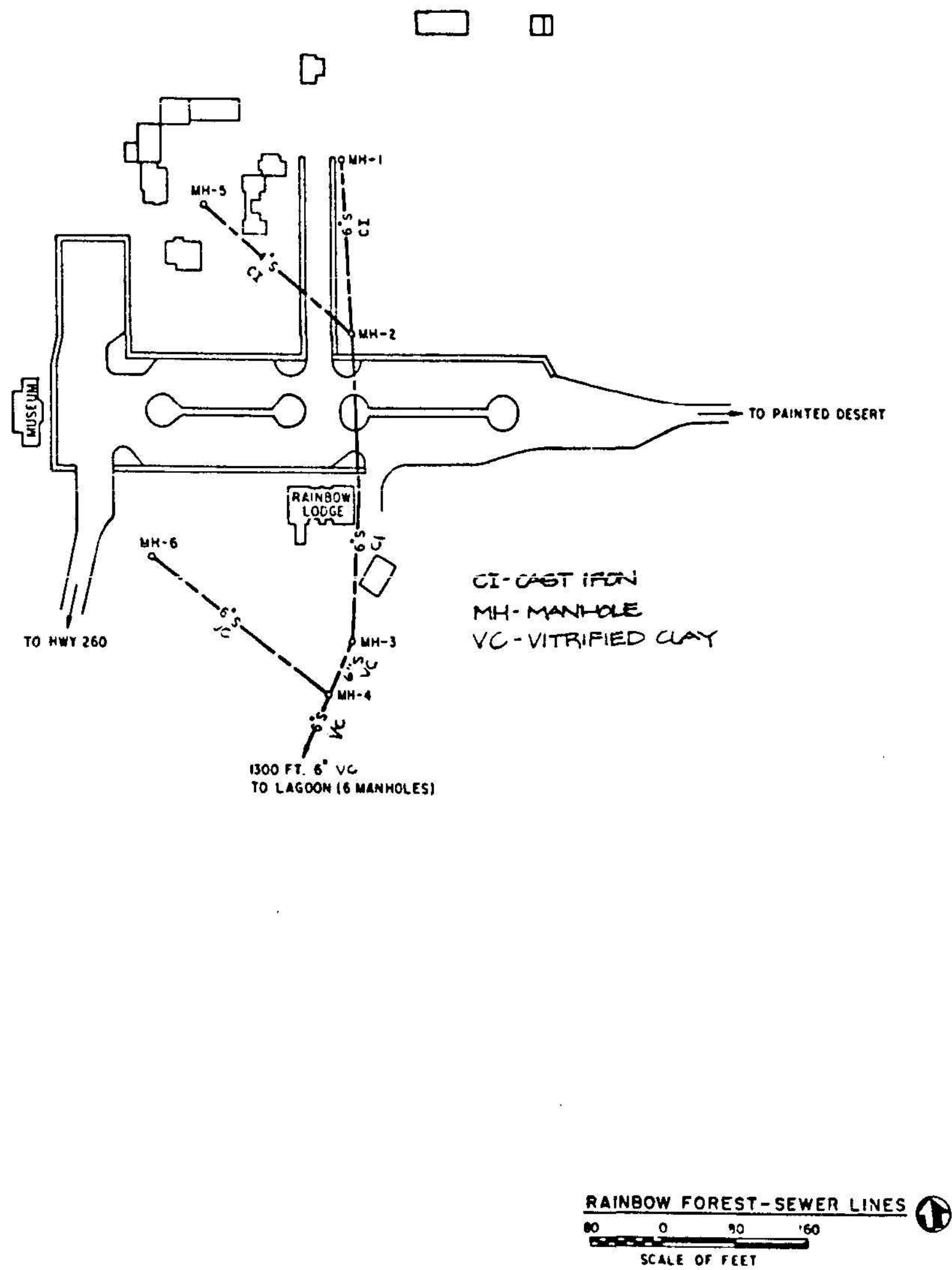


Figure 8.14. Rainbow Forest sewer system.

improvements. For more detailed explanations please refer to the preceding section in this chapter.

Alternative A, Option 1

The sites most likely to be impacted by construction of one water treatment plant with an east-west access road in Area 3 are located along the northern boundary of the proposed construction boundary--AZ Q:1:87, 89, 90 and 91. This conclusion is based on preliminary drawings in the DSC planning document (National Park Service 1986) as well as on the most recent set of plans submitted to WACC in January, 1987. However, it is believed that these sites could be avoided.

If the railroad access road is chosen, two sites (AZ Q:1:94 and 95) and PEF0 86B-IF-4 could be affected. IF-2, also located in this cluster, does not require further attention. See Figure 8.12 and Tables 8.4 and 8.5 for site locations and summaries of site characteristics.

Alternative A, Option 2

Although there are seven sites within the proposed project boundaries for this option, plans for placement of the treatment plant in the borrow pit location restrict construction to the borrow pit area and existing access road. The nearest site, AZ K:13:58, is 140 meters south of the access road.

The powerline that would be installed on the east side of the Mainline Road and the waterline connecting the plant and Puerco Well No. 2 both pass through AZ Q:1:58, which was tested (Jones 1986) prior to Mainline Road resurfacing. AZ K:13:58 and AZ K:13:12 are 20 m (65 feet) east of the road and 50 m (165 feet) west of the road, respectively. Refer to Figures 8.11 and 8.12 as well as Tables 8.3 to 8.6 for site locations and site information.

Alternatives B and C

These alternatives involve building treatment plants at both Painted Desert (Area 1) and Rainbow Forest (Area 4) developed areas. In

the Painted Desert developed area, the 35th Parallel Route is well defined where it has not been previously disturbed and PEF0 86B-IF-8 is so small that it should be possible to avoid this feature. Please note that the 35th Parallel Route is on the National Register of Historic Places; Section 106 compliance will be necessary if any action is going to disturb it.

The entire Rainbow Forest developed area lies within AZ Q:1:28, a large petrified wood quarry. It is recommended that construction be restricted to previously disturbed areas. Any activity in undisturbed areas north of Jim Camp Wash will require archeological consultation. The three sites south of Jim Camp Wash are on the edges of the proposed project area and can probably be avoided by careful planning.

Waterline

Replacement of two segments of waterline are planned along with the addition of a second pipe in another segment. Replacing the 7.1-km (4.4-mile) segment that runs north of Puerco Well No. 2 and follows the west shoulder of the Mainline Road will not impact any archeological sites (see Figures 8.11 and 8.12). AZ K:13:13 and AZ Q:1:58, which are located in the waterline corridor, were tested (Jones 1986) prior to resurfacing the road; monitoring in the vicinity of AZ Q:1:58 is recommended. The only other site that is close to the waterline, AZ K:13:12, is 50 m west of the road, well beyond the 6-m-wide corridor specified in the project plans.

The segment of waterline between the Painted Desert Reservoir and the Painted Desert Inn is also to be replaced (see Fig. 8.9). No archeological resources were located in the path of the pipeline; however, the Painted Desert Inn is a historical structure on the National Register of Historic Places and any alterations to the fabric of this structure must conform to NPS-28.

A second waterline is to be installed between the Painted Desert Reservoir and the Painted Desert headquarters if construction Alternatives A or B are chosen (see Fig 8.9). PEF0 86B-IF-23, a small scatter of artifacts and sandstone slabs, will need to be relocated by WACC archeologists when the east-west pipeline has been flagged. The

location of the IF relative to trenching activities will determine the need for testing.

Sewerlines

All sewer improvements can be approved if construction can be restricted to previously disturbed areas. In the Painted Desert developed area the residences and the sewage lagoons are not near any known sites (see Fig. 8.9). In the Rainbow Forest developed area, the potential for disturbing chipping loci at site AZ Q:1:28 is high in the area north of Jim Camp Wash (see Fig 8.13). Onsite inspection of the project area in the Rainbow Forest may be necessary.

Conclusion

The maps and tables used in this chapter should be useful for assessing impact if design changes develop for the water system and for future planning in any of these areas in Petrified Forest National Park. Of course, there are still unsurveyed blocks in these areas and any work in these blocks will require further archeological survey.

The recommendations made in this chapter apply to plans outlined in the NPS document "Environmental Assessment: Construct Water Treatment System and Repair Sanitary Sewer System, Petrified Forest National Park, Arizona--DRAFT" (National Park Service 1986). Before archeological clearance can be granted, final plans will have to be examined by WACC archeologists; final recommendations will be made at that time. Avoidance of archeological resources is the preferred treatment from an archeological point of view; however, data recovery to mitigate impact of construction activities is possible when planners are faced with problems that outweigh archeological concerns.

Chapter 9
EXCAVATIONS AT AZ K:13:60:
UTILIZATION OF CORN AT A LATE ARCHAIC SITE IN
PETRIFIED FOREST NATIONAL PARK

by
Martyn D. Tagg

In July 1985, a small survey was conducted by Jones (1985) in the vicinity of PEF0 Site 236 (AZ K:13:41 [ASM]), a Pueblo II period site recently acquired by the National Park Service that includes a small room block and a great kiva. During this work, AZ K:13:60, a small preceramic site consisting of three rock features (one with dark soil), nearly 300 pieces of flaked stone debitage, five bifaces, and a possible handstone, was recorded. The site also had buried features eroding from edges of a deflated blowout. Included in the assemblage was the base of a Folsom point broken during manufacture (Jones 1986:7). The projectile point was the only diagnostic artifact recovered from the site. This point, the absence of other diagnostic artifacts, and the subsurface features, suggested that the site might be a buried Paleo-Indian campsite (Jones 1986:7).

No known Paleo-Indian sites occur in Petrified Forest National Park; they are rare in the Southwest in general. Due to the extensive deflation of the deposits, the site was tested to determine its condition and National Register significance. These investigations consisted of limited test excavations and surface collections carried out by archeologists from the Western Archeological and Conservation Center with assistance from volunteers. Radiocarbon dates only from the Late Archaic period were obtained.

Setting

AZ K:13:60 is on a small knoll, on a finger ridge extending out from the second Pleistocene terrace north of the Puerco River (see Fig. 8.11). This area is covered by an uneven sand mantle with occasional blowouts and gullies. Higher knolls, such as the one on which AZ K:13:60 occurs, appear to be stabilized sand dunes. Between the knolls is a sandy desert pavement of small chert cobbles and pebbles resulting

from recent deflation (Jones 1986:12). According to Fred Nials, Eastern New Mexico University geologist, the eolian sand deposits were never active dunes, as illustrated in profile by the uniform sand deposits overlying the Pleistocene layer. Until recently, erosion has been slight. This recent erosion of the stabilized sand dunes has exposed sites such as AZ K:13:60, and has deposited artifacts on the Pleistocene gravel surfaces. Few artifacts or features could be seen in the still intact dune.

At an elevation of 1,688 m (5,540 feet), the knoll on which the site occurs is the highest point in the vicinity. This point affords an excellent view to the east and south, as the second terrace gradually drops onto the first terrace and eventually down to the Puerco River 4 km to the south. Dead Wash, a large tributary to the Puerco River, downcuts the river terraces 1 mile east of the site. Between AZ K:13:60 and Dead Wash, the distinctive multicolored badlands for which the Painted Desert is known erode out of the edges of the terraces. To the north and west of the site is the broad rolling and grassy mesa top that characterizes the north end of the park.

The site and surrounding vicinity lie in a sage-saltbush-mixed grass association of the Great Basin desertscrub community (Stewart 1980:5, Fig. 2). Onsite vegetation is dominated by Great Basin sagebrush (Artemisia tridentata), Mormon tea (Ephedra sp.), fourwing saltbush (Atriplex canescens), snakeweed (Gutierrezia sp.), and various grasses such as Indian rice grass, needlegrass, and side-oats grama. A single large juniper tree (Juniperus sp.) occurs on the site, and a few scattered narrowleaf yucca (Yucca angustissima) and wild onion (Broderia sp.) also occur. No wildlife was seen in the site area during fieldwork, but small animals such as coyotes, skunks, bobcats, ground squirrels, lizards, snakes, and toads are common to this environment (Stewart 1980:7).

Site Description

Before being assigned an Arizona State Museum number, AZ K:13:60 was originally recorded as PEF0 85B-8. The site boundaries were determined by those areas having a relatively high artifact density,

features, or both. This includes an area approximately 50 m northwest-southeast by 30 m northeast-southwest (Fig. 9.1). The northern and eastern edges of the site are in an intact dune, and there are few artifacts. No features are present on the surface there, although one feature, consisting of black soil and a few sandstone slabs, is eroding from the edge of a nearby sand dune. The center of the site includes the blowout, where the dune has been deflated down to the Pleistocene gravel level. This area is covered with a moderately dense artifact scatter, and two rock clusters are present.

Surface artifacts consist almost entirely of flaked stone debitage, with a possible handstone and a sherd near one of the rock features. Two additional sherds were recovered 30 m south of the main artifact scatter. The two rock features (Feas. 1 and 2) consist of medium-sized river cobbles, some of which are fire-cracked. Feature 1 is oblong and is 2.2 m long by 1.2 m wide. Feature 2, 13 m northwest of Feature 1, appears more deflated; it is round and is 1.6 m in diameter. Feature 3, 8 m northeast of Feature 1 and eroding out of the intact dune, consists of a small area of black soil with a few tabular sandstone slabs. A few other areas of dark soil and tabular slabs were noted in the sand dune just north of Feature 3. Two were labeled as features during the testing project. Feature 4 is an oval stain lying 17 m northwest of Feature 3. Feature 5, also a charcoal stain, lies 6 m southeast of Feature 4. A scatter of unmodified petrified wood log segments lies 15 m southeast of Feature 1, outside the surface artifact scatter. It was not investigated or given a feature number.

Methods

Fieldwork was carried out between June 16 and 20, 1986, by four WACC archeologists and four volunteers under the direction of the author. This accounted for 18.5 man-days in the field. The fieldwork was carried out to help determine the nature of the site and the extent of subsurface remains and to recover additional material (artifacts or samples) to help date the site. A plane table and alidade contour map was made of the site, using the original WACC site stake as datum. With

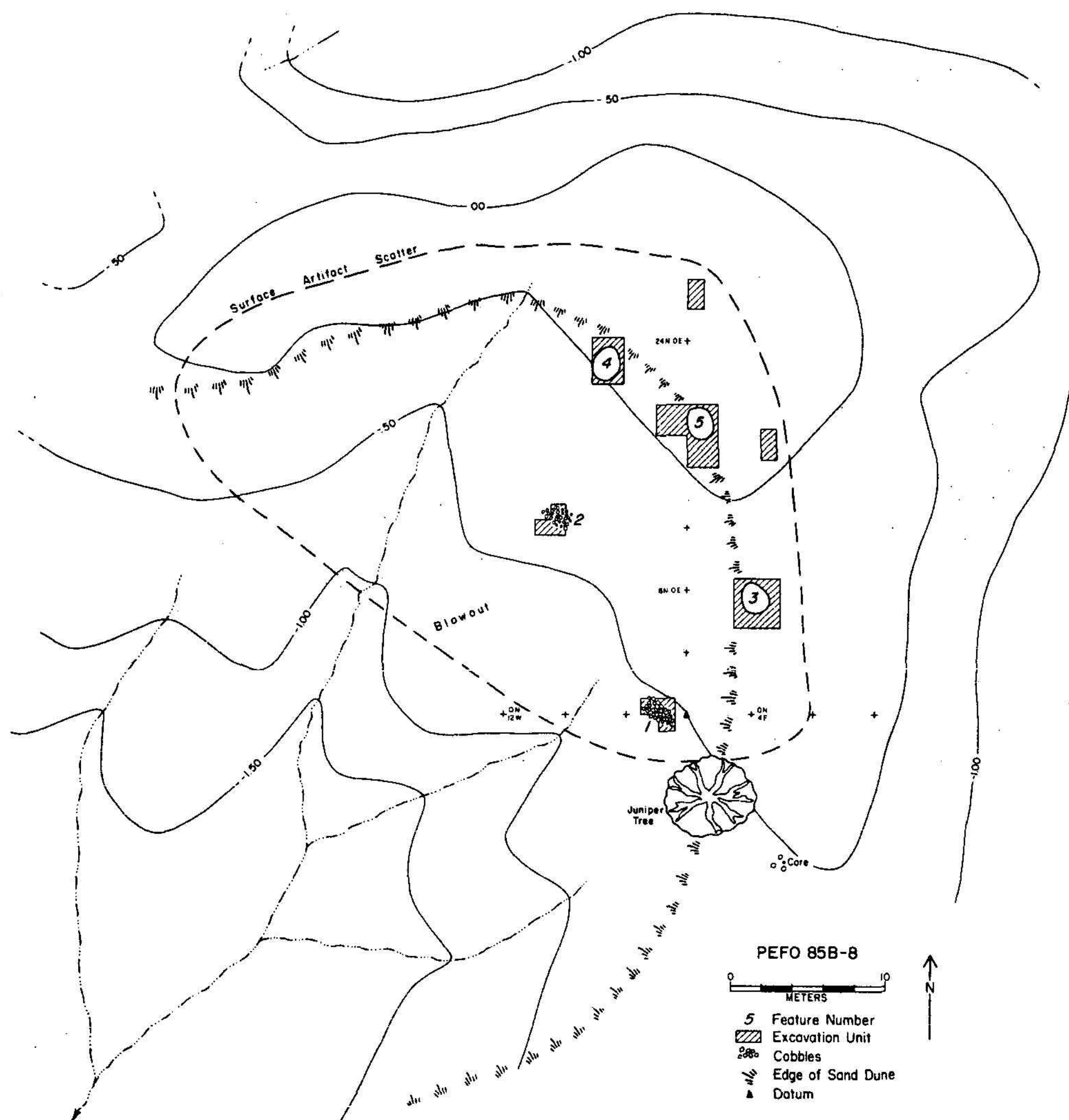


Figure 9.1. AZ K:13:60 (ASM) site map.

this map, a grid was laid out over the entire site and was used for the placement of excavation units. Excavation test pits consisted of 1 m by 2 m units judgmentally placed over features and areas with potential for subsurface remains (for example, those areas with dark stains or a lot of surface artifacts). The southwest corner was designated the unit datum and depth measurements were taken from this corner, which was tied in vertically to the main site datum.

The test units were excavated in arbitrary 10 cm levels using shovels and trowels. All soil was screened through 1/8-inch or 1/4-inch mesh, and all artifacts were collected. Plan views were drawn for every feature, as were profile maps if applicable. Flotation and pollen

samples were collected from features. All test units were backfilled at the end of the project.

All collected artifacts, maps, photographs, and records from this project are housed at WACC in Tucson, Arizona.

Results

At the completion of the testing program the three visible features had been completely excavated, two additional features had been discovered (one of which was investigated), and two test units were excavated that did not hit features. A total of 549 artifacts were recovered from these excavations. The remainder of this chapter is a description of the features and the artifacts recovered from them and a comparison of these results with what is currently known about the archeology of the region and the time period in which the site falls.

Features

Five features were identified at AZ K:13:60, including two rock clusters and three pit features (one with an associated hearth).

Pit Features

The three pit features include Features 3, 4, and 5; the latter two were discovered during the test excavations. The three features lie in an arcuate pattern at the east end of the site; all are exposed at the edge of the eroding sand mantle (see Fig. 9.1). Feature 3 was originally noted as a few sandstone slabs surrounded by black soil eroding out of the edge of the intact dune. Excavation revealed that the slabs were associated with a hearth, which was in turn associated with a dark, hard-packed surface, possibly representing a compacted living surface. A few pieces of flaked stone and small fragments of burnt bone were recovered from feature fill although most artifacts came from above the feature. Feature 3 was completely excavated. This feature consists of an uneven hard-packed surface approximately 2 m in diameter (Fig. 9.2). In profile, the feature is dish-shaped, extending 20 centimeters below the present ground surface (bpgs) in the center and

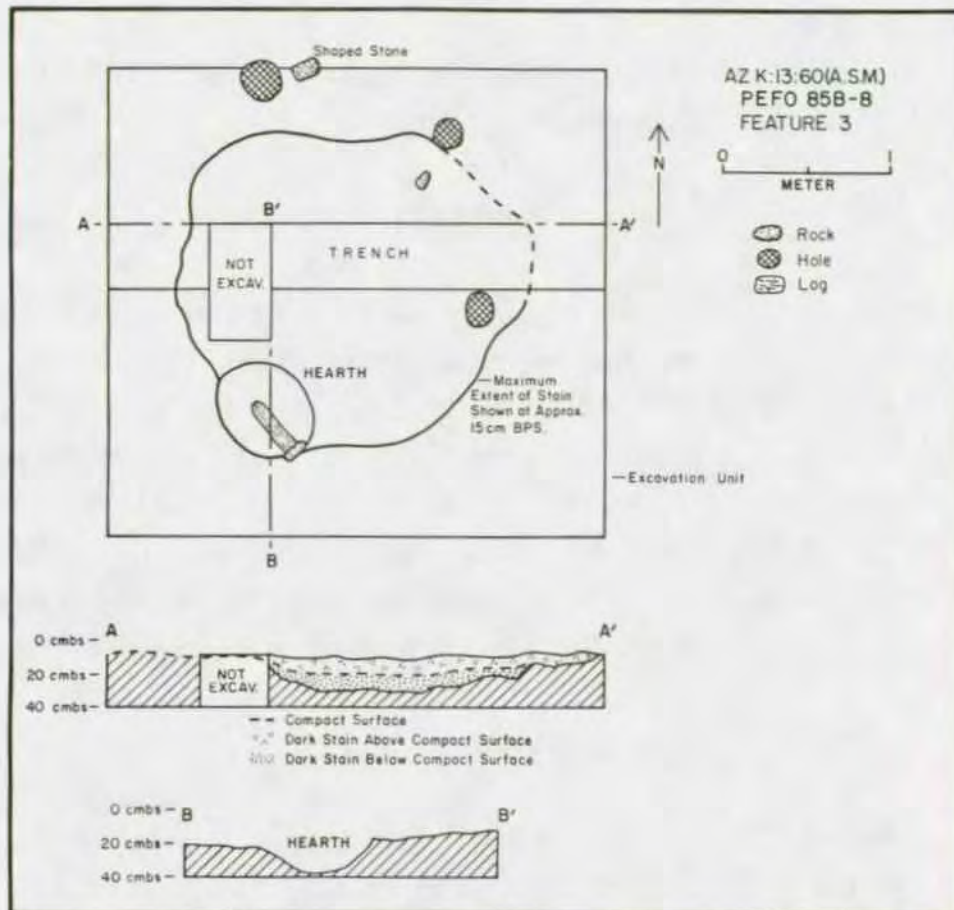


Figure 9.2 Plan and profile of Feature 3, pit feature and hearth.



Figure 9.3 Juniper log on floor of hearth in Feature 3 at AZ K:13:60.

gradually sloping up on the sides to about 5 cm bpgs. The hard-packed surface lies 10 cm bpgs, bisecting the center of the profile stain and lying even with the top of the hearth. The hearth is located in the southwest corner of the feature. It is oval-shaped, 65 cm by 50 cm, and is 20 cm below the hard-packed surface. The base of the hearth was fire-baked red and the fill consisted of black, greasy ash. One small flat rock was lying against the wall of the pit and several larger ones were lying above it prior to its excavation. The charred remnants of a juniper log were lying on the hearth floor (Fig. 9.3). The log was 40 cm long by 10 cm in diameter, and was relatively intact. Three 20 cm diameter depressions were found spaced 1 m apart. One is 15 cm from the northwest corner of the feature; one lies just outside the northeast corner; and the third lies just inside the eastern edge of the feature. They ranged from 7 to 10 cm in depth and are irregular. The one inside the feature's east edge was at the end of a dark horizontal stain, apparently following a root. Another contained flecks of charcoal, and the third had ashy fill. They may just represent root or rodent disturbance, but their even spacing outside the feature might also suggest that they were postholes.

Feature 4 was originally noted as a dark stain showing through the surface sand. Excavation revealed a second pit feature. It is roughly oval, 2.5 m north-south by 2 m east-west, with a maximum depth of about 20 cm (Fig. 9.4). As with Feature 3, the feature profile is dish-shaped, with maximum depth at the center, and a gradual slope up to the ends. Feature fill consisted of black-stained brown sand mottled throughout. Four amorphous stains extend out from the feature outline on the southern, eastern, and northern sides, ranging from 75 cm to 1 m apart. They are all approximately 20 cm in diameter and may be either natural disturbances or postholes. A fifth, separate stain lies about 20 cm south of the feature. It is also about 20 cm in diameter. These were not excavated. The base of the feature was not compact like that at Feature 3 and was difficult to follow because its texture was like that of the surrounding soil. Half of the feature was excavated and only a few flaked stone artifacts were recovered.

Feature 5 was originally noted as a slightly dark stain with a number of surface artifacts. Because of the nature of the Feature 3 and

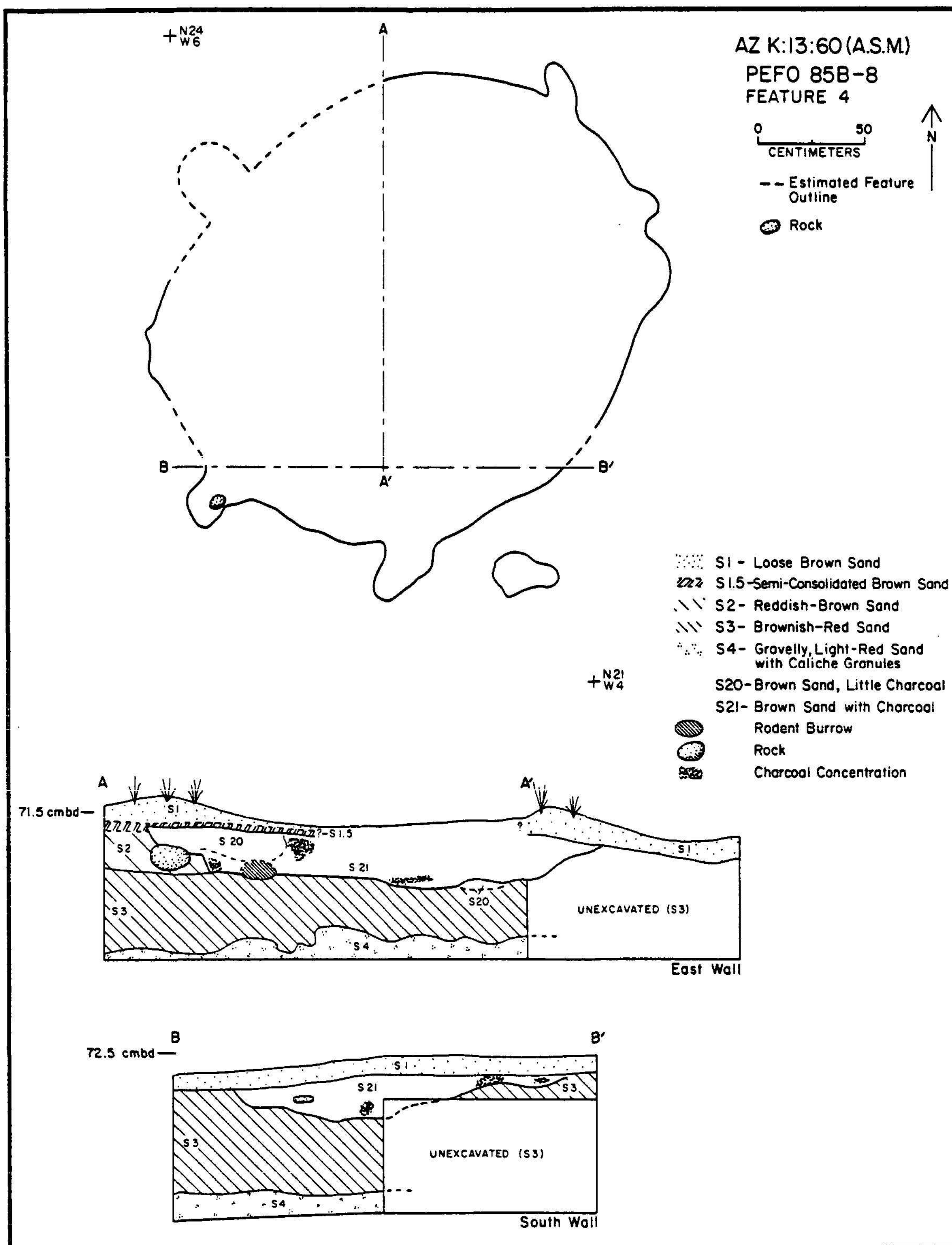


Figure 9.4. Profile and plan view of Feature 4, pit feature.

4 stains, the area around this stain was stripped down about 2-3 cm to expose another possible pit feature. Due to time constraints the feature was defined, but not tested any further. It appeared as a charcoal-mottled roughly oval stain approximately 2 m north-south by 1.8 m east-west. Two lightly stained mottled areas lie to the north and west of the main features. A large number of flaked stone artifacts was recovered from the blow sand above the feature.

Rock Clusters

The two rock clusters, Features 1 and 2, lie in the south central portion of the site, exposed in the Pleistocene gravels of the blowout area. Both features were completely excavated, but neither had any depth or pit features remaining. Feature 1 was an oval cluster of fire-cracked rock, 1.4 m by 1 m in area, with a lighter scatter of pit cleanout or erosional debris extending 1.2 m to the southeast (Fig. 9.5). The feature consisted mainly of small- to medium-sized sandstone cobbles, with a few petrified wood chunks. Fill was tan sand with a few very small flecks of charcoal. Three flakes were recovered among the cobbles.

Feature 2 appeared as an amorphous scatter of sandstone cobbles 1.8 m long and 1.1 m wide. Excavation revealed a smaller concentration of cobbles that appeared to be in situ, with cobbles up to four deep (Fig. 9.6). This concentration was 80 cm long and 60 cm wide and consisted of a tight cluster of unshaped, medium-sized sandstone cobbles. Feature fill was tan sand with a few small flecks of charcoal and one flake.

Test Units

Two 1 m by 2 m test units, 26N0E and 16N5E, were excavated in the stable sand dune to determine if artifact concentrations were associated with subsurface remains. No features were discovered in these test units. However, a hard-packed occupation surface was encountered in 26N0E, and 16N5E was excavated deeper than other units at the site to expose the stratigraphy of the hilltop. Both test units are described below.

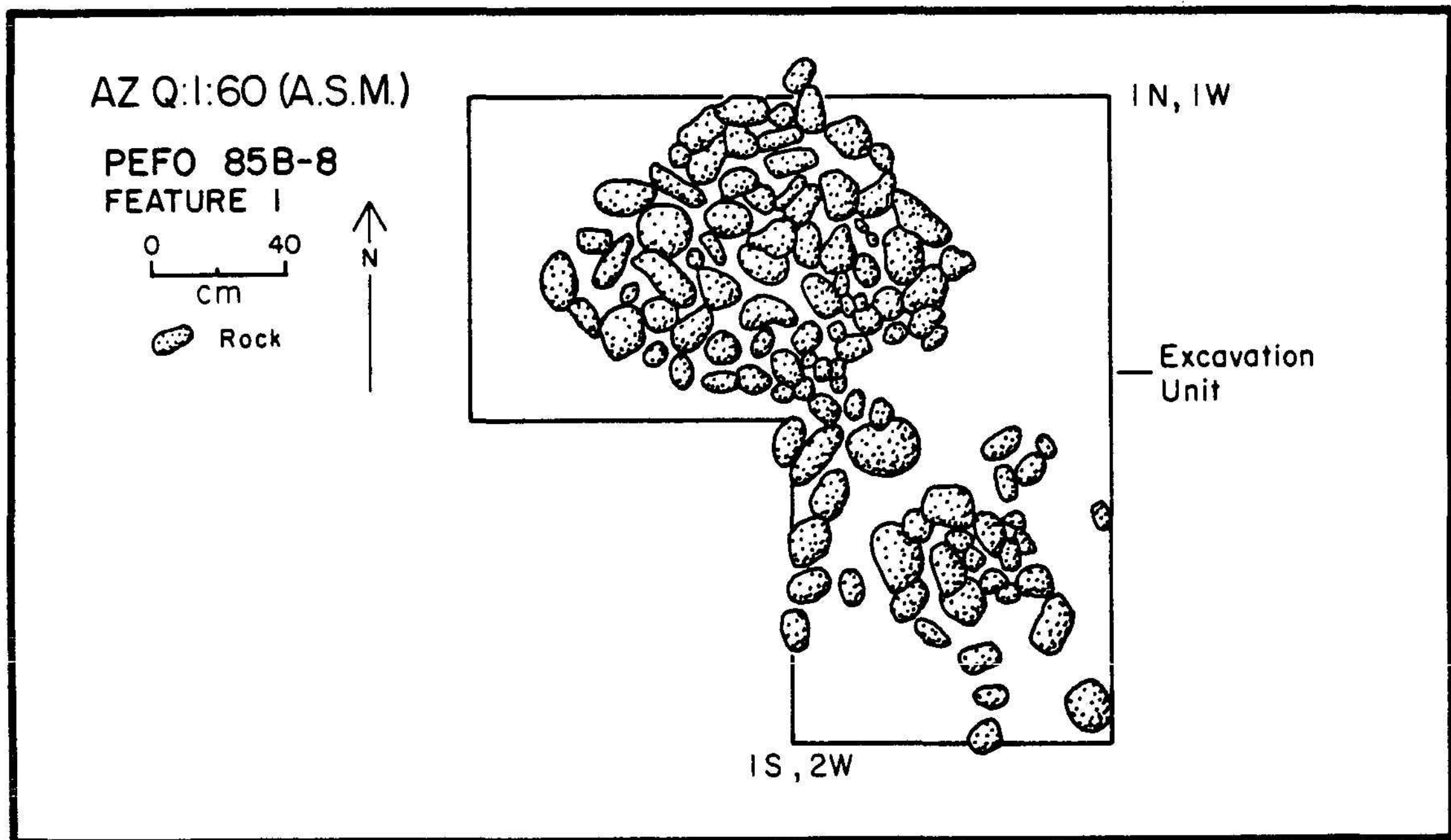


Figure 9.5. Feature 1, rock cluster after excavation.

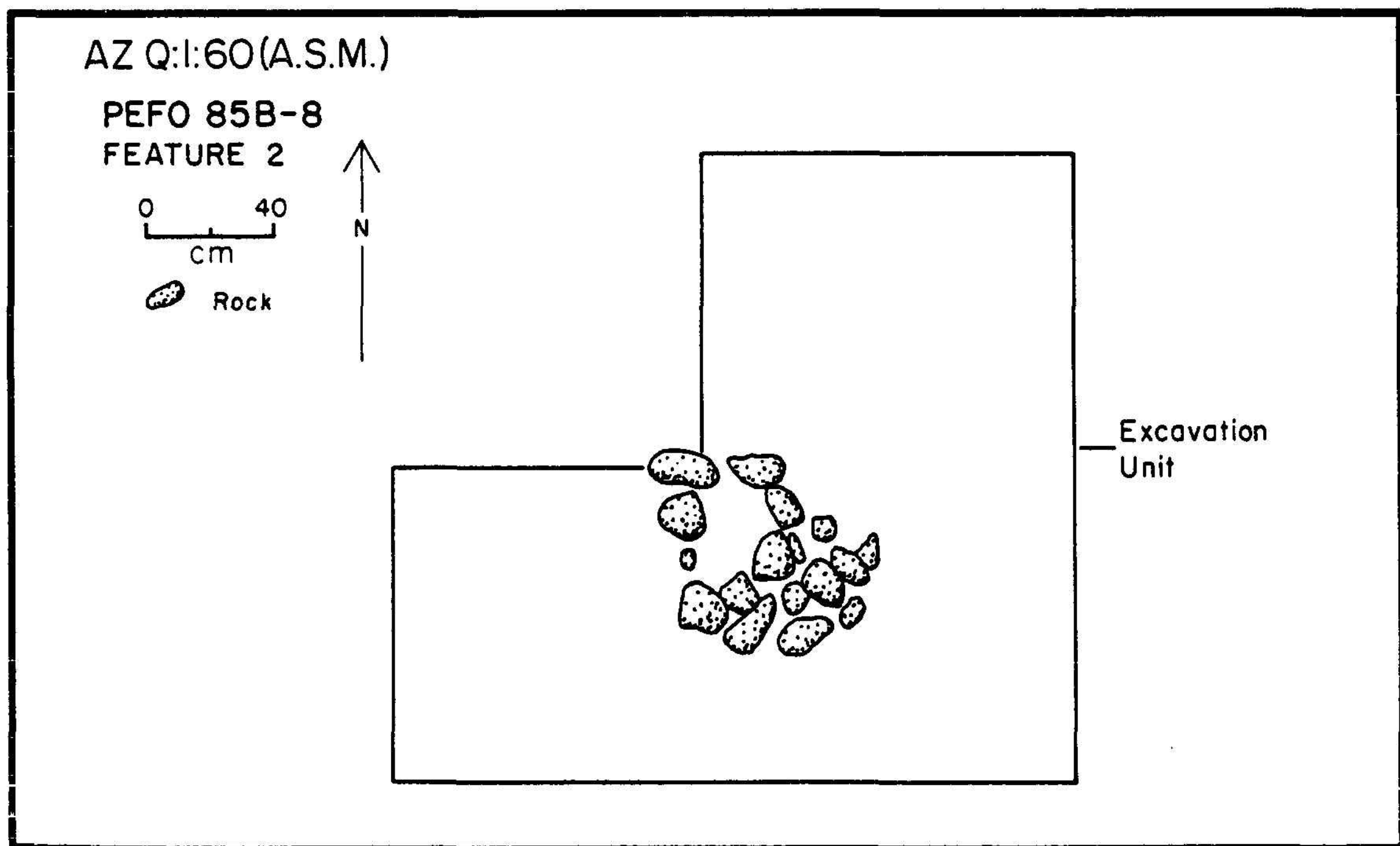


Figure 9.6. Feature 2, rock cluster after excavation.

26N0E

This unit lies on the northeast edge of the site, 6 m north of Feature 5. It was excavated to a depth of 30 cm bpgs. At 28 cm bpgs a dark, compact layer with charcoal flecks was encountered in the northwest corner of the unit. This surface, although uneven, was thought to represent either a prehistoric occupation surface or perhaps the edge of another pit feature. Only a few flaked stone artifacts were recovered from the unit, most in the upper 10 cm. Due to time constraints, the unit was not investigated further.

16N5E

This unit lies on the eastern boundary of the site, 3 m east of Feature 5. Although a few charcoal stains were discovered in the upper levels, no features were found. This unit was excavated to some depth in order to expose the stratigraphy of the dune (Fig. 9.7). This unit, as well as the original 1 m by 2 m unit excavated in Feature 4, was investigated by Fred Nials to determine the geomorphology of the site.

16N 5E

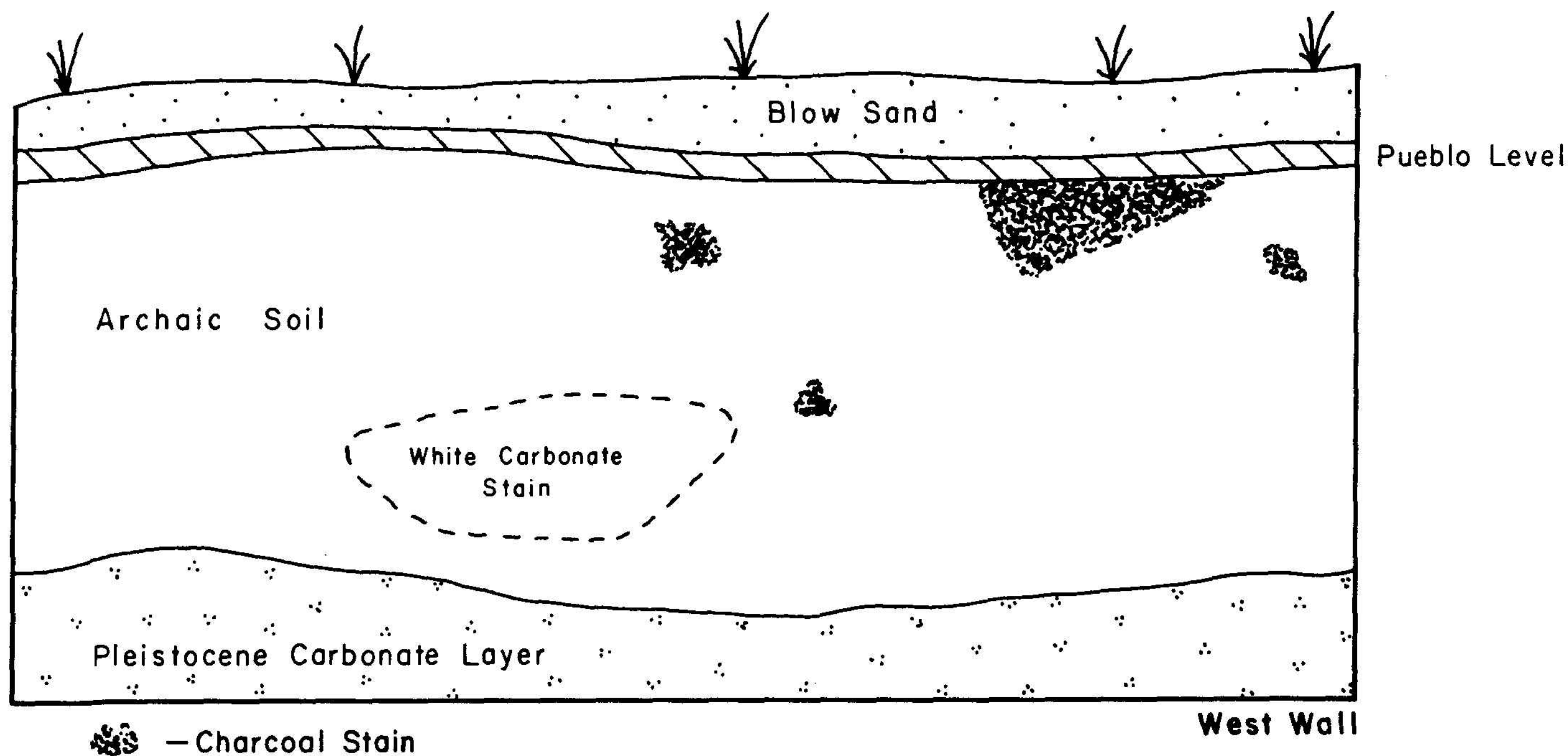


Figure 9.7 Profile of Test Unit 16N5E illustrating stratigraphy of site. Profile is 2 m long.

There are four natural strata exposed in the first meter of depth. Stratum 1 is a 5 to 10 cm thick level of very loose, recent eolian sand. This level contains the highest concentration of recovered artifacts on the site (almost 50 percent of those recovered in this unit). Stratum 2 is a more compact eolian sand deposit, but is still relatively loosely structured. Artifacts decrease by half from the previous level. Stratum 2 is the Pueblo Deposit, formed after around A.D. 1, thus postdating the Archaic occupation of the area. It is likely that Stratum 2 is deflated, so that many of the artifacts from the level occur in the upper blow sand of Stratum 1. Stratum 3 is the Archaic horizon. It consists of a 50 to 60 cm level of firm sand, which becomes looser with depth. The site features lie at the very top of this stratum, and charcoal is deposited in the upper half of the level in the many rodent burrows present. A moderate number of artifacts were in the top 10 cm. There is charcoal in the features and the normally tan sand directly around the features is a pinkish hue indicating that the features may have burned. Stratum 4 is the Pleistocene deposit, which starts about 80 cm bpgs. This consists of a gravelly sand that is slightly cemented and friable, with discrete calcium carbonate chunks. Cobbles and pebbles in this deposit have rinds of calcium carbonate, indicating that the surface at the time of deposition was eroding. This stratum continues below the excavated level.

The soils are massive with occasional vertical fractures and irregular to wavy boundaries between horizons, although boundaries are still sharp. The carbonates are patchy and diffuse, decreasing with depth until very little remains at the base of the Pleistocene level. As a general rule, Paleo-Indian remains can occur in the Pleistocene gravels, Archaic remains in the firm, massive sands with some calcium carbonate chunks, and ceramic period remains in the thin deposits of loose, friable eolian sand with no carbonates.

The fills of the cultural features are consistent with the Archaic horizon soil. After deposition, the cultural deposits went through the same soil formation processes as the natural horizon and are associated with the strata, rather than having been intruded into them at a later time. The dune was probably more active during the cultural occupation,

and reached its main episode of stability after the inhabitants left. The depositional sequence was as follows:

- (1) Deposition of Pleistocene gravels
- (2) Continual eolian deposition of sand, with interspersed weathering episodes. There are two vertical zones of artifacts: strata 1 and 2 contain ceramic period artifacts; Stratum 3 contains aceramic artifacts dispersed through the upper half of the unit.
- (3) Massive modern eolian deflation of dune edges.

Artifact Analysis

A total of 549 artifacts was recovered from surface collection and excavations at AZ K:13:60, including flaked stone, ground stone, bone, ceramics, and a historical artifact. The artifacts were divided by type for analysis.

Flaked Stone

Flaked stone was the dominant artifact type, with 540 specimens recovered. For the analysis of these artifacts, a number of metric and nonmetric attributes were recorded that focused on the consideration of reduction stages (primary versus secondary); reduction techniques (hard hammer, soft hammer, and pressure flaking), which, in turn, relate to types of stone working activities (such as lithic material procurement or tool manufacture and refurbishing); and the preferred raw materials of the inhabitants of the site. To determine these factors, the assemblage was broken down for further analysis into lithic debris and retouched pieces. The analysis technique closely follows a format developed previously for use on projects such as this with small assemblages of flaked stone (see Tagg and Huckell 1984). This method of analysis was patterned after a more detailed analysis used by Rozen (1981) in the St. Johns region to interpret the various steps of tool manufacture from primary (core reduction) through secondary (tool manufacture and remodification). A similar abbreviated analysis style was also used by Jones (1983; 1986) on assemblages from sites excavated in Petrified Forest National Park, thus presenting an opportunity to

compare this assemblage with others from sites dating from late Basketmaker III through Pueblo III periods.

Debitage

This category includes unmodified flaked stone artifacts such as complete and fragmentary flakes and shatter.

Methods

Several metric and nonmetric variables were recorded for each artifact: artifact type, maximum dimension, raw material type, amount of cortex, striking platform type, and lipping. From these variables, an interpretation of the types of reduction activities that occurred at the site can be advanced.

The artifact types consist of complete and fragmentary flakes and shatter. Complete flakes are all flakes in which the striking platform and both the lateral and distal edges are intact. Fragmentary flakes are further subdivided into those with platforms and those without platforms. Fragments with platforms are proximal flake fragments that retain all or most of the striking platform, but have lost the distal end of the flake through breakage. Fragments without platforms are those distal and medial fragments that are missing the striking platform and portions of the lateral or distal ends as a result of breakage. Shatter includes irregular, angular pieces of debris in which the interior and exterior surfaces cannot be distinguished.

The maximum dimension was recorded on each piece ofdebitage using a metric size class chart created by Huckell (1984:86), which consists of a series of numbered square units drawn on graph paper. Raw material type and the presence or absence of cortex was recorded for alldebitage. On those flakes or flake fragments with striking platforms, the platform type was recorded using four categories: cortical platforms, which are entirely or partially covered with cortex; plain platforms, which are plain, noncortical surfaces with no flake scars; faceted platforms, which are plain, noncortical surfaces with portions of two or more flake scars running across their surface; and crushed platforms, which are those whose type cannot be determined because the

platform was destroyed by crushing or shattering during the removal of the flake.

The final attribute recorded for those complete or fragmentary flakes with platforms was the presence or absence of lipping. Lipping is the term given to a protruding lip or overhang on the interior edge of the striking platform of a flake that is produced by the sharp angle the flake is removed at. Lipping is generally associated with soft hammer bifacial retouching of an implement. Although it is not always visible to the eye, running a fingernail over the interior edge of the platform and detecting resistance will indicate its presence.

Results

Table 9.1 presents the results of the debitage analysis. As illustrated, 512 pieces of debitage were recovered. Flake fragments (including proximal and distal fragments and shatter) dominate the assemblage with 289 (56.1 percent), but there is also a very high percentage of complete flakes, with 225 (43.9 percent). Debitage size is generally small. Over 75 percent of the debitage, including both complete and fragmentary flakes, are less than 2 cm in maximum size (size classes 2-4), with 33.6 percent of the artifacts less than 1 cm (size class 2).

As expected, raw material types are dominated by locally available petrified wood, which makes up 76 percent of the assemblage. The availability of this fine-grained lithic material may have been the reason for heavy prehistoric use of this region. Most of the wood is rainbow-colored with hues of white, red, yellow, and purple. This brightly colored wood is exposed primarily in the southern Rainbow Forest part of the park: the closest quarry is near Blue Mesa, about 11 km south. A small percentage (6.1 percent) of black petrified wood was also noted. This wood is found primarily to the north in the Painted Desert, but is also available in small quantities elsewhere in the park (Jones 1986:50). Cobble chert, another fine to medium-grained material, is also common and represents 18.5 percent ($n = 94$) of the sample. The tan, maroon, yellow, and brown fossiliferous cobbles and pebbles (usually 1 to 5 cm in diameter) are available in the recently exposed Pleistocene gravels in the site area. Smaller quantities of

Table 9.1
DEBITAGE CHARACTERISTICS

	N	%	FEA. 1	FEA. 2	FEA. 3	FEA. 4	FEA. 5	N16E5	N26E0
ARTIFACT TYPE:	512	100.0	7	5	69	78	255	82	16
Complete	225	43.9	5	2	29	34	105	42	8
Fragment + Platform	59	11.5			6	10	28	14	1
Fragment - Platform	213	41.6	2	2	30	31	117	25	6
Shatter	15	2.9		1	4	3	5	1	1
FLAKE SIZE:									
2 (1 cm)	172	33.6		1	18	39	96	16	2
3	139	27.1	1	2	19	15	77	22	3
4 (2 cm)	86	16.8		1	14	9	39	19	4
5	44	8.6			9	6	13	12	4
6 (3 cm)	32	6.3	4	1	3	3	13	7	1
7	17	3.3			5	2	6	3	1
8 (4 cm)	14	2.7	1			1	10	2	
9	3	.6	1					1	1
10 (5 cm)	3	.6			1	1	1		
>10 (>5 cm)	2	.4				2			
CORTEX:									
0- 25%	174	77.3	2	2	23	23	86	32	6
26- 75%	30	13.3	2		4	4	12	7	1
76-100%	21	9.3	1		2	7	7	3	1
PLATFORM TYPE:									
Cortical	51	18.0	3		5	6	24	11	2
Plain	140	49.3	2	1	20	16	70	28	3
Faceted	32	11.3			5	9	9	6	3
Crushed	61	21.5		1	5	13	30	11	1
LIPPING:									
Present	21	7.4			3	5	10	2	1
Absent	263	92.6	5	2	32	39	123	54	8
FRAGMENT CORTEX:									
Present	103	35.9		1	14	8	70	6	4
Absent	184	64.1	2	2	26	36	80	34	4
RAW MATERIAL:									
Petrified Wood	358	69.9	4	4	46	50	186	55	13
Petrified Wood (Black)	31	6.1	1	1	4	6	12	6	1
Cobble Chert	94	18.4	2		13	20	39	19	1
Chalcedony	16	3.1			4	1	9	1	1
Quartzite	10	2.0			2	1	6	1	
Limestone	3	.6					3		

another fine-grained material, chalcedony, and two coarse-grained materials, quartzite and limestone, also were present in the assemblage.

Cortex is generally lacking on the debitage from the site, with 77.3 percent (n = 174) of complete flakes having 25 percent or less, and 64.1 percent (n = 184) of the flake fragments lacking it completely. Cobble chert tended to have more cortex because the original pieces of material were usually small cobbles or large pebbles with little noncortical area. Cortex is also lacking on platforms, with 49.3 percent of the debitage exhibiting plain platforms (n = 140). Less than 20 percent of the assemblage had cortical platforms, and 11.3 percent were faceted. Lipping was present only on a very small number (n = 21, 7.4 percent) of the platforms present.

Retouched Pieces, Hammerstones, and Cores

Retouched pieces are defined as pieces of flaked stone that exhibit evidence of secondary retouch, with flakes removed from one or more edges, usually in a uniform fashion (Tagg and Huckell 1984:76).

Methods

The retouched pieces recovered from AZ K:13:60 were classified into one of five artifact types based on form similar to traditionally defined tool types commonly used in the Southwest. Hammerstones and cores were included in this section for convenience of discussion. These type names do not necessarily suggest tool function, since no studies of use-wear were conducted to indicate how, or if, the artifact had been used. In some cases, pieces were divided within a category to distinguish variation within the specific artifact types. Depending on the artifact type, a number of metric and nonmetric attributes were recorded on each retouched piece, including material type, completeness, metric dimensions or size class, and retouch type. Hammerstones and cores were also weighed, and reduction types recorded for cores. The seven artifact types are defined below, with definitions based on Rozen (1981).

Projectile points are small bifaces (20 mm to 60 mm long), usually triangular or lanceolate in shape, with some specialization in form to facilitate hafting, such as stems or notches.

Scrapers are unifacially retouched pieces that have had a series of flakes removed from a flat surface along one or more margins of the interior of a flake to create a fairly steep working angle and edge.

Unifaces are pieces exhibiting retouch along one margin and are generally smaller, thinner, and exhibit more variability and less uniformity in edge shape than scrapers. This category includes unifacially retouched fragments too small to place in other categories.

Bifaces are those pieces exhibiting continuous bifacial flake removal from a common, continuous margin. They rarely exhibit evidence of pressure flaking and have no specializations for hafting.

Perforators are those artifacts exhibiting projections or bits produced by unifacial or bifacial retouch.

Hammerstones are natural river cobbles that exhibit battered margins from use as hammers to remove flakes from cores, and from other battering tasks.

Cores are pieces of lithic material that have had large flakes removed and exhibit negative percussion bulbs. Tested cobbles, or pieces with two or more flakes removed to test the material, were also included in this category.

Results

Eighteen retouched pieces, 1 hammerstone, and 9 cores or tested cobbles were recovered from AZ K:13:60. These artifacts represent 5.2 percent of the flaked stone assemblage (Table 9.2).

Three projectile points were recovered, representing the only temporally diagnostic flaked stone artifacts in the assemblage. The points were fragmentary and made of petrified wood. Two separate styles of points are represented by base fragments; the single tip fragment was unidentifiable. The tip fragment, from Feature 3, is 2.8 cm long and has a transverse snap fracture at its midsection, a snap fracture of its tip, and slight margin damage. It was identified as a projectile point because it was pressure flaked. The two bases include a Folsom point and an unidentifiable base fragment. The Folsom point base was recovered from the surface of the site between Features 4 and 5. It has a maximum dimension of 3.3 cm and has a transverse snap fracture through its midsection, indicative of breakage during manufacture (Fig. 9.8a).

Table 9.2

DISTRIBUTION OF RETOUCED PIECES, HAMMERSTONES, AND CORES

	N	SURFACE	FEA. 1	FEA. 3	FEA. 4	FEA. 5	N16E5	N27E0
Projectile Points	3	1			1	1		
Scrapers	2			1			1	
Unifaces	3				1		2	
Bifaces	9	4		1		3	1	
Perforators	1						1	
Hammerstones	1				1			
Cores:								
Core	7		1	2	2	2		
Tested Cobble	2				1			1
N	28	5	1	4	6	6	5	1

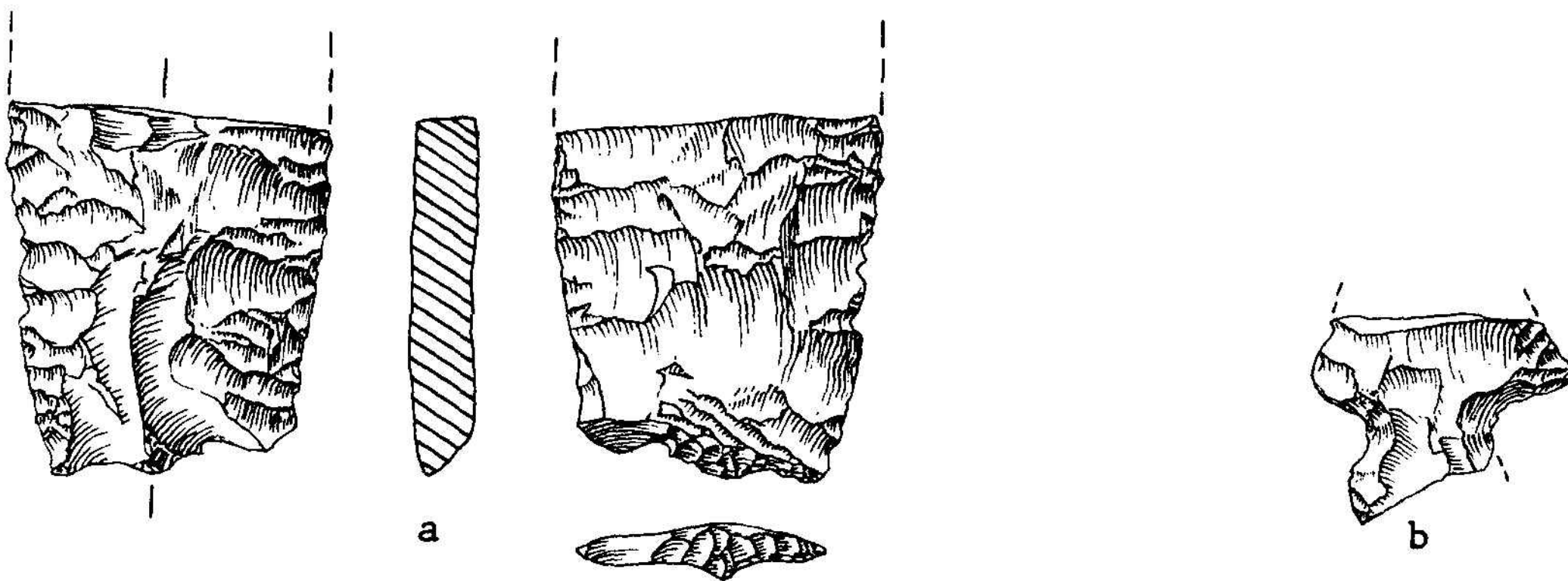


Figure 9.8. Projectile points from AZ K:13:60.

The point was probably broken during fluting and still retains a slight nipple in the concavity of the base that was isolated as the platform for removing the flutes. According to Bruce Huckell and Ken Rozen, Arizona State Museum archeologists, the knapper probably mis-struck the blow meant to run the flute, which resulted in a stress fracture. The point also has slight margin damage. The final point is a side-notched

specimen with a transverse snap fracture across its midsection and another diagonally across the base of the stem (Fig. 9.8b). One shoulder is also slightly damaged, and the point has been burned. This point, recovered in a badly fragmentary state from Feature 4, may be a Basketmaker II style point such as those recovered from the Flattop Site (Wendorf 1953:68, Fig. 36a-c). Unfortunately, it is too fragmentary to positively identify.

Bifaces were the most common type of retouched piece found, with nine specimens recovered. Two separate types of bifacially worked implements were recognized: bifaces and preforms. Bifaces represent what are considered by the author to be finished tools--thin, lanceolate-shaped implements exhibiting even, overlapping flake scars. Preforms are more crudely flaked, and are larger and thicker than bifaces. With their large, unevenly spaced flake scars and irregular shape, they probably represent unfinished bifaces (Tagg and Huckell 1984:85). Five bifaces and four preforms were recognized. The five bifaces included three complete specimens and two fragments. The complete specimens are small, relatively well flaked pieces of petrified wood ($n = 2$) or cobble chert ($n = 1$) (Fig. 9.9a-c). The two petrified wood specimens are better shaped than the cobble chert specimen. One is triangular-shaped with a flat base and rounded tip (Fig. 9.9b). The second is more diamond-shaped, with a drill-like sharpened tip and a contracting base (Fig. 9.9c). It may have been an attempt at a projectile point that failed because it could not be thinned enough. The cobble chert specimen is triangular-shaped with a flat base and rounded tip (Fig. 9.9a). The complete bifaces range in size from 3.9 to 4.7 cm long, 1.3 to 2.4 cm wide, and 0.7 to 0.8 cm thick. The biface fragments, a base and a midsection, are both petrified wood. The base appears to be a fragment of a small triangular biface with a flat base: it has a transverse snap fracture across its midsection. The midsection fragment appears to have been from a much larger biface (it is 3.4 cm wide), but it is too fragmentary for any other observations. Both fragments are from well-shaped specimens. Bifaces were recovered from the surface ($n = 2$), Feature 5 ($n = 2$), and Unit N16E5 ($n = 1$).

The preforms are larger and more crudely worked than are the bifaces. The specimens are all complete, ranging in size from 4.4 to

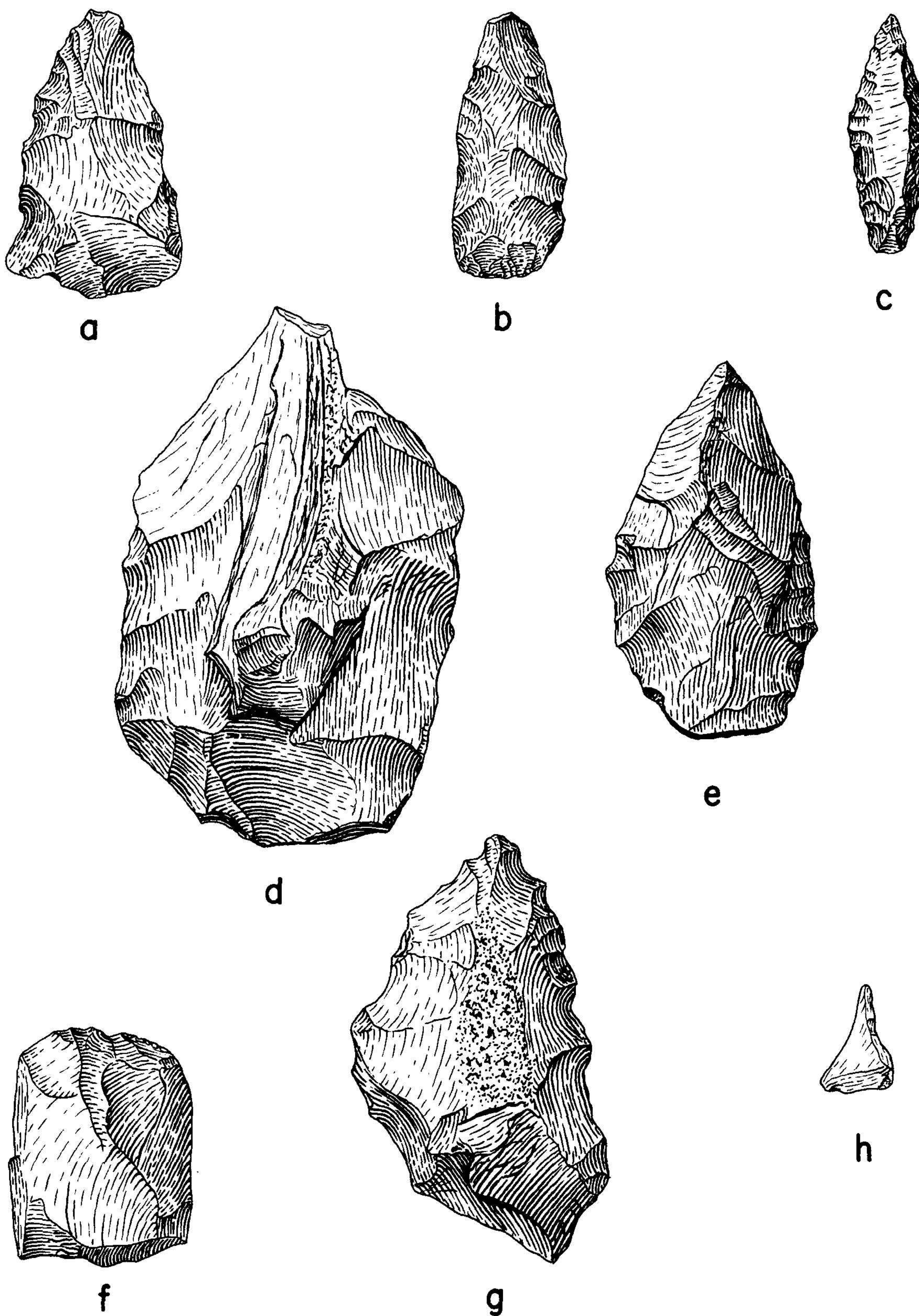


Figure 9.9. Retouched pieces from AZ K:13:60. (a-c) are bifaces; (d-e) are preforms; (f-g) are scrapers; (h) is a projection.

8.5 cm long, 2.2 to 5.4 cm wide, and 1.2 to 2.2 cm thick (Fig. 9.9d-e). Three of the specimens are lanceolate-shaped and one is oval. All are thick, which may be why they were never finished. Three are petrified wood (including one of black petrified wood) and one is cobble chert. One of the petrified wood specimens could actually be considered a triface, with three edges modified to produce a sharpened tip (Fig. 9.9e). Two preforms were recovered from the surface and one each from Feature 5 and Feature 3.

Unifaces are the next most common type of retouched piece--all three specimens were fragmentary. When complete, unifaces may be classified in another retouched piece category such as scraper. They are all petrified wood, including one black piece. Unifaces were recovered from Unit N16E5 (n = 2) and Feature 4 (n = 1). Two of the fragments could tentatively be classified as fine flake tools, exhibiting a uniform row of small microflakes removed from a single edge. The final uniface has an uneven edge, with large flakes removed, and may have been a denticulate.

Two scrapers were recovered, one each from Feature 3 and Unit N16E5. The first specimen is oval, with retouch along its entire margin (Fig. 9.9g). Due to the high, convex side, it could also be termed a turtleback scraper. This artifact is 7.0 cm by 3.8 cm by 2.7 cm, and is made on a chert cobble. The retouch is relatively even, and the retouched edges meet at a point on one end. The second specimen is an end scraper, with even retouch along one end of the piece (Fig. 9.9f). This scraper was manufactured on a complete petrified wood flake, with retouch along the distal edge.

A single perforator was recovered from Unit N16E5. The petrified wood specimen is 1.8 cm by 1.2 cm by 0.2 cm and was made on a small flake with a hinge fracture on the distal end (Fig. 9.9h). The hinge created a narrow point on one lateral edge, which was modified with unifacial retouch to create a "bit" or projection. The artifact resembles a graver more than a drill because of the small bit with only slight modification.

Six cores and three tested cobbles were recovered, three from Feature 4, two each from features 3 and 5, and one each from Feature 1 and Unit N27E0. The cores are small, exhausted pieces or fragments

ranging from 4.1 cm to 7.1 cm in maximum dimension and weighing from 28 to 100 grams. Of the six small cores or fragments, four have less than 25 percent cortex, one has more than 25 percent, and one is too fragmentary to determine amount of cortex. Flake removal techniques vary between double ($n = 2$) and multidirectional ($n = 2$) platforms, with two pieces too fragmentary to determine platform type. Both petrified wood ($n = 4$), including a black petrified wood core fragment, and cobble chert ($n = 1$) were present.

The three tested cobbles were all chert with only a few flakes removed from them to test material suitability. Two of the cobbles are small or fragmentary, have single platform flake removal, and weigh between 40 and 185 grams. The third cobble is 15.5 cm in maximum dimension and weighs 2,365 grams. All three specimens have at least 75 percent cortex.

The final artifact is a hammerstone. It is an oblong chert cobble, 8.2 by 4.2 by 2.3 cm, with slight battering and spalling at one end. The cobble would have been an ideal flint knapping tool due to its small size, although the light wear indicates it was used only a few times.

Ground Stone

Only two pieces of ground stone were recovered from the site, a handstone and a polishing stone. Two pieces of shaped stone were also included in this category for convenience.

The handstone was recovered from the surface, 3 m west of Feature 2. It is triangular shaped with a plano-convex cross section. One surface has been pecked and utilized and a contiguous edge appeared to have been used, but much of it had spalled off. The handstone is a sandstone cobble 11 cm by 8.3 cm by 6.9 cm with light to moderate wear.

A polishing stone also was recovered from Feature 3. It is a small chert cobble, 6.0 by 4.3 by 2.8 cm, with bifacial use. The use surfaces are highly polished and exhibit striations perpendicular to the length. Bruce Huckell said that polishing stones found on preceramic sites (such as Double Adobe in southeast Arizona) were thought to be hide graders for working animal hides. These polishing stones do not have the sheen on the working surface like those used for pottery polishing.

Two pieces of shaped stone were recovered from Feature 3. One small sandstone slab was recovered just above the hearth. It has light pecking along the remaining margin and in a few places on one face. It has a maximum dimension of 13 cm and is 2.6 cm thick. It was blackened from exposure to fire. The second piece is a complete red sandstone cobble, 18 cm by 12 cm by 6.8 cm, which was recovered adjacent to Feature 3. This cobble resembles a two-hand mano, but closer investigation revealed that the use area was only very smooth cortex. The cobble was pecked around its entire margin and was abraded on one surface, perhaps from use as a mano. The function of both of these shaped stones is unknown, but it seems possible they were used for architecture or as hearthstones.

Bone

Two very small fragments of bone were recovered from Feature 3. Both fragments are less than 1.4 cm long, have been burned, and appear to be long bone shaft fragments from a small animal. The fragments are too small for identification.

Miscellaneous

One historical artifact, three sherds, and a fossil shell were recovered during the excavation. The historical artifact is a stamped iron five-pointed star found in the upper level of Feature 4 during excavation. It is 1.9 cm high with a square hole punched in the outer edge bordered by a circular depression. This would suggest that it was attached by a round headed rivet with a square shank. It is identical to two artifacts found at an early 1900s Navajo habitation site at the Painted Cliffs Rest Area along Interstate 40 near the New Mexico border (Ferg 1978:130; Fig. 63c). They are probably decorations which attached to some sort of canvas or leather hardware on a wagon or horse's gear. They might also be decorative rivets used on items such as clothing (especially pants, as a method of fastening pocket openings).

A fossil oyster shell was recovered from the fill above Feature 5. Alan Ferg, Arizona State Museum, said it looked identical to some recovered from excavations at AZ K:12:3 (ASM) at the Painted Cliffs Rest Area that were identified as Pycnodonte newberryi (Ferg 1978:12). They

are frequently referred to in the literature, though, as belonging to the genus Gryphaea, and probably came from either Mancos shale or Dakota sandstone. Exposures of these formations closest to the site are in St. Johns, Arizona, 50 km east of Petrified Forest. The unworked shell is 2.6 cm by 2.2 cm by 1.0 cm. One of the fossils recovered by Ferg (1978:76, Fig. 42c) had been made into a piece of jewelry. The umbo had been drilled down and perforated.

Two sherds were found 30 m south of the site area, and were probably not associated with the site. They were identified by Trinkle Jones as a unidentified redware bowl rim (possibly Woodruff Red) and a Holbrook B Black-on-white jar body sherd. The latter sherd dates from around A.D. 1023 to 1061 (Breternitz 1966:77-78). A third sherd, identified as Adamana Brown, was recovered from the site surface near Feature 2. This is the earliest identified pottery type in Petrified Forest, dating to the Basketmaker II period (ca. A.D. 300).

Pollen and Flotation Analysis

Three pollen samples were analyzed by Suzanne Fish, two from the Feature 3 hearth and one from Feature 4 (see Appendix C). The most numerous pollen types were Cheno-am (including chenopods and amaranth), Ambrosia-type (bur sage), pine (Pinus), Gramineae, and wild buckwheat (Eriogonum). Much of this pollen spectrum is consistent with the shrubby grassland vegetation of the area, lacking nearby trees. The exceptions are small amounts of pine pollen and oak pollen. If the environment was the same then as now, sources for oak and pine pollen would not have been present in the site area. As shown in other studies (see Appendix C), windborne transport has accounted for pine pollen in a grassland environment, but high percentages of oak pollen have only been accounted for where oaks were present. Both Cheno-ams and wild buckwheat are common colonizers of disturbed habitats. A number of species of these plants have been used for edible seeds and greens by aboriginal groups in Arizona.

Seven flotation samples and a charcoal sample from Feature 3, and one flotation sample from Feature 4 were submitted to Lisa Huckell for analysis (see Appendix B). Four taxa were identified in the samples:

maize (Zea mays L), Indian rice grass (Oryzopsis hymenoides), Cheno-ams, and juniper (Juniperus cf. J. monosperma). Maize consisted of fragmentary flint or popcorn kernels and cupules which indicates agricultural plants were used by the inhabitants of AZ K:13:60. Huckell indicates that rice grass and Cheno-ams were exploited by historical native southwestern Indian groups between the late spring and fall months. Juniper remains and charcoal undoubtedly represent easily accessible fuel wood.

Radiocarbon Analyses

Two wood charcoal samples from Feature 3 and a composite sample from Feature 4 were sent to Washington State University for radiocarbon analysis. In addition, a carbonized corn kernel from Feature 3 was submitted to the University of Arizona for analysis. The dates (Table 9.3) were calibrated using tree ring dates (Klein, Lerman, Damon and Ralph 1982).

Table 9.3
RADIOCARBON DATES FROM AZ K:13:60 (ASM)

SAMPLE NUMBER	MATERIAL	PROVENIENCE		DATE (YRS B.P.)	CALIBRATED DATES*
		FEATURE NUMBER	DEPTH (cm bpgs)		
AA #2438	Carbonized Corn	3	24-35 cm	2100+60 (150 B.C.)	--
WSU #3576	Wood Charcoal	3	24-30 cm	2960+90 (1010 B.C.)	1420-885 B.C. (1152 B.C.)
WSU #3575	Carbonized Juniper Log	3	30-35 cm	2420+110 (470 B.C.)	790-225 B.C. (508 B.C.)
WSU #3577	Wood Charcoal	4	Composite	2900+95 (950 B.C.)	1380-830 B.C. (1105 B.C.)

* 95% Confidence Interval

The three radiocarbon dates from Feature 3 range from 2100 to 2960 B.P. With standard deviations of around 100 years or less, this is a substantial spread. All the wood charcoal identified from the site was juniper. Wood is scarce in the park today; juniper trees occur as solitary specimens thousands of meters apart in the vicinity of the site. The prehistoric inhabitants may have used old or dead wood, as well as recently cut wood, from trees over a wide area. This may also explain the apparent reverse stratigraphy of the wood charcoal dates (WSU Sample Nos. 3575 and 3576). Fortunately, maize was recovered from the hearth. The "old wood" problem is irrelevant when dating maize, an annual domesticate. Thus, on the basis of the direct date of the corn kernel from the hearth fill, the site was occupied at least around 2100 B.P.₊₆₀ (150 B.C.), and may have been occupied no earlier.

Interpretations

Summary

The test excavations at AZ K:13:60 uncovered three pit features and two rock clusters. Numerous stone artifacts and samples were recovered. Analysis of these data indicates that the remains probably represent a seasonal or short-term habitation site occupied during the Late Archaic period.

Site layout cannot be determined with certainty because more features may remain unexcavated, but the pit features appear to be lying in a semicircular pattern, with the rock clusters inside the arc. The pit features were probably simple brush-and-pole shelters or wattle-and-daub structures or perhaps a covered feature such as a ramada or windbreak, the charcoal in the features may represent the burned remains of these superstructures. Others suggest that Feature 3 may be the product of a deflating hearth and southwest prevailing winds. From the regularity of the three features and comparisons to similar sites in Arizona, though, these features are considered structures in this interpretation. The pit structures are round to oval, ranging in size from 2 m by 1.8 m to 2.25 m by 2 m, and are very shallow, less than 20 cm deep. Two of the features may have exterior postholes, and one has

an interior hearth. The two rock features probably represent roasting pits, but were too badly deflated for accurate interpretation.

The artifacts consist almost entirely of flaked stone debitage, with a few stone tools. The flaked stone assemblage is characterized by a high percentage of flakes and flake fragments (94.8 percent) and a low percentage of retouched pieces, hammerstones, and cores. The flakes, which tend to be small and thin with very little cortex, were produced from locally available materials such as petrified wood and cobble chert. These characteristics suggest that secondary reduction (including tool production and repair) was the principal stone-working task at the site. Secondary reduction is characterized by a high frequency of flake fragments and a low frequency of complete flakes, retouched pieces and hammerstones, by small thin flakes with very little cortex, and by a high frequency of lipping and faceted platforms (Rozen 1981:206).

Bifacial implements are the dominant type of retouched pieces, and unfinished preforms are common. A high number of soft hammer produced bifaces is a trait common to preceramic, hunter-gatherer sites in the Southwest, and is especially true of Late Archaic sites (see Rozen 1981, for instance). Only projectile point fragments were recovered, but they are not helpful in the temporal placement of the site. The only identifiable fragment is a Folsom point base broken during the fluting process. Other retouched pieces include scrapers, uniface fragments, a graver, and a slightly used hammerstone. A number of exhausted cores and tested cobbles are also present.

Only two pieces of ground stone were recovered, a handstone and a polishing stone. Both are complete--the handstone is only slightly used, and the polishing stone exhibits facets worn from more extensive use. A single, locally made plain ware sherd of Adamana Brown was recovered from the site. It may represent a later intrusion or may be associated with the site. It is not uncommon to find crude plain ware sherds on Late Archaic sites, and it has been suggested that Late Archaic agriculturalists may have been contemporaneous with the earliest ceramic-producing agricultural groups or that a currently unknown local plain ware tradition bridges a transition to the known ceramic sequence (Fish and others 1986:570).

Certain subsistence activities are suggested by the results of the pollen and flotation analyses. Wild plant remains include Cheno-am and wild buckwheat pollen, Cheno-am seeds, Indian rice grass caryopses, and juniper charcoal. Cheno-ams and buckwheat are common colonizers of disturbed habitats but are also known to have been used by aboriginal groups in Arizona. Cheno-ams produce large numbers of small, edible seeds, and a number of species have been used for greens by aboriginal Southwestern cultures. The seeds are gathered in late summer and early fall, and are usually consumed as mush or gruel (see Appendices B and C). Wild buckwheat seeds have been used as food by the Navajo. Indian rice grass grains are harvested in late spring to midsummer, and are an important food among most northern Arizona Indian groups. These plant types have been identified at Late Archaic sites at St. Johns (Westfall 1981) and on Basketmaker II sites in northeastern Arizona (Guernsey and Kidder 1921).

Trees, represented by juniper pollen and charcoal, and oak and pine pollen also were identified. Juniper was locally available and, as indicated by the log in the Feature 3 hearth, was used as fuel wood. Juniper also was identified in Archaic context at St. Johns (Westfall 1981:313). Pine and oak are not locally present; their occurrence in the site may be from windblown context, or these species were nearby during the site's occupation. Based on these limited data, it may be inferred that the site was occupied sometime between midsummer and early fall.

One domesticate, maize, also was recovered from AZ K:13:60 in kernel and cupule form. It is probably a flint or popcorn. The lack of corn pollen implies that only processed forms of corn or corn grown elsewhere were brought to the site. Suzanne Fish indicates that if corn were grown and harvested in the immediate vicinity, corn pollen should have been introduced into the sample (see Appendix C). Westfall (1981:93) also suggests the possibility of Archaic groups carrying beans and corn during seasonal hunting and gathering expeditions rather than growing the plants at the campsites. Maize has been identified on Late Archaic sites in southern Arizona (see, for instance, Huckell and Huckell 1984; Fish and others 1986), and on Basketmaker II sites in northern Arizona (see Smiley and others 1986; Wendorf 1953).

The only faunal remains are two small, burned long bone shaft fragments from a small animal. Late Archaic use of rabbits is noted from Black Mesa (Parry and others 1985:28).

The ground stone implements also indicate subsistence strategies. The handstone would have been used in plant processing activities. As mentioned earlier polishing stones have been interpreted as animal hide grainers. The polishing stone and the recovery of projectile points indicate hunting. In all, these few floral and faunal remains suggest the use of small animals, natural seeds and greens, and of imported maize.

Petrified Forest Context

While AZ K:13:60 provides some interesting data on the Archaic occupation of Arizona, it is also extremely important in the interpretation of earlier occupations at Petrified Forest. First, the site yielded a Folsom point base, diagnostic of the Paleo-Indian period of big game hunters (about 9500 to 7500 B.C.). The point may have been curated, as was suggested for the single Folsom point found in a pithouse on the Flattop Site (Wendorf 1953). The small size of the fragment from AZ K:13:60, which makes it impractical for reuse, and the fact that it was broken during manufacture, might also imply that the point belongs to a Paleo-Indian site underlying the Archaic site. It is possible that the two rock clusters (Feas. 1 and 2), lying on the Pleistocene gravel surface and more eroded than the pit structures, also may belong to a Paleo-Indian occupation. A Late Paleo-Indian occupation also was suggested for a second Petrified Forest site, AZ Q:1:129, which yielded a Cody point and Cody knife fragment. The use of local petrified wood for the three Paleo-Indian points and Cody knife discovered in the park suggests the possibility of Paleo-Indian utilization, and perhaps stone quarrying, in Petrified Forest or its vicinity. Twenty-three additional Folsom points have been found throughout northeastern Arizona since 1982, especially around St. Johns (Huckell 1982).

Dating at some time between 150 and 1010 B.C., AZ K:13:60 is the earliest investigated site in Petrified Forest. It provided indications

that during the Late Archaic period, the inhabitants in the park had access to cultigens and lived in temporary campsites with possible structures. Prior to these investigations, the earliest corn and structures found at Petrified Forest were from the Flattop Site, which dates between A.D. 300 and 500 (Wendorf 1953).

The site also presented the opportunity to see whether the utilization of petrified wood varied through time. This was made possible by the results of the previous excavations (Jones 1983, 1986) of ceramic period sites. For this comparison, Locus B of AZ Q:1:42 represented Basketmaker III; AZ K:13:13 and AZ Q:1:58 were combined for Pueblo II; loci A, C, and D of AZ Q:1:42 were combined for Late Pueblo II/Early Pueblo III; and AZ K:13:19 represented Pueblo III. With few exceptions, all of the assemblages are relatively similar. Petrified wood was dominant in all cases, but the Late Archaic and Basketmaker III peoples relied a little less on petrified wood, and used more cobble chert. Artifact assemblages were very similar, with slightly more complete flakes, a lot more distal flake fragments, and fewer chunks on the Archaic site than on the ceramic sites. The Archaic site had fewer cortical platforms and more faceted platforms. Debitage was smaller in size on the Archaic site, and bifaces were much more common. Scrapers were more common on ceramic sites. Secondary reduction may have been slightly more prevalent at the Archaic site than at the later ceramic period sites as is generally the case between sites of these time periods, but the differences are minor enough to suggest that flaked stone exploitation varied little through time at Petrified Forest.

Regional and Temporal Context

Preceramic Late Archaic and Basketmaker II sites similar to AZ K:13:60 have been investigated in both northern and southern Arizona. The morphology, abundance, and arrangement of features on these sites are extremely variable. Four sites excavated on the TEP project near St. Johns yielded C-14 dates ranging from 2180 to 225 B.C., and were considered to be Late Archaic (Westfall 1981:225, Table 59). The sites (AZ Q:7:33, Q:7:22, Q:12:27, and Q:11:69 [ASM]) consisted of "occupation surfaces" with postholes indicating possible brush surface structures

and multiple firepits or roasting pits associated with fire-cracked rock concentrations. Artifacts consisted of mixed tool assemblages (including manos and metates) and soft hammer biface production (small bifaces were the dominant tool types). Gasser (Westfall 1981:313) suggests that the few plant remains were wild species, although Westfall (1981:93) mentions domestic bean and corn from a feature at AZ Q:11:69 (ASM), Locus E, which was radiocarbon dated to 4130 ± 90 B.P. (2180 B.C.). This early date may be in error. However, according to Ken Rozen, the absence of any ceramic component at a site that yielded evidence of substantial occupation (structures, ground stone, multiple fire pits, and so forth) implies that these domesticates are associated with an Archaic occupation of the excavated area. Both longer and more intensively occupied "base camps" and small limited or specialized activity sites were identified. Relatively intensive use of the St. Johns area by Late Archaic groups was suggested (Westfall 1981:313, 355-356).

During the Black Mesa Archeological Project, four sites on Black Mesa were identified as Late Archaic, with C-14 dates ranging from 1550 B.C. (3500 ± 90 B.P.) to 670 B.C. (2620 ± 60 B.P.) (Parry and others 1985:4). These sites were small ephemeral campsites that lacked evidence of structures. Features consisted of shallow, circular, basin-shaped hearths. Low densities of nonlocal flaked stone were present, and wild plants and small mammals were exploited. It was suggested that the Black Mesa area was only briefly visited on infrequent occasions by highly mobile Late Archaic groups (Parry and others 1985:28).

Late Archaic sites in southern Arizona, ranging in age from approximately 850 B.C. (2800 ± 110 B.P.) to about 250 B.C. (2200 ± 130 B.P.) have also been investigated. Some are ephemeral hearth sites, but others appear larger and more intensively occupied than sites identified as Late Archaic in northern Arizona. Excavations at four sites in southeastern Arizona have uncovered shallow, basin-like structures ranging in maximum size from 2.25 m to 4.5 m in diameter. Some have interior bell-shaped storage pits and hearths, and are ringed by exterior wall postholes (Huckell 1987:4-5). Common extramural features include bell-shaped pits, rock-filled hearths or roasting pits, and

clusters of fire-cracked rocks. Human burials also were found. Flaked and ground stone artifact densities were usually high at these sites, and subsistence items included both domesticates (maize and possibly beans) and wild plant foods. The sites were large semisedentary residential bases with intensive occupation by 1000 to 500 B.C., where agriculture formed an important aspect of subsistence (Huckell 1987:18).

Similar sites found in northern Arizona date to the Basketmaker II period. These sites also are preceramic, have shallow pithouses, and appear to have been semipermanent or permanent, intensively occupied "base camps." As many as 95 Basketmaker II sites were tested or excavated at Black Mesa. These sites typically were shallow with numerous features, and many had evidence of from 1 to 12 structures. Other features included bell-shaped pits, roasting pits, hearths, and slab-lined pits. Flaked stone tools and debitage and ground stone were abundant, and ornaments, abrading stones, axe heads, and bone tools are also present (Smiley 1985:23). Almost all of the sites yielded evidence of corn, as well as wild plant foods. Both small and large mammals apparently were hunted. These sites have been radiocarbon-dated to between 186 B.C. and A.D. 370 (Smiley 1985:373). More recent work by Parry and Smiley on the Three Fir Shelter and Kidder and Guernsey's Basketmaker II cave sites, has extended these dates back before 500 B.C. (Parry 1987).

Gumerman (1966) excavated two Basketmaker II villages near Sanders, Arizona. These villages had oval pithouses from 3.75 m to 4.5 m in diameter. The houses are saucer-shaped, with unprepared walls and floors, unlined hearths, and occasional interior features. A few examples of sandstone slabs on floors or lining hearths were noted. One site had bell-shaped pits. Flaked and ground stone artifacts were present, as were bone tools and ornaments. No chronometric dates, or faunal or floral analyses, were reported.

Two additional sites in northern Arizona include the County Road Site and the Hay Hollow Site, excavated by the Southwest Archeological Expedition in Hay Hollow Valley, 30 km southwest of Petrified Forest (Martin 1967; Plog 1974). Both sites contained remains of house floors. Corn was recovered, although the major subsistence was still hunting and gathering. At Hay Hollow, a few crudely made brown ware sherds, the

earliest ceramics in the region, were recovered along with lithics such as projectile points, basin metates, and cobble manos. The site was occupied between 200 B.C. and A.D. 200, and contained three major clusters of from one to three houses with associated pits used for storage and hearths. The County Road Site was occupied about 1000 B.C. and contained four houses and outdoor use areas in a configuration similar to that of the Hay Hollow Site (Stewart 1980:77-78).

In Petrified Forest, the term Basketmaker II has been used to describe the earliest ceramic period sites, on the basis of excavations at the Flattop Site (Wendorf 1953). These sites have slab-lined pithouses with ramp entryways and slab-lined storage bins. Adamana Brown is the diagnostic ceramic type, and corn was found in quantity. The site was dated from about A.D. 300 to 500 because of its similarities to sites in the Forestdale region (see Haury 1940, 1985; Haury and Sayles 1947). This site would probably be considered Basketmaker III by current northern Arizona standards.

The relationship of the southern Arizona Late Archaic to the Late Archaic and preceramic Basketmaker III occupations in northern Arizona has not been determined. There is an unquestionable similarity between Late Archaic sites in southern Arizona and Basketmaker II sites in northern Arizona. Bruce Huckell suggests that the southern Arizona Late Archaic and northern Arizona Basketmaker II are, at least in part, coeval, and differ in name more than anything else. Parry and others (1985:2-4), using data from the Black Mesa Archeological Project, suggested that there were distinct differences between the Late Archaic and preceramic Basketmaker II occupations. The major differences were in lithic assemblages, with Archaic people utilizing nonlocal material and the Basketmaker II people using local material. Also, the Late Archaic period on Black Mesa was preagricultural, whereas corn was grown in Basketmaker II times. Radiocarbon dates placed the Late Archaic between 1550 B.C. (3500 \pm 90 B.P.) and 670 B.C. (2620 \pm 60 B.P.) with a mean date of 1140 B.C. (3090 B.P.), and Basketmaker II was placed between 610 B.C. (1560 B.P.) and A.D. 350 (1600 B.P.) with a mean of 170 B.C. (2120 B.P.). There was no overlap between the occupations, and the two periods were considered chronologically discrete (Smiley 1985:4-5). With the new dates on Kidder and Guernsey's site, though, Parry (1987)

suggests that the transition from Late Archaic to Basketmaker II was around 600 B.C., or even earlier.

AZ K:13:60 has oval, shallow features (one with a hearth) with possible postholes and fire-cracked rock concentrations, a flaked stone assemblage with small bifaces as the dominant tool type, the presence of corn, and C-14 dates ranging from 1010 to 150 B.C. With these features, AZ K:13:60 is morphologically and temporally very similar to the southern Arizona Late Archaic sites. However, the shallow structures and presence of corn make it morphologically similar to the preceramic Basketmaker II sites, which are considered temporally later.

The similarity with Basketmaker II sites is not unexpected though, considering the similar nature of southern Late Archaic and northern preceramic Basketmaker II sites. Huckell (1984) suggested that the Southwest had a single broad cultural entity during the Archaic period rather than regionally distinct groups, and that appears to apply here. The similarities between these early campsites cannot be ignored, and even though Basketmaker II sites normally date later than Late Archaic sites, they may fall in the later part of the Archaic temporal period as indicated by the Late Archaic dates from the TEP Project. AZ K:13:60, with its preceramic Basketmaker II features, the presence of corn, and the several Late Archaic dates, may suggest that the site may be transitional between the Late Archaic and Basketmaker II periods. It may also suggest that the Basketmaker II and Late Archaic periods may be one and the same. AZ K:13:60 also indicates that, as in southern Arizona (see Huckell 1984), there may have been increased use of cultigens during the Late Archaic period. As agriculture became more important, there would have been an increasing trend towards semisedentary settlements in northern Arizona. Also on nearby Black Mesa, many sites identified as Late Archaic yielded nonlocal lithic materials, indicating a highly migratory group, but Basketmaker II groups utilized local materials as would be expected of a more sedentary group. The latter is the case at AZ K:13:60. Perhaps the availability of petrified wood was one of the reasons the Late Archaic people frequented the area, and may have contributed to a more sedentary settlement type. This appears to be the pattern, in any case, in the Petrified Forest region.

Conclusions

The investigations at AZ K:13:60 revealed a small campsite dating to the transition between the Late Archaic and the Basketmaker II periods (about 1010 to 150 B.C.). The presence of corn in the hearth of one of the structures indicated that some cultigens were being used in addition to the normal hunting and gathering activities associated with Late Archaic period subsistence. The lack of depth and the sparse artifacts identified at the site suggest limited or short-term occupation of the site. The type of floral remains indicates perhaps only seasonal (midsummer to early fall) occupation. The site is temporally and morphologically similar to Late Archaic sites in southern Arizona, but also is morphologically similar to sites placed in the Basketmaker II period in northeastern Arizona. It was suggested tentatively that the Basketmaker II period of Petrified Forest may correspond to the Late Archaic period in southern Arizona because of the many similarities the two periods demonstrate.

On the park level, AZ K:13:60 adds a new dimension to the archeology of the Petrified Forest. It provides evidence of the earliest known site with structures in the park, and indicates a date for corn at least 500 years earlier than was previously known in the park. Unlike on nearby Black Mesa, it appears that Archaic peoples were more sedentary at Petrified Forest. Preservation was good at AZ K:13:60 which suggests that more Late Archaic habitation sites may be discovered in the park. The excavation at the site did not uncover the remains of a Paleo-Indian campsite as was expected, but it did provide a wealth of information on a previously unstudied facet of the early prehistory of Petrified Forest National Park.

Chapter 10

A BRIEF SYNTHESIS OF RESEARCH RESULTS

The data presented in this volume and by Hammack (1979) provide an excellent opportunity to reconsider past conclusions about Petrified Forest prehistory. Since 1978, 5 sites have been partially excavated, and 182 sites have been recorded to current standards. All of the projects were initiated in response to management needs, but the survey areas do provide an 11 percent (10,539 acres or 16.5 square miles) nonrandom sample of park lands. Large blocks around developed park areas and several extended transects were surveyed. The 200 to 400-m wide transects were along the Mainline Road and the boundary fences, from the south end of the park to the Painted Desert Rim. The results of the surveys specifically concern the research topics of economic orientation, culture history, regional interaction and trade, and technological change.

Culture History

In terms of chronology, the new data document much earlier occupation of the park than was known. The discovery of two additional Paleo-Indian points made of petrified wood, one on AZ K:13:60, a preceramic campsite that may have a Paleo-Indian component, lends credit to the working hypothesis that hunters were in the area before 6000 B.C. Testing at AZ K:13:60 documented a campsite of the Late Archaic Period in the first millennium B.C. Direct dating of corn from the hearth suggests that domesticates were in use by 150 B.C. and possibly as early as 1010 B.C.

Evidence from the early end of the Anasazi sequence, the Adamana Horizon (Reed 1980:201), should be reassessed when new data are available. On the basis of literature reviews and discussions with other archeologists working in the region, we believe the pit house sites with no ceramics other than Adamana Brown date later than A.D. 500 (Wendorf 1953). Direct chronometric dates probably would fall into the Early Basketmaker III period, rather than the Basketmaker II period to which Wendorf assigned them.

The new data suggest few changes in dating sites from the later Pueblo periods, not too surprising when one remembers that those periods were emphasized in earlier archeological research. However, our analyses shed some light upon the cultural affiliation of these people. Most of the ceramic wares found on sites can be attributed to the Anasazi. The most common ware, Little Colorado White Ware, is usually attributed to the Winslow branch. The Holbrook Black-on-white style predominates, implying that most of the sites were occupied prior to A.D. 1130. The collections differ enough from the classic type descriptions to suggest that some of the pottery was made locally.

Cibola White Ware is found on sites dating as early as Basketmaker III, and continues to be traded into the area until A.D. 1250 or 1300 (see Tularosa Black-on-white, Breternitz 1966:99). I feel that compared to Little Colorado White Ware, it is relatively more abundant after about A.D. 1130. Some of the Cibola White Ware sherds differ enough from the classic type descriptions to suggest that some of the pottery was made locally.

After about A.D. 1200 (Early Pueblo III), occupation of almost every environmental niche in the park ends. Less than a handful of sites, including Puerco Ruin, are inhabited until the late 14th century. The Winslow and Homol'ovi Orange wares and Awatovi Black-on-yellow are abundant at Puerco and the few later sites. In other areas, Jeddito Black-on-yellow became popular after A.D. 1350 (Smith 1971:601). Because this type is rare at Puerco Ruin and at Petrified Forest, in general, we assume the park was virtually abandoned then.

Economic Orientation

For an analysis of the economic orientation of the prehistoric inhabitants of the park, it is helpful to look at the distribution of sites throughout the park. The sites from our surveys and Hammack's (1979) were plotted by site type (Figs. 10.1-10.3).

The location of artifact scatters that have high proportions of primary flaking debris in badlands areas where petrified wood outcrops is understandable. The boundaries of the quarries recorded by Hammack (1979) and our 1985 survey, might more easily have been defined by

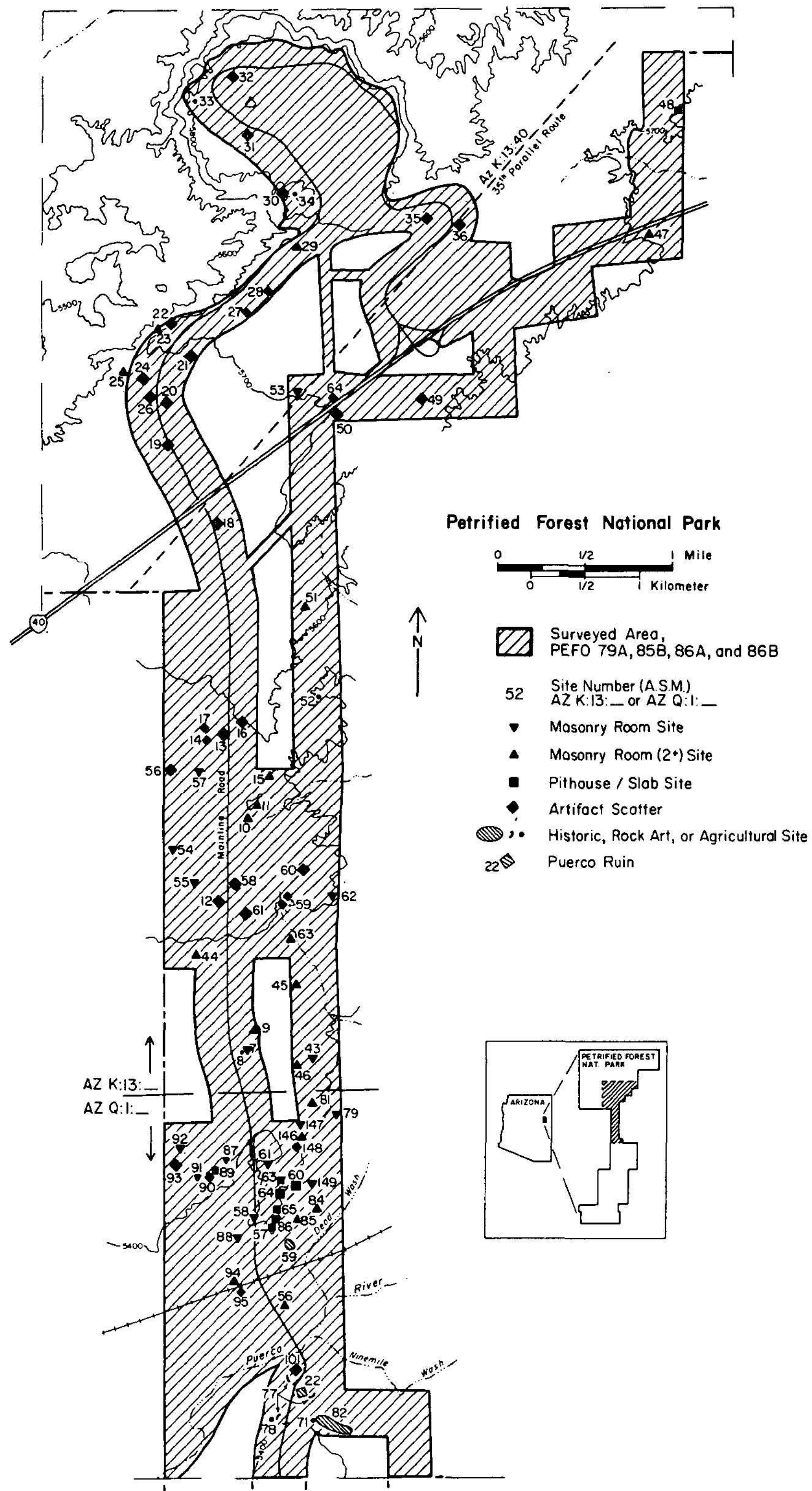


Figure 10.1 North section of park showing sites recorded between 1979 and 1986 plotted by site types.

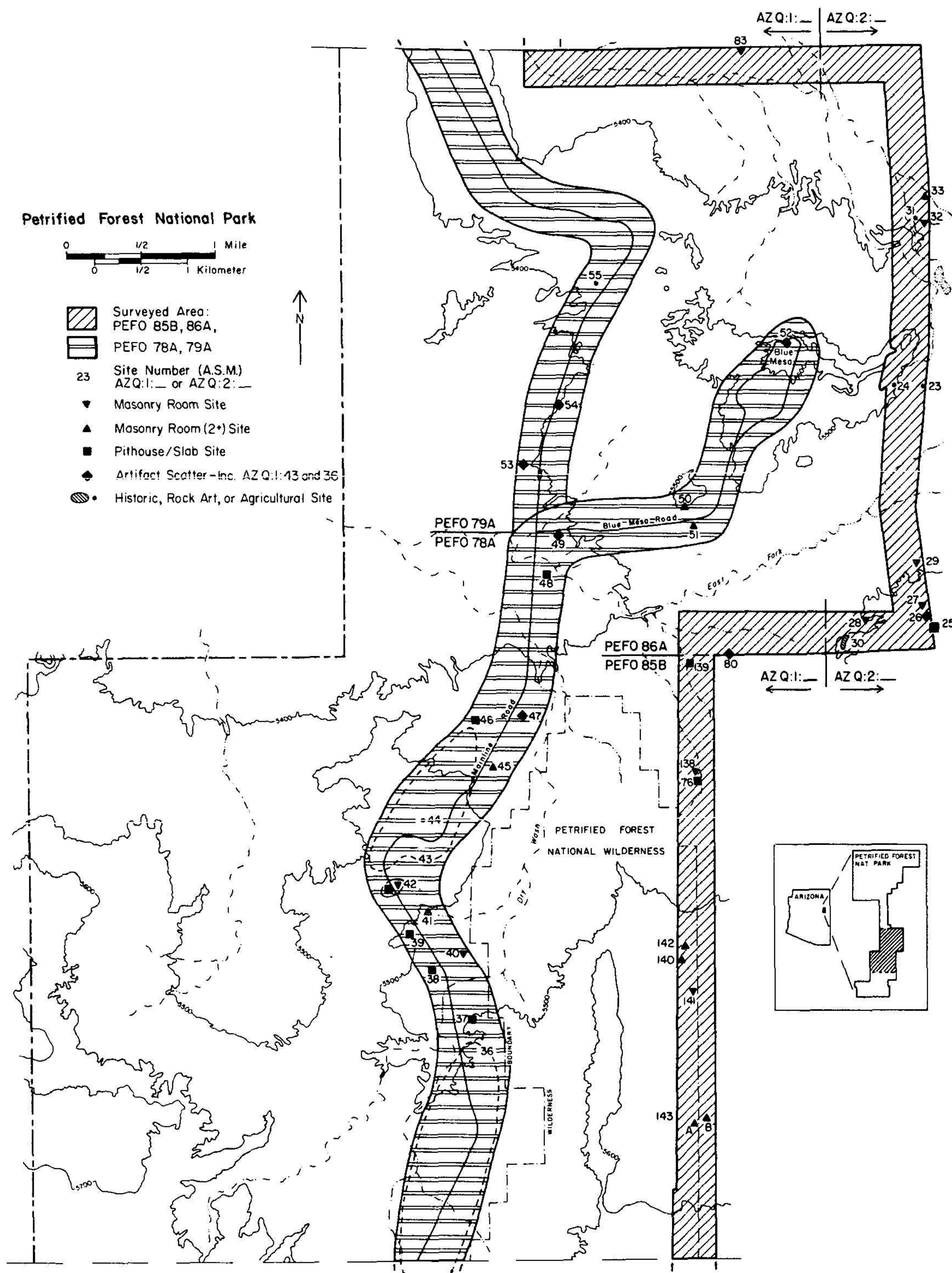


Figure 10.2 Central section of park showing sites recorded between 1978 and 1986 plotted by site types.

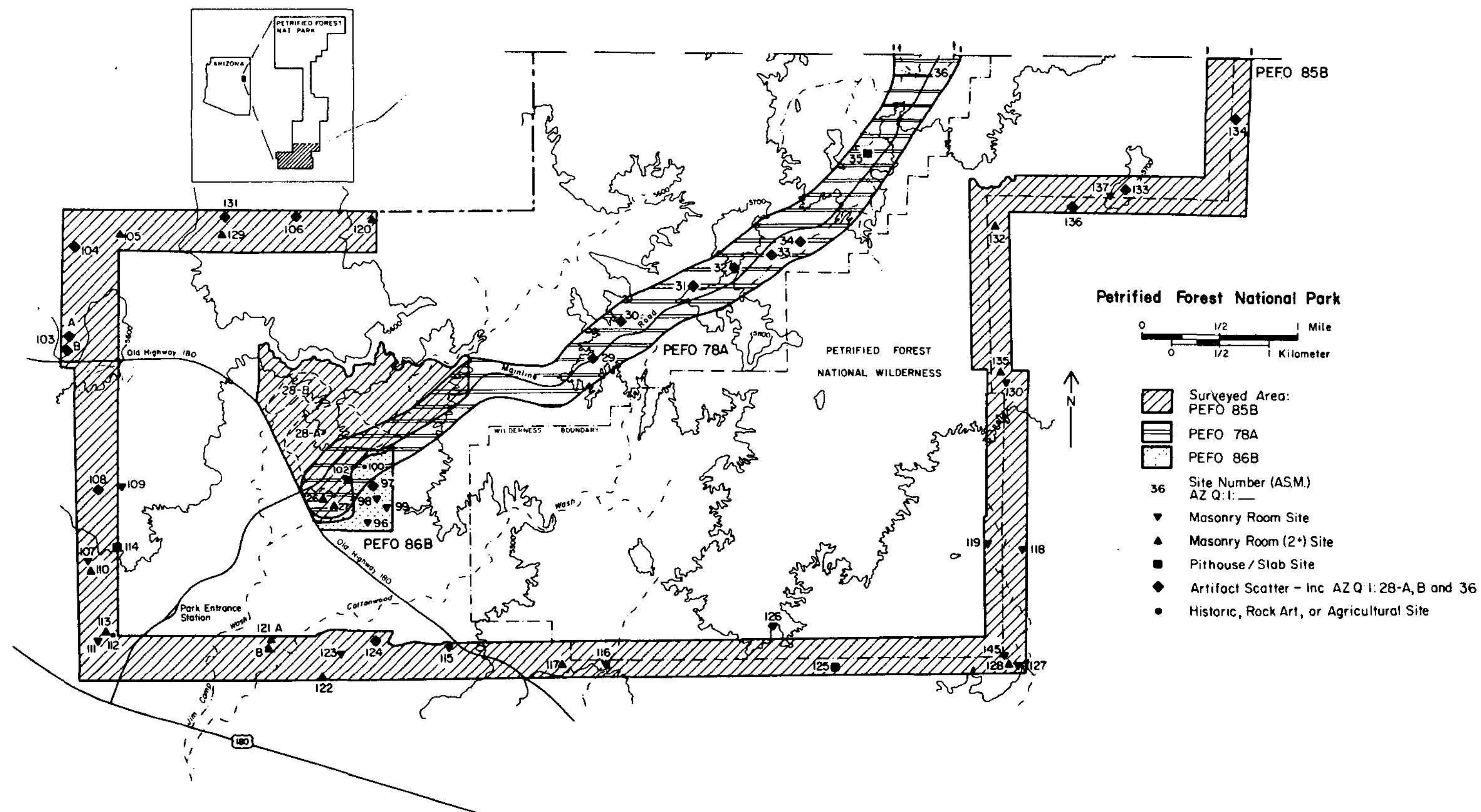


Figure 10.3 South section of park showing sites recorded between 1978 and 1986 plotted by site types.

plotting the distribution of the petrified wood exposed on the surface. Around the logs in some areas, one can wade ankle-deep in debitage, debitage that may have been produced at any time during the prehistoric or historic periods. Clearly this was an important resource since Paleo-Indian times.

Pit house sites characteristic of the Basketmaker II and III periods do often occur on the edges of mesas and badlands scarps. They are widely spaced throughout the park, even in the south end where earlier surveys located none. Three were located in the Dry Wash floodplain in the central part of the park, and possibly may be linked to the large Twin Butte site. There is also a cluster north of the Puerco River. Both areas were singled out by Hammack (1979:43) as more densely occupied during those periods, and our surveys concur. The locations are often south-facing and within 1 km of major drainages, places that were favorable for agriculture.

Several sites in the grasslands north of the Puerco River have ceramic assemblages that date to the Pueblo I period. While most of the park may have been abandoned, as suggested by Stewart (1980), this area seems to have been the focus of occupation during that dry period when permanent water and a higher water table in the Puerco River valley would have been important.

Sites with coursed masonry remains were divided into two groups: one-room sites and those with two or more rooms. We assume that the larger sites are predominantly permanent habitations occupied during the Pueblo periods, and that the smaller sites were field houses. No site has more than about 10 to 15 rooms, and many of the multiple room sites appear to be conglomerations of the smaller units, one or two rooms each with discrete trash areas to the south or southeast (cf. Jones 1986:74-81). There are few single, planned room blocks.

The habitations appear fairly evenly dispersed throughout the park. The smaller structures occur in proximity to the habitations; however, field house distribution seems to be restricted to areas where construction materials, such as petrified wood blocks and sandstone slabs, are abundant. In the grasslands northeast of Rainbow Forest and north of the Puerco River where construction materials are scarce, artifact scatters frequently occur near the habitations. Often there

are very small sandstone spalls, dense artifact concentrations 3 to 4 m in diameter, and chunks of daub with stick impressions. This probably indicates that small structures were constructed of jacal with a minimum of rock reinforcement along the foundation.

Parenthetically, the major difference in the site types between our work and Hammack's, is that she had double the proportion (43 percent versus 21 percent) of artifact scatters. Of those, she noted that more than half had possible buried structures. We generally tried to further classify our sites with possible structures, rather than using the artifact scatter site type as a catchall.

What sorts of activities did the prehistoric inhabitants pursue throughout the area? The broad grasslands north of the Puerco River were perhaps the most ideal locations in the park for hunting. Then, as now, they were probably thoroughfares for men and herds; all of the Paleo-Indian and Late Archaic remains are located there. The abundance of ground stone on both Basketmaker and Pueblo sites attests that plant foods were indeed important. Direct evidence for the use of cultigens consists of maize cupules and kernels found at the Late Archaic site, AZ K:13:60, and two Pueblo II and III sites, all north of the Puerco River. Fields probably were located along soil and water-control features at the Basketmaker III Twin Butte site and a nearby Pueblo II/Pueblo III site, AZ Q:2:30.

The change in the distribution of sites throughout the park during different time periods is informative. Basketmaker and the larger Pueblo II/Pueblo III sites seem to be evenly dispersed throughout all environmental niches in the park. During the drier Pueblo I period and during the Late Pueblo III/Early Pueblo IV, the sites appear to cluster around major drainages, particularly the Puerco River. Prior to the Pueblo I period, a dispersed settlement pattern may have been practiced to allow collection of a diversity of wild resources to supplement incipient agriculture. After this time, the people practiced technological (soil and water control, solar calendars) and possibly sociological (small-scale aggregation, cooperation and redistribution) techniques to allow them to farm all environments in the park.

The overall density for the Pueblo period sites is 17 masonry rooms per square mile (6.6 rooms per square km). North of the Puerco

River along the terraces and grasslands, the density is as high as 23.5 rooms per square mile, while in the south end of the park, it is only 13.8. Site density was highest in the grasslands at the confluence of the Puerco River and Dead Wash during all periods of prehistoric occupation. Only during the Pueblo II and Pueblo III periods was there a large occupation in the southern area of the park that drains into the Little Colorado River; nearly 80 percent of the sites there were occupied during those periods, as opposed to 60 percent in other areas of the park.

Regional Interaction and Trade

On a local scale, there is evidence of community interaction during the Pueblo II and Pueblo III periods. Small field houses seem to cluster around larger, more substantial masonry remains. The field houses were probably seasonal or intermittent shelter and storage associated with agriculture, while a broader range of activities occurred at the large sites. The number of people that could have lived in the 5- to 10-room structure at McCreery Pueblo seems too low to have supported the types of activities usually associated with the Great Kiva. The inhabitants of the larger sites throughout the park may have been integrated at economic, social or religious gatherings centered around the Great Kiva (Jones 1986).

On a regional scale, we have suggested that at least in part, Little Colorado wares and possibly some of the Cibola White Ware may have been locally produced. Other pottery types, Tusayan White and Gray wares, White Mountain Red Wares, and most of the Mogollon Brown Wares, probably are trade wares.

Tusayan White Ware types or Lino Black-on-gray occur on 21 percent (n = 39) of the sites. Of those, 29 sites (74 percent) are located north of the Puerco River along the edges of the upper and lower Pleistocene terraces.

Mogollon ceramic types, in particular, Showlow Black-on-red, occur on 40 (22 percent) of the sites. Thirty-five percent of those occur at the south end of the park in the Little Colorado River drainage (as compared to only 8 percent of the sites with Tusayan wares).

Surprisingly, of the 12 sites where both Tusayan and Mogollon wares occur, none are located in the southern area, and 9 (75 percent) occur just north of the Puerco River along the lower and upper Pleistocene terraces northwest of the confluence of the Puerco River and the Dead and Nine-Mile washes. It is tempting to assume that in the southern area that drains into the Little Colorado River, Mogollon and Anasazi peoples were living in their respective sites. However, the occurrence of pottery blending along the Puerco River suggests that variations in site function and trade might be better explanations. Also, the broad ceramic dates lead us to believe that most of the sites were contemporaneous. We are at the limits of what we can learn with the standard analytical techniques. Better temporal control, as well as quantified trait and source analyses, still are needed if we are to progress with this research topic.

Technological Change

The survey data and limited artifact collections add in a small way to what we know about technological change through time. The trend in architectural style from shallow pit house to a more substantial pit house to aboveground masonry follows those described elsewhere in the Southwest. Without broad scale excavation, it is unknown how long the use of pit houses persisted as storage or special function structures. Clearly, during the later Pueblo II and Pueblo III periods, jacal construction for field houses was necessary in locations where rock construction material was unavailable.

Flaked stone debitage was noted throughout the park wherever petrified wood outcropped. Rarely are tools or preforms found with the debris. These occur most often on sites or as isolates. A variety of points were collected or sketched, and a chronological point typology from Paleo-Indian through late prehistoric times was defined. What is clear from Tagg's analysis of the Late Archaic assemblage and from earlier work is that more secondary retouch occurred in the assemblages prior to the Pueblo I period. The later Pueblo period assemblages contain a higher proportion of primary flaking debris. The technology was more expedient; with such abundant raw material, unretouched flakes

with sharp edges may have been produced at will when needed. With regards to raw material types, it is surprising that as much as 21 percent of the Late Archaic assemblage consists of materials other than petrified wood, and 18 percent is of the local small cobble chert, the flakes of which are produced with the bipolar technique. Although this remains the case throughout time at Petrified Forest, it also seems that more of the retouched pieces are indeed made of petrified wood.

Ceramic technology is quite complex, and varies drastically through time. The most puzzling change is from the use of the paddle-and-anvil type, Adamana Brown, in Basketmaker times, to other more common scraped ceramics later. Characterized by the prominent selenite temper, widely available in the park, Adamana Brown probably was locally made. Variations in other wares, such as Little Colorado White and Gray wares and Cibola White Ware, may also support local or at least nearby production. The changing emphasis in pottery, for example the increased abundance of Cibola White Ware after about A.D. 1130, and the change in red wares from the Mogollon Brown Ware type, Showlow Black-on-red, to White Mountain Red Ware may demonstrate changing trade relationships or interaction spheres.

Our slow progress in deciphering the meaning of these variations in chronology, economic orientation, trade and exchange, and technology, is frustrating. Yet these studies still surely hold the key to understanding the past at Petrified Forest, a haven for some prehistoric peoples, a middle ground and thoroughfare for others.

Chapter 11
STATUS REPORT: PETRIFIED FOREST ARCHEOLOGY

Introduction

Management recommendations specific to the water system (including the surveys of the environs of PEF0 Site 236 and of the Rainbow Forest Developed Area) already were covered in detail elsewhere in this report (see Chapter 8). The boundary survey was initiated to produce an evaluation of sites within 400 m (0.25 mile) of the park boundary fence that are most susceptible to looting. Those data and a complete set of maps are summarized in a memorandum to the park superintendent.

Seven of the sites (AZ Q:1:119, 126, 133, 140, 35, 42, 49 through 143) recorded during the Boundary Survey are in a special management class because they are located within the boundaries of the Petrified Forest National Wilderness Area. Any proposals for research or management projects need to consider regulations governing the administration of a wilderness area.

On the basis of the new data and of past recommendations (Stewart 1980:134-138; Teague 1984b), the need for future archeological studies at Petrified Forest National Park can be assessed. A brief status report of the work completed, as well as suggestions for new projects and priorities, are discussed here. Since cost estimates need frequent updating, those (Jones 1986) were presented separately.

The projects are divided into management and research categories. As stated by Teague (1984b), the division is somewhat arbitrary because both management and research projects contribute data useful for interpretation and inventory. However, management projects, which are directly concerned with the preservation and protection of resources, are more likely to be funded through normal budgetary processes.

Management Studies

Park Boundary Survey

In Progress. Survey of a corridor 400 m (0.25 mile) wide along the boundary fence was begun in 1985. This report summarizes the results produced through 1986. A total of 43 miles (47 percent) of the 91-mile boundary has been surveyed. This includes the most easily accessible areas of the park: the entire eastern fenceline south of old Route 66, the southern boundary, and the western boundary around the Rainbow Forest. To date, 92 sites have been found within the corridor. Of the remaining 48 miles of fence line, 27 miles, mostly along the western boundary south of the Puerco River (Phase III), can easily be accessed. This should be the first priority in completing the boundary survey. Access logistics for the 21 miles along the north and northwest boundaries (Phase IV) are more complex. There is a low probability that sites in the area will be pothunted, so this can be the last section of the fence line surveyed. With two crews of three or four volunteers each led by one professional assistant crew chief and one crew chief, the former section can be completed in approximately 15 working days; the latter in 20.

Developed Area Survey

Complete. In conjunction with several projects (Project Nos. PEF0 78A, 79A, 85B, 86A and 86B) funded by the Denver Service Center, large areas around the developed areas at the Painted Desert and Rainbow Forest headquarters have been surveyed. More limited work has been done recently at the horse corrals at Rainbow Forest (Proj. Nos. PEF0 77B and 85B) and along various pullouts, overlooks and parking lots along the Mainline Road (Proj. Nos. PEF0 83D, 85B, 87A). Although no work has occurred recently at the Painted Desert Inn or the Puerco sewage ponds as recommended by Teague (1984b), for all intents and purposes the developed areas need no further survey. This does not negate the necessity of completing archeological clearances prior to each ground-disturbing project, but once WACC staff is contacted, the

clearance can be issued quickly, perhaps with only a check of existing records.

Catalog Artifacts in Park

In Progress. Since Stewart (1980) recommended additional work to upgrade the cataloguing of archeological and ethnographic specimens in the park Study Collection, the park has assigned several staff members and volunteers to the project. At present, one of the subsidiary duties of a permanent staff member is to continue and complete this work.

Sample Survey of Park

No Change. Although no funding has been obtained for this project, the boundary and water system surveys in 1985 and 1986 have contributed data useful for updating the sample survey design. Large surveys completed since 1978 have covered more than 11,000 acres (12 percent) of the park area (93,493 acres). Hammack's Mainline Road survey and the boundary surveys constitute transects through the park, thus negating the need for the preliminary transect survey recommended by Teague (1984). Data on site location and patterning derived from those works can be used to stratify the park on the basis of landform, vegetation type and natural resource location. Low-level aerial photography should be used to help locate large sites or those with highly visible structural remains, and to facilitate accurate site recording. We propose surveying 23 half-section quadrants (blocks) selected by a stratified, systematic, unaligned technique. (Half-section quadrants are large enough to justify the time necessary to locate them.) This would provide coverage of an additional 7,400 acres for a total of 18,700 (20 percent) of the park. Due to access difficulties and a predicted high site density, coverage during quadrant survey is expected to not exceed 25 acres/person-day. Assuming that professional crews are used, we estimate that two crews of four people each would need 35 days in the field, plus analysis and writeup time, to complete this project.

Salvage of Endangered Sites

No Change. Teague suggested salvage of sites in order to mitigate the adverse effects (as provided for under Title 36 CFR 800) of the erosion that is so pronounced at Petrified Forest. Data on the nature and degree of erosion then can be used during future survey to assess the integrity of individual site deposits and further, to determine how the sites should be managed. The archeological surveys in 1985 and 1986 provided information on a number of sites that are heavily eroded or deflated. Of these, six were chosen on the basis of the degree of erosion, the potential for portions of each site to provide significant scientific data regarding the prehistory of the site and the nature of the erosion processes, and the ease of access. Each site is described briefly below.

AZ Q:1:110 (ASM)

This site consists of a three- to five-room coursed masonry structure with close to 1,000 artifacts dating to the Late Pueblo II/Pueblo III periods. The structure, as well as the trash, is eroding off the edge of the badlands near Rainbow Forest. A crew of four professionals could complete mapping, surface collection of diagnostic artifacts, definition of the wall tops, and trenching of the structure in eight days.

AZ Q:1:114 (ASM)

This is a large Basketmaker II site on the edge of the badlands near Rainbow Forest. Four of the seven features noted have upright slabs and include at least one storage bin and the remnants of a pithouse. It is unknown whether undisturbed deposits occur beneath the grasslands away from the rim. Salvage by a crew of four would include mapping and surface collection of diagnostics, excavation of two intact features, testing of two other features, and excavation of four 1 m by 2 m test pits in the grasslands. A crew of four professionals could complete the work in seven days.

AZ Q:1:141 (ASM)

This site appears to be multicomponent and dates to the Basketmaker III/Pueblo I(?) and Late Pueblo II/Pueblo IV periods. There are one rock rubble feature and amorphous buried rubble, and over 500 artifacts. The dunes on the site are extensively eroded and deflated. In five days, salvage by a crew of four professionals would include mapping and surface collection of diagnostics, bisection of the two features, and trenching into the dunes to determine cultural and natural stratigraphy.

AZ K:13:15 (ASM)

This is a Pueblo II multiroom masonry structure with over 5,000 artifacts. The site is eroding down both sides of a finger ridge on the edge of the badlands overlooking Dead Wash. A crew of four professionals could complete mapping and surface collection of diagnostic artifacts, testing the trash deposits for integrity, and trenching of the ridgetop to determine whether buried rooms exist, in about seven crew-days.

AZ K:13:11 (ASM)

This Pueblo II site has two large rubble concentrations and over 1,500 artifacts which are eroding down the edge of the badlands overlooking Dead Wash. Salvage would consist of mapping and surface collection of diagnostic artifacts, trenching of features, definition of wall tops to determine the size of the structures, and complete excavation of one feature, if one is reasonably defined. A crew of four professionals could complete the fieldwork in about seven days.

AZ Q:1:65 (ASM)

This site is a Basketmaker III/Pueblo I site with from one to three pithouses and more than 350 artifacts. It is eroding down the edge of a terrace overlooking Dead Wash. Four days would be necessary for a crew of four professionals to map and surface collect diagnostic artifacts and to bisect two slabs areas and a dark stain.

Research Studies

Archaic Site Testing Program

No Change. Two additional Archaic sites (AZ K:13:59 and 60) were recorded in 1985. A Paleo-Indian Folsom point base was found on the latter site; the results of limited testing are presented in Chapter 9. Further testing at this site and at the others will provide much needed data on an obscure period in Southwestern prehistory.

Painted Desert Reconnaissance Survey

No Change. Archeologically, this area is the least known in the park. Transects to be completed by the on-going boundary survey will provide more information on which to base a survey design. Further, in order to fill the gap in knowledge, survey of this area should take precedence over any sample survey or general inventory of the park.

Quarry Survey and Assessment

No Change. Although no detailed surface reconnaissance and mapping of quarries has been done at Petrified Forest, the results of work scheduled in the spring of 1987 at a dense lithic use area (AZ Q:1:101) near Puerco Ruins will be instructive. Field methods and analysis used at the site for Project No. PEFO 87B (Pkg. 140 [Phase IV]) may be applicable to quarry definition and analysis.

Recording of Site 236

Complete. In 1985, prior to the survey of the environs of Site 236, detailed surface mapping and 100-percent surface collection of the site proper were completed. The Archeological Conservancy prepared a draft National Register nomination form for the site prior to the official transfer of title in December 1986. Cost estimates are in preparation for the completion of the documentation.

Lithic and Ceramic Source Pilot Studies

No Change. Attribute analysis of petrified wood artifacts, including color, chemical composition, and structure studies, may establish specific sources within the park. Then parallel analyses of existing collections from other Southwestern sites may help define trade relationships and routes (Stewart 1980:137). Similar results may accrue from studies of ceramic composition, form and contextual associations. These projects, which are not only expensive but time-consuming as well, would be excellent research topics for graduate students. If likely candidates are located, they will be urged to apply for a research grant directly from the Petrified Forest Museum Association Board of Directors.

Historical Records Search and Site Recording

New Project. During site surveys since 1978, a number of historical sites, including homesteads, stock tanks, and Civilian Conservation Corps work areas, have been recorded. These sites normally are dated by the types of artifacts recovered and by consultation with park personnel. Historical records can often pinpoint dates more accurately, provide photos of buildings taken before they were razed or burned, and in general fill in the details about specific uses and individuals connected with the sites. A comprehensive search of records and documents located in Holbrook and St. Johns, the county seats of Navajo and Apache counties, respectively, is recommended. Homestead records and General Land Office (GLO) maps will be located and the pertinent information copied for archiving. Park archives will be searched for data relevant to sites previously recorded. Historical sites, including the CCC work area below Puerco Ruins (AZ Q:1:82[ASM]), will be recorded and mapped in detail as time allows. A crew of two professionals will spend 10 days in the field.

Priorities

Although all of the above projects are considered worthwhile, several were chosen that may provide information more useful for research, interpretation and management. These are listed below in order of priority, which is based only on that potential and not on the costs.

1. Park Boundary Survey
2. Salvage of Six Endangered Sites
3. Painted Desert Reconnaissance Survey
4. Archaic Site Testing Program
5. Quarry Survey and Assessment
6. Historical Records Search and Site Recording.

Should funding not be adequate for the larger projects, there are small projects that can be accomplished. Alternatively, the staff at the Western Archeological and Conservation Center would be pleased to assist park managers in paring down scopes of work and budgets should that be considered preferable.

Appendix A

CONCORDANCE OF SITE NUMBERS

This list is a concordance of state trinomial site numbers with WACC field numbers and site names. The concordance was done only for projects directed from WACC since 1978. Many of these sites were recorded on earlier surveys by Mera (1934) or Reed (1940; Jepson 1941). Site location plots are difficult, if not impossible, to correlate; maps of different scales and detail were used on each project. Also, site sketch maps were not made during the earlier projects. Without site maps, the vague site data allow few comparisons. Correlations will be completed when time permits.

ASM NUMBER	FIELD NUMBERS AND NAMES	SITE TYPE	ASM NUMBER	FIELD NUMBERS AND NAMES	SITE TYPE
AZ K:13:004	PAINTED DESERT INN	HISTORICAL	AZ K:13:043	PEFO 86A-27	MASONRY ROOM (1?)
AZ K:13:007	PEFO 79A-14	ROOM	AZ K:13:044	PEFO 86A-19	MASONRY ROOMS (2+)
AZ K:13:008	PEFO 79A-15	HISTORICAL	AZ K:13:045	PEFO 86A-17	MASONRY ROOMS (2+)
AZ K:13:009	PEFO 79A-16	SURFACE STRUCTURE	AZ K:13:046	PEFO 86A-16	MASONRY ROOMS (2+)
AZ K:13:010	PEFO 79A-17,86B-10	MASONRY ROOMS (2+)	AZ K:13:047	PEFO 86A-18	MASONRY ROOMS (2+)
AZ K:13:011	PEFO 79A-18,86B-11	MASONRY ROOMS (2+)	AZ K:13:048	PEFO 86A-14	PITHOUSE/SLAB FEATURES
AZ K:13:012	PEFO 79A-19,86B-32	ARTIFACT SCATTER	AZ K:13:049	PEFO 86A-13	ARTIFACT SCATTER
AZ K:13:013	PEFO 79A-20	ARTIFACT SCATTER	AZ K:13:050	PEFO 86A-12	ARTIFACT SCATTER
AZ K:13:014	PEFO 79A-21	ARTIFACT SCATTER	AZ K:13:051	PEFO 86A-11	MASONRY ROOMS (2+)
AZ K:13:015	PEFO 79A-22,86B-12	MASONRY ROOMS (2+)	AZ K:13:052	PEFO 86A-10	ROCK ART
AZ K:13:016	PEFO 79A-23	ARTIFACT SCATTER	AZ K:13:053	PEFO 86A-29	MASONRY ROOM
AZ K:13:017	PEFO 79A-24,86A-30	ARTIFACT SCATTER	AZ K:13:054	PEFO 86A-31	MASONRY ROOM
AZ K:13:018	PEFO 79A-25	ARTIFACT SCATTER	AZ K:13:055	PEFO 86A-20	MASONRY ROOM
AZ K:13:019	PEFO 79A-26	ARTIFACT SCATTER	AZ K:13:056	PEFO 86A-15	ARTIFACT SCATTER
AZ K:13:020	PEFO 79A-27	ARTIFACT SCATTER	AZ K:13:057	PEFO 86A-32	MASONRY ROOM
AZ K:13:021	PEFO 79A-28	ARTIFACT SCATTER	AZ K:13:058	PEFO 85B-06	ARTIFACT SCATTER
AZ K:13:022	PEFO 79A-29	ARTIFACT SCATTER	AZ K:13:059	PEFO 85B-07	ARTIFACT SCATTER
AZ K:13:023	PEFO 79A-30	UNIT PUEBLO	AZ K:13:060	PEFO 85B-08	ARTIFACT SCATTER
AZ K:13:024	PEFO 79A-31	ARTIFACT SCATTER	AZ K:13:061	PEFO 85B-09	ARTIFACT SCATTER
AZ K:13:025	PEFO 79A-32	UNIT PUEBLO	AZ K:13:062	PEFO 85B-10	MASONRY ROOM
AZ K:13:026	PEFO 79A-33	SHERD SCATTER	AZ K:13:063	PEFO 85B-11	MASONRY ROOMS (2+)
AZ K:13:027	PEFO 79A-34	ARTIFACT SCATTER	AZ K:13:064	PEFO 86B-33	ARTIFACT SCATTER
AZ K:13:028	PEFO 79A-35	ARTIFACT SCATTER	AZ Q:1:022	PUERCO RUIN	PUEBLO
AZ K:13:029	PEFO 79A-36	SURFACE STRUCTURE	AZ Q:1:026	PEFO 78A-01,85B-03	MASONRY ROOMS (2+)
AZ K:13:030	PEFO 79A-37	LITHIC SCATTER	AZ Q:1:027	PEFO 78A-02,85B-04	MASONRY ROOMS (2+)
AZ K:13:031	PEFO 79A-38	LITHIC SCATTER	AZ Q:1:028	PEFO 78A-03,85B-01	ARTIFACT SCATTER (QUARRY)
AZ K:13:032	PEFO 79A-39	LITHIC SCATTER	AZ Q:1:029	PEFO 78A-04	LITHIC SCATTER
AZ K:13:033	PEFO 79A-40	HISTORICAL	AZ Q:1:030	PEFO 78A-05	LITHIC SCATTER
AZ K:13:034	PEFO 79A-41	HISTORICAL	AZ Q:1:031	PEFO 78A-06	LITHIC SCATTER
AZ K:13:035	PEFO 79A-42	ARTIFACT SCATTER	AZ Q:1:032	PEFO 78A-07	ARTIFACT SCATTER
AZ K:13:036	PEFO 79A-43	ARTIFACT SCATTER	AZ Q:1:033	PEFO 78A-08	ARTIFACT SCATTER
AZ K:13:037	PEFO 79A-44	ARTIFACT SCATTER	AZ Q:1:034	PEFO 78A-09	LITHIC SCATTER
AZ K:13:040	35TH PARALLEL ROUTE	HISTORICAL	AZ Q:1:035	PEFO 78A-10	SURFACE STRUCTURE
AZ K:13:041	PEFO SITE 236, McCreery Pueblo	GREAT KIVA SITE	AZ Q:1:036	PEFO 78A-11	QUARRY

ASM NUMBER	FIELD NUMBERS AND NAMES	SITE TYPE
AZ Q:1:037	PEFO 78A-12	SURFACE STRUCTURE
AZ Q:1:038	PEFO 78A-13	LITHIC SCATTER
AZ Q:1:039	PEFO 78A-14	SURFACE STRUCTURE
AZ Q:1:040	PEFO 78A-15	FIELDHOUSE
AZ Q:1:041	PEFO 78A-16	SURFACE STRUCTURE
AZ Q:1:042	PEFO 78A-17	SURFACE STRUCTURE
AZ Q:1:043	PEFO 78A-18	QUARRY
AZ Q:1:044	PEFO 78A-19	HISTORICAL
AZ Q:1:045	PEFO 78A-20	UNIT PUEBLO
AZ Q:1:046	PEFO 78A-21	PITHOUSE VILLAGE
AZ Q:1:047	PEFO 78A-22	ARTIFACT SCATTER
AZ Q:1:048	PEFO 78A-23	ARTIFACT SCATTER
AZ Q:1:049	PEFO 78A-24	ARTIFACT SCATTER
AZ Q:1:050	PEFO 78A-25	SURFACE STRUCTURE
AZ Q:1:051	PEFO 78A-26	UNIT PUEBLO
AZ Q:1:052	PEFO 78A-27	CHIPPING STATION
AZ Q:1:053	PEFO 79A-01	CHIPPING STATION
AZ Q:1:054	PEFO 79A-02	ARTIFACT SCATTER
AZ Q:1:055	PEFO 79A-03	HISTORICAL
AZ Q:1:056	PEFO 79A-04,86B-07	MASONRY ROOMS (2+)
AZ Q:1:057	PEFO 79A-05,86B-19	PITHOUSE/SLAB FEAT HISTORICAL GRAVE
AZ Q:1:058	PEFO 79A-06	ARTIFACT SCATTER
AZ Q:1:059	PEFO 79A-07	HISTORICAL
AZ Q:1:060	PEFO 79A-08&10,86B-30	PITHOUSE/SLAB FEATURES
AZ Q:1:061	PEFO 79A-09,86B-22	MASONRY ROOM
AZ Q:1:063	PEFO 79A-11,86B-31	PITHOUSE/SLAB FEATURES
AZ Q:1:064	PEFO 79A-12,86B-23	PITHOUSE/SLAB FEATURES
AZ Q:1:065	PEFO 79A-13,86B-21	PITHOUSE/SLAB FEATURES
AZ Q:1:071	PEFO 86A-25	ROCK ART
AZ Q:1:076	PEFO 82B-02	PITHOUSE/SLAB FEATURES
AZ Q:1:077	PEFO 79A-46	ROCK ART
AZ Q:1:078	PEFO 79A-47	ROCKSHELTER
AZ Q:1:079	PEFO 86A-26	MASONRY ROOM
AZ Q:1:080	PEFO 86A-21	ARTIFACT SCATTER
AZ Q:1:081	PEFO 86A-28	MASONRY ROOMS (2+)
AZ Q:1:082	PEFO 86A-33	HISTORICAL
AZ Q:1:083	PEFO 86A-05	MASONRY ROOM
AZ Q:1:084	PEFO 86B-25	MASONRY ROOM
AZ Q:1:085	PEFO 86B-24	MASONRY ROOMS (2+)
AZ Q:1:086	PEFO 86B-20	PITHOUSE/SLAB FEATURES
AZ Q:1:087	PEFO 86B-18	MASONRY ROOM
AZ Q:1:088	PEFO 86B-17	MASONRY ROOM
AZ Q:1:089	PEFO 86B-16	PITHOUSE/SLAB FEATURES
AZ Q:1:090	PEFO 86B-15	ARTIFACT SCATTER
AZ Q:1:091	PEFO 86B-14	MASONRY ROOM
AZ Q:1:092	PEFO 86B-13	MASONRY ROOM
AZ Q:1:093	PEFO 86B-09	ARTIFACT SCATTER
AZ Q:1:094	PEFO 86B-08	MASONRY ROOMS (2+)
AZ Q:1:095	PEFO 86B-06	ARTIFACT SCATTER
AZ Q:1:096	PEFO 86B-05	MASONRY ROOM
AZ Q:1:097	PEFO 86B-04	ARTIFACT SCATTER
AZ Q:1:098	PEFO 86B-03	MASONRY ROOM
AZ Q:1:099	PEFO 86B-02	MASONRY ROOM/ROCK ART
AZ Q:1:100	PEFO 86B-01	HISTORICAL
AZ Q:1:101	PEFO 85B-02	ARTIFACT SCATTER
AZ Q:1:102	PEFO 85B-05	MASONRY ROOM (1?)
AZ Q:1:103	PEFO 85B-12	ARTIFACT SCATTER

ASM NUMBER	FIELD NUMBERS AND NAMES	SITE TYPE
AZ Q:1:104	PEFO 85B-13	ARTIFACT SCATTER
AZ Q:1:105	PEFO 85B-14	MASONRY ROOMS (2+)
AZ Q:1:106	PEFO 85B-15	ARTIFACT SCATTER
AZ Q:1:107	PEFO 85B-16	MASONRY ROOM
AZ Q:1:108	PEFO 85B-17	ARTIFACT SCATTER
AZ Q:1:109	PEFO 85B-18	MASONRY ROOM
AZ Q:1:110	PEFO 85B-19	MASONRY ROOMS (2+)
AZ Q:1:111	PEFO 85B-20	MASONRY ROOM
AZ Q:1:112	PEFO 85B-21	ROCK ART
AZ Q:1:113	PEFO 85B-22	MASONRY ROOMS (2+)
AZ Q:1:114	PEFO 85B-23	PITHOUSE/SLAB FEATURES
AZ Q:1:115	PEFO 85B-24	MASONRY ROOM
AZ Q:1:116	PEFO 85B-25	MASONRY ROOM
AZ Q:1:117	PEFO 85B-26	MASONRY ROOMS (2+)
AZ Q:1:118	PEFO 85B-27	MASONRY ROOM
AZ Q:1:119	PEFO 85B-28	MASONRY ROOM
AZ Q:1:120	PEFO 85B-29	MASONRY ROOMS (2+)
AZ Q:1:121	PEFO 85B-30	MASONRY ROOMS (2+)
AZ Q:1:122	PEFO 85B-31	MASONRY ROOMS (2+)
AZ Q:1:123	PEFO 85B-32	MASONRY ROOM
AZ Q:1:124	PEFO 85B-33	ARTIFACT SCATTER
AZ Q:1:125	PEFO 85B-34	PITHOUSE/SLAB FEATURES
AZ Q:1:126	PEFO 85B-35	MASONRY ROOM (1?)
AZ Q:1:127	PEFO 85B-36	MASONRY ROOM (1?)
AZ Q:1:128	PEFO 85B-37	MASONRY ROOMS (2+)
AZ Q:1:129	PEFO 85B-38	MASONRY ROOMS (2+)
AZ Q:1:130	PEFO 85B-39	MASONRY ROOM
AZ Q:1:131	PEFO 85B-40	ARTIFACT SCATTER
AZ Q:1:132	PEFO 85B-41	MASONRY ROOMS (2+)
AZ Q:1:133	PEFO 85B-42	ARTIFACT SCATTER
AZ Q:1:134	PEFO 85B-43	ARTIFACT SCATTER
AZ Q:1:135	PEFO 85B-44	MASONRY ROOMS (2+)
AZ Q:1:136	PEFO 85B-45	ARTIFACT SCATTER
AZ Q:1:137	PEFO 85B-46	MASONRY ROOM
AZ Q:1:138	PEFO 85B-47	MASONRY ROOM
AZ Q:1:139	PEFO 85B-48	PITHOUSE/SLAB FEATURES
AZ Q:1:140	PEFO 85B-49	MASONRY ROOMS (2+)
AZ Q:1:141	PEFO 85B-50	MASONRY ROOM (1?)
AZ Q:1:142	PEFO 85B-51	MASONRY ROOMS (2+)
AZ Q:1:143	PEFO 85B-52	MASONRY ROOMS (2+)
AZ Q:1:144	PEFO 85B-53	MASONRY ROOMS (2+)
AZ Q:1:145	PEFO 85B-54	MASONRY ROOM
AZ Q:1:146	PEFO 86B-26	MASONRY ROOMS (2+)
AZ Q:1:147	PEFO 86B-27	MASONRY ROOM
AZ Q:1:148	PEFO 86B-28	ARTIFACT SCATTER
AZ Q:1:149	PEFO 86B-29	MASONRY ROOM
AZ Q:2:023	PEFO 86A-23	MASONRY ROOM
AZ Q:2:024	PEFO 86A-24	MASONRY ROOMS (2+)
AZ Q:2:025	PEFO 86A-01	PITHOUSE/SLAB FEATURES
AZ Q:2:026	PEFO 86A-02	ARTIFACT SCATTER
AZ Q:2:027	PEFO 86A-03	MASONRY ROOM
AZ Q:2:028	PEFO 86A-04	MASONRY ROOM
AZ Q:2:029	PEFO 86A-06	MASONRY ROOM
AZ Q:2:030	PEFO 86A-22	AGRICULTURAL SITE
AZ Q:2:031	PEFO 86A-08	ROCK ART
AZ Q:2:032	PEFO 86A-07	MASONRY ROOM
AZ Q:2:033	PEFO 86A-09	MASONRY ROOMS (2+)

APPENDIX B

PLANT REMAINS FROM AN ARCHAIC SITE (AZ K:13:60 [ASM]) IN PETRIFIED FOREST NATIONAL PARK

by

Lisa W. Huckell

Introduction

No preceramic sites have been excavated in Petrified Forest National Park, resulting in a paucity of information about the ways in which the park area was used by preceramic people. The test excavations carried out at AZ K:13:60 offered a rare opportunity to make a significant contribution to our understanding of Archaic exploitation of the park environment. Plant macrofossil analysis was undertaken to obtain data that could add to the picture of wild plant utilization by site inhabitants. However, the discovery of maize in some of the samples indicated that considerably more could be learned from the plant assemblage.

Eight flotation samples and one charcoal sample from AZ K:13:60 were submitted for analysis. The charcoal and seven of the flotation samples came from Feature 3, a hearth and associated possible pit structure. The eighth flotation sample was taken from Feature 4, another possible pit structure located 17 m northwest of Feature 3. The samples yielded small quantities of four identifiable taxa: maize or corn (Zea mays L.), Indian rice grass [Oryzopsis hymenoides (Roem. and Schult.) Ricker], Cheno-ams, and juniper [Juniperus cf. monosperma (Engelm.) Sarg.].

Methods

The processing of the flotation samples was carried out using the technique described by Bohrer and Adams (1977:37). After the volume was taken, each sample was passed through a fine screen into a water bath. All large, readily visible macrofossils were removed and the remaining dirt in the screen was added to the water. The sediment was gently

agitated to free the buoyant macrofossils, after which the liquid was decanted through a fine screen containing a mesh of 0.5 mm. The remaining heavy fraction was discarded.

After thorough drying, the samples were put through a graduated geological screen series that divided them into five size classes: (1) >4.75 mm; (2) >2.0 mm; (3) >1.0 mm; (4) >0.495 mm; and (5) <0.495 mm. These size classes greatly expedite the efficient sorting of the samples and provide a useful framework within which to subsample.

Sample sorting was accomplished by using a binocular stereozoom microscope with a magnification range of 10x to 70x. Carbonization was used as the criterion by which items with the greatest likelihood of association with the prehistoric occupation were distinguished from those that are in all probability later contaminants. Unburned seeds were identified and counted along with insect parts, fecal pellets, molluscs, bones, and so forth, as a means of assessing the postoccupational disturbance experienced by the site.

Of the eight flotation samples, half were completely examined and half were examined through size class 3. Size classes 4 and 5 were found almost exclusively to yield small seed coat fragments and other plant remnants bearing few diagnostic clues, all of which would require more time and labor than the modest identification potential could justify. It was felt that the remaining time would be better spent searching for more maize remains, particularly those of a size suitable for radiocarbon dating. It should be noted that size classes 4 and 5 were in most cases subsampled. Depending on the volume of the size class fraction, sampling ranged from 100 percent to no less than 10 percent. The entries in Table B.1 reflect the actual numbers of items recovered; a calculated estimate of the total number present in the sample follow in parentheses.

Charcoal from the site was analyzed by snapping fragments to expose fresh transverse, radial, and tangential views. The specimens were then examined with an Olympus DHMJ incident light microscope with a magnification range of 50x to 750x that was made available by the Laboratory of Traditional Technology, Department of Anthropology, University of Arizona. Identifications were made using wood anatomy

Table B.1
PLANT REMAINS FROM AZ K:13:60 (ASM)

FEA. NO.	FIELD NO. (FN)	FLOTATION VOL. (ml)	CARBONIZED										TOTAL	UNCARBONIZED			CHARCOAL	
			MAIZE KERNELS	MAIZE KERNEL FRAGS.	MAIZE CUPULE FRAGS.	RICE GRASS CARYOPSIS FRAGS.	RICE GRASS LEMMA FRAGS.	GRAMINEAE CARYOPSIS	CHENO-AM SEEDS	cf. CHENO-AM SEEDS	"SEED COAT" FRAGS.	UNKNOWN		GRAMINEAE CARYOPSIS	RICE GRASS CARYOPSIS	SNAILS	JUNIPER	UNKNOWN SOFTWOOD
3	4	2,230									18 (51)	3	21 (51)	1 (3)	22		5	
3	16-1*	2,950		5		1				1		2	9					
3	16-2*	3,500		1									1					
3	16-3*	3,400		5	3		2				1	26	37			1		
3	16-4	3,200		4						1	8 (58)	5 (7)	18 (65)				20	
3	16-5*	3,960				2	2					1	5					
3	16-6	3,810	1	3				1	1		20 (111)	9 (10)	35 (121)				20	
3	13	Log															5	
	TOTAL		1	18	3	3	4	1	1	2	47 (220)	46 (17)	126 (237)	1 (3)	22	1	50	
4	10	4,650									1 (11)	2	3 (11)				2	4

* Indicates first three size classes examined.
Entries indicate actual number of items counted; estimated total number of items in parentheses.

keys (Panshin and de Zeeuw 1980) and modern comparative specimens in the author's collection. For charcoal derived from flotation, at least half of the identifiable fragments from size classes 1 and 2 were examined from four samples.

Results

Examination of the flotation samples revealed that they were primarily composed of wood charcoal and rootlets. Additional items present included modern juniper leaflets, rice grass caryopses, fecal pellets, leaf fragments, insect exoskeletal elements, an unidentified grass caryopsis, and a single terrestrial snail. These items occur in surprisingly low numbers, which suggests that minimal bioturbation has taken place at the site.

The results of the analysis are summarized in Table B.1, in which the nature and number of recovered items are presented by provenience. Each of the four taxa will be discussed individually below.

Maize

Maize remains were found in five of the six hearth samples from Feature 3. They consist of fragmentary kernels and cupules. The single, relatively intact kernel from FN 16-6 is between one-half and two-thirds complete; both the embryo and cap are missing. Roughly globose in shape, the kernel measures a minimum of 5.4 mm in height, 6.8 mm in width, and 5.5 mm in thickness. Another fragment is complete enough to yield a width measurement of 5.9 mm, while the last large fragment, a base representing about one-third of the kernel, has a minimum width of 5.5 mm and a minimum thickness of 5.3 mm. The remaining 16 kernel fragments are small pieces of caps and bases from which dimensions could not be taken. The specimens exhibit dense, flinty endosperm, although one appears to enclose a core of soft, very porous floury endosperm.

The cupules are also too incomplete to permit meaningful measurements to be taken. All three are pieces of the floor of the cupule, the pocket in the cob that subtends a pair of grains. They are

too fragmentary to offer an idea of cupule shape or size. One of the two largest specimens was submitted for radiocarbon dating (see Chapter 9).

Maize data from comparable open sites are not common (Donaldson 1984; Toll 1982). Much of what is known comes from rockshelters or later cultural occupations. Maize has been recovered from a number of Basketmaker II sites (Kidder and Guernsey 1919; Guernsey and Kidder 1921; Nusbaum 1922; Guernsey 1931; Jones and Fonner 1954) in northeastern Arizona, southwestern Colorado, and southern Utah. This corn, along with maize recovered from the earliest levels of such well-known sites as Bat Cave, Tularosa Cave, Cordova Cave, and Jemez Cave that fall within the Mogollon cultural sphere in west-central New Mexico, has also been shown to be a small-cobbed popcorn of the Chapalote type (Ford 1981:11). With the advent of the Basketmaker III period, new genetic input from an 8-rowed flour corn, Harinoso de Ocho, yielded a much greater diversity of ear, cob, and kernel morphologies that initiated the development of the great variety of Southwestern maize races. Unfortunately, the maize from AZ K:13:60 is too fragmentary to reveal much about its identity beyond the fact that it is a flint or popcorn.

Rice Grass

Rice grass was recovered at AZ K:13:60 from the hearth in Feature 3. Three caryopses and four lemma fragments were found. It is highly likely that a substantial number of the items in the "seed coat fragments" category in Table B.1 are rice grass lemma fragments. The recovered specimens are probably the by-products of parching with hot coals to remove the chaffy lemma, during which some of the grains escaped and were lost in the fire.

Rice grass is a perennial that grows in dense clumps found scattered both on open, sandy plains and hills and in juniper woodlands. It is usually found at elevations between 3,500 and 6,500 feet (Gould 1951:256). The distinctive grass is characterized by the delicate, open inflorescence, kinky pedicels that subtend individual spikelets, and the abundant silky hairs present on the lemma. The caryopses are also

distinctive, being large, round, and plump. It is this latter characteristic that has attracted the attention of native plant gatherers for hundreds of years. Because the florets readily dissociate from the glumes, the grains may be harvested rapidly and in quantity in late spring to mid-summer. Prior to consumption, the grains are parched to remove the tightly adherent lemma and then ground into meal.

The significance of rice grass in aboriginal diets is revealed by the archeobotanical and ethnographic records. It is frequently found in Archaic sites in northwest New Mexico (Donaldson 1984; Simmons 1986) and has been recovered from Basketmaker II sites on Cedar Mesa in Utah (Matson and Chisholm 1986) and in the Marsh Pass area of northeastern Arizona (Guernsey and Kidder 1921:43). Its presence at such sites as Antelope House in Canyon de Chelly, Arizona, and Arroyo Hondo, Chaco Canyon's Chetro Ketl, and Salmon Ruin in northern New Mexico (Bohrer 1975:Table 1) indicates that the grain continued to play a major economic role among ceramic period cultures despite their reliance on maize agriculture.

Cheno-ams

Three incomplete seeds recovered from the Feature 3 hearth were classified as Cheno-ams. This term refers to the Chenopodiaceae and Amaranthaceae families, some members of which tend to produce tiny, lenticular seeds that are often difficult to distinguish, particularly after being exposed to the destructive effects of extreme heat. In addition to the morphological similarities of their seeds, they tend to favor the same sorts of growing conditions and seasons, making it less critical to an understanding of site subsistence that they be distinguished. They are, therefore, combined under the name Cheno-am.

Of the three specimens found in the Feature 3 hearth, only one can unequivocally be identified as a Cheno-am. The lenticular seed is nearly complete, missing only a portion of the lateral margin. It measures 1.7 mm in height, 1.9 mm in width, and 0.8 mm in thickness. Although the surfaces have been somewhat eroded, the remnant of the style base is present at the center of one face, a feature identifying it as a chenopodiaceous species. The remaining two fragments have

undergone expansion, partial seed coat loss, and the loss of the encircling embryo, leaving only the central perisperm intact. The absence of absolute diagnostic features necessitates a tentative identification of the two as Cheno-ams.

The Cheno-ams most often exploited for food in the Southwest are weedy annuals that favor disturbed soils. They are prolific producers of small seeds whose size is offset by the large numbers produced. They are easily gathered in quantity in the later summer and early fall, after which they are customarily parched, ground into meal, and consumed as mush or gruel. Young plants from several genera including Amaranthus, Chenopodium, and Monolepis have been consumed as nutritious greens. Both seeds and greens were extensively utilized by historic native Southwestern cultures (Castetter 1935:15-16, 21-25; Gasser 1982). The seeds are also commonly retrieved from Southwestern archeological sites (Gasser 1982:221-222; Donaldson 1984). The broken seeds found in the Feature 3 hearth probably represent losses incurred during the parching process. Small pieces of seed coat from these seeds are also present in the "seed coat fragments" category in Table B.1.

Juniper

All of the wood identified from features 3 and 4 is juniper (see Table B.1). It is in all likelihood Juniperus monosperma, the only species recorded as being present in the park (Kierstead 1981). A single juniper tree presently grows on the site and is undoubtedly the source of the modern leaflets found in the flotation samples. Additional junipers in the area are widely scattered, solitary individuals. The site occupants' preference for or ready access to juniper for fuel is reflected in the charcoal present in the smaller flotation size classes and in those samples not formally analyzed; all charcoal that had a clear cross section that was seen while sorting was softwood. No hardwoods were evident.

Unknowns

The "unknown" category consists mainly of small fragments that bear minimal diagnostic features. Most appear to be endosperm fragments from maize and possibly rice grass caryopses. Three exceptions were found, two of which came from Feature 3, and one from Feature 4. The Feature 3 items consist of an ovoid unknown with a badly fractured, distorted surface that measures 1.6 mm in length, 1.3 mm in width, and 1.4 mm in thickness. No diagnostic features are visible. The second is a globose grass caryopsis that measures 1.7 mm in both length and width and 1.5 mm in thickness. Although the caryopsis is in good condition, time did not permit additional identification effort. The last item, from Feature 4, is also of uncertain identity. It appears to be an incomplete fruit that is obovoid in shape and bears five irregular, poorly defined vertical ridges that converge into a rapidly tapered base. The incomplete specimen measures 2.8 mm in height, 2.67 mm in width, and 2.4 mm in thickness.

Conclusions

Based on the limited macrofossil data yielded by the site, it may be inferred that occupation occurred sometime between mid-summer and early fall. The presence of maize kernels and cupules indicates that agriculture was a part of the subsistence system, but whether the corn was raised locally or elsewhere is not clear at present. The absence of maize pollen (Fish, this volume) would suggest a nonlocal origin.

AZ K:13:60 compares favorably to some of the Archaic sites excavated by Simmons (1986) as part of the ADAPT I project in the San Juan Basin of northwestern New Mexico. He describes them as small sites located on or near sand dunes that bear few if any diagnostic artifacts. They are ephemeral in nature, representing single occupational episodes or moderate reuse. Hearth and pit features present in three of these sites (LA 17337, LA 18103, LA 18091) yielded pollen or macrobotanical evidence for the use of maize by the site occupants. Radiocarbon dates obtained from charcoal and maize fall between 3985 \pm 155 B.P. (2035 B.C.) and (excluding an anomalous date of 225 \pm 90 B.P.) 2675 \pm 105 B.P.

(725 B.C.) (Simmons 1986:Table 2). Chronologically, the sites were considered to be late San Jose/early Armijo or late Armijo/early En Medio.

The four radiocarbon dates from AZ K:13:60 are somewhat equivocal in helping to place the site temporally. Charcoal from the Feature 3 hearth yielded dates of 2960 \pm 90 B.P. (1010 B.C.) from the upper fill and 2420 \pm 110 B.P. (490 B.C.) from a floor contact log. Maize from this feature produced a date of 2100 \pm 60 B.P. (150 B.C.). A composite charcoal sample from Feature 4 was dated at 2900 \pm 95 B.P. (950 B.C.). The wide disparity in dates suggests that serious consideration should be accorded to the old wood problem (Schiffer 1982:324-325), particularly given the xeric climate of the park area and the decay-resistant nature of juniper wood. The two older dates fall securely within the Archaic period, while the two younger dates can be placed in the Basketmaker II period, which, through recent work done in southern Arizona (Smiley, Parry and Gumerman 1986) and central New Mexico (Wills 1985), has been extended back to approximately 560 B.C. Unfortunately, additional evidence from the tested portion of AZ K:13:60 in the form of diagnostic artifacts is lacking. However, the direct date on maize, an annual plant that is not susceptible to the biases inherent in charcoal, lends greater support to the interpretation of the site as Basketmaker II. Despite the inability of the dates to securely identify the site as Archaic or Basketmaker II, the site contributes some very significant information on a largely unknown area, and will help to define the role of preceramic agriculturalists in local and regional subsistence systems.

Appendix C
RESULTS FROM POLLEN ANALYSIS AT AZ K:13:60 (ASM)

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Methods

Three pollen samples were submitted from excavated proveniences at AZ K:13:60 in the Petrified Forest National Park. Sixty cubic centimeters of sediment were deflocculated with dilute hydrochloric acid after the addition of Lycopodium spore tracers to permit evaluation of the extraction procedure. A swirl-and-timed settling rate as described by Mehringer (1967:136-137) was employed to initially separate polleniferous materials from the heavy fraction. Heavy liquid flotation with zinc bromide of 2.0 density further reduced sample matrix. Reduction of residual silicates was accomplished with hydrofluoric acid. A final treatment with potassium hydroxide removed organic detritus. Extract was mounted in a glycerol medium and stained for microscope viewing at a power of 600x.

A standard sum of 200 pollen grains was identified from each sample. This total has been shown to adequately register distributions of representative pollen from southwestern vegetation (Martin 1963:30-31). The standard sum is used as the basis for percentage calculations of the pollen types (Table C.1). After completion of tabulation, additional material was scanned at lower magnification in order to detect rare types. Identifications made only in scanning are so indicated in the table. Types that occurred in aggregates of six or more grains are also noted. Since clusters would be less efficiently transported by wind than single grains, presence of aggregates may indicate a relatively immediate plant source for the pollen.

Table C.1

PERCENTAGES OF POLLEN TYPES IN
SAMPLES FROM AZ K:13:60 (ASM)

	<u>Ambrosia-</u> type	High-spine Compositae	<u>Artemisia</u>	Gramineae	
Feature 4, 10-20 cm	24.5	12.0	2.0	12.5	
Feature 3, W. 1/2, 0-10	13.5	8.5	6.0	9.5	
Feature 3, W. 1/2, 10-20	8.0	12.0	7.5	11.5	
	Cheno-am	<u>Eriogonum</u>		Cruciferae	
Feature 4, 10-20 cm	39.0*	1.0		0.5	
Feature 3, W. 1/2, 0-10	2.0	3.5		1.0	
Feature 3, W. 1/2, 10-20	22.5	17.5			
	Umbelliferae	Rosaceae		cf. Leguminosae	
Feature 4, 10-20 cm					
Feature 3, W. 1/2, 0-10	0.5	2		2.5	
Feature 3, W. 1/2, 10-20				1.0	
	<u>Ephedra</u>	<u>Pinus</u>	<u>Quercus</u>	<u>Juniperus</u>	<u>Salix</u>
Feature 4, 10-20 cm	2.5	4.0	0.5	0.5	0.5
Feature 3, W. 1/2, 0-10	3.5	28.0	11.5	6.5	+
Feature 3, W. 1/2, 10-20	2.0	11.5	1.5	1.0	
	Unidentifiable				
Feature 4, 10-20 cm	0.5				
Feature 3, W. 1/2, 0-10	1.5				
Feature 3, W. 1/2, 10-20	4.0				

* = Indicates the occurrence of aggregates larger than air grains.

+ = Indicates a type observed in scanning of additional material after completion of a 200-grain standard sum.

Results

A sample was collected from Feature 4 at a level 10 to 20 cm below present ground surface in brown sand with charcoal flecks resting on the floor of this apparent pit structure. The pollen spectrum is consistent with a shrubby grassland vegetation lacking nearby trees (Hevly 1968; Gish 1982). The low percentage of sagebrush (Artemisia) pollen does not preclude these species as important constituents of surrounding vegetation; similarly low amounts have been reported from areas of sagebrush growth (Gish 1982).

The most numerous pollen type is Cheno-am, a palynological category encompassing chenopods and amaranths. Aggregates occur as well. A number of species have been used for edible seeds and greens by aboriginal groups in Arizona. Furthermore, chenopods and amaranths are characteristic disturbance plants in cultural environs. However, Cheno-am values above 30 percent have been reported for natural grassland vegetation associations in northern Arizona (Hevly 1968; Gish 1982). It is therefore not clear whether percentages in this sample reflect substantial vegetation disturbance by site inhabitants. No economically interpretable pollen distributions were recognized in this sample.

Two samples from different depths in the western half of the pit structure, Feature 3, are dissimilar in pollen content from one another. Sediments sampled at 0 to 10 cm and at 10 to 20 cm are strikingly different in appearance. The upper sample is brown, charcoal-flecked sediment resembling that from Feature 4, whereas the lower is reddish sand.

The lower red sand sample from 10 to 20 cm of depth differs from the Feature 4 sample in somewhat higher values for pine (Pinus) and sagebrush (Artemisia). These differences are of a scale that might be a function of sampling variability (Maher 1972). Cheno-am pollen and Ambrosia-type, which is produced by bur sage and taxonomically related species, are lower. Another nonarboreal pollen type is present in unusual values for natural vegetation. Wild buckwheat (Eriogonum) is a common colonizer of disturbed habitats (Kearney and Peebles 1964:230). Wild buckwheat seeds have been used as food by the Navajo (Wyman and

Harris 1951). Percentages in this Feature 3 sample are likely enhanced by culturally encouraged weeds or by introduction of wild buckwheat as a resource.

No corn pollen was encountered in the Feature 3 samples although charred corn was recovered by flotation. If the corn had been grown and harvested in the immediate vicinity, a maximal opportunity should have existed for pollen introduction before transport or processing reduced adhering grains. The lack of corn pollen suggests that only processed forms or corn grown elsewhere were brought into the structure.

The upper Feature 3 sample, collected 0 to 10 cm below surface, contains substantially more arboreal pollen than the two previous ones. Pine (Pinus), oak (Quercus), and juniper (Juniperus) are each higher and collectively total 46 percent of all pollen. With the exception of isolated individual juniper, sources for this arboreal pollen would have been absent in the study area if vegetation distributions at the time of sample deposition resembled current ones.

Modern surface samples analyzed for the Coronado Project between St. Johns and Navajo, Arizona (Gish 1982:105-108), demonstrate that windborne transport can produce arboreal pollen levels of generally equivalent magnitude in grassland and juniper grassland associations. For example, approximately 25 percent pine pollen in Coronado Project grassland compares with the 28 percent in Feature 3. This amount is correlated with the closest pine trees at a distance of 20 to 30 miles (Gish 1982:108). However, the abundance of oak pollen in the Feature 3 sample (11.5 percent) cannot be matched in the Coronado study and values as high as 10 percent are reported by Hevly (1968) only in communities containing oak.

The brown sand sampled between 0 and 10 cm below surface in Feature 3 appears to have been derived from a different sediment source than the lower red level. A change over time in the direction of prevailing winds carrying airborne arboreal pollen might be involved. Alternatively, the brown sand could represent redeposition of older local sediments, which incorporate pollen of an earlier mesic interval. In either case, reduced percentages of Cheno-am and wild buckwheat pollen in the upper Feature 3 sample are probable indicators of a pollen assemblage little affected by cultural activity.

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