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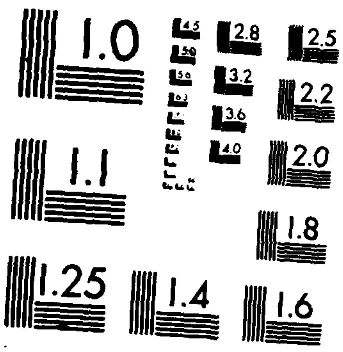

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ARCHEOLOGICAL EXCAVATIONS AT TWO PREHISTORIC CAMPSITES NEAR KEYSTONE DAM, EL PASO, TEXAS

BY DAVID CARMICHAEL

WITH CONTRIBUTIONS BY:

JEAN ELSASSER
HIRAM HENRY
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Prepared for the U. S. Army Corps of Engineers
Albuquerque District, New Mexico
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NEW MEXICO STATE UNIVERSITY

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Two prehistoric campsites on the west side of El Paso, Texas were excavated in order to mitigate the adverse effects caused by the construction of the Keystone Dam Highway Diversion Channel. The construction is part of the El Paso Flood Control Project being carried out by the U.S. Army Corps of Engineers, Albuquerque District. Keystone Sites 36 and 37 (41EP496 and 41EP492) are small lithic and ceramic scatters located at the eastern margin of the Rio Grande Valley, adjacent to Interstate Highway 10. Both sites

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functioned as short-term camps for the procurement and processing of leaf succulents, as indicated by the presence of large fire-cracked rock roasting facilities. The most significant results of the study concern chronology and the roles played by the sites in relation to prehistoric adaptive strategies. A new method of obsidian hydration was used to obtain a large number of direct chronometric dates. These were used to evaluate the C14 dates and it was concluded that some radiocarbon chronologies in the El Paso area are hampered by the effects of the old wood problem. The obsidian results also indicate a date of A.D. 1100-1400 for Site 37 which had originally been assigned to the late Archaic. Analyses of variability and distribution in the sites' contents reveal that they may be the result of two different mobility patterns. Site 36 is interpreted as a short-term logistic camp and Site 37 as a short-term base camp. The late date for Site 37 argues for the existence of a generalized, highly mobile adaptive strategy at roughly the same time as more sedentary Pueblo-based strategies.

ARCHEOLOGICAL EXCAVATIONS AT TWO PREHISTORIC CAMPSITES NEAR KEYSTONE DAM, EL PASO, TEXAS

By David Carmichael

With Contributions by:

Myles Miller III
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M. Justin Wilkinson

A REPORT PREPARED FOR THE U.S. ARMY CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT, NEW MEXICO, CONTRACT DACW47-84-C-0006, under the direction of David G. Batcho, Fred Plog and Steadman Upham of the Cultural Resources Management Division, Sociology and Anthropology Department of New Mexico State University, Las Cruces, New Mexico.

December 1984

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ABSTRACT

Two prehistoric campsites on the west side of El Paso, Texas were excavated in order to mitigate the adverse effects caused by the construction of the Keystone Dam Highway Diversion Channel. The construction is part of the El Paso Flood Control Project being carried out by the U.S. Army Corps of Engineers, Albuquerque District. Keystone Sites 36 and 37 (41EP496 and 41EP492) are small lithic and ceramic scatters located at the eastern margin of the Rio Grande Valley, adjacent to Interstate Highway 10. Both sites functioned as short-term camps for the procurement and processing of leaf succulents, as indicated by the presence of large fire-cracked rock roasting facilities. The most significant results of the study concern chronology and the roles played by the sites in relation to prehistoric adaptive strategies. A new method of obsidian hydration was used to obtain a large number of direct chronometric dates. These were used to evaluate the C14 dates and it was concluded that some radiocarbon chronologies in the El Paso area are hampered by the effects of the old wood problem. The obsidian results also indicate a date of A.D. 1100-1400 for Site 37 which had originally been assigned to the late Archaic. Analyses of variability and distribution in the sites' contents reveal that they may be the result of two different mobility patterns. Site 36 is interpreted as a short-term logistic camp and Site 37 as a short-term base camp. The late date for Site 37 argues for the existence of a generalized, highly mobile adaptive strategy at roughly the same time as more sedentary Pueblo-based strategies.

PREFACE

It is unusual in archaeology when the research results from a single project have the potential to change the way that archaeologists interpret the archaeological record of an entire region. Yet this is the way archaeology should proceed. The results of each new project should inform subsequent thinking. It is the case, however, that archaeological research and particularly that brand of archaeology known as cultural resources management rarely brings to the attention of the discipline results that alter interpretive frameworks in the rapid fashion that the pace of work and dollars spent might indicate. It is instead a slow and incremental process, additive in a way that often obscures the pattern of developing ideas about how people in the past adapted on the landscape. Such both is and is not the case with the following report.

David Carmichael has used the opportunity provided by the contract with the Corps of Engineers to satisfy the federal cultural resources requirements and to perform state-of-the-art archaeological research. Both of these accomplishments are of equal significance since the methods and scope of work outlined in the proposal submitted to the Corps of Engineers by the Cultural Resources Management Division built upon several years of prior research and fieldwork in the area. The fieldwork conducted by Carmichael, however, realized the goals of the research design in a variety of unexpected ways.

One of the most significant contributions of the work at the Keystone sites has been the identification of a previously unrecognized portion of the regional adaptive pattern. This pattern, based on high levels of residential mobility and a presumed reliance on hunted and gathered resources, has particular importance since it occurred during the latter periods of prehistory, at a time when culture historical reconstructions for the area suggest that populations were living in a settled village way of life. Our perceptions of this "traditional wisdom" are now changed and future work in the region will focus on describing and explaining this new aspect of the Jornada adaptive pattern in more detail.

The field methodology Carmichael used to identify the archaeological evidence of this pattern is also significant. Using a carefully designed sampling scheme augmented by proton magnetometer surveys and the judicious use of power equipment, Carmichael identified the remains of numerous pit structures. Due to the nature of these structures and the depositional characteristics of the Keystone sites, remains of these dwellings were difficult to define. Were it not for the use of the backhoe to cut slit trenches it is certain that evidence of these ephemeral structures would have gone unnoticed. Consequently, the use of the backhoe and the careful interpretation of the stratification as exposed in the trenches is in large part responsible for the findings presented here.

Also of note is Carmichael's use of obsidian hydration dating to provide chronometric estimates of antiquity for the Keystone sites. As his discussion makes clear, this dating technique is based on the induced hydration method and, consequently, is sensitive to source-specific variability in the composition of obsidian and to local environmental conditions. It is only fair to point out, however, that in some respects the technique is still experimental. Questions about rate development, variability in paleoclimatic conditions (especially past temperature regimes) and replicability of results between laboratories remain to be answered more completely. Moreover, the obsidian dates are, in a few cases, in conflict with radiocarbon age determinations. I believe Carmichael has adequately accounted for such discrepancies, however, by citing the problems of "old wood" in desert environments. The site dating based on obsidian is internally consistent and correlates well with other data from the sites. Consequently, I believe the results of obsidian dating mark a tentative step forward in dating the occupation spans of open sites (normally devoid of organic materials) in the Jornada region.

As we move toward a better understanding of prehistoric cultural developments in Jornada region, I believe the work done at the Keystone sites will mark an important change in our perceptions about the nature of human adaptive diversity. Much of what was realized in archaeological data from the Keystone sites was presaged theoretically in a few prior publications. It is gratifying to see that cultural resource management studies can contribute to the discipline in such a fundamental manner.

Steadman Upham

ACKNOWLEDGMENTS

The efforts of many individuals have contributed to the completion of this project. Coordination with the U.S. Army Corps of Engineers, Albuquerque District, was handled by Mr. Jasper Coombes, Contracting Officer's Representative and the following members of his staff: Andrew Saiers, John Schelberg and Jan Biella. Ms. Barbara Hower assisted in the pre-work conference and Bill Willis helped implement the Corps' response to vandalism at the sites. David Harned, City Engineer for the City of El Paso arranged for access through city property and provided maps and ground control for property in the vicinity of Sites 36 and 37.

The field crews are to be commended for maintaining a high level of professionalism despite the occasionally trying field conditions encountered during the winter months. Crew members included Lorenzo Ballesteros, Agustin Balsach, Bruce Boeke, John Carpenter, Vicki Clay, Kelt Cooper, Kevin Dunn, Jean Elsasser, Karen Fourqurean, Tim Graves, Pete Gregg, Bill Haas, Joanne Hempel, Hiram Henry, Wayne Howell, Barbara Kauffman, Tom Korsmo, Laura Michalik, Myles Miller, Alfonso Morales, Richard Newton, Sam Ortiz, Mike Schutz, Eric Simmons, Trace Stuart, Mary Sullivan and Richard Yarnell. Area residents Jose and Monica Gomez were helpful in monitoring site security and extended generous hospitality to field crew members.

Artifact cataloging and laboratory analyses were carried out by Laura Michalik, Tom Boese, Mary Sullivan, Jean Elsasser, Rick Sleeter, Margaret Tobin-Johnson, Gordon Dean and Vicki Clay. A special thanks is extended to Myles Miller who carried out most of the coding and analysis of lithic artifacts. Staff members from the Digital Image Processing Laboratory, Department of Earth Sciences, New Mexico State University assisted the lab crew in compiling the artifact and feature distribution maps. Michael Green designed the computer programs necessary to carry out the spatial analyses of artifacts and features. The drafting of maps and figures was done by Rhoda Winters and Roz Drohobyczer. Rowena Gilstrap and Maria Palacios did a commendable job on the immense task of typing and editing the draft report.

Several professional colleagues were helpful in providing unpublished research results or other information relevant to the results of the project. Thomas O'Laughlin and Rex Gerald provided background information on earlier work in the Keystone area and Vernon Scarborough allowed me to include unpublished obsidian hydration and archeomagnetic dates from the Meyer Range Pithouse Site, Fort Bliss. Michael Schiffer graciously supplied a manuscript detailing his most recent work on old wood problems in radiocarbon dating. Steadman Upham provided access to unpublished dates and materials from recently excavated sites in the southern Organ Mountains. I would also like to express my special thanks to Stead for his encouragement throughout the project and for the

useful discussions regarding the implications this study holds for Jornada area archeology.

I appreciate the efforts of those colleagues who took the time to provide thoughtful and useful reviews of an earlier draft: Glen DeGarmo, LaVerne Herrington, David Johnson, Thomas O'Laughlin, Jack Rudy and Lynn Teague.

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CHAPTER 1

INTRODUCTION

Project Background

This report presents the results of archeological investigations at two prehistoric campsites located within the western limits of the city of El Paso, Texas (Figure 1.). The work was undertaken by the Cultural Resources Management Division (CRMD), New Mexico State University, in response to U.S. Army Corps of Engineers, Albuquerque District, solicitation DACW47-83-R-0022. The scope of work is designed to mitigate the effects on cultural resources caused by construction of the Highway Diversion Channel associated with Keystone Dam.

The Keystone Dam and Highway Diversion Channel are parts of the El Paso Flood Control Project designed to provide protection against runoff from the Franklin Mountains. Keystone Dam will receive runoff from directly upslope and additional flow will be diverted to it from drainages to the south. The Highway Diversion Channel will extend north from Sunland Park Drive, paralleling Interstate 10, entering the dam via an existing arroyo at the north edge of the study area. The project area is located between Interstate 10 and the Coronado Hills Subdivision as shown in Figure 2. The reader will note the relationship of the planned diversion channel and the locations of Keystone Sites 36 and 37. The investigation and interpretation of these two sites is the subject of this report.

The sites are located within .7 km of each other along the east margin of the Rio Grande Valley (Figure 1). They are situated near the lower edge of a series of gravel ridges extending toward the river from the Franklin Mountains. These ridges have been truncated by the construction of Interstate 10 which runs immediately to the west of both sites (Figure 2). The other Keystone Sites studied previously (O'Laughlin 1980; Fields and Gerard 1983) are located just west of the highway on lower elevation ridges and on the edge of the Rio Grande floodplain. A more detailed discussion of the site locations is presented in Chapter 5 of the report.

The excavations of Keystone Sites 36 and 37 (41EP496 and 41EP492) are only the latest in a series of archeological investigations, extending back to 1976, related to the construction of flood control facilities in the immediate area. Previous work has been directed at the excavation of Keystone Sites 32, 33 and 34; the results of those studies are briefly summarized in Chapter 2. They have contributed significantly to our understanding of archeological variability in the El Paso area, particularly as it relates to the remains of mobile populations from the Archaic period. Since Sites 36 and 37 date

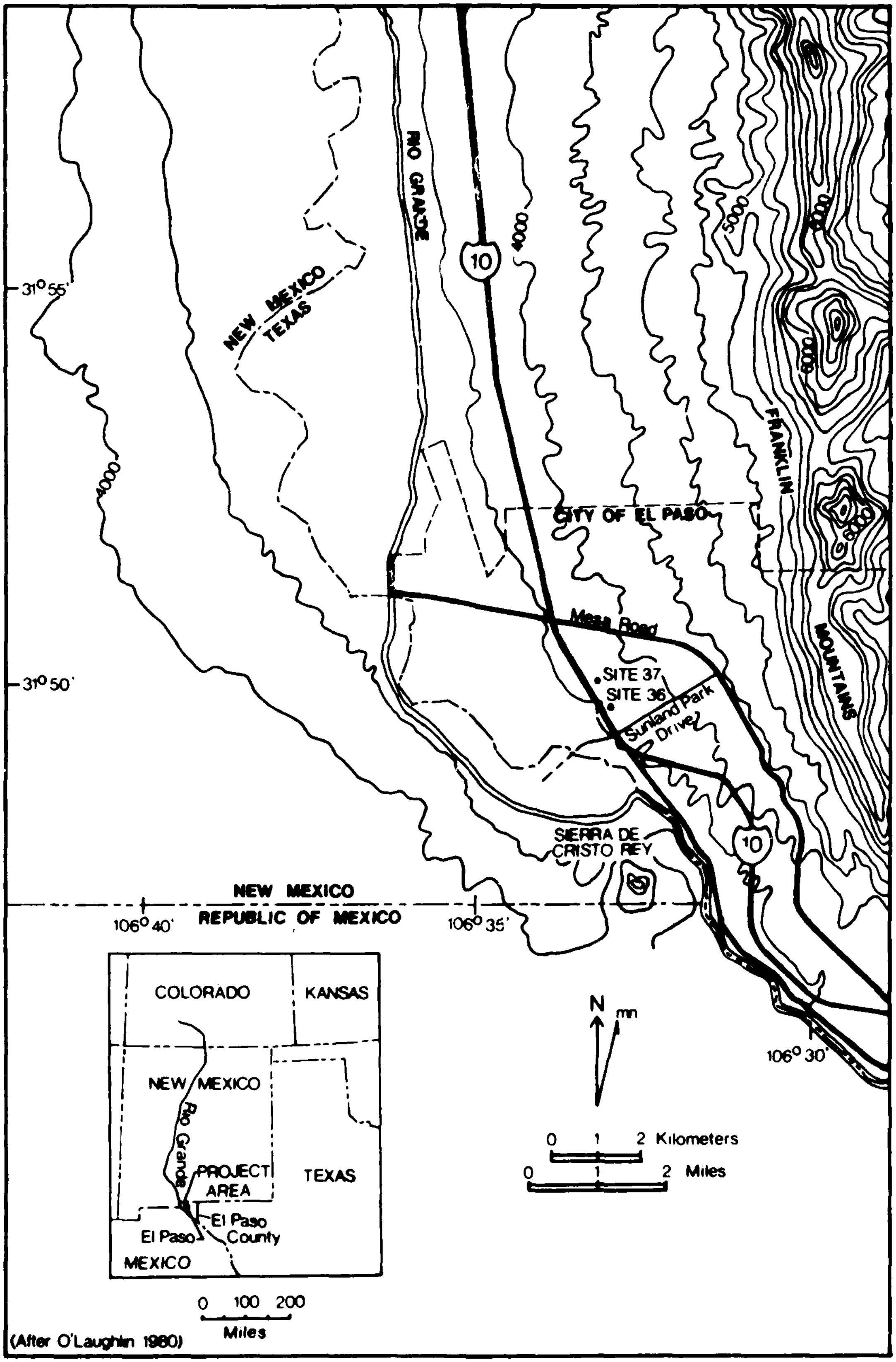


Figure 1. Location of Keystone Sites 36 and 37, El Paso Texas.

Figure [illegible] [illegible]pographic setting of Keystone Site [illegible]
[illegible] the proposed [illegible]

to a later time period they cannot be viewed as being systemically related to the previously investigated sites. Nevertheless, the body of data resulting, as a whole, from the Keystone Dam investigations consists largely of information on the deposition of cultural materials in the context of mobile adaptive strategies from various time periods.

The recovery of important problem-oriented data in the context of the Keystone Dam construction has been fostered by the application of a progressive view of the role played by contract archeology within the discipline at large. Beckes (1977:217) has observed that in the past, specific cultural resource management (CRM) goals have not been responsive to archeological research orientations in the area. It is no longer acceptable to consider CRM archeology as analytically separate from the rest of the discipline. CRM research undoubtedly accounts for the majority of archeology presently conducted in this country. In light of the resultant impact on the nonrenewable resources of the archeological record, contract archeology must be justifiable in terms of needs defined by the project sponsor and the archeological community. In other words, data collection and analysis should result from problem-oriented research designed in response to current archeological issues. For the most part, research at Keystone Dam, including this study, has been responsive to this approach and the Army Corps, Albuquerque District, is to be commended for soliciting interpretive reports which go beyond simple descriptions of the fieldwork accomplished.

Scope of Project and Overview of Results

The planned construction of the Highway Diversion Channel was expected to destroy 100 percent of Site 36 and 85 percent of Site 37. Following O'Laughlin's (1980:248) recommendations, the Army Corps requested complete mitigation of both sites. Available information on the sites suggested they were both low density lithic scatters covering 5000 and 7000 square meters, respectively. Both sites had between five and ten fire-cracked rock features exposed on the surface and small amounts of ceramics were recorded near these features on Site 36. Both sites had been disturbed by wind erosion and off-road vehicle traffic and it had been estimated that cultural deposits would only be about 20 cm deep (RFP:74).

The mitigation plan called for in the RFP elaborated upon the recommendations stemming from O'Laughlin's investigations (1980:247-249). Field investigations were to include four basic tasks: site mapping, surface collection, systematic subsurface test excavation and controlled hand excavation of features.

Fieldwork was initiated on December 12, 1983, and was originally scheduled to be completed within six weeks. Because of delays due to site vandalism and additional excavation prompted by the discovery of unexpected features, the period of fieldwork extended through March 30, 1984. Surface activities included site mapping, proton magnetometer survey, piece plotting of artifact distributions and surface collection. Testing and excavation units consisted of a combination of random, systematic and judgemental hand excavations as well as backhoe trenches. The details of these techniques and the sampling designs through which they were applied are discussed in Chapter 4.

The results of our field investigations had been unexpected but they are archeologically very interesting. The analysis of these two visually uninspiring campsites has provided significant new information concerning the range of variability in the local archeological record. The results are theoretically interesting since they challenge some aspects of the conceptual frameworks which have traditionally been used to assign meaning to the archeological record. The most significant results of this study can be summarized within the following topical areas: 1) evaluation of field methods in relation to the recovery of features, 2) identification of another variety of short-term hut or shelter, a feature type which has only recently been recognized in the local archeological record, 3) development of improved chronological control, 4) detailed intrasite distributional analysis and 5) evidence for a mobile adaptive strategy relatively late in time. These topics are briefly outlined below.

1) The cultural deposits were found to be deeper than had been anticipated and, in spite of evidence for extensive erosion at the sites, many features were identified which lacked surface indications. Eighteen and 30 fire-cracked rock features were recorded at Sites 36 and 37, respectively. This finding argues the need for a reassessment of our general archeological expectations of surface sites in similar settings. It is noteworthy that the careful use of mechanical equipment played an important role in the successful documentation of subsurface features.

2) Even more significant is the identification of at least 16 shallow pit structures. This group of features constitutes one of the largest sets (along with Keystone 33) of non-pueblo structures reported from a single site in the southern New Mexico-west Texas region. The features are small shallow depressions probably representing the remains of wikiups or similar short-term shelters. Much of the body of the report involves the presentation and discussion of data on these structures. They provide a substantial addition to the recorded range in variability among prehistoric features in the region.

3) Careful feature excavations have provided a total of 36 samples for chronometric dating, making these two sites among the best dated in the El Paso area. The induced hydration technique of obsidian dating was applied to 4 samples from Site 36 and 17

from Site 37. This relatively new technique avoids some of the problems associated with older methods because it provides source-specific hydration rates for each of the three distinct source groups identified at the sites. Since the hydration rates are determined experimentally, the dates are independent measures of artifact age, requiring no calibration with other chronometric techniques. In addition, the two sites yielded five and ten radiocarbon determinations, respectively. Neither site dates to the Archaic period as had been suggested by earlier studies. Site 36 dates to about A.D. 600-800, well within the early Formative Mesilla phase. Site 37 was occupied later and over a longer period of time, with dates ranging from about A.D. 1050-1350. Detailed information on the dating methods used and the results of the chronological analyses are presented in Chapter 11.

4) Intrasite patterning among artifacts and features has been investigated through the use of computer mapping techniques and multivariate statistical procedures. At both sites, artifact associations, density distributions and feature distributions all indicate functional partitioning of space by the prehistoric occupants. A basic dichotomy is identified between low intensity special use space around the site periphery and higher intensity use space occurring in more central locations; the pattern is best developed at Site 37. The identification and interpretation of within site patterning is discussed in Chapter 10.

5) The relatively late dates obtained from Site 37 are perhaps the most interesting finding of the project because the short-term pit structures appear to have been contemporaneous with nearby Doña Ana and/or El Paso phase pueblos. However, Site 37 does not closely resemble most other sites in the region which have been assigned to the Pueblo phases. This raises the provocative question of what type of adaptive strategy may be represented by Keystone Site 37. It is suggested that the remains could have been produced by groups employing a strategy involving high levels of seasonal mobility. Data relating to this issue are dealt with in Chapters 7, 8, 9 and 13.

Organization of the Report

The report is divided into three main sections covering the Background, Investigation Results, and Discussion and Interpretation. The Background materials, contained in Chapters 1 through 5, include discussions of previous research, the research design, field methods and the environmental context. Chapters 6 through 11 are devoted to the presentation of data resulting from this study. Included in this section are evaluations of the various data recovery techniques, chronological analyses, spatial analyses, descriptions of features and discussions of the lithic and botanical analyses. The final section of text, Chapters 12 and 13, consists of interpretations resulting from the analysis of activity patterning, site structure and regional settlement patterns, along with a report summary. The results of the analyses of soils, obsidian and radiocarbon samples and botanical remains are provided in the appendices.

CHAPTER 2

PREVIOUS RESEARCH

The Keystone Dam project area is part of the region includ in the Jornada Branch of the Mogollon area (Corley 1965; Lehme 1948). Compared to other parts of the Southwestern United Stat areas lying within the Jornada Branch have received relative little attention from archeologists. The Jornada region has oft been conceptualized as having been marginal to the better-stud cultural developments elsewhere in the Southwest. Thus viewed a marginal area, the Jornada Mogollon attracted litt professional attention until the recent implementation of cultu resource management policies.

In the last decade, the Jornada area has been the focus increasing attention from archeologists, largely in response developments undertaken by the U.S. Army and other governmental agencies. Even so, our understanding of the archeological recor lags behind other areas of the Southwest where chronologies an the range in site variability are better known. This section contains a brief overview of research conducted in the regi relevant to the present study. It is followed by a summary of th prehistoric sequence generally applied in the Jornada area, and discussion of problems generated by the traditiona conceptualization of that sequence. The latter part of th chapter consists of a review of previous work conducted as part the Keystone Dam project and an examination of the results wh are relevant to the present study.

History of Research in the Jornada Area

The earliest archeological research in the study area da to the 1920s and 1930s. During this period a variety researchers conducted excavations directed at the recovery perishable materials from caves and rockshelters in the Hueco Guadalupe Mountains (Alves 1930, 1932; Ayer 1936; Bryan 19 Conkling 1932; Cosgrove 1947; Howard 1932; Roberts 1929). Th investigations provided the initial documentation for prece and early Formative materials in the area but were necess limited by their bias for only one class of site type.

Other investigations during the same period focused on survey and testing of sites in the Tularosa Basin, Hueco Bo Rio Grande Valley and Jornada del Muerto (Alves 1931, 19 Chapman 1926; Crimmins 1929; EPAS 1965; Sayles 1935; Stubbs 19 Vermillion 1939). Early attempts at synthesizing and classify the finds mentioned in the descriptive reports were undertaken Stallings (1932) and Mera (1938, 1943). It is not unexpected th archeological remains from south-central New Mexico and west Texas were classified within the Basketmaker-Pueblo framework based on the better studied Anasazi materials to the north. The conceptualization of the Jornada area as being peripheral or marginal to neighboring Puebloan developments begins at this time. The effects this notion has had on archeologists' perception and expectations for this region have persisted, in varying degrees, up to the present.

Based on excavation and survey work carried out during the early 1940s Lehmer (1948) defined the Jornada Branch of the Mogollon. The resultant phase sequence, discussed below, still provides the basic chronological framework for research on the Formative period in this region. Only recently have the form and content of the phase categories been questioned or revised by some researchers.

Following this early period of activity, the Jornada appears not to have attracted much professional interest. Sporadic research efforts were directed primarily at the description of Formative sites (Hammack n.d., 1961; Holden 1952; Kelley 1966; McCluney 1961; Schaafsma n.d.). In the El Paso area, most work in the 1950s and 60s was conducted and published by the El Paso Archeological Society, and these efforts were also directed at the description of large Formative sites. The publications of the society represent a significant proportion of the published data available for the El Paso area.

Most of the professional research in the Jornada area has been accomplished since 1970, largely in response to cultural resource management concerns. Several extensive surveys have been conducted in the context of planning and field training exercises at Fort Bliss (Beckes 1977; Whalen 1977, 1978, 1980; Skelton et al. 1981; Carmichael 1983a). Additional smaller surveys have been implemented on other public lands (Wimberly and Eidenbach 1977; Way 1977; Lord 1980; Eidenbach and Wimberly 1980, Eidenbach 1983; Hilley et al. 1982; Duran 1982; Hester 1977; Laumbach 1982). Small clearance surveys and excavations provide more detailed data, but coverage is spotty relative to survey data (O'Laughlin 1979, 1980; Kegley 1980; Moore and Bradley 1980; Hard 1983; Batcho 1984b; Fields and Girard 1983). One notable pattern in most recent work has been an emphasis on the study of the floors of desert basins. Very few reports have been generated regarding the archeology of mountain ranges in the area, but the available evidence suggests that mountains were more important than would be indicated by the present data base (HSR 1973; Bohrer 1980; Carmichael 1982; Stuart and Farwell 1983; Harrill 1980; Ravesloot and Spoerl 1984). Similarly, with relatively few exceptions (O'Laughlin 1977, 1980, 1981; Foster et al., 1981; Greiser 1973; Kauffman 1984; Carmichael and Elsasser 1984), the study of the Rio Grande Valley has been neglected.

Although the last ten years have seen a great increase in the amount of archeological research, there still exists in the Jornada area an imbalance in the kinds of data which have been recovered. As LeBlanc and Whalen (1980) note, research in the Jornada is heavily dominated by survey projects. Very little analysis of excavated data has been done compared to nearby regions containing Anasazi and Western Mogollon materials. For this reason, excavation projects, like those associated with the construction of Keystone Dam, take on added significance. Almost every new excavation provides improved chronological control and insights regarding the meaning of archeological variability as recorded in survey data. Specific contributions made by previous Keystone investigations are discussed below.

Regional Culture History

As a background to this study it is useful to consider the developmental sequence normally applied to the prehistoric record of the southern Jornada area. The archeological continuum is subdivided into developmental stages such as Paleoindian, Archaic and Formative. Although designed to reflect sociocultural variability, these taxa usually carry temporal connotations as well. It is this latter characteristic of the sequence which has led to some of its conceptual limitations, as discussed herein.

Paleoindian Period

The earliest well-documented archeological remains in the Southwest are assigned to the Paleoindian Period, dating between 11,000-8,000 years ago. Late Pleistocene climates were wetter and cooler than at present and southern New Mexico and west Texas probably supported large areas of savanna or open woodlands associated with heavily forested mountains. Numerous lakes and permanent streams attracted a wide variety of large game animals which were exploited by prehistoric groups.

The distinctive Paleoindian stone tool assemblages, containing finely made lanceolate spear points, are generally thought to be indicative of adaptations specialized for the hunting of large game by small bands of highly mobile hunters. Paleoindian materials are generally comparable over wide areas of the continent, but the earliest of these assemblages, characterized by Clovis points, is rather poorly represented in south central New Mexico. Isolated Clovis points have been reported along the Rio Grande Valley and in the southern Tularosa Basin (Harkey 1981; Krone 1976), and at least two sites are known from the general area. These occur near Mockingbird Gap, 190 km to the north (Weber and Agogino 1968) and on a site in Rhodes Canyon on the northeast side of the San Andres Mountains (Eidenbach, 1983).

The earliest materials documented in the immediate area are those of the Folsom complex, as identified by the presence of distinctive fluted points. The assemblages have been dated elsewhere to the range of about 11,500-10,000 years ago (Wheat 1972). Several types of sites are probably assignable to the period. Kill sites, butchering stations, and other types of procurement loci are found associated with ancient ponds and lakebeds (Judge and Dawson 1972; Beckes 1977; Carmichael 1983a; Hilley et al. 1982). Some of these sites cluster in areas which may have been used for short-term base camps (Russell 1968; Krone 1975). Additional staging areas, or logistical camps, may be identified in the canyons and foothills adjacent to major mountain ridges, as in Fillmore Pass and Rhodes Canyon (Carmichael 1983a; Eidenbach, 1983). Several caves in the region probably were occupied during this period (Bryan 1929; Conkling 1932; Howard 1932; El Paso Archaeological Society files), but these sites are poorly documented. The distribution of Folsom sites suggests a highly mobile hunting and gathering strategy.

This pattern continued on into late Paleoindian times when a more diverse set of lithic traditions is defined on the basis of points from the Laterally-thinned (Midland, Plainview), Constricted Base (Agate Basin, Hell Gap), and Indented Base Series (Firstview, Cody Complex). These are collectively known as the Plano tradition and are da[illegible] from about 10,500-8,000 BP (Wheat 1972; Cordell 1979). Aside from changes in projectile point manufacture, the assemblages are similar to those found on Folsom sites. Site distributions and densities are also similar, with perhaps more emphasis on the use of permanently watered areas (Judge and Dawson 1972; Carmichael 1983a). This change may be due to the onset of a gradual drying trend which continued into the Archaic period. Big game hunting is still the suggested subsistence base, but there is evidence for increasing specialization using labor-intensive hunting techniques involving larger social groups (Wheat 1972). Locally, the only Plano sites known are camps found in locations similar to those recorded for Folsom sites (Everitt and Davis 1974; Russell 1968). Kauffman (1984) recently documented a late Paleoindian component on a campsite in southeast El Paso. It is in a valley margin setting similar to the Keystone area so it is possible that Paleoindian groups exploited the present study area as well.

Archaic Period

The lengthy Archaic period is generally dated to about 8,000-2,000 BP, although both the beginning and closing dates are matters of debate (Stuart and Gauthier 1981; Beckett 1979). Post-Pleistocene drying trends produced an essentially modern climate regime by the Middle Holocene (8,000-4,000 BP) (Van Devender and Spaulding 1979). Prehistoric occupations of this period adapted to desert grassland and desert scrub resources, and to increased spatial and seasonal variability in key resources.

This was accomplished through the development of patterns of seasonal mobility keyed into the availability of natural resources. Increasing variability in projectile point styles suggest that regionalization may have been an associated development (Taylor 1964; Jennings 1964; Winters 1969). Nevertheless, social groups were still probably organized at the family and band level with a high degree of residential mobility.

Relatively little is known about the earliest Archaic adaptations due to a lack of materials from the Early Holocene. However, by about 7,000 BP increasing numbers of people were involved in seasonal subsistence rounds. Archaic sites recorded in the area reflect the use of a wider range of topographic settings (i.e., resource zones) than is known for Paleoindian times (Carmichael 1983).

An emphasis on seed gathering is often considered to be a hallmark of the Archaic period. In Fresnal Shelter alone, the remains of 37 food plants have been identified (Human Systems Research 1972). Variations in the spatial and seasonal availability of these species would contribute to the patterns of mobility developed during the period. As part of this pattern, scheduling of procurement activities was probably accomplished by partitioning the environment on the basis of available resources. Thus, within a logistical settlement strategy, many sites can be expected to reflect the exploitation of discrete resource zones.

It appears that such a pattern emerges in the study area during the Archaic period. As might be expected for a broad-spectrum economy, a number of different site types are known, distributed over a wide range of topographic settings. However, due to the seasonal limitations on specific resource zones, the vast majority of these sites can be viewed as short-term camps.

In the Tularosa Basin, dispersed camps containing quantities of groundstone probably reflect the use of mesquite and a variety of annuals (Brethauer 1978; Carmichael 1981; Eidenbach and Wimberly 1980). Specialized agave processing camps probably date to the late Archaic in the Guadalupe Mountains (Katz and Katz 1979; Applegarth 1976) and adjacent to the Sacramento and Franklin Mountains (Beckes 1977; O'Laughlin 1980). The archeology of mountain zones is poorly known in this region, but there are indications that these upland areas were important for hunting during the Archaic (O'Laughlin 1977; Human Systems Research 1972, 1973; Carmichael 1982).

In contrast to these short-term procurement camps are the sites representing longer-term occupations. Fresnal Shelter and Keystone Dam Site 33 can be interpreted as seasonal base camps reflecting early summer and fall, and winter occupations, respectively. Long-term residence is indicated by the accumulation of extensive trash deposits, the maintenance of living floors, and by the relative lack of groundstone tools characteristic of ephemeral procurement camps in the region (Human Systems Research 1973; O'Laughlin 1980). Many residential base camps are probably located outside the basin floor environmental zone, in response to the distribution of reliable water supplies, around which band territories were probably oriented (Taylor 1964).

One additional important development occurring during the Archaic period was the introduction of domesticated plants. Although the local data are still not clear, this process may date as early as 3500 BP (Dick 1965; HSR 1972; Carmichael 1982; cf. Wills et al. 1982). All available evidence indicates that cultigens played a minor role in overall subsistence during the Archaic period, serving mainly to add to the diversity provided by the wild plants in the diet (Minnis 1980; Bohrer 1981). The eventual intensification of the use of domesticates, presumably in the face of increasing population and decreasing mobility, is one of the processes generally used to characterize the ensuing Formative period.

Formative Period

The study area lies within the region defined by Lehmer (1948:73) as the Jornada Branch of the Mogollon. The cultural sequence originally defined for the Jornada was based primarily on differences in pottery and architecture. However, Lehmer also proposed the existence of a Hueco phase comprising foraging populations which spanned the preceramic/ceramic transition (A.D. 1-900). Early use of the Hueco phase was analogous to that of Basketmaker elsewhere in the Southwest. This usage has been confused in more recent work, and the Hueco phase has been attributed to the late Archaic (Beckes 1977; Whalen 1978; Skelton et al. 1981). As Beckett (1979:223) notes, the Hueco phase lacks viability given its inconsistent application.

The definition of the Jornada includes three ceramic phases relevant to this study area. As defined by Lehmer (1948:89) these are the Mesilla phase (A.D. 900-1100), Doña Ana phase (A.D. 1100-1200), and El Paso phase (A.D. 1200-1400). This framework has provided the basis for most recent work in this area. However, this system of phases is becoming increasingly unwieldy in light of the greater range of variability being documented in the archeological record.

Mesilla Phase

It is traditional in archeology to consider the advent of the use of ceramics as representing an important cultural threshold. Locally, the appearance of El Paso Brown has been treated in this manner, and, along with the use of pithouses, has been used to define the beginning of the Mesilla phase. However, most recent research shows that these developments occurred independently, and much earlier than was originally assumed.

Shallow pithouse structures excavated in the Hueco Bolson have been attributed to, and have been part of the definition of, the Mesilla phase (Whalen 1978, 1979). But similar structures are also known during the Archaic period (Minnis 1980). At Keystone Dam, these pit structures date back to 4,000 BP (O'Laughlin 1980). The similarity between Archaic and Mesilla phase dwellings is instructive but it argues against the utility of the trait in the phase definition. It should not be surprising to find pithouses at much later dates as well (Cordell 1979).

The remaining criterion is problematical due to the fact that dates on El Paso Brown have been pushed back in time, and because this ceramic type is not confined to the Mesilla Phase. Excavations in the Hueco Bolson and Rio Grande Valley have yielded dates on local brownware ranging back to A.D. 200 +/- 60 (Whalen 1980). This extends the Mesilla phase to span a period of 700 years (O'Laughlin 1980). It is likely that significant archeological patterning is being obscured by subsuming this long a period of time within a single phase. In addition, it must be recognized that when defining phase identity on the basis of local plainware, the potential exists for assigning short-term Pueblo and Proto-Historic period camps to the Mesilla Phase.

Traditionally, the Mesilla phase has been interpreted as being characterized by the use of pithouse villages (Lehmer 1948; Whalen 1978). Yet, the vast majority of Mesilla phase sites are ephemeral short-term camps (Hester 1977; Moore and Bailey 1980; Beckes 1977; Carmichael 1983b; Upham 1984). A high degree of mobility and a generalized subsistence pattern seem to be indicated, and both conditions contribute to a high degree of seasonal functional variability (Hard 1983). In fact, general similarities to the Archaic with regard to site size, contents, and distributions suggest that much of the Mesilla phase represents essentially an Archaic adaptation with the addition of ceramics. Nevertheless, a six-fold increase in the rate of site formation suggests significant population growth during Mesilla times (Carmichael 1983a). By the end of the phase substantial pithouse villages are known, some of which which appear to have been occupied by larger social groups (e.g., Los Tules, Rincon Site, Hatch Site, Hatchet Site). Increasing levels of social integration may be indicated by a possible ceremonial room at Los Tules, and nonlocal ceramics reflect interregional interaction with western Mogollon groups.

Mesilla phase sites exhibit a dispersed settlement pattern distributed over a range of environmental zones. Nevertheless, the availability of permanent water appears to act as a major factor in the location of long-term residential sites until late in the phase. Most villages are situated along the Rio Grande Valley or adjacent to small drainages in the mountains and foothills (Lehmer 1948; O'Laughlin 1980, 1981; Beckes 1977:72; Hammack n.d.; Schaafsma n.d.; McCluney 1961). Some late sites are located on alluvial fans, a pattern which becomes characteristic in the Pueblo period. The large basins and the smaller mountain ranges appear to have been exploited through the use of short-term logistic camps.

Sites in the area have been interpreted as reflecting hunting in the mountains (Way 1977; O'Laughlin 1977), processing of agave and other succulents in the foothills and along the Rio Grande Valley margin (Whalen 1978; O'Laughlin 1979, 1980) and the gathering of mesquite, grasses, cacti, and various annuals in the basins (Brethauer 1978; Carmichael 1981; Eidenbach and Wimberly 1980). O'Laughlin also suggests the presence of a riverine component within the Mesilla phase settlement system, on the basis of work at the Sandy Bone Site (1977). The use of domesticated plants increases throughout the phase and by A.D. 1100 becomes an important aspect of reorganization of land use patterns in the area.

Doña Ana Phase

As conceived by Lehmer (1948:78) the Doña Ana phase is a short-lived transition between the Mesilla and El Paso phases. House forms include both pithouses and adobe surface structures. The ceramic assemblage is dominated by El Paso Brown and early El Paso Polychrome, but El Paso Red-on-brown, Mimbres Black-on-white, Three Rivers Red-on-terracotta, Playas Red, and Chupadero Black-on-white are also present.

Although the phase has been poorly documented, Doña Ana sites are now known from the Tularosa Basin and Rio Grande Valley (Beckes 1977; Carmichael 1983a; O'Laughlin 1981:146). Sites of this phase provide the first evidence of substantial long-term habitation in nonriverine settings. Adobe village complexes are clustered on and along the lower ends of alluvial fans and at canyon mouths, presumably due to the potential for rainfall runoff agriculture (Beckes 1977; Carmichael 1983a; Carmichael and Kauffman 1984).

The number of large village sites recorded indicates significant growth and reorganization of the population relative to the Mesilla phase (Whalen 1981). Very likely, it is at this time that southern New Mexico becomes part of an interaction sphere centered at Casas Grandes in northern Chihuahua (Schaafsma 1979). It has been suggested (Carmichael 1983a) that the Doña Ana phase represents an occupation at least as intensive as that normally attributed to the El Paso phase. This view argues against the linear model of culture change implicit in the traditional phase sequence. The results of the present study also bear directly on the problem of the nature of cultural succession, and the non-linear model will be discussed at length in Chapters 3 and 13.

El Paso Phase

The El Paso phase is traditionally viewed as the climax of cultural development in the Jornada area, a development supported by a specialized intensive farming adaptation (Whalen 1978:38). Remains of cultigens recovered from El Paso phase sites include maize, beans, squash, and bottle gourd (Ford 1977). Nevertheless, hunting and gathering continue to play an important role in the overall subsistence strategy. A variety of wild plant remains are identified at El Paso phase sites, including mesquite, yucca, acorns, cheno-ams, and cacti (LeBlanc and Whalen 1980:428).

Adobe pueblos are generally viewed as typical of the phase but the sedentary nature of settlement at this period may be overstated. In the southern Tularosa Basin, only 24% of the recorded El Paso phase sites are interpreted as long-term habitation sites (Carmichael 1983a:110). These large villages are clustered at the foot of alluvial fans and around playa depressions. The rest of the sites are small procurement camps scattered throughout the basin and nearby mountains. Additional villages are also known along the Rio Grande, perhaps reflecting a riverine component to the settlement system (Foster et al. 1981).

In addition, it is not clear to what extent El Paso phase "pueblos" correspond to expectations fostered by archeologists' conceptions of pueblos known from Anasazi contexts. Many El Paso phase villages appear to lack the extensive trash accumulations one might expect from large sedentary populations (Beckett and Wiseman 1979:397). It is possible that some pueblos were only occupied seasonally or on a permanent basis by only a portion of the population (Foster and Bradley 1984). An ancillary residential site, possibly a field house, has been discovered on the mesa west of El Paso (Batcho 1984b) but the role played by such sites in the overall settlement system has yet to be worked out. Suffice it to note that some investigators have suggested higher levels of mobility (i.e., a greater variety of adaptive strategies) for the El Paso phase than is implied by traditional views (Carmichael 1983b; Upham 1984).

Given the recent data on Doña Ana occupation, it is also not clear that the El Paso phase represents an increase in local population or organizational complexity over the previous phase. The overall adaptive pattern is probably very similar to the Doña Ana phase, although some shifts in settlement patterns are noted. El Paso sites show a somewhat reduced tendency to be located on alluvial fan, and an increased orientation toward playas on the basin floor (Beckes 1977; Carmichael 1983a). In the Rio Grande Valley, a southward shift of settlement along the river has been suggested (O'Laughlin 1981). Such shifts may be related to fluctuations in the intensity of occupation in a given study area rather than large scale changes in land use patterns throughout a region.

As Stuart and Gauthier (1981) suggest, cultural systems can be modeled as having the ability to oscillate between intensive, specialized adaptations and generalized, efficient ones. They suggest that in the northern Tularosa Basin this type of oscillation is reflected in the altitudinal shifting of long-term residential sites. Similarly, the Doña Ana and El Paso phases may represent two different cycles of intensive occupation of the basin (Carmichael 1983b). This argument is also relevant to a consideration of the post-Pueblo period as noted below.

One additional feature of interest is the evidence for changes in regional patterns of interaction during the El Paso phase. Nonlocal ceramics found on El Paso phase sites reflect a wider variety and range of contacts than at any other time during the prehistoric sequence (Whalen 1978; Smiley 1977). In addition, marine shells from the Pacific and Gulf Coasts are recorded (Whalen 1978) as well as copper bells from Mexico (Lehmer 1948). It may be that these data indicate a shift in regional patterns of exchange, perhaps related to a reduction in the importance of Casas Grandes after A.D. 1300 (LeBlanc 1980).

Post-Pueblo Period

There is little recognized archeological evidence for the occupation of southern New Mexico and west Texas after about A.D. 1400. Environmental change and attendant failure of adaptive systems are often invoked to explain the widespread pattern of apparent abandonment. However, several authors have noted that archeologists have failed to produce the data needed to support a depopulation model (Wimberly 1979; Tainter 1981; Upham 1984). Rather than (or in addition to) depopulation, it may be reasonable to postulate a return to a generalized, efficient adaptive strategy.

The great majority of sites in the Jornada area are small lithic and ceramic scatters. These sites are difficult to place in the normative culture-historical sequence because they lack the characteristics used to assign phase affiliation (e.g., visible architecture and large ceramic assemblages). Yet, these very sites are the ones which conform to expectations regarding remains deposited by small mobile groups with a generalized subsistence base (Cordell et al. 1983). The large number of unidentified sites could refer to mobile components of pueblo-based settlement systems or separate mobile strategies occurring at various times.

Groups of small ephemeral sites could be predicted as the result of aboriginal systems in operation at the time of Spanish contact. Reports of settled pueblo-dwelling Indians are consistently lacking from the section of the Rio Grande Valley between the Rio Concho and modern day San Marcial, New Mexico (Everitt 1977). On the other hand, hunter and gatherer bands exhibiting a pattern of seasonal residential mobility are documented along the river. Periz de Luxan described a rancheria comprised of flat roofed pithouses along the Rio Grande (Hammond and Rey 1929). Based on observations by Espejo in 1582-1583, these rancherias appear to have been winter settlements (Hammond and Rey 1966). This same stretch of valley was uninhabited when the Rodriguez expedition passed through in the summer of 1581. A similar pattern of seasonal movement is later noted by Whiting (1849) for the Apache: winter settlements along the river, and summer encampments in the mountains.

Apaches are known to have frequented the study area, yet they remain almost invisible archeologically. It is significant that the mobility patterns described for late prehistoric and historic Indians resemble what we know about Archaic settlement patterns. Thus archeologists must accept the idea that Archaic-style adaptations have not necessarily been limited to the Archaic period. The remains of such adaptations will be especially difficult to identify since they are very likely to have been assigned to the Archaic or early Formative periods. In light of the high degree of mobility suggested by some for the Jornada area, this model of post-Pueblo generalization warrants serious attention when nondiagnostic ephemeral camps are involved. As discussed at length below, the results of the recent excavations at Keystone Dam bear directly on this issue of temporal variability in adaptive strategies.

Previous Investigations Associated with Keystone Dam

The present study is the most recent in a series of archeological investigations related to the construction of flood control facilities on the west side of El Paso, Texas. Archeological sites were reported in the vicinity of the Keystone Dam as early as 1974 (O'Laughlin 1980:1) but it was not until 1976 that a systematic survey of the area was undertaken. As a result of that survey, 18 prehistoric sites were defined (Gerald 1976). The sites were identified within the numbering system used by the El Paso Centennial Museum (EPCM:31:106:2:31. 32. etc.) and, as a shorthand convention, sites were referenced by the last number in the series (e.g., Keystone Site 33). This form of reference has been adopted by the Army Corps and previous investigators (Request for Proposal; O'Laughlin 1980; Fields and Girard 1983) and it is followed herein as well. However, some of the sites have additional institutional numbers, and all have designations within the Texas trinomial system. The relationships among the various sets of site numbers are shown in Table 1.

Out of the original 18 recorded sites, eight were suggested as being eligible for nomination to the National Register of Historic Places (Gerald 1976). These were separated into three groups on the basis of site size and number of features, and one

Table 1. Keystone Dam site number equivalents

KS Number (EPCM)	Texas Trinomial	NMSU
29	41EP491	
31	41EP492	
32	41EP325	
33	41EP493	
34	41EP494	
35	41EP495	1536
36	41EP496	1530
37	41EP492	1531
	41EP2461	1534
	41EP2462	1535

site was chosen from each group for mapping, surface collection and test excavations. These Phase II investigations were carried out at Sites 29, 33 and 34 as reported by O'Laughlin (1980). Part of the results of O'Laughlin's study was the reevaluation of the nature and extent of several sites, including the ones reported here. Sites 36 and 37 were found to be larger and to contain greater numbers of features and artifacts than had originally been reported (O'Laughlin 1980:247-248). In light of this new information, the Army Corps requested a Determination of National Register Eligibility for Sites 32, 33, 34, 36 and 37 (Fields and Girard 1983:2).

After receiving determinations of eligibility for these sites procedures were implemented to mitigate the adverse impact of construction. The Keystone Dam was redesigned in order to avoid portions of Sites 33 and 34. Mapping, surface collection and excavations were carried out at Site 32 by Prewitt and Associates in 1982 (Fields and Girard 1983). The present report contains the results of mitigation efforts at the remaining two of the five sites which have been or will be directly impacted.

In addition to these Corps-sponsored projects, the CRMD recently reported on mapping, surface collecting, and test excavations at Site 35 and other sites to the east of the Highway Diversion (Carmichael and Elsasser 1984; Stuart 1984). Even though the site was identified during the original Keystone survey, it lies outside the construction easement on private land. Site 35 was contained within a parcel surveyed for the developer and the results are incorporated into this study. The relationship between the Keystone Sites and those occurring nearby on private property is shown in Figure 2.

The archeological investigations conducted in relation to the Keystone Dam construction have contributed important new information to our understanding of local prehistory. The bulk of O'Laugnlin's (1980) work in the area was directed toward the excavation of Sites 33 and 34. Both sites are located on an alluvial fan and terrace remnant approximately 450 m west of the present study area. The data pertaining to Archaic adaptations are especially noteworthy.

Site 33 contains evidence for approximately three dozen shallow circular houses or huts dating back to 4450 BP. They were apparently constructed of mesquite, cottonwood, creosote, reeds, etc., and plastered with mud. Some houses indicate the superposition of later floors over trash accumulations on previously occupied floors. The structures are also associated with trash filled pits, a possible storage pit and several large fire-cracked rock concentrations. Based on the range of features and the nature of the artifact assemblage, the site is interpreted as an intermittently occupied residential base camp (O'Laughlin 1980:234).

Formative period occupations are also documented at Site 34 and in the upper portions of Site 33. It is interesting that the Formative components are smaller and more ephemeral than the Archaic occupations. This would seem to indicate that later use of the Keystone Dam area was responsive to different logistical factors than were operating during the Archaic (see Binford 1982).

This possibility is borne out by differences in the lithic assemblages. The Archaic levels are characterized by greater use of fine-grained raw materials, greater emphasis on biface production and greater curation of tools and cores. Formative period components have higher proportions of tools, indicating an expedient technology related to greater specialization for the processing of leaf succulents (O'Laughlin 1980:235). These findings raise the question of whether the remaining Keystone Sites are base camps similar to the Archaic levels of Site 33, or short-term task group sites like those attributed to the Formative. This issue continues to be important and is discussed in relation to Sites 36 and 37 in Chapter 13.

Another problem raised by previous work in the area includes the question of the function of fire-cracked rock features and changing patterns in their use through time. O'Laughlin argues that fire-cracked rock features were specialized for the processing of leaf succulents such as agave (1980:101-119). He further contends that all rock hearths are functionally equivalent regardless of size (1980:119). However, it is noted that the largest features of this type are attributable only to the Formative occupations. This suggests that the importance of leaf succulents may have increased through time (O'Laughlin 1980:235).

O'Laughlin's work is also important because it draws together information about the nature and distribution of other Archaic and Formative sites in and along the lower Mesilla Valley (1980:27-31). His synthesis contains or summarizes the bulk of the published data on lithic artifact frequencies from El Paso area sites. These data, along with those from the Roth Site (O'Laughlin 1981), Las Cabranas (Foster and Bradley 1984) and the Doña Ana County Airport sites (Batcho 1984b) provide a basis for making comparisons among artifact assemblages in the area.

One of the main aspects of the significance of Site 32 was the possibility that it was temporally related to Site 33 and subsequent dating of the site confirmed the presence of Archaic components (Fields and Girard 1983:123-124). The site is interpreted as representing repeated short-term occupations at four different times during the late Archaic and early Formative periods. No structures were recorded but the recovery of a piece of wattle-impressed clay is suggestive of the occurrence of structures similar to those at Keystone 33 (Fields and Girard 1983:125).

Based on artifact and feature content, the earlier components of the site are interpreted as specialized camps for the processing of leaf succulents. The later components are viewed as field camps with less evidence for the use of special processing features. These results contradict the evidence from Site 33 for an increase in the use of fire-cracked rock features through time. However, it is noted that none of the features at Site 32 are as extensive as those attributed to the early Formative occupation at Site 33 (Fields and Girard 1983:124). Thus, questions regarding the trajectory of leaf succulent exploitation over time remain open.

The analysis of lithic artifacts from Site 32 provides additional comparative data for Archaic period raw material procurement and tool use. Variability in the lithic assemblage is inferred to have been produced by a pebble reduction strategy applied to local gravels and the deposition of curated tools manufactured elsewhere (Fields and Girard 1983:165-168). Such a pattern corresponds to the expected by-products of a short-term camp, the function suggested for the site. This interpretation is supported by the recovery of 40 bifaces, a much larger number than has been reported from other Keystone Sites (Fields and Girard 1983:152). Together with the data from the other sites mentioned above, the Keystone Dam investigations report the assemblage characteristics for a variety of site and component types. Such data are relatively rare in this region and they provide the basis for assessing the systemic contexts of Sites 36 and 37.

More specifically, the Archaic assemblages are used as models for mobile strategies in general. Prior to this study, Site 37 was expected to date to the late Archaic or early Formative period (Request for Proposal, Part III, Section J). In spite of some general similarities between the assemblages of Site 37 and known Archaic sites (e.g., lack of ceramics, high variability among cherts), the results of our chronological analyses indicate a much later date for the occupation of the site (Chapter 11). This apparent contradiction can be clarified by recognizing that Archaic-style artifact assemblages and adaptive strategies need not be confined to the Archaic time period.

As a result of previous archeological investigations in the Keystone area several research topics relevant to the analysis of Sites 36 and 37 have become evident. These topics include various aspects of a growing concern with the role of individual sites and components within adaptive strategies:

1) chronological control and the identification of reoccupation,

2) assessing functional variability among features, especially fire-cracked rock concentrations,

3) defining the nature of the lithic procurement and reduction sequence,

4) interpreting site function and contextual relationships, and

5) identifying changes in land use patterns over time. The approaches used to carry out analyses related to these research topics are detailed in the following chapter.

CHAPTER 3

RESEARCH DESIGN

Introduction

This chapter outlines the theoretical perspective brought to the collection and the analysis of data at Keystone Sites 36 and 37. The discussion is organized around three major research issues: elucidation of the systemic context of the two sites, evaluation of the sites in relation to regional cultural systematics, and development of site chronologies.

One major concern is the use of a regional systemic approach in the interpretation of the significance and functional role of individual archeological sites and components. Of special interest is the identification of characteristics which can be used to distinguish sites which have been produced by different adaptive strategies. Expectations derived from models of differential mobility are applied to Keystone Sites 36 and 37.

A second area of concern is the identification of conceptual problems fostered by the use of traditional approaches of cultural systematics. The temporal framework currently in use in the Jornada area has been defined on the basis of characteristics observed on the most visible sites. It is difficult to interpret low visibility sites like Site 37 within this framework. An examination of the relationship of such lithic scatters to the other components of an overall adaptive strategy is important for interpreting the remains recorded at Site 37.

Improved chronological control is a third goal for the present program of research, and the results contribute to two main areas of research. Dating is required to establish at least some degree of site contemporaneity if we are to consider settlement patterns produced by a given adaptive strategy. Also, better temporal control is necessary in order to test the traditional phase assignments made on the basis of relative dating of "diagnostic" artifacts.

In the latter part of the chapter these concerns are translated into a series of general research topics presented in the form of problem domains identified at the outset of the project. It is within these domains that the analyses of specific research problems proceed. The topics are outlined with regard to their relevance to existing interpretations of the local archeological record and to the issues raised by previous Keystone Dam investigations.

Systemic Context of Sites

Archeological sites cannot be fully understood as individual entities. They are often more usefully conceived of as interrelated parts or components of settlement systems. A settlement system refers to the functional relationships among the various occupational loci utilized in the context of an adaptive strategy (Winters 1969:110-111). A basic assumption is that the physical environment is structured, or contains patterned variation. It is argued (Raab 1977; Vayda and Rappaport 1968) that cultural behavior constitutes a rational attempt to adapt to the structure of the environmental context. This being the case, it is expected that the patterning of material remains should reflect a population's attempt to interact with its physical and social surroundings. Thus, a settlement pattern is seen to represent the ways in which a population is deployed in order to exploit the environment (Struever 1968). The goal in attempting to understand the physical remains at any given site is to specify how they relate to, and what information they provide about, the overall settlement pattern and the strategy which produced it.

Components are defined as the archeological manifestations of constituent elements of temporally distinct settlement systems. A single component site is taken to reflect one element of a given adaptive strategy, but a reoccupied site may contain components from two or more distinct strategies. In such a case the site is a compound entity, combining material remains from more than one type of utilization of that site location. The functional significance of the different components could potentially be quite variable; one's ability to assign functional meaning to multicomponent sites will likely rely on the extent to which successive components are functionally redundant (Binford 1982).

Niche partitioning is a common aspect of human adaptations. Different portions of the environment are viewed as being useful for the exploitation of different resources. Assuming that individual components are located to facilitate the recovery of different kinds of resources, characteristics of the site locations and artifact assemblages should ideally reflect their function or role within the adaptive strategy (Binford 1980).

Relatively permanent sites, such as villages or seasonal base camps, can be expected to contain evidence of a wide variety of behavior such as food production, processing and storage, the manufacture of stone tools, and site maintenance. The resultant heterogeneous assemblages are due both to the length of occupation and the diverse makeup of the residential groups (Binford 1982). In some kinds of strategies, limited activity sites can also be anticipated. Limited activity sites are considered to be the result of relatively short-term occupations by task groups or specialized segments of the local group. They are expected to exhibit a narrower range of artifacts reflecting an orientation toward specific extractive tasks. It is this kind of reasoning which leads O'Laughlin (1980) to interpret the Archaic component at Site 33 as a base camp but the Mesilla phase component as a specialized plant processing camp. In theory then, it should be possible to identify the systemic context of Sites 36 and 37 by comparing their contents with each other and with other sites in the region. These comparisons will focus on details of the features recorded and the technological characteristics of the lithic artifact assemblages, as outlined below.

Most models of settlement patterns attributed to mobile adaptive strategies in the Southwest explicitly require or imply the existence of limited activity sites (Biella and Chapman 1980). Limited activity sites are also commonly assumed to be produced as parts of sedentary, village-based settlement systems due to the logistic nature of mobility reported in the ethnographic literature (e.g., Hack 1942; Ellis 1974). It is expected that most limited activity sites would be represented archeologically as lithic and ceramic scatters. However, a variety of potential site types could produce similar surface remains. In some cases, lithic and ceramic scatters might be pithouse villages lacking structural remains visible on the surface. In other cases, such a site may be a short-term residence where brush shelters were constructed which are not now identifiable. In addition, lithic and ceramic scatters can also represent the activities of a task group at a limited activity site, or the combined results of multiple occupations by a number of task groups. A major problem exists with the ability of archeologists to distinguish between lithic scatters representing limited activity sites auxiliary to sedentary residential bases and those representing short-term residences produced within a pattern of greater mobility.

Binford (1980) makes the useful distinction between two different kinds of mobility which can be identified among human groups: logistical mobility and residential mobility. Logistical mobility refers to the degree to which groups utilize short-term hunting and gathering trips beyond the foraging range of a residential base camp or village. Sites occurring in the logistical zone would be produced by task groups and would consist of those archeological loci known as limited activity sites. Residential mobility refers to the periodic movement of base camps, a pattern which, in this region, would most likely have strong seasonal correlates. Binford predicts that logistical camp sites will have functionally homogeneous artifact assemblages, while residential sites occupied by mobile hunter-gatherers will contain heterogeneous assemblages. Building upon Binford's models, Most and Hantman (1982) identify four aspects of lithic technology which may be useful in distinguishing limited activity sites from mobile residences. These characteristics relate to artifact size, raw material variability, intensity of tool use and the diversity of functional artifact classes represented in the lithic assemblage.

Most and Hantman (1982:11) suggest that artifact size may be a useful measure of the amount of energy invested in tool manufacture and maintenance. Tools which are part of a curated technology (Binford 1979) utilized by mobile groups will be smaller than the tools of logistical groups which are used expediently and discarded within that context. Tool size could be indicative of transportation costs associated with high mobility and/or the amount of maintenance or retouching applied to a tool before discard.

Another attribute which can be expected to exhibit variability among adaptive strategies is patterning in lithic raw material use. Various researchers have reported the preference for high quality lithic raw materials reflected in Paleoindian and Archaic assemblages (Thompson 1979; Gomolak 1980; Goodyear 1980; Laumbach 1980; Carmichael 1983a). To some extent, this preference can be viewed as having been influenced by technological constraints operating within a curated biface production technology. That is, the potentially high costs of obtaining higher quality raw material would be offset by the curation and maintenance of bifacial tools. However, the recovery of Paleoindian and Archaic bifaces made of average-to-low quality local cherts (Carmichael 1983a) suggests that materials in this region placed few serious technological constraints on tool manufacture. A major portion of the diversity in a given lithic assemblage may simply reflect the degree of naturally occurring variability within the normal range of mobility for a given group. In any case, lithic raw material diversity should be higher on sites produced by mobile populations.

A third attribute suggested by Most and Hantman (1982:12) is the intensity of tool use, as measured by the number of utilized edges. More completely utilized tools should measure curation and mobility in the same way as tool size. More expedient behavior is expected to produce low intensity of tool use indicative of logistic groups. The low level of use of formal tools on such sites could also be expected to complement a high proportion of utilized flakes (informal expedient tools).

Finally, one can expect the density and diversity of artifacts to differ between sites produced by different mobility strategies. At sites which were occupied for a short period of time (logistical campsites) artifact density is expected to be low, even if they were repeatedly occupied. Since these sites are the loci of a restricted set of activities, artifact diversity is also low (Binford 1980). At hunter-gatherer base camps, a more diverse set of activities is involved, reflecting a more complete range of socioeconomic roles carried out at that location. Such sites are expected to yield a greater variety of artifact types and a greater density of cultural debris.

It is not clear that all of the above expectations would necessarily be applicable to situations like that in the Keystone Dam area. Most and Hantman (1982) direct their efforts at distinguishing between limited activity sites in a system with low residential mobility and residential sites in a system with high residential mobility. Sites resulting from the activities of a task group within a residentially mobile system may well be similar to limited activity sites in general. For example, in areas of abundant and varied lithic raw materials, such as the ridges surrounding Keystone Sites 36 and 37, one might expect evidence for expedient use of the local gravels on limited activity sites in the context of either residential or logistic mobility. However, the analysis of features and artifacts at the two sites suggests that they may not both fall into this category, and it is possible to characterize them in terms of logistical expectations. The specific hypotheses used in the analysis of site function and context are enumerated below as part of the problem domains.

Cultural Systematics

By most standards, the archeology of the Southwest is well known. As in other parts of the Southwest, the phase system developed by Gladwin and Gladwin (1934) provides the basic spatial and temporal framework for research in the Jornada area. As Plog notes, (1983:290, 311) phase frameworks assume a homogeneity of material culture for an area at a given time period. That is, all the archeological sites in a given region are assumed to be relatable to the overall developmental trajectory defined by the sequence of phases.

Most often the material patterns used to define phases are based on the characteristics of the larger (i.e., more visible, earliest described) sites in a region. It can be difficult to interpret lithic and ceramic scatters in the context of such a framework since they usually lack, for functional reasons, the key attributes (e.g., architecture, extensive ceramic assemblages) used to assign them to phases. As a result, archeologists are very likely under-representing the range of variability within adaptive strategies by assigning potentially contemporary sites to different phases on the basis of formal attributes. Moreover, in many parts of the Southwest the majority of known prehistoric sites can not be assigned to any phase due to lack of the appropriate formal characteristics. The Jornada area is a case example of precisely this situation.

A further assumption of phase sequences is that directional culture change is shared by all inhabitants of a region. For example, the pithouse to pueblo transition in the Southwest has traditionally been viewed as a one-way process. It is assumed that once sedentary strategies develop in an area, instances of recurring or cooccurring mobility strategies are precluded. It has been difficult to test this assumption since the traditional emphasis on cultural phases serves to direct attention away from the many "unidentifiable" lithic and ceramic scatters. Yet these relatively low visibility sites are precisely the ones which can provide evidence for the existence of mobile strategies not adequately expressed in the phase system (Cordell et al. 1983:9).

Some recent models of cultural succession explicitly recognize the potential for the representation of alternative adaptive strategies in the archeological record (Adams 1980; Stuart and Gauthier 1981). Both models identify dichotomous evolutionary modes, or adaptive strategies, as having contributed variability to the archeological record: resilient strategies and stable strategies (Stuart and Gauthier refer to these as efficiency and power drives). Cultural succession is viewed as a product of the interaction between the resilient and stable poses of adaptive strategies.

Stable strategies are characterized by increasing rates of population growth, high levels of overall productivity and high rates of energy expenditure (Stuart and Gauthier 1981:10). Growth in these areas is supported by intensification within the subsistence strategy. In contrast, resilient strategies exhibit decreased rates of population growth, production or energy expenditure. They reflect extensive adaptations which tend toward the maintenance of homeostasis. As Upham (1984) has noted, this dichotomy is probably overly simplistic except as a heuristic device. Most cultural systems may be viewed as falling somewhere along a continuum between the two extremes.

The characteristics of stable and resilient strategies can contribute to archeological variability in at least two ways. First, individual systems have the potential to oscillate between stable and resilient modes depending on the circumstances at hand. Intermittent periods of growth, or disequalibria, can be balanced by intervening periods of resiliency. A pattern of population aggregation followed by dispersal in the San Juan Basin is one example proposed as evidence of such cycles (Cordell and Plog 1979). Second, one must allow for the possibility that stable and resilient strategies could coexist at any time after the advent of intensive sedentary adaptations (Wimberly 1979; Cordell et al. 1983; Plog 1984).

It must be emphasized that different adaptive strategies are not to be equated with ethnicity. Reference to a particular strategy refers explicitly to the identification of certain characteristics of population size, distribution, mobility, etc.; at this level, no correlation with specific ethnic (i.e., cultural) groups is implied. Archeological evidence for the existence of different strategies at a given time might be produced in several ways. It is certainly possible that distinct strategies might reflect the behavior of different ethnic groups.

However, it is not yet clear that archeological materials are capable of measuring ethnicity, except perhaps during protohistoric or historic periods. In light of this problem, at least two other possibilities are equally plausible. Multiple adaptive strategies could represent the activities of different segments (e.g., upland/lowland) of the same population. Short-term fluctuations in land use practices by a single population over time might also produce evidence for a variety of strategies which, given current chronological limitations, might appear to be roughly contemporaneous in the archeological record.

Sites used to define a phase sequence will represent the remains of a stable strategy while the others (perhaps the majority) could be the byproducts of several strategies. Archeologists have typically directed their efforts at the definition of stable cultural patterns (i.e., phase sequences) as if they were the only strategy operating in a given area (Plog 1984). In cases where both stable and resilient strategies are present (either serially or coexisting) the more visible remains of the stable pattern will likely be identified as the characteristic pattern for the region and the resilient strategy may go unrecognized. Such a situation is suggested by the Apache occupation of southern New Mexico and West Texas. Although the Apache use of the study area is very well documented in ethnographic and historical records, they remain, by definition, virtually invisible archeologically. Their small, highly mobile groups can be expected to have produced lithic and ceramic scatters which have been assigned to the Archaic, interpreted as Formative limited activity camps, or added to the growing corpus of "unidentifiable" sites in the Jornada area. Similar problems probably exist in the treatment of prehistoric remains as well.

The Jornada area provides a prime example of a phase sequence which defines a stable pattern that is not directly reflected in the majority of archeological sites. Most researchers have identified fewer than 15% of their sites as loci of permanent habitations (Beckes 1977; Hester 1977; Moore and Bailey 1980; Taylor and Brethauer 1980; Harkey 1981; Laumbach 1982; Duran 1982; Hilley et al. 1982; Carmichael 1983a; Upham 1984; cf. LeBlanc and Whalen 1980). In addition, 80% or more of the sites recorded lack the diagnostic artifacts necessary to assign a cultural affiliation. The majority of sites are lithic or ceramic scatters best interpreted as short-term camps referable to one of several potential adaptive strategies. In the Jornada area at least, the data appear to indicate that settlement in sedentary villages was not characteristic of adaptive strategies in general. Either village-based strategies were much more variable than is normally assumed, or the archeological record is the result of a variety of strategies.

The idea that limited activity sites are part of sedentary settlement systems is based on ethnographic studies of the modern Pueblos. Many kinds of limited activity sites have been reported in the ethnographic literature (hunting stands, gathering camps, quarries, fieldhouses, etc.). While some archeological sites appear to correspond to recognizable ethnographic site types (Wilcox 1978), others do not. Lithic and/or ceramic scatters could be produced by a number of different activities as discussed above: logistic camps ancillary to sedentary residences, logistic camps related to mobile residences, or base camps in a strategy of high residential mobility. The potential for strategies with high residential mobility to occur both prior to and contemporaneously with strategies of low residential mobility means that improved chronological control is also needed to help sort the multiple possibilities for the systemic contexts of site formation.

Site Chronology

As is the case with assigning cultural affiliation, the determination of temporal placement is often based on normative criteria. Sites are usually dated by reference to the characteristics of "diagnostic" artifacts, a procedure which is most likely to cause problems on low visibility sites like Keystone 36 and 37. If sites like these contain brownware ceramics they are traditionally assigned to one of the Formative phases. If they are nonceramic and/or contain "Archaic style" projectile points they are typically assigned to the Archaic. This procedure may be inevitable in the context of surface survey, but data from excavations indicate that such assignments must be considered tentative. Recent work by New Mexico State University at Peña Blanca in the southern Organ Mountains illustrates the difficulty (Steadman Upham, personal communication, 12/5/84). Field crews recovered over 70 projectile points, most of which were dart points which would generally be identified as Archaic. However, radiocarbon dates from the site indicate an occupation between A.D. 1100-1400 (see Appendix III D). In light of these results, an attempt has been made to maximize the recovery of radiocarbon and obsidian samples which can be used for chronometric dating. The results have been illuminating since the dates for Site 37 are much later than was predicted through the traditional interpretation of formal characteristics. The dating procedures and results are detailed in Chapter 11.

Problem Domains

The general theoretical concerns expressed above can be articulated as a group of primary research topics which are addressed throughout the report. They follow directly from the theoretical perspective, perceived problem areas in the traditional interpretations of the local prehistoric sequence, and from requirements of the RFP. The issues addressed can be grouped within four problem domains: 1) chronology and site formation, 2) subsistence strategies, 3) site function and 4) systemic context of the sites. The specific research problems addressed within each domain are outlined below.

Chronology

It is clear from the theoretical perspective adopted here and from the previous work undertaken in the project area by O'Laughlin (1980) and Fields and Girard (1983) that the establishment of a more detailed chronology is of critical importance. Chronological control will contribute to the analyses of site context, or role within an adaptive strategy, in two major ways to the analyses in two major ways. First, if one is to consider a site as part of a system, it is necessary to establish at least general contemporaneity among the various components of that system. Also, in the event that the identified components can be attributed to more than one adaptive strategy, improved dating will be required to determine whether or not the different strategies may have coexisted in time.

The second area in which chronometric dates are helpful is in the identification of multiple components at a site. Reliance on the use of relative dating techniques, such as projectile point styles or ceramic types, can result in the assignment of an entire assemblage to a single period when multiple occupations are in fact present. Using obsidian hydration dates, Kauffman (1984) has shown that a site in east El Paso contains significant Paleoindian and Archaic components in spite of the fact that it was recorded as a Mesilla phase site on the basis of surface artifacts. In another case, a number of lithic scatters exhibiting characteristics generally identified with Archaic sites (high raw material diversity, preponderance of biface manufacturing debris, etc.) have yielded hydration dates in the 12th through 14th centuries (Batcho 1984b).

Chronometric dating is used both to evaluate the temporal and cultural placement of Sites 36 and 37 and to provide a temporal dimension to the adaptive strategies of which they are a part. This is accomplished through the dating of 15 radiocarbon samples and the application of an improved technique of obsidian hydration to 21 samples. The details and results of these analyses are discussed in Chapter 11.

Subsistence Behavior

The analysis of dietary patterns from botanical and palynological data is an important endeavor both in the context of testing various settlement models and in terms of the state of our present knowledge of subsistence patterns generally. O'Laughlin (1980) attributed a significant dietary role to the use of leaf succulents in the Keystone area. Fields and Girard (1983) were unable to contribute corroborating evidence for this view from Keystone 32 and the inferred function of fire-cracked rock features requires further testing. Subsistence activities are further examined herein through the use of standard techniques of flotation and identification of macrofloral remains. Research problems to be addressed include feature function, resource potential of the site environs and seasonality of the floral remains. The consideration of feature function is supplemented by soil chemistry analyses as discussed by Rice and Dobbins (1981).

O'Laughlin's and Fields and Girard's earlier work in the Keystone area indicates that the recovery of suitable pollen remains can be a problem. For this reason, an attempt has been made to maximize pollen recovery through the application of extraction techniques developed recently for use in arid areas (also see RFP:8). Such techniques rely on sieving, the use of noncorrosive chemicals and the processing of relatively large soil samples (Woosley 1978; Horowitz et al. 1981).

Due to the importance of insect-pollenated plants such as the leaf succulents, in aboriginal diets, the potential for recovering economically significant pollen is limited. However, pollen spectra should contribute to an understanding of resource potential in the Keystone area and prehistoric environments in general. The results of all these analyses are reported in the Appendices and discussed in Chapter 12.

Site Function

As reflected in the discussion above, one of the most important questions which can be addressed with data from the Keystone Sites is their function as it relates to a regional adaptive strategy. The issue of site function is approached from a variety of perspectives, including feature typology, lithic analysis and the identification of technologically related associations within the assemblage, spatial analysis of features and artifacts and considerations of the structure of site contents as it relates to other types of sites. The basic thrust of all these analyses is the interpretation of the relative permanence of the occupation of the sites and definition of the range of behaviors represented.

The ability to identify archeological sites or components produced by different types of adaptive strategies is of special interest. To this end, points from the general discussion of theoretical perspective have been rephrased into a series of testable hypotheses:

<u>Hypothesis 1.</u> Homogeneity of artifact assemblages will be inversely related to duration of occupation.

Homogeneity within artifact assemblages is measured by the quantity and diversity of artifact classes represented on the sites. Task groups responsible for the deposition at a limited activity site are expected to discard fewer artifacts due to the shorter duration of the occupation, and fewer types of artifacts due to the functional specialization of the site. Conversely, residential sites (e.g., villages, base camps) will be formed by larger groups of people engaged in a wider range of activities over a longer period of time. As a result, the sites should contain higher densities of artifacts and a greater variety of artifact classes.

<u>Hypothesis 2.</u> The diversity of lithic raw materials will vary directly with the duration of occupation.

Within any given time period, sites occupied for longer periods of time are expected to contain a greater variety of lithic raw materials. Binford (1979) argues that lithic material procurement is an embedded strategy among some Eskimo groups. That is, lithic raw materials are collected incidentally to other, more logistically planned, procurement activities. This may in fact be a general condition applicable to many human groups. Preliminary observations from the Tularosa Basin provide some evidence for embedded lithic procurement. The utilization of chert on a variety of sites is generally focused on locally available materials (Pigott and Dulaney 1977; Laumbach 1980; Carmichael 1983a; Eidenbach 1983). If this is the case, variability in raw material will measure, at least in part, the relative mobility of the groups occupying a site. Mobile strategies involving curated technologies should lead to a wide variety of source areas being represented on a given site. The longer a site is occupied, the greater the chance that task groups related to it will introduce raw materials collected at diverse locations.

<u>Hypothesis 3.</u> Intensity of use of formal tools will vary inversely with duration of occupation.

Curated tool assemblages should exhibit greater intensity of tool use, as indicated by the total number of edges. Curated assemblages should be more characteristic of short term occupations at logistic camps. Residential sites should contain <u>proportionately</u> fewer formal tools with fewer utilized edges due to the larger amounts of manufacturing debris produced at these loci.

<u>Hypothesis 4.</u> Artifact size will vary inversely with the duration of occupation.

Artifact size is taken to be a measure of energy expended in tool manufacture. Sites produced by mobile populations should be more likely to contain curated assemblages. Since curated tools are carried from place to place and maintained for longer periods, they should be smaller at the time of discard. Within a system with low residential mobility, logistic sites should exhibit smaller artifacts than those occurring at residences. However, all site types in a highly mobile strategy might contain smaller tools than either of the two above.

<u>Hypothesis 5.</u> The ratio of tools to debitage will vary inversely with the duration of occupation.

Although the absolute number of tools discarded at limited activity sites is small, the relative frequency of tools can be expected to be higher than for residential sites. In the Jornada area this pattern has been documented in the Rio Grande Valley (O'Laughlin 1979) and the Three Rivers Drainage (Wimberly and Rogers 1977). The lower proportion of tools on residential sites reflects the greater accumulation of unutilized debitage at those loci where longer occupations are likely to involve tool manufacture and maintenance.

<u>Hypothesis 6.</u> The quantity and diversity of features on a site will be directly related to the length of occupation.

Sites which are occupied for longer periods of time will contain more features and a greater variety of features. This is due to the potential for a greater variety of functional tasks to be carried out at residential sites, the potential for communal processing features in the context of a larger social group, and the greater likelihood of investment in storage and habitation facilities on residential sites. The presence of features such as storage pits, houses, or formalized patterns of trash deposits could be expected to indicate a residential base of some sort. Short-term camps should contain few features and they can be expected to be functionally redundant.

<u>Hypothesis 7.</u> The degree to which intrasite patterning is observable will vary directly with duration of occupation.

Patterned use of space is potentially observable on any site but the reoccupation of a site over time should tend to obscure intra-site patterns. In addition, extremely small sites could lack definable patterns when few artifacts or features are present. We would expect patterns in the distribution of feature types to occur in the context of a longer occupation unless extremely redundant reoccupation was conditioned by the functional stability of the location (Binford 1982:19).

Some examples are provided by Fort Bliss survey data from the southern Tularosa Basin. Site FB-1525 is a large site of about 11 ha containing primarily small hearths and scattered lithics. Intrasite artifact and feature distributions are very homogeneous, with the locations of hearths not apparently conditioned by one another. Based on the variety of projectile points identified, the site was reoccupied from late Paleoindian times to the El Paso phase. The site is not a single component settlement but rather a series of small limited activity sites located in the same general vicinity (Carmichael 1983a:214). In contrast, FB-1567 is an Archaic site at which there is evidence for intrasite activity patterning. Lithic concentrations are confined primarily to the west edge of the site and a group of large fire-cracked rock features are situated at the east edge. This site is more likely the result of activity organization within a base camp than is FB-1525 (Carmichael 1983a:253, unpublished field notes). As noted below, the distributional pattern at the latter site is similar to that recorded for Site 37. Investigations of the patterns expected to accompany such organization will proceed through the testing of the hypotheses listed above. The results of these analyses are discussed in Chapters 8, 9, 10 and 11.

In addition to the analysis of the artifactual content of the site, the interpretation of site function is aided by the investigation of feature function. Fire-cracked rock features have been divided into two groups on the basis of a cluster analysis of size and further subdivisions have been noted which appear to have functional significance (Chapter 7). The results of botanical studies are applied to these groups in an attempt to test O'Laughlin's (1980) interpretations of rock features at Keystone 33. The spatial distribution of these features and the pit structures in relation to artifact densities and technological clusters (Chapter 10) is also relevant to this problem domain.

Systemic Context and Organization

The interpretation of the systemic relationships of the Keystone sites involves the synthesis of information on site function and structure (from analyses mentioned above) with considerations of social organization and regional settlement patterns. The results of artifact and feature analysis support interpretation that both Keystone 36 and 37 were short-term camps. However, the differences between them suggest they were formed in the context of somewhat different logistic strategies. Comparisons between the sites are extended to other archeological remains known from surveys in the region. A discussion of regional settlement patterns as they relate to the Keystone sites, and the utility of catchment analysis in defining the relationships is presented in Chapter 15.

CHAPTER 4

FIELD METHODOLOGY

by David Carmichael and Hiram Henry

Introduction

The methodology employed in data recovery at Keystone Sites 36 and 37 is responsive to several concerns called for in the RFP and required by the research design. The primary goals of the data recovery procedures can be summarized as: the identification of the range of features at the two sites, the identification of variability within the artifact assemblages, recording the distributional contexts of the features and artifacts, maximization of the recovery of samples amenable to chronometric dating, and maximization of the recovery of botanical remains. This chapter contains a brief outline of the techniques used in our investigations in response to these goals. They are considered roughly in order of their application in the field and their relationships to problem-oriented data recovery requirements are noted. The usefulness of these techniques is discussed in Chapter 6, along with a summary of the range of features and artifacts recovered from each site.

Surface Mapping

The Army Corps provided basic locational information, including maps of the sites as they appeared in the fall of 1980. The site boundaries shown on these records were revised during the first stages of surface mapping. The site edges were intensively walked and boundaries were marked where artifact densities dropped to zero for a distance of 20-30 meters. This approach yielded site sizes of approximately 4,300 and 16,800 square meters for Sites 36 and 37, respectively. The site boundaries and their relationships to topography are shown in Figures 3 and 4.

One exception to this procedure occurred in the distinction of Sites 35 and 36. The boundaries at Site 36 are well defined on three sides where topographic changes are marked. The site is bounded by erosional cuts on the north and south and by the road-cut for Interstate 10 on the west. To the east there appears to be little justification for the distinction between Sites 35 and 36 (Figure 2). There is a gap of some 15-20 meters between the artifact scatters but the area is one of loose dune sand and it may well be that the scatters are continuous. Recent test excavations at Site 35 support the view that the sites are part of a continuous scatter (Stuart 1984). The original boundary thus reflects the difficulties of defining the limits of scatters in active dunes.

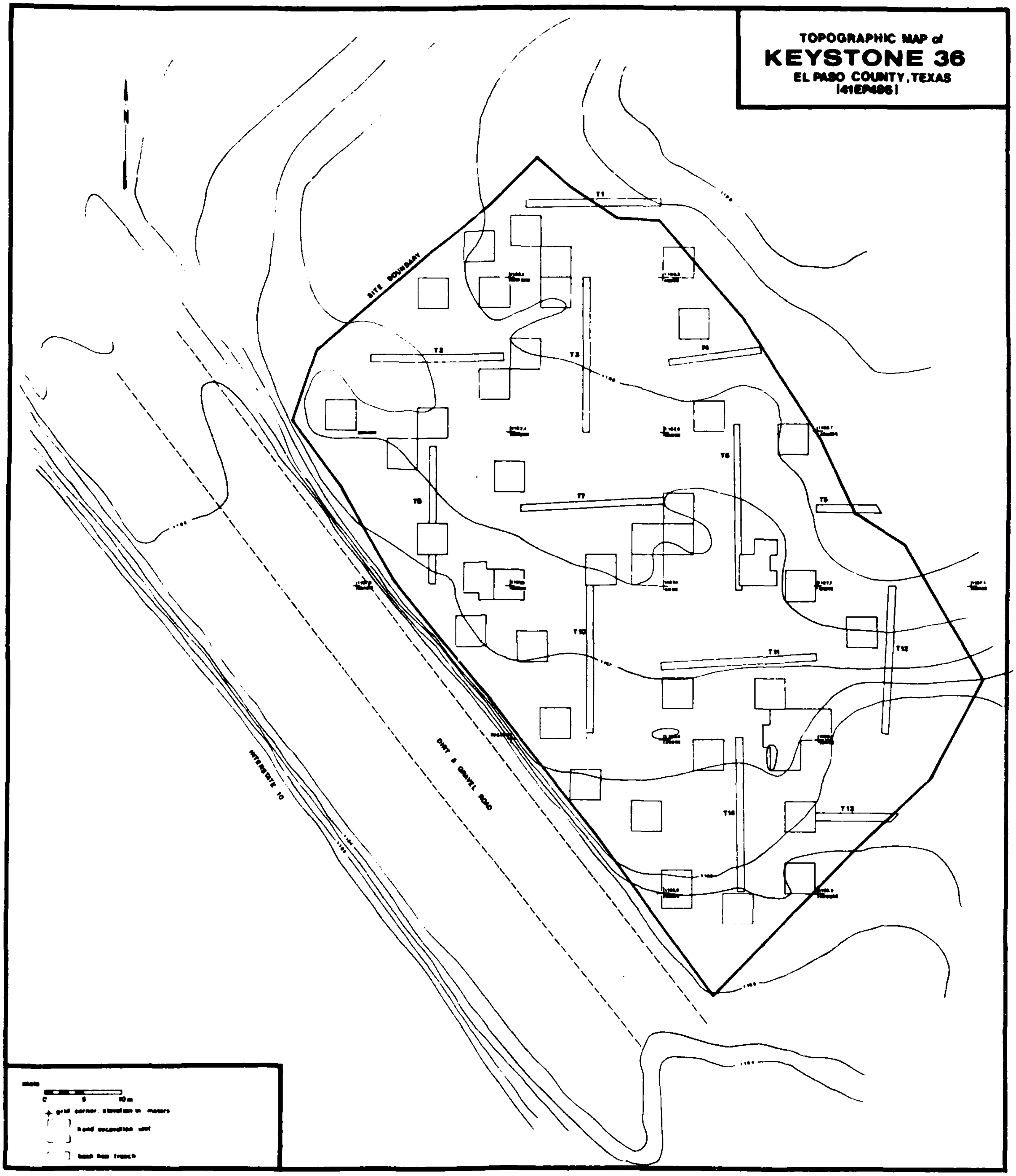


Figure 3. Topographic Map of Keystone 36

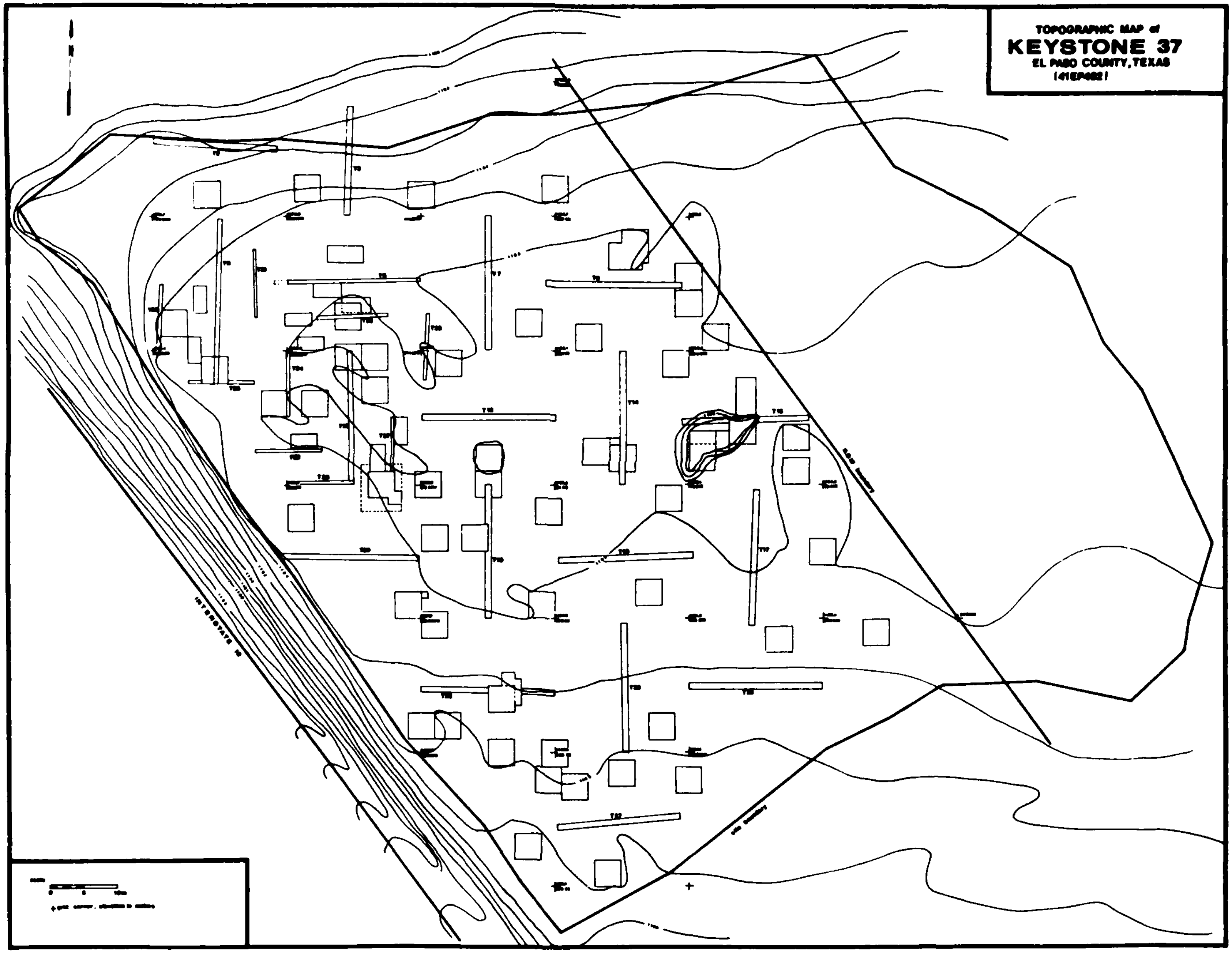


Figure 4. Topographic Map of Keystone 37

At Site 37 the boundaries were extended slightly on the northwest side and substantially on the east. The eastern extension encloses an eroded area which was apparently taken to be the eastern edge during initial survey. However, the eroded area is ringed by a scatter of lithic artifacts extending east into a slight saddle where additional fire-cracked rock features were recorded (Figure 8). Artifacts and features within the extension were recorded during surface mapping but because the area lies beyond the construction easement, no further investigations were carried out in the eastern third of the site. This will likely have no effect on subsequent analyses since even the undisturbed areas in the eastern portion of the site contain few artifacts or features. All maps and analyses deal with materials and features west of the Right-of-Way (ROW) boundary, an area of about 10,500 square meters, as shown in Figure 4.

Surface mapping involved the establishment of vertical control, topographic contouring and the recording of artifact and feature distributions. Datum points and grid lines were laid out using a theodolite with elevation control tied into nearby benchmarks. The datum at Site 37 was tied into City of El Paso monuments in the Coronado Hills Subdivision and Site 36 was located by reference to existing Army Corps benchmarks on the ridge east of the site. The results of topographic mapping are presented in Figures 3 and 4.

In light of the reported low density and dispersed nature of artifacts on the sites, it was determined that the most effective method for mapping surface distributions was through recording point proveniences. This was accomplished with the use of a Sokkisha SDM3E laser transit which provides immediate readouts for locational coordinates and elevation. All surface artifacts, features and scattered fire-cracked rocks were recorded in this manner. Field maps constructed with these locational data were later taken to the Digital Image Processing Laboratory at NMSU where the coordinates were digitized for the production of computer maps. The resultant distribution maps were used to facilitate the placement of judgemental excavation units. In addition, the digitized data were transformed on the computer for use in the locational analyses discussed in Chapter 10. Surface artifact counts for Sites 36 and 37 were 289 and 823 respectively, yielding densities (.07 and .08 per square meter) only slightly higher than those reported during a previous survey of the sites (O'Laughlin 1980).

Magnetometer Survey

Following the discovery of Archaic residential structures at Keystone Site 33, a major concern of all subsequent investigations in the area has been the identification of additional subsurface archeological features. In order to assist in the location of features prior to the application of destructive excavation techniques, a magnetic reconnaissance survey was conducted at Sites 36 and 37. In addition, the survey serves to assess the utility of magnetometers in the type of site and topographic setting represented by Sites 36 and 37.

Archeologists have been using magnetometers for subsurface explorations with varying degrees of success since the late 1950's. Although many sites are not amenable to magnetic surveying, some researchers have achieved very satisfactory results in locating and identifying subsurface features. During recent studies conducted by the Dolores Archeological Program in southwestern Colorado, researchers were able to provide archeologists with feature locations, probable feature types (i.e., pit structures, fire hearths, etc.) and approximate depths with a high degree of success (Huggins and Weymouth 1978, 1981; Bennett and Weymouth 1982). Others have detected objects such as bricks, tiles, pottery, fire pits, buried pathways, burials, and iron artifacts (Breiner 1973).

Magnetometers detect archeological features by measuring local irregularities in the earth's magnetic field. The instruments most commonly used for archeological applications are proton precession magnetometers. The magnetometers utilize the free precession of spinning protons of hydrogen atoms to measure magnetic field strength by passing current through a coil immersed in decane (a protein-rich hydrocarbon fluid). When current is flowing the spinning protons align with the magnetic field created by the coil. When the current is interrupted the protons realign with the earth's magnetic field, causing them to precess, or wobble about the earth's field. The precessing protons then generate a small current in the coil which is proportional to the strength of the magnetic field being measured. Small magnetic variations, or anomalies, are measured in nano-Teslas, more commonly referred to as gammas, with an accuracy of one gamma.

Measurable anomalies are caused by a variety of natural and cultural factors. The degree of residual magnetism in soils and rocks is a result of their composition. Materials susceptible to magnetic alignment are mainly the iron compounds found in soils: hematite, magnetite and maghemite. Under ideal conditions a magnetic survey could potentially measure equal readings throughout a given area. In reality a number of geologic and anthropogenic processes provide mixing and variability in mineral content which are reflected as magnetic anomalies. Anthropogenic sources of anomalies can be assigned to three categories: thermal, mechanical and chemical (Huggins and Weymouth 1981).

Thermal alteration of soils is the major source of culturally produced magnetic variations. Minerals with lower magnetic susceptibility can be transformed into materials with higher susceptibility through oxidation and reduction. Also, thermoremanent magnetization can be produced by heating in soils containing iron oxide. Thus, it is expectable that archeological features involving the heating of soils, such as campfires and roasting pits, should have an effect on susceptible soils.

Mechanical disturbances in the natural residual magnetism can also produce anomalies. Due to physical and organic processes involved in pedogenesis, the upper strata of soils are generally more magnetic than lower levels. When the upper strata are displaced by the excavation of pits, graves, cultivation, etc., anomalies may result. Pithouses could be expected to produce variations of this sort.

Chemical processes occurring naturally in soils can act much like heat alteration. Humic decomposition may produce reduction and oxidation reactions which in turn convert materials with low susceptibility into more magnetic materials.

Many, or most, (Breiner 1973) archeological site situations are poorly suited to the application of magnetometer surveys. One reason for this is that sandy soils exhibit low levels of magnetic susceptibility and measurable contrasts are difficult to identify. Other unfavorable conditions include irregular surface topography, the presence of igneous or metamorphic boulders, near surface bedrock and proximity to modern iron in the form of trash, fences, pipes, structures, etc.

Variations in the earth's external magnetic field can also significantly affect the values recorded during magnetometer survey. These variations are the result of changes in the electrical currents radiating from the sun and by movements of the earth in relation to the currents. Diurnal variations occur as the earth rotates, with magnetic field strength at any given location decreasing throughout the morning, reaching a low at noon, and increasing throughout the afternoon. Magnetic survey readings can be corrected for diurnal variation by using two magnetometers at the same time. One instrument is used as a base station which automatically records fluctuations at one location throughout the day. Readings taken from various locations within the site are corrected by removing that part of the variability attributable to fluctuations recorded at the base station.

Magnetic surveys were conducted at Sites 36 and 37 using two EG&G Geometrics Model G-856 proton precession magnetometers. Base station locations were established just outside the boundaries of each site and the same instrument was used for the base station throughout the survey. Survey crews were made up of two or three people with one responsible for placing the sensor on the proper grid corner and the others involved in various recording procedures. Magnetic readings were recorded at every point on a 2 x 2 meter grid across the sites, at the average rate of three to four readings per minute.

Two different gridding methods were used on the sites in order to compare their effectiveness. At Site 37 readings were taken at two meter intervals within 400 square meter (20x20 m) blocks. This allowed the site to be divided into manageable segments with convenient stopping points at the end of each day. Site 36 is somewhat smaller and was completed in two days. It was divided in half along the north-south baseline and readings were taken along lines perpendicular to the baseline. Grids were marked by stretching nonmetallic metric tapes across the area to be surveyed. During the process of establishing the grids, the sites were searched for metal objects that might adversely affect the readings. Many items of modern trash were removed at this point, ranging from tin cans and wire to stove and auto parts.

In an attempt to establish magnetic signatures for the types of features known to occur at the sites, a number of test passes were made over various exposed surface features (prehistoric and modern hearths) and large rhyolite boulders. Passes were made in several directions across the features in order to measure minimum and maximum values and to differentiate magnetic readings produced from induced and remnant magnetization (Breiner 1973). Unfortunately, no variation could be attributed to those surface features tested.

The G-856 magnetometer has the capability to internally store field data from up to three days of survey work. At that time the data were transferred into a computer file by dumping them directly into a Hewlett-Packard Model 87 housed in the lab. A software package developed by EG&G Geometrics, Inc. was used to compare the data from the two instruments and printouts were produced of magnetic readings corrected for diurnal fluctuations in the earth's magnetic field. These readings were then used to plot magnetic contour maps.

The record of anomalies on the sites was used to inform the placement of excavation units. Judgemental 4x4 m excavation units were placed over nine anomalies at Site 36 and over two at Site 37. Several additional discontinuities were tested by their inclusion within randomly selected units or backhoe trenches. The interpretation of the magnetic contour maps is discussed in Chapter 6.

Excavations

Excavation activities were directed toward the recovery of two primary types of information, the types of features represented and the kinds of artifacts associated with the features. The identification and analysis of feature types figured prominently in the inferences of site function drawn from the previous Keystone Dam investigations. Given the importance placed on the range of feature types on sites in the area, every effort was made to insure that within-site variability would be adequately addressed by this study. Keystone Sites 36 and 37 were excavated using a variety of techniques in order to maximize the recovery of features and to recover artifacts presumed to be spatially related to different classes of features. The techniques used included hand excavations within judgemental and randomly located units, backhoe trenching and mechanical scraping of large areas of the sites. The application of these approaches is detailed below and an evaluation of results is contained in Chapter 6.

All prehistoric surface features were excavated by hand by circumscribing them within 4 by 4 meter grid units (Figures 5 and 6). The units were used to define the features but did not preclude the horizontal exposure of living space around and between them. The units were shovel scraped in 10 cm arbitrary levels within 1 by 1 meter squares and all soil thus collected was passed through 6.5 mm (1/4 inch) screens. Soil and flotation samples were collected from each level within and outside the features. A total of 30 surface features were identified on the two sites but five were modern and two were outside the ROW. The excavation of the remaining 23 prehistoric features disclosed six more.

Hand excavations were also undertaken in a series of 4 by 4 meter units comprising a five percent random sample of the site areas. The excavation techniques were identical to those outlined above for surface features. The random component to the research design was intended to provide an unbiased sample of features and artifacts whose characteristics and distributions might not be reflected in the surface maps.

In order to select the random units a 4 by 4 meter grid was superimposed on the baselines for each site to provide a sampling frame. Numbering of the grid was initiated at a randomly chosen unit and the units were numbered sequentially thereafter. Excavation units were then selected from the sampling frame (without replacement) until samples of 16 and 22 units were obtained for Sites 36 and 37 respectively. If a sampled unit fell within an area already affected by surface feature excavations or backhoe trenches, another unit was selected. An additional step in this procedure was employed at Site 36 where the site area was stratified prior to sampling. The site was stratified along the 4N grid line in response to the differential distribution of magnetic anomalies recorded on the site. The northern stratum contains a great many anomalies while the southern stratum produced very few (Figure 7). This assured us of obtaining a five percent sample of the area in which the magnetic survey indicated a possibility of buried features. The sampled units are listed in Table 2 and mapped in Figures 5 and 6.

An additional five percent sample of 4 by 4 meter units was chosen judgementally on each site in order to bring the sampled area up to 10 percent in addition to the surface feature excavations. Judgemental units were generally located in areas of high artifact densities adjacent to known features or were used to

Table 2. Excavation units selected at KS-37

Sample Unit	Judgemental Unit	Random Unit
1	23S20W	42N2W
2	12N28W	17N29W
3	2S21W	24S32E
4	16N18W	10S14W
5	22N58W	22N6W
6	46S3W	60S6E
7	45S8E	23N33W
8	7S40W	42S12W
9	38S18W	20N22E
10	56S6W	2N12W
11	2N8E	5N34E
12	3N4E	42S2W
13	17N33W	29N18E
14	15N53W	25N18E
15	4S15E	10N44W
16	38S14E	41N54W
17	18S12E	2S12W
18	16N16E	46S18E
19	20N23E	12S38E
20	6S3W	10N38W
21	42N22W	42N39W
22	24S46E	38S22W

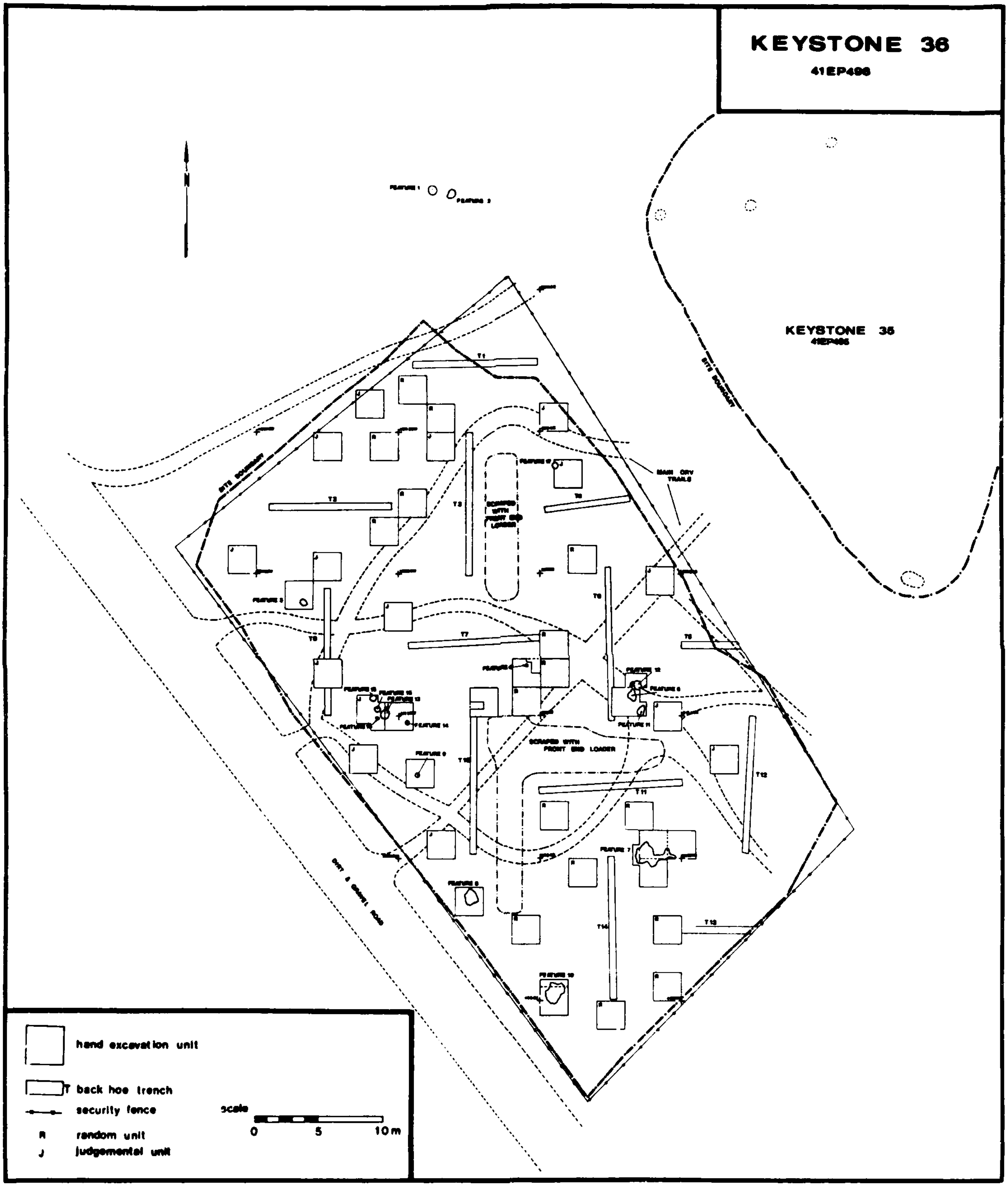


Figure 5. Site map of Keystone 36, indicating features, excavation units and relationship to Keystone 35.

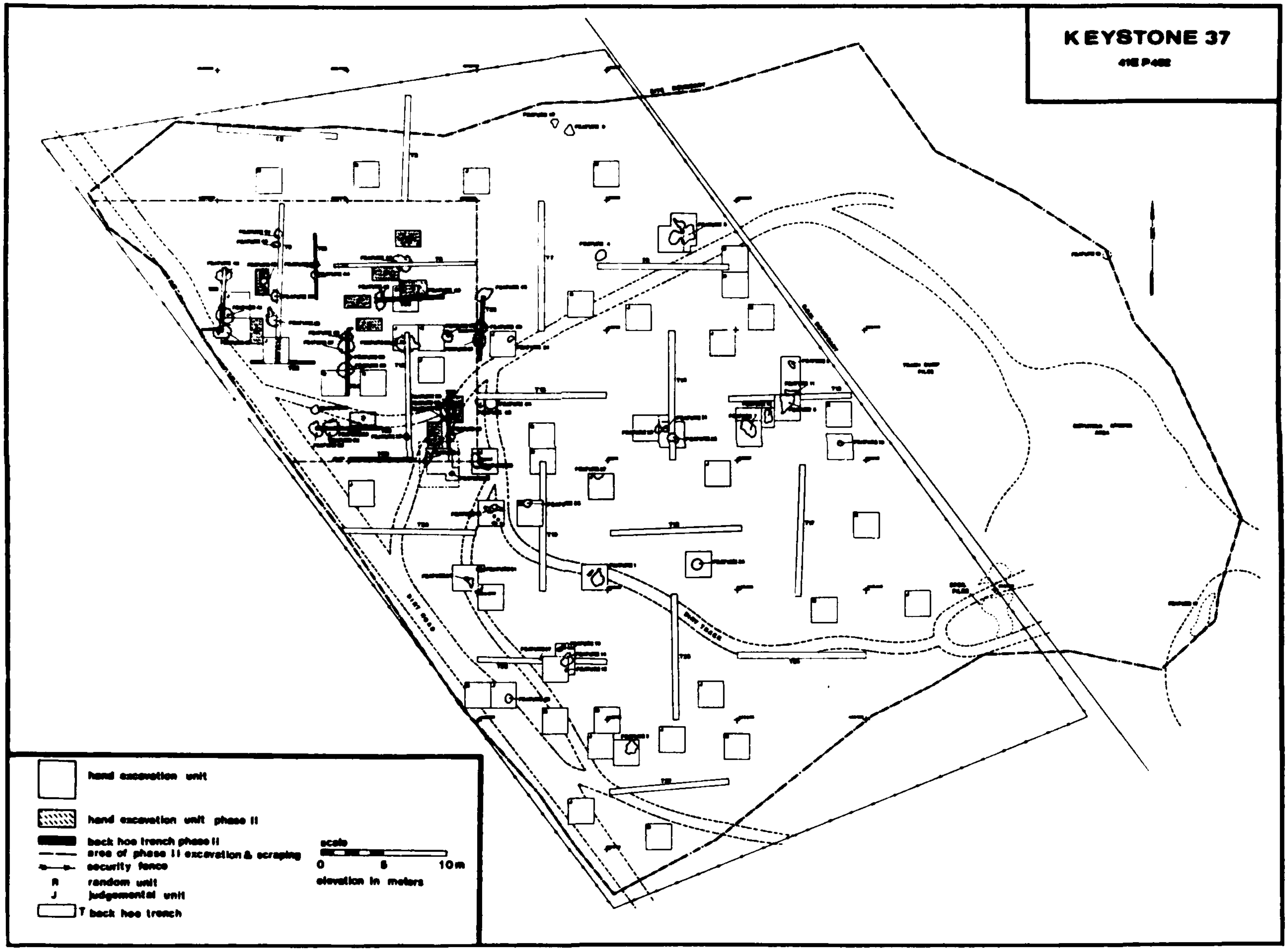


Figure 6. Site map of Keystone 37, indicating features, phases of excavation and site boundary relative to the Right-of-way.

investigate anomalies identified during the magnetometer survey. Some units were also placed to provide systematic testing of gaps in the coverage of random units. Excavation methods were the same as those noted above. Sixteen and 22 judgemental units were selected on Sites 36 and 37, respectively, as shown in Table 3 and Figures 5 and 6.

Further subsurface testing was accomplished through the application of a systematic backhoe trenching procedure. As part of the initial mapping effort, 20 by 20 meter grids were surveyed at both sites. The grid units were then used as a framework for the systematic location of backhoe trenches across all parts of the sites. The first trench was oriented along the east-west centerline of a 20 by 20 meter unit, and adjacent trenches were oriented north-south, forming a checkerboard pattern across the sites (Figures 3-6). Each trench was excavated into the carbonate horizon and then cleaned and profiled in an attempt to identify features.

In contrast to previous uses of trenching on the Keystone Dam sites, backhoe testing was conceived of as a statistical sampling device. As demonstrated by Rice and Plog (1983) for the Hohokam area, trenching can be an efficient method for locating subsurface features and predicting total populations of such features. Since a feature does not have to fall completely within a trench in order to be discovered, a relatively small number of trenches can provide a large Equivalent Sampled Area (Rice and Plog 1983:12). In the case of Keystone 37, for example, the excavated area of the backhoe trenches shown in Figure 6 amounts to less than a four percent sample of the site area. Nevertheless, due to the boundary effect in transect sampling, the trenches each provide an Equivalent Sampled Area of 70.8 square meters for features four meters in diameter.

The backhoe trenching procedure was very productive indeed, initially exposing four pit structures at Site 37 (Features 29, 35, 38 and 39) which were not discovered by the use of other excavation techniques. Due to the fact that the trenches provided a specifiable sample of the site, the formulae presented by Rice and Plog (1983:12) could be used to predict the probable existence of additional structures. The Equivalent Sampled Area (ESA) provided by the trenches is calculated using the formula:

$$ESA = .33\ (2FW \times TL) + (TL \times TW)$$

where FW is the width of the ideal feature and TL is the trench length and TW is the trench width. At Keystone 37 the ESA produced by each of our initial trenches is 70.8 square meters for features approximating the size of the pit structures (about four meters across). It is then possible to determine the sample fraction of features of this size which have been identified:

Table 3. Excavation units selected at KS-36

Sample Unit	Judgemental Unit	Random Unit
1	20S16W	28N20W
2	8S27W	36N24W
3	4N32W	40N16W
4	20N44W	8N0E
5	2S44W	4N0E
6	36N16W	44N20W
7	32N2E	20N4E
8	8S24E	24N24W
9	17N15E	0N4W
10	1S26W	44S8E
11	2S16E	32S16E
12	42N26W	32S4W
13	12N22W	16S0E
14	19N32W	24S4E
15	40N0E	40S16E
16	36N32W	16S12E

$$\text{Sample Fraction} = \frac{(\text{ESA} \times \text{N})}{\text{total site area}}$$

Using an equivalent total of 18 trenches and a site area of 9400 square meters, the sample fraction for Site 37 is 14%. Note that the site area used in the calculations here is smaller than the total within the ROW. The difference reflects the fact that backhoe trenching was carried out within 20 by 20 meter grid units. Several partial units occurred too close to the edge of the highway cut to allow use of the backhoe and these areas were subtracted for the purposes of determining the sample fraction. If the features are assumed to be distributed at the same density recorded in the trenches, we can predict that the four structures represent only about 1/7 of the total number on the site. Thus it was estimated that the four pit structures originally recorded might indicate the presence of as many as 28 such features.

In light of these preliminary results and predictions, and due to the fact that the site was expected to be destroyed by construction, it was recommended that the original scope of work be modified to allow for additional excavation. As a result of consultation with the Army Corps and the Texas State Historical Preservation Officer, a research plan was developed for a second phase of trenching and hand excavations.

Phase II excavations were confined to an area of approximately 1600 square meters in the northwest portion of the site, where lithic artifact densities were the highest and where the pit structures were discovered (Figure 6). The equivalent of ten additional backhoe trenches were dug; nine ten-meter-long trenches were excavated and two existing Phase I trenches were extended. In order to maintain systematic coverage of the site area, these trenches were placed in order to half the distance between the Phase I trenches. The trench walls were then surfaced and profiled.

Under the terms of the contract modification CRMD was originally limited to the excavation of five pit structures or their equivalent. After the discovery of some 20 possible features, it was agreed that we could open up more of them at our own cost. Features 29, 39, 40, 50, 51 and 55 were excavated in their entirety and Features 35, 45, 52, 54, 59 and 53 were partially excavated. The remainder were defined in profile and mapped in plan view. The factors used in selecting features for excavation included evidence of potentially datable charcoal, evidence for high densities of associated lithic materials and evidence for superposition (see Chapter 8).

In an attempt to recover additional artifactual materials associated with structures, provisions were also made to include hand excavation of a total of 80 square meters around selected features. The task was carried out by the distribution of ten two-by-four meter units throughout the area of Phase II investigations, each adjacent to one or more pit structures (Figure 6). Data recovery procedures were identical to those used in the Phase I hand excavation units.

The final excavation technique used at the Keystone Sites was extensive mechanical stripping of the surface in order to identify any subsurface features missed by the other methods. At Site 36 this was done with a front end loader following completion of Phase I excavations (Figure 5). Since no additional features were identified at Site 36 no Phase II investigations were implemented at that site. At Site 37, the sand dunes were removed from the Phase II excavation area with the use of a bulldozer in preparation for stripping. Gradual stripping of the surface down to the carbonate horizon was accomplished with a front end loader on the last day of fieldwork. Only two additional features were recorded by this method, one fire-cracked rock feature (Feature 69) and one pit structure excavated into the caliche (Feature 70). Both were mapped and sampled for botanical remains and the pit structure was profiled.

Through the application of the above procedures many more features were identified on Site 37 than had originally been recorded or expected. Results of the investigations are summarized in Chapter 6. An evaluation of the efficacy of the various field techniques and a comparison of their relative success in identifying subsurface features and artifacts is included in that section.

Table 4. Summary of areas excavated, by technique of excavation at Keystone Sites 36 and 37

Technique	Site 36	Site 37
Surface feature excavations	166 m^2	359 m^2
Random units	256 m^2	352 m^2
Judgemental units	256 m^2	352 m^2
Phase I trenches	230 m^2	340 m^2
Phase II trenches	----	40 m^2
Phase II judgemental units	----	86 m^2
Totals	908 m^2	1529 m^2
Percentage of site area	21%	16%

CHAPTER 5

ENVIRONMENTAL CONTEXT

by M. Justin Wilkinson and David Carmichael

Geographical Setting

The study area lies within the Mexican Highlands section of the Basin and Range province. It is characterized by narrow mountain ranges oriented north-south and isolated by broad desert basins (Kottlowski 1958:46; Hawley and Kottlowski 1969:89). The mountains are largely upthrown normal fault blocks and the basins are filled grabens, or downthrown fault blocks. The only major through drainage in the region is the Rio Grande which occupies the major graben system within which the study area is situated (Chapin and Seager 1975). The corresponding upthrown fault blocks are locally manifested as the Franklin Mountains which parallel the river valley only 4-5 km to the east (Figure 1). The sites occur at the western edge of a series of colluvial surfaces between the Franklin Mountains and the nearby Rio Grande. Along the valley margin the colluvial surfaces have been eroded and deflated, resulting in a complex series of rounded gravel ridges. It is within such an area that Keystone Sites 36 and 37 are located.

Beyond the river to the west lies the Mesilla Bolson, the floor of which corresponds to the La Mesa surface. This extensive level surface overlies lacustrine and riverine deposits of the Camp Rice formation of the Santa Fe group. The upper levels of these materials make up the prominent scarp which forms the western valley margin about six km west of Keystone Dam.

Within a six km radius of Sites 36 and 37, a variety of topographic settings are encountered, ranging from the Franklin Mountains on the east to the Rio Grande and the La Mesa surface to the west, as well as various transitional zones. O'Laughlin (1980:14) has classified the local variability into six environmental zones distinguished by topography, soils and vegetation. The present study area lies at the extreme western edge of the Lower Bajada zone (ibid.: 17) and our discussion focuses on this setting. The reader is referred to O'Laughlin (1980) for a more complete treatment of environmental characteristics of the Keystone area as a whole.

The Lower Bajada contains the remnants of several colluvial geomorphic surfaces of various ages. Due to the complex depositional sequence and the proximity of the area to the erosional setting at the valley margin, the western edge of the zone exhibits a variety of inset and dissected surfaces. In most places, extensive deflation has produced a gravel pavement which mantles the ridges. These gravel ridges support a sparse vegetation dominated by creosotebush (Larrea tridentata), ocotillo (Fourquieria splendens) and lechuguilla (Agave lecheguilla). Concentrations of lechuguilla are especially evident on south-facing slopes. Other less prominent species include whitethorn (Acacia constricta), yucca (Yucca bacatta) and a variety of cacti.

The western extremity of the gravel ridges often contains pockets of recent aeolian sand, such as those within which Sites 36 and 37 are located (Figure 2). Mesquite (Prosopis glandulosa), soaptree yucca (Yucca elata) and creosotebush dominate these areas and semistabilized dunes are often anchored around larger individuals. Major arroyo drainages straddle both sites to the north and south. Within these drainages the most common shrubs are desert willow (Chilopsis linearis), mesquite and four-wing saltbush (Atriplex canescens). A variety of annuals are also present in the arroyo bottoms. As O'Laughlin notes (1980:18), the food resources of the Lower Bajada are poor in comparison to any of the other nearby zones.

Geomorphology

In this section we trace the landscape evolution at Sites 36 and 37 from the late Middle Pleistocene onwards. This in turn provides background for an understanding of the topographic environment, lithic resources base, and edaphic substrate of the sites.

The sites occupy most of the area of two, small interfluve surfaces, each four ha in area, slightly convex in overall morphology, but covered by low (0.5-1.0 m) "coppice dunes." The coppice dunes are occupied by one or more yucca and creosotebush plants, imparting a more prominent hummocky and vegetated appearance to the distal interfluve surfaces overlooking the eastern flank of the Rio Grande floodplain than is evident further from the river.

The interfluves are stepped longitudinally such that gravel-covered surfaces lie 15-18 m above the Sites and immediately to the east (Figure 7). Sites 36 and 37 lie 27-30 m above the floodplain (1135 m above sea level), bounded by steep-sided arroyos, locally 7 m deep (Figure 8), which drain the western slopes of the Franklin Mountains, flow west-southwest, and enter the Rio Grande floodplain 0.5 km to the west of the Sites.

The 2-3 m thick sandy unit occupied by the sites, referred to here informally as the Keystone formation, contrasts strongly with the subangular to subrounded gravels of the immediately surrounding surfaces which they overlie (Figure 8). This topographic pattern is repeated for tens of km northward (contra Holliday 1983) along either side of Interstate 10 and cuts across the distal ends of many low, flat-topped interfluves, all occupied

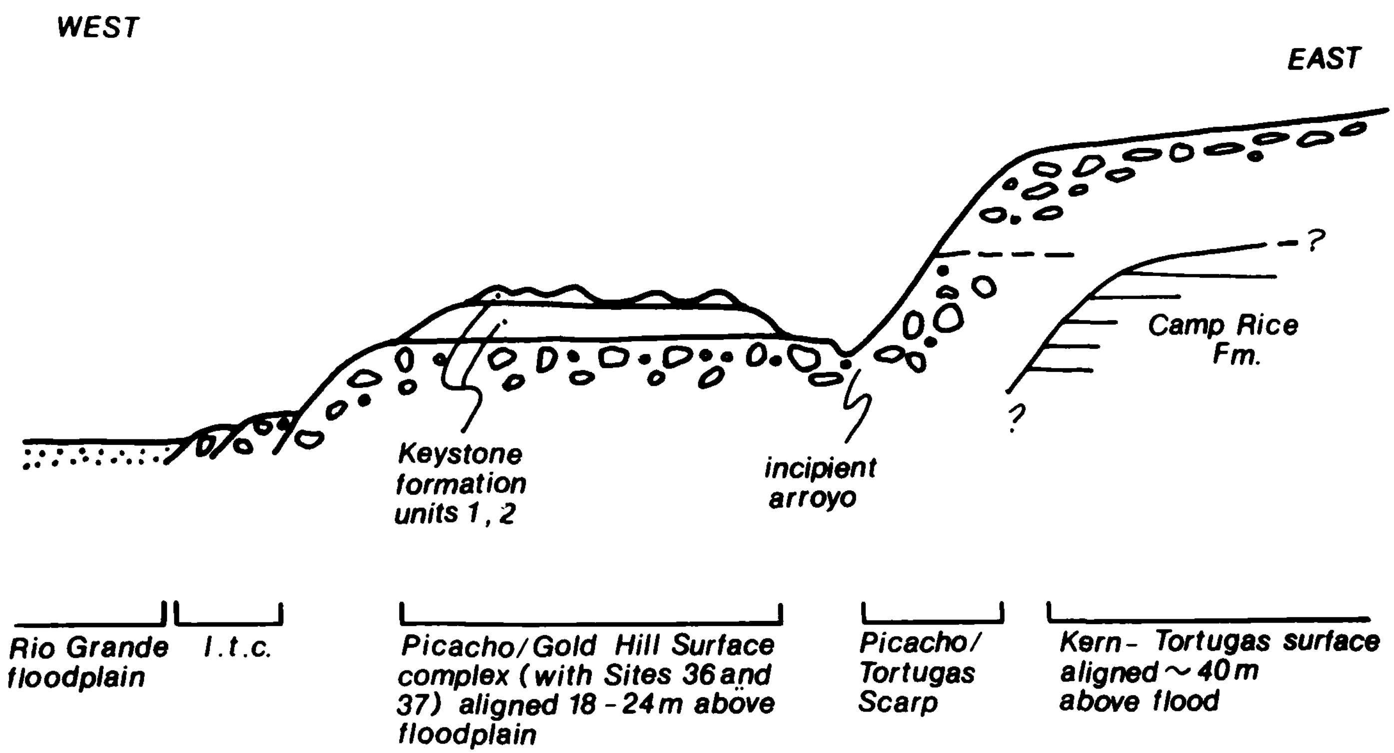


FIGURE 7. Schematic section from Rio Grande floodplain to Tortugas surface showing position and altitude of Picacho dual surface (not to scale) and associated Keystone formation. Dashed line --- possible lithologic contact between quartzite-rich gravels (above) and quartzite-poor gravels (below) (see text); l.t.c.-- "lower terrace sequence" complex of surfaces.

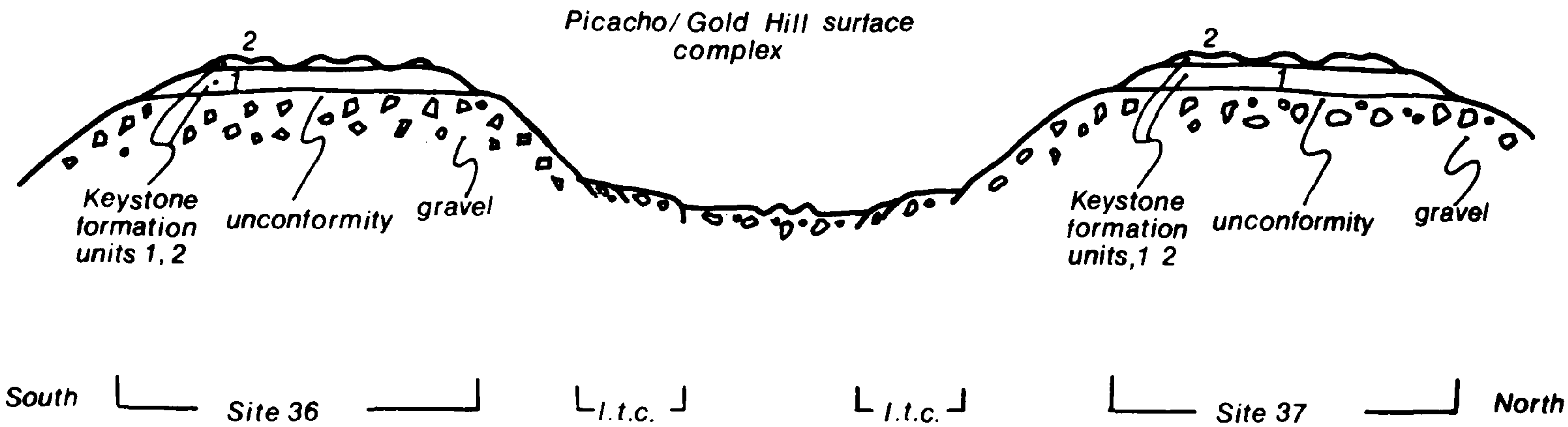


FIGURE 8. Schematic N-S section (not to scale) illustrating Picacho/Gold Hill and lower surfaces (l.t.c. - "lower terrace sequence" complex), Keystone formation and lower bounding contact. See text for discussion on gravel body.

by prominent yucca stands and coppice dunes.

Landscape Evolution

The landscape of the Mesilla Bolson, the section of the Rio Grande Valley between Las Cruces, New Mexico, and El Paso, Texas, post-dates the mid-Pleistocene draining of Lake Cabeza de Vaca, the floor of which is preserved in many places as the highest surface within the Mesilla Bolson. A remnant of this surface, termed the La Mesa surface by Kottlowski (1958) and Ruhe (1964) in the El Paso and Las Cruces areas, comprises the highest elevation gravels which abut the Franklin Mountains (Kottlowski 1958) due east of the Site (at an altitude of 1322 m, or 190 m above the Rio Grande floodplain).

Subsequent evolution of the lower Mesilla Bolson landscapes was controlled by the progressive and apparently episodic downcutting of the Rio Grande into the Bolson fills (Camp Rice Formation sediments) since the late Middle Pleistocene (Gile et al. 1981). The Rio Grande created five major base levels in the process, towards which tributary drainages were successively graded. The resulting erosional and constructional land forms consist of a series of stepped surfaces. Several workers have noted the valley-wide regularity of landscapes in the Las Cruces area, patterns which undoubtedly extend into the El Paso area. There is little doubt that Sites 36 and 37 occupy the third highest Gold Hill surface which Kottlowski (1958) has argued is the correlate of the Picacho surface identified around Las Cruces (Dunham 1935; Ruhe 1964).

The Picacho/Gold Hill surface comprises the small "noseslope" flats on the valleyward ends of the flat-topped ridges which characterize the east slopes of the Rio Grande Valley. Along most of their length, these ridges belong to the earlier Kern Place complex of surfaces (Kottlowski 1958), which correlate with the Tortugas surface in the Las Cruces area. Below the Picacho lies a "lower terrace sequence" (Kottlowski 1958), equivalent to the Fort Selden surfaces to the north. These occupy the lowest parts of the arroyos and spill out onto the floodplain (Figures 7 and 8).

The Tortugas surface is aligned towards a Rio Grande base level "less than 130 ft. (40 m) above the present floodplain" (Gile et al. 1981, Table 9). It was a sloping, almost planar feature until being incised to the Picacho base level both along its valleyward margins and along the major arroyos which traverse it. The resulting Picacho surface, aligned to a floodplain level about 20 m above the present one, was covered in part by subsequent thin sandy deposits upon which Sites 36 and 37 now lie and which is termed here the Keystone formation. The unconsolidated nature of this formation explains why it has been eroded back from the flanking arroyo scarps on the downhill sides of present Picacho surface remnants. However, runoff from the upslope Tortugas surface (and its scarp) explains the local removal of Keystone formation deposits and the growth of incipient arroyos at the bottom of the scarp (Figures 7 and 8). The small size of the weak Keystone formation bodies, together with their high infiltration capacity, have undoubtedly contributed to their preservation as convex "knolls" by preventing the growth of significant rills of highly erosive channelized water flow. In contrast, the cemented Picacho gravels are markedly incised.

The ubiquitous valleyward (i.e., western to southwestern) slope of the Picacho surface remnants (and those of the Kern Hill as well) north of Sites 36 and 37 indicated that these surfaces are not terraces of the Rio Grande (<u>contra</u> Holliday 1983: Figures 74 and 75), but surfaces related to the "curvate" channel geometries of <u>tributary</u> drainages entering from the Franklin Mountains and their eastern slopes (Ruhe 1967). Gile et al. (1981) indeed note that the morphostratigraphic equivalents of the Picacho/Gold Hill surface around Las Cruces can be traced up into the arroyo valleys as terraces or straths of these tributary drainages, aligned to a base level 21 m above the modern Rio Grande floodplain.

The Keystone formation was probably laid down on the Picacho surface prior to the late-Wisconsin (Gile et al. 1981) phase of the Rio Grande incision. As a generalization for the central Mesilla Bolson, Gile et al. (1981) place the age of soils of the Picacho/Gold Hill surfaces in the bracket between 25 and 75 thousand years ago. Since they envision the initiation of the Picacho/Gold Hill incision as 150-130 thousand years ago, the possibility exists of a significant hiatus (in regional terms) between these events. The unconformity between the Keystone formation and the underlying gravels may well reflect this break. The unconformity is widespread, and also prominent, both stratigraphically and in its topographic expression (Figures 7 and 8).

It is thus realistic to speak in terms of two geomorphic component surfaces within the altitudinal span of the Picacho landscapes, (1) the present upper surface of the Sites, and (2) an earlier sub-Keystone formation surface (i.e., the unconformity). Where these component surfaces are not exposed subaerially, they continue to be modified up to the present, although classed as surfaces of a certain age: the surface is buried in places by the historic sand sheet and eroded in others by continuing lateral and vertical arroyo cutting. It is argued later that the Keystone formation is mainly a locally derived colluvium of predominantly aeolian sands. The stratigraphy, thickness and topographic position of this body suggest that it was deposited prior to the late-Wisconsin incision of the bounding arroyos, and comprised a semicontinuous colluvial sheet resting on the Picacho surface at the foot of the Tortugas scarp.

A discontinuous sheet of unconsolidated aeolian sand, 10-30 cm thick, now mantles this living surface. The sheet has been fashioned locally into coppice dunes up to 1.5 m high, with associated bushy vegetation, especially yucca and creosotebush. The sand sheet comprises the upper unit of the Keystone formation and, although widespread, appears to characterize only the small Picacho surface remnants along the southeastern side of the Mesilla Bolson. Gile (1966) has argued that these dune sands were laid down between 1885 and 1920 as a result of vegetation destruction by heavy grazing and periodic droughts.

The vigor of recent geomorphic activity is attested by the complete burial of a galvanized air-conditioning duct (Feature 24, Site 37) approximately 60 cm beneath a coppice dune. The duct was probably discarded during the construction of the adjacent housing subdivision in the 1940s.

Deflation of the colluvial unit by wind has probably continued to varying degrees since its deposition, and the process continues today. Where the present brown-sand mantle is discontinuous, a significant "lag" deposit composed of the pebbly component of the colluvium has built up and includes artifactual lithic debris.

The weak consistency of the Keystone formation sediments may be responsible for the particularly strong plant growth at Sites 36 and 37 and on equivalent sandy units further north. Certainly the bushy vegetation has helped fix blowing sand in the form of stabilized coppice dunes, with which they now have a symbiotic relationship.

Prehistoric populations occupied the surface of the colluvial unit during the later Holocene. This better vegetated unit appears to have provided a more hospitable microenvironment for the building of pit structures and fire pits than the surrounding steep, cobble-covered hillslopes. Not only does the substrate appear to have been more acceptable as a living surface, but protection from prevailing westerly winds was undoubtedly afforded both by the bushy vegetation and by the convex morphology of the Keystone formation remnants. It can be predicted that the topographic and morphostratigraphic similarities of landscapes stretching many kilometers north of El Paso imply the existence of archeological remains and relationships little different from those of the Keystone Dam Sites.

Stratigraphy

The major stratigraphic units which are relevant to Sites 36 and 37 are described and four issues are briefly discussed. (1) The origin of the Tortugas gravels is examined as the major source of lithic raw material at Sites 36 and 37. (2) To explain the lithological difference of the gravel exposures on the Tortugas and Picacho surfaces, various competing and as yet unresolved stratigraphic interpretations are presented. (3) Evidence for the colluvial origin of the major (lower) limit of the Keystone formation is evaluated, and (4) the origin of upper aeolian unit sands is indicated.

Tortugas Surface and Associated Gravels

The Tortugas surface is underlain at depth by "predominantly sandy" fluvial facies of the Camp Rice Formation (upper unit of the Santa Fe Group) (Gile et al. 1981), as seen in a pipeline trench to the south of Site 37. These in turn are overlain by a veneer of pebble to cobble grade, subangular to subrounded gravels several meters thick. Gravel talus covers most arroyo banks so that the lack of visible contacts makes it unclear whether the gravels - the preferred source of lithic material for past populations - are part of the Camp Rice Formation "piedmont-slope facies" or whether they belong to inset units termed "older valley alluvium" (Gile et al. 1981). The latter are locally derived alluvial fan veneers of post-La Mesa surface incision phases. The former are preincision deposits, as much as 200 m thick (Gile et al. 1981, Table 7) which underlie the La Mesa surface. Topographically controlled pedogenetic horizons which parallel the modern west-sloping Tortugas surface may give a false impression of fan alluvium bedding sympathetic to the post-La Mesa incision phases.

Tortugas surface gravels may thus derive from older Camp Rice Formations sediments if the surface is mainly erosional, or they may derive from areas drained by the modern arroyo system (in the case of the "older valley alluvium") if the surface is constructional. The distinction cannot yet be ascertained but may not be important in terms of gravel lithology if drainage patterns of modern and Camp Rice times are essentially similar.

Picacho Surface and Associated Gravels and Sands

In the area of Sites 36 and 37, the Picacho surface *per se* is underlain by three major sediment types, a sandy gravel overlain by a mainly colluvial unit, which in turn is capped by a discontinuous dune sand veneer.

Picacho/Gold Hill Gravels.

Kottlowski (1958) has described the coarse gravels in the immediate area (White Spur) as "subangular to subrounded pebbles and cobbles in a matrix of coarse-grained sand." A lithologic analysis of gravels in fact shows compositional differences between those of the Tortugas surface and those of the Picacho surface (Table 5). The latter, which underlie Sites 36 and 37, proved to be richer in dolomite and rhyolite/volcanic clasts, whereas those of Tortugas immediately upslope of the sites showed

Table 5. Clast Lithologies for Geomorphic Surfaces near Keystone Sites 36 and 37

GEOMORPHIC SURFACE	MATERIAL TYPES (PERCENTAGES)				
	DOLOMITE	RHYOLITE VOLCANICS	CHERT	QUARTZITE	OTHER
TORTUGAS/KERN PLACE East of KS-36, near 41EP2461	48	25	6	16	5
PICACHO/GOLD HILL					
1. North of Site 37	82	15	3	1	0
2. North of Site 37	72	15	9	2	2
3. North of Site 37	54	17	8	6	16
4. Northwest of Site 37	86	14	2	6	4
5. Southeast of Site 37	61	27	2	6	4
6. South of Site 36	84	14	0	0	2
AVERAGE	72.9	16.9	4.2	3.7	4.0

significant quartzite and chert components.

These lithologic distinctions between the gravels of the two geomorphic surfaces were significant to prehistoric occupants of the area. The lithologies presented in Table 5 refer to clasts of a sufficient size to be usable as pebble cores (ca. 6-8 cm minimum). The percentages reveal that Fillmore alluvia generally contain little or no chert. Chert is present at several sample loci on both the Tortugas and Picacho surfaces. However, the Tortugas surface contains both chert and the highest percentage of quartzite.

The significance of this composition is indicated by the results of a recent archeological survey just to the east of the present study area (Carmichael and Elsasser 1984). Within a 172 acre tract containing Tortugas, Picacho and Fillmore materials, only two sites were recorded on the gravel surfaces. Both were located on the Tortugas surface where chert and quartzite were relatively abundant. The sites are interpreted as lithic procurement stations since both were characterized by high proportions of tested cores and expedient hammerstones. Such sites were apparently located selectively at those spots where the preferred chert resources were available in association with abundant quartzite cobbles for use as hammerstones.

As in the case of Tortugas materials, stratigraphic relationships are obscured so that two explanations for the lithological discontinuity are possible: (1) if the Picacho gravel is locally a constructional feature related to the development of the Picacho surface, then it comprises an inset unit. (2) However, if the surface is erosional, as seems more likely geomorphically from the apparent lack of a major contact in the vicinity, then the gravel comprises one of the older gravels, viz. the Tortugas fan material, or the Camp Rice piedmont-slope deposits, as mentioned above. If the latter (erosional) preferred case is indeed true, then a stratigraphic discontinuity within these other gravel units is implied (dashed line, Figure 7) as an explanation of the compositional differences. The texture, angularity, and lithology of the gravels certainly indicate source areas nearby in the Franklin Mountains to the east (as does the general westward slope of the piedmont surfaces in relation to any younger gravel units).

Keystone Formation

This formation comprises the substrate which underlies Sites 36 and 37, as well as Sites 32, 35 and probably 29. Probable morphostratigraphic equivalents on Picacho surface correlatives can be seen for at least 20 km north of the Keystone Dam area. It has been noted that the unconformity between the Keystone formation and the underlying Picacho gravels probably represents a significant time span, as the earlier of two subdivisions of the Picacho surface. It is also noted that the unconformity is topo-

Table 5. Clast Lithologies for Geomorphic Surfaces near Keystone Sites 36 and 37

GEOMORPHIC SURFACE	MATERIAL TYPES (PERCENTAGES)				
	DOLOMITE	RHYOLITE VOLCANICS	CHERT	QUARTZITE	OTHER
FILLMORE					
1. Arroyo draining Site 37 to north	83	14	0	1	2
2. Arroyo draining Site 37 to north	88	12	0	0	0
3. Arroyo draining Site 37 to north	67	21	4	8	0
4. Arroyo across major drainage to north	80	16	4	0	0
5. Major drainage north of Site 37	82	17	0	0	1
6. Major drainage north of Site 37	89	11	0	0	0
7. Major drainage north of Site 37	85	11	2	2	0
8. South of Site 36	85	12	1	0	2
AVERAGE	82.4	14.3	1.4	1.4	0.6

graphically prominent and that the formation itself comprises a major, lower sandy unit, and a minor discontinuous aeolian mantle.

Detrital Sand Colluvium - Unit 1

At each site this unit comprises a tabular mass of sand and pebbly sand three m thick which thins abruptly at the edges. The fine earth component is predominantly a massive, consolidated, uniformly pale to very pale brown (10YR 6/3-8/3) fine sand showing fair sorting, and a minor mode in the clay fraction (usually 10%). The pebble component is widely dispersed and mainly detrital. Unit 1 hosts caliche horizons and archeological remains. Its stratigraphic relationship to other features within the upper Keystone formation are indicated in Figure 9.

Minor lenses of bedded sandy gravel (pebble to cobble grade, subrounded) occur within the unit, usually less than 25 cm thick and discontinuous, apparently never longer in section than 25 m. These are loose to unconsolidated except where cemented in K-fabric horizons. Two thin (2-5 cm) stringers of caliche-impregnated (5YR 7/2) blocky clay were encountered.

Emplacement of this unit with the aid of water is indicated, except for minor aeolian bedding at the base of one trench. However, textural peaks in the fine sand range are strongly suggestive of world means for wind-sorted grains (e.g., Kukal 1970; Goudie 1981).

In this topographic setting, unit 1 appears to represent most closely the accumulation of aeolian sands by sheetflow as colluvial deposits, appropriately along the break of slope at the foot of the Tortugas scarp wherever it meets the Picacho surface. The Keystone formation thus in major part probably constituted a continuous sheet along the Picacho/Tortugas junction prior to subsequent incision.

Examination of clast imbrication in the minor gravel lenses of unit 1, together with investigations of a modern cobbly slope colluvium in the vicinity of Keystone Dam, support the interpretation of unit 1 as a colluvial body.

A pebble count on a steep (35 degree) man-made slope in the Gold Hill gravel showed two exaggerated discoid (platy and bladed) clast orientations: on rectilinear slopes the dip of discoid clasts was downslope in the ratio 2:1; in the bedload material of rills on this slope where water movement was dominant over gravity movement, true imbrication (i.e., upslope dip) was observed in the ratio of 1.7:1. (At points of maximum rock creep on the rectilinear slope, convex lobes developed with upslope and cross-slope clast dip outweighing downslope dips).

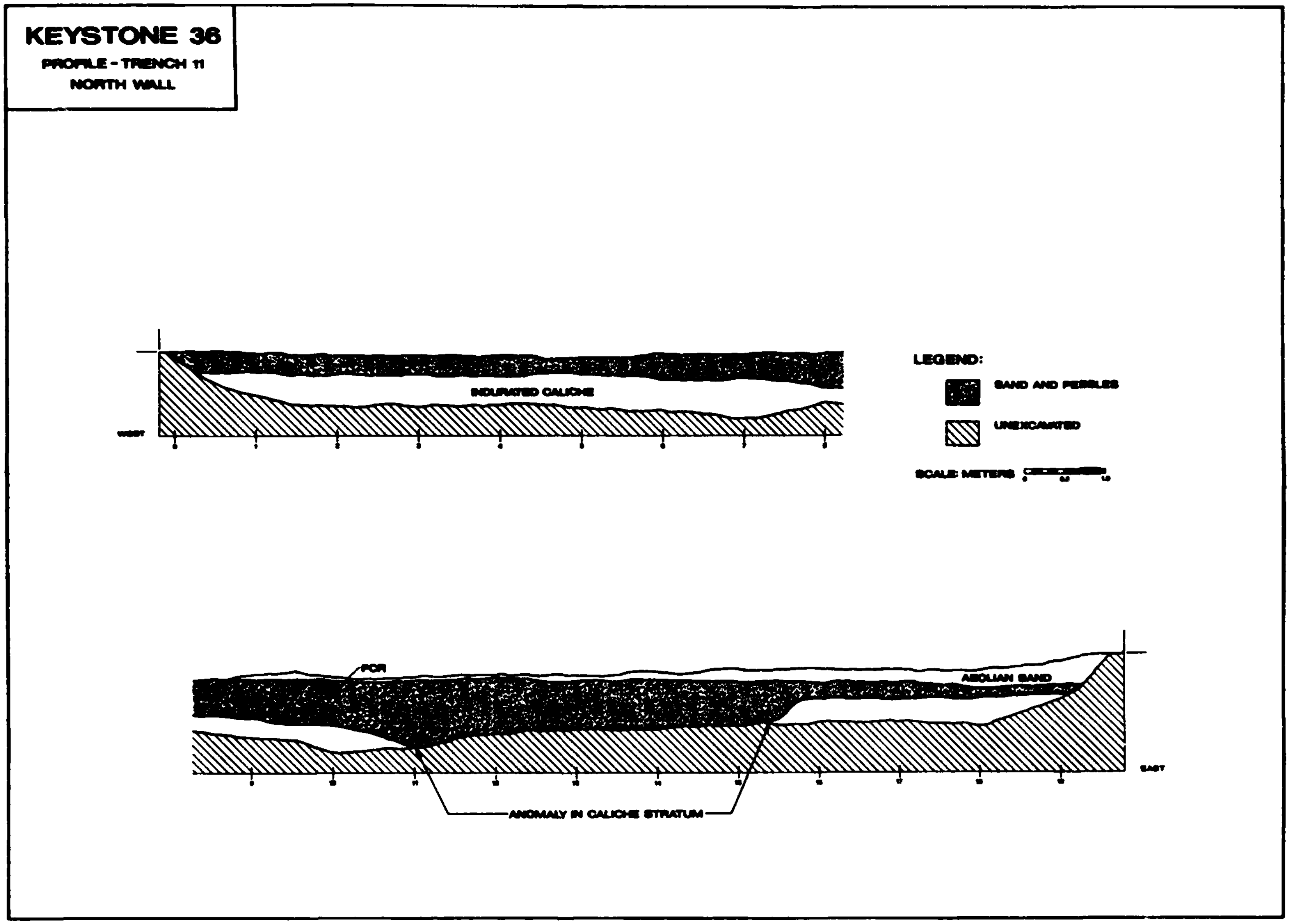


Figure 9. North profile of trench 11, Site 36. Note the superficial nature of the aeolian sand, and the discontinuity in the carbonate horizon.

A similar though less steep paleotopography is indicated in the sectional exposure of one particular unit 1 gravel lens: depositional environments varied from locally channelized flow (paleochannels 20 cm wide, 4-7 cm deep, coarser clasts) with expected imbrication (upstream discoid clast dip) to dominant intervening thinner veneer of slightly finer clasts with opposite, or downslope discoid clast dip.

These parallels strongly suggest that the gravel lens is colluvial and that the nature of the depositional environment of unit 1 as a whole is thus also colluvial. Its massive structure and clear detrital component accords well with this interpretation. Imbrication in fact shows paleochannel flow from northeast and southeast, that is, from upslope rather than north or northwest as might be expected if the Rio Grande deposited the Keystone formation as proposed by Holliday (1983).

The subsidiary clay mode in unit 1 probably derives from pedogenesis in the unit (see below). The minor gravel and clay lenses within unit 1 are not incompatible with a colluvial environment, since they relate to expected rill deposition at the bottom of slopes.

Aeolian Sand - unit 2

This discontinuous veneer of pale brown (10YR 6/3), fair to well-sorted fine sand, 10-30 cm thick, is fashioned in places into coppice dunes up to 1.5 m thick, semistabilized by dispersed vegetation with a shrubby growth habit.

On the east side of the Rio Grande Valley, at the south end of the Mesilla Bolson, the small Picacho/Gold Hill remnants are the preferred locales for the accumulation of these aeolian veneers and dunes. In terms of color and texture, they are very similar to the underlying unit 1 colluvial sands. Gile et al. (1981) argue that such similarities in the Las Cruces area are good evidence that unit 2 sands have been derived from unit 1 sediments, a conclusion which probably holds true at Sites 36 and 37.

Soils of the Keystone Formation

The 1971 low intensity soil survey of El Paso County assigned the Picacho/Gold Hill surface (with surrounding lower surfaces and arroyo beds down to the Rio Grande floodplain) to the Bluepoint association, and the Tortugas/Kern Hill surface to the Delnorte-Canutio association (Jaco 1971).

This investigation allows a more detailed description of the soils, one which reflects climatic, topographic, parent material and age variables within the limited 4 ha areas of the Keystone formation remnants. Textural and carbonate analyses of 17 samples obtained from the systematic backhoe trench excavations indicates three major soil types can be provisionally recognized.

In brief, the differences allow the identification of an argillic horizon in the center of the sites because of the sandy nature of the parent material. However, this horizon is truncated by erosion around the periphery of the Keystone formation convexities. By contrast, calcic horizons are ubiquitous to the margins of the formation.

It is therefore possible to identify Haplargid soils at least 1.25 m deep in the center of the sites and Calciorthid soils around the peripheries. Such differences in the soil suborder as a result of truncation are well-documented in the Desert Project area (Gile et al. 1981). Color variation towards brown (10YR 6.3) and a hard consistency of the argillic horizon also characterize the Haplargids in the central areas: Pedon 37-1 is typical (Table 6).

Both Haplargids and Calciorthids are characterized by significant carbonate accumulation generally 30-60 cm below the surface. Calcic horizons vary from Stage I to Stage III (definitions per Gile et al. 1981, and Table 20), typically with numerous nodules and much amorphous carbonate. Lithologic changes from unit 1 fine sands to occasional gravel lenses result in sudden increases in K-fabric in the gravel, occasionally producing thin (1-3 cm) laminar horizons (Pedon 37-2, Table 7).

Despite the high dolomite content in surrounding gravels, percentages of carbonate in the soils are low (< 12%), so that the unit 1 sands do not constitute high carbonate (> 15%) parent materials. Considering also that unit 1 can be defined as a low gravel sand (<20% gravel), the calcic horizon is suggestive of Late Pleistocene Calciorthids of the Picacho surface in the Desert Project area, characterized by truncated argillic horizons.

The historic unit 2 sands of the Keystone formation cover most of the surface of the formation, but the veneer is generally less than 50 cm thick. The above mentioned soils are thus not regarded as buried. No evidence was found for more deeply buried soils either, although the backhoe trenches did not at any point penetrate through the Keystone formation.

Loose, unit 2 laminated, well-sorted fine sands support Torripsamment soils with occasional thin, slightly harder crusted layers within. They typically contain very little carbonate and are laced with plant roots. Stratigraphic relationships among some features provide some evidence of local stability during the deposition and development of unit 2 soils (see Features 13-16, 18, Site 36, Figure 16). However, pedogenesis is so poorly developed within these sands that the unit cannot be subdivided

Table 6. Haplargid, Site KS-37, Pedon 37-1

Horizon	Depth	Description
A	0-7	pebbly fine sand[1], pale brown[2] (10YR 6/3); this and subsequent horizons structureless and hard unless otherwise stated; sharp smooth boundary; 6% clay, 0.7% $CaCO_3$. (Excludes discontinuous aeolian unit 2 fine sands[3], pale brown 10YR 6/3, av. 0-30 cm thick)
B2t	8-17	slightly pebbly loamy fine sand, pale brown (10YR 6/3), diffuse wavy boundary; 13% clay, 3.6% $CaCO_3$
B2tca	18-25	pebbly loamy fine sand, gray (5YR 6/1), gradual smooth boundary; 10% clay, 8% $CaCO_3$
K2	26-33	pebbly loamy fine sand, light gray (5YR 6/1); numerous discrete carbonate nodules (internodular sand 11% $CaCO_3$); gradual broken boundary; 12% clay
K3	33-60+	pebbly loamy fine sand, light gray (5YR 6/1); local powdery amorphous carbonate accumulations (11% $CaCO_3$), 12% clay

1 Designations after Soil Science Staff (1975) and Gile et al. (1981); textures carbonate-free
2 Munsell colors dry
3 Overlying Keystone formation unit 2

Table 7. Calciorthid, Site KS-37. Pedon 37-2

Horizon	Depth (cm)	Description
A	1-12	fine sand[1] with dispersed pebbles, light yellowish brown (10YR 6/4)(wet); diffuse boundary; this and subsequent horizons structureless and hard; 5% clay, 3% $CaCO_3$. (Excludes discontinuous aeolian unit 2 fine sands [3], pale brown 10YR 6/3, av. 0-30 cm thick)
B2t	12-25	fine sand with few pebble stringers, pale brown (10YR 6/3[2]); diffuse boundary; 5% clay, 7% $CaCO_3$
B31ca	25-70	pebbly sand, pinkish gray (10YR 7/2); diffuse boundary
B32ca	70-120	pebbly sand, very pale brown (10YR 8/3); sharp boundary; 4% clay, 7% $CaCO_3$
2K2m	125-135	coarse sandy gravel (pebble to cobble grade), weakly to strongly cemented, matrix light gray, diffuse boundary
B2K3	135-160+	gravel as above with thin carbonate coating on occasional clasts

1 Designations after Soil Science Staff (1975) and Gile et al. (1981); textures carbonate-free
2 Munsell colors dry
3 Overlying Keystone formation unit 2

into depositional strata. Although not always mixed, the loose unit 2 sands containing archeological materials are part of a single homogeneous level without microstratigraphic characteristics which might allow subdivision of the assemblages.

Late Pleistocene Paleoenvironments

The Picacho surface appears to have been initiated during the last Interglacial. Aeolian sands probably deflated from nearby arroyos were then deposited on the Picacho and Tortugas surfaces, implying a phase of greater aridity or windspeed than existed before or after.

These sands were then reworked, mainly by sheetwash, into the colluvial unit of the Keystone formation, which occupied the Picacho surface and experienced pedogenesis probably from the Last Glacial onward. The calcic horizons may indicate greater rainfall, but the effects of topographic and parent material need to be examined more closely before this possibility can be accepted.

Somewhat later during the Last Glacial (25,000-10,000 yr. B.P.) regional incision resulted, perhaps partly induced as Gile et al. (1981) and others have suggested, by climatic controls. The Keystone formation and Picacho surface were correspondingly segmented, giving rise to the present landscape. Blowing sand during historic times caused the accumulation of a dunesand veneer, probably as the result of a combination of climatic and land use factors.

Stated differently, since no incursion of unit 2-type blown sands occurred until historic times, it can be postulated by negative inference that the prehistoric populations living on the surface of unit 1 experienced landscapes stabler (grassier?) than those of today. Such an inference is supported by pollen evidence from previous Keystone Dam investigations (Horowitz et al. 1981).

Meso and Micro Environments Around the Sites

The Keystone Sites are located at points in the Rio Grande Valley which are topographically the most varied. The significance of topography lies in the fact that different geomorphic surfaces usually give rise to (1) different lithic materials, (2) different soils, and hence (3) different vegetation and faunal associations which may determine the distribution and variety of a whole range of crucial resources. Under certain circumstances, topographically varied areas are thus likely to be the most favored in terms of settlement.

Considering the Rio Grande Valley at mesoscale along a floodplain-mountain transect, the sites have access to five different geomorphic surfaces with the radius of one km. These are the modern floodplain and arroyos, the two related surfaces of the lower terrace sequence (Fort Selden equivalents), the Picacho complex (with two subsurfaces of very different type), and the extensive Tortugas surface above this. These options appear to have been exploited differently from different sites. While a strategic ecotonal location may have been important in the placement of a long term village like Site 33, floral materials at Sites 36 and 37 suggest a more specialized use of a narrow range of resource zones.

The only other locale along the transect with similar topographic richness is centered on the small La Mesa surface remnants up against the mountain front. Here four landscape types interfinger in close proximity, namely the La Mesa and Tortugas surfaces, the modern arroyos, and the bedrock hillslopes in the mountains.

At the microlevel, within the one km radius, topographies are yet more varied (Table 8). No more than a brief outline can be presented here.

(a) The youngest surface is historic and occupied by the Rio Grande floodplain with its accordant arroyos. Entisols of three different textural types occur, each with associated vegetation. Comparatively fine-grained floodplain soils used to be flooded (Jaco, 1971) and carry riverine vegetation. Gravelly soils of the arroyo bed are heavily vegetated along convex midchannel bars, but sparsely vegetated along the steep arroyo walls. O'Laughlin (1980:17) enumerates typical arroyo species.

(b) The lower terrace sequence displays Entisols and better developed soils as a result of the greater age of these two surfaces. Periodic access to ground water probably gave rise to a riverine association of trees and shrubs of what O'Laughlin (1980) has termed the Riverine Zone.

(c) The Picacho surface, hosting Sites 36 and 37, is characterized by a more open vegetation (Lower Bajada Zone of O'Laughlin 1980) of ocotillo and creosotebush on the older gravels and creosotebush, mesquite and soap-tree yucca on the younger Keystone formation. The latter species are now closely associated with unit 2 coppice dunes - probably of historic age - so that the question arises as to the nature of preunit 2 vegetation types. Some differences must have existed since unit 1 hosts soil types (Calciorthids and Haplargids) different from those on unit 2 dune sands (Torripsamments).

Even within the small area of the Keystone formation remnants, there appears to have been a topographically determined division of human activity: roasting pits are situated downwind (i.e., generally to the east) and dwelling (pit) structures upwind

Table 8. Landscape and soil types in relation to geomorphic surfaces of various ages in the Keystone Dam area (Sites 36 & 37) (modified from Gile et al. 1981)

Geomorphic Surface	Topographic Position	Soil order, great group	Age (BP)
A. Recent	Rio Grande floodplain	Entisols (loams to silty clays[1])	historical
	Arroyo channels	Entisols (sandy, gravelly)	historical
	Arroyo wall slopes	Entisols with coarse talus	historical
B. Lower terrace sequence (Fort Selden equivalents)			
1. lower (Fillmore)	Valley border terrace	Entisols, Camborthids, Haplargids	100-7000
2. upper (Leasburg)	Valley border terrace	Entisols, Camborthids, Haplargids, Calciorthids	early Holocene-latest Pleistocene
C. Gold Hill	Valley border interfluve flats		
1. Keystone formation unit 1		Haplargids, Calciorthids, Paleorthids, Paleargids	late Pleistocene
2. Keystone formation unit 2	(Local coppice dunes and aeolian veneer)	Torripsamment	historical
3. Surrounding gravel surface		Calciorthids, Paleorthids	late Pleistocene
4. Kern Hill/ Gold Hill scarps	Steep west-facing scarps	Calciorthids, Paleorthids Entisol on scarp talus	mid-to late Pleistocene recent
D. Kern Hill	Major Rio Grande valleyside interfluves	Calciorthids, Paleorthids	mid-to late Pleistocene

1. Jaco, H.R., 1971

(possibly to avoid smoke and the fire danger of blown coals?). The roasting pits also lie in the lee of the convex Keystone formation surface protected from the prevailing winds.

The smoother surface and lesser coherence of the Keystone formation sediments may explain the preference shown by past populations for these surfaces as compared with the surrounding harder and more irregular surfaces.

(d) The Tortugas surface and the scarp ascending to it, lie as little as a few tens of meters distant. These supplied preferred lithic raw materials. Since these slopes are older, gravelly and dolomitic, they are characterized by petrocalcic horizons suggestive of Paleorthid soils and sparser vegetation than that of the Picacho surfaces, at least today. This analysis suggests that the valleyward ends of the Rio Grande sideslopes may indeed have acted as one of a few preferred topographic locales for settlement.

Post-Pleistocene Environment

Paleoclimatic sequences have been reconstructed for this general region by a number of researchers, using a variety of techniques. Changes which have occurred since the late Pleistocene are of particular interest due to their potential influence on the human adaptive strategies responsible for producing the Keystone Dam sites. Several seem to have accepted the validity of Antevs' (1955) Altithermal model of climate change for this region with little question. However, recent paleoclimatic data support an alternative view that the Altithermal in the Chihuahuan Desert was a moist period (Van Devender and Spaulding 1979). Other data have been used to suggest that multiple Holocene thermal Maxima occurred but produced a variety of vegetation types (Davis 1984).

Martin (1963) argues that Altithermal erosion was due to heavy runoff from intensified summer monsoonal rains. Three separate pollen profiles dating to Altithermal times (Double Adobe, Whitewater Draw and Murray Springs) document high frequencies of grass, pine and sedge pollen. This suggests a wet Altithermal with intensified summer rains favoring the spread of grass. Due to increased runoff the presence of shallow ephemeral ponds was likely as a source for the sedge pollen. Several profiles even suggest the local development of cienega communities.

The model of a wet Middle Holocene is supported by herpetological data from Howell's Ridge Cave in southwestern New Mexico. Based on habitat preferences of observed species, VanDevender and Worthington (1977) have determined that the nearby playa was permanently wet until 4,000-5,000 years ago. This would indicate that the Early Holocene (Anathermal) was moist as well. Mesic grassy habitats are indicated by the presence of voles until the drying of the playa. These data accord well with extensive studies of vegetation from fossil packrat nests. Through detailed recording of plant remains preserved in dated packrat (*Neotoma sp.*) nests, VanDevender and others have compiled a large body of data bearing on Late Pleistocene and Holocene climates of southern New Mexico (VanDevender 1977; VanDevender and Everitt 1977; VanDevender, Freeman and Worthington 1978; VanDevender and Spaulding 1979; VanDevender and Riskind 1979; VanDevender, Spaulding and Phillips 1979; VanDevender and Toolin 1983).

The packrat data for southern New Mexico and west Texas coincide in most respects with Martin's model of a moist Altithermal. The main point of departure concerns the Early Holocene. A moist Early Holocene is demonstrated by the persistence of woodland until about 8,000 BP (VanDevender and Spaulding 1979:208). By combining the interpretations of Martin, VanDevender and others, a general paleoenvironmental sequence may be suggested for this study area.

The late Wisconsin is represented in the El Paso area by the presence of dense mesic forests. The remains of white pine, pinon and fir are found as late as 11,500 BP in the lower elevations of the Hueco, Sacramento and Guadalupe Mountains (VanDevender and Riskind 1979; VanDevender, Spaulding and Phillips 1979). A winter precipitation regime is indicated, characterized by mild winters and cool summers.

The Early Holocene continued to be characterized by a winter rainfall regime. It was, however, a transitional period reflecting a lag in climatic response to glacial withdrawal in northern latitudes. Xeric juniper woodlands are recorded in the region at least as low as 1,465 m elevation at Bishop Cap in the southern Organ Mountains. Grasslands were an important aspect of the vegetation (VanDevender and Spaulding 1979; Harris 1977).

The present climatic regimes were established in the Middle Holocene (8,000-4,000 BP) with the reduction of winter rainfall and intensification of the summer monsoon. In the Mojave and Sonoran regions the change brought desert conditions. However, in the Chihuahuan Desert the shift produced desert grassland. Also noted is the first appearance of desertshrub species such as creosotebush, acacia, mesquite, agave, sotol and ocotillo (VanDevender and Riskind 1977; VanDevender and Toolin 1983).

Widespread loss of well-developed soils due to wind erosion is inferred for the period 4,000-5,000 BP. The timing of this event correlates well with the drying of playa basins (VanDevender and Worthington 1977), decreasing effective precipitation (Mehringer 1967; Martin 1963) and with periods of erosion on Rio Grande Valley border surfaces (Ruhe 1967; O'Laughlin 1980). These regional changes probably favored the development of the desertshrub/grassland which characterized the Late Holocene. This is the most recent major vegetation change in the Southwest which was climatically induced (VanDevender and Spaulding 1979:709).

A series of relatively minor climatic fluctuations, which would nevertheless be significant to human populations in the region, are recorded throughout the Late Holocene. For example, an increase in pine at lower mountain elevations is widely documented between 2,500 and 2,000 BP (Oldfield and Schoenwetter 1975; Bryant 1977; VanDevender, Betancourt and Wimberly n.d.). This reflects an increase in moisture which is also recorded by the presence of more mesic faunal elements in the Guadalupe Mountains (Lundelius 1979) and in increased erosion in the Rio Grande Valley (Ruhe 1967; O'Laughlin 1980).

Another summer rainfall peak at about A.D. 1100 is roughly contemporaneous with Freeman's (1972) increase in grass pollen, Bryson and Wendland's (1967) Neo-Atlantic grassland expansion and Ruhe's (1967) erosion of alluvial materials.

Less widely documented changes are also recorded during the Late Holocene. Some may represent local variability while others, such as the drought of A.D. 1276-1299, may have wider importance. However, given the arguments discussed above, and Martin's (1963:68) recognition that tree rings of all species are not indicative of summer rainfall, the correct interpretations of recorded "droughts" are not necessarily clearcut.

Suffice it to note that the Late Holocene record includes a series of fluctuations in local climate conditions. It is likely that our ability to record such fluctuations is directly related to the time period under consideration. Relatively minor changes, like those documented for the last 4,000 years, probably occurred throughout the Holocene but are not readily identified due to the relative insensitivity or incompleteness of earlier records.

CHAPTER 6

SUMMARY AND EVALUATION OF FIELD INVESTIGATIONS

by

David Carmichael and Hiram Henry

Introduction

In this chapter a general summary of the results of the field investigations is presented. The various sampling strategies and excavation techniques are compared in terms of their relative success in identifying archeological features. Cultural resource management concerns such as cost effectiveness and relative destructiveness are addressed in an attempt to help inform future investigations in the area.

The results of the magnetometer survey are presented and recommendations are made for identifying environmental contexts where the technique would be more useful than it has been in the present study. The chapter concludes with an evaluation of the overall research design and a discussion of the problems encountered during the course of the project. The observations to be discussed should provide useful information for future researchers and land managers in the region.

Feature and Artifact Recovery

Prior to detailed mapping and excavation, Keystone Sites 36 and 37 were recorded as superficial or shallow sites containing low artifact densities and a total of no more than 20 features (O'Laughlin 1980; RFP:74). On the surface at least, these two sites were similar to large numbers of lithic and ceramic scatters recorded on surveys throughout the Jornada area and it was expected that characteristics identified during excavation might be extrapolated to many surface sites which would never be excavated. For this reason, a major concern expressed in the research design was that every reasonable attempt would be made to identify the complete range of features and artifact types present at the sites.

The task was carried out through the use of a variety of techniques, as described in Chapter 4. The resulting investigations included judgemental components used in response to observable distributional characteristics. In addition, systematic and random techniques were used to insure against overlooking subsurface cultural remains. The use of a combination of investigative techniques proved to be quite effective and many more features were identified than had been expected. The data on feature identification have at least two important implications for future research in the region. First, archeologists must be willing to reassess traditional assumptions regarding the data recovery potential of small unobtrusive sites. Second, some investigative methods will be more expedient and cost effective than others in the investigation of such sites.

During the course of fieldwork at Keystone Sites 36 and 37, a total of 83 features (77 prehistoric) were identified. This figure is four times the expected number and the recovery of these additional features, especially at Site 37, has added to the previous understanding of the local archeological record. Nineteen features were recorded at Site 36 and 64 were found at Site 37. The features are listed in Tables 9 and 10, respectively, according to the techniques with which they were first identified.

The first task of excavations, as identified in the RFP, was the investigation of all known features, i.e., those visible on the surface. Surface features contributed heavily to the totals, especially in the case of the larger fire-cracked rock concentrations (see Chapter 7 for typology). All but two of the large features were identifiable as such at the surface and one of the exceptions (Site 37, Feature 2) was at least indicated by a few disarticulated rocks on the surface. Excavation of surface features also revealed seven buried features in their immediate vicinity.

In addition to the site areas contained within the feature excavations, a five percent sample of each site was selected randomly for the purposes of identifying any distributional patterns not reflected by surface remains. The random units yielded only a single feature at Site 37. The low figure can probably be attributed to two factors. First, the random units were (by design) distributed throughout the site irrespective of surface distributions. As a result, the units were usually not associated with the clusters of features already identified. Second, the random units were selected after excavation of the judgemental units was already underway. The original random samples included six units which had already been excavated. The ten features contained in these units all contribute to the totals for judgemental excavation. For the purposes of comparing excavation techniques these ten features could be added to the total for random units, but, strictly speaking, they were not discovered by random excavation since they were visible at the surface. It should be noted, however, that the randomly selected excavation units provided unbiased estimates of sitewide artifact densities and distributions which contributed greatly to the analyses presented in Chapter 10.

The results of the systematic backhoe trench testing program were perhaps the most unexpected. At Site 36 no features were located in backhoe trenches but at Site 37, thirty-two (50%) were identified in this manner. Trenching exposed both small fire-cracked rock features and pit structures. Most significant

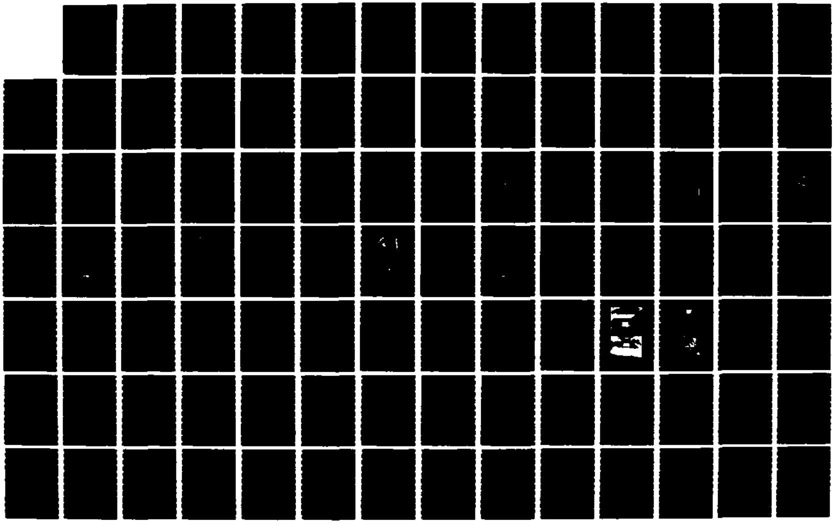
Table 9. Comparison of features identified at Keystone 36, by investigative technique

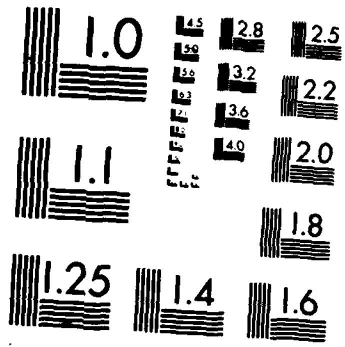
SURFACE FEA. EXCAVATIONS	RANDOM UNITS	JUDGEMENTAL UNITS	BACKHOE TRENCHING
1 (MODERN)	--	13	--
2 (MODERN)		14	
3		15	
4		16	
5		17	
6		18	
7		19	
8			
9			
10			
11 (SUBSURF.)			
12 (SUBSURF.)			
COLUMN TOTALS 12 (.63)	0	7 (.37)	0

GRAND TOTAL = 19 (17 prehistoric)

AD-A174 038 ARCHEOLOGICAL EXCAVATIONS AT TWO PREHISTORIC CAMPSITES NEAR KEYSTONE DAM (U) NEW MEXICO STATE UNIV LAS CRUCES CULTURAL RESOURCES MANAGEMEN D CARMICHAEL ET AL 2/6

UNCLASSIFIED 19 JUL 85 NMSU-14 DACW47-84-C-0006 F/G 5/6 NL





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NATIONAL BUREAU OF STANDARDS-1963-A

Table 10. Comparison of features identified at Keystone 37, by investigative technique.

SURFACE FEA. EXCAVATION	RANDOM UNITS	JUDGEMENTAL UNITS	PHASE I TRENCHES	PHASE II TRENCHES	MECHANICAL SCRAPING
1	36	23	25	40	69
2 (SUBSURF)		24 (MODERN)	27	41	70
3		26	28	42	
4 (MODERN)		30	29	44	
6		31	35	45	
7		34	38	46	
8		37	39	49	
9 (MODERN)		66	43	50	
10 (MODERN)			61	51	
11				52	
12				53	
13				54	
14				55	
15				56	
16 (SUBSURF)				57	
17 (OFF ROW)				59	
18 (SUBSURF)				60	
19 (OFF ROW)				62	
20				63	
21 (SUBSURF)				64	
22 (SUBSURF)				65	
				67	
				68	
COLUMN 21 TOTALS (.33)	1 (.02)	8 (.12)	9 (.14)	23 (.36)	2 (.03)

GRAND TOTAL = 64 (58 Prehistoric features within ROW) however is the fact that none of the pit structures were initially identified using traditional hand excavation techniques. It should be emphasized that backhoe trenching was not intended as a final check of stratigraphy. Rather, it served as an integral part of subsurface testing by adhering to established sampling procedures (Rice and Plog 1983). It had originally been intended that trenching would be the first excavation activity undertaken. However, movement of the machinery around the sites caused too much damage to the surface so most other tasks had to be completed first.

A key aspect in the success of the backhoe investigations was the exposure of long continuous profiles. The availability of extensive profile exposures was important for the distinguishing pit structures from noncultural stratigraphic changes. The Keystone 37 pit structures were generally shallow, contained no evidence of burning and few artifacts and were consistently subtle in their manifestation. As discussed in Chapter 8 the definition of these features relied on differences in soil texture and compaction. Slight soil color changes in profile walls provided the first indication of the structures, but the subtle differences were not visible until the trench sidewalls had dried thoroughly. For example, in Trench 12, Feature 28 (a small hearth) was discovered at the time the trench was dug but Feature 29 (the first pit structure identified) was not visible until the trench walls had dried for three days. Rice and Plog (1983:30) note similar difficulties with the identification of Hohokam canals in trench walls. The importance of working from dried exposed profiles is emphasized by the fact that three structures (Features 41, 56 and 70) were contacted from above by shovel scraping within hand excavation units but were not identified without profiles.

In addition to enhancing subtle variations in soil colors and textures, the use of backhoe trenches provided complete cross sections of individual features. Thus the process of identifying the pit structures was more rapid and reliable than would be possible with coring or hand excavation. Finally, a number of structures were most clearly indicated by slight depressions in the upper surface of the carbonate horizon where it formed the floor of the features. Extensive systematic backhoe trenching is the most efficient technique for excavating a large number of profiles to the depth needed to expose the carbonate horizon. Alternative techniques such as augering, might have identified changes in the carbonate horizon, but the availability of long continuous profiles allowed us to distinguish between the structures and noncultural disturbances such as root sockets and krotovina.

As noted in Chapter 4, the use of backhoe trenching at Keystone 36 and 37 followed procedures which have been well developed and tested elsewhere in the Southwest (Rice and Plog 1983). Aside from the likelihood that the Site 37 pit structures would not have been identified using other excavation techniques, the two major advantages to backhoe trenching are its function as a statistical sampling procedure and its cost effectiveness.

In Chapter 4 the backhoe trenches were treated as transect sample units and using formulae presented by Rice and Plog (1983:23) it was determined that the sample fraction for Site 37 was 14%. Since the 14% sample identified four pit structures (Features 29, 35, 38 and 39) it was predicted that the site might contain as many as 28 such features. This prediction provided the impetus for additional excavation at the site and ultimately proved to be reasonably accurate. A total of 25 possible pit features were identified at the site. Only 16 are confidently identified as structures since not all the possible features were excavated. Nevertheless, most of the remaining features closely resemble the excavated structures and the prediction is seen as fairly accurate and useful.

The cost effectiveness of backhoe trenching is also discussed by Rice and Plog (1983:28). They report data from Arizona State University which show the cost of mechanical backhoe trenching to be approximately half that for hand excavation of trenches. Furthermore, backhoe trenches were consistently dug twice as deep as the hand excavation trenches. Clearly there are advantages to the use of mechanical equipment, assuming the necessity to excavate trenches. In the El Paso region, critics of the archeological use of backhoes have not viewed the technique as necessary and suggest the use of soil augers as an alternative.

The main criticism of the use of backhoes at archeological sites is the relative lack of control and the resultant destruction of larger portions of the features under investigation. Several researchers in the El Paso area have used systematic hand augering as a less destructive alternative to trenching. Subsurface structures have been successfully located in this manner at Keystone 33 (O'Laughlin 1980), Castner Range (Hard 1983), Meyer Range (Scarborough 1984) and in the Hueco Bolson (Whalen 1978). Nevertheless, it can be argued that backhoe trenching possesses two main advantages over augering which were well demonstrated at Keystone 36. These advantages are the identification of low visibility features and cost effectiveness.

Soil auger testing programs are most successful in the identification of features containing burned materials. In all of the cases cited above, buried structures were located or identified by the presence of ash or stained soil (see O'Laughlin 1980:139; Hard 1983:40; Whalen 1978). Thus, augering can be a reliable technique for the identification of burned structures, structures with hearths, trash middens and trash filled pits. However, augering would not be a reliable way to locate the subtle indications of unburned ephemeral structures like those at Site 37.

The El Paso phase pithouse at Meyer Range on Fort Bliss (Scarborough 1984) may provide an informative case example. At that site, a deeply buried pithouse was initially identified in auger test holes. However, the feature was originally identified as a trash midden on the basis of the auger data. It was not until the feature was excavated that it was found to be a trash-filled pithouse (Scarborough, personal communication 8/84). In other words, the auger technique was successful in identifying the trash accumulation, not the pit structure within which it was deposited.

This distinction is most important for sites like Keystone 37 where the pit structures were not defined by distinct discontinuities in soil color. Other characteristics besides soil color which might be indicative of structures include relative artifact densities inside and outside the features. Even though there are identifiable distinctions between interior and exterior artifact densities (see Chapter 10), the absolute frequencies are low enough that it would be difficult to identify a pattern in the samples provided in a 6 inch auger hole. The identification of the Site 37 structures was largely due to the careful investigation of extensive profiles encompassing complete cross sections of individual features. It is believed that auger data would have been a less informative substitute for extensive profiles. Following the initial identification of the structures at Site 37, it would have been a useful methodological exercise to test the efficacy of both techniques side by side. We were precluded from conducting such an experiment because of concerns for the cost effectiveness of augering.

Using the backhoe trenches as transect samples, a 14% Sample Fraction of the site was obtained in an expedient manner. The alternative augering techniques are generally designed to sample the corners of a grid (such as 2 x 2 meters) laid out across the site. A 2 x 2 meter grid was employed at Site 37 for the magnetometer survey. Magnetic readings were undertaken at every grid corner, at the rate of one approximately every 30 seconds. At this rate it took the magnetometer crew six days to cover the site. Obviously, excavating an auger hole to the depth of .5 m or more requires considerably more time than taking a magnetometer reading. Estimating ten minutes per auger hole, one can project an equivalent 49 crew days required to place auger holes over the same 2 x 2 meter grid. Such a costly investment in simply locating features is unrealistic in the context of most contract research. In the case of this study, such an effort directed at Site 37 alone would have amounted to more than half of the original fieldwork scheduled for the entire project.

At Keystone 37 backhoe trenching proved to be a cost effective approach to site-wide subsurface testing. Furthermore, it was very productive in exposing pit structures which were essentially not identified by any other means. The important methodological implication is the possibility that other sites also contain similar features which have not been previously recorded using hand excavation and augering. It is not suggested that systematic backhoe trenching will always be the preferred testing technique. Nevertheless, under some conditions and when dealing with certain types of features, the technique will be valuable addition to traditional methods. In order to identify the fullest range of variability among features, researchers in the El Paso area should be prepared to utilize systematic test trenching as part of a multifaceted excavation procedure.

Detailed data on the nature and distribution of the artifactual assemblage were obtained through detailed surface mapping and by hand excavation units distributed around and between features. Surface mapping at Sites 36 and 37 recorded 289 and 823 artifacts respectively, yielding average densities of .07 and .08 artifacts per square meter. The surface assemblages comprised only about 20% of the artifact total for each site and the resultant totals of 1120 and 4643 artifacts provide a more than adequate data base for the analyses discussed in Chapter 9. The use of a variety of sampling strategies allowed us to maximize artifact recovery by excavating judgemental units in high density areas while still obtaining an unbiased estimate of site-wide densities and distributions from the random units. The resultant distributional data make up the basis for many of the analyses presented in Chapter 10.

One area of potential systematic bias in the recovery of artifacts is related to the use of 1/4 inch mesh screen in hand excavations. Small tertiary flakes, such as those produced by the final stages of tool manufacture or retouch, are often small enough to pass through standard screens. If the proportions of flake types are to be used to interpret on-site behavior, a consistent bias in recovery could affect the results. In order to control for this possibility we used the random excavation units as a means of obtaining screen loss samples. The heavy fraction of flotation samples were analyzed for their debitage content. The analysis is discussed fully in Chapter 9 but suffice it to note that the results do not contradict the conclusions which were drawn from the analysis of the rest of the assemblages.

Proton Magnetometer Survey

The magnetometer survey of Sites 36 and 37 was not as successful as had been hoped; no prehistoric cultural features were identified by this technique but some of the results are of methodological interest. A variety of magnetic anomalies were recorded on the two sites (Figures 10 and 11) but all the ones tested can be attributed to either geologic features or modern debris.

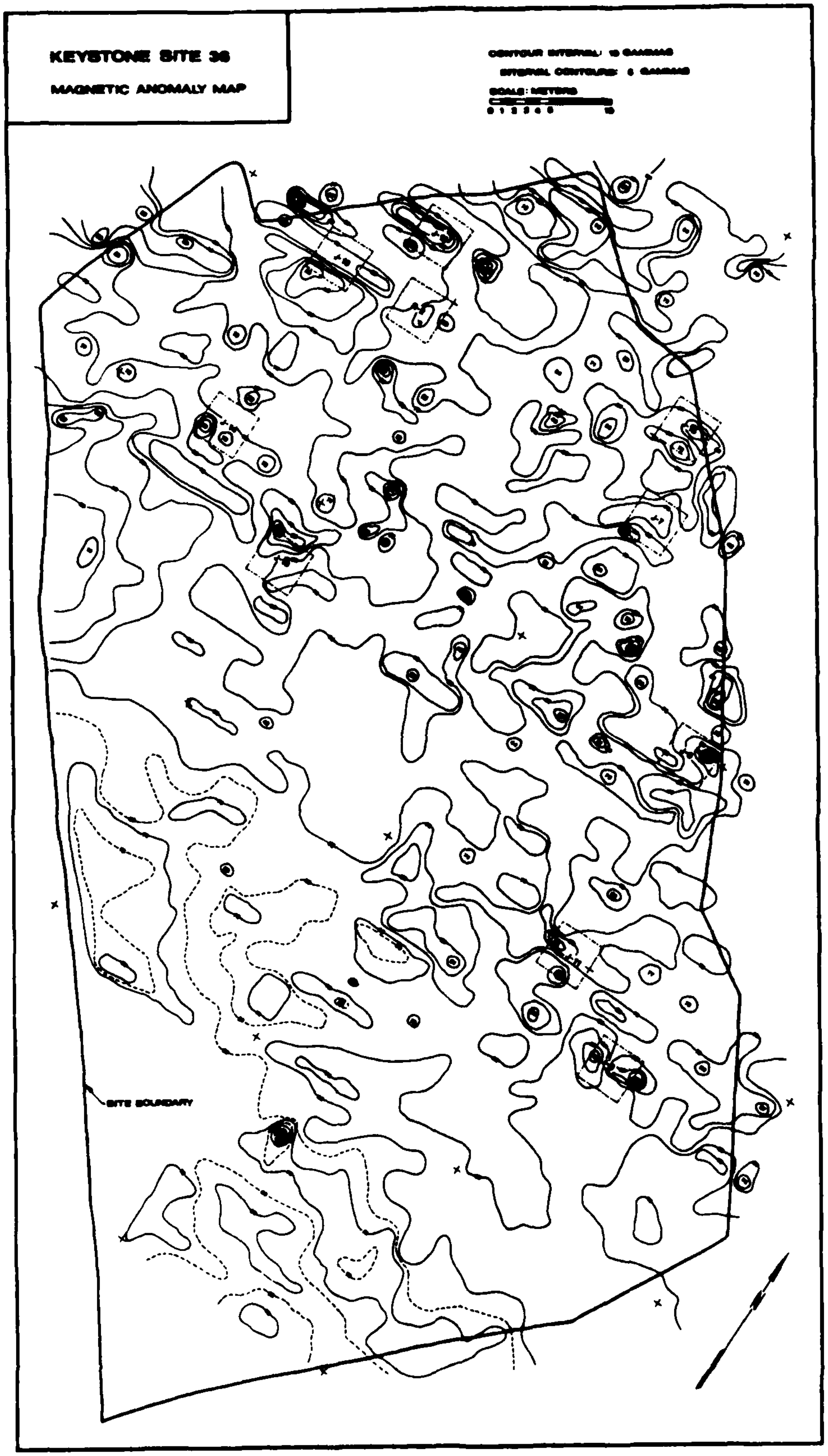


Figure 10. Magnetic contour map of Site 36. Random and judgemental excavation units used to test magnetic anomalies are also shown (see also Tables 2 and 3).

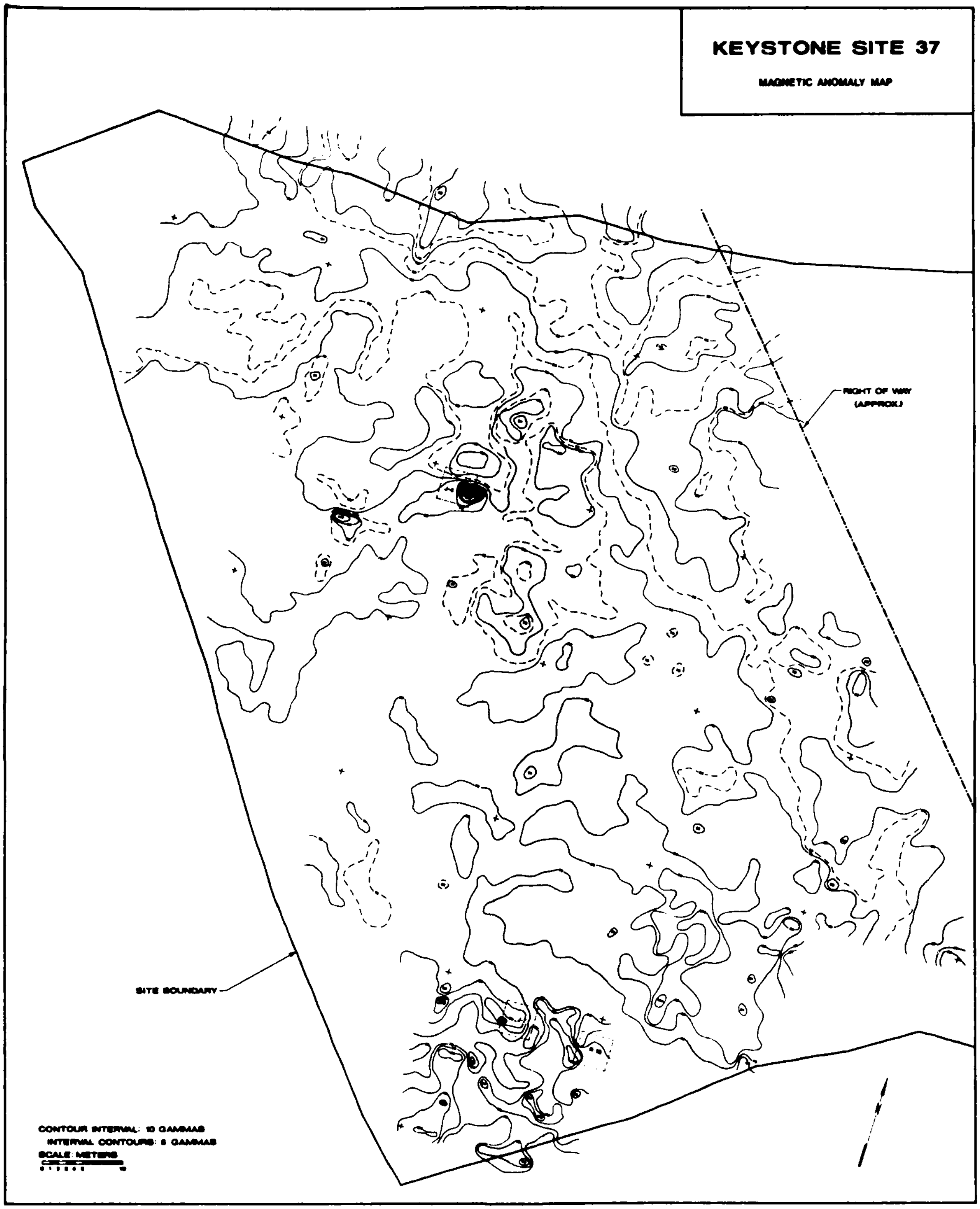


Figure 11. Magnetic contour map of Site 37, including locations of excavation units used to test anomalies. The anomaly southwest of unit J-4 is caused by a highway right-of-way marker.

Magnetic anomalies produced by archeological features can vary greatly in shape, size and magnitude. For comprehensive discussions of their interpretation the reader may refer to Breiner (1973) and Aitken (1974). It should be mentioned here that two main types of irregularities are identified. Monopole anomalies are those with a single magnetic reading which is either higher or lower than the surrounding field. Dipole anomalies exhibit a pair of magnetic readings, one higher and one lower than the surrounding field, in close proximity to one another. Anthropogenic features generally produce dipolar changes. In this study, the irregularities investigated by excavation were chosen on the basis of magnitude and the presence of dipole readings. The testing results are summarized in Table 11 and the locations of test units are shown on the magnetic contour maps.

All but two of the anomalies tested at both sites may be explainable by reference to subsurface geological irregularities or by the presence of buried metal fragments. One additional strong monopole anomaly in the northwest portion of Site 37 (Figure 11) was produced by a highway right-of-way benchmark. None of the archeological features at either site could be discerned on the magnetic contour maps.

Pit structures at Site 37 were apparently backfilled with the same type of soil into which they were excavated. Thus, the magnetic susceptibility of the feature fill would be the same as the surrounding soil and no anomaly would be produced. It is unclear why the prehistoric hearths did not produce magnetic contours. The sandy soils characteristic of the sites probably did not contain enough iron-bearing materials to produce particle orientation in the vicinity of heated features.

Even though the magnetometer survey was not successful in locating prehistoric features during this study, we can use the negative results to suggest more promising settings for future analyses. As already noted, the soil composition is probably an important factor in the formation of anomalies, and very sandy soils can be expected to have minimal magnetic susceptibility. Since most of the soils in the El Paso area are sandy, large areas of the landscape can be expected to be rather unproductive for magnetic survey. Areas with better potential will be those containing clayey soils such as the Rio Grande floodplain and terraces. Pueblo architecture and other features constructed of adobe may be detectable regardless of soil type but features like those at Site 37 cannot be expected to show up in sandy soils.

A second difficulty clearly is the contamination of archeological sites by modern metal. Every effort was made to remove all scrap metal, tin cans and other trash from the site prior to the survey work. Nevertheless, many metal fragments, both large and small, had been incorporated into the unconsolidated aeolian sand and were not visible at the surface. The intensity of readings from scrap metal are so high that even a

Table 11. Results of magnetic anomaly testing

EXCAVATION UNIT	ANOMALY TYPE	ORIENTATION	MAGNITUDE (GAMMAS)	APPARENT CAUSE OF ANOMALY
KEYSTONE 36				
J-7	Monopole	------	43	Modern Hearth
J-8	Dipole	E/W	75	Caliche Rise
J-9	Dipole	SW/NE	58	Caliche Dip
J-11	Dipole	NW/SE	60	Caliche Dip
J-12	Dipole	N/S	51	Modern Metal
J-13	Dipole	N/S	50	Caliche Dip
J-14	Dipole	E/W	43	Iron Spike in Level 2
J-15	Dipole	N/S	37	Iron Fragments
J-16	Dipole	SW/NE	55	Caliche Undulations
R-2	Dipole	E/W	31	Tin Can
KEYSTONE 37				
J-4	Dipole	N/S	159	Galvanized Ducting
J-7	Dipole	SE/NW	50	Unknown
R-18	Dipole	N/S	48	Unknown
Trench 27	Dipole	E/W	51	Gravel-filled Channel

small piece could produce an anomaly intense enough to mask any evidence of prehistoric residual magnetism. A prime example of the problem is presented by Feature 24, Site 37, which proved to be a segment of galvanized ducting completely buried by a creosote-stabilized sand dune. The only way to escape this difficulty is to focus analysis on sites which are not in the vicinity of modern settlements or other sources of scrap metal such as military firing ranges, off road vehicle recreation areas, campgrounds, etc. Many of the areas in and around El Paso can be expected to present the same kinds of problems with modern trash that were identified during this study. Evidence for small ephemeral features especially would most likely be overwhelmed by readings from bottle caps, tin cans, nails, etc.

Thirdly, the presence of a well developed carbonate horizon relatively close to the soil surface (see Chapter 5) may also have caused some of the anomalies recorded by our survey. As noted in Table 7, several of the test excavation units contained nothing of note except for some type of discontinuity or irregularity in the underlying carbonate horizon. The irregularities recorded in hand excavation units take the form of undulations which were observed either as high spots or dips in the upper contact of the caliche. Other irregularities included discontinuities in the carbonate horizon and gravel-filled channels cut into the caliche. At Site 36, Trench 11 exposed a four meter wide break in the caliche horizon (Figure 8) which may be the source of a 36 gamma change in contours observed southwest of unit J-11 (Figure 10). A similar break, filled with coarse gravel, was noted in Trench 14 in the vicinity of the strong monopole anomaly at the southern end of Site 36 (Figure 10). Coarse gravels truncating the caliche horizon were also observed at Site 37 in Trench 27, and they may account for the several anomalies recorded at the southern end of the site (Figure 11). Such geologic features are expected byproducts of multiple cycles of erosion and deposition involved in the formation of the valley border geomorphic surfaces (Chapter 5). It is not certain that the geologic features are the source of the observed variations but their patterned cooccurrence is suggestive. The potential for recording noncultural anomalies in soils with shallow indurated carbonate horizons may have an adverse effect on magnetometer survey on all of the local bajada landforms. Again, this limitation should apply mainly to small ephemeral features. Structures of adobe may well retain enough residual magnetism in the clays to produce useful readings in spite of natural and/or modern background effects.

Evaluation of the Research Design

In this section the research design is assessed in terms of its effectiveness in providing the data necessary for interpreting Keystone Sites 36 and 37. The discussion includes two parts: an evaluation of the utility of the research problems and the difficulties encountered in actually carrying out the research design.

Responsiveness to Data Recovery Goals

The three major research goals identified by the research design were 1) the elucidation of the systemic context of Sites 36 and 37, 2) evaluating the relationship of the sites to regional cultural systematics and 3) to develop improved chronological control for the sites. All of the analytical approaches and data recovery techniques were directed toward one or more of these goals. It is believed that these efforts have been successful inasmuch as they have provided new empirical data on site contents which are also relevant to a series of substantive and theoretical issues of regional significance. The positive results of the investigations indicate that when appropriate questions are posed, even some of the most ephemeral and commonplace sites can yield significant research results.

The research design called for the identification of site contents which, in turn, bears directly on the issues of site function and systemic context. One component of the analysis has been a multifaceted approach to the identification, definition and interpretation of the range of features present on the sites. The identification of ephemeral pit structures at Site 37 has had a great impact on the subsequent analysis of site function and its role within an adaptive strategy. The discovery of those features is directly attributable to the systematic approach applied to subsurface testing.

Interpretation of site function was further enhanced by the detailed excavation of as many features as possible. Complete or nearly complete excavation of a large number of features provided the necessary data for the feature typology, analysis of feature distribution and the investigation of artifact-feature associations. Furthermore, the feature contents yielded most of the samples required for botanical analysis.

Given the exposure and soil conditions characteristic of most sites in the area, preservation of plant remains is relatively rare. The excavation of many features is often necessary in order to recover usable organic samples. At Sites 36 and 37 the extensive investigation of features led to the recovery of 15 dated radiocarbon samples which figure prominently in the analysis. Flotation samples from the features have yielded plant remains bearing directly on the interpretation of fire-cracked rock features. In addition, the use of nondestructive extraction techniques yielded countable pollen spectra for almost all the samples analyzed. All these analyses were relevant in the context of addressing site function.

Site structure is further investigated through the use of detailed lithic artifact analysis. The extent of horizontal exposure provided by hand excavations was an important factor in obtaining adequate artifact samples. Hand excavations comprised samples of approximately 15% of the area on each site. This level of coverage contrasts with the previous Keystone studies where hand excavations amounted to samples of 1% or less (Fields and Girard 1983:50,56; O'Laughlin 1980:40). In addition to providing an artifact sample, the extensive hand excavations also served to maximize the recovery of obsidian artifacts for hydration dating. A total of 26 datable samples were recovered from the two sites, placing them among the best dated sites in the El Paso area.

As important as the extent of excavation is the process by which units are selected. In the case of hand excavations, a portion of the units were located randomly and the results provided site-wide estimates of artifact density and feature distributions. We believe that such randomizing and systematic aspects of the research design are important and useful for at least two reasons. It can be suggested with some assurance that within-site variability was adequately recorded. The research potential of the probabilistic artifact sample was not maximized however. Most of the randomly sampled excavation units fell outside the areas with the highest artifact densities. It was decided that it would be better to draw artifacts for lithic analysis from the site as a whole rather than those few random units which contained adequate numbers of items. Random units did contribute to the lithic analysis by providing the small debitage from the heavy fraction of flotation samples.

Another research goal which was successfully met is the development of improved chronological control for Sites 36 and 37. On-going research at New Mexico State University has led the way in the application of experimentally induced hydration dating of obsidian in the region. As a result, nearly all of the obsidian artifacts obtained during fieldwork were datable. Of equal importance was the recovery of numerous radiocarbon samples as a result of the complete excavation of many features.

A detailed comparison of the dating results from the two techniques provides two very significant conclusions. First, even though Site 37 "looks like" a late Archaic/Early Formative campsite, it dates to the Pueblo period, calling into question the basic assumptions of cultural systematics. Second, the Keystone dates provide a classic example of the prehistoric use of "old wood" and the problems associated with generating a chronology from such cases. It is perhaps ironic that these two sites, which initially would be assessed as having a low potential for chronometric dating, have provided a theoretically important set of dates for assessing the regional chronology. Even small, ephemeral sites have significant research potential when the proper questions are asked and the appropriate techniques are employed.

As described in Chapters 9, 10 and 13, there appear to be differences between Sites 36 and 37 in terms of their systemic contexts. Nevertheless, some of the evidence for the differences is fairly subtle; while basic artifact descriptions form a standard part of archeological reporting, the detailed comparisons between sites were directed at those variables expected to exhibit the kinds of variability identified as significant in the research design. Some studies have been made in maximizing the recovery of data from Sites 36 and 37 within the time alloted for the investigation. With only a few exceptions, CRMD approaches to further investigations would be comparable, given similar conditions.

Two aspects of the research design and plan proved to be less useful than had been anticipated. The first was the hope that the identification of, and data recovery from, relevant cultural features would be enhanced by the use of a magnetometer survey. As noted above, several aspects of the site settings proved nonconducive to the preservation of anomalies indicative of prehistoric features.

A second concern relates to perspectives brought to the investigation of site function and settlement patterns. One of the questions targeted for study in the RFP was whether or not catchment analysis would be a useful approach from which to interpret the Keystone sites. The question is discussed more fully in Chapter 13, but, it should be noted here that the approach was not found to be very satisfying. For one reason, both sites have been interpreted as limited activity camps, and it is not clear that the logistic assumptions intended for long-term communities are appropriate for such sites. Secondly, catchment analyses are best applied to sets of sites rather than single sites. The intention had been to incorporate settlement pattern data from throughout the region into the analysis. However, one result of the chronological analysis has been to point out that Site 37 does not fit adequately within the traditional cultural historical framework. Thus, it is not yet possible to place it within an analytically meaningful group of sites (e.g., representing a settlement system).

This raises the more general issue of incorporating regional survey data into an analysis and/or extrapolating excavation results to such a data base. Since, on the basis of its surface morphology, Site 37 would not have been assigned to the appropriate time period, it is difficult to make comparisons with data sets structured by traditional categories and within which Site 37 is essentially undefined.

An unanswered methodological question which arose during the course of fieldwork involves the relative efficiency of alternative excavation techniques. Future studies could be specifically designed to incorporate the use of multiple techniques in the same setting in order to compare their overall effectiveness. A similar strategy could also be used to compare sampling techniques used to locate excavation units, select artifact samples, etc. Over a period of time, the results of various studies could then be used to identify the contexts in which specific methodologies are most appropriate.

Problems Encountered in Carrying Out the Research

The most bothersome difficulties faced during the course of the investigation were those surrounding the occasional need to respond rapidly to changes in field or lab conditions. One example is provided by the problems surrounding site vandalism. Although both sites had received extensive off-road vehicle impact prior to this study, additional damage occurred as a result of vandalism during the early phases of fieldwork.

The vandalism at the two sites consisted of the damage and/or removal of datums and grid corners, extensive off road vehicle traffic and one instance of excavation. Since both sites are located near residential areas the problems were not unexpected, but no protective actions were authorized until after damage had delayed the fieldwork schedule.

Perhaps more complete discussion of, and planning for, a variety of potential contingencies prior to field work will prevent them from affecting data recovery schedules in the future.

CHAPTER 7

FEATURE DESCRIPTIONS AND ANALYSIS: FIRE-CRACKED ROCK FEATURES

by Myles Miller, David Carmichael, Jean Elsasser and Hiram Henry

Introduction

Excavations at Keystone Sites 36 and 37 yielded information on a large number of features. In this and the following chapter descriptive data on these features are provided as a basis for the discussion of distributional patterns and interpretation of site function later in the report. The data are summarized under the headings of large and small fire-cracked rock features and small pit features. Excavation techniques are detailed and problems associated with the definition of features are identified. Also presented are discussions of the spatial distribution of features and of associated artifact densities and distributions, summaries of associated botanical remains, and an assessment of comparative data from other sites in the region. Inferences derived from such data are used to aid in the functional interpretation of features identified at Keystone Sites 36 and 37, as well as comparable features reported during previous investigations associated with Keystone Dam.

Feature Typology

Forty-five prehistoric fire-cracked rock (FCR) features were identified and investigated at Keystone Sites 36 and 37. This number is nearly three times the total of 16 reported by previous surveys prior to this study (RFP:74). The recovery of greater numbers of features was fortunate because analysis has identified patterns in feature morphology which might be less evident in a smaller sample. Based on characteristics of size and rock weight, the majority of the features have been securely assigned to one of two morphological categories: large fire-cracked rock features and small fire-cracked rock features. Additional variability is noted within the latter group as discussed below.

Burned rock features are a common characteristic of archeological sites in the southern Jornada and they have been discussed by a variety of researchers in the El Paso area. The previous Keystone Dam projects (O'Laughlin 1980; Fields and Girard 1983) and an excavation in east El Paso (Hard 1983) have all identified a similar dichotomy based on some aspect of feature size. The consistency of this distinction suggests the likelihood that the differences may be attributable to prehistoric patterns of use. It is useful to group the two types of features, not for the sake of classification, but rather, in order to analyze any spatial or temporal relationships among features and between features and artifacts. For the purposes of this study discriminant analysis was used to produce feature groupings with specifiable levels of significance.

Metric data on rock features were computerized on a Kaypro II pc as a Database file. This file was transferred to the NMSU mainframe system (Amdahl 470 V/5) for further manipulation. The discriminant analysis was carried out with an SPSSX routine using several methods (Norusis 1983). The results were similar with all methods; the figures reported here were generated with the direct method. The resulting feature groups were then plotted with an SAS graphics routine.

The variables used to group the features are plan view area and rock weight. Area is reported in square meters but rock weight is converted to pounds in order to reduce congestion in the final plot. Raw data for all features analyzed are listed in Tables 12 and 13.

As would be expected, the values for feature area and rock weight covary strongly. It is also not surprising that rock weight figures more prominently in the discriminant functions since feature area is more drastically affected by post-depositional processes. The discriminant functions have Chi Square values of 13.0 (df.=2, p .002) for Site 36 and 32.2 (df.=2, p .0001) for Site 37. The discriminant analysis of feature group membership correctly classified 92% of the cases for Site 36 and 96% at Site 37, thus lending confidence to the size typology.

The numbers and sizes of features in the Large and Small feature groups are summarized in Table 14. Note that there is no overlap between even the maximum ranges for most comparisons. The single exception is at Site 37 where one small fire-cracked rock feature (as identified primarily by rock weight) is so dispersed that its area overlaps into the range for large features. The site means for feature size variables correspond rather closely with those reported from Keystone Site 32 (Fields and Girard 1983:121) but are notably larger than the figures summarized from O'Laughlin's work at Sites 33 and 34. The smaller mean size at the latter sites most likely reflects the higher proportion of small features contributing to the mean. This observation may also be indicative of behavioral differences associated with site typology; greater specialization of activities on short-term campsites may lead to higher proportions of large fire-cracked rock features. This possibility is further addressed below.

It is interesting to note that membership in the feature groups is nearly proportional between the two sites, there being roughly twice as many small features as large ones. Group assignments and size distributions are presented graphically, by site, in Figures 12 and 13. Although based on different measures

Table 12. Characteristics of fire-cracked rock features at Keystone Site 36

Feature No.	Area in Square meters	Rockweight (kg)	Rockweight (lbs)	Size Group *
3	1.0	30	66	S
4	2.8	22	48	S
5	0.8	21	46	S
6	4.5	197	433	L
7	11.5	399	878	L
8	2.1	93	205	L
9	0.6	18	40	S
10	4.4	328	722	L
11	1.6	42	92	S
12	1.5	37	81	S
13	1.7	47	103	S
14	0.5	3	5	S
15	0.9	8	18	S
16	0.5	0	0	S
17	0.5	5	12	S
18	1.1	47	103	S

*Large FCR feature (L) or Small FCR feature (S)

Table 13. Characteristics of fire-cracked rock features at Keystone Site 37

Feature No.	Area in Square meters	Rockweight (kg)	(lbs)	Size Group *
1	4.2	259	570	L
2	5.9	721	1587	L
3	14.8	341	750	L
6	11.2	327	719	L
7	4.0	330	725	L
8	7.0	40	88	S
12	2.9	67	147	S
13	0.8	0	0	S
14	4.0	204	450	L
15	2.4	114	252	L
16	1.5	18	40	S
18	0.9	20	44	S
20	1.0	49	107	S
21	1.0	8	13	S
22	0.7	61	134	S
23	7.0	227	500	L
25	1.0	21	46	S
26	1.2	54	119	S
28	0.7	23	50	S
30	1.1	16	35	S
31	0.8	2	4.4	S
34	4.8	454	1000	L
36	1.3	57	125	S

Table 13. Continued

Feature No.	Area in Square meters	Rockweight (kg)	(lbs)	Size Group *
37	2.0	45	100	S
44	1.0	34	75	S
47	1.0	Not Excavated		S
60	1.5	45	100	S
66	0.8	23	50	S
67	0.8	34	75	S
68	0.5	Not Excavated		S
69	2.6	80	175	S

* Large FCR feature (L) or Small FCR feature (S)

Table 14. Summary of FCR feature groups by site

KEYSTONE 36

	LARGE	SMALL	TOTAL
No. of cases	4	12	16
Mean Area	5.6 m^2	1.1 m^2	2.2 m^2
(SDEV)	(4.0)	(0.7)	(3.0)
RANGE	2.1-11.5	0.5-1.7	0.5-11.5
Mean Weight	254 kg	23 kg	81 kg
(SDEV)	(132)	(17)	(127)
RANGE	93-399	0-47	0-399

KEYSTONE 37

	LARGE	SMALL	TOTAL
No. of cases	8*	20	28
Mean Area	6.4 m^2	1.5 m^2	2.9 m^2
(SDEV)	(4.3)	(1.4)	(3.3)
RANGE	2.4-14.8	0.5-7.0	0.5-14.8
Mean Weight	244 kg	37 kg	125 kg
(SDEV)	(183)	(21)	(170)
RANGE	114-721	0-67	0-721

* Feature 23 at Site 37 was deleted from this summary due to its problematical identification as a large FCR feature (see text).

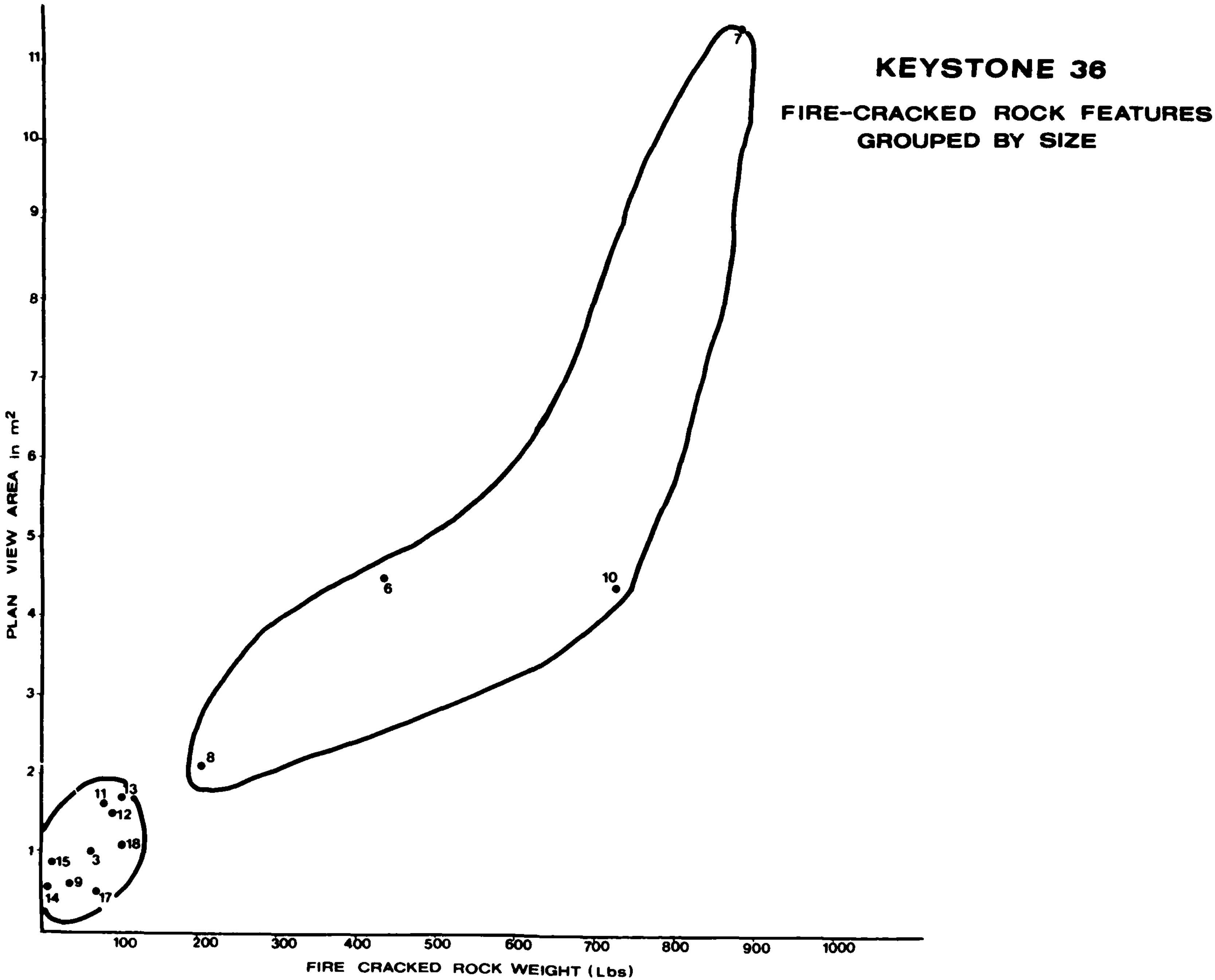


Figure 12. Size groupings of fire-cracked rock features at Keystone 36.

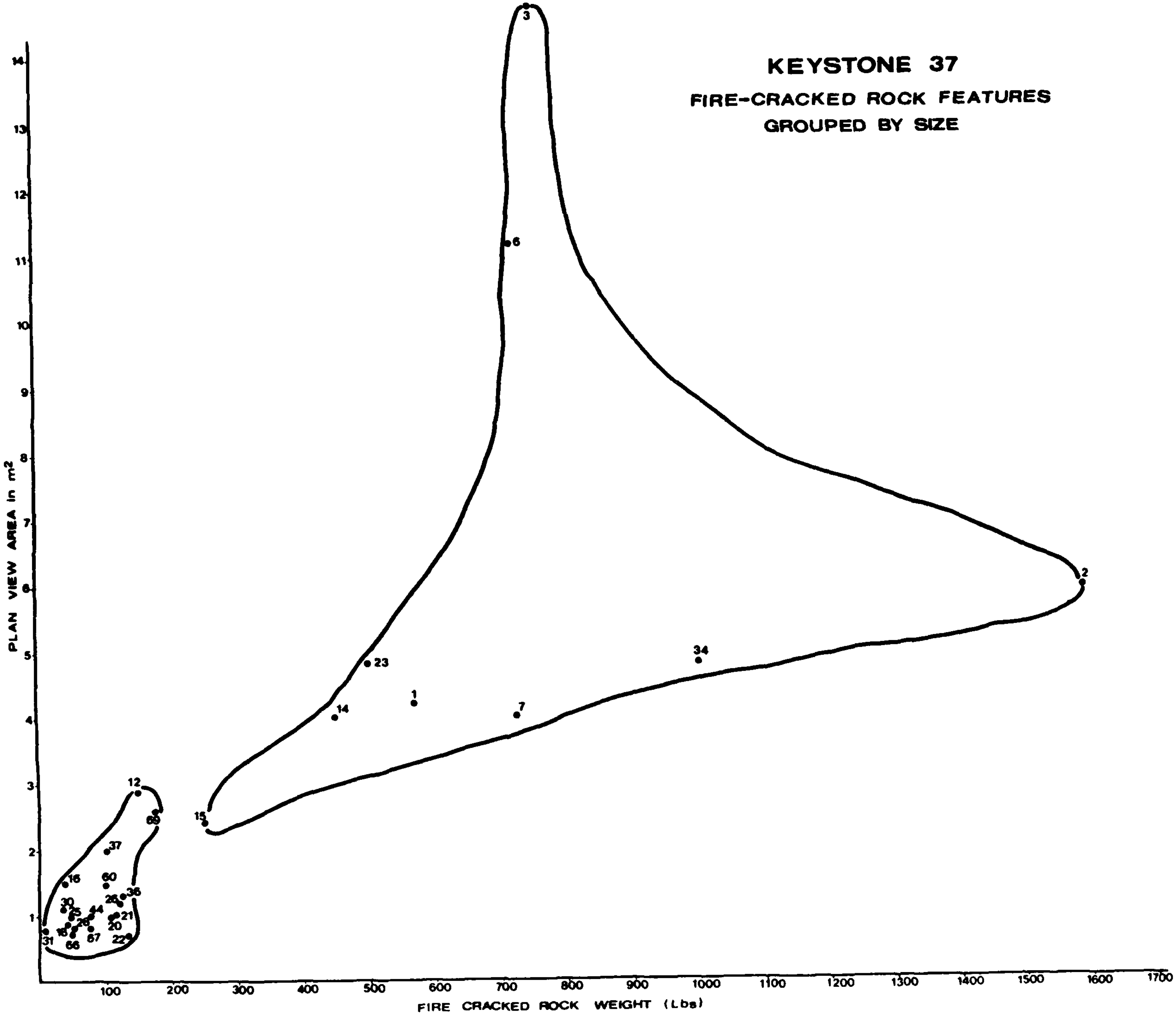


Figure 13. Size groupings of fire-cracked rock features at Keystone 37.

of size, Hard's (1983) distribution of rock features at Castner Range exhibits similar groupings and degrees of dispersion within the groupings. Again, general similarities in the relative proportions of different sizes of rock features may reflect behavior patterns related to feature function. Brief summary descriptions of each category are given below and then examples from each site are discussed in detail.

Large Fire-Cracked Rock Features

The group of large features on the sites are characterized by extensive concentrations and/or dispersals of fire-cracked rock often associated with carbonaceous or burned soil. Varying amounts of ash and charcoal may be present in the lenses of discolored soil, depending on the extent to which deflation and erosion have affected the integrity of the feature. The dimensions of the most dense rock concentrations range from 1.8 to 3.6 m in diameter although adjacent areas containing discolored soil and scattered rocks can extend out to eight meters in diameter. Profiles of the better preserved features indicate construction within shallow pits or basins, with the thickness slightly greater in the center than at the edges. Weights of the fire-cracked rock from these features range from 93 kg to 721 kg, with an average of 325 kg (Tables 12, 13).

Four Large Fire-Cracked Rock Features were investigated at Site 36 and nine at Site 37. Of the 13 total, all but one were partially exposed at the surface, the exception being feature 34 at Site 37 which was covered by 20-30 cm of aeolian sand. Due to their large size and general proximity to the surface, it is likely that no Large Fire-Cracked Rock Features remained undetected at either site.

Small Fire-Cracked Rock Features

These features are spatially compact, with areas of dense fire-cracked rock concentrations and cultural deposits averaging one meter in diameter. Although in many cases post-abandonment disturbance processes have altered the original shapes and dimensions of these features, the better-preserved examples are characterized by an articulated circular concentration. Rock weights from these features range up to 67 kg, with an average of 40 kg.

Most Small Fire-Cracked Rock Features at Sites 36 and 37 have been subjected to wind and slope erosion, thus appearing as circular or oval shaped, relatively flat, single layer concentrations of fire-cracked rock. Preservation within the associated soil deposits varies among these features; the remnants range from a light gray stain of heat-reduced sand to a deep matrix of dark carbonaceous soil, ash and charcoal. Profiles of these features show some evidence of pit or basin construction cut into the underlying compact pebbly sand or caliche, although the boundaries between the cultural deposits and natural soils are often indistinct and disturbed by rodent burrows and the leaching action of rainwater percolating through these highly permeable soils.

A small sample of features, including Feature 22 at Site 37, were located in compact pebbly sand under deep deposits of unconsolidated aeolian sand or dune-consolidated sand and have consequently been less exposed to erosional and disturbance processes. These examples are circular in shape, have a high density of fire-cracked rock around the edges, and a much lower fire-cracked rock density with a matrix of dark carbonaceous soil and charcoal in the center. Profiles of these features show a shallow basin-shaped construction, although the pit walls are generally irregular.

Other features at Sites 36 and 37 were located in or near roads and trails and have been heavily disturbed by vehicle activity causing the dispersal of fire-cracked rocks and erosion of cultural deposits. However, sufficient articulation of fire-cracked rock with areas of reduced sand remain to reconstruct these features as Small Fire-Cracked Rock Features.

The five Small Fire-Cracked Rock Features investigated at Site 36 and the 18 at Site 37 are listed in Tables 12 and 13.

Small Pit Features

These features are usually located near Small Fire-Cracked Rock Features and may be the remnants of such features. Most examples have fire-cracked rock present within the fill, although in small quantities. These Small Pit Features are basin-shaped constructions cut into the compact pebbly sand and caliche horizons. They measure an average 0.5 m diameter and 5-15 cm depth, and are filled with a soil matrix of light gray carbonaceous sand which sometimes includes small lenses of charcoal. Evidence of heat-reduced stained sand is present in the side walls of these pits.

Features assignable to this group include 9, 14, and 16 at Site 36 and 13, 18, and 31 at Site 37. Features 1 and 2 at Keystone Site 34 and 5, 6, 8, and 9 at Site 33 North show similar characteristics to the Site 36 and 37 Small Pit Features (O'Laughlin, 1980:128-134).

Two features at Site 36 and four at Site 37 are wide dispersals of fire-cracked rock showing no articulation or evidence of associated cultural deposits. These may represent destroyed fire-cracked rock features from which the cultural deposits have been entirely eroded, or may be dispersals of fire-cracked rock from other nearby features. In either case, lack of data precludes their assignment to any of the three aforementioned categories with confidence. Also, several features located during the initial surface survey were found to be modern (Keystone 36, Features 1 and 2; Keystone 37, Features 4, 9 and 10). Beyond their being recorded, no further time was expended on them.

The majority of fire-cracked rock features at Sites 36 and 37 were detected as small dispersals and concentrations of fire-cracked rock exposed at the surface, while others were found during the excavation of judgemental and random units or in the profile walls of backhoe trenches. In accordance with contract stipulations, 4 by 4 m excavation units were established around features located at the surface and for the selected judgemental and random excavations. At times it was necessary to expand these units in order to encompass the total extent of a feature or to investigate other nearby features discovered during the excavations. To facilitate later artifact analyses, standard practice was to place the datum at the southwest corner and number the one meter subunits starting at the datum corner and proceeding from west to east.

Excavation proceeded by arbitrary 10 cm levels. Deposits of unconsolidated aeolian sand were removed until the horizontal dimensions of the features were defined, the excavation then proceeding by trowel to the next level leaving the features pedestalled. Before excavating the unit to a level below the fire-cracked rock or to the carbonate horizon, the features were bisected in order to observe and record vertical characteristics of depth, stratigraphy, and feature shape.

Field records were maintained on the dimensions, artifact recovery, material composition of the fire-cracked rock, weight of the fire-cracked rock, and other characteristics of each feature. Maps and measurements were taken for each level, noting the size, density, positioning, and material of the fire-cracked rock, as well as the horizontal and vertical extent of the associated cultural deposits.

During the excavation of all 4 by 4 m units, 1/4" mesh screen was utilized to recover artifacts. Tools and groundstone artifacts were point provenienced, as were any C-14 samples. Soil, flotation, and pollen samples were collected at each level from inside the feature, with additional samples collected outside of the feature boundaries for control purposes. Photographic records were maintained for each level. Finally, the fire-cracked rock was weighed.

A number of rock features were discovered during the trenching and backhoe operations undertaken during the project extension. These were cleared and mapped, but time and contractual constraints prohibited detailed investigation and artifact recovery (contract modification 2). Fire-cracked rock weights for these features are estimated, with those estimations given in 11.5 kg (25 lb.) increments based upon observations of size and density compared with other features with known weights.

The fire-cracked rock features present at Sites 36 and 37 are discussed below by site. A listing and brief description of each feature is provided (Tables 15 and 16), followed by more detailed discussions of a number of representative features from each site. Since a total of 45 fire-cracked rock features were excavated, description of every example would be redundant.

Keystone Site 36

Large Fire-Cracked Rock Features

Feature 7

Feature 7 is located in the southeastern area of Site 36, where the initial surface survey noted an extensive scatter of fire-cracked rock measuring over 60 square meters (Figure 14). As no central feature area could be discerned at the surface, four 4 by 4 m excavation units were established around the scatter at the coordinates 20S14E, 20S18E, 24S14E, and 24S18E. After the feature was exposed, another 1 by 3 m unit was required in order to encompass the extreme western edge. Excavation of unit 20S18E was not required as it was found to be outside the feature.

The highest density of fire-cracked rock and cultural deposits were found within unit 20S14E situated under three to four cm of unconsolidated aeolian sand. After pedestalling, the feature was excavated in two arbitrary 10 cm levels, labeled Levels 1A and 1B. Level 1A consisted of a layer of small fire-cracked rocks, 5-15 cm in diameter, situated in a matrix of carbonaceous soil. At this level, the feature had an irregular shape and measured 3.6 m N/S and 3.3 m E/W, with dispersals of fire-cracked rock spread 3.5 m to the east, 2.0 m south, and 1.0 m west.

With the removal of the overlying fire-cracked rock of level 1A, the level 1B excavation revealed an oval-shaped cluster of large fire-cracked rocks measuring 10-35 cm in diameter. This dense concentration of fire-cracked rock was situated directly on indurated caliche, where a shallow depression was observed to extend into the caliche to a depth of three to five cm. Throughout this depression and the concentration of fire-cracked rock was a deep matrix of very dark carbonaceous soil. Numerous C-14 samples were collected from this deposit.

Table 15. Site 36 Fire-Cracked Rock Features

Feature	Dimensions*	Weight	Comments
			Large Fire-Cracked Rock Features
6	2.1/2.2m	197kg	FCR deflated and dispersed. Some areas of reduced sand with charcoal lenses.
7	3.6/3.3m	399kg	Large dispersal of FCR around a dense central concentration with deep deposits of carbonaceous soil, ash and charcoal.
8	1.4/1.5m	93kg	Very dense circular FCR concentration with deposits of very dark carbonaceous soil and charcoal.
10	1.9/2.2m	328kg	Dense FCR concentration over thin deposit of reduced sand. Moderate deflation.
			Small Fire-Cracked Rock Features
3	1.1/0.9m	30kg	Deflated and slightly dispersed. Small area of carbonaceous soil.
13	1.3/1.3m	47kg	Deflated with soil matrix eroded.
15	0.9/1.1m	8kg	Deflated but compact. FCR overlying a small basin-shaped pit with a matrix of carbonaceous soil and charcoal.
17	0.8/0.6m	5kg	Well-preserved and articulated with deposits of carbonaceous soil and charcoal.
18	1.0/1.0m	47kg	Well-preserved FCR concentration over a basin-shaped pit with carbonaceous soil and charcoal.
			Small Pit Features
9	0.6/0.6m	18kg	Probably a destroyed Small Fire-Cracked Rock Feature. Small amount of FCR in a basin-shaped pit with some carbonaceous soil and charcoal flecks. Heat reduction noted on walls.

Table 15. Continued

Feature	Dimensions*	Weight	Comments
14	0.5/0.5/m	----	Pit in caliche. Fill of slightly reduced sand with some charcoal. No FCR present in fill.
16	0.5/0.5m	----	Pit in caliche. Some FCR but no ash or charcoal.
			Fire-Cracked Rock Scatters
4	1.8/1.9	48kg	Near Feature
5	0.3/0.4	46kg	Near Feature

* Dimensions given are maximums for the densest FCR concentrations, excluding dispersals. Any apparent discrepancies between these dimensions and areas listed in Table 12 are due to irregularities in feature shapes.

Table 16. Site 37 Fire-Cracked Rock Features

FEATURE	DIMENSIONS	WEIGHT	COMMENTS
			Large Fire-Cracked Rock Features
1	1.7/1.8m	259kg	Dense circular concentration of FRC, slightly eroded and deflated.
2	2.6/2.0m	721kg	Large concentration of FCR overlying deposits of carbonaceous soil.
3	2.0/2.0m	341kg	Ring-shaped cluster of FCR with large areas of FCR dispersals. Carconaceous soil in central areas.
6	3.0/2.5m	327kg	Asymmetrical concentration of FCR, deflated and with soil matrix eroded.
7	2.0/2.0m	330kg	Articulated oval-shaped feature. Soil matrix eroded with only a thin deposit of reduced sand observed.
14	1.5/1.8m	205kg	Well-preserved and articulated FCR concentration in a circular shape. Deep deposit of carbonaceous soil and charcoal.
15	1.0/1.0m	115kg	Borderline between Large and Small FCR Features. Vehicle-disturbed FCR with small area of reduced sand and some carbonaceous soil.
23	2.4/2.0m	227kg	Highly dispersed FCR associated with extensive and deep deposits of very dark carbonaceous soil and charcoal.
34	2.5/2.0m	454kg	1/4 excavated. Very dense and well-preserved. FCR in a moist, dark matrix of carbonaceous soil with dense pockets of ash and charcoal.

Table 16. Continued

Small Fire-Cracked Rock Features

12	2.0/1.2	67kg	Proximity to the surface has resulted in high level of disturbance, FCR dispersed and soil matrix eroded.
16	1.5/1.0m	18kg	Deflated but articulated. Soil matrix eroded.
21	1.0/1.0m	8kg	Vehicle-disturbed FCR scattered around a small cluster of FCR associated with a pit of carbonaceous soil and charcoal.
22	0.9/0.8m	61kg	Intact feature. Ring-shaped FCR with soil matrix preserved.
25A	0.5/0.8m	21kg	Intact feature located inside Feature 25B.
25B	1.3/1.2m	44kg	Well-preserved feature, although disturbed by 25A.
26	1.3/0.9m	54kg	Deflated but articulated. Soil matrix eroded.
27	---/0.8m	----	No excavation. Observed and mapped in trench profile.
28	0.9/0.8m	23kg	Deflated with a matrix of reduced sand.
30	1.1/1.1m	16kg	Disarticulated FCR around a basin-shaped pit with a fill of carbonaceous soil.
36	1.1/1.2m	57kg	Slightly deflated. Circular shape of FCR with a deposit of carbonaceous soil and charcoal.
37	1.4/1.4m	45kg	Deflated. Thin deposit of reduced sand.
44	0.7/0.7m	34kg	Deflated with soil matrix eroded.
47	---/1.2m	----	No excavation. Observed to be a well-preserved circle of FCR over a pit filled with carbonaceous soil and charcoal.

Table 16. Continued

60	0.9/1.2m	45kg	Deflated. Small pit with a fill of reduced sand and some charcoal noted below.
66	0.8/0.7m	23kg	Deflated and eroded semicircle of FCR.
67	0.8/0.7m	34kg	Deflated and eroded ring of FCR.
68	---/---	----	No excavation. Noted in trench profile.
69	1.5/1.2	80kg	Well-preserved oval concentration of FCR. Ringshape apparent. Matrix of carbonaceous soil with some charcoal flecks.
			Small Pit Features
13	0.6/0.6m	----	Round pit excavated into caliche with carbonaceous soil and some charcoal flecks.
18	0.6/0.6m	20kg	Pit in compact pebbly sand. Fill includes slightly reduced sand, some charcoal, and FCR.
31	0.7/0.8m	----	Basin cut into compact pebbly sand. Some reduction noted in basin walls, but no ash or charcoal. Two small fire-cracked rocks present in fill.
			FCR Scatters
5	-------	----	Near Feature 6
11	-------	----	Near Feature 6
20	-------	----	Near Feature 21
8	-------	----	Near Features 22 and 23. Possibly a downslope dispersal of FCR from Feature 23.

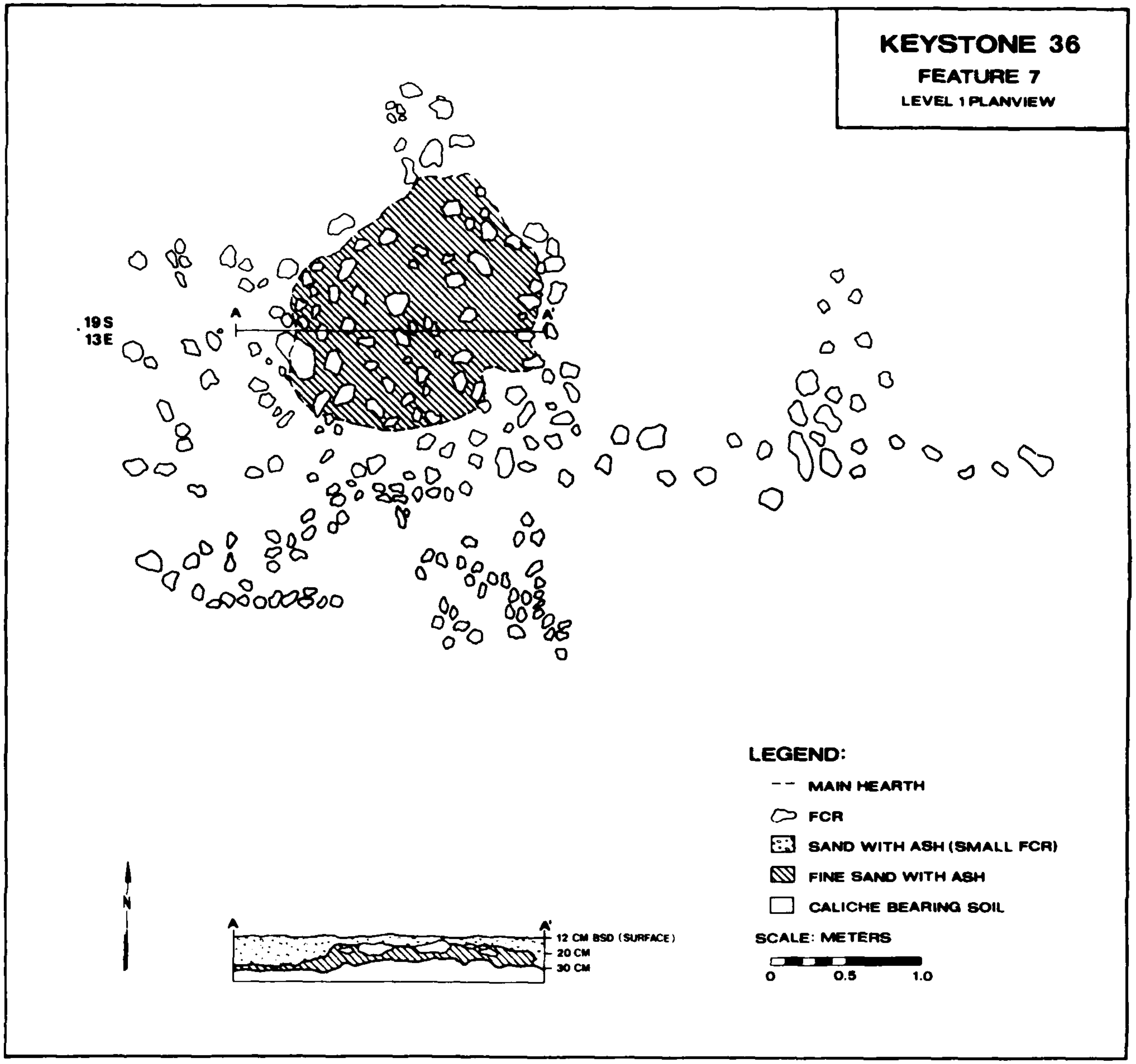


Figure 14. Plan and profile views of Feature 7, Site 36

The fire-cracked rock weight total from this feature was 399 kg, most of which was from the central concentration within the scatter. Of this weight, only four kilograms were rhyolite, the remainder consisting of dolomite.

A relatively high artifact density was noted in the excavation of this feature. Artifacts include plain brownware body sherds, hammerstones, and a groundstone fragment.

Feature 10

Feature 10 is located in the southern area of Site 36 at the coordinates 42S0E, where a 4 by 4 m excavation unit was established over a large surface scatter of fire-cracked rock (Figure 15). A dense concentration of fire-cracked rock was located in the center of the unit, but upon removal of the overlying deposits of aeolian sand the feature was found to extend north and a 1 by 4 m unit was added at the coordinates 38S0E.

Defined at level 1, the feature measured 3.3 m N/S and 3.3 m E/W. The fire-cracked rock was well articulated and associated with a dark soil matrix of carbonaceous sand, ash and charcoal. Subsequent excavation revealed that the feature decreased in size with depth, although the fire-cracked rock and carbonaceous soil continued to the caliche contact at a depth of 22 cm. A shallow, basin-shaped pit extending into the caliche was noted in profile.

The fire-cracked rock of Feature 10 was moderately fractured and averaged 5-15 cm in size. Total weight was 351 kg, of which only 2 kg were rhyolite, the majority being dolomite.

Artifact density in the area surrounding the feature was moderate. No groundstone artifacts or ceramics were recovered.

Small Fire-Cracked Rock Features

Feature 15

Feature 15 is located in the western portion of Site 36 in an area of high feature density (Figure 16). Small Fire-Cracked Rock Features 14 and 16 and Small Pit Features 13 and 18 are all located within a 10 m radius from Feature 15. It was discovered in a judgementally selected unit, coordinates 2S22W, originally established to investigate a surface dispersal of fire-cracked rock leading from the previously excavated Feature 13. Feature 15 was not visible until 15 cm of aeolian sand had been removed from the unit.

Figure 16 illustrates the stratigraphic relationships among Features 14, 15, and 18. Feature 15 is situated at a level 10 cm

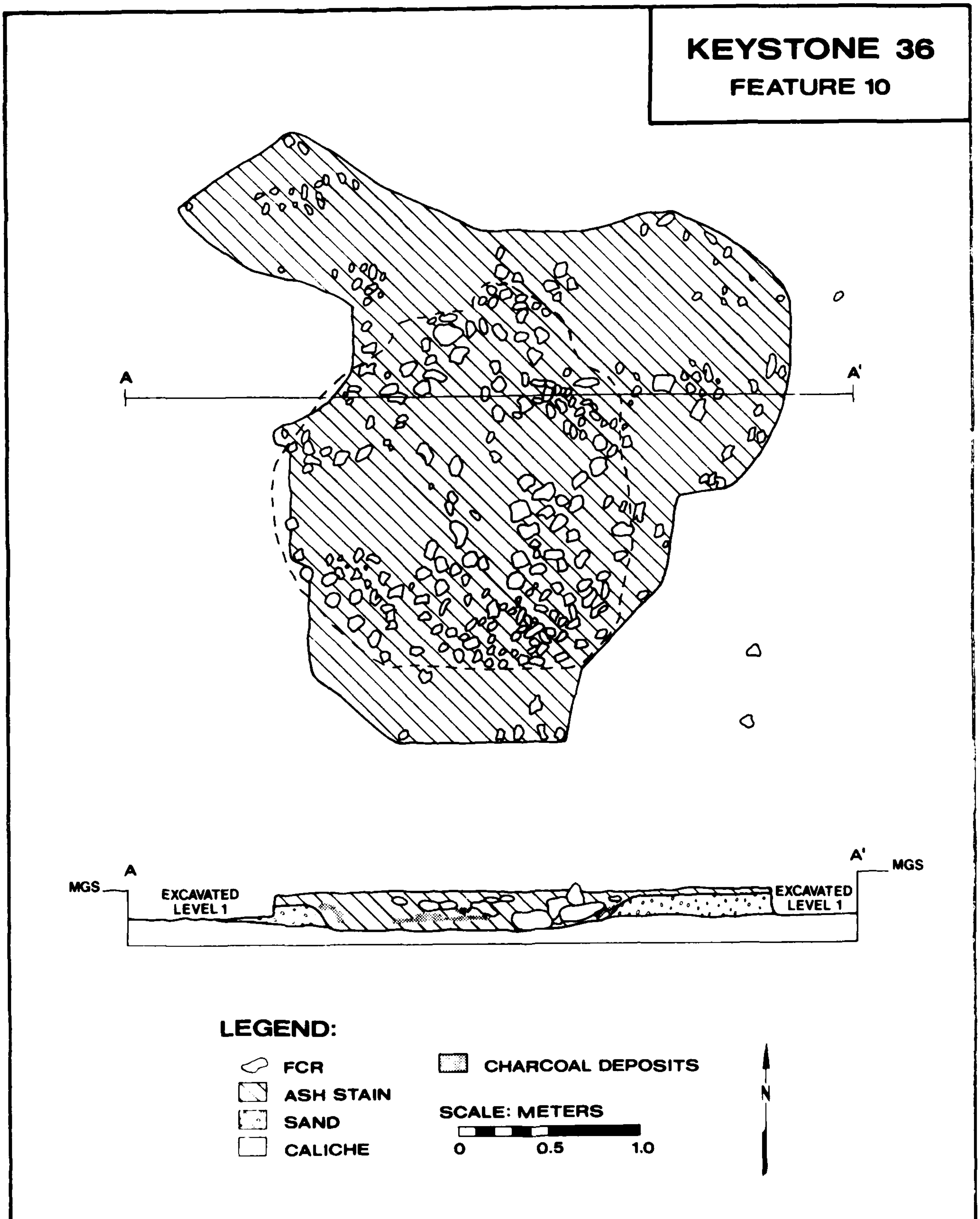


Figure 15. Plan and profile views of Feature 10, Site 36

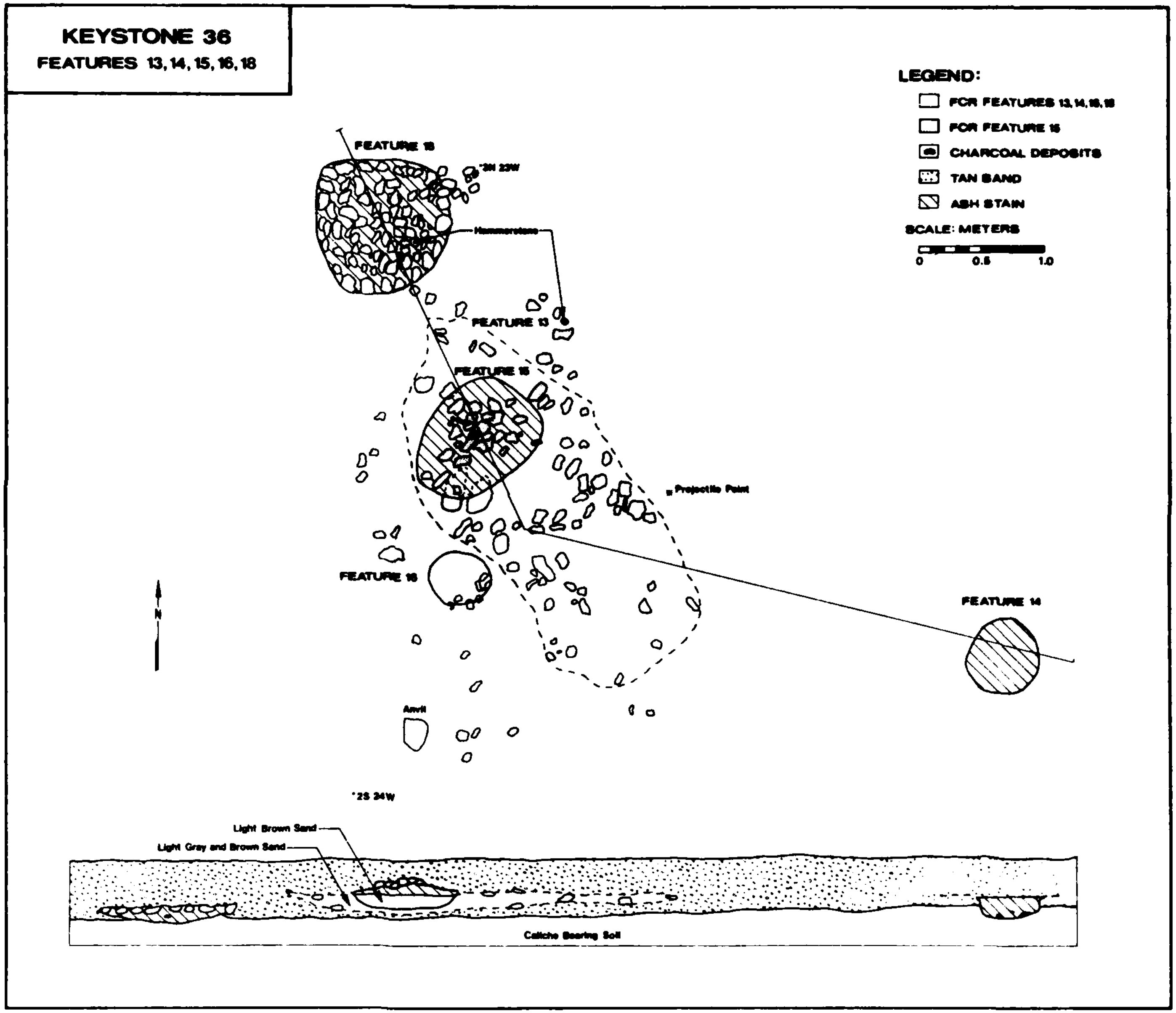


Figure 16. Plan and profile views of Features 13, 14, 15, 16, and 18, Site 36. Note the locations of the anvil, hammerstones, and projectile point. (See Figure 66a).

above Features 18 and 14. Feature 13, into which Feature 15 is cut, is located at the same occupational level as Feature 16; thus Feature 18 is the oldest of these features and 15 is the youngest. See Chapter 11 for a discussion of C-14 dates from these features.

Feature 15 is a well-preserved circular concentration of fire-cracked rock measuring 0.9 m N/S and 1.1 m E/W. The southern half of the feature was excavated, revealing in profile a basin-shaped pit extending 12 cm into the indurated caliche. Reduction stains were noted on the walls of this pit; however, the deposit of dark carbonaceous soil was only a few centimeters deep. The fire-cracked rock in this feature is highly fractured and oxidized, with an average size of 10-15 cm. Dolomite is the only material represented, with a weight of eight kg.

Feature 18

Feature 18 is located in the same area of high feature density as Feature 15 (Figure 16). It was situated under a deposit of dune-consolidated sand at a depth of 40 cm. As defined at this level, the feature is a dense concentration of fire-cracked rock measuring 1.1 m in diameter and is associated with a deposit of carbonaceous soil and charcoal. Construction of this feature appears to have been a basin cut into the compact sand and caliche horizons which was lined with cobbles. The highest fire-cracked rock density is in the upper portion of the feature and along the walls of the pit, while the densest carbonaceous soil and charcoal deposits are located in the bottom 5 cm of the pit fill. Two C-14 samples were collected.

Total weight of the fire-cracked rock is 41 kg, of which only 2.3 kg were rhyolite. Cobbles show a moderate amount of fracturing.

Feature 18 is located stratigraphically below the nearby Features 13, 15, and 16.

Small Pit Feature

Feature 14

Feature 14 is located in a judgemental unit at the coordinates 2S22W, a few meters to the southwest of the complex of features discussed above (Figure 16). Its stratigraphic position in relation to those other features indicate that it was at or slightly below the occupational level of Features 13 and 16. It was discovered 30 cm below the surface.

Feature 14 is a small basin-shaped pit measuring 0.5 m in diameter and is cut 14 cm through compact pebbly sand into the underlying indurated caliche. The fill is a grayish-brown deposit of reduced sand with some charcoal flecks present. Reduction of the caliche was noted in the side walls of the pit. Only 3 kg of fire-cracked rock was found within the fill.

Artifact density surrounding the feature was high. A projectile point base, Golondrina type, was recovered just west near Feature 13. However, there is no apparent temporal association between this Paleoindian point and the Small Pit Feature.

Keystone Site 37

Large Fire-Cracked Rock Features

Feature 2

Feature 2 was located in the extreme southern area of Site 37 at the coordinates 47S1E. A 4 by 4 m excavation unit was established around a surface scatter of fire-cracked rock from the feature. Excavation revealed a dense, oval-shaped concentration of fire-cracked rock (Figure 17), compact except for some deflation and dispersal in the southern extent where vehicle activity has disturbed and lowered the surface 30-35 cm. Maximum extent of the feature is 3.0 m N/S and 3.0 m E/W, with the area of highest fire-cracked rock density occupying an area of 2.6 by 2.0 m.

Excavation of three 10 cm levels revealed that the feature was covered by a 10-15 cm deposit of unconsolidated aeolian sand in the northern half and 2-3 cm of vehicle-compacted sand in the southern half. The depth of the feature is 31 cm in the center and 15-21 cm at the edges. A 1.5 by 1.5 m area of dark carbonaceous soil extended below the base of the fire-cracked rock, and a pit shape in this area is indicated by the decreasing areal extent noted in successive excavation levels.

Fire-cracked rock composition is primarily dolomite and is small, angular, and highly fractured. Average size is 10 cm. Weight of the fire-cracked rock is 66 kg found loose in the excavation unit and 654 kg recovered from within the feature, for a total of 720 kg.

Artifact density was moderate. One groundstone fragment was recovered from inside the feature.

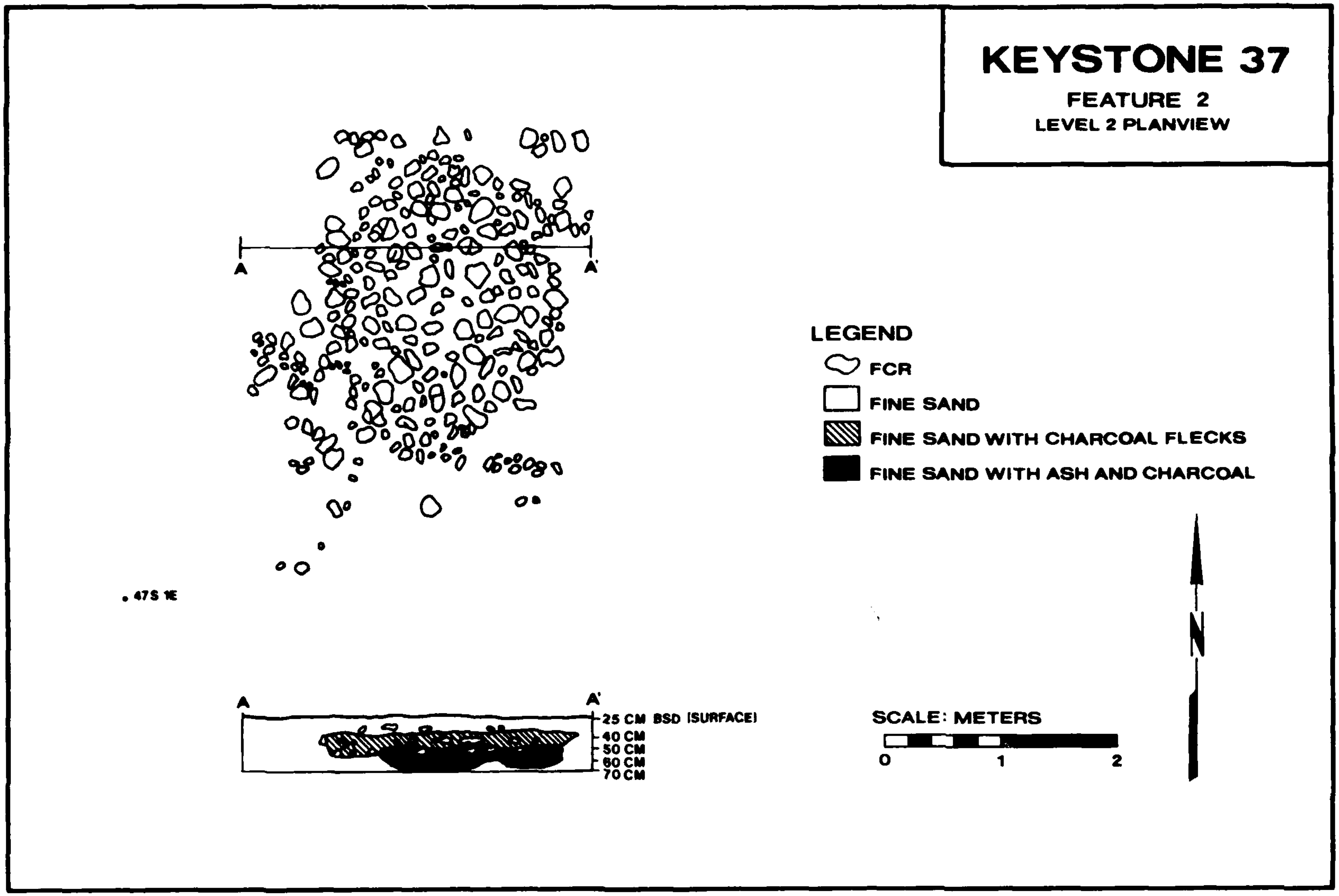


Figure 17. Plan and profile views of Feature 2, Site 37.

Feature 3

This feature was a circular ring of fire-cracked rock located in the northern area of Site 37 at the coordinates 32N8E. A 4 by 4 m excavation unit was established over a highly dispersed surface scatter of fire-cracked rock and was later extended 2 meters north and east in order to encompass the total extent of the feature (Figure 18).

Three arbitrary 10 cm levels were excavated. Feature 3 was found to be situated in compact pebbly sand underneath 2-3 cm of aeolian sand. As defined at level 1, the feature is a circular ring of fire-cracked rock measuring 2.1 m N/S and 1.8 m E/W, with a large area of dispersed fire-cracked rock and carbonaceous soil spread 2 m north and 3 m east. Within the ring of fire-cracked rock are moderately dark deposits of carbonaceous soil and some pockets of charcoal. Little fire-cracked rock was located in this area.

A 2 by 2 m strip was excavated as level 2 to a depth of 10 cm below the fire-cracked rock. The long axis of this strip cut through the center and southern areas of the fire-cracked rock ring and extended through a portion of the fire-cracked rock dispersal located to the east. Fire-cracked rock extended into this level only in the northern portion of the ring, and although deposits of carbonaceous soil were noted as particularly dense within the ring, they were also present outside of it.

Excavation of another 10 cm level revealed no further extension of carbonaceous soils, although some reduction stains were noted.

The profile of the level 2 and 3 excavation walls confirm that no cultural deposits extended below level 2 within the fire-cracked rock ring but were present in level 3 in areas outside of the ring to the east. This may be due to rodent activity. However, a more plausible explanation may be that the lower cultural deposits represent either an earlier use of the feature or emptying of the feature. The data on this feature indicate that at one time it was emptied, resulting in the ring-shaped remnant and the surrounding dispersal of scattered fire-cracked rock.

The fire-cracked rock of Feature 3 contained dolomite with a small percentage of rhyolite. Average rock size was 10-20 cm, with a high degree of fracturing noted and total weight was 341 kg.

A dolomite metate fragment was recovered from the ring of fire-cracked rock. Also, five sherds of an unidentified brownware were recovered from the excavation unit within a 2 m radius from the feature.

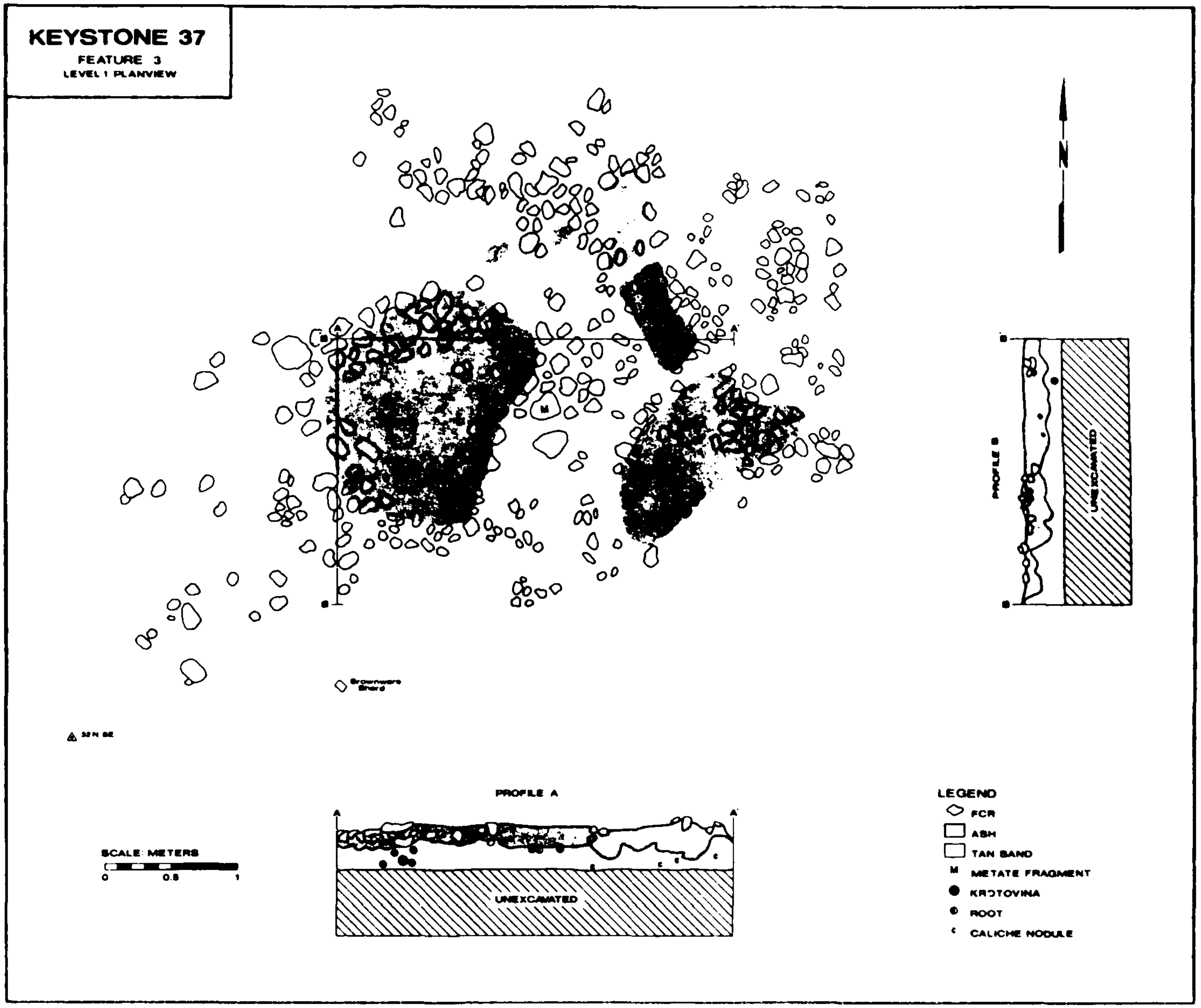


Figure 18. Plan and profile views of Feature 3, Site 37.

Feature 23

This feature consisted of an oval-shaped, loosely articulated scatter of fire-cracked rock encircling a deep deposit of carbonaceous soil (Figure 19) located in the central area of Site 37 at the coordinates 2S21W. A 4 by 4 m excavation unit was established here when replacement of a grid stake identified a buried soil stain. No evidence of the feature was noted at the surface.

Excavation of four arbitrary 10 cm levels revealed that the feature extended to a depth of 40 cm below the surface. Examination of the excavation wall profiles furnished evidence that the feature was originally a basin-shaped pit covered with a layer of fire-cracked rock slightly thicker in the center than at the edges. Fire-cracked rock was present throughout the entire excavation unit, and deposits of carbonaceous soil and charcoal were also extensive. These deposits extended 5 cm below the layers of fire-cracked rock.

As defined at the base of level 1, Feature 23 was a semi-circular ring of fire-cracked rock with displaced cobbles scattered primarily to the west and north. The western extent of the feature was estimated, as extension of the excavation unit was impeded by a large dune and numerous backdirt piles from the excavation of a nearby unit. Dimensions of the portion of the feature which was excavated are 2.6 m N/S and 2.0 m E/W.

The fire-cracked rocks were mostly small, highly fractured pieces, indicating either high temperature or long usage. Size ranged from 5-30 cm, with an average of about 10 cm. Dolomite was predominant, although some rhyolite occurred. Total weight is 172 kg for the estimated 3/4 of the feature excavated, with 230 kg estimated for the total weight.

A number of groundstone artifacts were collected from the feature and its excavation unit, including a small metate fragment, a large grinding slab, and one other unidentifiable fragment. It is also notable that the artifact density for the unit surrounding this feature was one of the highest at Site 37, with over 300 lithic artifacts recovered from the surrounding excavation unit.

Feature 34

This feature was located in the south-central area of Site 37 at the coordinates 18S12E, where a 4 by 4 m judgemental unit was established to fill a gap in the distribution of random units. No fire-cracked rock or other evidence of the feature was noted on the surface.

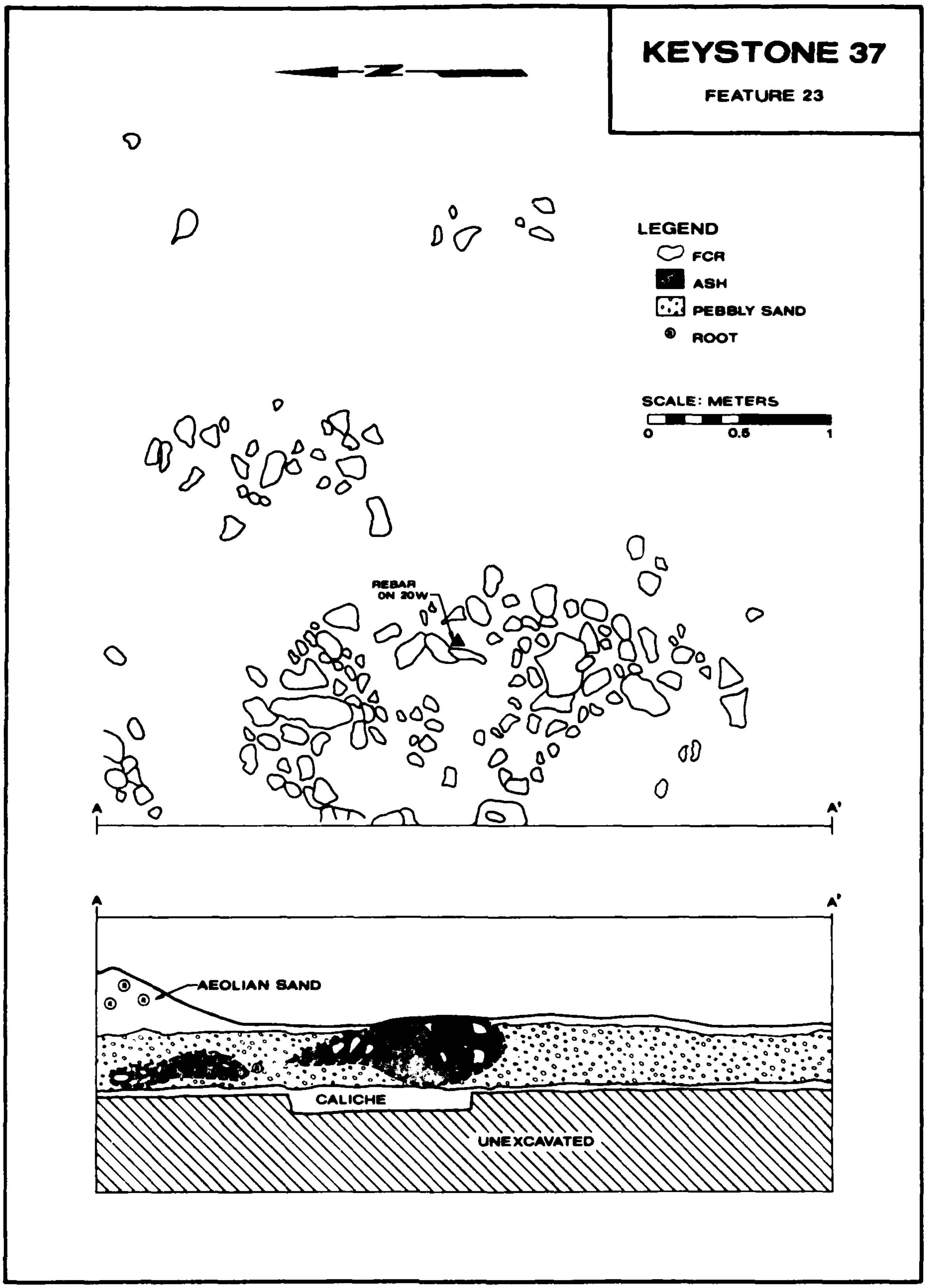


Figure 19. Plan and profile views of Feature 23, Site 37.

Excavation of the first arbitrary 10 cm level cleared overlying deposits of unconsolidated sand. The feature was encountered just below the interface between the compact pebbly sand horizon and overlying aeolian sand. As defined on the surface of this level, the feature is a roughly circular area of very dark carbonaceous soil with a very high ash content and dense pockets of charcoal (Figure 20). Fire-cracked rock protrudes from the center in a 0.5 m diameter area, and a few other cobbles are present throughout the surface. Maximum dimensions of the feature on the surface are 2.5 m N/S and 2.0 m E/W.

Terms of the contract modification limited the amount of investigation possible, so only the southwestern quarter of the feature was excavated. This revealed a deep deposit of very dark soil consisting primarily of carbonaceous soil, ash, and numerous pockets of charcoal. Fire-cracked rock was present in quantity throughout the upper portions of the fill.

Examination of the profile walls found no evidence of an underlying pit or basin. Rather, the base of Feature 34 was relatively level and had been dug into the compact pebbly sand horizon. In profile B-B a slight thickening can be seen at the center. Depth of the feature is 32 cm in the center and 20-25 cm around the edges.

The fire-cracked rock recovered from the quarter of the feature excavated was primarily dolomite and little rhyolite was noted. Cobbles are moderately fractured and average 10-20 cm in size. Weight for the excavated quarter is 120 kg, giving an estimated total of 480 kg for the entire feature.

Small Fire-Cracked Rock Features

Feature 21

This feature was located in the east-central area of Site 37 at the coordinates 20S24W, where a 4 by 4 m excavation unit was established over a small surface scatter of fire-cracked rock originally designated as Feature 20. Feature 21 was discovered during the excavation of this scatter, about 1 m to the northeast.

Feature 21 was detected in the northeast corner of the excavation unit under 20 cm of aeolian sand and compact pebbly sand. It is a small cluster of fire-cracked rock bordering a 0.3 m diameter pit (Figure 21). The fill of the pit was a dark carbonaceous soil. Heat reduction was noted on the sides of the pit, and a large sample of charcoal was recovered from the fill.

Both Feature 21 and the fire-cracked rock scatter designated as Feature 20 were located in an area of soft aeolian sand in an off-road vehicle track. The fire-cracked rock from Feature 20 is highly dispersed with no recognizable articulation or associated

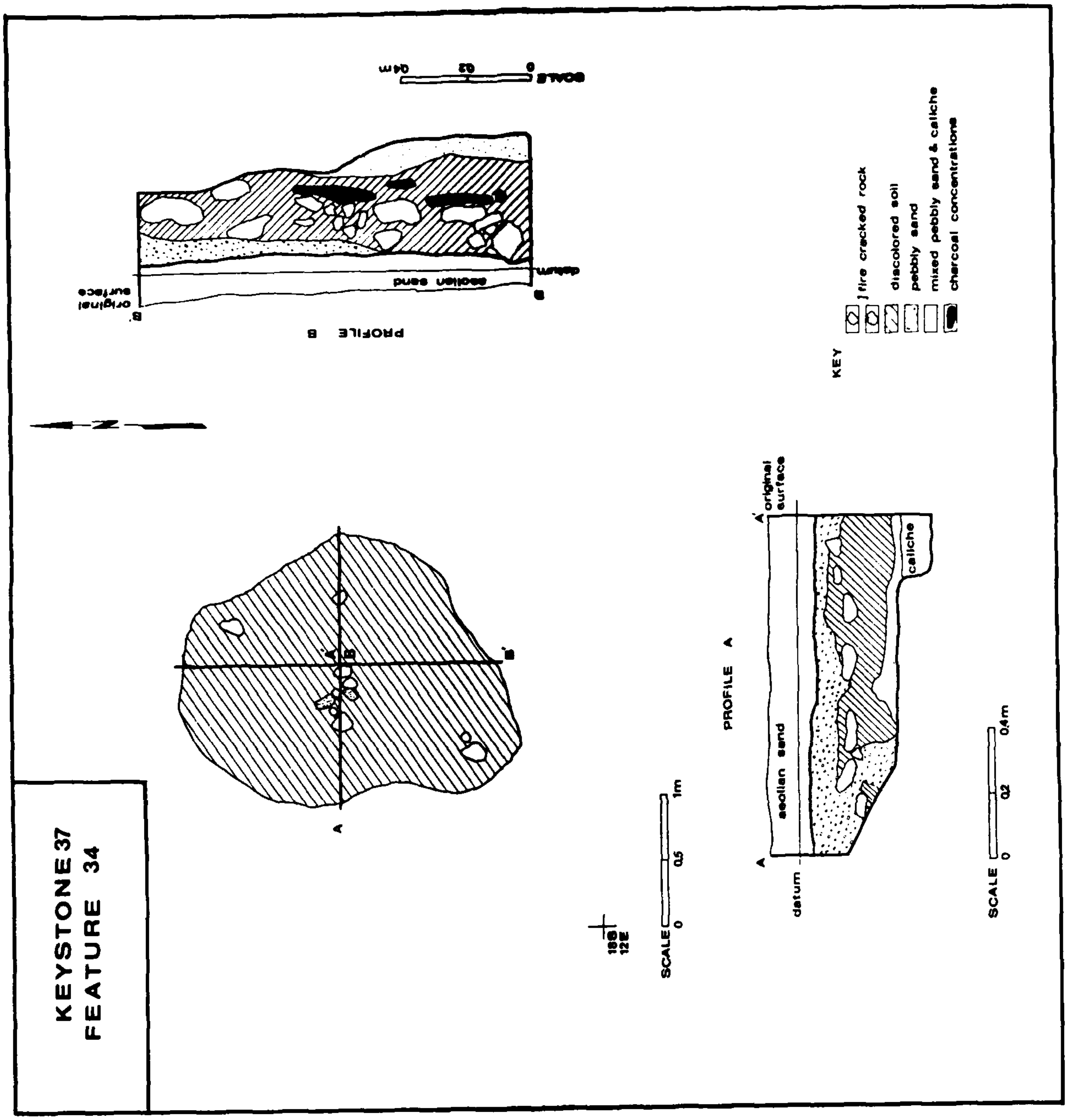


Figure 20. Plan and profile views of Feature 37, Site 37.

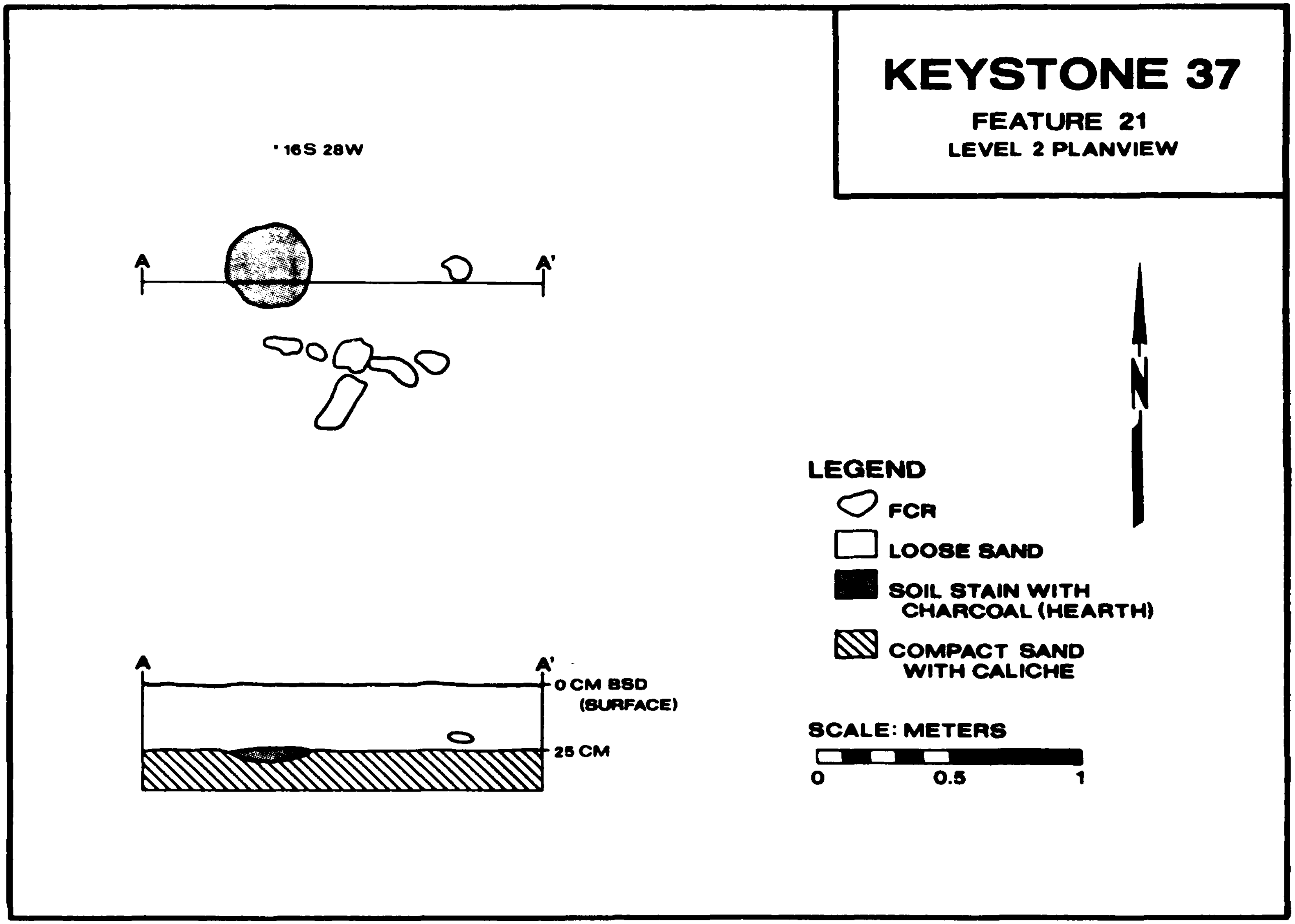


Figure 21. Plan and profile views of Feature 21, Site 37.

pit. Therefore, it is felt that Feature 20 may be a downslope dispersal of the fire-cracked rock once comprising Feature 21. This dispersal and destruction of Feature 21 could have resulted from the extensive vehicle disturbance in the area.

Reconstructed measurements for the feature are 1.0 by 1.0 m, and are based upon evidence of discolored soil in the excavation walls and the surface of the excavation unit around Feature 21.

Fire-cracked rock ranged from 3 to 30 cm in size. Total weight of the fire-cracked rock recovered from both features in the unit was 50 kg. It should be noted that only eight kg were directly associated with the pit of Feature 21, the other 42 represented that which was recovered loose in the excavation unit and labeled Feature 20. Over 135 artifacts were collected during the excavation, making the area around Features 20 and 21 one of the highest density concentrations at Site 37.

Feature 22

Feature 22 was a small, very well preserved feature located in the west-central area of Site 37 at the coordinates 2S22W. A 2 by 2 m excavation unit was established when the corner of this feature was detected at the base of level 3 during the excavation of an adjacent unit, 4S29W. No evidence of the feature was seen on the surface, as it was situated under 25 cm of dune sands.

Feature 22 contained a well-articulated concentration of fire-cracked rock, circular in shape, and with a higher density of fire-cracked rock around the edges than in the center (Figure 22 profile A-A'). This gives it an apparent ring-shape. Dimensions of the feature are 1.0 m N/S and 0.8 m E/W.

The areas surrounding the rocks contained a dense deposit of carbonaceous soil with dark pockets of ash and charcoal. These deposits were concentrated in the central region of the feature where the fire-cracked rock density was lowest. In profile, the fill occupies a basin-shaped pit cut into compact pebbly sand to a depth of 13-15 cm. The base of the pit lay 2-4 cm above the caliche substrate.

Little erosion, deflation, or root disturbance had affected the feature, although two rodent burrows outlined the fire-cracked rock around the north and east sides. Examination of these burrows revealed that they had not penetrated or disturbed the inner fill of the feature.

The fire-cracked rock was primarily moderately fractured dolomite, ranging in size from 5 to 15 cm. Total weight of the fire-cracked rock amounted to 61 kg.

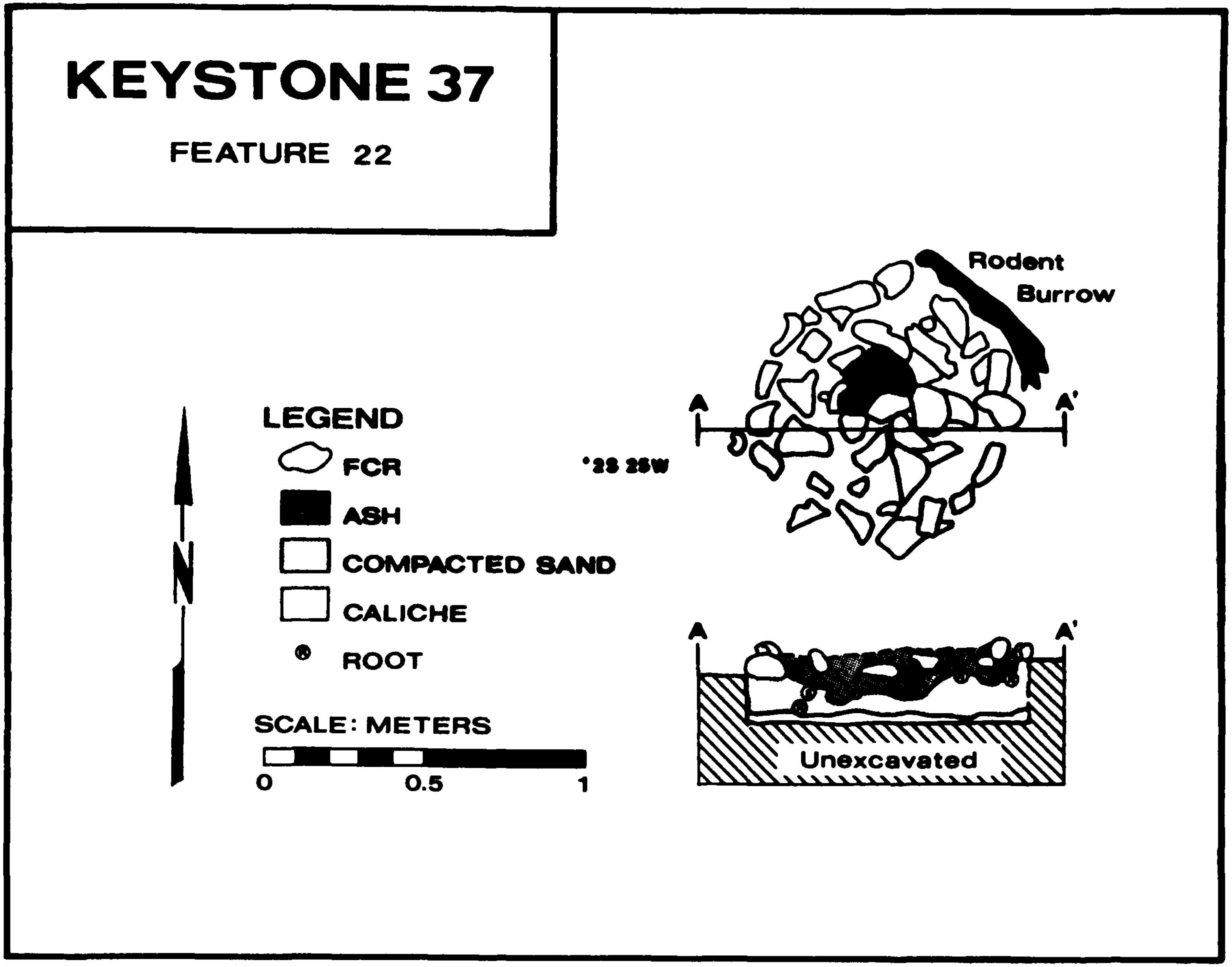


Figure 22. Plan and profile views of Feature 22, Site 37.

Artifacts recovered from the nearby 4 by 4 m excavation unit include a mano and grinding slab fragment, both found ca. 3 m from the feature and at a level equivalent to that of Feature 22. However, it is uncertain whether these artifacts are associated with Feature 22, or Feature 23 which is located to the east. A large number of flakes and scrapers were also recovered from this unit. A drill was found on top of Feature 22, and a small chalcedony core was retrieved from inside the feature.

Feature 25 (A and B)

Feature 25 was detected by backhoe excavations in Trench 14. A 4 by 4 m judgemental excavation unit was established around the feature at the coordinates 2N8E. Examination of Feature 25 in the trench profile and during excavation found that it is actually two superimposed Small Fire-Cracked Rock Features representing two distinct episodes of construction and utilization. These two features were labeled 25A and 25B. Excavation determined that Feature 25A was the most recent as it intruded into Feature 25B (Figure 23).

Both features were located in compact pebbly sand under 5-10 cm of aeolian sand. As revealed at level 1, Feature 25B is a roughly circular area of loosely-articulated fire-cracked rock situated in a matrix of mottled tan sand, ash, and carbonaceous soil and measures 1.5 m N/S by 1.6 m E/W. Its southern extent was disturbed by Feature 25A, a circular area of moderately dark carbonaceous soil and ash which measures approximately 0.5 m N/S and 0.8 m E/W. A much lower density of fire-cracked rock was present within Feature 25A than Feature 25B. Both features were disturbed at the south side by the excavation of Trench 14.

Excavation proceeded by removal of the fill of the western half of each feature, leaving a north/south profile. A second profile was cut along an east/west axis parallel to the edge of Trench 14. In both profiles Feature 25A was observed as a semi-rectangular pit which had been excavated through Feature 25B and the underlying compact pebbly sand to a depth of 25 cm. Two strata were present within the pit fill. In the central area of the pit, the upper 15 cm of fill consisted of mottled tan sand, carbonaceous soil, and ash nodules. Surrounding this deposit and lining the walls and base of the pit was a second deposit of very dark carbonaceous soil and charcoal averaging 7-10 cm in depth. Little fire-cracked rock was present in either stratum.

Feature 25B was observed in profile as a shallow-sided basin constructed 20 cm into the compact pebbly sand horizon. Three strata were noted within the fill of this pit. The upper 10 cm is a deposit of dark carbonaceous soil and charcoal. Almost all of the fire-cracked rock for Feature 25B was recovered from this stratum. A second fill of mottled tan sand and charcoal lined the walls and base of the Feature 25B pit. A third deposit of ash and

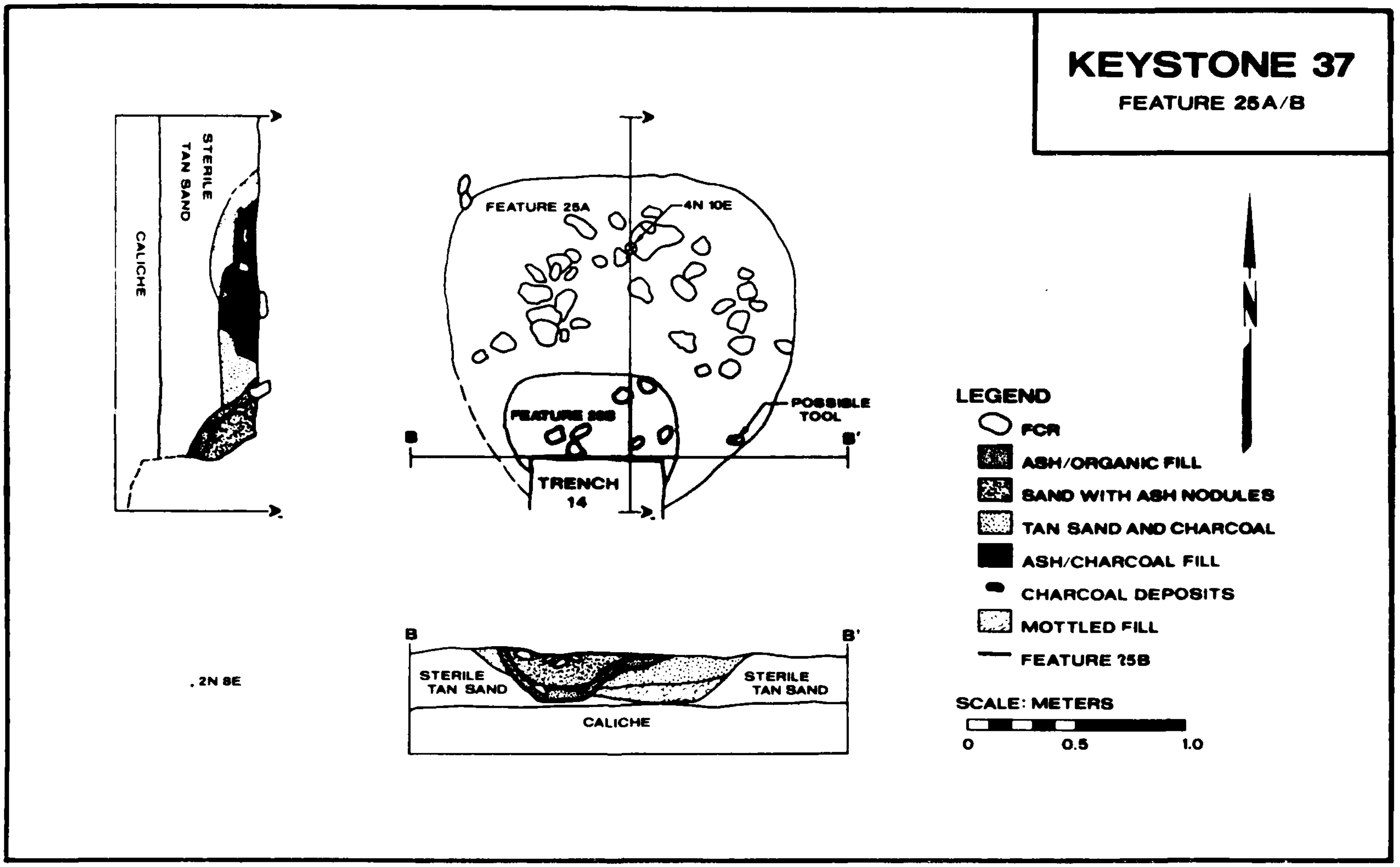


Figure 23. Plan and profile views of Feature 25, Site 37.

charcoal occupied a small area between these two strata.

That two episodes of construction and utilization are represented by Features 25A and 25B is clearly evident. Additional episodes of reuse may be indicated by the different strata revealed in the two profiles. This factor will be further discussed later in this section.

The fire-cracked rock composition of both features was primarily dolomite, although a much higher percentage (20-25%) of rhyolite was present in these features than the others at Sites 36 and 37. The total fire-cracked rock weight for Feature 25A was 21 kg, of which 4 kg were rhyolite. Feature 25B had a total weight of 44 kg, 10 kg consisting of rhyolite.

The artifact density in the surrounding excavation unit was moderate. A groundstone mano was recovered from within Feature 25B. Also recovered was a small unidentified brownware ceramic sherd.

Feature 36

Feature 36 was located in the central area of Site 37 at the coordinates 10S14W. It was discovered at the base of level 2 under 20 cm of unconsolidated aeolian sand in a random excavation unit. No indication of the feature was present at the surface.

As defined at level 2, the circular feature measured 1.1 m N/S and 1.2 m E/W. The fire-cracked rock was well-articulated although deflated, appearing as a single layer in profile. No ring configuration was apparent.

The soil matrix of Feature 36 is a dark deposit of carbonaceous soil with numerous small flecks of charcoal. Depth of this deposit is unknown, as budgetary constraints prohibited excavation beyond level 2. The fire-cracked rock is small in size and is moderately fractured. Estimated weight of the fire-cracked rock is 57.5 kg.

Fifty-five artifacts were recovered from the random excavation unit encompassing the feature, making it one of the higher artifact densities at Site 37. No groundstone or ceramics were recovered.

Feature 44

Feature 44 was initially detected in the west profile of Trench 31. Time constraints prohibited a complete excavation of this feature, and thus it was defined and mapped only at the surface.

Feature 44 was a deflated and eroded feature consisting of a single layer of dispersed fire-cracked rock. Although the eastern 1/3 of the feature was removed by the backhoe trench and the remainder of the feature is eroded, a ring-shape can be reconstructed based upon the lower fire-cracked rock density present in the central area of the fire-cracked rock concentration. Maximum dimensions of the feature are 1.0 m N/S and an estimated 1.0 m for the E/W extent.

The soil matrix contained a slightly discolored area of heat-reduced sand. Any deposits of carbonaceous soil or charcoal have been eroded. In profile, no pit or basin was evident.

The fire-cracked rock of Feature 44 is primarily dolomite, moderately fractured and averaging 5-15 cm in size. Total weight is estimated at 33.5 kg.

Small Pit Feature

Feature 31

Feature 31 was located in Judgemental unit 11, coordinates 2N8E, directly to the east of Feature 30 just three m north of Feature 25. Feature 31 is a shallow basin cut into compact pebbly sand to a depth of 9 cm. Dimensions of the pit were 0.8 m N/S and 0.8 m E/W, within which a fill of slightly discolored sand and ash was observed. Heat reduction was noted on the side walls of the pit. No charcoal was present within the fill, and only two fire-cracked rocks were recovered during the excavation.

Functional Interpretations of Fire-cracked rock Features

Large Fire-Cracked Rock Features

Fire-cracked rock features comparable to the large features excavated at Keystone Sites 36 and 37 have been reported from a number of locations in west Texas and Southern New Mexico (Greer 1968a; Mera 1938; Sayles 1935; Wilson 1930). In the El Paso region, circular or semicircular fire-cracked rock features similar to the Site 36 and 37 features have been investigated on alluvial slopes near the Sierra Blanca Mountains southeast of El Paso (Skinner et al. 1974), the Hueco Mountains east of El Paso (Whalen 1977:160-161; Greer 1968b:111-115), and alluvial slopes of the eastern Franklin Mountains (Aten 1972; Hard 1983:15-37; O'Laughlin 1979).

Other large accumulations of fire-cracked rock have been identified in the Guadalupe Mountains and the Trans-Pecos area of west Texas and southeastern New Mexico (Applegarth 1976; Katz and Katz 1981:2033-207; Henderson 1976:47-51; Marmaduke 1978). These features are significantly more extensive and of greater depth than the Site 36 and 37 features, with numerous examples having horizontal dimensions of up to 20 m in diameter.

In the immediate Keystone area, large fire-cracked rock features are present at Site 32 (Fields and Girard 1983:96) and Sites 33 and 34 (O'Laughlin 1980:1-108). Discounting the different degrees of disturbance affecting the features at these sites, the majority are quite similar to the Site 36 and 37 large fire-cracked rock features in terms of size and material composition, particularly those located at Site 32. However, significant variation exists among the feature rock weights calculated during the three separate Keystone projects at Site 32, Sites 33/34 and Sites 36/37.

Existing data allow an interesting comparison among Sites 32, 36, 37, Sites 33 and 34. Although Fields and Girard (1983) do not give much attention to the differentiation between large and small fire-cracked rock features at Site 32 (presumably due to the extensive disturbance and dispersal of fire-cracked rock features at that site), two features, 21 and 32, may be identified as large fire-cracked rock features. The total weights of these two features (17.6 kg and 414.7 kg) are comparable to those at Sites 36 and 37. The Site 33 and 34 large fire-cracked rock features, however, are characterized by much greater total weights, with Features 2 and 3 at Site 33 and Feature 1 at Site 34 estimated at 2755 kg, 13215 kg, and 2013 kg respectively.

In their detailed functional interpretations of large fire-cracked rock features at Keystone Sites 33 and 34 and the Castner Heights Sites, O'Laughlin (1980:104-108) and Hard (1983:45-52) interpret such features as specialized roasting pits for the processing of the leaf succulents lechuguilla (Agave), and Sotol (Dasylirion wheeleri). Their analyses are based upon archeological, distributional, and ethnographic data.

Both O'Laughlin (1980:105-108) and Hard (45) reiterate the positions proffered by Sayles (1935), Wilson (1930) and Mera (1938) that the large, doughnut-shaped fire-cracked rock features, referred to as mescal pits and sotol pits, which they excavated in west Texas and southern New Mexico, have distributions following that of sotol (Dasylirion spp.) and are specialized roasting pits for the processing of these succulents. Mera (1938) also notes the possibility of agave (Agave spp.) roasting, and Hard (1938:49) and O'Laughlin and Greiser (1973) suggest the possibility that Yucca elata was also processed in rock features.

In the El Paso area, all of the known large fire-cracked features (Skinner et al. 1974; Greer 1968b; Whalen 1977; Aten 1972; Hard 1983; this study) are located near plant communities which include sotol and/or another leaf succulent variety, Agave lechuguilla.

As for the Keystone area, the location of Sites 36 and 37 in the upper Bajada vegetation zone correlates the distribution of the large fire-cracked rock features of these sites with local communities of leaf succulents, in this case lechuguilla. However, Sites 33 and 34 are not situated in the upper Bajada zone. Although Applegarth (1976) found no direct correlation between large fire-cracked rock middens and permanent water sources in the Guadalupe Mountains, permanent water is a criterion in the selection of agave roasting sites among the Mescalero Apache (Carmichael, unpublished field notes). This factor may also be operative at Keystone Sites 33 and 34; O'Laughlin (1980:105) states that the presence of the Rio Grande may have influenced the location of these sites.

Hard (1983:45-49) and O'Laughlin (1980:105-107) review a number of ethnographic accounts on the pit roasting of the leaves, roots, and hearts of leaf succulents by such Indian groups as the Diegueno of California (Castetter et al. 1938), Mescalero and Chiricahua Apache (Basehart 1974; Castetter et al. 1938), and Tarahumara of northern Mexico (Bye et al. 1975; Pennington, 1963, 1969). The Mescalero, Chiricahua, and Tarahumara occupy arid or semiarid regions bordering the El Paso area, and the ethnographic accounts of these groups often describe the processing of various Agave, Dasylirion, and Yucca species in roasting pits similar to the large fire-cracked features encountered in the El Paso area (O'Laughlin 1980:105-106; Hard 1983:45-49).

Similar interpretations have been proposed by investigators working in the Guadalupe Mountains and the Trans-Pecos regions (Henderson 1974; Katz and Katz 1981; Marmaduke 1978). In the Guadalupe Mountains, extensive accumulations of fire-cracked rock follow the distributions of Agave and Dasylirion. Basehart (1974:49-51) notes that the Mescalero Apache were known to have come to the Guadalupe Mountains to process agave.

From the preceeding discussion, it is evident that there is a general agreement that large fire-cracked rock features were utilized for the roasting of various leaf succulents. Evidence from Keystone Sites 36 and 37 will now be reviewed in light of the interpretations offered by other investigators.

The presence of large fire-cracked rock features at Sites 36 and 37 occur in the general vicinity of the natural distribution of lechuguilla. Although an important factor, this distributional pattern alone cannot substantiate the proposed utilization of these plants. Conclusive evidence depends upon the recovery of these species from cultural deposits within the fire-cracked rock features. Small amounts of carbonized leaf succulents have been recovered from Features 2 and 3 at Keystone Site 33 (O'Laughlin 1980:89, 107) and some features at the Castner Heights sites (Holloway in Hard, 1983:81). One of the primary objectives stated in the research design for the Keystone Site 36/37 project was a concerted attempt to recover botanical and pollen samples from the cultural deposits within fire-cracked rock features. The results of the analyses of pollen and flotation samples from the Site 36 and 37 large fire-cracked rock features provide tentative support for the view that leaf succulents were processed in them. One example of a fiber resembling agave was recovered from Feature 10 at Site 36 (see Chapter 12). In addition, on the basis of the results of soil phosphorous (Appendix 1) it is possible to rule out the roasting of rodents as an alternative (cf. Rice and Dobbins 1981).

The majority of fire-cracked rock features at Sites 36 and 37 were completely excavated, providing more detailed information on their shape and construction attributes than was available from the limited excavations at Sites 33 and 34. The body of data available on the Site 36 and 37 large fire-cracked rock features allows for comparisons with the characteristics of roasting pits reported in the ethnographic literature.

Among the large fire-cracked rock features subjected to a lesser degree of disturbance and erosion, thus retaining more of their original configurations, some evidence of a domed configuration is apparent. Furthermore, evidence of a pit or basin construction can be seen in the profiles bisecting a number of large fire-cracked rock features (e.g., Figures 14, 20).

Such data mirrors the accounts of roasting pit construction reported in the ethnographic literature. The construction of roasting pits involved the digging of a pit which was lined with rock, heating the rocks with a large fire, and placing the leaf succulents over a layer of grass or pine needles upon the heated rocks. In the Keystone area, it is likely that mesquite, reeds and grass were the primary materials used, although the presence of small juniper scales in charcoal from the features may indicate the inclusion of evergreen twigs analogous to pine needles in ethnographic accounts (see evidence on botanical remains in Chapter 12). A layer of rocks and/or soil was then placed over the leaf succulents (Basehart 1974:51; Castetter et al. 1938:32; Pennington 1963:129). After a period of one to several days, the cooked leaf succulents were removed.

Many of the large fire-cracked rock features at Sites 36 and 37 appear as flat, single layer concentrations of fire-cracked rock. It has been stated previously in this chapter that this configuration may be due to deflation processes. However, these features may be representative of another form of open roasting pit reported among the Tarahumara of northern Mexico by Pennington (1963:130) and Bye, Burgess, and Trias (1975:87-88). In this form of roasting pit, a thin layer of grass and pine needles was placed over a single layer of hot stones. Leaf succulents and a second layer of grass, pine needles, or wood branches were then placed over the first layers, and hot stones were pushed into this upper layer. The entire roasting pit was situated about a foot below the ground level.

The reuse and emptying of roasting pits is noted in the ethnographic accounts of the Diegueno (Castetter et al. 1941). Mera (1938) and Greer (1968a) also infer a process of reuse and emptying of archeological fire-cracked rock features. At Keystone Site 37, reuse of large fire-cracked rock features may be suggested in a number of cases, such as Feature 23. Two different concentrations of fire-cracked rock and cultural deposits were noted, and carbonaceous soil and fire-cracked rock were present throughout the 4 x 4 m excavation unit. The extraordinary amount of artifacts recovered from this excavation unit and the high degree of fracturing among the fire-cracked rock may be indicative of multiple use episodes.

The emptying of large fire-cracked rock features is evident at Feature 3 on Site 37, where large dispersals of fire-cracked rock surround a ring remnant of the original feature. An emptied large fire-cracked rock feature has also been noted at the Castner Heights Site 80 (Hard 1983:27-29).

Although the utilization of large fire-cracked rock features as roasting pits for processing of the leaf succulents sotol and lechuguilla is still not conclusively substantiated, it is believed that the data from Keystone Sites 36 and 37 further support the propositions of Hard (1983), O'Laughlin (1980) and others that this interpretation is most parsimonious.

Small Fire-cracked Rock Features

Fire-cracked rock features (or hearths) comparable to small fire-cracked rock features excavated at Keystone Sites 36 and 37 have been identified at numerous locales throughout the El Paso region (Aten 1972; Hard 1983; Lynn 1976; O'Laughlin 1979, 1980; O'Laughlin and Greiser 1973; Quimby and Brock 1967; Thompson and Beckett 1979; Whalen 1977, 1978, 1980; Carmichael 1983). These features have often been found cooccurring at sites with large fire-cracked rock features, although many have also been reported as occurring separately or within residential contexts (Whalen 1977, 1978; Carmichael 1983).

In the Keystone area, small fire-cracked rock features were excavated at Sites 29, 32, 33, and 34. Tables 6, 7 and 9 in Fields and Girard (1983) and Table 9 in O'Laughlin (1980) illustrate the morphological variation among small fire-cracked rock features described during the other Keystone projects. It can be seen that fire-cracked rock features at Sites 32, 36 and 37 have very similar morphologies in terms of average size and fire-cracked rock weight. However, comparisons between these sites and Sites 33 and 34 show that there is some apparent variation in small fire-cracked rock feature sizes and weights. The importance of this factor will be discussed later in this section.

In the El Paso area, investigators offering interpretations of the functions of small fire-cracked rock features have generally viewed them as representing either specialized single purpose features or as more general, multifunctional features. As with large fire-cracked features, direct archeological evidence in the form of associated botanical remains is rare, and thus the arguments have relied primarily upon artifactual, morphological, distributional, and ethnographic data. O'Laughlin (1979; 1980:118-125), concludes that as with large fire-cracked rock features, the small fire-cracked rock features at Keystone Sites 29, 33, and 34 and at other sites in the El Paso area are special purpose facilities utilized for the processing of leaf succulents. A brief summary of four of his arguments which are pertinent to the Site 36 and 37 data is provided below:

1) Again consulting the ethnographic literature, O'Laughlin (1980:118-119, 123-125) contends that the small fire-cracked rock features at Sites 29, 33, and 34 have diameters, shapes and other formal attributes within the range of ethnographically reported roasting pits but also notes that those within the small category have much shallower depths. Although ethnographic comparisons are important to the argument, he states that such an inconsistency in formal attributes makes functional interpretations based solely upon ethnographic analogies dubious unless further types of data are presented.

O'Laughlin (1980:119) sees the size and weight differences between large and small fire-cracked rock features as resulting from different degrees of recurrent utilization. Small fire-cracked rock features are compared to ethnographic accounts of newly constructed roasting pits being used for the first time, as opposed to large fire-cracked rock features representing accumulations of fire-cracked rock and cultural soil deposits resulting from successive episodes of utilization.

Another factor noted by O'Laughlin (1980:121) in a review of the ethnographic literature is that descriptions are lacking of small fire-cracked rock features being used as general purpose facilities.

2) Carbonized remains of leaf succulents have been retrieved from a small number of hearths in the El Paso area, principally from the Hueco Bolson (Ford 1977) and from Keystone Site 33 (O'Laughlin 1980:121). Although the sample is small, O'Laughlin states that the absence of carbonized leaf succulent remains in the preponderance of small fire-cracked rock features should not be considered as negative evidence, since the processing of leaf succulents would not necessarily result in the deposition of substantial quantities of such carbonized remains.

3) O'Laughlin (1980:121-122) disputes the interpretations of Wetterstrom (1978) and Whalen (1977, 1978) that small fire-cracked rock features are general purpose facilities used for meal preparation and warmth. If so, they should be widely distributed throughout the local environment and be frequently associated with sites where cooking and warming activities were common, such as residential sites or sites in higher altitudes. In a review of the distribution of small fire-cracked features through the El Paso area, he finds that hearths are rare in the Franklin Mountains (Way, n.d. in O'Laughlin 1980:121), absent at many excavated lowland residential sites in the region, and generally lack a distribution which correlates their proposed function as general use facilities.

4) The distribution of small fire-cracked rock features covaries with the distribution of leaf succulent plant communities (O'Laughlin 1980:122-123).

Functional interpretations of small fire-cracked rock features contrary to those of O'Laughlin have been proposed by Whalen (1977, 1978, 1980), Wetterstrom (1980), and Hard (n.d. in O'Laughlin 1980:120).

Whalen (1977:164) considers small hearths with burned caliche and small fire-cracked rock features, both termed "small campfire-sized hearths", as general purpose constructions utilized for a number of daily activities. His arguments are based upon criteria of their distribution within sites and throughout the Hueco Bolson, artifact associations, and their similarity in formal attributes through time.

Unlike O'Laughlin, Whalen (1977:21,164) sees a broad distribution of small fire-cracked rock features throughout numerous environmental zones and site contexts. In the Hueco Bolson, small fire-cracked rock features occur frequently at different types of sites, including examples which he has characterized as special activity or residential (Whalen 1977:21,164; 1978). Similar distributions were noted by Carmichael (1983a) in the Tularosa Basin.

From an analysis of artifact collections from large and small fire-cracked rock features Whalen supports his interpretation with the observation that ceramics, lithics, and groundstone artifacts are significantly more numerous in association with small fire-cracked rock features (Whalen 1977:164, Table B1) than across sites generally.

Finally, in a later study Whalen (1980:26) notes that hearth attributes of size, shape, and distribution show little variation through time, indicating some consistency in hearth function through successive periods of differing subsistence patterns and strategies.

In an analysis of botanical remains from small fire-cracked rock features in the Hueco Bolson, Wetterstrom (1980:26) views the paucity of hearth associated, carbonized leaf succulent remains as negating the utilization of small fire-cracked rock features for the processing of such plants. She interprets a pattern of generalized use, primarily a function of domestic cooking and body warmth, based upon the recovery of seeds from a number of plant species in small hearths.

Hard (n.d. in O'Laughlin 1980:120; 1983) takes a position between those of O'Laughlin and Whalen. Using ethnographic data, he contends that small fire-cracked rock features weighing over 13 kg and having dimensions greater than one meter were functionally equivalent to large fire-cracked rock features in the processing of leaf succulents. Small fire-cracked rock features with lower weights and smaller sizes are the equivalent of Whalen's "campfire-sized hearths" and were general purpose facilities used for domestic cooking and body warmth.

It is clear from the preceeding discussion that the function of small fire-cracked rock features has not been conclusively determined and that existing data which could support a conclusive interpretation, especially hearth associated botanical remains, is sparse. Previous investigations in the Keystone area have added some dimension to the debate, primarily O'Laughlin's report on Keystone Sites 29, 33, and 34. In the Keystone Site 32 report, Fields and Girard (1983:122-123) lean towards O'Laughlin's arguments, although they also note that the insufficient data existing on small fire-cracked rock features precludes a definite assessment of their function. However, their discussion is a rather brief comparison of the views held by O'Laughlin and Whalen and contains little reference to the archeological record of Site 32.

Sites 36 and 37 are the most intensively studied sites in the Keystone area, and the excavations have provided some additional insight into the possible functions of small fire-cracked rock features. Much of the debate over the function of small fire-cracked rock features is centered around the significance of the botanical remains recovered from a small sample of hearths and the otherwise general absence of significant botanical remains from the majority of small fire-cracked rock features in the El Paso region. The positions of O'Laughlin, Whalen and Wetterstrom have been summarized above, and will not be repeated here. However, it should be noted that the results of botanical analyses at Sites 36 and 37 also bear on the issue. Agave fibers were rare but were recovered only from a large fire-cracked rock feature. In contrast, several small hearths contained cheno-ams which may have been processed in the smaller features (see Chapter 12).

Intrasite data on the spatial distribution, comparative morphology, and associated artifacts of fire-cracked rock features at Keystone Sites 36 and 37 is also informative. The relatively large sample of well-documented and well-preserved fire-cracked rock features and information on their distributions relative to pit structures add a new dimension to analogous ethnographic accounts of roasting pit construction and usage.

First of all, it should be reiterated that there are definite morphological differences between large and small fire-cracked rock features in terms of size, depth, and weight (see Figures 12 and 13). This pattern has also been identified among the fire-cracked rock features at the Castner Heights Sites on the east slope of the Franklin Mountains, where Hard (1983:51, Figure 18), although using fire-cracked rock number as a variable rather than our variable of fire-cracked rock weight, has found a definite separation between the two types of features. Having identified the morphological distinction between large and small fire-cracked rock features, a consideration of the overall configurations of the examples retaining most of their original shape is important in light of ethnographic comparisons between large and small features.

That large fire-cracked rock features at Sites 36 and 37 and other sites in the El Paso region resemble the ethnographically documented roasting pits has been established in the previous section. A number of well-preserved small fire-cracked rock features, however, do not resemble better-preserved examples of large fire-cracked rock features, or ethnographic examples of them, and thus do not support O'Laughlin's (1980:118-125) contention that the two feature types represent the same task-specific function.

Feature 22 at Site 37 is particularly notable. This small, ring-shaped feature (Figure 22) does not resemble the ethnographically reported roasting pits, and it is difficult to envision a substantial amount of leaf succulents being processed within this feature, especially in the manner described by the ethnographic accounts (Basehart 1974; Castetter et al. 1938; Bye et al. 1975; Pennington 1963, 1969). The location of a chalcedony core within and a chert drill atop the feature is another factor which argues against a roasting function for Feature 22. A general purpose domestic hearth is a more likely function.

A number of other small fire-cracked rock features at Sites 36 and 37 are notable since their profiles reveal few rocks in the lower and central portions of the feature fill (see Figures 21 and 23). Such an appearance does not correlate well with the flat and bottom-lined rock constructions of the ethnographically reported roasting pits.

Data from Sites 36 and 37 do not support the proposition that small fire-cracked rock features may be first-use facilities and that large fire-cracked rock features are accumulations resulting from emptying and recurrent use of small features. Except for the problematical Feature 23 at Site 37, profile and plan view configurations of large fire-cracked rock features at Sites 36 and 37 show no evidence of having resulted from the successive reuse of a number of small features. The profiles show single episode construction and plan views demonstrate a relatively homogeneous clustering of fire-cracked rock. These characteristics support the suggestion that most Site 36 and 37 large fire-cracked rock features were constructed in a single episode, not by accumulation. It follows that the probability of small fire-cracked rock features being large features in-the-making, and, thus, functionally equivalent, is not great.

The argument for functional differences between the feature groups is further strengthened by patterns in their spatial distribution and on associated artifact distributions. At Site 37, the discovery of pit structures added a significant variable to a consideration of the spatial arrangement of large and small fire-cracked rock features. As discussed in detail in Chapter 10, a significantly closer association exists between small fire-cracked rock features and pit structures than large fire-cracked rock features and pit structures, implying a more general, domestic function for the small features (see also Chapter 9, Table 24). Large fire-cracked rock features average about 36 m from the nearest pit structures. The distance is significantly different than the 17 m recorded for the smaller features of probable domestic origin.

Whalen (1977:164) discussed an apparent dichotomy between the range and number of artifacts associated with large and small fire-cracked rock features in the Hueco Bolson and inferred from this pattern a multiple use function for the small features. His brief analysis has been questioned by Fields and Girard (1983:123), but the basis for their disagreement is not presented. Observations at Keystone Sites 36 and 37 on the range and number of artifacts and tool types recovered from areas surrounding large and small fire-cracked rock features support Whalen's findings.

A multivariate cluster analysis undertaken on the entire lithic assemblages of the two sites provided additional corroborating evidence (see also Chapter 10). At Site 37, the distribution of secondary flakes, tertiary flakes, and cores is mainly restricted to the area containing pit structures and small fire-cracked rock features. Primary flakes are distributed mainly around large fire-cracked rock features. It can be suggested that different activities were taking place in areas around pit structures and small fire-cracked rock features than were common at large fire-cracked rock features (see Chapter 10 Figures 51-64).

The nearly exclusive distribution of primary flakes around large fire-cracked rock features may be indicative of functionally specific utilization of the features. The initial processing of leaf succulents and lithic raw materials (primary core reduction) apparently occurred simultaneously around the large fire-cracked features. Thus, the absence of primary flake concentrations and the presence of cores and tertiary flakes around small fire-cracked rock features, is evidence against their representing the same task-specific function as the large features.

Having reviewed the intrasite data on small fire-cracked rock features at Keystone Sites 36 and 37, the broader implications of this data as it relates to patterns identified at other sites can now be addressed. Of primary interest is the spatial patterning of large and small fire-cracked rock features and pit structures observed at Site 37. Figure 36 (Chapter 10) illustrates that most large fire-cracked rock features are located around the periphery of Site 37 and as previously noted, they are more distant from pit structures than are the small features. This arrangement is manifested on other sites in the El Paso area at which large and small fire-cracked rock features and residential structures have been identified (O'Laughlin 1980; Whalen 1977, 1978, 1979).

At Sites 132 and 739 in the Hueco Bolson, Whalen (1977:3; 1979:349) reported a pattern where large to medium-sized "ring midden" roasting pits were distributed at irregular intervals around the periphery of the sites, separated from a number of household/small hearth clusters in the central regions of these sites. The implication is differential patterning of general, individualized activities from specialized communal activities at the large features around the periphery.

Another pertinent factor is the relative proportions of small to large fire-cracked rock features. At all sites where both have been identified (Fields and Girard 1983; Hard 1983; O'Laughlin 1979, 1980; O'Laughlin and Greiser, 1973; Whalen 1977, 1978, 1979) the ratio of small to large features is high, ranging from 2:1 to 10:1. Such frequency differentiation can be interpreted as representing different functions for small and large fire-cracked rock (or burned caliche) features. At sites with fire-cracked rock features, and especially at residential sites such as Keystone 33 and 37 and Hueco Bolson Sites 132 and 739 (Whalen 1977:3, 1979:345-358), the less frequently encountered large features may have served as special function facilities utilized by a number of families or social groups who resided at those sites. Whalen (1977:3; 1979:349) has implied communal usage by groups larger than a single household (in his view a single household is comprised of a nuclear family) for the large fire-cracked rock or burned caliche hearths at Sites 132 and 739. Both he (personal communication 8/82) and O'Laughlin (1980:124) envision the possibility that large fire-cracked rock features located on the fringes and alluvial terraces of the Franklin and Hueco Mountains were also used by task groups composed of several families or social groups.

Thus, in the preceeding scenario, small fire-cracked rock features located nearer to residential structures would represent single family use, and it follows that the implications of this pattern indicate a domestic, general purpose function. O'Laughlin, (1980:124) however, maintains his position that the small fire-cracked rock features were used for the processing of small amounts of leaf succulents but by small social groups similar in size to a single household although possibly different in composition (i.e., nuclear family vs. extended family).

In the opinion of the authors, the possibility of these two patterns operating simultaneously within a particular site is not viable. Furthermore, it seems unreasonable that the labor investment required for the construction of large roasting pits and processing of leaf succulents would be continually replicated at a smaller scale.

A final concern involves the overall distribution of small fire-cracked rock features throughout the El Paso region. As with other sites in the Keystone area, Sites 36 and 37 are located within the natural distribution of the leaf succulents sotol and lechuguilla. The small fire-cracked rock features located at other sites near the Franklin or Hueco Mountain alluvial terraces also covary with the distribution of these leaf succulents. However, numerous small features, incorporating either rock or burned caliche, have been found throughout the Hueco Bolson (Whalen, 1977, 1978, 1980) and Tularosa Basin (Eidenbach and Wimberly 1980; Carmichael 1983a) in environmental zones where sotol and lechuguilla are absent.

Fire-cracked rock hearths and burned caliche hearths have been determined to be equivalent facilities (O'Laughlin 1980:123; Whalen 1980), the variation in the types of materials (rock vs caliche) used in their construction relating to their distance or proximity to rock and caliche sources (Carmichael 1983a). Since there is no apparent functional difference between these two forms of small features, O'Laughlin (1980:123-125) contends that their distance from plant communities including sotol and lechuguilla can be explained by their distribution within a different environmental zone characterized by the occurrence of Yucca elata. He suggests that small fire-cracked rock features and burned caliche hearths in these basin areas thus served the same function as their counterparts near local mountain regions - the processing of leaf succulents, but with Yucca elata instead of sotol and lechuguilla as the utilized food source.

This argument is not well supported by ethnographic evidence for the region since Yucca elata is noted as being roasted relatively rarely. It also runs counter to botanical evidence in the desert basin areas for the processing of a variety of seeds (Ford 1977; Wetterstrom 1978; Brethauer 1978). It is certainly possible that yucca was occasionally roasted but it seems unlikely that such activities could account for all of the hearths on the more than 5000 sites reported (from all time periods) in the southern Tularosa Basin (Carmichael 1983a).

In summation, the data from Keystone Sites 36 and 37 support a conclusion that large fire-cracked rock features and small fire-cracked rock features represent different functions:

1) There are definite and consistently identified morphological differences in size, shape, depth, weight, and overall configuration.

2) The better-preserved small fire-cracked rock features do not have formal attributes resembling ethnographically reported roasting pits, and the absence of ethnographic descriptions of small, general purpose hearths is not a strong argument for their suggested absence in the prehistoric record. Also, small fire-cracked rock features appear not to be the initial stages of a feature which by reuse would become a large fire-cracked rock feature.

3) Cluster analysis of artifacts indicates different activities occurring near the two types of fire-cracked rock features.

4) Small fire-cracked rock features are located closer to pit structures than are large fire-cracked rock features. The large features have location peripheral to residential clusters, and there is a higher proportion of small features than large features throughout sites in the El Paso region. These factors indicate a more general use for small features, possibly by individual households or families, and a task-specific and possibly communal utilization of large features.

5) Distribution of small fire-cracked rock features throughout alluvial mountain slopes and basin areas does not follow consistently the distribution of sotol and lechuguilla. Strong arguments have not yet been presented in support of the view that roasting yucca produced significant proportions of the hearths recorded on desert basin floors.

These patterns support Whalen's (1977, 1978, 1979) contention that small fire-cracked rock features and burned caliche hearths are general purpose facilities. Unfortunately, the conclusive botanical evidence is lacking, and so the argument still cannot be settled with total certainty. It is felt however, that the evidence from Sites 36 and 37 have provided a significant weight to the proposition that small and large fire-cracked rock features are the remains of functionally distinct facilities.

CHAPTER 8

FEATURE DESCRIPTIONS AND ANALYSIS: PIT STRUCTURES

by Myles Miller, David Carmichael and Mary Sullivan

Introduction

One of the more remarkable results of this project was the discovery of a series of shallow pit structures at Keystone Site 37. Since the site had originally been recorded as an ephemeral processing camp, the structures were completely unexpected. Furthermore, they differ from other small structures reported from the region in that more had been burned; they were detected during the final weeks of Phase I excavations, only after the profiles in trenches 8 and 12 had dried thoroughly. An investigation of two basin-shaped stratigraphic irregularities in these trenches revealed the structural nature of the features. The appearance of Feature 29 in profile, prior to excavation, is shown in Plates 1 and 2. A similar view of Feature 35 is seen in Plate 3. Plate 4 shows the result of Phase I excavations in Feature 29 and provides a good example of the general characteristics of the structures at Site 37.

Subsequent Phase II trenching and hand excavation located 23 additional possible structures. Of this total only a sample was excavated and at least 16 of the irregularities can now be identified as pit structures. Many of the remainder are probably structures as well, but, some appear to be too small and straight-sided to be comparable to the documented structures. It is possible that some of the smaller pits may represent storage facilities like those reported by Del Bene and Rorax (1984) near Mescalero, N.M., but the excavations produced no evidence of a storage function and some of the irregularities remain enigmatic.

All of the structures investigated at Site 37 were located in the northwestern area of the site. A second examination of the Phase I trenches placed throughout the site found no further structures, and the final backhoe scraping located only one. Considering the clustered distribution of the structures, the degree of testing accomplished, and the rationale behind the testing procedures (Chapter 4), it is felt that all, or nearly all, of the pit structures existing at Site 37 were exposed and recorded.

No pit structures were found during the examination of test trenches at Site 36, a fact which may seem surprising given the general similarities between the sites. It might be suggested that, due to differences in site size, fewer structures may have existed on Site 36, resulting in a reduced probability of identifying them during testing. While this possibility can not

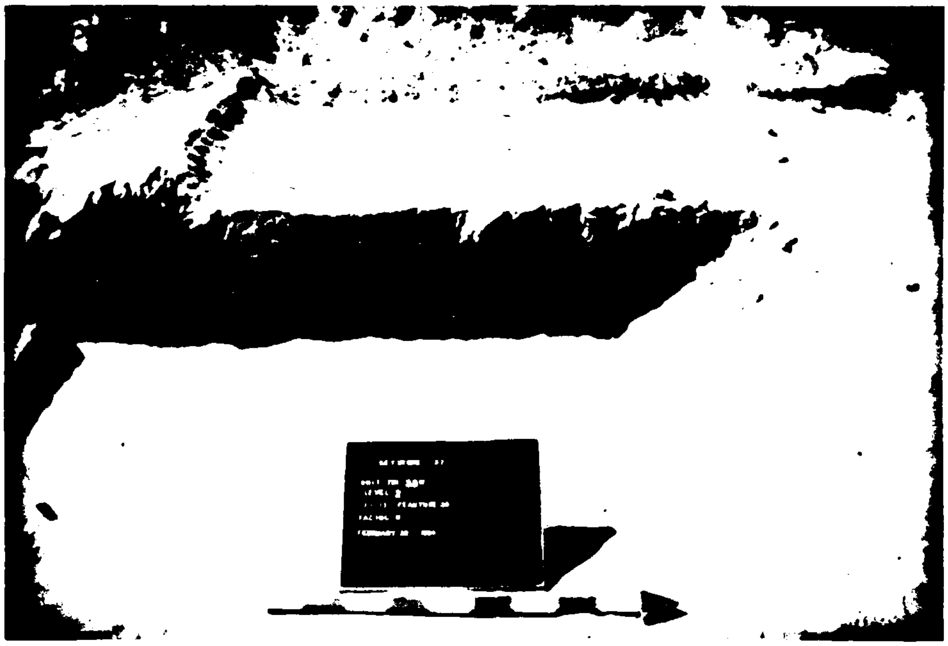


Plate 1. West profile of Trench 12, Site 37, showing the first indications of a pit structure (Feature 29) prior to excavation - North arrow is one meter long.

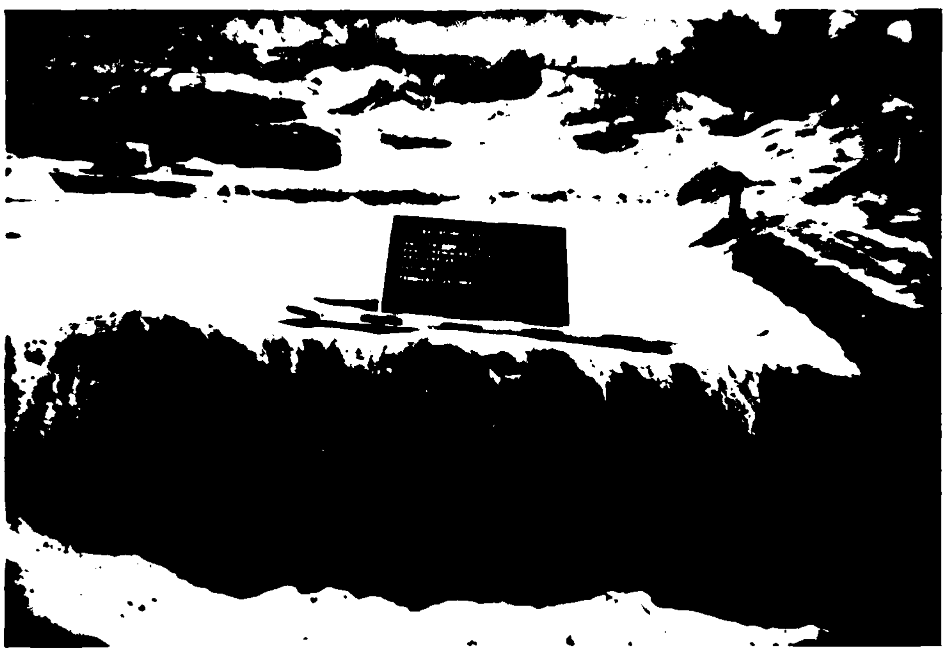


Plate 2. East profile of Trench 12, Site 37 showing outline of Feature 29 prior to excavation. North arrow is one meter long.

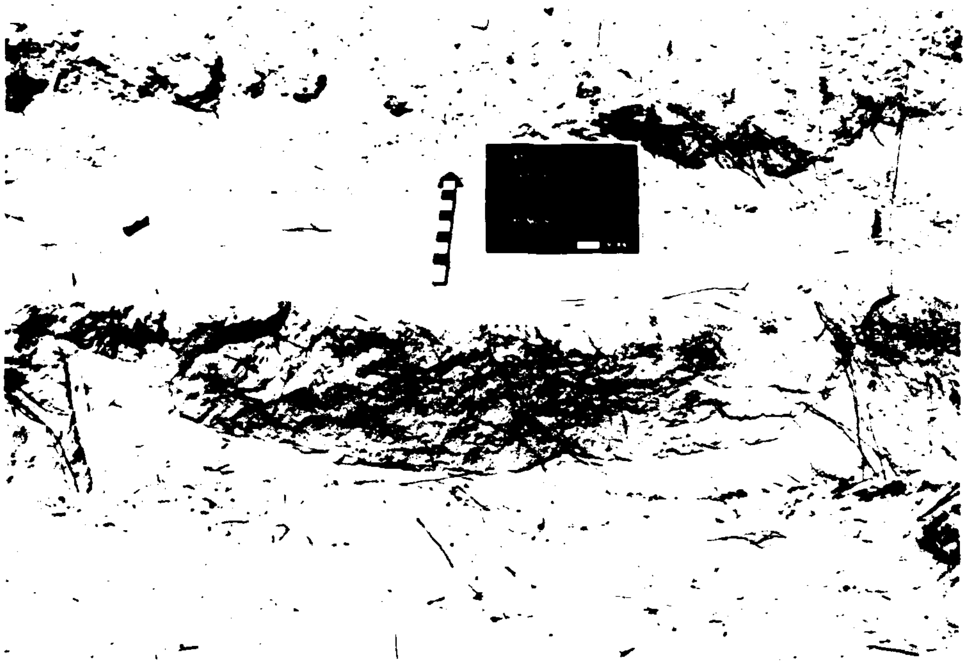


Plate 3. North wall of Trench 8, Site 37 indicating the presence of pit structure, Feature 35, prior to excavation. Scale is one meter in length.

Plate 4. Site 37, Feature 29 after completion of excavations. North arrow is one meter long.

be completely ruled out, there are several details regarding the excavation of Site 36 which suggest that structure identification was not affected by problems of sample size.

First, it should be noted that a proportionately greater area of Site 36 was tested by trenching than was the case at Site 37. Using the formulae presented in Chapter 4 in order to account for the edge effect in transect sampling, the estimated sample fraction (ESF) was calculated for each site. Trenching at Site 36 provided a subsurface sample of 19%, as compared to only 14% at Site 37. Thus, if structures existed in similar densities at both sites, their probability of identification would be greater at Site 36. Even if they occurred in reduced frequency at Site 36, the larger sample should have ameliorated much of the problem.

In addition to trenching, approximately 8% of Site 36 was scraped down to the carbonate horizon (see Figure 5). At Site 37, the pebbly sand stratum was relatively thick and not all of the structures reached caliche. At Site 36, however, the carbonate zone was considerably more indurated and closer to the presumed living surface. If there were to be any differences in the indication of potential structures at the two sites, features would be more likely to leave depressions in the carbonate horizon at Site 36. The identification of several features, but no structures, excavated into caliche at the site supports the view that structures are in fact lacking.

A third line of evidence for a lack of structures at Site 36 was provided by subsequent CRMD excavations at Keystone Site 35 (Stuart 1984). Site 35 is merely an eastward extension of Site 36 and it could have been possible that any structures were concentrated in areas east of the right-of-way. Backhoe exploration was also carried out at Site 35, with the trenches providing an 18% subsurface sample. Finally, by the time CRMD crews were working at Site 35, Corps construction of the diversion channel through Site 36 was well underway. The channel provided a cut approximately 20 m wide through the main area of the site. The sidewall profiles were checked and, although subsurface cultural remains were ocassionally noted, no structures were observed.

This discussion serves to note that although the presence of pit structures at Site 36 can not be entirely ruled out, it seems unlikely that such features could have been completely overlooked at one site while being clearly in evidence at the other. The differential occurrence of pit structures is important because it implies some differences in on-site behavior, related mainly levels of mobility. This issue will be addressed at length later but suffice it to note that the lack of residential structures provided the first evidence that Site 36 may have functioned as a shorter-term logistic camp.

This chapter provides information on the form, distribution, artifact associations and dating of the Site 37 structures. Also included is a discussion covering the problems of identification and excavation confronted during the investigations of the structures, as well as the excavation techniques employed to overcome such problems. Primary emphasis, however, is given to detailed architectural descriptions.

The unexpected discovery of these pit structures has added another dimension to the study of ephemeral residential occupations and mobility strategies in the Keystone area and El Paso region. In the latter part of the chapter the Site 37 pit structures are compared to residential structures excavated at other sites in the region, and implications relating to the nature of ephemeral residence in the El Paso region are addressed.

Excavation Problems and Techniques

As previously noted, the first two pit structures discovered at Site 37 were found in the dried profile walls of two Phase I test trenches. All but one of the additional 23 features were located during the Phase II placement of nine 1 by 10 meter test trenches in the area where the first structures were situated. The rationale for the placement of these trenches has been reviewed in Chapters 4 and 6, and will not be repeated here. One pit structure, Feature 70, was found during the backhoe scraping undertaken on the final day of the project.

The Site 37 pit structures are ephemeral and lack many of the formal attributes characterizing long-term residential structures. This factor, along with the nature of the soils and post-depositional processes present at Site 37, created a number of problems in identifying them. The main difficulty encountered during the identification of the structures was the subtlety of the feature boundaries in the sandy soils. The pit structures were backfilled naturally with materials derived from, and very similar to, the surrounding alluvial pebbly sand horizon. The presence of any moisture within these soils effectively conceals their identity. Color and textural differences resulting from differential grain size or degrees of compaction of the aeolian deposits within and outside of the structures could therefore only be discerned after the profiles had dried for a period of several days (Plates 1, 2).

Another problem was that in many cases the interface between structure walls or floors and the surrounding natural soils had been obscured by root and rodent disturbances and water percolation through the soils. In such cases the structure boundaries were located by interpolation from existing boundaries and by noting compaction differences. These slight compaction differences were detected by inserting the point of a trowel 2 to 5 cm into the fill and cutting across the fill until a slight resistance was felt. The utility of this technique will be further discussed later in this section.

Time and contractual constraints prohibited the complete excavation of all pit structures, and thus three levels of investigation were undertaken. Basic architectural data on size, shape, depth, and post socket arrangement was recorded for all structures. Six structures, Features 29, 39, 40, 52, 55, and 70 were completely excavated. Features 35, 41, 45, 50, 51, 54, 59, and 63 were partially excavated, usually by removing the fill from one side of the trench contacting the feature. The remaining nine features (38, 42, 49, 56, 57, 61, 62, 64, and 65) were only cleared and defined at the surface.

The six structures chosen for complete excavation and the nine chosen for partial excavation were selected based upon the following criteria: 1) definite identification as a residential structure, 2) high artifact density in the surrounding area, 3) artifacts noted in the fill, 4) superposition of two or more structures, and 5) to evenly distribute the excavated samples throughout the area of the site containing structures.

Preliminary clearing operations were undertaken on all pit structures. Overlying deposits of unconsolidated sand were removed until the compact pebbly sand horizon was reached. The features were then defined at the surface. Surface definitions of the spatial dimensions and configurations were hindered by the same identification problems noted for the trench profiles. However, unlike the trench profiles, no color or textural differences could be discerned between the soil of the structures fill and the exterior soils at the surface, whether wet or dry. Delineation of the structure dimensions therefore relied upon differential soil compaction.

Pit structure boundaries could be discerned by inserting the point of a trowel 2 to 5 cm into the feature fill and cutting across the fill with a moderate degree of force until a definite resistance was noticed. This resistance was, of course, the more compacted natural aeolian sand deposit surrounding the less compact, more recent fill of the pit structure. The accuracy of this technique was repeatedly verified by the fact that the surface boundaries established by trowel point cutting almost invariably matched the pit structure boundaries observed in the trench profiles. In addition, subsequent excavation of structure fill showed that the curvature and size of the structures outlined at the surface were almost always verified by the subsurface configuration determined by the floors and caliche walls of excavated pit structures. Furthermore, a high degree of comparability was noted in the identification of feature boundaries by different excavators.

The shortcomings of this technique were apparent in areas of disturbance where the soil had been loosened. Roots were especially difficult. Not only was trowel cutting impossible among the roots, but soil compaction had been disturbed. In such cases, the pit structure boundaries were estimated. All things considered, the accuracy of the trowel point cutting technique and other evidence gives a high confidence that the dimensions and configurations recorded for the majority of the pit structures are accurate representations.

Each pit structure was circumscribed by a series of exterior post sockets. The term post socket is used to denote a hole whose diameter is not strictly indicative of the post dimensions. This view derives from the fact that some sockets contained one or two expended cores or fire-cracked rocks. The artifacts would presumably function as shims to wedge in posts of considerably smaller diameter than the sockets. There was no evidence of charred wood or stained soil which might indicate the size and location of posts. Identification of the sockets was difficult, as they could only be detected as small areas of a very slightly different texture than surrounding soils. Identification was accomplished through observation of such textural differences and by probing suspected post sockets with a chaining pin or pin flag. Once located, their horizontal dimensions were determined by trowel point cutting and their depths determined by probing.

For Features 29 and 70, the validity and accuracy of the post socket arrangement was verified by removing the compact sand horizon and examining the underlying caliche horizon. It was found that each original post socket locus had a corresponding 2-5 cm deep depression in the caliche. However, a number of other pit structures had areas of root and rodent disturbance around their perimeters. Only a 50-75% success in determining the post socket arrangement can be claimed for these features.

Interior postholes were easily identified and verified, as they could be seen in the floors and penetrated into the caliche bearing soil horizon.

Entrances were located for 12 pit structures. However, they were very shallow and many are questionable as to whether they are entrances or areas of disturbance. Some are definite, as trowel point cutting outlined them as rectangular areas leading from the boundaries of the pit structures.

After clearing and definition, 14 structures were selected for complete or partial excavation. Excavation of the pit structure fill proceeded by arbitrary 10 cm levels, with artifacts provenienced by quadrant (NW, NE, SW, SE). The lower 5 cm of the fill were carefully excavated by trowel scraping in order to permit point proveniencing any cultural materials present on the floors. All soil was screened through 1/4 inch mesh to recover artifacts, floral or faunal remains, and any roofing materials. Pollen, soil, and flotation samples were collected near the floor of each feature. Additional soil samples were collected from within the fill and directly outside the feature. These were used for later quantitative studies.

Many of the pit structures had been excavated into the carbonate horizon, and determination of the floor or base of these structures was relatively easy. Excavation proceeded more slowly for those which were dug into the compact pebbly sand. For these structures, the base was initially estimated by probing and this was checked against the feature depth observed in the trench profile. Most of the floors were found to slope upwards towards the outer boundaries, and thus the trench profiles were useful for determination of floors only in areas near those trenches. After probing, careful trowel scraping located the base of the features by observing slight compaction differences. Some structures had dried sufficiently for a slight color difference to be noted when the compact pebbly sand was reached.

Other observations aided in the identification of floors and the subsurface configuration of the pit structures. Roots were found to follow the interface between the feature fill and the surrounding soil both in the side walls and floors. Also, a change in the sound of the trowel scraping occurred when the more compact exterior sand was reached.

As with all features excavated during the Keystone Dam Project, detailed field records were maintained on all facets of the excavations. Maps were drawn of all pit structures, recording all architectural data in plan and profile, and associated artifacts were point provenienced on the maps. Photographs were taken of the features during all operations.

Pit Structure Characteristics

Distribution and Dating.

It is clear from Figure 2, that all of the pit structures present at Keystone Site 37 are located in the northwestern portion of the site, separate from the Large Fire-Cracked Rock Features. Within that portion of the site no particular distribution pattern is apparent and a number of structures are superimposed upon one other. Feature 51 was constructed over Feature 50, Feature 64 over Feature 65, Feature 57 was superimposed on Feature 62, and Feature 52 was found to be superimposed over two earlier structures, Features 59 and 63.

Chronologies for the features excavated at Sites 36 and 37 are addressed in Chapter 11. However, a brief review of the dates obtained for the Site 37 pit structures will be provided.

Five radiocarbon dates were obtained from charcoal samples collected in the fill of pit structures or near their floors. It should be noted that these samples were not found within any type of formalized hearth, but were recovered from small areas of carbonaceous soil located in the fill sands 2 to 3 cm above small depressions in the caliche floors, or as in the case of Feature 40, from the pit structure fill 10 cm above its base.

The radiocarbon dates obtained from the three pit structures having sufficient charcoal are as follows:

Feature 40	380+/- 80 A.D.	(1570+/- 80 B.P.)
Feature 35	1000+/-150 A.D.	(950+/-150 B.P.)
Feature 29	1090+/-130 A.D.	(860+/-130 B.P.)
Feature 29	1210+/- 90 A.D.	(740+/- 90 B.P.)
Feature 29	1390+/-100 A.D.	(560+/-100 B.P.)

Except for the aberrant date from Feature 40, the dates for charcoal from the pit structures fall within the period 1000-1400 A.D. (950-550 B.P.), through the range for the late Early Formative and Pueblo period. Also notable are the three internally consistent dates obtained from Feature 29. These dates further support the 1100-1400 A.D. range of obsidian hydration dates for Site 37 (See Chapter 11).

Characteristics.

It should be apparent from the preceeding discussion of excavation techniques that the pit structures located at Site 37 are ephemeral structures showing little formalization and having few attributes resembling longer-term residential structures. A review of the characteristics of the Site 37 pit structures is thus in order. These characteristics are discussed below under the headings of surface configuration and fill, floors and side walls, and superstructure.

Surface Configuration.

Some degree of uniformity is apparent among the horizontal definitions of the pit structures in that the majority are either circular or oval in shape. However, most structures show little symmetry. Some structures, such as Feature 49, are characterized by a rather amorphous shape which may be due in part to problems of definition arising from their being located in areas of root disturbed soils. Significant variation exists among the sizes of pit structures. The average diameter is 2.0 m with a range of 1.3 to 3.2 m.

Entrances were suggested for 10 pit structures. Some degree of uniformity characterizes such entrances as seven are oriented towards the north, two to the east, and one to the northeast. One southeastern entrance is highly questionable. The entrances of the pit structures were shallow depressions in the compact pebbly sand leading from the perimeters of the structures, and were determined by trowel point cutting. Their average depth was 10 cm.

Profile Configuration.

In the trench profiles, the pit structures appear as shallow basin-shaped constructions averaging 35 in depth, although some were as deep as 50 or more centimeters (Figure 21). All pit structures had been constructed by digging into the compact pebbly sand horizon and 13 were observed to extend into the underlying caliche horizon. As with the surface configurations, there was a wide range of variability among the depths and lengths of the structures observed in the trench profiles.

The fill of the pit structures was usually a homogeneous deposit of very pale brown (10YR 7/3), compact reworked alluvial sand. Evidence of internal stratigraphy was present in only two structures, Features 45 and 55. In both instances, thin layers of clean, pebble-free aeolian sand had accumulated on the floor prior to further in-filling by surrounding alluvial sands. Small pebble inclusions were abundant within the fill in all structures in amounts roughly equivalent to the natural soils surrounding the features. However, an important factor noted during excavation of the structure fill is that the small pebble inclusions were significantly more numerous in areas near the side walls of the pit structures than in the central areas of the pit structure basins. Since erosional processes would be more likely to deposit such small pebbles around the side walls within abandoned pit structures, such evidence further validates their cultural origin.

In an attempt to further document the characteristics of the pit structures, bulk density analyses were done on soil samples from inside and outside the structures. ˋe procedure involves the collection of equal volume samples of soil from the areas to be compared. The samples are then oven dried at 110° C. for 24 hours and weighed in order to calculate the density. Unfortunately the results of the bulk density analysis are inconclusive. We would expect the samples from the slightly less compact feature fill to have lower densities but this result is not always the case. The cause(s) of the inconsistent results are unclear but small sample sizes and similarity of feature fill and the surrounding parent material are likely contributing factors. The proveniences of the samples analyzed and the test results are listed in Appendix 1c.

In the trench profiles, artifacts and small lenses of charcoal were noted with the fill of Features 29, 39, and 55. Although exterior post sockets were seldom located in profile, interior post sockets were clearly seen as areas of compact sand extending into the caliche horizon.

The superposition of pit structures was noted by observing the floors of the features; the floor of an earlier structure curves upwards to, and is truncated by, the floor of the upper structure. Within the fill, however, the boundaries between two structures were indistinct and had to be determined by trowel point cutting. The relative temporal placement of two superimposed pit structures was further aided by the identification of a later structure's post sockets within the fill of an earlier structure.

Floors and Side Walls.

No formal plastered or use-compacted floors were found among the Site 37 pit structures. The floors were simply the compact pebbly sand or caliche horizon into which the structures had been excavated. The floors were uneven, usually sloping towards the center of the structures, and some were disturbed by bioturbation. Those structures having as their floor the caliche horizon were extremely rough due to the numerous caliche nodules in the soil.

No formal hearths were encountered on the floors. However, Features 29 and 35 had small 10-20 cm in diameter "fire areas" of carbonaceous soil and charcoal. These deposits were 2 to 5 cm thick and were situated in compact sand 2-3 cm above slight depressions in the caliche floors. The "fire area" of Feature 35 was located in front of the entrance (Figure 25).

Arguments that formal hearths present in other pit structures were removed by the backhoe test trenching operations of Phase II can be ruled out, as such trenching operations were closely monitored and no charcoal or fire-cracked rock was observed during the trenching or in any backdirt piles. On the other hand, it could be argued that other "fire areas" were present in the pit structures and that these were removed by the backhoe and the small samples of charcoal went unnoticed.

As with the floors, no plastered side walls were present in any structure. The Site 37 pit structures had walls consisting of the natural compact pebbly sand and caliche-bearing soils of the site.

Artifacts and fire-cracked rocks were present on the floors of five structures. Two flakes were found on the floor of Feature 29 near the "fire area". Feature 35 had fire-cracked rock on the floor, and Feature 39 had a number of large fire-cracked rocks, an anvil, and a flake on the floor (Figure 26). A pebble tool was found on the floor of Feature 40. Feature 55 had fire-cracked rocks and five flakes on its floor (Figure 30). None of the fire-cracked rock present on the floor of these structures was articulated or associated with any form of hearth.

Superstructure.

That some form of roof was erected over the Site 37 pit structures is suggested by the presence of both interior and exterior post sockets. The cultural origin of these post sockets has been established by a number of factors which will be discussed below, although as noted previously in this section, only a 50-75% accuracy can be claimed for the location and arrangement of the exterior post sockets.

Eight of the excavated pit structures have from one to four interior post holes present in their floors. No standard arrangement is apparent, although they are generally situated more often nearer the side walls than the central regions of the structure floors. The post holes generally penetrate into the caliche zone to an average depth of 10-15 cm, and average 10-15 cm in diameter. These dimensions could be clearly delineated as all interior post holes were excavated into the carbonate horizon.

Rodent burrows were also present in some floors. The post holes were easily differentiated from the rodent burrows through an examination of the fills and depths of these two features. Rodent burrows had a dark "mealy" fill composed of soft silty soil and a high percentage of very small, white pieces of caliche, while post hole fill was a homogeneous deposit of slightly compact aeolian sand. Furthermore, the bottom of the post sockets could be clearly viewed in the hard caliche horizon while rodent burrows extended well into the caliche.

Exterior post sockets were found surrounding all of the pit structures at Site 37. The number of sockets for each feature is variable, ranging from 11 to 33. This variation is primarily due to two factors: the wide range of sizes characterizing the structures and the difficulties in locating and defining sockets in the sandy soils of Site 37.

Exterior post sockets are small pits, tapering slightly to their bottoms, and excavated into the compact pebbly sand to an average depth of 12 cm and averaging 8-15 cm diameter. Many sockets had fire-cracked rock or exhausted cores in their side walls, functioning as shims for the posts. Post sockets were also located around "entrances" when present.

Evidence for the type of materials utilized in construction of the pit structure roofs at Site 37 is entirely lacking. Numerous examples of roofing clay have been found at other sites in the Keystone area. At Keystone Site 33, O'Laughlin (1980:140-144) recovered fire-hardened roofing clay from a number of contexts and houses. A small piece of clay daub and burned adobe plaster was also found at Keystone Site 32 (Fields and Girard, 1982:123). Unfortunately, at Site 37 no roofing clay or wood was recovered from the fill, floor, or post sockets of any pit structures.

Descriptions of the 25 pit features investigated at Site 37 are given below. Those pit structures which were completely or partially excavated are treated in more detail than those which were only defined at the surface. Descriptions of two problematical features, 43 and 53, will be reserved for the end of this discussion.

Feature 29

Feature 29 is located at the north end of Trench 12 at the coordinates 17N29W. A 4 by 4 meter judgemental unit was established around the structure, and thus an idea of the extramural artifact distribution is available for this pit structure.

In the trench profile, Feature 29 was observed as a basin-shaped pit with steep sides excavated through compact pebbly sand and into the carbonate horizon (Figure 24). Root and rodent disturbances had mottled the soil on the northwest edge of the structure. Within the structure was a homogenous fill of slightly discolored and compact aeolian sand. A small sample of charcoal was present at the interface of the structure fill and the caliche horizon in the west profile. Clearing and excavation revealed a circular pit structure measuring 2.35 m N/S and 2.70 m E/W, with a maximum depth of 0.40 m. An entrance is located to the east (Figure 24).

No use-compacted floor was present in the structure, the floor simply being the caliche substrait. This generally undulating and rough floor had an upwards slope of 10-20 cm towards the eastern side wall. Two "fire areas" were located on the northeastern and northwestern sides of the structure floor, measuring 4 cm and 40 cm diameter, respectively. These "fire areas" were dark areas of carbonaceous soil and charcoal situated 2-3 cm above the caliche. A very slight depression was noted in the caliche under the northeastern "fire area". Eight substantial C-14 samples were retrieved from these areas.

Four interior post holes averaging 20 cm diameter were found to be excavated through the floor and into the caliche to a depth of 18 cm. Thirty-three exterior post sockets circumscribe the structure and the entrance. The average diameter for these post sockets is 15 cm and the average depth is 15 cm. No artifacts or other cultural materials were found within any of the post sockets.

The post socket arrangement for Feature 29 was verified by removing the compact pebbly sand and examining the caliche horizon, where depressions in the caliche corresponded to the loci of post sockets as originally determined on the surface.

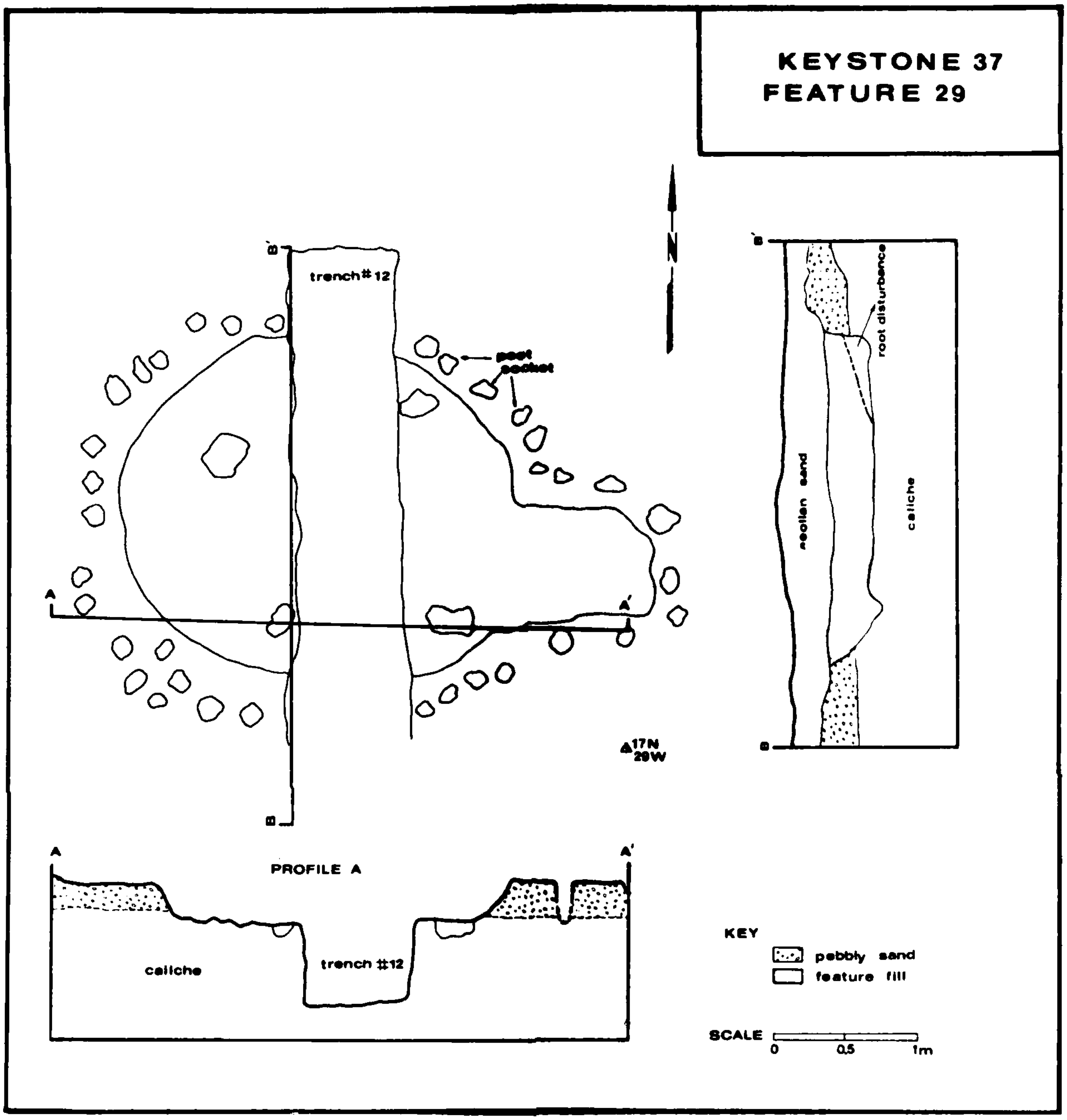


Figure 27. Plan and profile views of Feature 29, Site 37.

A high number of artifacts were recovered during the excavation of the surrounding judgemental unit and fill of the structure. Of interest is the high number of cores and scrapers found in both excavation units. Within the fill, artifacts were restricted mainly to the upper 20 cm, although two small flakes were also found on the floor of the feature near the "fire areas". A quartzite projectile point base was recovered from the judgemental unit.

Feature 35

Feature 35 is located in the center of Trench 8 at the coordinates 31N33.5W. Depth of the feature in profile is 35 cm, with the floor of the structure extending 20 cm into the caliche horizon (Figure 25).

The northern half of the structure was excavated; the southern half only cleared and defined on the surface. It is a steep-sided, basin-shaped pit structure with dimensions of 2.30 m N/S and 2.00 m E/W. An entrance is located to the northeast.

The pit structure fill is a homogenous deposit of slightly compacted aeolian sand, noticeably darker than the surrounding soils (after drying). Excavation of half of this fill revealed the structure floor to be the caliche horizon. No use-compacted floor is present, and the caliche floor is uneven and slopes upwards towards the northwest pit wall. In the floor near the entrance is a 5 cm deep depression in the caliche. This shallow pit has an interior fill of discolored carbonaceous soil and charcoal, but no fire-cracked rock was present.

No interior post holes are located in the excavated northern half of the pit structure. Fourteen probable post sockets surround the structure, although an unusually soft soil matrix around the feature made a certain location of these sockets questionable. One post socket had a fire-cracked rock shim (Figure 25). Few artifacts were recovered from within the fill. One large limestone cobble was found on the floor of the structure in an upright position.

Feature 38 (unexcavated)

Feature 38 is located in the center of Trench 9 at the coordinates 24N50W. Only half of the structure was outlined at the surface. Dimensions are estimated at 1.40 m N/S and 1.70 m E/W. Depth of the fill in profile is 30 cm, and the fill did not extend into the caliche horizon.

No entrance was detected in the half of the structure which was cleared. Eleven exterior post sockets were located. They

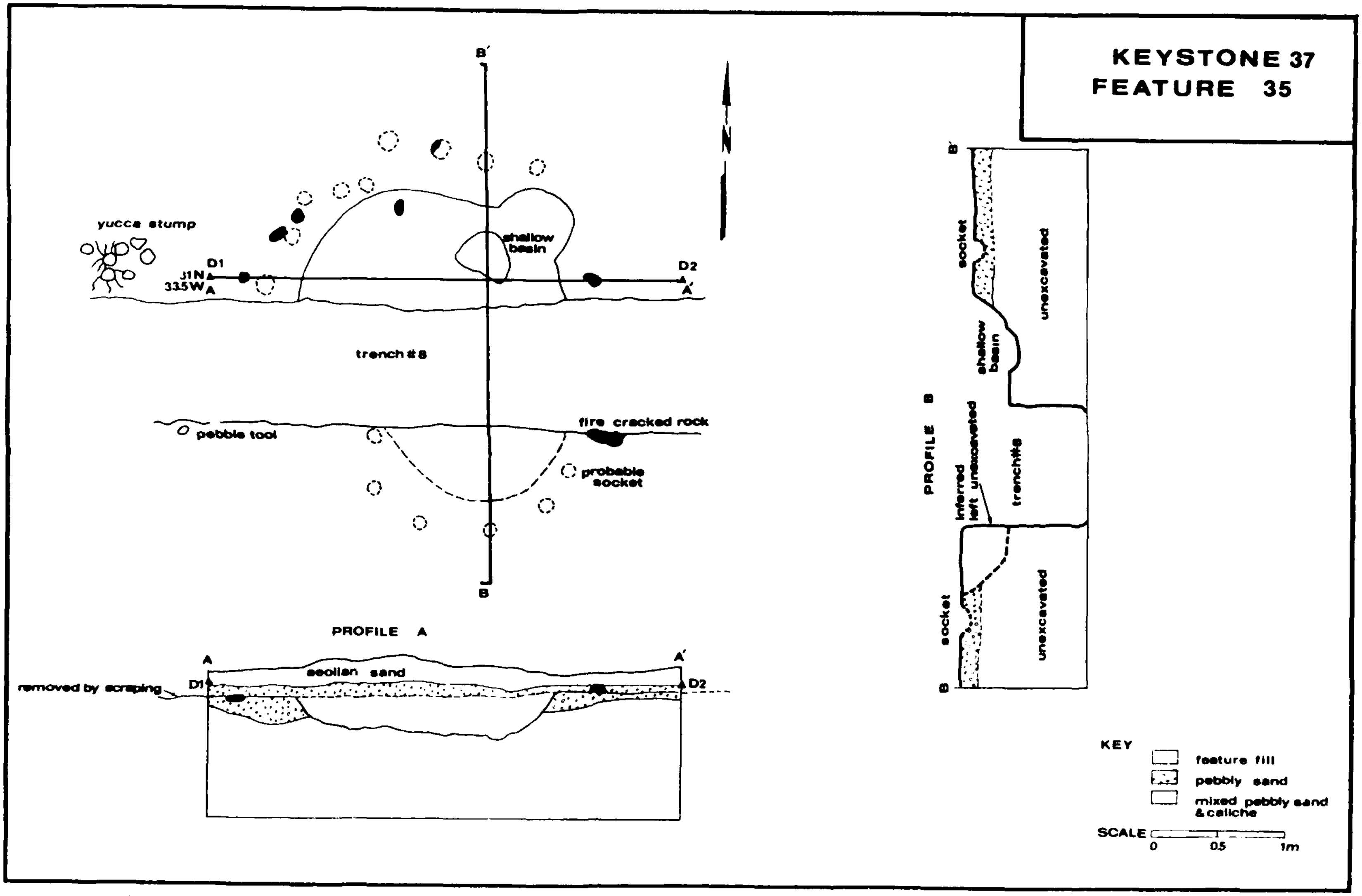


Figure 25. Plan and profile views of Feature 35, Site 37.

average 15 cm diameter and 12 cm in depth.

Feature 39

Feature 39 is located in the south end of Trench 9 at the coordinates 20N52W. This is an unusual structure in that two periods of occupation or construction may be represented for there are two structure boundaries evident at the surface (Figure 26). Post sockets indicated by cross hatching are those which fall outside the later and deeper floor but within the previously existing structure. Also important is the presence of a possible prepared floor in this structure. Artifacts were recorded on a pebbly sand surface overlying an irregular pit bottom (Figure 26, profile B-B').

The eastern third of the feature was removed by Trench 9. In profile, Feature 39 is a deep pit structure excavated into compact pebbly sand and the caliche horizon to a depth of 57 cm. Two strata could be discerned within the feature fill. The upper 45 cm is a homogeneous deposit of slightly compact sand with a flat base. Two artifacts were present in profile at this base. Below this deposit is a 12 cm deep, basin-shaped strata of lighter and more compact sand.

Excavation of the structure fill revealed evidence of two construction episodes. An interior pit had been excavated into the caliche horizon. This pit followed the profile outlines of the structure and measures 1.50 m N/S. The original eastern extent of the feature was removed by the trench, and the measurement from the trench to the west pit structure wall is 1.20 m. Above the structure walls to the west is a caliche "bench", the floor of a previous structure, into which five post sockets had been excavated. These post sockets measured 15 cm in diameter and 8 cm deep. A small flake was also found on this "bench".

Following the outline of the caliche "bench" around the perimeter of the inner pit structure led to the identification of the earlier structure. This pit structure measured approximately 1.50 m N/S and 1.65 m E/W. An entrance is located to the north. Twenty-five exterior post sockets, one of which contained a rock shim, surround the structure. The sockets average 15 cm in diameter and 10 cm deep.

The floor of the inner pit structure is a compact deposit of lightly colored sand, very even, and with no interior post holes. A large rodent burrow was present at the southern edge of the floor. A number of cultural materials were recovered from the floor, including six large fire-cracked rocks and a small chert flake (seen in profile). The fire-cracked rocks were not arranged in such a way to suggest a formal hearth, but they provide the most substantial evidence for an interior feature of any of the structures. Of special note is a large dolomite anvil which was

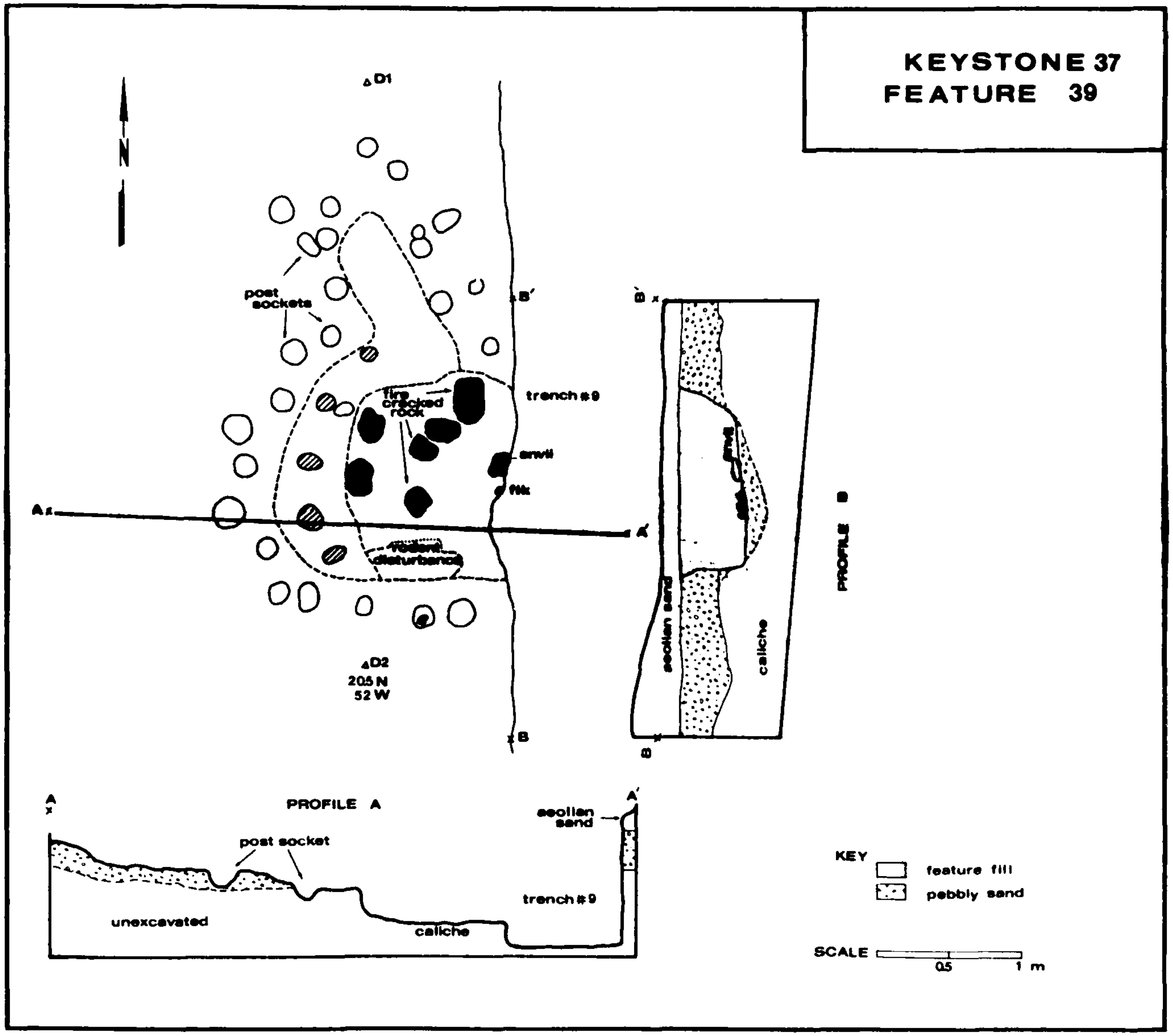


Figure 26. Plan and profile views of Feature 39, Site 37. Note the two sets of post sockets indicating reuse of the structure.

observed in profile and was situated on the compact sand floor (Figure 26, profile B-B'). A number of flakes and a heavily patinated, corner-notched chert projectile point were recovered from the fill. Feature 39 is important for it appears to be the only example of a use-compacted floor among all of the structures at Site 37.

Feature 40

Feature 40 was detected in the southern terminus of Trench 30 at the coordinates 19N60W, where the trench profile showed a basin-shaped pit with a dark fill cut 35 cm into the compact pebbly sand horizon. Excavation revealed Feature 40 to be an oval-shaped pit structure measuring 2.00 m N/S and 2.65 m E/W with an entrance to the north (Figure 27).

The floor of the structure is compact sand with no use-compacted surface noted. No formal hearth was found on the floor, nor were any charcoal samples. However, two small samples of charcoal were recovered from within the fill ca. 10 cm above the floor. One small flake was found on the floor near the northeast pit wall.

Two interior post holes were found in the northeastern area of the structure floor. A third circular area in the floor was found to be a rodent burrow. Twenty-five exterior post sockets were identified, averaging 18 cm diameter and depth. Two of the sockets had fire-cracked rock and exhausted core shims.

Feature 41

Feature 41 is located in the southern extent of Trench 30. In profile it is a 40 cm deep basin-shaped pit excavated into compact pebbly sand. Only half of this feature was excavated.

Excavation revealed an oval-shaped pit structure measuring 2.3 meters N/S and 2.7 meters E/W. Entrance is to the north. The floor of the structure is compact pebbly sand. One interior post hole and 24 exterior post sockets were found. Their measurements are 15 cm average diameter and 10 cm average depth.

Feature 42

Feature 42 is an oval-shaped pit structure located in the north of Trench 30 at the coordinates 29N60W. No excavation was undertaken. A high incidence of rodent burrows and root disturbance made an assessment of the dimensions of this feature difficult, and thus the size is estimated at 1.45 m N/S and 2.60 m E/W. No entrance was located. In profile, the structure is a

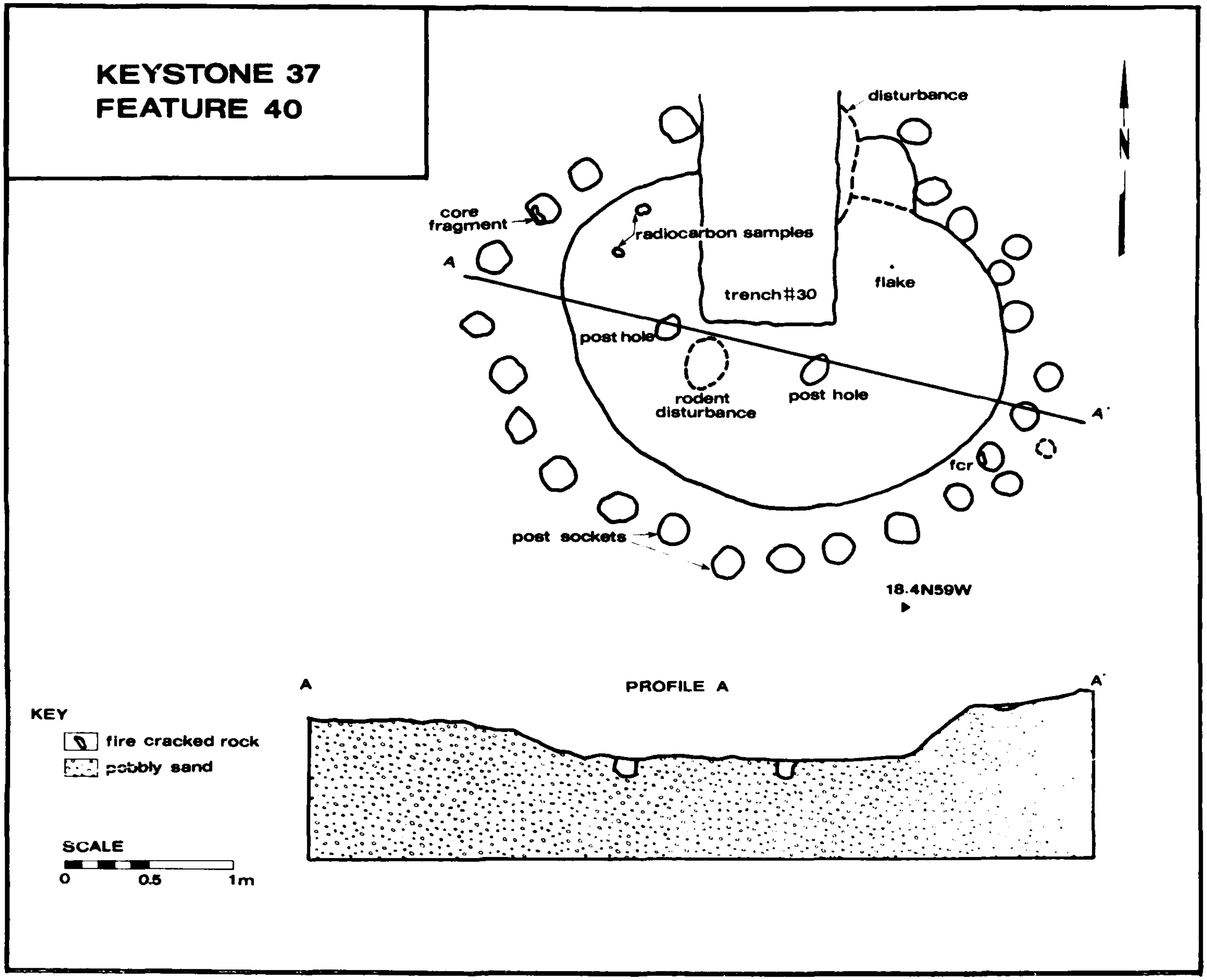


Figure 27. Plan and profile views of Feature 40, Site 37.

basin extending 30-40 cm deep through the compact pebbly sand and caliche horizons. Seventeen exterior post sockets were determined, averaging 15 cm in diameter and 10 cm in depth.

Feature 43

This pit structure is located in the north of Trench 9 at the coordinates 33N50W. Its function as a residential structure is highly questionable and it will be discussed at the end of this section.

Feature 45

Feature 45 was bisected by the western end of Trench 32, and is located at the coordinates 23N34.8W. As observed in the trench profile, it is a basin-shaped pit structure constructed 30 cm deep through compact pebbly sand to the interface of the underlying caliche horizon (Figure 28).

The southern half of the structure fill was excavated, revealing that the floor was the interface between the compact sand and caliche horizons and that the caliche protruded slightly in the center. No use-compacted surface was noted, nor were there any interior post holes. Two fire-cracked rock cobbles were embedded in the pit side walls, and a number of other fire-cracked rocks were present on the floor near the western side wall. Also found on the floor were a battered limestone cobble and a small cobble tool.

On the surface, Feature 45 is an oval structure, slightly truncated at its eastern edge, and measuring 2.4 m N/S and 1.40 m E/W. An entrance is located to the north. Twenty-five exterior post sockets are arranged around the structure perimeter, averaging 15 cm in diameter and 12 cm in depth. Four of the sockets had fire-cracked rock shims. Compared to other structures, a large number of artifacts were recovered from within the fill, primarily from the upper 20 cm.

Feature 49

Feature 49 is located in the northern terminus of Trench 33 at the coordinates 26N20W. A large mesquite bush was present near the northern edge of the structure, with the result that the entire surface has been root-disturbed and definition of the structure boundaries was difficult. No excavation was undertaken on this feature.

The best assessment possible of the structure boundaries gives a measurement of 1.80 m N/S and 2.30 m E/W. Depth of the feature in profile is 20 cm, and the pit did not extend into the

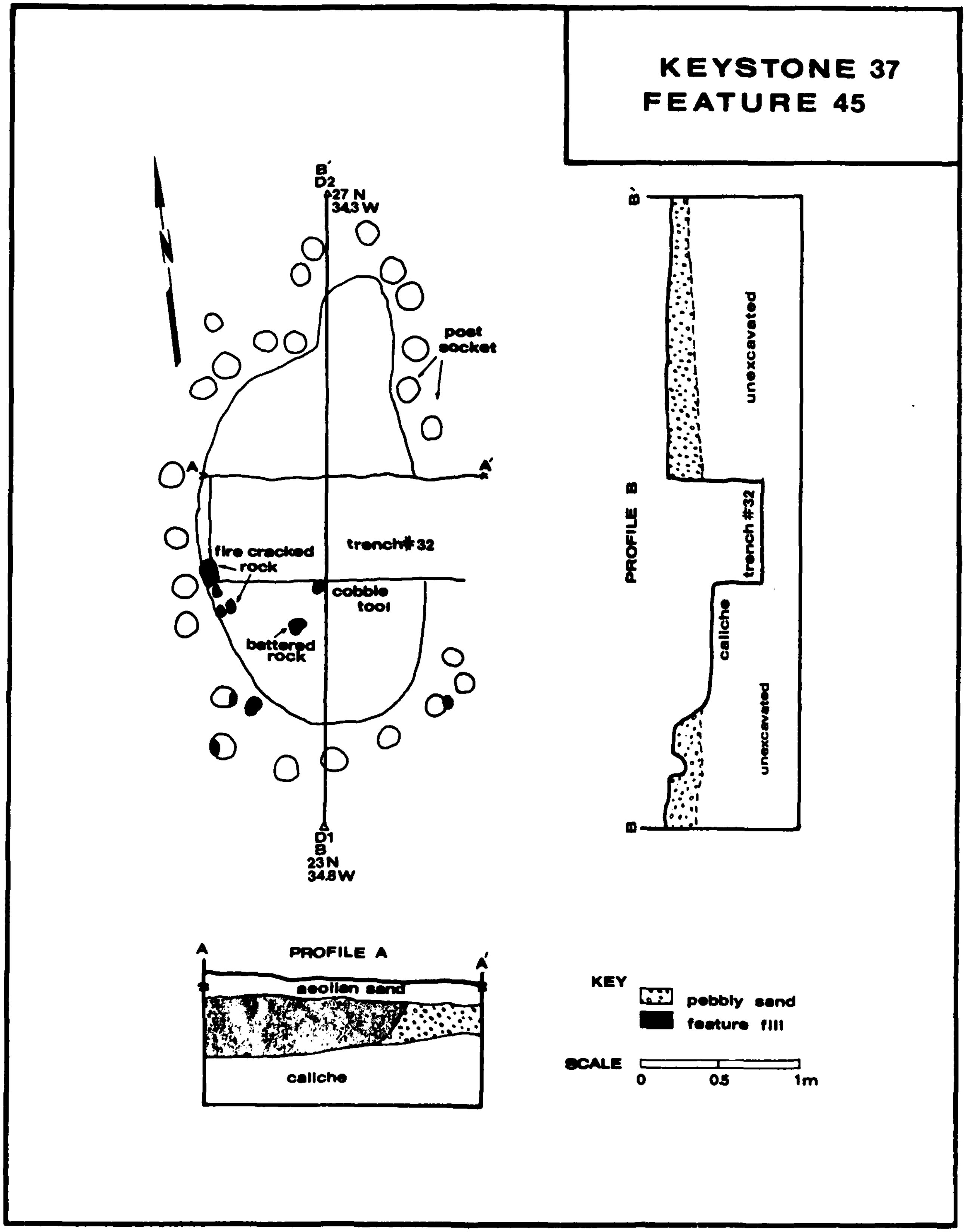


Figure 28. Plan and profile views of Feature 45, Site 37

caliche horizon. Twenty-three possible sockets are arranged around the pit structure.

Features 50 and 51

These two pit structures are located in the central area of Trench 33 at the coordinates 20N20W. Examination of the trench profiles and trowel point cutting determined that Feature 50 was a later construction which had been superimposed on the earlier Feature 51 (Figure 29). In the west profile, Feature 50 was observed as a basin-shaped pit with gently sloping sides which had been cut 40 cm into the compact pebbly sand horizon. Feature 51 was situated at a slightly higher level, and was 20 cm deep. In the east profile, the two pit structures were separated by a 30 centimeter deposit of compact pebbly sand. Also observed in the east profile was a post hole in the floor of Feature 50.

Excavation of the western half of the two structures found gently sloping floors of compact pebbly sand in both structures. No caliche or use-compacted surface was noted. One interior post hole was present in the floor remnant of each structure, but no artifacts or "fire areas" were located. Artifacts were also absent in the fill of both structures.

On the eastern side of Trench 33, the two pit structures were outlined at the surface. Unfortunately, Feature 50 had been partially removed on this side by the previous excavation of a judgemental unit, and its dimensions are questionable. Feature 50 measures 2.20 m N/S and an estimated 1.95 m E/W. Feature 51 measures 1.70 m N/S and 2.0 m E/W. Both structures are circular in shape and have entrances leading to the north.

Eighteen post sockets were arranged around Feature 50, of which two were found to be intrusive into the fill of Feature 51. Eleven post sockets surrounded Feature 51 (the open circles at the northwest end of Feature 50 and in the southwest edge of Feature 51, Figure 29). Average diameters and depth of the post sockets are 13 cm and 10 cm, respectively.

Features 52, 59, and 63

These three pit structures are also superimposed. They are located in the north of Trench 37 at the coordinates 10N25W. In the east and west profiles of Trench 37, Feature 52 was observed as a basin-shaped pit with sloping sides cut 50 cm into compact pebbly sand and caliche (Figure 30). To the north and south of this feature are two other pit structures, Features 59 and 63. Trowel probing and the presence of Feature 52 post sockets in the fill of the other two structures indicate that Feature 52 had been constructed over Features 59 and 63 at a later time (Figure 30).

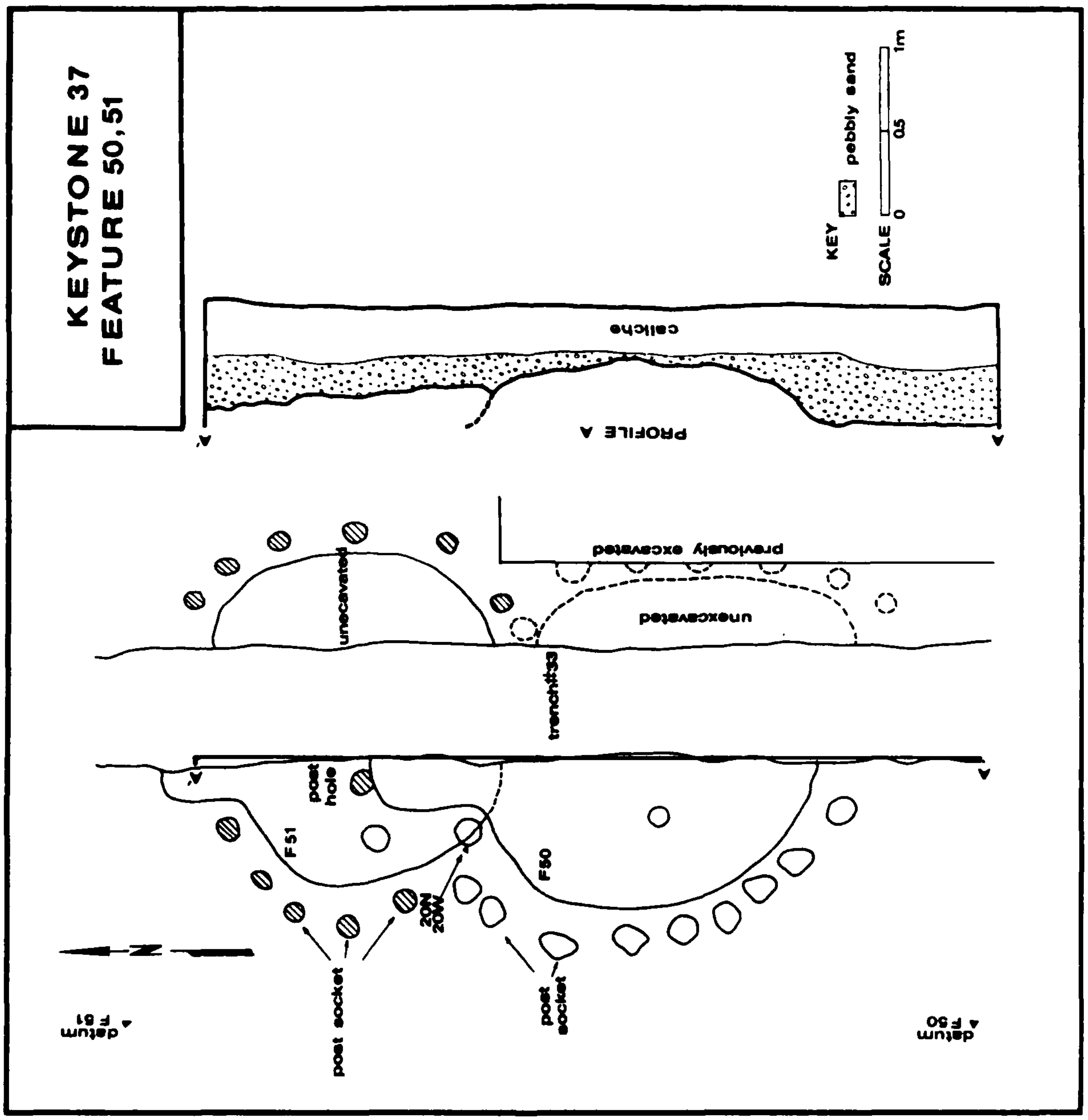


Figure 29. Plan and profile views of Features 50 and 51, Site 37.

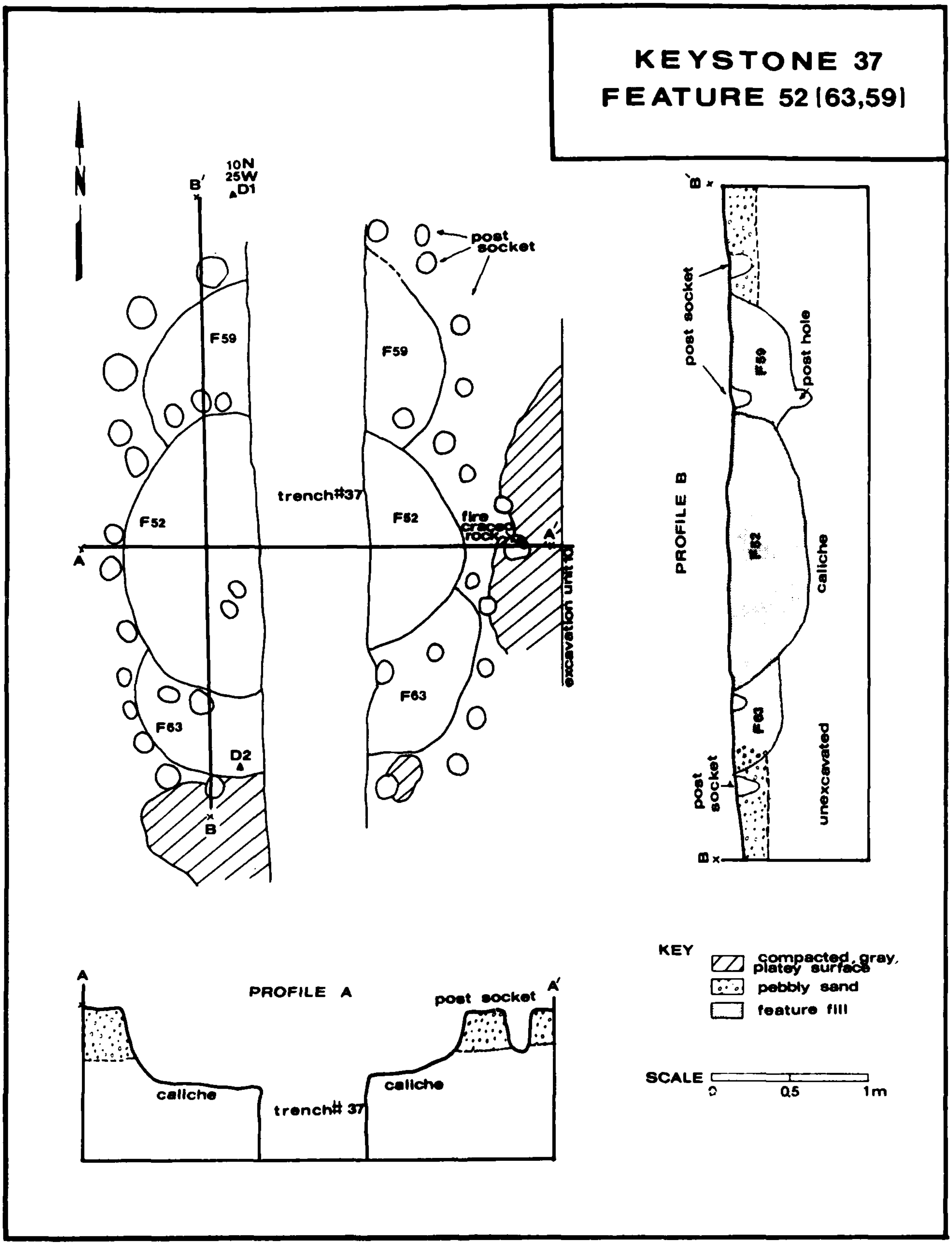


Figure 30. Plan and profile views of Features 52, 59 and 63, Site 37.

Feature 52 was completely excavated, revealing a circular pit structure measuring 1.80 m N/S and 2.20 m E/W. No entrance was detected. The floor of the structure is the caliche horizon and has a slight slope towards the center. No use-compacted surface is present, and no artifacts were recovered from the floor. Two interior post holes are located close together on the floor and measure 11 cm in diameter and 11 cm in depth.

Around the structure perimeter are 15 post sockets averaging 12 cm in diameter and 10 cm deep. Four of the northern sockets and four of the southern are intrusive into the fill of Features 59 and 63. The easternmost socket contained a fire-cracked rock shim. Three of the eastern post sockets cut through an unusual surface consisting of a thin "platey" layer of dark gray compacted soil possibly composed of clay and ash. The compacted soil appears to be the result of off-road vehicle traffic since it occurs only beneath the major trail cutting through the site (see Figure 6).

Features 59 and 63 were partially excavated on the west side of Trench 37 and cleared on the east side. Both structures had been disturbed by the trench and the superposition of Feature 52. Features 59 and 63 have east/west dimensions of 1.90 m and 2.15 m respectively. The north/south dimensions can only be estimated since the construction of Feature 52 had removed substantial portions of each structure. Probable north/south dimensions are 1.5 m and 1.4 m respectively. No entrance was detected for either pit structure.

Caliche horizon floors are present in both structures at a depth of 40 cm for Feature 59 and 35 cm for Feature 63. No use-compacted surface or artifacts are present, but one post hole extends through the floor remnant of each structure. The interior post hole for Feature 59 measures 10 cm in diameter and 10 cm in depth and the Feature 63 post hole measures 15 cm by 10 cm.

Nine exterior sockets were located for Feature 59 and 10 for Feature 63. These averaged 15 cm in diameter and 18 cm deep. Two of the Feature 63 post sockets penetrated the compacted platey surface described above.

Feature 53

This feature is located south of Trench 37 at the coordinates 3N24W. As with Feature 43, this is questionable as a residential structure and will be discussed at the end of this section.

Feature 54

The feature is located in the west of Trench 36 at the coordinates 5N43W. The northern half of this structure was excavated and the southern half only cleared and defined at the surface. This revealed an oval-shaped pit measuring 3.20 m N/S and 2.30 m E/W. A possible entrance is located to the southeast, although confidence in its determination is very low.

The floor of the structure is the caliche horizon, 30 cm below the surface and is not use compacted. It was uneven, sloping upwards towards the pit structure walls and had a number of depressions resulting from bioturbation. No interior post holes were detected but 23 exterior post sockets are arranged around the perimeter. They average 12 cm in diameter and 15 cm in depth, and one contained a fire-cracked rock shim. No artifacts were recovered from the structure floor, although a high percentage of cores were found around the structure perimeter.

Feature 55

Feature 55 is a pit structure partially bisected by the western terminus of Trench 36 at the coordinates 6N47W. It is of interest in that two distinct fill strata were identified within the pit (Figure 31).

These two strata were not evident in the preliminary examination of the trench profiles but were first detected during the outlining of the pit structure boundaries at the surface. Two oval-shaped boundaries were noted, one located inside the other. The outside boundary represented the actual shape of the structure and was defined by a shallow 1-4 cm trowel point cutting. When the trowel was cut deeper into the fill, a smaller diameter outline was defined 5 to 10 cm back from the outside boundary.

The trench profile was then reexamined and the two strata were delineated. It was decided to excavate the southern half of the structure, thus leaving an inside profile of the pit structure fill following an axis along the north trench wall and center of the structure (See Figure 31). A detailed discussion of this profile and the two fill strata are provided below.

The upper stratum was designated as Fill A and the lower stratum as Fill B. Fill A was an unconsolidated deposit of pale brown (10YR 6/3) sand with a slight moisture retention. No textural differences were noted between this fill and Fill B. The profile also showed Fill A to be shallow in the western edge of the structure, becoming up to 20 cm deep in the center and at the eastern edge.

Fill B was a dry, compact deposit of light gray (10YR 7/2) sand. Two areas of rodent disturbance were present and had deposited small amounts of Fill A soil into Fill B. Fill B had a uniform depth of 10 cm.

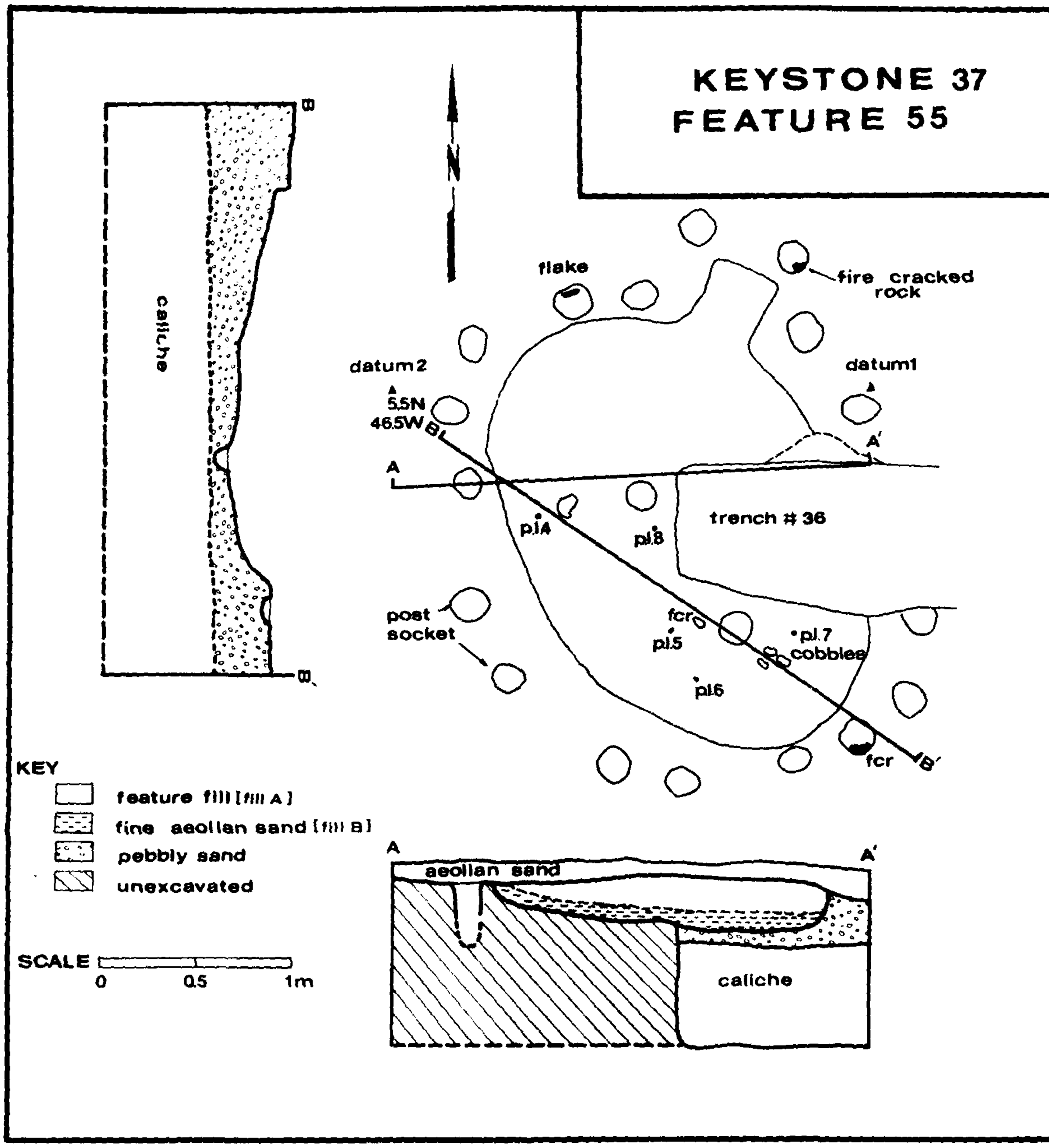


Figure 31. Plan and profile views of Feature 55, Site 37. The spots labeled p.l, refer to the point locations of artifacts mapped in situ on the floor.

As observed in the trench profiles, Feature 55 was cut into compact pebbly sand with the floor of the structure situated 5 - 8 cm above the caliche horizon. The boundary between the pit structure Fill B and the compact pebbly sand horizon, although slight, was nevertheless definable by close observation and trowel point cutting. Fill B was slightly darker and much more compact.

During excavation of the structure, a relatively large and varied amount of cultural material was recovered from Fill A. Approximately 9 kg of limestone and rhyolite fire-cracked rock was found loose in the fill, along with 51 artifacts including 47 flakes, three cores, and a split cobble. The interface between Fills A and B was defined through observation of color and compaction differences. At this interface, a hammerstone, an exhausted core, and a small charcoal sample were collected.

Fill B was scraped slowly in order to locate and provenience any artifacts present on the floor. At some areas in the southern half of the pit caliche protruded to the surface; otherwise, the floor was compact pebbly sand. Roots were observed to follow the contours of the floor and small pebble inclusions were significantly more numerous in areas near the pit walls than in the central regions.

These observations indicate two distinct or depositional periods for the in-filling of Feature 55 and may provide some insight into the nature of the post-abandonment depositional processes which affected the pit structures at Site 37. The shape and contour of Fill A corresponds to blow sand deposition patterns observed at Site 37 during the windy spring months during which excavations were in progress. The high percentage of small pebble inclusions near the walls of the pit structure with a much lower occurrence in the central regions may indicate erosional processes which deposited sand and pebbles into the structure from the surrounding soils above.

Fill B is a natural redeposition of sands and small pebbles. The high number of artifacts recovered from Fill A probably reflects later activities occurring near the structure and/or reworking of some of the soils and cultural materials in the upper part of the stratigraphic sequence. It should be noted that during the sandstorms of the spring months at Site 37, up to 20 cm of aeolian sand were deposited in excavated pit structures which were left uncovered overnight. It can thus be argued that an abandoned pit structure at Site 37 could be completely covered within a very short period after abandonment.

As revealed by the completed excavation, Feature 55 is an oval-shaped pit structure measuring 2.25 m N/S and 1.70 m E/W and 30 cm deep. An entrance is present leading to the northeast.

The floor is compact pebbly sand with the caliche horizon protruding in some areas. Five flakes, a fire-cracked rock spall, and a cluster of three small limestone rocks were present on the floor in the southern half of the structure. Two interior post holes were detected. They measure 15 cm in diameter and extend 12 to 14 cm into the caliche horizon.

Around the pit perimeter were 17 post sockets averaging 18 cm in diameter and 15 cm in depth. Two sockets had fire-cracked rock shims and a third had a shim of an exhausted chert core.

Feature 56

This feature is located in the north of Trench 34 at the coordinates 14N40W. In both the east and west profiles it was observed as a basin-shaped pit with gently sloping sides dug into the compact pebbly sand horizon to a depth of 30 cm. Feature 56 was cleared and defined only at the surface. It is a circular pit structure measuring 2.0 m N/S and 3.0 m E/W with an entrance located to the east. Twenty exterior post sockets surround the structure. They average 15 cm in diameter and 12 cm deep. One socket had a fire-cracked rock shim. No artifacts were found within or around the structure.

Features 57 and 62

These two structures are located in the north of Trench 34 at the coordinates 18N40W. Feature 57 was superimposed upon the southern edge of Feature 62. In the trench profiles, Feature 57 was observed as a basin-shaped pit structure cut 35 cm deep through compact pebbly sand to the caliche horizon. Feature 62 was 40 cm deep and was also dug into the caliche horizon.

Trowel point cutting and the location of Feature 57 post sockets in the fill of Feature 62 determined that Feature 52 was the later structure. Both were only cleared and defined at the surface. Measurements are 1.85 by 2.00 m for Feature 57 and 1.80 by an estimated 1.25 m for Feature 62. Both structures were circular and neither had a preserved entryway.

Eighteen exterior sockets were identified for Feature 52. They averaged 15 cm in diameter and 12 cm in depth and two had fire-cracked rock shims. The northern sockets were situated in the fill of Feature 62. Feature 62 had 12 post sockets averaging 15 cm in diameter and depth. One had a small flake within its fill. A small number of flakes were found around the two structures. Also, Feature 62 had a rhyolite core and a flake within the fill noted in profile.

Feature 61

Feature 61 is located in the north of Trench 9 at the coordinates 35N50W. In profile, this structure is unusually shallow, extending into the compact pebbly sand to a depth of only 15 cm.

Feature 61 was cleared and defined at the surface only on the west side of the trench. The east side was severely root disturbed by a large creosotebush. Dimensions of this structure are 1.2 m N/S and 0.4 m from the trench to the western pit boundary. Five possible post sockets are located around the western pit structure perimeter.

Confidence in the interpretation of this feature as a residential pit structure or cultural feature is low. The shallow basin noted in profile may be the result of bioturbation or some other natural process.

Feature 64 and 65

These two superimposed pit structures were located in the west of Trench 13 at the coordinates 10N20W. The northern edges of both structures were removed by Trench 13 and thus only appeared in the south profile of that trench.

In profile, Feature 64 is a basin-shaped pit structure with sloping sides excavated 35 cm through compact pebbly sand and into the caliche horizon. To the west of Feature 64 is another pit structure, Feature 65, which is truncated at its eastern edge by Feature 64. Trowel point cutting in the region of the interface between the two pits, plus the location of Feature 64 post sockets in the fill of Feature 65, indicate that Feature 64 is the later structure. A large limestone cobble was noted in the profiles of both pit structures.

Feature 64 was cleared and outlined at the surface. The eastern edge of the structure was located in an area of off-road vehicle activity, and thus the definition of its boundary in this region is questionable. Dimensions are estimated at 1.50 m N/S and 1.70 m E/W. No entrance was detected. Fourteen exterior sockets were located, although seven are questionable. The two westernmost sockets are located within the fill of Feature 65. Average dimensions are 15 cm in diameter and 10 cm deep, and one had a fire-cracked rock shim.

Feature 65 was constructed 40 cm into the compact pebbly sand and caliche horizons. Outlining at the surface revealed an oval-shaped pit structure measuring 1.55 m N/S and 1.75 m E/W. The eastern edge of the feature had been removed by the later superimposition of Feature 64. No entrance was detected.

Post socket determinations for this structure are questionable, as the surrounding soil had been severely churned by off-road vehicle activity. Only five post sockets were located. Besides the cobbles noted in profile and the fire-cracked rock shim in a Feature 64 post socket, no other cultural materials were found during the examination of these features.

Feature 70

Feature 70 was discovered through the use of a front end loader during the final mechanical scraping of Site 37 at the coordinates 19.5N24.5W. The structure was initially detected as a small oval-shaped depression with a dark fill extending into the caliche horizon. Since the upper deposits of aeolian sand and compact pebbly sand had been removed by scraping, this small oval represents the bottom of the structure.

Dimensions of the structure are 1.50 m N/S and 1.35 m E/W. Depth of the remnant pit is 10 cm below the compact pebbly sand/caliche horizon interface. One artifact was recovered from the fill. A large rodent burrow was present in the floor of the structure, but no interior post holes were located. Fourteen exterior post sockets were arranged around the pit structure. They were observed as small, 2 - 4 cm deep depressions in the caliche.

Problematical features

Features 43 and 53 are characterized by different shapes and sizes than other pit structures at Site 37, and are believed to be nonresidential due to their small and deep configuration. Both are deep, straight-sided circular irregularities extending through the compact pebbly sand to the caliche horizon. Feature 43 is 35 cm deep and Feature 53 is 61 cm in depth. Measurements for Features 43 and 53 are .90 by .95 m and 1.0 by .80 m respectively. A number of soft spots (dubious post sockets) were detected around the perimeter of each feature. Neither feature was excavated because of their questionable cultural origin, and their function, if any, is unknown. It is possible that they represent storage facilities like those recorded along Tularosa Creek near Mescalero, N.M (Del Bene and Rorax 1984). However, while the general configuration is similar to those at Mescalero, the Site 37 features lack any evidence cultural materials in their fill.

Functional Interpretation of Pit Structures

A discussion of the functional significance of the Keystone 37 structures is important in light of the new data they provide. It is also critical to subsequent evaluations of site structure later in this study. As other researchers have noted (Marshall

1973; Whalen 1979; Hard 1983), pit structure morphology in the Jornada area is quite variable. In the past, the observed variability has been viewed as components of the Mesilla phase and/or Doña Ana phase (transitional Pueblo). The structures at Site 37 contribute further to the variability among Jornada pit structures, but this fact is all the more interesting because the site dates well within the local Pueblo period (Chapter 11).

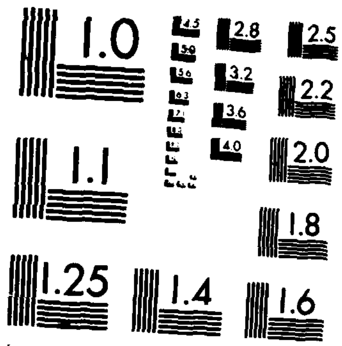
As discussed in Chapter 3, it is assumed that some aspects of site structure will be reflected in the nature, density and distribution of cultural remains within a site. Some aspects of within-site characteristics will be due strictly to functional differences in the tasks carried out in relation to other sites. Additional patterning can be expected to reflect the way in which the functional tasks were carried out, such as the relative length of occupation at a given site. The type, quantity and diversity of features on a site can be expected to be directly related to the length of occupation (Chapter 3, Hypothesis 6). In order to assess the meaning of the Site 37 pit structures it is useful to first summarize their characteristics. They are then compared with a variety of structures reported elsewhere in the Jornada region. Finally, the behavioral implications of the Site 37 structures are explored in light of existing interpretations of structures previously identified at those other sites.

Characteristics of Keystone 37 Pit Structures

The structures identified at Site 37 are generally circular in form but are consistently small and shallow. Areas contained within the structures range from 2.0-5.9 square meters with depths of 0.20-0.50 m (Table 17). The structures have sloping walls and irregular floors constructed by digging a shallow basin down to, or slightly into, the carbonate soil horizon. The features generally contain one, two or four interior post holes excavated another 10-20 cm into the indurated caliche. Formal interior hearths are completely lacking but small areas of grey soil were identified in Features 29 and 35, possibly representing the use of coals prepared in exterior hearths for warmth inside the structures. Small rectangular or lobate irregularities, presumably entryways, are found in some cases and, when present, are oriented to the north, northeast or east.

Each structure is surrounded by a series of post sockets encircling the perimeter of the basin and dug into the occupational surface adjacent to the structure. The sockets are often excavated down into the caliche substrate. They were apparently meant to accommodate branches smaller than their diameter because many contained shims of fire-cracked rock or expended cores. In spite of careful screening, no fragments of daub or other potential roofing materials were recovered. This suggests the superstructure may have consisted simply of interwoven branches.

AD-A174 038 ARCHEOLOGICAL EXCAVATIONS AT TWO PREHISTORIC CAMPSITES 3/6
NEAR KEYSTONE DAM (U) NEW MEXICO STATE UNIV LAS CRUCES
CULTURAL RESOURCES MANAGEMEN D CARMICHAEL ET AL
UNCLASSIFIED 19 JUL 85 NMSU-14 DACW47-84-C-0006 F/G 5/6 NL



CROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

The structure fill generally contains low densities of artifacts and very few items are situated on the floors. Even in structures yielding relatively large numbers of artifacts, these tend to occur at the upper contact of the fill and the aeolian sand where they probably reflect backfilling by natural processes. Specific figures for interior and exterior artifact densities are presented and discussed in Chapter 9.

In spite of the general dearth of artifacts inside the features, the structures are consistently located in the west-central portion of the site, in the areas of highest artifact density. The structures also tend to be associated with small hearths and removed from the large fire-cracked rock features.

Comparisons With Other Jornada Area Structures

Table 13 provides a summary of selected characteristics of pit structures excavated throughout the central and southern Jornada area. As Carmichael (1983) and Hard (1983) have noted elsewhere, these data reflect a basic distinction between typical Mogollon pithouses and less substantial shelters or huts. The characteristics of these structures and their associated features are instructive for interpreting site functions and structure.

Pithouses are identified at least at the Hatchet Site, Los Tules, the Rincon and Hatch Sites, Abajo del Cruz and LA 2000. The structures at these sites are formed by substantial vertical walled pits, a fact indicated by depths of about 0.5-1.2 m (Table 17). Even more compelling are the large floor areas which average 16.5 square meters (n=28, sd.=10.7). These sites, often called pithouse villages, are generally recognized to represent some significant duration of occupation and they correspond to what has elsewhere been termed Long Term Habitation sites (Carmichael 1983b). These sites also tend to have the greatest variety of associated features, including trash middens, interior and exterior storage pits and cists, trash pits, burials, etc. (Table 17). In a general way at least, the observed variability of features on Jornada pithouse sites tend to confirm one's expectations for occupations of relatively long duration.

Another group of sites containing smaller and less formalized pit structures or huts has been identified by O'Laughlin (1980) and Hard (1983). Sites assignable to this group include at least the following: Keystone 33, Hueco Bolson Sites 132 and 739, Castner Range Site 80, and the Roth Site. The structures on these sites tend to be very shallow, with depths ranging from 0.15 - 0.3 m. They are also smaller than typical pithouses with areas averaging 6.5 square meters (n=12, sd.=1.8). By reference to structure form and size in relation to the ethnographic record these features are quite reasonably interpreted as relatively ephemeral huts or brush and mud houses (O'Laughlin 1980; Hard

Table 17. Comparison of residential structures in the southern Jornada area.

SITE	FEATURE	AREA(m^2)	DEPTH(m)	ASSOCIATED FEATURES	REFERENCE
KEYSTONE 33	HOUSE 1	6.2	0.18	Interior hearths, exterior trash-filled pits, one possible storage pit	O'Laughlin 1980
	HOUSE 2	5.9	0.15		
	HOUSE 3	3.8-5.9 est.	0.25		
SITE 132 (Hueco Bolson)	1	8.8	0.20	Interior fire pits, Exterior hearths	Whalen 1977
	3	8.0	0.20		
HATCHET SITE	1	44.8	1.07	Interior fire hearths, Subfloor pits, exterior trash midden	Marshall 1973
	2	15.6	1.20		
	3	21.8	0.54		
	4	13.0	0.47		
LOS TULES	1	4.4		Ash concentrations or hearths inside six houses subfloor pits in 2 and 11. Exterior hearths, storage pits, three burials, trash midden	Lehmer 1948, Marshall 1973, Hard 1983
	2	14.0	0.20		
	4	24.5	0.55		
	5	50.2			

Table 17 (Continued)

SITE	FEATURE	AREA(m^2)	DEPTH(m)	ASSOCIATED FEATURES	REFERENCE
	6	19.9	0.75		
	7	10.5	0.40		
	8	14.7	0.40		
	9	6.3			
	10	16.0	0.80		
	11	14.7	0.40		
SITE 739 (Hueco Bolson)	2	4.9	0.25	Interior fire pit, Exterior trash midden and rubble-filled pits	Whalen 1978
	3	5.0	0.15		
	4	4.8	0.30		
	6	5.1	0.30		
CASTNER RANGE	7	8.0	0.30	Interior hearth area	Hard 1983
ROTH SITE	1	7.4	0.25	Refuse-filled pit in House 1, hearth in House 2.	O'Laughlin 1981
	2	9.6	0.20	Exterior trash midden, burials.	

Table 17 (Continued)

SITE	FEATURE	AREA(m^2)	DEPTH(m)	ASSOCIATED FEATURES	REFERENCE
RINCON SITE	1	13.9		Interior hearths, bell shaped subfloor cist in House 2. Exterior trash-filled pit	Marshall 1973 Hammack 1962
	2	9.6			
	3	7.1	0.60		
	4	24.5	0.85		
	5	3.2	0.60		
HATCH SITE	6	17.0	0.45	Interior hearths, subfloor pits in earlier houses (6,9) several exterior trash areas	Schaafsma 1964 Marshall 1973
	9	15.4	0.70		
	2	27.7	0.50		
	3	13.2	0.60		
	5	21.2	1.10		
ABAJO DEL CRUZ	12A	9.0	.30-.40	Interior hearths, shallow subfloor basins. Exterior storage cists, surface masonry.	Wiseman 1973 Marshall 1973
	28	6.6	1.0-1.25		

Table 17 (Continued)

SITE	FEATURE	AREA(m2)	DEPTH(m)	ASSOCIATED FEATURES	REFERENCE
LA 2000	A-1	12.0		Interior clay lined hearths, subfloor pit in B-1. Exterior storage pit. Four burial, 1 intermural	Marshall 1973
	B-1	12.2	0.25		
DONA ANA CO. AIRPORT (NMSU 1393)	Room 1	4.0	0.50	Interior hearth, exterior trash-filled pits	Duran and Batcho 1983
MEYERS RANGE FT. BLISS	1	ca.9.0	0.50	Collared fire pit, step entry, exterior pits	Scarborough 1984
KEYSTONE 37 (Excavated Structures Only)	29	4.9	0.40	No formal interior features; slight ashy spots in Features 29 and 35. External small rock hearths	This Study
	35	3.8	0.35		
	39	2.0	0.45		
	40	4.5	0.35		
	41	4.9	0.40		
	45	3.4	0.30		
	50	3.5	0.40		

Table 17 (Continued)

SITE	FEATURE	AREA(m2)	DEPTH(m)	ASSOCIATED FEATURES	REFERENCE
	51	2.8	0.20		
	52	3.1	0.50		
	59	2.8	0.40		
	63	3.0	0.35		
	54	5.9	0.30		
	55	3.5	0.30		
	70	2.0+	0.10+		

1983). As expected the sites containing these structures have a lower number and diversity of associated features which can be interpreted as evidence for shorter duration occupations. Note however that even though the brush huts are interpreted as ephemeral structures, most examples contain some type of intramural hearth or fire pit.

One additional type of pit structure deserves mention here. Pithouses are a recently documented component of El Paso phase settlement patterns in the southern Jornada area with examples recorded at the Doña Ana County Airport near Santa Teresa, N.M. and at Meyer Range on Fort Bliss. The Airport Site pithouse is two by two meters square and is excavated 0.50 m into the carbonate horizon (Duran and Batcho 1983). The Meyer Range structures are somewhat larger but both contain interior features which are typical of El Paso phase rooms in pueblos. These features include a small fire pit and two main post holes at the Airport Site and a collared hearth and step entry at Meyer Range. These features are of interest to the present discussion because, as nearly as can be determined at present, they are contemporaneous with the structures at Keystone 37. Yet, in spite of this apparent cooccurrence, the El Paso phase pithouses bear little or no resemblance to those at Site 37 and the other two sites clearly indicate occupations of far greater duration (Duran and Batcho 1983; Scarborough 1984).

Interpretation of Keystone 37 Structures

If the Hueco Bolson and Castner Range structures can be considered to be the remains of ephemeral brush houses, then the features at Keystone are arguably even more ephemeral. Feature depths are similar among the sites but feature sizes are even smaller with Site 37 structures producing an average area of 3.6 square meters (n=14, sd=1.1). These figures place the Site 37 structures at the small end of the size range for the Jornada area, implying occupation by smaller groups for shorter periods of time. Even more important is the complete lack of formalized hearths within the structures, a characteristic which sets them apart from even the brush hut features identified by O'Laughlin (1980) and Hard (1983). The Site 37 structures also lack the quantities of animal bone, ceramics and other artifacts contained in the Castner hut.

In addition to their small size, the Keystone 37 structures lack any association with interior or exterior trash or storage pits, trash middens, burials, or other features normally associated with long duration occupations. There is also direct archeological evidence that the 14 excavated pit structures do not represent the remains of a single community. In at least four instances, later structures were built or rebuilt within or overlapping previous structures. In the case of Feature 39 at least, the rebuilding appears to have taken place within the still-visible remains of the earlier structure. It is not possible to specify how many structures were utilized simultaneously, but, all indications point to occupation by small groups of perhaps several families.

As discussed earlier, the small fire-cracked rock features recorded at Site 37 may reasonably be interpreted as general purpose domestic hearths. In this regard it is noteworthy that hearths are completely lacking within the pit structures. In addition, few artifacts were recovered from the structures even though the occupation surface immediately outside them contained high densities of lithic artifacts (see Chapter 10). These patterns would seem to indicate that most activities at the site took place outside the structures. Such a situation would fit with general expectations for a warm season occupation, with the pit structures effectively functioning as sun shades, windbreaks, sleeping shelters, etc.

In sum, it is suggested that the pit features at Keystone 37 are the remains of short term ephemeral brush shelters erected for periods of perhaps days to weeks. A potential ethnographic analog for such a feature is provided by a 19th century description of an Apache wickiup:

> The wigwams of the Apache scarce peep above the brushwood of the country, being not more than 4 feet high, slightly dug out in the center, and dirt thrown around the twigs, which are rudely woven into an oven shape, as a canopy to the house. A tenement of a few hours' work is the home of a family for years or a day (Doniphan 1847:110).

The inferred function of the Keystone 37 structures, and the site itself, fits well within a regional settlement model for mobile hunting and gathering strategies outlined by Carmichael (1983b) and elaborated by Hard (1983). The regional implications for such an interpretation are discussed at length in Chapter 13; suffice to note here that the significance of such a strategy is magnified by its apparent contemporaneity with pueblo-based strategies traditionally assigned to the Doña Ana and El Paso phases. Despite the evidence for cooccurrence (see Chapter 11), there are no formal similarities between the features observed at Keystone 37 and known El Paso phase pueblos or pithouse sites. Similarly, there were no artifacts recovered at Site 37 which could be used to assign the site to the El Paso or Dona Ana phase (see Chapter 11). In short, by virtue of the inferred function of features at Keystone 37 and the relatively late dates obtained therefrom, the site cannot be adequately classified within the traditional phase framework used in the region. The data supporting this view, and their ramifications, are explored further in the sections on chronology (Chapter 11) and site context (Chapter 13).

CHAPTER 9

ARTIFACT ANALYSIS

By Myles Miller and David Carmichael

Introduction

This chapter provides a description and analysis of the chipped stone and groundstone assemblages from Keystone Sites 36 and 37. The few ceramics recovered from the sites proved to be rather uninformative but they are discussed briefly in the section on relative chronology (Chapter 11). Even more important than basic description are the analyses of several technological aspects of the lithic tools and debitage. Assemblage characteristics to be discussed include raw material procurement, reduction strategies, patterns of expediency and curation, and functionality of utilized edges. It will be seen that many similarities exist between the assemblages of Site 36 and 37; at a general level they can be inferred to have had similar functions. However, significant and informative differences between the assemblages do exist which allow speculation about their differing systemic contexts. That is, although the two sites appear to have functioned in generally similar ways (i.e., leaf succulent processing) there are indications that they may have articulated with their respective settlement systems in different ways.

The characteristics of each assemblage are first described then compared with one another and with materials from other sites in the region. In the process, hypotheses presented in the research design will be addressed where the data are applicable. The reader is referred to Chapter 3 for a review of the hypotheses.

It should be noted that in an effort to avoid redundancy detailed analyses were conducted on only a sample of the total lithic assemblages. The process of sample selection involved several types of decisions. First, it was decided to draw the sample from the entire collected assemblage rather than from the random excavation units only. The random units were designed primarily to insure that subsurface activity areas not conforming to surface distributions were not overlooked. Since the sampling frame consisted of the entire site, most random units fell outside the areas of maximum artifact density. That is, they provide a random sample of the site area, not the dense artifact scatters. Even if all the random units had been completed prior to the placement of judgemental units, the feature excavation requirements called for in the RFP would have caused most artifacts to be recovered from judgemental units. In order to best characterize the entire assemblages the samples used herein were drawn from all recovery units. It is noted, however, that it would be possible to structure any future reanalysis using only the random units.

The second issue of importance is the problem of sample size. Since the lithic analysis was carried out in two stages, it was possible to sample subpopulations within each assemblage. In the first stage of analysis, all artifacts were sorted into the following initial categories:

flake (primary, secondary or tertiary)	utilized flake
angular debitage	core
hammerstone	chopper
point	mano
scraper	metate
drill	pestle
other biface	anvil
ceramics	groundstone fragment

These categories represent the level of detail utilized in the cluster analysis of artifact distributions (Chapter 10) with all artifacts included in the analysis. The relative frequencies of artifacts within these groups are listed in Table 18.

The stage two lithic analysis was designed to investigate the technological details of production and use of artifact by monitoring flake morphology, edge angle, raw material types, etc. within artifact groups. For this purpose, samples were drawn from the 1120 and 4772 artifacts collected at Sites 36 and 37, respectively. In order to adequately address the known structure of the assemblages, samples were drawn from within each of the initial sort groups listed above.

Sample sizes were determined by using a SAMSIZ program (Van Tassel 1981:56-58) adapted for a Kaypro 10 computer. The computed sample sizes indicated the number of items to be selected from within each category in order to obtain a 95% confidence interval sample for that group. The process is similar to that discussed by Cochran (1977:72-77); it does not yield sampling for similar proportions or rare item sampling (cf. Cochran 1977:77) but rather, random samples within subpopulations. As an example, 95% confidence interval samples from Site 36 included 15 of 15 scrapers, 133 of 196 cores and 227 of 548 flakes. After determining the sample sizes, artifacts were selected using random numbers corresponding to individual specimen numbers generated during stage one analysis. The resulting samples contain 576 artifacts from Site 36 and 1133 from Site 37 (Table 19).

This approach produces a weighting of the less common items such that their occurrence in the sample is disproportionately higher than in the total assemblage. For this reason, general comparisons of artifact percentages between sites require the use of the stage one groups involving the entire collections (Table 18). The stage two analytical samples are used for making

Table 18. Distribution of Initial Sort Artifact Groups at Keystone Sites 36 and 37.

Artifact Group	Site 36	Site 37
Flake	633 (56.5%)	3426 (71.8%)
Utilized Flake	87 (7.8%)	367 (7.7%)
Angular Debitage	131 (11.7%)	273 (5.7%)
Test Core	73 (6.5%)	120 (2.5%)
Other Core	104 (9.3%)	370 (7.8%)
Hammerstone	43 (3.8%)	65 (1.4%)
Utilized Chunk	1 (.09%)	20 (.42%)
Projectile Point	1 (.09%)	7 (.15%)
Other Biface	--- ---	7 (.15%)
Scraper	15 (1.3%)	49 (1.0%)
Chopper	2 (.18%)	12 (.25%)
Other Tool	4 (.36%)	2 (.04%)
Mano	1 (.09%)	18 (.38%)
Metate	1 (.09%)	7 (.15%)
Pestle	1 (.09%)	9 (.19%)
Anvil	3 (.27%)	2 (.04%)
Groundstone Fragment	1 (.09%)	3 (.06%)
Ceramics	19 (1.7%)	15 (.30%)
TOTALS	1120 (99.95%)	4772 (100.03%)

comparisons of the range of variability within artifact groupings (e.g., proportions of material types or proportion of primary vs tertiary flakes). A few minor discrepancies between the two tables reflect the fact that some stage one group assignments were revised during stage two analysis.

Description of the Lithic Assemblage

Before reviewing the distributions of the various artifact classes identified at the sites, a brief definition of the attributes distinguishing each class is in order. The classification is based on technological and functional attributes representing various reduction categories and tool types.

Cores

A core is the nucleus of parent material from which flakes and angular debitage have been detached through the application of force. With the exception of Tested and Split Pebbles which have an unprepared cortex platform, at least one striking platform is present. Positive bulbs of force are absent. Five types of cores were catalogued in the lithic assemblages of Sites 36 and 37: tested, single platform, opposing platforms, multiple platform and bifacial.

Tested or Split Pebble

These are round or tabular nodules which exhibit varying degrees of testing but no reduction or shaping. They may be either one-half of a split nodule or an entire nodule showing a small amount of flake removal, but all samples retain more than 90% cortex and none have prepared platforms or secondary flake removal.

It is possible that a number of these cores were found to be unsuitable for reduction due to structural flaws or some other fault. It is expectable that nodules would be initially tested at their source location and, if found unsuitable, would not be transported or further reduced. It is also possible that the deposition of test cores at a site could constitute a form of caching behavior (Carmichael 1984).

Single Platform Core

On these cores, all flake scars originate from a single platform surface. The preparation of the single platform and shaping of the core exhibit greater attention than most other cores and is usually maintained towards the controlled production of relatively long flakes and blades.

Opposing Platform Cores

These cores are characterized by two platforms on opposite ends of the specimen. Usually, bipolar reduction is indicated by this arrangement and the technique is most commonly noted on small obsidian and chalcedony pebble cores.

Multiple Platform Cores

On these cores, several surfaces were used as striking platforms. These platforms show variable flake scar arrangements and there is little indication of platform preparation or core shaping. Multiple platform cores may be indicative of an expedient form of flake and tool production.

Bifacial Cores

Flakes have been removed from a series of adjoining and opposing platforms, resulting in a continuous, bifacially flaked edge which has a sinuous outline. Platform preparation is well developed and these cores are usually shaped. These cores may have been curated for reduction at a number of habitation sites.

Utilized Cores

These are cores which exhibit modifications and wear patterns on one or more edges. Usually, the wear patterns indicate battering.

Flakes

Flakes are the pieces of material removed from cores by the application of force. Flakes are distinguished by the presence of one or more of the following attributes: a striking platform at the proximal end of the specimen; a bulb of force on the ventral surface; conchoidal fracture patterns radiating from the bulb of force and either a feather, hinge, or step termination at the distal end of the specimen. Cortex may or may not be present on the dorsal surface. Flake fragments can be identified by the presence of one or more of these attributes and have been characterized as distal, medial, proximal, or lateral fragments.

Flakes have been assigned to one of three reduction categories based upon the amount of cortex present on the dorsal surface of a specimen. Various investigators have used differing degrees of dorsal cortex for identifying the reduction stages of flakes. For this study, the following definitions were used:

Primary Flake. Primary flakes have more than 50% cortex remaining on their dorsal surfaces.

Secondary Flake. A flake having on its dorsal surface any amount of cortex less than 50%.

Tertiary Flake. A flake having no cortex on its dorsal surface.

Two other types of flakes were identified at Sites 36 and 37. Blades are defined as a parallel-sided flake having a lengthwise dimension measuring at least two times its width. Rejuvenation flakes are generally large and irregular specimens which result from the shaping of a core in order to form its surface into a more readily workable area for flake removal.

Utilized Flakes. These are any form of flake which exhibits wear patterns on its platform or one or more of its edges. Retouched flakes are also included in this category.

Angular Debitage

These are angular fragments resulting from the application of force to a core, flake, or tool, but which lack flake attributes such as a bulb of force or striking platform. Conchoidal fracture is sometimes present.

Utilized Chunks

These artifacts are simply angular debitage having wear patterns or modifications on one or more edge. They can be considered as expedient tools.

Formal Tools

Scrapers

Scrapers are facially retouched artifacts with one or more modified or heavily utilized edge. They are distinguished from utilized flakes, cores, and chunks by a number of characteristics: usual absence or removal of any platform; some degree of shaping indicated by a generally circular or oval shape; and a greater degree of finishing and controlled edge modification. They also differ from bifaces and unifaces in that they are thicker in cross-section and do not show the high degree of shaping and retouch scars which are diagnostic of shaped bifaces and unifaces.

Three types of specialized scrapers were identified on the basis of shape. These include spokeshave (concave) scrapers, denticulate scrapers having small projections on one or more edges, and hinge scrapers. The latter are modified large flakes which have hinge terminations exhibiting use wear patterns.

Drills

Drills are specialized tools characterized by a thin cross-section and a much greater length than width. They are usually facially modified over the entirety of both opposing surfaces and exhibit wear patterns in the form of edge polish. Some specimens have a broad and flat base which facilitates their manipulation.

Bifaces and Unifaces

Following Chapman and Schutt (1977:93), bifaces are defined as "artifacts which exhibit retouch scars extending over one-third or more of both their opposing surfaces". Projectile points are a specialized form of biface which have a specific function.

Only one shaped uniface (knife) was recovered during the excavations at Site 36 and 37.

Choppers

Choppers are large tools which are usually round or oval in shape and have evidence of edge damage in the form of battering. Usually there is only one modified edge produced by the bifacial removal of a small number of flakes. The edge angles of choppers are usually in the range of 90 degrees.

Pebble Tools

These are artifacts of indeterminate function. They are large pebbles which have up to four flakes removed from one edge. Evidence of edge damage is not always present on the margins of the flake scars or edges, although a small number show some form of battering and numerous hinge fractures.

Hammerstones

Hammerstones are generally spherical or oval quartzite river cobbles showing evidence of battering on either end. Some examples show additional wear in the form of negative spall scar. Specimens at both Site 36 and 37 tend to be minimally used, often with only a few impact fractures visible on the cortex (Plate 5).

Groundstone

Groundstone Fragment

A groundstone fragment is defined as an artifact with evidence of grinding on at least one surface but which cannot be determined to be either a mano, metate, or other functional type.

Pestle

Pestles are large oblong artifacts which exhibit wear patterns in the form of crushing, grinding, abrasion, or striae around the entire perimeter of one or both ends. Most appear to be made of materials which occur naturally in the form of long, thin chunks or spalls (Plates 6, 7).

Mano

"Manos are defined as artifacts which exhibit at least one surface characterized by one or more smooth facets produced through grinding. Manos are hand-held implements presumably used primarily to crush and grind vegetal foodstuffs such as seeds against metates" (Chapman and Schutt 1977:93).

Metates

Metates are the implements upon which vegetal foodstuffs were ground using a mano. At Sites 36 and 37 all metates were minimally utilized, unshaped slabs characterized by a slight depression but no broad grinding surface set deep into the specimen (Plate 8).

Polishing Stones

These are small pebbles which have a very smooth and polished surface. They are distinguished from natural, water-worn pebbles through the identification of their having a smooth, flat surface on one side. This surface is much more polished than the other natural surfaces on the pebble.

Anvil

These are large tabular cobbles used in the preliminary reduction of raw material nodules. They exhibit concentrated areas of pecking on their surfaces presumably resulting from the support of pebbles of raw material during reduction (Plate 9).

Plate 5. Hammerstones

Plate 6. Pestle

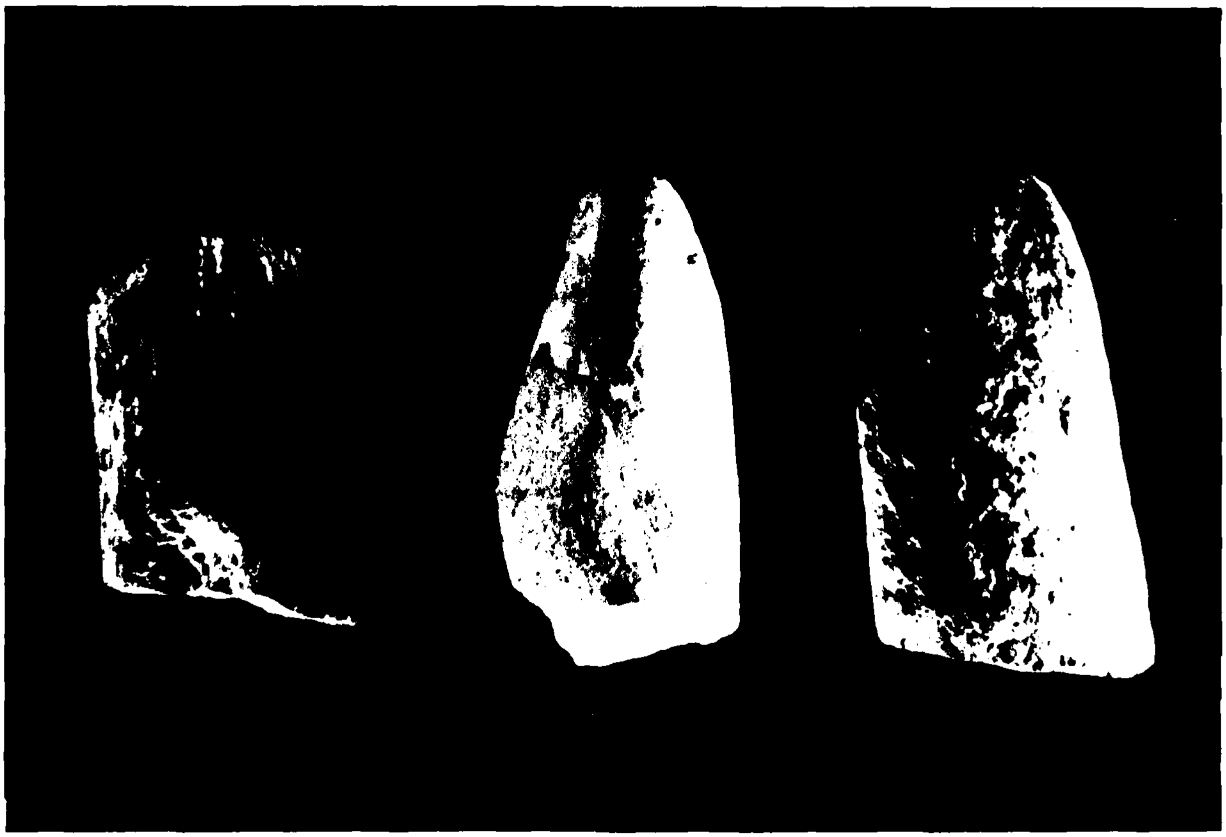


Plate 7. Pestle fragments

Plate 8. Metate

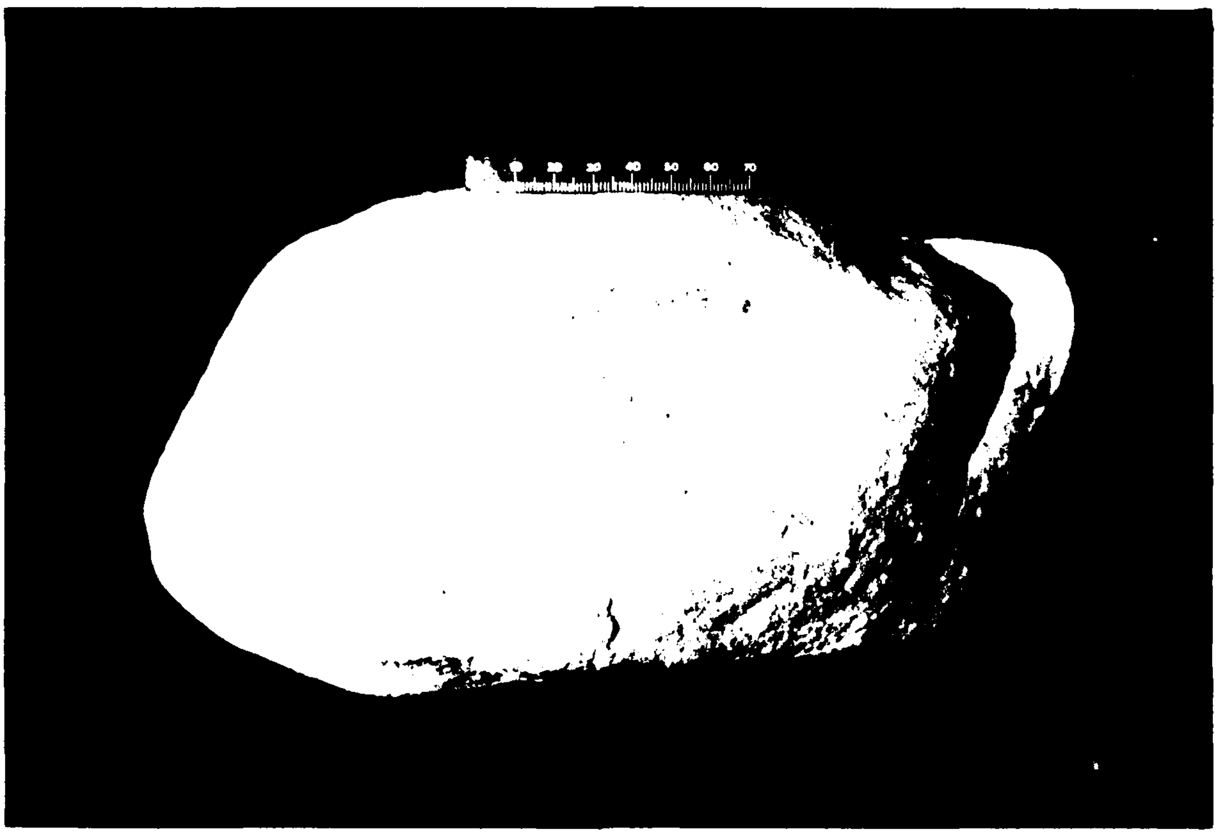


Plate 9. Anvil

Untested Pebble

These are raw nodules of materials which can be identified as having off-site sources. Although there is no evidence of wear or reduction, by nature of their occurrence at a site they are indicative of procurement activities. They are usually of obsidian, although other materials were also noted.

Other, Indeterminate

These are artifacts which exhibit some form of wear or damage, but due to their fragmentary state or unusual appearance cannot be assigned to any artifact class with confidence.

Artifact Types and Frequencies

It was suggested in Chapter 3 that the homogeneity of the artifact assemblage at a given site is inversely related to the duration of occupation (Hypothesis 1). It was also argued that assemblage homogeneity/diversity could be measured by the number of artifact categories represented on each site. If the hypothesis is correct, one would predict a wider variety of artifact categories, reflecting a greater diversity of behaviors, on long-term sites. These data are shown for Sites 36 and 37 in Table 19.

Site 37 contained 28 artifact classes while only 20 were recorded at Site 36. Since Site 37 is suggested as the result of longer occupation, the higher number of observed artifact types would appear, at first glance, to support the hypothesis. It is necessary however, to consider the difference in sample size when comparing the two sites. A difference of proportions statistic (Blalock 1972) was used to test the significance of the difference between numbers of artifact categories. A total of 29 artifact types were identified during stage two analysis. Twenty-eight (97%) of these were recorded at Site 37 and 20 (69%) were noted at Site 36. Following Blalock (1972:228-232) and Thomas (1976:492-496), the difference between the proportions of total classes is shown to be significant ($Z = -15.56$, $p = .00001$). Nevertheless, noting the statistical significance of the difference does not provide information on its meaning.

Although long an issue of discussion in ecology, diversity measures have only recently received close attention in the archeological literature (e.g., Grayson 1981; Jones et al. 1983; Kintigh 1984; Henss 1984). It has been noted that diversity within an assemblage can sometimes be explained simply as a function of sample size, with larger assemblages containing expectably greater variety (Kintigh 1984:44; Leonard 1985:11). Some investigators have dealt with this difficulty by performing

Table 19. Distribution of Artifact Classes in the Stage Two Sample from Keystone Sites 36 and 37

Artifact Type	Keystone 36 N	Keystone 36 %	Keystone 37 N	Keystone 37 %
1. Flake				
Whole Flake	210	36.3	468	41.2
Flake-Proximal Fragment	17	2.9	12	1.1
Flake-Medial Fragment	8	1.4	4	0.4
Flake-Distal Fragment	23	4.0	32	2.8
Flake-Lateral Fragment	10	1.7	20	1.8
2. Blade	2	0.3	1	0.1
3. Rejuvenation Flake	--	----	2	0.2
Utilized Flake*	(63)	(10.9)	(173)	(15.2)
4. Angular Debitage	105	18.2	175	15.3
Utilized Chunk*	(7)	(1.2)	(16)	(1.2)
5. Core-Tested or Split Pebble	90	15.6	82	7.2
6. Core-Single Platform	10	1.7	45	4.0
7. Core-Opposing Platform	3	0.5	22	1.9
8. Core-Multiple Platform	29	5.0	103	9.1
9. Core-Bifacial	1	0.2	8	0.7
Utilized Cores*	(7)	(1.2)	(3)	(0.3)
10. Projectile Point	1	0.2	7	0.6
11. Thin Biface	1	0.2	4	0.4
12. Shaped Uniface (Knife)	--	---	1	0.1
13. Scraper	13	2.2	37	3.3
14. Spokeshave Scraper	--	---	1	0.1
15. Hinge Scraper	--	---	3	0.3
16. Denticulate Scraper	2	0.3	2	0.2
17. Drill	1	0.2	1	0.1
18. Burin	--	---	--	---
19. Chopper	--	---	13	1.1
20. Pebble Tool	--	---	4	0.4
21. Large Pebble Tool	--	---	1	0.1
22. Hammerstone	42	7.3	45	4.0

Table 19. Continued. Distribution of Artifact Classes in the Stage Two Sample from Keystone Sites 36 and 37.

Artifact Type	Keystone 36 N	Keystone 36 %	Keystone 37 N	Keystone 37 %
23. Groundstone Fragment	1	0.2	3	0.3
24. Pestle	1	0.2	9	0.8
25. Mano	1	0.2	18	1.6
26. Metate	1	0.2	7	0.6
27. Anvil	3	0.5	2	0.2
28. Polishing Stone	--	---	2	0.2
29. Other, Indeterminate	1	0.2	1	0.1
Total Number of Artifacts	576	100%	1133	100%
Total Number of Artifact Types	20		28	

*Number and frequencies in parentheses not included in overall totals.

regression analysis of population size and diversity and using the results as a basis for determining the expected diversity within a given sample for a specific data set (Kintigh 1984; Henss 1984; Leonard 1985). Outliers, or individual cases which deviate significantly from the regression line contain either more or fewer categories than would be expected.

The main problem with applying this technique to the Keystone sites is that firm guidelines for the expected range in variability do not yet exist for El Paso area prehistoric sites. The problem is particularly acute since so few lithic assemblages from the area have been examined in detail (Leonard 1985:7). Even if one includes previous Keystone Dam studies and other published lithic analyses from the area, too few cases are available to permit satisfactory regression analysis.

The meaning of differential artifact diversity at Sites 36 and 37 remains unclear. If the number of artifact types were proportional to sample size, one would expect only about 14 types at Site 36; the smaller assemblage appears to be more diverse than would be expected. In fact, a comparison with previous Keystone analyses suggests that both sites contain more diverse assemblages than might be expected. A reclassification of artifacts from Sites 32 and 33 (Fields and Girard 1983; O'Laughlin 1980) according to categories used in this study yielded gross estimates of 20 and 21 categories in samples of approximately 18,000 and 5,000 items, respectively. These estimates imply a curvilinear relationship which has yet to be defined. It is not yet clear whether or not Kintigh's (1984) expected curve is realistic for camps where 60% or more of the artifacts fall in a single category (i.e., flakes). The issue cannot be resolved with the data from this study and further investigation must await the accumulation of additional lithic analyses conducted at comparable levels of detail.

Even in the absence of diversity expectations for local sites, it is possible to suggest that the data from Sites 36 and 37 do not seem to support Hypothesis 1 as written. It can not be concluded that the sites represent different functions because of a different range of on-site behaviors. Instead, it could be argued that the greater number of artifact classes reflects a larger assemblage, which, in turn is a measure of occupational duration/intensity. Such a suggestion is, in fact, consistent with the interpretations of Sites 36 and 37 developed below. It is suggested that the general similarities between the sites indicate corresponding general functions (leaf succulent processing) but that certain details reflect differences in duration of occupation and, thus, systemic contexts. In order to address this proposition, it is necessary to examine the differences between the assemblages within specific artifact classes.

Table 18 lists the distribution of artifact types for the entire assemblages at Sites 36 and 37. Note that these data are derived from the initial sort and that some artifacts were reclassified during the more detailed stage two analysis. For instance, the difference between the proportion of utilized chunks seems potentially significant. However, during stage two analysis, most of these items were reassigned to other artifact types, yielding similar percentages at both sites. The same is true for the category "other tool" at Site 36 since they were eventually assigned to the blade, biface and drill categories.

Many artifact types which might be used to infer different site functions show similar distributions at both sites. The proportions of utilized flakes, scrapers and choppers are nearly identical at the two sites (Table 18). Although Site 37 appears to contain more bifaces the difference between proportions (Blalock 1972:228-232) is not significant (Z = -1.363, p = .0869). A comparison of projectile point frequencies produces the same result, indicating no significant difference in the discard of bifaces at the two sites. Somewhat surprisingly, the paucity of groundstone artifacts at Site 36 is not significantly different from Site 37. Pestle fragments are more common at Site 37 but the proportions are not significantly different (Z = -.7143, p = .2389). Metates and groundstone fragments display greater similarity between the sites. Even the proportions of manos at the sites are not appreciable (Z = -1.5263, p = .0630). Although some activities occurred only rarely, it would appear that the range of behaviors carried out at the two sites corresponded in large part.

Almost all of the significant differences between the assemblages at Site 36 and 37 relate to the procurement and initial reduction of lithic raw materials. The one exception is the significantly greater proportion of ceramics in the smaller assemblage from Site 36 (Z = 5.60, p = .0001). The behavioral meaning, if any, attributable to this difference is unclear but, as discussed in Chapter 13, the unexpectedly small quantity of ceramics at Site 37 could be related to a strategy of high residential mobility. All the remaining artifact groups which exhibit significant differences relate in some way to lithic reduction.

Perhaps most striking are the relatively high proportions of test cores and hammerstones at Site 36. Test cores are proportionately more than twice as common at Site 36 (Z = 6.7797, p = .0001), a condition not necessarily predicted from the assemblage size. These cores are almost exclusively of materials available on the Tortugas surface a short distance east of the site. They consist of water worn pebbles exhibiting three or fewer flake scars and no evidence of edge modification. Apparently the cores were either discarded or cached on the site after testing.

In accordance with the apparent importance of initial core reduction (i.e., testing) at Site 36, hammerstones are also more common ($Z = 5.333$, $p = .0001$). They are usually made on quartzite cobbles available in the gravels of the nearby Tortugas surface. Although hammerstones play an important role in primary core reduction, their occurrence in proportions greater than one or two percent is seldom reported, even at lithic procurement sites (Bucy 1974; Singer and Ericson 1977; Klausen 1980). This is because hammerstones can usually be considered to be curated implements which enter the archeological record in a variety of settings. At Site 36, however, most hammerstones exhibit minimal damage in the form of only a few impact fractures on the cortex (Plate 5). It would appear that the hammerstones were an expedient part of the technology, many being discarded after testing only one or a few cores. This expediency can be seen as an efficient strategy only in the context of the local abundance of quartzite cobbles in the gravels of the Tortugas surface (see Chapter 5).

The apparent emphasis on lithic reduction at Site 36 is further evidenced by the percentages of reduced cores and angular debitage. Reduced (i.e., "other") cores follow the pattern for test cores, occurring in a significantly greater proportion at Site 36 ($Z = 1.648$, $p = .05$). Angular debitage, a common byproduct of primary core reduction, is almost twice as common at Site 36 than at 37. The difference is significant at $p = .0001$ ($Z = 7.1429$). The presence of significantly different proportions of anvils at Site 36 also supports the importance of initial core reduction ($Z = 2.5556$, $p = .0054$). The anvils consist of large dolomite cobbles with clusters of pecking marks on one or more surfaces (Plate 6). It is likely that they were used with hammerstones to split raw material pebbles with a bipolar technique.

In light of these data, it may seem unusual that Site 36 contains a significantly lower proportion of flakes than Site 37 ($Z = -9.9351$, $p = .0001$). However, this observation is consistent with a model of differing logistic contexts for the sites. Proportionately more cores were being initially reduced at Site 36, but these activities did not lead to the deposition of as many flakes as would be expected had they been completely reduced. In this region, high relative frequencies of waste flakes have been associated with longer-term residential sites (O'Laughlin 1979, 1980). Proportionately greater amounts of waste accumulate at such sites because they are the foci for tool production and maintenance. Conversely, short-term camps contain lower percentages of flakes presumably because fewer tools were manufactured there. If these expectations are accepted as reasonable, then Site 36 can be seen as the remains of a shorter-term occupation. While functioning primarily as a plant processing camp, lithic procurement appears to have been a secondary, embedded strategy. Lithic procurement would be a requisite at either site, but cores appear to have been more thoroughly reduced at Site 37 (see below), thus producing the higher proportion of flakes. The use of cores for shims in the post sockets of some structures at Site 37 (Chapter 8) suggests that many cores were expended at the site. At Site 36, after the initial testing of raw materials, cores, and perhaps some flakes, were probably carried from the site for further reduction elsewhere.

The differences between the sites suggest that, in the contexts of their respective settlement systems, Site 36 was probably a short-term camp ancillary to a more permanent residence. Site 37 may have served as a short-term residential base camp. This possibility, which is in accord with data on flake morphology, biface manufacture and curation, feature variability and activity patterning, is discussed further in later sections of the report.

Lithic Raw Materials

The Keystone Site 36 and 37 lithic assemblages are comprised of 21 general categories of raw materials. Two hundred and ten material varieties were identified within these general categories. The range of material categories present in the Site 36 and 37 assemblages is similar to that reported for Keystone Sites 33 and 34 (O'Laughlin, 1980:167-180) and Site 32 (Fields and Girard, 1983:160-162). However, the relative frequencies of the raw material categories varies among the assemblages of each site, and the 210 material varieties identified at Sites 36 and 37 represents a much greater variety of lithic resources than has been identified at the other Keystone sites. The greater variability observed in study is probably due to differences in the level of detail used in relation to previous investigations.

A complete listing of the 210 raw material varieties is provided in Appendix IIc. The detailed listing of material varieties is included mainly as a reference for other research in the region. In the past, the presence of a variety of fine-grained cherts in the El Paso area has often been interpreted as evidence for the use of nonlocal lithic sources. However, such a view cannot be supported without first characterizing the nature and variability of local resources. Most of the lithic types recorded at Sites 36 and 37 were observed in the immediate area during the geomorphic study (Chapter 5). None of the site materials can confidently be identified as nonlocal. The list in Appendix IIc is important because it reflects the range of resource variability within the local Tortugas geomorphic unit (i.e., within a single local lithic source).

Numerical codes have been assigned to the material varieties as listed in Appendix IId. Sedimentary rocks are given codes in the 100 series; igneous rocks are represented by 200 series codes, and metamorphic rocks are 300 series codes. Four hundred, 500, and 700 series codes include various siliceous cryptocrystalline materials such as cherts, jaspers, chalcedonies, and silicified wood.

Of the 21 general material categories, eight groups make up the bulk of the artifacts in the Keystone Site 36 and 37 lithic assemblages. These major categories are briefly described below: Chert - In the analysis of lithic raw materials comprising the assemblages of Keystone Sites 32, 33, and 34, O'Laughlin (1980:170) and Fields and Girard (1982:160) classified siliceous cryptocrystalline materials, including jaspers, chalcedonies, and silicified wood, under the general category of chert. Although these materials are basically similar in terms of siliceous composition, availability, and nodule size in the local gravels, some investigators have noted different degrees of fracture mechanics and fracture quality among them. Gomolak (1981) notes that due to their generally finer cryptocrystalline structure and homogeneity, jaspers and chalcedonies have superior fracture mechanics compared to most cherts and silicified woods.

In light of variation in fracture quality among the materials and, in the interest of determining whether such qualities were a possible factor in the selection of specific materials for the production of different artifact types at Keystone Sites 36 and 37, cryptocrystalline materials were separated into the four categories of chert, jasper, chalcedony, and silicified wood.

Cherts are siliceous cryptocrystalline materials which have good conchoidal fracture and edge strength. One hundred forty-one varieties of chert were catalogued in the Site 36 and 37 assemblage, encompassing an extensive range of colors, textures, inclusion types, and fracture quality.

Cherts are available in the local gravel deposits, although not in particular abundance compared to the amounts of dolomite and rhyolite (see Table 5). They occur in nodular and tabular form, with both forms having a cortex and rarely exceeding 8 cm in length (O'Laughlin 1980:170; also this chapter below).

One variety of local bedded chert has a notably high incidence in the Keystone area, both in the lithic assemblages of the archaeological sites and the local gravels. It has been given the name "Rancheria" based upon its common occurrence in the Rancheria formation in the Franklin and Organ Mountains (Carmichael 1983:167). It is a brown-weathering and porous chert with colors ranging from black to light brown; the brown areas represent weathered zones. Four varieties of Rancheria chert have been identified and catalogued based upon the presence or absence of banding and mixing of the unweathered black zones and weathered light brown zones (see Appendix IId, Codes 450-453).

Rancheria chert occurs in nodules or thinly laminated deposits within limestone strata (Loudon and Bowsher, 1949:19), and is widely distributed throughout the Franklin and Hueco Mountains and Bishop Cap regions of the Keystone project area and southern New Mexico (Carmichael 1983:167). In the local Keystone area, it is most commonly found as small, 5 - 8 cm tabular fragments, but small nodules are also common in the local alluvial gravels.

Compared to other cherts, Rancheria chert is generally inferior in terms of fracture quality. Whalen (1978:4) has stated that the majority of cherts available around the Franklin Mountains are of poor quality; presumably the high proportion of Rancheria chert in the alluvial and colluvial gravels around the Franklin Mountains led to his assessment. The black porous and brown porous varieties (Codes 451 and 452) have especially poor conchoidal fracture, and percussion often leads to breakage and block debitage along solution joints or texture faults, making the removal of large flakes and the thinning of cores difficult. However, the black/gray banded and black/gray mixed varieties (Codes 450 and 453) are characterized by a slightly more homogeneous structure and subsequently are more suitable for utilization in particular types of flake and tool production.

Rancheria cherts comprise a significant proportion (up to 31%) of the total chert sample utilized at Sites 36 and 37. Interestingly, the inferior structure qualities marking these cherts as less suitable for well controlled reduction and tool production appear to have made them particularly suitable for the production of at least two types of tools. A preference of Rancheria chert for the manufacture of scrapers, is evident at Sites 36 and 37 (see below, this chapter). A lesser preference is evident for utilized flakes. The selection of Rancheria chert for the production of these two tool types may be due to its structure and fracture qualities. Although it is by no means definite, observations in the field and lab have suggested that Rancheria cherts are slightly denser and more durable than many other local cherts. Future controlled experimentation is suggested in order to evaluate this possibility.

Jaspers and Chalcedonies. These are siliceous, highly cryptocrystalline materials. Jaspers generally are notable for their homogeneous texture; chalcedonies for their waxy luster. All samples are characterized by excellent conchoidal fracture properties and good edge retention.

Jaspers and chalcedonies occur as nodules in the local alluvial gravels. Chalcedony nodules usually have a hard, uneven cortex and are small in size. Eleven varieties of jasper and 31 varieties of chalcedony were identified in the Site 36 and 37 lithic assemblages (see Appendices IIc and IId).

Silicified Wood. Silicified wood (petrified wood) is present in minimal quantities as small tabular cobbles in the local alluvial gravels. The fracture mechanics of this material are dependent upon the character of the mineral replacements of the original wood structure (Chapman 1977:429). Some samples have tabular fracture planes which render the material sample unsuitable for further use. Others have tabular fracture along the wood grain but fracture conchoidally across the grain. Good conchoidal fracture occurs only in those samples which have most of the original wood structure replaced (Gomolak 1981). The latter two types of fracture quality were noted among the samples of silicified wood in the Site 36 and 37 lithic assemblage.

Rhyolite. Rhyolite is an igneous rock which ranges in texture from fine to coarse grained. Large to small-sized phenocrysts of quartz, feldspar, and biotite are usually present within a fine-grained matrix.

Eight varieties of rhyolite were identified in the Site 36 and 37 assemblages. Predominant are the Thunderbird rhyolite red and black varieties. They are both very coarse-grained porphyry with large phenocrysts which are surrounded by a finer-grained matrix, red or black in color. Fracture qualities are poor and they tend to bre . or crumble into irregular blocks and fragments upon application of force. Thunderbird rhyolite is a major geologic component of the Franklin Mountains, and small to large-sized cobbles are present in large quantities throughout the Keystone area, making it a readily available lithic resource.

Soledad rhyolite represents the second highest proportion of rhyolites at Site 36 and 37. It is a material with a nonlocal origin in the Organ Mountains but which is available in Rio Grande gravels downstream of Las Cruces. This rhyolite has a light red or purple matrix (7.5R 6/2 or 5/2) with very small pinkish-gray phenocrysts. It is very fine-grained and has conchoidal fracture properties equal to that of many cherts.

Other rhyolites are present in small quantities. Reworked flow-banded Thunderbird rhyolite is a slightly finer-grained variety of Thunderbird rhyolite. Its phenocrysts are generally smaller and occur in a band surrounded by a fine-grained matrix which usually lacks phenocrysts. Picacho rhyolite is a medium-grained, red-banded material with a source near Las Cruces, New Mexico. Two varieties of rhyolite Welded Tuff were identified. These are glassy materials with fine-grained matrices and relatively good fracture quality. No source has been pinpointed for the welded tuffs, although possible origins near the Organ Mountains of New Mexico have been suggested (Carmichael 1983:168-169).

Dolomite. A high proportion of the Site 36 and 37 lithic assemblages is comprised of dolomite (limestone). This material varies greatly in texture and color; however, the majority are medium-grained and light gray in color. Conchoidal fracture is fair, although many samples are easily shattered. In all samples, production of flakes and thinning of cores is difficult due to a tendency for hinge fractures to result from percussion and pressure flaking (O'Laughlin 1980:170). Furthermore, edge retention and durability is poor.

As with rhyolite, dolomite is a major geologic component of the Franklin Mountains and is the most abundant material type represented in the local alluvial gravels of the Keystone area.

Quartzite. Quartzite varies from fine to medium-grained, but does not fracture well conchoidally and has little edge retention. Its importance in the Site 36 and 37 assemblages, and the Site 32 assemblage (Fields and Girard 1982:161) is that the one artifact category of hammerstones consists almost entirely of this material. Quartzite is found in small quantities in the local alluvial gravels. However, a major local source for quartzite hammerstones is located east of Site 36 on the Tortugas geomorphic surface (Carmichael and Elsasser, 1984; see also this chapter below).

Obsidian. Obsidian is easily worked and has excellent conchoidal fracture. However, it has poor edge retention and durability relative to chert and the other siliceous cryptocrystalline materials (O'Laughlin 1980:170).

Obsidian nodules are very small and have a distinctive cortex. The occurrence of obsidian nodules in the local alluvial gravels is rare, and the material is correspondingly rare in the Keystone assemblages. Its importance derives from its potential for providing chronometric dates (See Chapter 11).

Discussion

The distributions of material types at Sites 36 and 37 are summarized in Table 20. All percentages represent the relative frequencies of raw materials occurring in each of the three columns. Below the main table are supplementary listings for the Thunderbird rhyolites and Rancheria cherts, the total number of material varieties for each site, and a comparison of the total proportions of fine-grained and coarse-grained materials.

Considering the combined assemblages from Keystone Sites 36 and 37, the most frequently recovered material is chert (45.2%), followed by rhyolite (14.7%), dolomite (13.8%), chalcedony (10.3%), quartzite (5.7%), obsidian (2.6%) and jasper (1.9%). The remaining 5.8% of material varieties, representing those utilized less frequently, include sandstone, siltstone, basalt, granite, silicified siltstones, quartzitic sandstone, schist, quartz, silicified shale, and various undifferentiated sedimentary, igneous, and metamorphic rocks.

A comparison of the assemblages from Sites 36 and 37 reveals differences in the relative frequencies of chert, dolomite, rhyolite and quartzite (Table 20). The differences appear indicative of a general pattern in the use of fine, medium and coarse-grained raw materials. It should be noted that the distinctions between fine, medium and coarse-grained textures are relative qualities noted within individual material categories (i.e., a medium-grained chert is often finer than a fine-grained rhyolite). For present purposes, fine-grained materials include all siliceous cryptocrystallines and obsidian. Medium to coarse-grained materials include all textures of rhyolite, dolomite and other siliceous rocks.

As shown in Table 20, Site 36 exhibits a significantly higher proportion of fine-grained materials ($Z = 4.00$, $p = .0001$), with the medium and coarse group showing the opposite pattern. This distinction is mirrored by the occurrence of cherts at the sites. Although cherts are predominant in both assemblages, they make up a higher proportion of the artifacts at Site 36 ($Z = 3.438$, $p = .0003$). Within the chert portion of the assemblages, however, Site 37 contains a greater number of material varieties. As in the case of artifact types, the number of material varieties is very likely conditioned by the size of the collection, and little meaning can be attributed to the difference at the present time.

In contrast to the distribution of chert, the coarser material such as rhyolite and dolomite are significantly more common at Site 37. The difference of proportions for dolomite are significant at $p = .0002$ ($Z = 3.5028$) and for rhyolite at $p = .001$ ($Z = -3.0387$). Quartzite is the only coarse material type which is significantly more common Site 36 ($Z = 2.437$, $p = .0073$). Nearly 90% of this material occurs in the form of hammerstones and some additional specimens are hammerstone spalls. Thus, quartzite was primarily collected for use as hammers rather than for flaking material.

These differences between the assemblages would appear to indicate greater selectivity in the use of raw materials at Site 36 and, conversely, a more eclectic procurement strategy at Site 37. Presumably, fine-grained rocks (i.e., cherts) would be selected for qualities such as greater predictability of fracture which contribute to greater control during reduction. Control would be especially important in the manufacture of curated tools. Although formal tools are not common at Site 36, it has already been suggested that the procurement of stone for such tools may have been an embedded strategy at the site. The higher proportions of fine lithic raw material would support a model

Table 20. Distributions of Material Categories by Site

Material Category	Keystone 36		Keystone 37		Total Assemblage	
Sedimentary, Undifferentiated	1	0.2	2	0.2	3	0.2
Sandstone	2	0.3	8	0.7	10	0.6
Dolomite	56	9.7	181	15.9	237	13.8
Siltstone	9	1.6	9	0.8	18	1.1
Igneous, Undifferentiated	2	0.3	1	0.1	3	0.2
Obsidian	10	1.7	34	3.0	44	2.6
Basalt	--	---	9	0.8	9	0.5
Rhyolite (8 varieties)	64	11.0	188	16.5	252	14.7
Granites and Diorites	--	---	7	0.6	7	0.4
Metamorphic, Undifferentiated	1	0.2	1	0.1	2	0.1
Quartzitic Sandstone	2	0.3	5	0.4	7	0.4
Quartzitic Sandstone Conglomerate	--	---	2	0.2	2	0.1
Quartzite	44	7.6	54	4.7	98	5.7
Schist	--	---	2	0.2	2	0.1
Silicified Shale	1	0.2	3	0.3	4	0.2
Quartz	1	0.2	1	0.1	2	0.1
Silicified Siltstone (3 varieties)	3	0.5	8	0.7	11	0.6
Silicified Wood	2	0.3	17	1.5	19	1.1
Jasper (11 varieties)	10	1.7	22	2.1	32	1.9
Chalcedony (31 varieties)	58	10.1	118	10.4	176	10.3
Chert (141 varieties)	312	54.0	463	40.8	775	45.2
Totals	576	99.9	1133	100.0	1709	99.8
Total number of varieties	130		184		210	
Rancheria Cherts	85	14.7	142	12.5	227	13.3
Thunderbird Rhyolites	39	6.7	89	7.8	128	7.5
% of total chert sample which are Rancheria cherts	27%		31%		29%	
Recent coarse and medium-grained	32.4%		42.4%		39%	
Percent fine-grained materials (jasper, chalcedony, obsidian, chert, silicified wood)	67.6%		57.6%		61%	

within which cherts were tested and selected at Site 36 for eventual use in the manufacture of curated tools at a more permanent site. The somewhat more eclectic strategy evidenced at Site 37 would indicate a greater emphasis on the production and use of expedient flake tools. The implications of these two potentially different reduction trajectories for flake morphology are explored later in the chapter.

A general summary of the raw material variability within the assemblages will not be presented here. Instead, the importance and implications of this variability will become apparent during the following discussions of raw material utilization in the manufacture of specific types of artifacts and tools. A primary goal of the analysis is to identify aspects of raw material availability, suitability, and utilization as they relate to tool curation and expediency.

Material Utilization Among Artifact Classes

Sources of raw materials used in the manufacture of tools are known to have specific distributions within a given environment. Information on the distributions of lithic raw materials among archeological sites can provide insights into the migratory patterns and procurement strategies of prehistoric populations. However, lithic raw materials should not be viewed as a descriptive attribute alone, but as part of a broader series of behavioral considerations (Chapman 1977:372; Schutt and Vierra 1980:45). Different materials exhibit a wide range of source locations and availability relative to floral and faunal resources and favorable settlement areas. Also, various physical properties such as texture, homogeneity, elasticity, density, and hardness make them more or less suitable for differing tasks. However, data from Keystone Sites 36 and 37 indicate that the physical properties of raw materials alone do not account for the distributions of material varieties among artifact classes at these sites.

Given the ephemeral nature of Sites 36 and 37, a variety of factors besides material quality may have conditioned material selection. Such factors might well include the energy expenditure required for procurement, and logistical concerns pertaining to the use of different tool classes. As discussed below, rhyolite, dolomite, Rancheria chert, and other materials of generally inferior quality are well represented in the artifact classes at Sites 36 and 37. Although the distributions of these materials might be considered as merely indicative of their general abundance in the local gravels, a more satisfying explanation would also consider the above mentioned issue of site context as it relates to patterns of expediency or curation in the assemblages.

In the following discussion, raw materials identified among the various classes of artifacts at Sites 36 and 37 will be analyzed with reference to their association with different patterns of reduction. The analysis will also be directed towards the consideration of broader patterns of site occupation. It is felt that raw material selection at Sites 36 and 37 was governed in part by interrelated factors of material suitability and material availability. These factors were, in turn, operating within specific logistic contexts characterizing ephemeral sites with differing systemic relationships.

Tables 21 and 22 list the distribution of raw materials among the five types of cores identified at Sites 36 and 37. Percentages reflect the frequency of a raw material occurring within a particular type of core, and totals for each material type are provided at the right of the table.

Tested pebble cores are the most common type at Site 36 and multiple platform cores predominate at Site 37. At both sites fine-grained materials are the most common but their distributions differ between sites. Fine-grained siliceous materials comprise 72.2% of the tested cores at Site 36 but only 58.5% of those at 37, a difference which is statistically significant ($Z = 1.895$, $p = .0294$). The opposite relationship is seen among multiple platform cores where fine materials total 73.8% at Site 37 and 52.7% at 36 ($Z = -2.273$, $p = .0116$). Since tested cores are minimally reduced, while multiple platform cores are relatively completely reduced, the differential distributions would seem to indicate that even though fine siliceous rocks were the predominate materials tested at Site 36, they were less thoroughly reduced than at Site 37. This observation is in accord with the suggestion made earlier that fine materials were tested by the occupants of Site 36 for eventual removal to other sites.

This pattern is further supported by the distribution of raw materials among flake types (Table 23). It is evident that a higher proportion of the flakes at Site 36 are of chert (50.7% versus 42.1%). This difference is significant at $p = .0104$ ($Z = 2.318$). Conversely, a significantly higher proportion (39.5% versus 27.8%) of the flakes at Site 37 consist of medium to coarse-grained materials ($Z = -3.277$, $p = .0006$).

Raw material distributions relative to primary, secondary and tertiary flakes are listed in Table 24. A comparison of the two assemblages indicates differences in the distribution of fine-grained materials among flake types. Specifically, tertiary flakes at Site 36 show higher percentages of fine materials and lower percentages of medium to coarse-grained materials than at Site 37. The data contributing to this pattern may be summarized as follows:

	Site 36			Site 37		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Fine-grained silicious	13 (6.7%)	105 (53.8%)	77 (39.5%)	54 (16.4%)	189 (57.4%)	86 (26.1%)
Medium and coarse	13 (17.6%)	53 (71.6%)	8 (10.8%)	38 (18.3%)	104 (50.5%)	66 (31.8%)

Due to the number of categorical variables involved in this comparison, the significance of the distribution is most readily tested using a chi-square statistic (Blalock 1972:233). In a cross tabulation of the occurrence of fine materials at each site by flake type, the differences between the assemblages are found to be significant beyond the 95% confidence level (chi-square = 16.3912, df = 2, p = .001). The main deviations from the expected distribution occur at Site 36 where fine-grained materials are more common among tertiary flakes and less common among primary flakes than was predicted. The complementary differences in the distribution of medium and coarse materials are significant at a similar confidence level (chi-square = 13.7011, df = 2, p = .001). Coarse-grained materials are more common than expected among tertiary flakes at Site 37 and less common than expected for the same flake type at 36. While it is possible to produce tertiary flakes in all stages of lithic reduction, they are generally viewed as typical of the later stages. Among the artifacts representing the later stages of reduction, there is supporting evidence for the pattern of material use identified earlier among cores. The higher proportion of fine-grained materials at Site 36 again indicates greater selectivity in raw material use. Since virtually identical raw materials were locally available to the occupants of both sites, the higher proportion of fine-grained types at Site 36 indicates greater selectivity in the exploitation of the lithic resource. The more eclectic use of materials at Site 37 extends even to tertiary flakes. This was unanticipated since it had been expected that extensive reduction (i.e., requiring greater control) would be confined mainly to finer materials when they are so readily available.

Tables 25 through 28 present the occurrence of material types among utilized flakes and the more formalized tools recorded at each site. Chert, dolomite and rhyolite were most frequently selected for utilized flakes, with chalcedony, obsidian and jasper also present in varying amounts (Table 25). Although it appears that fine-grained materials were more commonly used at Site 36, a difference of proportions test (Blalock 1972:228) was not significant (Z = .9615, p = .1685).

Table 26 shows the material distributions among scrapers from Sites 36 and 37. The three forms of specialized scrapers (spokeshave, hinge and denticulate) have not been listed separately since they are few in number. Furthermore, their

Table 21. Material Composition of Cores - Keystone Site 36

Material Type	Tested/Split Pebble	Single Platform	Opposing Platform	Multiple Platform	Bifacial	Totals
Chert	54 (60.0)	5 (50.0)	1 (33.3)	15 (51.7)	--	75 (55.7)
(Rancheria)*	(17) (18.9)	(3) (30.0)	---	(5) (17.2)	--	(25) (18.8)
Jasper	1 (1.1)	---	---	---	--	1 (0.8)
Chalcedony	10 (11.1)	1 (10.0)	---	---	--	11 (8.3)
Dolomite	10 (11.1)	3 (30.0)	1 (33.3)	3 (10.3)	--	17 (12.8)
T-Bird Rhyo Red	4 (4.4)	1 (10.0)	---	5 (17.2)	--	10 (7.5)
T-Bird Rhyo Black	---	---	---	1 (3.5)	--	1 (0.8)
Reworked Flow Rhyo	---	---	---	1 (3.5)	--	1 (0.8)
Soledad Rhyo	1 (1.1)	---	---	1 (3.5)	--	2 (1.5)
Other Rhyo	1 (1.1)	---	---	---	1 (100)	2 (1.5)
Siltstone	---	---	1 (33.3)	2 (6.9)	--	3 (2.6)
Quartzite	7 (7.8)	---	---	1 (3.5)	--	8 (6.0)
Metamorphic, Undiff.	1 (1.1)	---	---	---	--	1 (0.8)
Quartz. Sandstone	1 (1.1)	---	---	---	--	1 (0.8)
Totals	90	10	3	29	1	133

* Material frequencies in parentheses not calculated in column totals

Table 22. Material Composition of Cores - Keystone Site 37

Material Type	Tested/Split Pebble	Single Platform	Opposing Platform	Multiple Platform	Bifacial	Totals
Chert	27 (32.9)	18 (40.0)	10 (45.5)	59 (57.3)	5 (62.5)	119 (45.8)
(Rancheria)*	(3) (3.7)	(11)(24.4)	(5)(22.7)	(17)(16.5)	(1)(12.5)	(37)(14.2)
Jasper	2 (2.4)	3 (6.7)	1 (4.5)	5 (4.9)	----	11 (4.2)
Chalcedony	11 (13.4)	4 (8.9)	2 (9.1)	9 (8.7)	----	26 (10.0)
Obsidian	4 (4.9)	----	----	3 (2.9)	----	7 (2.7)
Silicified Wood	4 (4.9)	3 (6.7)	----	----	----	7 (2.7)
Dolomite	10 (12.2)	5 (11.1)	2 (9.1)	12 (11.7)	1 (12.5)	30 (11.5)
T-Bird Rhyo Red	1 (1.2)	6 (13.3)	2 (9.1)	6 (5.8)	1 (12.5)	16 (6.2)
T-Bird Rhyo Black	----	1 (2.2)	2 (9.1)	2 (1.9)	----	5 (1.9)
Reworked Flow Rhyo	----	----	1 (4.5)	1 (1.0)	----	2 (0.8)
Soledad Rhyo	1 (1.2)	----	1 (4.5)	4 (3.9)	----	6 (2.3)
Rhyolite Tuff	2 (2.4)	----	----	----	1 (12.5)	3 (1.2)
Picacho Rhyo	----	1 (2.2)	----	----	----	1 (0.4)
Other Rhyo	6 (7.3)	2 (4.4)	1 (4.5)	----	----	9 (3.5)
Siltstone	1 (1.2)	----	----	1 (1.0)	----	2 (0.8)
Sandstone	1 (1.2)	----	----	----	----	1 (0.4)
Quartzite	3 (3.7)	1 (2.2)	----	1 (1.0)	----	5 (1.9)
Basalt	1 (1.2)	----	----	----	----	1 (0.4)
Silicified Shale	1 (1.2)	----	----	----	----	1 (0.4)
Silicified Siltstone	2 (2.4)	----	----	----	----	2 (0.8)
Metamorphic, Undiff.	1 (1.2)	----	----	----	----	1 (0.4)
Granite/Diorite	1 (1.2)	1 (2.2)	----	----	----	2 (0.8)
Quartz. Sandstone	3 (3.7)	----	----	----	----	3 (1.2)
Totals	82	45	22	103	8	260

* Material frequencies in parentheses not calculated in column totals.

Table 23. Material Composition of Flakes at Keystone Sites 36 and 37

Material Type	Keystone 36	Keystone 37
All Cherts	137 (50.7)	229 (42.1)
(Rancheria Cherts)*	34 (12.6)	60 (11.1)
Jaspers	7 (2.6)	8 (1.5)
Chalcedony	42 (15.6)	66 (12.2)
Obsidian	7 (2.6)	23 (4.3)
Silicified Wood	2 (0.7)	2 (0.4)
Thunderbird Rhyolite-Red	10 (3.7)	18 (3.3)
Thunderbird Rhyolite-Black	13 (4.8)	31 (5.8)
Reworked Flow TB Rhyolite	-- ---	11 (2.0)
Soledad Rhyolite	6 (2.2)	23 (4.3)
Rhyolite Tuffs	1 (0.4)	4 (0.8)
Other Rhyolites	9 (3.3)	11 (2.0)
Dolomite	25 (9.3)	83 (15.4)
Sedimentary, Undif.	1 (0.4)	-- ---
Sandstone	1 (0.4)	3 (0.6)
Basalt	-- ---	5 (0.9)
Granite/Diorite	-- ---	1 (0.2)
Quartzite	1 (0.4)	2 (0.4)
Quartzitic Sandstone	-- ---	2 (0.4)
Siltstone	6 (2.2)	6 (1.1)
Silicified Siltstone	2 (0.7)	5 (0.9)
Silicified Shale	-- ---	2 (0.4)
Totals	270 (100)	539 (100)

*Entries in parentheses not calculated in column totals

Table 24. Material Distributions Among Flake Types

Material Type	Keystone 36 Primary	Keystone 36 Secondary	Keystone 36 Tertiary	Keystone 37 Primary	Keystone 37 Secondary	Keystone 37 Tertiary
Chert	9 (6.6)	80 (58.4)	48 (35.0)	35 (15.4)	135 (59.5)	57 (25.1)
(Rancheria Chert*)	3 (8.8)	22 (64.7)	9 (26.5)	12 (20.0)	38 (63.3)	10 (16.7)
Jasper	1 (14.3)	2 (28.6)	4 (57.1)	4 (50.0)	3 (37.5)	1 (12.5)
Chalcedony	1 (2.4)	19 (45.2)	22 (52.4)	5 (7.6)	37 (56.1)	24 (36.4)
Obsidian	1 (14.3)	3 (42.9)	3 (42.9)	7 (30.4)	12 (52.2)	3 (13.0)
Silicified Wood	1 (50.0)	1 (50.0)	--- ---	3 (50.0)	2 (33.3)	1 (16.7)
Dolomite	3 (12.0)	20 (80.0)	2 (8.0)	13 (15.7)	45 (54.2)	25 (30.1)
(All Rhyolite*)	9 (23.7)	24 (61.5)	6 (15.4)	18 (18.6)	46 (47.4)	33 (34.0)
Thunderbird Rhyolite-Red	3 (30.0)	7 (70.0)	-- --	4 (22.2)	8 (44.4)	6 (33.3)
Thunderbird Rhyolite-Black	3 (23.1)	9 (69.2)	1 (7.7)	8 (25.8)	12 (38.7)	11 (35.5)
Reworked Flow-Banded Thunderbird Rhyolite	--- ---	--- ---	--- ---	--- ---	9 (81.8)	2 (18.2)
Soledad Rhyolite	1 (16.7)	3 (50.0)	2 (33.3)	6 (26.1)	10 (43.5)	7 (30.4)
Rhyolite Tuff	--- ---	1 ---	--- ---	--- ---	2 (50.0)	2 (50.0)
Other Rhyolite	2 (22.2)	4 (44.4)	3 (33.3)	--- ---	6 (54.5)	5 (45.5)

Table 24. Material Distributions Among Flake Types - Continued

Material Type	Keystone 36 Primary	Keystone 36 Secondary	Keystone 36 Tertiary	Keystone 37 Primary	Keystone 37 Secondary	Keystone 37 Tertiary
Sedimentary, Undifferentiated	---	---	---	1	1	---
	---	---	---	(50.0)	(50.0)	---
Sandstone	1	---	---	1	---	2
	(100)	---	---	(33.3)	---	(66.6)
Siltstone	---	6	---	3	3	---
	---	(100)	---	(50.0)	(50.0)	---
Basalt	---	---	---	---	3	2
	---	---	---	---	(60.0)	(40.0)
Granite/Diorite	---	---	---	---	1	---
	---	---	---	---	(100)	---
Quartzitic Sandstone	---	---	---	---	1	1
	---	---	---	---	(50.0)	(50.0)
Quartzite	---	1	---	1	1	---
	---	(100)	---	(50.0)	(50.0)	---
Silicified Shale	---	---	---	1	---	1
	---	---	---	(50.0)	---	(50.0)
Silicified Siltstone	---	2	---	---	3	2
	---	(100)	---	---	(60.0)	(40.0)

* Material frequencies in parentheses not calculated in column totals.

Table 25. Material Composition of Utilized Flakes

Material Type	Number and Percentage of Utilized Flakes, Site 36		Number and Percentage of Utilized Flakes, Site 37	
Chert	28	(44.4)	65	(37.0)
(Rancheria Chert)*	(5)	(8.0)	(20)	(11.4)
Jasper	3	(4.8)	1	(0.6)
Chalcedony	4	(6.4)	23	(13.5)
Obsidian	3	(4.8)	5	(2.9)
Silicified Wood	1	(1.6)	1	(0.6)
Dolomite	16	(25.4)	35	(20.2)
(All Rhyolites)*	5	(8.0)	32	(18.6)
Thunderbird Rhyolite-Red	--	---	6	(3.5)
Thunderbird Rhyolite-Black	1	(1.6)	5	(2.9)
Reworked Flow TB Rhyolite	--	---	5	(2.9)
Soledad Rhyolite	2	(3.2)	10	(5.8)
Rhyolite Tuff	1	(1.6)	2	(1.2)
Other Rhyolite	1	(1.6)	4	(2.3)
Sedimentary, Undiff.	--	---	2	(1.2)
Sandstone	--	---	2	(1.2)
Quartzitic Sandstone	--	---	2	(1.2)
Quartzite	1	(1.6)	--	---
Silicified Shale	--	---	1	(0.6)
Silicified Siltstone	2	(3.2)	4	(2.4)
Totals	63	100%	173	100%

*Material types in parentheses not calculated in column totals

Table 26. Material Composition of Scrapers at Keystone Sites 36 and 37

Material Types	Keystone 36	Keystone 37
All Cherts	8 (53.3)	15 (33.3)
(Rancherias)*	(5)(33.3)	(9)(20.0)
Jaspers	- ---	2 (4.4)
Chalcedony	2 (13.3)	5 (11.1)
Obsidian	- ---	2 (4.4)
Dolomite	3 (20.0)	13 (28.9)
Reworked Flow TB Rhyolite	- ---	1 (2.2)
Soledad Rhyolite	- ---	2 (4.4)
Rhyolite Tuff	1 (6.7)	- ---
Other Rhyolite	- ---	3 (6.7)
Granite/Diorite	- ---	1 (2.2)
Silicified Siltstone	1 (6.7)	1 (2.2)
Totals	15 (100)	45 (100)

*Entries in parentheses not calculated in column totals

functional relationship to more typical scrapers cannot be determined on stylistic grounds alone. More than half of the scrapers at Site 36 were of chert, with chalcedony and dolomite also proportionately high. A lower percentage of chert was noted among the Site 37 scrapers, although a difference of proportions test applied to all cryptocrystalline materials indicated no significant distinction between the assemblages ($Z = .8795$, $p = .1894$). Rancheria chert comprises 33.3% and 20% of the scrapers from Sites 36 and 37 respectively, but when considering the percentage of Rancheria relative to other cherts the use of this material is roughly equivalent between sites (Site 36-62.5%/Site 37-60%). There is no apparent significant difference in the quality of material used for scrapers at the two sites.

Table 27 summarizes the material distributions among the remaining chipped stone tool categories. Hammerstones are included here instead of with the later discussion of groundstone artifacts because it is felt that there is a closer functional connection between hammerstones and chipped stone tools and debitage.

Angular debitage selected for utilization resulted almost exclusively from the reduction of the finer materials at both sites, although Site 37 has some amount of dolomite, rhyolite, and quartzite. Chert was the most common material, probably because the high degree of chert reduction at both sites would have naturally resulted in a higher proportion of suitable debitage.

Hammerstones are notable in that 83.3% and 91.1% of the samples at Sites 36 and 37 respectively are of quartzite, reflecting the strong predilection for the use of quartzite cobbles from the local gravels. Dolomite and rhyolite cobbles were also occasionally used for hammerstones.

At Site 37, choppers were produced mainly from dolomite cobbles although chert and rhyolite were also used in small quantities. No choppers were found at Site 36. One drill was found at each site, and both are of chert.

Finally, the small sample of bifaces from both sites are comprised mostly of chert. The only exceptions, at Site 37, are of dolomite and quartzitic sandstone (metaquartzite). This material distribution is entirely expectable; given the greater control needed to manufacture bifaces, the fine-grained rocks would likely be the materials of choice whenever they were readily available. Further evidence for the emphasis on cryptocrystallines in biface production is provided by material distributions among biface debitage.

It has been suggested that flakes with converging dorsal scars are indicative of the advance stages of biface manufacturing and resharpening (Laumbach 1980) and that bidirectional flake scars represent the use of a bifacial core and controlled reduction sequence in a complex manufacturing trajectory for

Table 27. Material Composition of Other Tools at Keystone Site 36

Material	Ut. Chunk	Hammerstone	Biface	Drill
All Cherts	4 (57.2)	1 (2.4)	1 (100)	1 (100)
(Rancheria)*	(1)	---	(1)	---
Obsidian	1 (14.3)	---	---	---
Dolomite	---	1 (2.4)	---	---
Thunderbird Rhyolite-Red	1 (14.3)	1 (2.4)	---	---
Quartzite	---	35 (83.3)	---	---
Quartz	---	1 (2.4)	---	---
Igneous, Undif.	---	2 (4.8)	---	---
Sandstone	---	1 (2.4)	---	---
Silicified Shale	1 (14.3)	---	---	---
Totals	7 (100.1)	42 (100.1)	1 (100)	1 (100)

Keystone Site 37

Material	Ut. Chunk	Hammer-stone	Knife/ Biface	Chopper	Drill	Pebble Tool
All Cherts	17(54.9)	---	1(20.0)	2 (15.4)	1(100)	1(20.0)
(Rancherias)*	(9)	---	---	(1)	---	---
Chalcedony	5(16.1)	---	---	---	---	---
Sili. Wood	1(3.2)	---	1(20.0)	---	---	---
Dolomite	3(9.7)	1(2.2)	1(20.0)	7 (53.8)	---	2(40.0)
T-Bird Red	1(3.2)	1(2.2)	---	---	---	---
Flow TB Rhyo	2(6.5)	---	---	1 (7.7)	---	---
Soledad Rhyo	---	1(2.2)	---	---	---	1(20.0)
Rhyolite Tuff	---	---	---	1 (7.7)	---	---
Other Rhyo	---	1(2.2)	---	2 (15.4)	---	---
Quartzite	2(6.5)	41(91.1)	---	---	---	---
Igneous	---	---	---	---	---	1(20.0)
Quartzitic-Sandstone Conglomerate	---	---	2(40.0)	---	---	---
Totals	31(100)	45(99.9)	5(100)	13(100)	1(100)	5(100)

*Entries in parentheses not calculated in column totals

bifaces (Chapman 1982:238). Table 28 illustrates the frequencies of material types among flakes with such scar patterns at Sites 36 and 37. As expected, biface manufacture debitage is dominated, at both sites, by the use of finer raw materials (59.2% - 88.1%). Coarse-grained materials were more frequently used for bifaces at Site 37, in accord with patterns already discussed above.

The relatively high percentage of chert and other fine-grained materials at Site 36 implies a greater degree of selectivity in the use of local raw materials. That such selectivity appears to be especially characteristic of tested cores suggests that the procurement of preferred materials for later use may have been an important secondary strategy at Site 36. In contrast, the occupants of Site 37 appear to have been more eclectic in their choice of materials since medium and coarse-grained materials are more prevalent at the latter site. Since this distinction between the sites is evident in a variety of artifact classes and reduction stages, the quality of local raw materials appears not to have placed any severe constraints on their functional utility.

Such factors as availability of particular source materials and the energy expenditure required for their procurement are the factors often used to explain differential material use among sites. However, in this case, these factors do not constitute variables. As a result of the lithological analysis of the local geomorphic surfaces (Chapter 5), it seems clear that the same range of lithic resources would have been available to the occupants of both sites. Furthermore, the local terrain suggests that, prior to the construction of the Coronado Hills Subdivision, a portion of the Tortugas surface would have been readily accessible at Site 37 as it still is at Site 36. Nor can different technological requirements be invoked as a satisfying explanation of the differences in material use. In Chapter 7 and in part of the present discussion, it has been noted that the range of variability in features and artifacts is very similar at the two sites. As a result, it seems most prudent to infer similar functions for the sites. There do not appear to have been any tasks carried out at one site which would have required differential material selection. Yet, resorting to idiosyncratic variability is not a satisfying solution. If one assumes that settlement systems embody a rational attempt to cope with environmental variability, another plausible explanation must be considered. Although Sites 36 and 37 appear to have had similar functions, they may have had different systemic contexts.

Binford (1979) has argued that lithic resource procurement may generally be embedded within other more logistically organized strategies. If typical materials in a region apply no significant technological constraints to artifact production, the material distributions may provide indirect evidence of the logistical role of a site vis-a-vis the rest of the settlement system. It is

Table 28. Distribution of Materials Within Dorsal Scar Pattern Groups Indicative of Biface Manufacture

Material Type	Keystone Site 36 Bidirectional	Keystone Site 36 Converging	Keystone Site 37 Bidirectional	Keystone Site 37 Converging
Thunderbird Rhyolite	8.2%	---	5.6%	4.5%
Soledad Rhyolite	1.6	---	4.6	5.7
Other Rhyolite	3.3	3.4	2.8	11.3
Dolomite	13.1	1.7	18.5	9.1
All Chert	54.1	64.4	47.2	38.7
(Rancheria)*	(13.1)	(6.8)	(15.7)	(8.0)
Chalcedony	16.4	18.6	15.7	18.2
Jasper	1.6	5.1	1.9	2.3
Other	1.6	6.8	3.7	10.2
Totals	100%	100%	100%	100%
n =	60	51	101	77
Proportion of fine-grained materials within scar pattern groups	72.1%	88.1%	64.8%	59.2%

suggested that the selectivity evidenced at Site 36 can be explained by such factors. If Site 36 is viewed as a short-term task group camp, ancillary to a base camp, selectivity in material use becomes understandable. Since the plant processing activities at the site would not have required the use of any particular material type, the selection of cherts is best modeled as a choice based on the intent to reduce the preferred materials at the base camp. The fact that a less selective process was operating at Site 37 suggests that the occupants were less constrained by such logistical concerns. That is, Site 37 may have had a role as a short-term base camp, wherein materials were collected to serve the immediate needs rather than those of a logistically related longer-term site.

This intriguing possibility clearly requires further examination beyond that which is possible in this report. However, in the sections that follow, additional data provide further evidence of differences between the two sites. Patterns in lithic reduction technology and tool functions provide support for the model suggested here.

Lithic Reduction and Manufacturing Technology

The lithic assemblages of Keystone Sites 36 and 37 are both characterized by high proportions of flake tools, suggesting an expedient manufacturing trajectory. However, although few finished or shaped tools were recovered during the excavations at these sites, the manufacturing of such tools cannot be ruled out. As noted earlier, evidence of biface manufacture is present among certain attributes of the debitage assemblage from both sites.

It is evident that the reduction of chipped stone tools at Sites 36 and 37 is characterized by two different strategies. One is the expedient reduction of cores for the purpose of removing usable flakes. The second strategy is oriented towards the production of bifaces. There is also a third, minor sequence at Site 37 only. This is the direct reduction of nodules into large pebble tools such as choppers.

A number of characteristics of the Site 36 and 37 reduction technologies have been briefly reviewed in previous discussions, and are relevant to this section. Other attributes of the chipped stone assemblages to be considered in this section include the amount of cortex remaining on cores and the types of dorsal scar patterns on flakes.

The relative frequencies of primary, secondary and tertiary flakes at Sites 36 and 37 were noted in Table 24. As mentioned earlier, secondary flakes are the most common type in both assemblages. However, there is a difference in the occurrence of primary flakes, with Site 36 containing only 10% compared to 17%

at Site 37. A cross tabulation of the occurrence of flake types by site was used to test this pattern and it proved to be statistically significant (chi-square = 8.044, df = 2, p = .018). One possible interpretation of this pattern might be that less initial core reduction took place at Site 36, but such a view is contradicted by the data on core reduction.

Table 29 provides a breakdown of cortex retention among core types. It is clear that Site 37 contains a larger percentage of cores which indicate more complete reduction. A chi-square test of the distribution of core cortex groups by site indicates that the pattern differs significantly from an expected random pattern (chi-square = 15.5678, df = 2, p = .001). Thus, the core data for Site 36 provide less evidence for complete reduction than would be expected on the basis of flake types. This apparent contradition can best be resolved by reference to the simultaneous presence of two different reduction strategies at the site.

Flake and flake tools were the primary end product of the reduction sequences at both sites. However, biface manufacturing may have been a more important facet of the lithic technology at Site 36. Table 30 shows the frequencies of dorsal scar patterns among flakes at Sites 36 and 37. Flakes exhibiting dorsal scar patterns indicative of biface production (bidirectional and converging) comprise 41.4% of the total at Site 36 but only 33.2% at Site 37. These proportions are significantly different at p = .01 (Z = 2.29), implying the proportionately greater importance of biface manufacture (as opposed to maintenance and discard) at Site 36.

Additional evidence for a higher degree of biface manufacture at Site 36 is provided by the analysis of microdebitage from the heavy fraction of soil flotation samples. A greater number of microflakes were recovered from Site 36 soil samples (see below).

Data from Site 36 seems to indicate that the production of bifaces (i.e., cores?) was more common at that site. Although more actual specimens of bifaces and bifacial cores were identified in the Site 37 lithic assemblage, it can be suggested that the more intensive occupation of this site resulted in the more frequent discard and deposition of such artifacts in the context of tool kit maintenance (five of the points collected at Site 37 were damaged or fragmentary). Conversely, at Site 36, bifaces were apparently carried from the site, reflecting the shorter-term logistic occupation of that site.

Bifaces were manufactured almost exclusively of fine-grained siliceous materials at Site 36, and a correspondingly high amount of fine-grained tertiary debitage was produced. Therefore, although a lesser amount of overall core reduction is present at Site 36, the manufacture of bifaces not deposited at the site produced a higher percentage of tertiary debitage than would be predicted from the remaining cores. At Site 37, a more thorough

Table 29. Amount of Cortex Remaining on Cores from Keystone Sites 36 and 37

Site 36

Type of Core	50+%	1% to 50%	None	Row Totals
Tested/Split Pebble	54	36	---	90 (67.7)
Single Platform	7	3	---	10 (7.5)
Opposing Platform	1	2	---	3 (2.3)
Multiple Platform	7	21	1	29 (21.8)
Bifacial	1	---	---	1 (0.8)
Column Totals	70(52.6)	62(46.6)	1(0.8)	133(100)

Site 37

Type of Core	50+%	1% to 50%	None	Row Totals
Tested/Split Pebble	59	23	---	82 (31.5)
Single Platform	18	24	3	45 (17.3)
Opposing Platform	6	15	1	22 (8.5)
Multiple Platform	12	74	17	103 (39.6)
Bifacial	1	5	2	8 (3.1)
Column Totals	96(36.9)	141(54.2)	23(8.8)	260(100)

Table 30 . Dorsal Scar Pattern Frequencies Among Flakes Keystone Sites 36 and 37

Dorsal Scar Pattern	Site 36	Site 37
Indeterminate	52 (19.4)	104 (19.4)
Unidirectional	105 (39.2)	254 (47.4)
Bidirectional	60 (22.4)	101 (18.8)
Converging	51 (19.0)	77 (14.4)
Total	268 (100)	536 (100)
Total indicative of Biface manufacture or Sharpening	111 (41.4)	178 (33.2)

reduction of all cores is evident with the primary emphasis directed toward the production of usable flakes from a variety of both fine and coarse-grained materials.

Three other types of tools are represented as minor components of the Site 36 and 37 lithic assemblages implying additional reduction sequences or end products of such sequences. At Site 37 only, a small number of flakes were removed from large rhyolite and dolomite cobbles in order to produce chopping tools with durable edges. Core tools were found in significant quantities at Keystone Site 32 (Fields and Girard 1983:166) and Sites 33 and 34 (O'Laughlin 1980:194). Apparently this tool type was not important at Sites 36 and 37, as only 1.2% and 0.3% of the respective lithic assemblages are identified as utilized cores. Those specimens which were utilized are almost exculsively of the multiple platform variety. Scrapers are more formal examples of flake tools, indicating a process of selection and edge modification. Their characteristics are discussed below. The general characteristics of the reduction strategies of Sites 36 and 37 are summarized below and in Figure 32.

Fine-grained materials. Site 36 was oriented towards expedient production of flake tools with moderate amount of biface manufacture and maintenance. Bifaces were curated and transported from the site. Relatively high proportions of fine-grained secondary and tertiary debitage were left behind. Site 37 shows proportionately fewer flakes of fine-grained materials, but all materials were reduced more thoroughly during the production of usable flakes. Some biface manufacture is indicated by a moderate degree of tertiary reduction.

Coarse-grained materials. Site 36 exhibits some use of rhyolite and dolomite for flake tools. Almost no use of such materials is indicated for biface manufacture, and thus few tertiary flakes of these materials were found. At Site 37, coarse-grained materials were used for a variety of tools, including flake tools and heavy bifaces. A few choppers were manufactured directly from large cobbles. Moderate frequencies of coarse-grained tertiary flakes probably indicate retouching of large tools.

Manufacturing Trajectories. The sequences of tool production steps suggested by the data presented above are illustrated in Figure 32. Those sequences thought to be the most thorough are shown near the bottom, while the more expedient processes are at the top.

Functional Analysis of Chipped Stone Tools

The initial classification of chipped stone artifacts into typological categories such as scrapers, choppers, drills, and utilized flakes, cores, and chunks is usually dependent upon

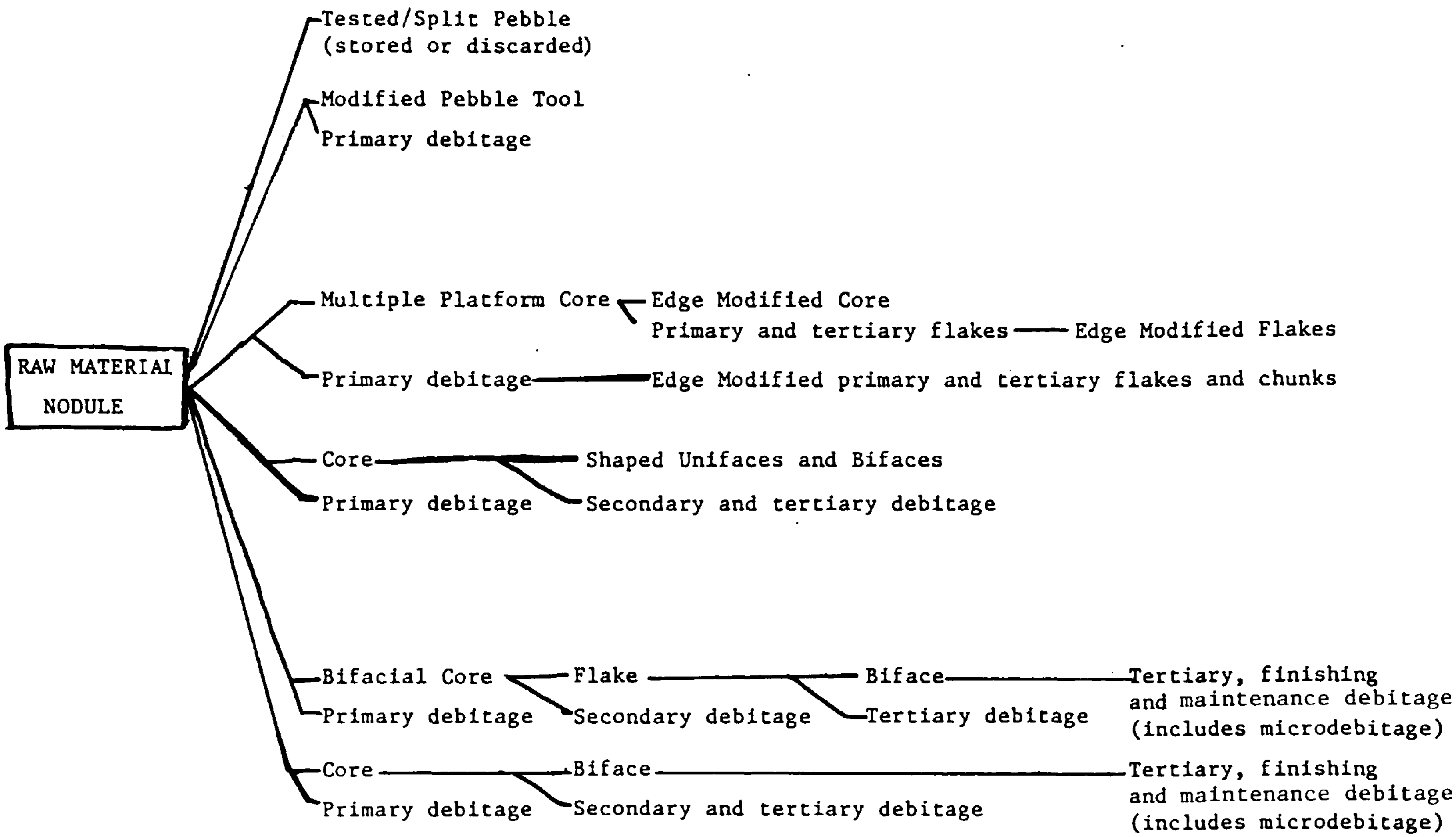


Figure 32. Reduction Trajectories - Keystone 36 & 37

considerations of morphological and stylistic attributes. However, this manner of categorization, based as it is upon attributes of tool shape, can provide only a very general insight into the functions of chipped stone tools. In recent years, the emphasis has shifted from such classifications to a concern with edge morphology and wear patterns.

Semenov (1964) demonstrated that the utilization of tool edges for different activities results in distinctive patterns of microscopic edge wear. Subsequent studies have for the most part been concerned with the determination of various wear patterns resulting from the functionally specific use of tools on a number of different media (Ahler, 1971; Keeley 1974; Keller 1966; Tringham, et al 1974; Odell 1974; Odell and Vereecken 1980; Chapman 1977; Chapman and Schutt 1977; Frison 1978; Schutt 1979, 1980). In addition, both Semenov (1964) and Wilmsen (1970) examined the suitability of various edge angles for the performance of different tasks.

Although promising, this research is still in an early stage of development and the significance of edge angles, wear patterns, edge outlines, and other attributes as they relate to performance of prehistoric activities is still being debated (Hayden and Kamminga 1979). A number of variables condition the wear patterns observed on chipped stone tools, including the type of material used to manufacture the tool, the texture and resiliency of the medium upon which the tool is utilized, the angle at which the tool is applied to the medium, and the duration and form of tool use (usually scraping, sawing, or cutting) (Chapman 1977:378). The fact that any combination of these factors could have been responsible for the wear patterns observed on a particular tool has thus far made conclusive assessments linking specific wear patterns to specific activities difficult.

Although it is not possible at the present time to determine the exact task for which a tool was utilized, analyses of edge morphology and wear pattern variability can nevertheless provide valuable information on the general range of activities performed at a particular site. A delineation of such general activity classes as light or heavy cutting, scraping, chopping, sawing, or perforating is of special importance for this study, as the identification of certain wear patterns and edge types can provide corroborative evidence for the proposed functional interpretations of the large and small fire-cracked rock features excavated at Sites 36 and 37. Of course, any correlations between functional interpretations of lithic assemblages and archeological features at Keystone Sites 36 and 37 by nature requires a number of assumptions about the activities performed during the prehistoric processing of leaf succulents. Such activities have, however, been documented in the ethnographic literature, and as noted below, are reflected in the edge attributes observed for both sites.

A final point for consideration involves the overall functional differentiation between Keystone Site 36 and Site 37. It has been stated previously that the presence of pit structures at Site 37 implies a residential aspect contrasting with the more task-specific nature of Site 36. It was further suggested that a broader range of activities at Site 37 might be reflected in the range of tool types represented in the collection. This expectation was not met, implying the general functional equivalence of the two sites. The characterization of functional variability is extended in this section to a consideration of the occurrence of selected edge attributes at the two sites.

Edge Modification

Edge modification patterns were noted on a variety of artifacts at Keystone Sites 36 and 37 including flakes, cores, scrapers, choppers, drills, and utilized angular debitage (chunks). The projectile points also have modified edges, but are excluded from this discussion as they exhibit no wear patterns and there is a general agreement on their specialized function. In the following analysis, each modified or utilized edge is treated as a distinct unit, and thus for each site there are discrepancies between the number of modified edges and the number of utilized tools. At Site 36, for example, 85 utilized edges were recorded on 63 utilized flakes and were analyzed as 85 discrete units.

Utilized flakes and scrapers exhibit by far the greatest amount of edge modification and wear pattern variability and the following discussion deals primarily with these artifacts. Utilized flakes were categorized as either primary, secondary, or tertiary in order to monitor any intersite differences in reduction strategy. All scrapers were analyzed as a single class. Less attention is devoted to the remaining artifact categories of utilized cores, choppers, and utilized chunks, as these exhibit little variation among their respective edges and are relatively infrequent among the total tool assemblages of both sites. Drills are also rare, representing only 0.2% and 0.1% of the total assemblages from Sites 36 and 37 respectively. As with projectile points, their function is presumed on formal grounds and no wear patterns other than a slight polish were noted.

In Chapter 3 it was suggested that differences in the duration of occupation at sites might be reflected in the intensity of tool use. Specifically, it was hypothesized that longer-term sites should contain proportionately fewer tools and fewer utilized edges (Hypothesis 3). As discussed at the beginning of this chapter, the distribution of artifact classes does not appear to conform to this expectation. The occurrence of utilized edges at the two sites presents a similar pattern.

Data on the numbers of modified edges, by tool type, are shown in Table 31. Scrapers are the most abundant formal tools in the sample, with 15 from Site 36 and 45 from Site 37. While the overall proportions of scrapers in the two assemblages are comparable, the tools appear to have been more extensively utilized at Site 37. Sixty-two percent of the scrapers at Site 37 exhibit two or more modified edges but less than half (46.6%) of those at 36 show that degree of utilization. However, a difference of proportions test indicates that the pattern is not significant (Z = -1.0612, p = .1446). The difference in the average number of modified edges per tool (1.7 versus 1.8) is also not significant (t = -.3934). These results do not support Hypothesis 3 since the proposed differences in duration have not affected intensity of use among formal tools. One possible reason for this result may be the fact that the expectations built into the hypothesis were originally derived from the comparison of villages and camps (Most and Hantman 1984). It may well be that the measure "intensity of tool use" is insensitive to variability among small camps.

Among utilized flakes, slightly greater percentages exhibiting 2 or more utilized edges occur at Site 37 (11.6% versus 7.9%). As in the case of scrapers, however, this tendency is not statistically significant (chi-square = 2.191, df = 2, p = .25). It would appear that there are no significant differences between the intensity of utilization of chipped stone tools at the two sites. Since both sites are interpreted as short-term camps with similar overall functions, the comparable intensities of tool use are perhaps expectable. Nevertheless, additional data derived from this same set of tools provide some evidence, presented in the next section, for differential task orientation at Sites 36 and 37.

Edge Morphology and Tool Function

In order to examine potential variability in edge morphology, three main attributes were monitored: edge angle, type of retouch and use wear pattern. These can be briefly defined as follows:

Edge angle is the angle of a utilized edge formed by the intersection of the dorsal and ventral surfaces of the artifact. The angle resulting from wear patterns on the edge margin was not considered (see Tringham et al 1974:178-180). Edge angles were plotted on polar coordinate graph paper and were estimated to the nearest 5 degrees.

Edge retouch is the removal of small flakes from the perimeter of an edge. The flakes do not extend over more than a third of the dorsal or ventral artifact surface. Retouched edges were presumably altered for specific reasons, such as adjusting edge shape, increasing edge strength or resharpening (Chapman 1977:378). The range of retouch types resulting from these

Table 31. Incidence of Edge Modification by Artifact Type Keystone Sites 36 and 37

Artifact	Number of Edges Modified	Site 36 N	Site 36 %	Site 37 N	Site 37 %
Flakes	1	42	15.7	111	20.7
	2	20	7.5	51	9.5
	3	1	0.4	11	2.1
Total number of utilized flakes		63	24.1	173	32.3
Total number of utilized edges		85		246	
Cores	1	5	3.8	2	0.8
	2	1	0.8	1	0.4
	3	1	0.8	--	---
Total number of utilized cores		7	5.4	3	1.2
Total number of utilized edges		10		4	
Scrapers	1	8	53.3	17	37.8
	2	3	20.0	19	42.2
	3	4	26.7	9	20.0
Total number of scrapers		15	100%	45	100%
Total number of utilized edges		26		82	
	1	5	71.4	13	81.3
Chunks	2	2	28.6	3	18.7
Total number of utilized edges		9		19	
Choppers	1	--	---	13	100%

activities at Sites 36 and 37 can be condensed down to three basic categories based on the location of occurrence on an edge: unidirectional dorsal, unidirectional ventral and bidirectional. Hereafter these are referred to as dorsal, ventral and bifacial retouch.

Edge wear consists of various sorts of damage imparted to the edge of a tool as it is used. If the wear is patterned it may be possible to infer the nature of the task or, at least something about the medium on which the tool was used. Different types of use wear are generated by the combination of various edge types applied to different worked media. Detailed discussions of use wear interpretation are available elsewhere in the literature (e.g., Ahler 1971; Keeley 1980: Wilmsen 1970; Chapman 1977; Schutt and Vierra 1980) and the topic need not be reiterated here. Suffice it to note that the following types of edge wear were monitored for the present study: microflakes, blunting, striae, polish, attrition and battering.

In the sections that follow, the distributions of various edge angles, edge types and wear patterns are used to delineate general classes of activities. Comparisons of the assemblages from Sites 36 and 37 provide some basis for inferring different ranges of activities at the sites. Patterns in the occurrence of these characteristics are presented first for utilized flakes, then for scrapers and other tools.

Table 32 presents data on the degree of utilization by flake type at Sites 36 and 37. It is apparent by referring to the column totals that different patterns of flake selection were in operation at the two sites. At Site 36, 68% of the utilized items were secondary flakes, compared to only 39.3% at Site 37. Conversely, Site 37 exhibits higher percentages of the primary and tertiary categories than does 36. This pattern was tested in a contingency table of utilized flake type by site, and the distribution differs significantly from the expected frequencies (chi-square = 15.986, df = 2, p = .001). The most striking departures from the expected distribution are in the higher proportions of secondary flakes and lower proportions of primary and tertiary flakes at Site 36.

The distribution of reduction categories noted in Table 32 should not be considered as merely a by-product of different amounts of raw material reduction at the two sites, but as a patterned response to the tool requirements of differing tasks. Tertiary flakes frequently have very narrow edge angles while secondary and primary flakes are characterized by larger angles. The differences between edge angles are to some extent a result of the mechanics of flake removal. However, flakes removed from cores were not chosen at random for use or modification but were more likely selected with reference to their suitability for performing a specific task. In other words, the edge angle of a flake conditions the "functional requirements" for the utilization

Table 32. Utilization by Flake Type

Keystone Site 36

	Primary	Secondary	Tertiary	Total
1 Utilized Edge	5 (7.9)	26 (41.3)	11 (17.5)	42 (66.7)
2 Utilized Edges	-- ---	16 (25.4)	4 (6.3)	20 (31.7)
3 Utilized Edges	-- ---	1 (1.6)	-- ---	1(1.6)
Total	5 (7.9)	43 (68.3)	15 (23.8)	63 (100)

Keystone Site 37

	Primary	Secondary	Tertiary	Total
1 Utilized Edge	20 (11.6)	52 (30.0)	39 (22.5)	111 (64.1)
2 Utilized Edges	12 (6.9)	16 (9.3)	23 (13.3)	51 (29.5)
3 Utilized Edges	4 (2.3)	-- ---	7 (4.1)	11 (6.4)
Total	36 (20.8)	68 (39.3)	69 (39.9)	173 (100)

	Site 36	Site 37
Percentage of primary flakes utilized	19.2	39.1
Percentage of secondary flakes utilized	27.2	23.2
Percentage of tertiary flakes utilized	17.9	45.4

of that flake (Wilmsen 1970:92). This process has also been noted by Schutt (1980) during a series of replicative experiments, where she found that after a short time of experimentation she was able to visually select flakes with edge angles meeting the functional requirements of certain activities.

The implications of this selection process can be applied to the pattern of flake use at Sites 36 and 37. The relatively greater use of tertiary flakes at Site 37 implies the performance of tasks requiring small, sharp edge angles, and thus strategies of core reduction were oriented towards the production of tertiary flakes having generally narrower edge angles. On the other hand, the more frequent use of secondary flakes at Site 36 implies a different emphasis in the tasks conditioning flake selection. This possibility is further examined below in the discussion of edge angles.

Due to the problems inherent in assigning particular wear patterns to specific activities, the morphological attribute of the angle of a utilized edge is considered as the most reliable indicator of general realms of tool use activities (Semenov 1964; Wilmsen 1970). Therefore, this is a reasonable place to begin the discussion of tool functions.

Figures 33 and 34 illustrate the distribution of utilized flake edge angles among the three reduction categories at Sites 36 and 37. The histogram bars combine the angles by 5 degree increments. At both sites, a wide range of edge angles are indicated from less than 20 to 90 degrees. At Site 37 this range occurs among all flake types but at 36, primary flakes are limited to larger edge angles. Despite the fact that a range of edge angles occur on both sites, the general distributions are quite different, characterized by larger angles at Site 36 and narrower angles at Site 37. This distinction becomes even more clear when the two distributions are superimposed (Figure 34). It is evident that most edges at Site 36 have angles in the range of 60 to 90 degrees. The distribution at Site 37 is nearly the reverse, with most edge angles in the 10 to 50 degrees. In addition, the angles from Site 37 span a wider range than was recorded for 36.

Semenov (1964) and Wilmsen (1970) have stated that certain ranges of edge angles are more efficient than others for the performance of some general classes of activities. Wilmsen further suggests that edge angles between 26 and 35 degrees are efficient for cutting meat, skin, and other soft materials. An angle between 46 and 55 degrees is best for moderate hide scraping, plant shredding, and heavy cutting of bone, wood, or horn. An angle between 66 and 75 degrees is suggested as most useful for heavy scraping, sawing, cutting, or working of hard materials. Other experimenters have elaborated upon other factors which may determine the suitability of various angles. Edge angles of 20 degrees or less have little edge strength and do not withstand

FIGURE 33 : KEYSTONE 36, EDGE ANGLES BY FLAKE TYPE.

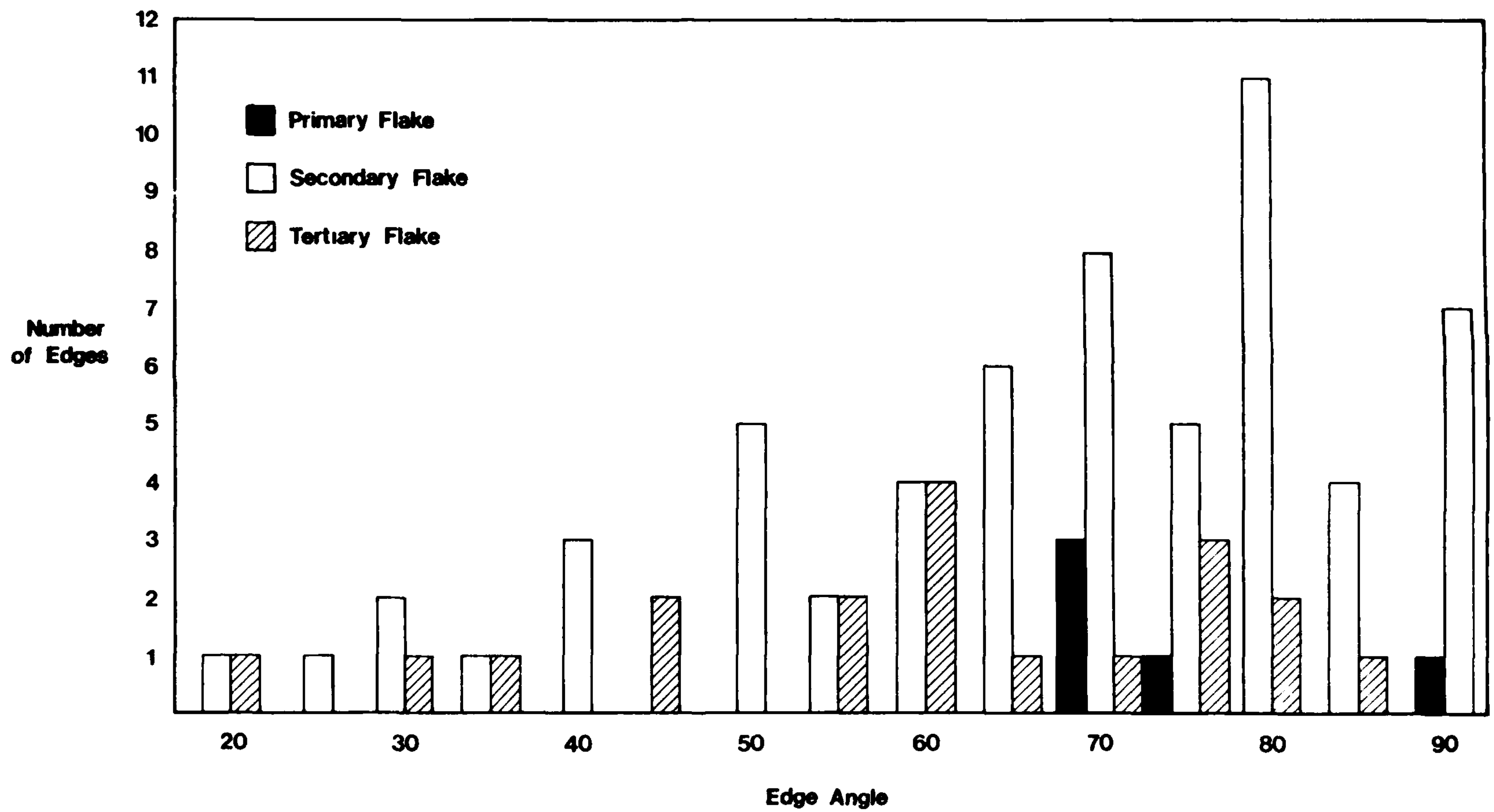
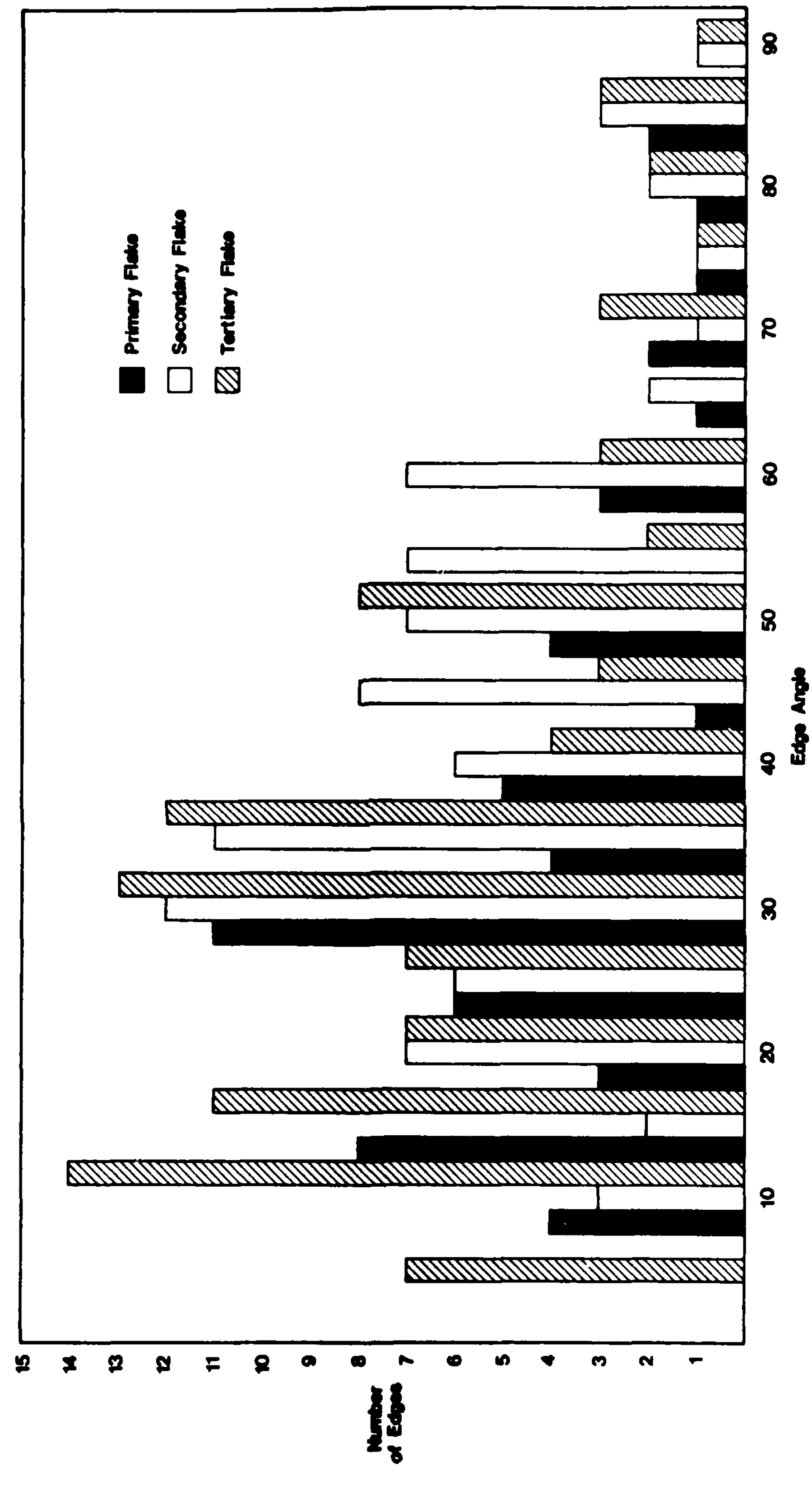


FIGURE 34 : KEYSTONE 37, EDGE ANGLES BY FLAKE TYPE.



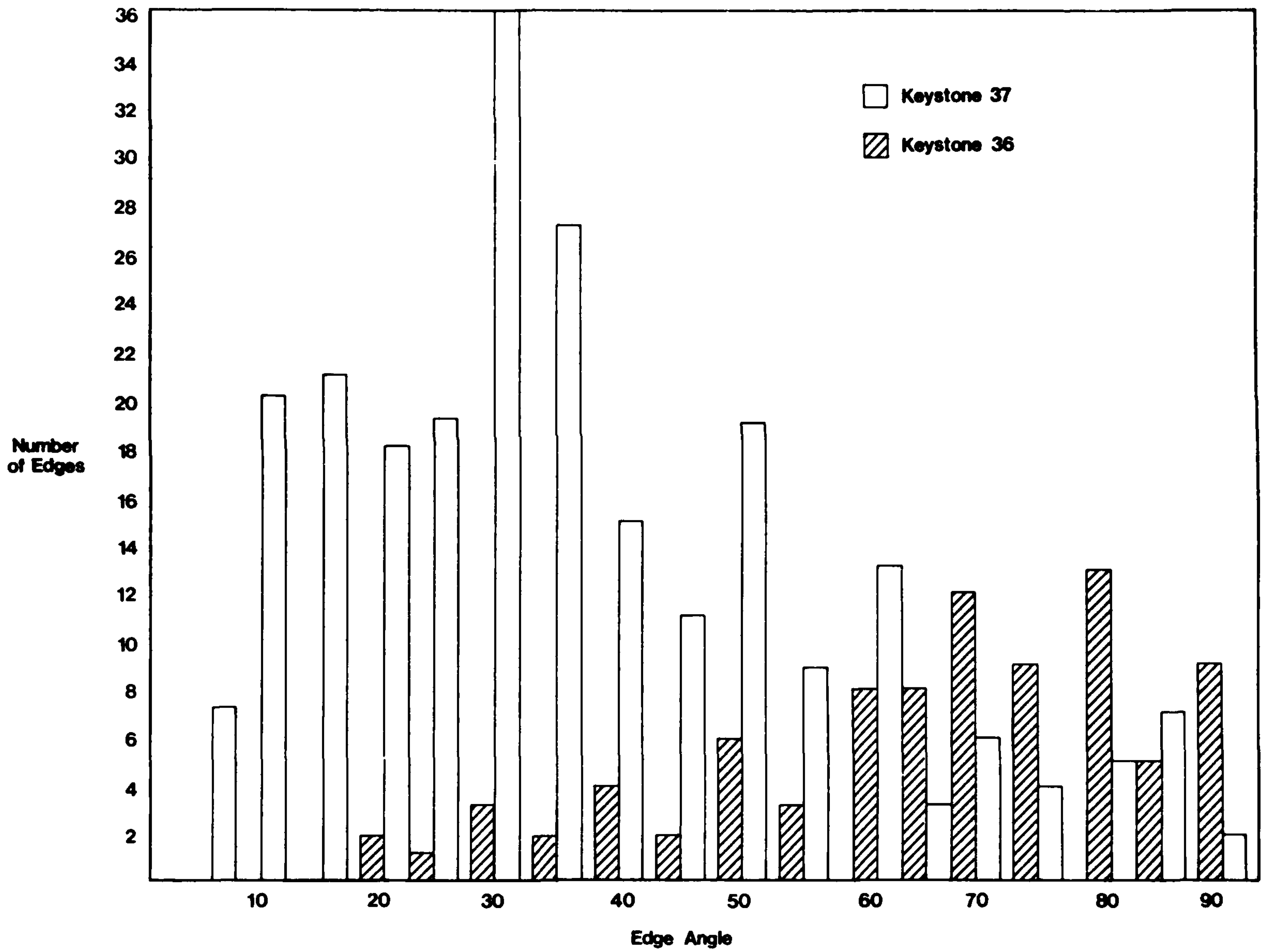
stress well, and thus will deteriorate when used for such activities as wood working (Schutt 1980). Edge angles around 30 degrees were found to be the most useful for wood whittling, and they also appear to be the most suitable for hide processing (Schutt 1980). Edge angles within the 60 to 90 degree range can absorb heavy stresses and are thus best for working and scraping hard materials (Wilmsen 1974:91).

In their analyses of the lithic assemblage from Keystone Site 32, Fields and Girard (1983:179) separate the sample of edge angles into three divisions: 10 to 40 degrees, 41 to 60 degrees and 61 to 90 degrees. O'Laughlin (1980:190) separates the Site 33 and 34 edge angle sample of utilized flakes and retouched flakes into two divisions: less than 55 degrees and greater than 55 degrees. The three categories used in the present analysis are similar to those used by Fields and Girard: 5 to 40, 41 to 60 and 61 to 90 degrees. Each of these groupings has a series of associated implied activities. In light of the experimental results mentioned above, the three edge angle groupings can be characterized as reflecting different tasks. Utilized flakes with edge angles between 5 and 40 degrees can be considered as tools for very fine cutting, scraping, and sawing of soft materials. Flakes with angles from 41 to 60 degrees represent medium cutting, scraping, and sawing of soft and relatively unyielding materials. Angles between 61 and 90+ degrees can be regarded as used for heavy activities performed on hard or coarse materials.

From Figure 35 and Table 33 it would appear that various "light" activities were more prevalent at Site 37 while "heavy" tasks were more important at Site 36. Both sites have roughly equivalent proportions of edge angles in the 41 to 60 degree range, indicating considerable overlap among "medium" activities. However, the overall patterns at the two sites are very distinctive. A cross tabulation of the column totals from Table 33 (edge angle groups) by site indicates the distribution is statistically significant (chi-square = 107.18, df = 2, p = .001). Thus, the patterns of edge angles among utilized flakes suggest that different types of tasks were emphasized at the two sites. This suggestion is further supported by data on the occurrence of use wear types.

Before discussing the data from Tables 33a and b, a brief review of the significance of wear patterns is in order. As noted at the beginning of this section, there is still considerable debate over the meanings of various patterns. However, some general conclusions are acceptable. Unifacial microflakes have been found during experimentation as usually resulting from scraping activities, while bifacial microflakes are considered to be the result of various cutting or sawing activities (Semenov 1964: Wilmsen 1970). Experiments have also found that rounding results from the use of an edge on soft materials like grasses, soft wood, and hides (Chapman 1977:386). Attrition occurs only on

FIGURE 35 : UTILIZED FLAKE EDGE ANGLES, KEYSTONE 36 and KEYSTONE 37.



the edge perimeter and is caused by the hard sawing or cutting of bone, wood, and possibly meat with the edge of the tool held perpendicular to the medium (Chapman 1977:386). Other wear patterns include polish, which has been found in some experiments to result from the cutting of grass-like vegetal materials or soft scraping of hides (Chapman 1977:386), and striations which result from the scraping of a medium which is harder than the material of the tool (Schutt and Vierra 1980:49).

The distributions of various wear patterns by edge angle are presented for both sites in Tables 33a and 33b. The occurrence of wear types is listed separately for unretouched and retouched flakes. The values in parentheses are frequencies relative to the total number of utilized edges at each site (85 at Site 36 and 246 at Site 37).

The distribution of wear types at the two sites provide additional evidence for emphasis on different types of activities. At Site 36, edges exhibiting unifacial microflakes make up greater than 60% of the edge wear total, compared to only about 40% at Site 37. A difference of proportion test indicates that the distinction is statistically significant ($Z = 3.3865$, $p = .0001$). The indication is that wear-producing activities at Site 36 were more narrowly focused, while at Site 37 a (presumably) wider range of activities produced more variable patterns of use wear.

Another notable pattern concerns the distribution of wear by edge angle. At Site 36, the combined frequencies of rows indicating unifacial microflake patterns total 48.2% within the 61 to 90 degree edge angle grouping. This implies that nearly 50% of the activities performed at Site 36 with utilized flakes involved heavy scraping, cutting, or shredding of relatively durable materials. On the other hand, at Site 37 these inferred functions comprise only a 6.5% sample of utilized flakes. The activities most likely represented in the Site 37 sample of utilized flakes are light cutting of soft materials (29.2%) and light scraping of soft materials (28%). Attrition wear patterns are also common at Site 37, and there is a greater variety of wear patterns which are distributed more evenly among the three edge angle functional groupings.

A cross tabulation of the distribution of unifacial microflake wear by edge angle groups indicated that the pattern differs significantly from the distribution expected due to random variation (chi-square = 63.1749, df = 2, $p = .001$).

The distribution of the edge angles recorded on the sample of scrapers analyzed from Sites 36 and 37 is illustrated in Figure 36. It can be seen that, unlike the pattern of utilized flakes, there is little variation among scrapers between the two sites. Both sites have peak distributions centered between 60 and 80

Table 33a. Functional Analysis of Utilized Flakes
Occurrence of Wear Patterns Among Edge Angle Groups

Keystone Site 36

Edge Retouch and Wear Patterns	Edge Angle Functional Groupings 5 to 40	41 to 60	61 to 90+	Row Totals
No Retouch				
Unifacial Microflakes	3 (3.5)	9 (10.6)	25 (29.5)	37 (43.5)
Bifacial Microflakes	4 (4.7)	5 (5.9)	10 (11.8)	19 (22.4)
Striae	-----	-----	1 (1.2)	1 (1.2)
Attrition	----	----	1 (1.2)	
Retouched				
Dorsal w/ Unifacial Micro	1 (1.2)	3 (3.5)	11 (12.9)	15 (17.6)
Dorsal w/ Bifacial Micro	3 (3.5)	----	1 (1.2)	4 (4.7)
Ventral w/ Unifacial Micro	----	1 (1.2)	5 (5.9)	6 (7.1)
Ventral w/ Bifacial Micro	----	1 (1.2)	----	1 (1.2)
Bifacial w/ Bifacial Micro	----	----	1 (1.2)	1 (1.2)
Totals	11 (12.9)	19 (22.4)	55 (64.7)	85 100%

Note: Entries within parentheses are proportions of total sample of 85 utilized edges

Total number of Unmodified flakes	7 (63.6)	14 (73.7)	37 (67.3)	58 (68.2)
Total number of Retouched flakes	4 (36.4)	5 (26.3)	18 (32.7)	27 (31.8)

Table 33b. Functional Analysis of Utilized Flakes
Occurrence of Wear Patterns Among Edge Angle Groups

Keystone Site 37

Edge Retouch and Wear Patterns	Edge Angle Functional Groupings 5 to 40	41 to 60	61 to 90+	Row Totals
No Retouch				
Unifacial Microflakes	46 (18.7)	16 (6.5)	9 (3.7)	71 (28.9)
Bifacial Microflakes	68 (27.6)	13 (5.3)	4 (1.6)	85 (34.5)
Rounding	----	----	2 (0.8)	2 (0.8)
Striae	1 (0.4)	2 (0.8)	----	3 (1.2)
Polish	3 (1.2)	2 (0.8)	1 (0.4)	6 (2.4)
Attrition	18 (7.3)	5 (2.0)	1 (0.4)	24 (9.7)
Retouched				
Dorsal w/ Unifacial Micro	10 (4.1)	11 (4.5)	6 (2.4)	27 (11.0)
Ventral w/ Unifacial Micro	10 (4.1)	1 (0.4)	1 (0.4)	12 (4.9)
Ventral w/ Bifacial Micro	2 (0.8)	----	1 (0.4)	3 (1.2)
Ventral w/ Polish	1 (0.4)	----	----	1 (0.4)
Bifacial w/ Unifacial Micrc	3 (1.2)	---	---	3 (1.2)
Bifacial w/ Bifacial Micro	2 (0.8)	2 (0.4)	2 (0.8)	5 (2.0)
Multiple Damage Types	3 (1.2)	----	----	3 (1.2)
Platform Retouch, Unifacial	----	----	1 (0.4)	1 (0.4)
	167 (67.9)	51 (20.7)	28(11.4)	246 100%

Note: Entries within parentheses are proportion of total sample of 246 utilized edges

	5 to 40	41 to 60	61 to 90+	Row Totals
Total number of Unmodified flakes	136 (81.4)	38 (74.5)	17(60.8)	191 (77.6)
Total number of Retouched flakes	31 (18.6)	13 (25.5)	11(39.2)	55 (22.4)

degrees, although Site 37 has a number of samples with smaller angles. Whether or not this indicates any functional difference depends on whether there are any significant variations among the wear patterns observed on these groups.

Table 34 shows the frequencies of wear patterns among the three edge angle groups for scrapers. Considering the distributions of wear patterns, edge angles, and associated activities for each site, two general patterns are apparent. First, the prominence of unifacial microflake wear in the large angle category reflects an emphasis on various heavy and medium scraping or shredding activities, although the occurrence of bifacial microflake wear patterns indicates that some cutting or sawing tasks were also performed. A chi-square test revealed no significant difference between sites in the distribution of scrapers among edge angle groups (chi-square = 2.4952, df = 2, p = .30).

However, the scraper edge angle distributions relate differently to utilized flake edge angles at the two sites (see Figure 36). At Site 36, scraper edge angles are concentrated in the same range as utilized flake angles. This implies that both types of tools, although formally different, served similar functions. In contrast, at Site 37 scraper edge angles complement the distribution for flake edge angles: scrapers have primarily larger edge angles while utilized flakes tend to fall in the 5 to 40 degree range. This pattern indicates that a wider range of tasks were undertaken at Site 37, with formal scrapers providing edges for heavy scraping, and flakes being used primarily for light and medium cutting tasks. This latter function is not unexpected for flake tools. What is notable is that utilized flakes did not function in this manner at Site 36. Instead, they were largely functional equivalents to formal scrapers. This convergence of edge angles among formally distinct tool classes implies some degree of specialization in the activities carried out at Site 36.

It is still not possible to associate particular edge angles and wear patterns with specific behaviors at Keystone Sites 36 and 37. Nevertheless, it should be noted that the archeological materials are compatible with ethnographically documented activities at agave roasting camps. Basehart (1974) describes the processing of leaf succulents by the Mescalero Apache as involving shredding, scraping, pounding and cutting. Since the textures of leaf succulents are rather coarse and fibrous, it is reasonable to identify those activities as requiring large edge angles in the medium or heavy use categories.

Table 34. Functional Analysis of Scrapers
Occurrence of Wear Patterns Among Edge Angle Groups

Keystone Site 36

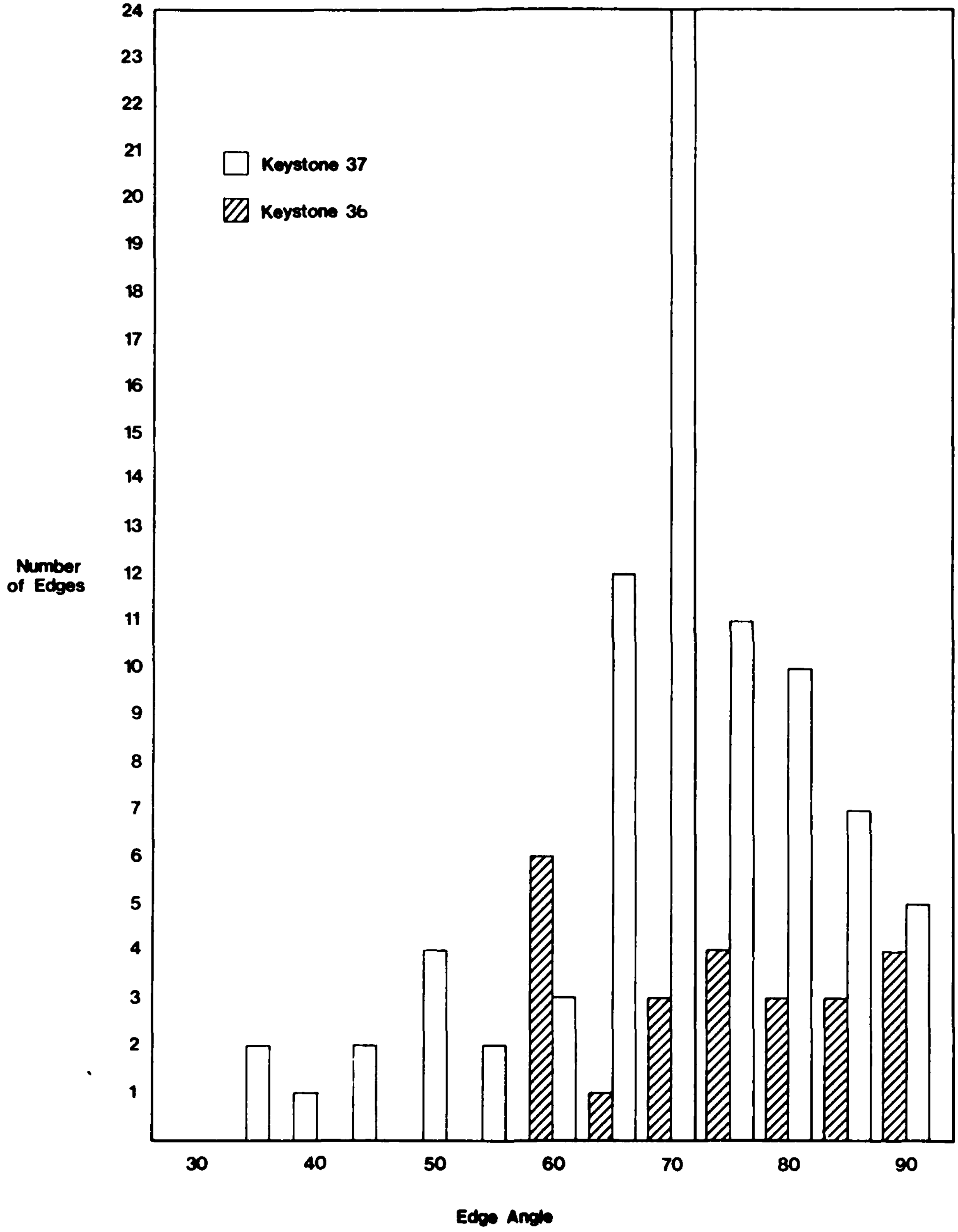
Edge Retouch and Wear Patterns	Edge Angle Functional Groupings 5 to 40	41 to 60	61 to 90+	Row Totals
No Retouch				
Unifacial Microflakes	----	1 (3.8)	5 (19.2)	6 (23.0)
Bifacial Microflakes	----	----	1 (3.8)	1 (3.8)
Retouched				
Dorsal w/ Unifacial Micro	----	3 (11.5)	7 (26.9)	10 (38.4)
Dorsal w/ Bifacial Micro	----	----	2 (7.7)	2 (7.7)
Ventral w/ Unifacial Micro	----	1 (3.8)	1 (3.8)	2 (7.7)
Bifacial w/ Bifacial Micro	----	1 (3.8)	4 (15.4)	5 (19.2)
Totals	0	6 (22.9)	20 (76.8)	26 (100%)

Keystone Site 37

Edge Retouch and Wear Patterns	5 to 40	41 to 60	61 to 90+	Row Totals
No Retouch				
Unifacial Microflakes	----	1 (1.2)	3 (3.7)	4 (4.9)
Attrition	----	1 (1.2)	----	1 (1.2)
Retouched				
Dorsal w/ Unifacial Micro	1 (1.2)	4 (4.9)	44 (53.7)	49 (59.8)
Ventral w/ Unifacial Micro	----	1 (1.2)	10 (12.2)	11 (13.4)
Ventral w/ Bifacial Micro	----	----	2 (2.4)	2 (2.4)
Bifacial w/ Unifacial Micro	----	----	2 (2.4)	2 (2.4)
Bifacial w/ Bifacial Micro	3 (3.7)	3 (3.7)	5 (6.1)	11 (13.4)
Multiple Damage Types	----	----	1 (1.2)	1 (1.2)
Platform Retouch	----	1 (1.2)	----	1 (1.2)
Totals	4 (4.9)	11 (13.4)	67 (81.7)	82 (100%)

Note: Entries within parentheses are proportions of total sample.

FIGURE 36 : SCRAPER EDGE ANGLES, KEYSTONE 36 and KEYSTONE 37.



Utilized Cores

Utilized cores represent a small component of the lithic assemblages from both Sites 36 and 37. Seven utilized cores were analyzed from the Site 36 assemblage and three from Site 37, providing a sample of ten utilized edges and four utilized edges respectively. Almost exclusively the edge angles recorded on all utilized cores are in the range of 75 to 90+ degrees, and the materials identified include only chert and rhyolite.

Of the ten utilized edges on cores at Site 36, four had been retouched and exhibited wear in the form of bifacial microflakes. Of the remaining six unmodified edges, four have unifacial microflakes and two have rounded edges. At Site 37, only one edge exhibited retouch scars and all four samples showed wear in the form of unifacial microflakes.

The small sample of utilized cores precludes any detailed comparisons between sites. However, based upon the available evidence, it would appear that the shaping of cores in order to obtain an edge suitable for utilization was a more important factor at Site 36.

The wear patterns observed on the edges of the utilized core sample indicate that various heavy scraping and shredding activities were predominant. The use of cores for chopping activities can be ruled out as no battering or other wear patterns indicative of this form of activity were noted.

Utilized Chunks

Among the samples of angular debitage analyzed for both sites, seven specimens at Site 36 and 16 at Site 37 exhibited wear patterns and edge modifications. The total number of edges recorded for each site was nine for Site 36 and 19 for Site 37. No difference in edge angles or wear patterns were noted between sites.

The edge angles from the utilized chunks at both sites were evenly distributed from 30 to 90 degrees. The proportions of retouched to unmodified edges were roughly 50% to 50% for both sites, and unifacial microflake wear patterns were predominant.

Choppers

Thirteen choppers were identified in the Site 37 lithic assemblage, but they were completely absent at Site 36. The edge angles recorded on the sample of choppers ranged from 70 to 100 degrees and all exhibited a substantial amount of crushing, battering, and numerous hinge fractures.

Although the specific activity involving the use of choppers can not be identified, the absence of this tool class at Site 36 implies that the associated chopping activity was not common at that site.

Summary

In the preceeding section, data have been presented from lithic analyses relating to four main topical concerns: artifact distributions, raw material use, reduction technology and tool edge function. Although the lithic assemblages of Sites 36 and 37 are generally very similar, significant differences were observed within each of the four main topic areas. The findings do not provide strong evidence for major functional differences between the sites but they do imply different logistical relationships to their respective settlement systems.

The general patterns of artifact distribution are similar at Sites 36 and 37. The range of artifact types represented on each site are comparable and any differences are likely due to the effects of sample size. In addition, the more formalized, functionally diagnostic tool types occur in similar proportions at both sites. Nevertheless, significant differences between the assemblages were documented which relate mainly to the collection and initial reduction of lithic raw materials. Site 36 contains significantly higher proportions of tested cores, hammerstones, anvils and angular debitage, all items closely associated with the selection and reduction of pebbles from the local gravel deposits. Site 37 is characterized by a higher proportion of flakes, a condition expected for base camps where the manufacture and maintenance of tools would produce greater amounts of debitage.

It is suggested that, although the sites are functionally similar, they reflect different logistical strategies. The high proportion of tested cores and hammerstones but relatively low proportion of flakes suggests that core selection, but not necessarily subsequent reduction, was an important activity. This can be explained by viewing Site 36 as a short-term task group site ancillary to a more permanent base camp. Lithic procurement was embedded within the more general function of plant processing. Many cores were tested for suitability for further reduction which appears to have taken place elsewhere. The same logistic constraints appear not to have operated at Site 37 where initial core reduction is a more balanced aspect of the range of behaviors carried out.

This model of the logistical organization of activities at Site 36 is supported by the observed patterns of raw material use. Virtually all of the raw materials on both sites are readily available in the local gravels. However, differential use of the resources is indicated by the pattern of distribution in material quality. Site 36 contains significantly higher proportions of chert and other fine-grained materials, indicating a greater degree of selectivity in raw material use. Such selectivity is understandable if materials (most likely preferable types) were being collected for removal to a more permanent site. There is no evidence that particular rock types were required for specific tasks carried out at either site. The lower proportion of cherts at Site 37 simply reflects a more eclectic pattern of procurement.

Characteristics of the reduction trajectories at the two sites provide additional evidence of the differences already identified. The higher proportion of tertiary flakes at Site 37 is indicative of more thorough core reduction directed, at least in part, towards the production of usable flakes. Significantly more tertiary flakes were utilized at the site than at 36. In contrast, Site 36 exhibits more evidence of biface manufacture in the form of higher proportions of converging dorsal flake scars and (pressure retouch) microflakes. The lack of bifaces but presence of biface debitage at Site 36 probably reflects a curated aspect of the overall technology, an aspect related to the logistical nature of the camp. Any bifaces produced at the site, along with some tested cores of preferred materials, were apparently removed from the site for use elsewhere.

Finally, the analysis of edge morphology suggests that different types of tasks were emphasized at the sites. At Site 36, edge angles on all tools tend to cluster in the 61 to 90 degree range, with utilized flakes functioning in the same manner as scrapers. In contrast, the utilized flakes at Site 37 have predominately narrow edge angles, indicating functions complementary to those carried out by scrapers. The wider range of edge angles at 37 implies a wider variety of on-site activities. Edge wear patterns point to the same conclusion, since a greater emphasis on heavy scraping is evident at Site 36. In all four areas of analysis, there are indications that the assemblage at Site 36 reflects an occupation(s) that is in some sense more specialized. It is suggested that the observed patterns may represent differences in the systemic contexts of the two sites. Although both are plant processing camps, Site 36 appears to have been occupied for shorter periods and for more specific purposes. This model is discussed further in Chapter 13.

Heavy Flotation Microdebitage Analysis

The recovery of specimens of microdebitage from the heavy fraction of soil flotation samples can provide a body of data relevant to a number of concerns. The shaping and resharpening of a number of tools, especially bifaces, frequently result in the deposition of minute flakes in the areas where such activities were performed. The recovery of such flakes furnishes evidence for the identification of activity areas within archaeological sites and may serve to further delineate functional differences between sites.

Traditional screening practices utilizing 1/4 inch mesh will not recover microdebitage, which is usually less than 3 mm in size. For this analysis the heavy fractions of soil flotation samples were examined including 28 samples from Site 36 and 47 samples from Site 37. The proveniences of these samples are from both the inside and outside of large and small fire-cracked rock features, pit structures, and various other excavation units selected for their proximity to these features. Furthermore, the random units located at the sites were sampled.

Each heavy sample was sorted and any suspected microdebitage specimens were collected for examination under 30x magnification. All cultural specimens were classified as either microangular debitage or microflake, and the total weights, numbers, and material varieties were recorded for the two classes in each flotation sample.

There are a few obvious problems in this analysis. The minute size of the specimens, even under magnification, made their identification difficult since they resembled natural pebble fragments. However, following the criteria of considering a specimen as cultural only if it exhibited the attributes of flakes and angular debitage prevented the inclusion of any significant amount of natural fragments, particularly in the class of microflakes. Microangular debitage may not be as accurate, since items in this class more often resemble natural pebble fragments.

Another problem concerns the identification of material types. At this minute level of analysis, many materials appear the same. However, it is felt that the material categories identified in the microdebitage assemblage are accurate, since texture differences, colors, inclusions, and other qualities could be clearly seen at 30x magnification. The identification of material varieties among the Rancheria cherts, is questionable. The high percentage of the black porous variety of Rancheria chert may be due to the small size of the specimens, as this variety of chert is infrequent in the general assemblages of Sites 36 and 37. It is also possible that this variety was more often selected for tool manufacture because of its more predictable fracture properties.

Table 35 lists the material varieties identified among the microdebitage samples of Sites 36 and 37. The overall percentages are notable in that they are remarkably similar to patterns discussed previously in this chapter:

1) Coarse and medium-grained materials are proportionately higher at Site 37 than at Site 36; fine-grained siliceous materials have a higher frequency at Site 36 than at Site 37.

Table 35. Heavy Flotation Analysis
Microdebitage Material Distributions by Site

CODE	MATERIAL TYPE	Site-36 N	Site-36 %	Site-37 N	Site-37 %
100	Sedimentary, Undifferentiated	4	1.2	1	0.6
120	Dolomite	24	7.3	22	12.9
130	Siltstone	1	0.3	-	---
230	Thunderbird Rhyolite-Red	9	2.7	13	7.6
231	Thunderbird Rhyolite-Black	1	0.3	4	2.4
310	Quartzitic Sandstone	1	0.3	1	0.6
320	Quartzite	5	1.5	4	2.4
350	Quartz	2	0.6	2	1.2
360	Silicified Siltstone	-	---	1	0.6
410	Jasper-Mustard	1	0.3	2	1.2
411	Jasper-Red	1	0.3	2	1.2
420	Chalcedony	10	3.0	7	4.1
440	Silicified Wood	1	0.3	-	---
400	Cherts, Undifferentiated	235	71.4	99	58.3
450	Rancheria-Black and Brown Banded	8	2.4	1	0.6
451	Rancheria-Black Porous	14	4.2	7	4.1
452	Rancheria-Brown Porous	2	0.6	1	0.6
453	Rancheria-Black/Brown Mottled	9	2.7	3	1.8
	Totals	328	99.4	170	100.2

	Site 36		Site 37	
% Rhyolites	10/328	3.0	17/170	10.0
% Cherts	268/328	81.7	111/170	65.3
% Fine-Grained	305/328	93.0	145/170	85.3
% Coarse-Grained	23/328	7.0	25/170	14.7

2) Cherts are by far the most frequent material type at both sites, indicating the biface manufacture and curation were primarily of these materials. Rancheria cherts are relatively rare.

3) Dolomite, rhyolite, and chalcedony are second in importance to cherts, but more frequent than other materials.

Another important pattern is that although a smaller number of soil flotation samples were analyzed from Site 36 than Site 37, nearly twice the number of microdebitage was recovered from the Site 36 samples (328 to 170 specimens). This total includes 270 microflakes collected from the Site 36 samples versus 141 microflakes from Site 37. If, for the purposes of comparison, these figures are combined with the assemblages from Table 18, they represent proportions of 19.4% and 2.9%, respectively. The difference is statistically significant at $p = .00001$ ($Z = 22.0$). This pattern supports the inference noted earlier that biface manufacturing was more common at Site 36.

A final area of interest is the intrasite distribution of microflakes. The volume of flotation samples were calculated in liters. The number of microdebitage and microflakes for each sample was then divided by the liter volume of the sample, providing a relative measure of microdebitage and microflake density per liter of soil. Table 36 lists the results of these calculations by excavation unit and feature for Sites 36 and 37.

These relative densities of microflakes were then plotted against diagrams of the feature distributions at Sites 36 and 37. The results of this plotting were inconclusive in that no apparent pattern was discernable between high and low microflake densities and their association with small fire-cracked rock features, large features, or pit structures. As expected higher densities were noted outside of features than within them. However, two observations should be noted. Microflake densities are very low in the peripheral random excavation units, indicating that activities associated with biface production were not usually performed in areas distant from features. Also notable is the fact that a number of high density loci correspond to the distribution of lithic clusters characterized by a predominance of secondary, tertiary, and utilized flakes (see Chapter 10).

Although somewhat time-consuming, the recovery of microdebitage from heavy flotation samples can provide a further dimension to the study of lithic assemblages. In this case, evidence for biface production was recovered which was not provided by cores deposited at the site.

Table 36. Heavy Flotation Analysis

Microdebitage Density per Liter by Unit and Feature

Keystone Sites 36 and 37

Site 36

SPEC	UNIT	FEA	DEB	FLA	DEB/1	FLA/1
1371	02s22w	13	6	5	1.9	1.6
1433	02s22w	13	3	3	1.1	1.1
1377	02s22w	14	14	10	4.4	3.1
1397	02s22w	14	18	16	6.5	5.8
1398	02s22w	14	10	9	3.8	5.4
1473	02s24w	13	9	7	3.1	2.4
1418	02s24w	15	7	3	2.1	0.9
1462	01s26w	18	10	9	3.4	3.1
0565	00n10e	6	6	5	2.2	1.9
0491	00n10e	6	32	24	13.2	9.9
0495	00n10e	6	9	6	3.7	2.4
0412	20s14e	7	8	8	2.8	2.8
0480	20s14e	7	9	7	3.6	2.8
0567	42s00e	10	18	16	5.5	4.9
0662	42s00e	10	6	4	2.1	1.4
0664	42s00e	10	5	2	1.6	0.7
0687	42s00e	10	2	1	0.4	0.2
0670	10s19w	9	13	12	3.7	3.4
0388	28s12w	8	6	5	2.1	1.7
1402	32n02e	17	17	15	5.6	5.0
1480	24s04e	0	2	2	0.7	0.7
1452	16s00e	0	23	20	7.7	6.7
1419	28n20w	0	8	7	2.7	2.3
1424	44n20w	0	11	8	3.7	2.7
1426	00n04w	0	24	20	8.0	6.7
1483	32s16e	0	2	2	0.7	0.7
1372	20n04e	0	15	14	5.0	4.7
1427	04n00e	0	35	30	11.7	10.0
		Totals	328	270		

Table 36. Continued

Site 37

SPEC	UNIT	FEA	DEB	FLA	DEB/1	FLA/1
3243	38s22w	0	5	3	2.0	1.2
3279	47s01e	2	7	6	1.9	1.6
3321	47s01e	2	8	8	2.8	2.8
3305	47s01e	2	4	3	1.1	0.8
3225	02n08e	25	4	4	1.8	1.8
3216	02n08e	25	3	3	1.2	1.2
3221	02s21w	23	6	4	1.6	1.1
3327	02s21w	23	5	3	1.6	1.0
3323	02s21w	23	3	3	1.2	1.2
3537	------	60	3	3	3.9	3.9
3361	18s12e	34	1	1	0.3	0.3
3332	18s12e	34	1	1	0.4	0.4
3299	17n33w	29	1	1	0.4	0.4
3497	------	40	3	2	4.4	2.9
3508	------	40	2	2	0.8	0.8
3525	------	54	1	1	1.6	1.6
3345	10n44w	0	1	1	0.4	0.4
3281	23n33w	0	3	3	1.2	1.2
3775	------	35	4	4	1.6	1.6
3492	------	35	3	2	1.2	0.8
0887	17s20w	21	4	4	1.4	1.4
1588	17s20w	21	3	3	0.9	0.9
3236	10n38w	0	4	4	1.6	1.6
3269	10n38w	0	3	1	1.2	0.4
3307	02s24w	22	0	0	0.0	0.0
3220	02s24w	22	4	4	1.6	1.6
3262	02s24w	22	2	1	0.7	0.4
3272	05n34e	0	4	3	1.6	1.2
1282	34s10w	14	7	6	2.8	2.4
1241	34s10w	14	5	3	2.5	1.5
3367	60s06e	0	1	0	0.4	0.0
3329	10s14w	0	9	5	3.6	2.0
0849	06n26e	6	2	2	0.8	0.8
0828	06n26e	6	13	11	5.0	4.3
3240	42s02w	0	4	3	1.6	1.2
3265	42s02w	0	3	3	1.2	1.2
3513	------	47	2	2	2.8	2.8
3368	00n34e	13	2	0	0.6	0.0
3368*	00n34e	13	-	-	---	---

Table 36. Continued

3490	------	28	1	1	1.6	1.6
0948	20s04w	1	5	4	1.4	1.2
3311	17n29w	0	3	3	1.2	1.2
3222	12n28w	29	8	7	3.2	2.8
3344	42n39w	0	1	1	0.4	0.4
3338	02n12w	0	1	1	0.4	0.4
3314	42s12w	0	6	6	2.4	2.4
0000	34s10w	18	6	5	2.4	2.0
		Totals	170	141		

*Heat-treated obsidian untested pebble

Groundstone Artifacts

Although groundstone is a minor component, representing only 1.3% and 3.7% of the artifact assemblages of Sites 36 and 37 respectively, it nevertheless is important for a number of issues concerning site function and associated activities. Definitions of the groundstone artifacts were presented at the beginning of this chapter and the frequencies of groundstone artifacts in the overall lithic assemblages of Sites 36 and 37 were included in Table 18. The following discussion will be primarily concerned with brief descriptions of the groundstone artifact classes at these sites and how the variability between these sites reflects on their functionally distinct occupations.

Table 37 summarizes the numbers of groundstone artifacts material composition and Table 38 provides descriptive data on the individual specimens. General descriptions of each category follow below.

Slab Metates

The metates recovered from Sites 36 and 37 are thick, relatively flat cobbles which have some smoothing, but little concavity resulting from grinding. Striae could be observed on the surfaces, but little or no pecking or other damage was present. Material composition of metates is dolomite and red Thunderbird rhyolite.

Manos

Eighteen manos were found at Site 37 but only one at Site 36. The majority are small, one-hand manos manufactured primarily from cobbles of dolomite, quartzite, and sandstone, though granite, Soledad rhyolite, and red Thunderbird rhyolite were also utilized. Most samples show a high degree of shaping and wear, appearing as oval or circular implements with a moderate to high amount of striae and polish on their grinding surfaces.

Pestles

One dolomite pestle was identified at Site 36 and nine at Site 37. Each is a long, round cobble with one or both ends tapering to a point. These points show various types and degrees of edge damage, including battering, polish, and striae. The localization of these wear patterns suggests that these tools may have been used to grind vegetal foodstuffs in mortars or some functionally similar vessel. Material composition is predominantly dolomite, although Soledad rhyolite and granite were also used. Two samples from Site 37 are of schist and represent the only use of this material in either assemblage. The use of

Table 37. Groundstone Artifacts

Keystone Site 36

Material	Groundstone Fragment	Pestle	Mano	Metate	Anvil
Dolomite	1 (100)	1 (100)	--	---	3 (100)
T-Bird Red	---	---	--	1 (100)	---
Quartzitic Sandstone	---	---	1(100)	---	---
Totals	1 (100)	1 (100)	1(100)	1 (100)	3 (100)

Keystone Site 37

Material	Groundstone Fragment	Pestle	Mano	Metate	Polishing Stone	Anvil
Dolomite	3 (100)	5(55.6)	7(38.9)	6(85.7)	---	2 (100)
T-Bird Red	---	---	1(5.6)	1(14.3)	---	---
Soledad Rhyo	---	1(11.1)	2(11.1)	---	---	---
Rhyolite Tuff	---	---	---	---	1(50.0)	---
Granite/Dio	---	1(11.1)	2(11.1)	---	---	---
Quartzite	---	---	3(16.7)	---	---	---
Quartz	---	---	---	---	1(50.0)	---
Sandstone	---	---	3(16.7)	---	---	---
Schist	---	2(22.2)	---	---	---	---
Totals	3(100)	9(100)	18(100)	7(100)	2(100)	2 (100)

Table 38. Attributes of pecked and groundstone tools.

Keystone Site 36

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
1059	anvil	2S24W Assoc. Fea. 13	25.5	19.0	6.0	2779	dolomite	bifacial pitting	complete
1151	metate	2S22W Assoc. Fea. 13	18.0	11.4	6.7	1986	Thunderbird rhyolite	unifacial very light smoothing of natural depression	complete
127	ground-stone fragment		4.1	1.9	0.7	8	dolomite	indeter-minate	fragment
448	mano	20S18E Assoc. Fea. 7	11.2	8.7	3.3	462	quartzitic sandstone	slight bifacial pecking	fragment
693	anvil	42S0E Assoc. Fea. 10	23.0	17.5	6.5	4192	dolomite	unifacial pitting	complete
225	anvil	41.6N43.6W	24.5	13.9	14.0	8636	dolomite	pecking on both sides	complete
219	pestle	8.6S20W	11.0	7.1	4.0	26	dolomite	flaked and battered on one end	fragment

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
84	pestle	15.5N29W	12.3	6.6	2.9	434	schist	ground on one end; shaped by pecking	fragment
371	pestle	18N63W	31.5	7.2	4.5	1920	dolomite	flaked and ground on both ends	complete
629	pestle	8N29.5E	11.2	4.9	2.4	201	Soledad rhyolite	slight grinding on one end, slight grinding and pitting both sides	fragment
633	pestle? hammerstone?	5N27.5E	10.0	4.4	2.2	125	granite	slight pecking on one end	complete
2996	pestle	16N18W	23.5	5.1	4.2	638	dolomite	battering & flaking on one end	complete
3580	pestle	Fea. 35	21.0	6.3	6.0	1341	dolomite	minor step flaking on one end	complete

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
3485	mano	Fea. 54	10.2	8.9	7.0	1108	granite	moderate bifacial smoothing; pitted on one side	complete
3489	metate	Fea. 39	37.0	24.0	7.5	7715	dolomite	slight smoothing of natural depression; pitting	complete
430	mano	32N73W	7.1	6.4	3.4	213	sandstone	unifacial, moderately smoothed	complete
643	polishing stone?	29.5N12.5E	3.0	2.6	1.7	8.6	welded tuff	slight smoothing on one side	complete
671	mano	36.8S57.5E	14.6	10.0	5.2	1164	dolomite	slight unifacial smoothing	complete
808	mano	48S56.5E	7.5	7.4	3.0	197	grano-diorite	moderately smoothed on both sides; no shaping	fragment

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
1267	metate	32N8E Assoc. Fea.3	19.5	15.1	6.1	2419	dolomite	slight unifacial smoothing of natural	fragment
1508	pestle? hammer-stone	4S29W Assoc. Fea. 8	12.7	4.5	2.7	200	dolomite	slight pecking at one end	complete
1539	mano	4S29W Assoc. Fea. 8	4.8	3.3	1.5	43	Soledad rhyolite	slight unifacial smoothing of natural surface	fragment
2059, 2060, 2061	mano	18S12E Assoc. Fea. 34	22.5	11.0	5.2	2319	dolomite	slight unifacial smoothing	complete mano in 3 pieces
2533	ground-stone fragment	4S29W Assoc. Fea. 8	11.5	6.2	5.4	572	dolomite	unifacial smoothing of natural surface	fragment
2538	ground-stone fragment	4S29W Assoc. Fea. 8	3.2	3.1	2.5	46	dolomite	unifacial smoothing of natural surface	fragment

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
2552	mano	4S29W Assoc. Fea. 8	9.1	5.8	3.5	247	quartzite	slight bi-facial smoothing	complete
2634	polishing stone	2S21W Assoc. Fea. 23	2.7	2.0	1.6	13	quartz	highly polished on two sides	complete
2653	metate	2S21W Assoc. Fea. 23	17.5	12.7	4.8	1345	dolomite	unifacial smoothing of natural surface; slight pecking	fragment
2750	ground-stone fragment	47S1E Assoc. Fea. 2	6.2	6.0	5.0	174	dolomite	undeter-minate	fragment
3578	anvil?	20S24W	39.5	25.5	8.5	8000	dolomite	pitting both sides, flaked on edge	complete
1017	mano	20S4W Fea. 1	8.6	8.1	4.4	551	dolomite	slight uni-facial grinding and pecking	fragment
3483	mano	In Fea. 54	9.3	7.5	7.0	815	granite		complete

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
3488	mano	In Fea. 39	17.5	9.3	4.8	1265	quartzite	slight bi-facial smoothing & pecking of natural surface	fragment
3558	metate	20S24W	33.5	19.5	9.0	7999	dolomite	smoothing and striae, unifacial. Battering on one end	complete
3568	mano	20S24W Assoc. Fea. 20	11.0	10.8	9.5	1796	dolomite	unifacial smoothing & pecking	complete
3569	pestle	In Fea. 26	13.8	8.4	5.7	885	dolomite	battered on one end	fragment
3577	anvil	In Fea. 1	32.5	18.5	9.9	8000	dolomite	pitted on both sides	fragment
1015	metate	20S4W In Fea. 1	17.5	13.6	8.0	2872	dolomite	slight uni-facial smoothing. 3 mm deep 7 x 16 cm.	fragment

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
1013	mano	20S4W In Fea. 1	11.7	5.0	0.9	62	dolomite	slight unifacial smoothing	fragment
90	metate?	15.5N6.5W	7.3	6.0	4.0	209	Thunderbird rhyolite	unifacial slight smoothing	fragment
703	metate	23.7N57.2W	16.9	13.0	6.9	2447	dolomite	bifacial smoothing & pecking of natural contours	complete
567	mano	17S5W	8.5	6.0	3.1	198	dolomite	bifacially smoothed, not shaped; pecked on one face	fragment
638	mano	6.5N25E	13.0	7.9	3.9	694	sandstone	slight unifacial smoothing	complete
669	mano	35S59E	8.2	6.4	2.6	186	quartzite	bifacial smoothing; no shaping	complete

Table 38. Continued

Keystone Site 37

SPECIMEN	ARTIFACT TYPE	LOCATION	LENGTH (CM)	WIDTH (CM)	THICKNESS (CM)	WEIGHT (G)	MATERIAL	USE AREA	CONDITION
937	mano	20S4W Assoc. Fea. 1	11.5	9.2	5.7	683	Thunderbird rhyolite	slight unifacial smoothing of natural surface	complete
1471	metate	22N34W Assoc. Fea. 8	26.0	23.0	11.0	5040	dolomite	slight unifacial smoothing of natural 1 cm groove	fragment
5014	pestle	general surface	10.0	6.5	2.5	170	schist	end battered, sides pitted; shaped by pecking	fragment

this material is notable because there are no sources of schist in the local alluvial gravels. Its nearest source is the Cristo Rey mountains across the Rio Grande to the southwest. The schist examples are quite similar to those commonly reported in the Tularosa Basin (Carmichael 1981; Eidenbach 1983). A number of the pestles from Site 37 were recovered from the floors and within the fill of the pit structures at that site.

Groundstone Fragments

These are small pieces which can be identified as groundstone of the basis of observed wear and damage patterns on one or more of their surfaces. However, due to their small size, they cannot be assigned to any particular category. One fragment was found at Site 36 and three at Site 37, and all are of dolomite. All appear to be fire-cracked.

Anvils

Three anvils were identified at Site 36 and two at Site 37. All examples are large, relatively flat cobbles of dolomite which exhibit battering on the surface. One from Site 37 was recovered from the floor of a pit structure.

Polishing Stones

Two polishing stones were found at Site 37. Both have one very flat surface which shows a high degree of polishing in contrast to the rough surface of the natural cortex present on the remainder of the piece. Further evidence of their cultural origin is provided by the fact that at least one specimen is of a material (Rhyolite welded tuff) having no local source. The other specimen is of quartz.

The presence of groundstone is usually indicative of activities associated with the processing of a variety of vegetal foodstuffs. The groundstone artifacts from Sites 36 and 37 show little formalization or utilization, with the exception of pestles which correspond to well defined examples elsewhere in the Jornada area. Groundstone tools would generally be identified with the processing of plant seeds, such as grasses or mesquite, rather than succulent leaf tissues. It seems safe to conclude that some limited amount of seed processing took place at the sites, probably for the daily support of groups involved in agave roasting. Aside from the patterns noted earlier for anvils, there are no significant differences in the occurrence of groundstone tools at the sites which would affect the interpretation of site function.

CHAPTER 10

INTRASITE DISTRIBUTIONAL ANALYSES

Introduction

In this chapter, the results of several distributional analyses designed to identify patterning in the occurrence of features and artifacts at Sites 36 and 37 are discussed. The patterns are then used to draw conclusions regarding the functional significance of spatial partitioning. In addition, the degree of patterning also has implications for interpreting site structure.

The results of these analyses identify several distinctions between the two sites which parallel the differences in artifact assemblages noted in the preceding chapter. These distinctions relate mainly to the degree of redundancy in the partitioning of space within the sites. Site 37 exhibits a well developed distributional pattern, among both features and artifact types. The complementary distribution of functionally different items suggests a general contemporaneity among the features. Further, the degree of patterning at Site 37 supports the view that it represents longer-term occupation(s) than Site 36.

Feature distributions are described first, followed by a treatment of artifact densities and activity clustering. The patterns are then summarized in relation to the hypotheses presented in the Research Design (Chapter 3).

Distribution of Feature Types

The spatial distribution of prehistoric features at Sites 36 and 37 are mapped in Figures 37 and 38 respectively. The features are differentiated according to their membership within the feature groups discussed in Chapters 7 and 8. The most obvious pattern is evident from the distribution of large fire-cracked rock features, shown in black. At Site 36 they occur basically at the southern and eastern periphery of the site but some association with small hearths is seen in the case of Feature 6. Most of the small (i.e., domestic) hearths are located in the western and northern portions of the site, somewhat removed from the larger rock features. By reference to the topographic map of the site (Figure 3) it is clear that Features 7, 8 and 10 also occur downslope of the main clusters of features. The location of large roasting features around the periphery of a site, downslope of the main occupation surface, is suggestive of intrasite activity patterning. This is especially the case if one accepts the argument that the large and small fire-cracked rock features

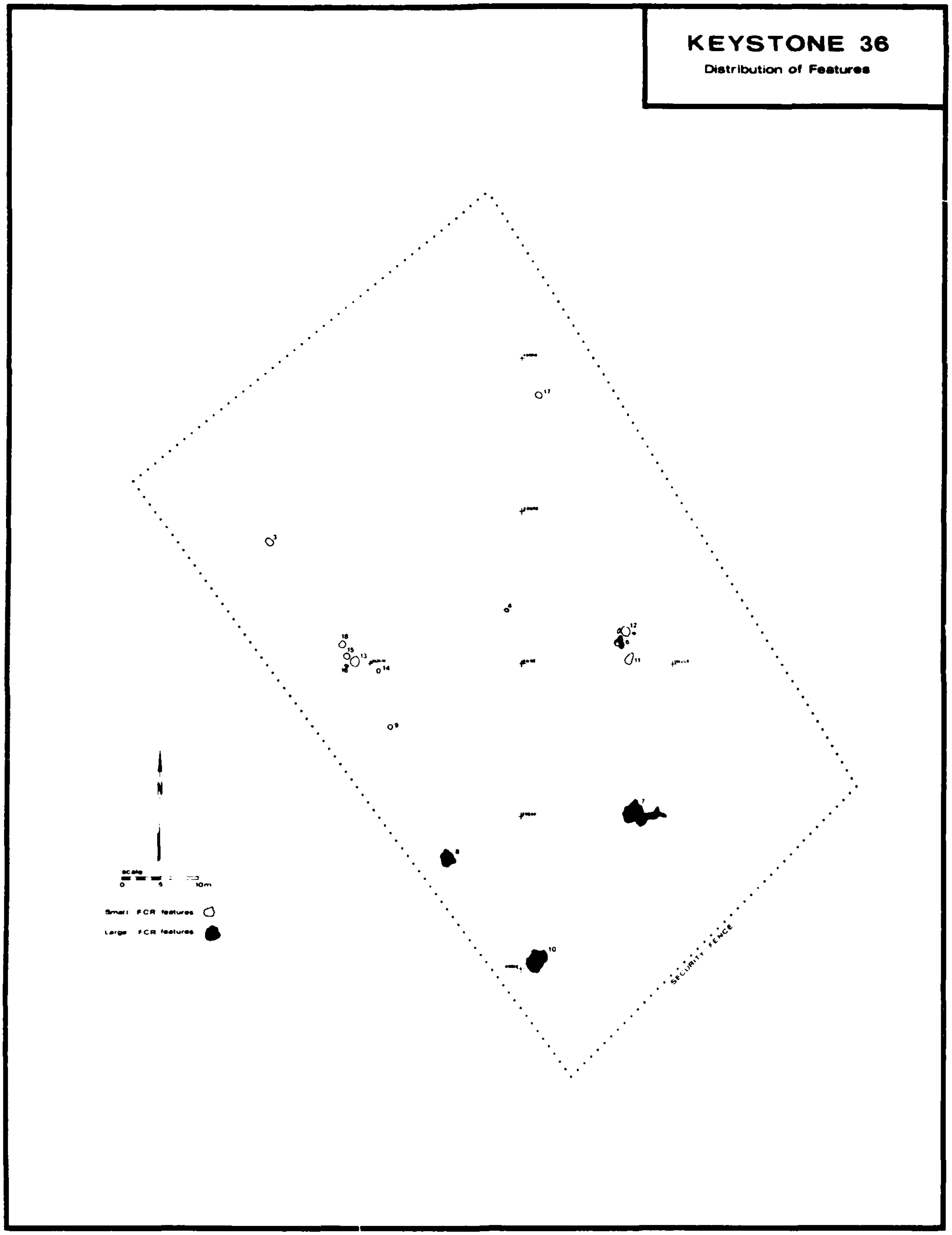


Figure 37. Distribution of Features at Keystone 36.

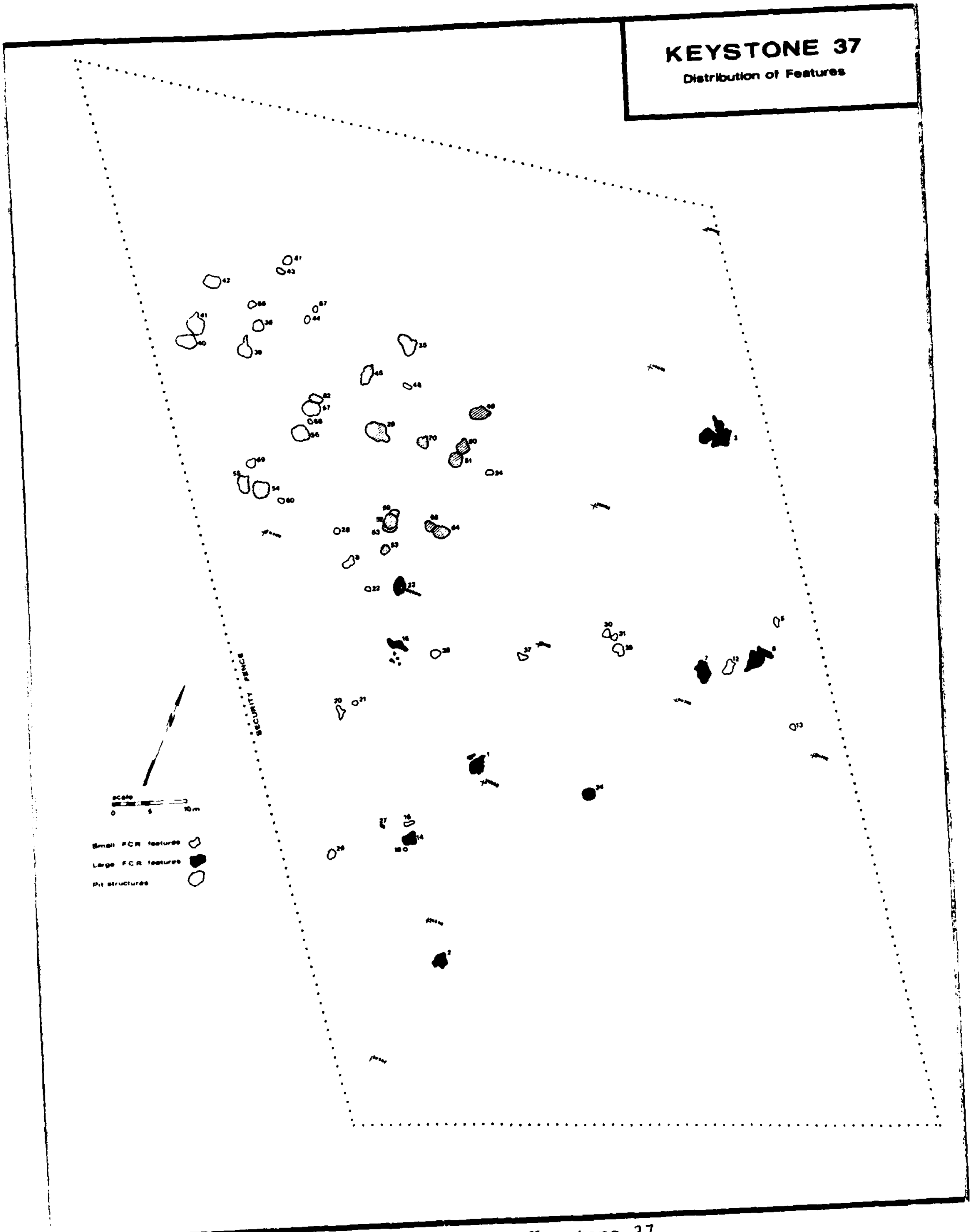


Figure 38. Distribution of Features at Keystone 37.

represent different functions. The evidence for this pattern at Site 36 is suggestive but the data at Site 37 are more convincing.

Feature distributions for Site 37 are shown in Figure 38. Note that the large fire-cracked rock features are again concentrated along the southern and eastern periphery of the site. There is also some overlap with the distribution of small hearths, but recognition of patterning is enhanced by the presence of the pit structures. The distributions of roasting pits and pit structures are essentially mutually exclusive, the structures being confined to the northwest quarter of the site. The smaller domestic hearths occur within both areas but, in the northwestern part of the site, are more often directly associated with another feature type. This is less often the case throughout the rest of the site (e.g., Features 13, 20, 21, 26, 30, 31, 35 and 37). Additional support for basic locational differences among sites is provided by comparative analyses of nearby features and artifacts.

Basic data on selected variables for fire-cracked rock features at the two sites are listed in Tables 39 and 40. These data permit comparisons of associated artifact density and number of associated artifact types to be made between the two groups of fire-cracked rock features. At Site 37 they are also compared on the basis of their degree of association with pit structures. A difference of means test (Table 41) indicates that, on the average, large fire-cracked rock features are located twice as far from pit structures as are the small hearths. Small hearths average 17.5 m spacing from structures while the larger features average 36.4 m from structures. The difference is significant at $p = .005$ ($t=3.57$, $df=15$). If spatial location is any indication, it would appear that small hearths represent related activities which are more or less removed from the large fire-cracked rock features.

Distinctions between large and small rock features can also be supported on the basis of artifact associations. Difference of means tests on the number of associated artifact types within a 4 X 4 meter area around features indicated no significant difference between large and small features ($t = -0.23$). However, the density of artifacts associated with the two feature types varied significantly at both sites (Tables 42 and 43). Artifact densities associated with small hearths are between two and three times greater than those recorded around the large fire-cracked rock features (differences significant at $p = .025$). These data strongly suggest that activities involving the manufacture and/or use of lithic artifacts were far more intensive in the vicinity of small hearths as opposed to large roasting features. This is precisely what would be expected in light of the association of small hearths with residential structures, the presumed focus of general domestic activities. Features 23 and 15 at Site 37 are the only possible exceptions to the pattern on either site. They are assigned to the large feature group on the basis of their rock weight, but all other characteristics suggest a greater similarity

Table 39. Summary of selected variables for fire-cracked rock features at Site 36

FEATURE NUMBER	SIZE GROUP	ARTIFACT DENSITY IN 4X4 m UNIT (PER m2)	NO. ASSOC. ARTIFACT TYPES
3	S	1.6	3
4	S	2.5	6
5	S	0.6	4
6	L	2.5	8
7	L	1.0	5
8	L	2.1	6
9	S	2.2	5
10	L	0.9	3
11	S	2.5	8
12	S	2.5	8
13	S	6.2	7
14	S	6.0	7
15	S	6.2	7
16	S	1.0	1
17	S	1.1	3
18	S	2.5	5

Table 40. Summary of selected variables for fire-cracked rock features at Site 37

FEATURE NUMBER	SIZE GROUP	ARTIFACT DENSITY IN 4X4 m UNIT (PER m2)	NO. ASSOC. ARTIFACT TYPES	DISTANCE TO STRUCTURE (m)
1	L	3.8	8	30
2	L	0.8	6	55
3	L	1.3	6	30
6	L	0.9	6	45
7	L	0.3	3	40
8	S	12.5	13	0
12	S	0.9	6	43
14	L	3.0	5	38
15	L	12.6	9	13
16	S	2.8	5	38
18	S	2.8	5	40
20	S	10.1	7	23
21	S	10.1	7	20
22	S	6.8	5	5
23	L	28.6	13	5
25	S	1.4	4	28
26	S	0.9	1	40
27	S	unexc.		38
28	S	unexc.		8
30	S	1.4	4	25
31	S	1.4	4	28
34	L	0.6	2	40

Table 40. Continued

FEATURE NUMBER	SIZE GROUP	ARTIFACT DENSITY IN 4X4 m UNIT (PER m2)	NO. ASSOC. ARTIFACT TYPES	DISTANCE TO STRUCTURE (m)
36	S	4.1	5	15
37	S	unexc.		23
44	S	unexc.		5
47	S	3.8	4	8
60	S	unexc.		5
66	S	5.5	4	2
67	S	unexc.		8
68	S	unexc.		1
69	S	unexc.		3

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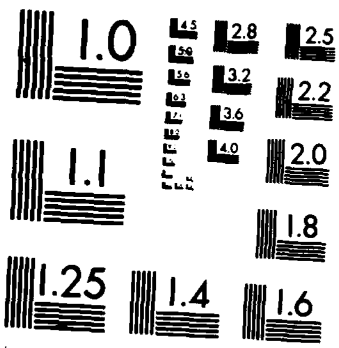

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with small hearths. They exhibit two of the highest associated artifact densities (Table 40) and are located among a series of small hearths, fairly close to a group of pit structures (Figure 38). It is possible that the features represent multiple-use general purpose hearths which have grown large by accretion. No other data were obtained which might settle the issue, but either way, these two cases do not nullify the identifiability of the overall distributional patterns.

The locational patterns identified here support the functional interpretations of features developed in previous chapters. At Site 37 the large fire-cracked rock features are somewhat removed from the residential structures and have low densities of associated artifacts. In contrast, small hearths are more closely associated with the pit structures and they occur in areas of relatively high artifact densities. These observations argue against O'Laughlin's (1980) conclusion that large and small fire-cracked rock features are functional equivalents. They instead support Whalen's (1978, 1979) view that only the large features are special processing facilities and that the small rock features are general domestic hearths. In both the analysis of the Hueco Bolson sites and this study, the most compelling support for a functional distinction is the clear distinction in feature distribution, with large roasting pits located rather consistently around the periphery of the site. That this pattern was not manifest at Keystone 33 may indicate a less specialized role within its respective adaptive strategy. If they were interpreted as domestic hearths, the large number of small fire-cracked rock features at Site 33 would fit with the large projected number of houses.

Given the above discussion, the feature distributions identified at Site 37 seem most readily explainable as indicating functional partitioning of space within the site. On the one hand, the northwestern part of the site is the focus of residential structures and, presumably, domestic activities. In contrast, the agave roasting features are situated down wind of the residential area around the site periphery. The pattern is somewhat less well developed at Site 36. This may be due to the lack of a defined residential area or less redundant reuse of the site. Nevertheless, the dichotomous distribution is fairly distinctive and is probably a reality at both sites.

As already mentioned, a similar intrasite pattern has been recorded by Whalen (1978, 1979) at Mesilla phase sites in the Hueco Bolson. On the basis of the relatively few large roasting features present and because of their location in peripheral areas away from residences, he argues that the roasting pits were specialized communal facilities utilized by more than a single household. The same argument could apply to Site 37 although it was not possible to define individual household groups due to the overlapping of some, and close proximity of all the structures

Table 41. T-test comparison of distance to nearest structure between large and small FCR features at Keystone 37

Group	n	Mean Dist. in Meters	S. Dev.	t	df	Result
Large FCR Features	8	36.4	12.4	3.57	15	difference is significant at $p < .005$ for 1-tailed test
Small FCR Features	24	17.5	14.6			

Table 42. T-test comparison of artifact density associated with large and small FCR features at Site 36

Group	n	Mean Dist. in Meters	S. Dev.	t	df	Result
Large FCR Features	4	1.63	0.60	-2.36	13	Difference is significant at p <.025 for 1-tailed test
Small FCR Features	9	3.42	2.09			

Table 43. T-test comparison of artifact density associated with large and small FCR features at Site 37

Group	n	Mean Dist. in Meters	S. Dev.	t	df	Result
Large FCR Features	7	1.53	1.33	-2.26	16	Difference significant at p <.025 for 1-tailed test
Small FCR Features	12	4.02	3.40			

(Figure 38).

One other important observation arising from the strong internal patterning at Site 37 is that the different feature types are probably roughly contemporaneous. It has already been noted that the site does not represent a community in the sense of all the structures being occupied at once. The superpositioning of some structures indicates that only a portion of them could have been strictly contemporaneous. Nevertheless, one is struck by the extent to which later occupations must have been affected by the placement of earlier ones. This suggests that the occupations were close enough in time that the remains reflecting spatial partitioning of earlier users were still available to structure later use of the same areas. In two instances (Features 39 and 52), the overlap with previous structures is so complete that it suggests rebuilding of a structure which was still visible at the surface. The important point is that even though not all the features were utilized simultaneously, they are distributed as if the different feature types were placed in relation to each other. Such a pattern is good evidence for at least general contemporaneity among the features. As Binford notes (1982), the extent to which intrasite patterning is preserved will depend on the level of redundancy in the use of space within that site. Multiple occupations from different time periods and representing different site functions will tend to obscure distinct patterns. This is because they are located irrespective of previous occupations and because artifacts representing different functional activities will be intermixed. The fact that a well defined locational pattern is preserved at Site 37 argues that the occupations at the site were fairly close together in time and that their functional use of space within the site was redundant. This interpretation of the general contemporaneity of the various feature types is further supported by the artifact distributions, as discussed below.

Artifact Distributions

It has been suggested that a pattern in the distribution of features is indicative of various degrees of activity clustering at Sites 36 and 37. The observed patterns were further tested through the application of three different spatial analyses to the artifact assemblages. The analyses consider surface artifact densities, the relationship between pit structures and artifact density, and clustering of subsurface artifact types. The results are quite gratifying since they provide independent corroboration for the functional inferences derived from the feature distributions.

Surface Mapping

The first data to be considered are the densities and distributions of surface artifacts. Point proveniences of all surface artifacts were recorded in the field with a laser transit. The locations, expressed as x - y coordinates, were later digitized at the Digital Imagery Processing Laboratory at NMSU. The results of the phase one lithic analysis were added to the digitized data so that the distributions of specific artifact types could be examined. The surface locations were also recombined to construct site-wide artifact density contour maps.

In order to produce the contour maps, the sites were subdivided into 4 x 4 meter units with the grid tied into the main base lines. The artifact densities calculated within each unit were used to construct the contours. Maps were drawn using a variety of different grid sizes but the 4x4 units provided the smoothest contours. The resulting density contours are shown in Figures 39 and 40. Note that the contour labels refer to the number of artifacts within the 4x4 meter units; conversions to density per square meters are provided in the map legends. Surface artifact densities range from 0 to .63 per square meter at Site 36 and from .01 to 1.88 per square meter at Site 37. The most obvious difference between the sites is the much lower density recorded at Site 36. This difference corresponds to the lower overall quantity of artifacts recovered from the site and implies less intensive occupation(s) than at Site 37.

At Site 36 the areas of highest density are located mainly along the west edge of the site (Figure 39). Severe erosion along the Interstate 10 roadcut contributes to high surface densities in that area but a comparison with Figure 37 reveals that the high density areas are located near Features 3, 8, and the cluster of small hearths at 0N/20W. High surface densities are not clearly associated with only one or the other feature type. Also, the higher density areas occur throughout the site rather than being confined to a specific area. These observations support the view, inferred from the feature distribution, that cultural patterning is rather poorly developed at this site when compared to Site 37.

At Site 37 the greatest densities are also on the west side of the site, but they are not at the edge of the embankment in areas of maximum erosion. Close comparison of Figures 38 and 40 indicates that the highest surface artifact densities correspond to concentrations of domestic features (i.e., pit structures and small hearths). Even though it was impossible to predict specific structure locations on the basis of surface artifacts, it is still noteworthy that the high density contours are good predictors of the areas within which the structures were located. Note that, in sharp contrast, most of the large roasting features occur in areas having 0.13 or fewer artifacts per square meter. The association of roasting features with low artifact densities corroborates the comparisons of subsurface artifact density by feature type (Table

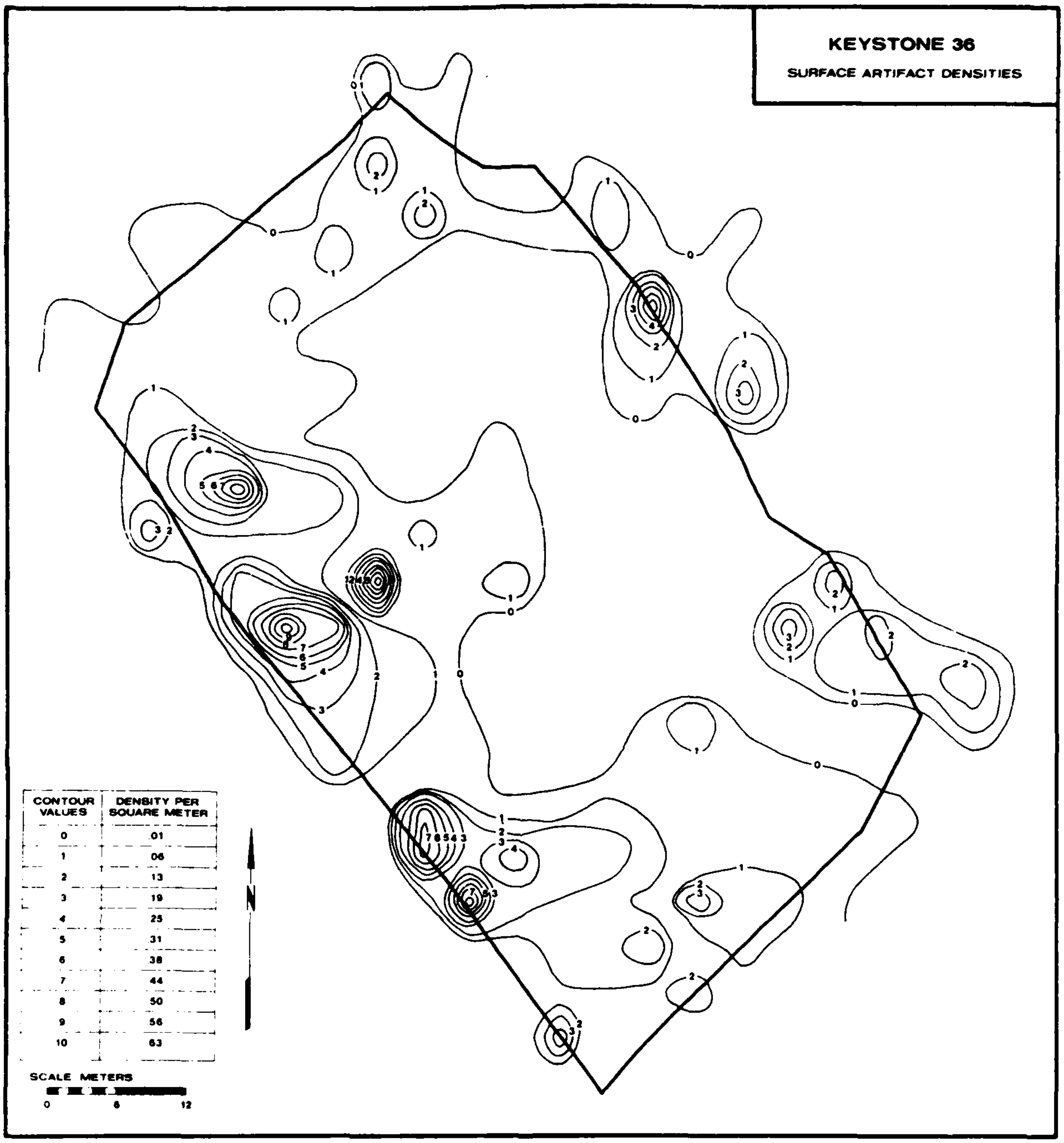


Figure 39. Surface artifact density contour map of Keystone 36.

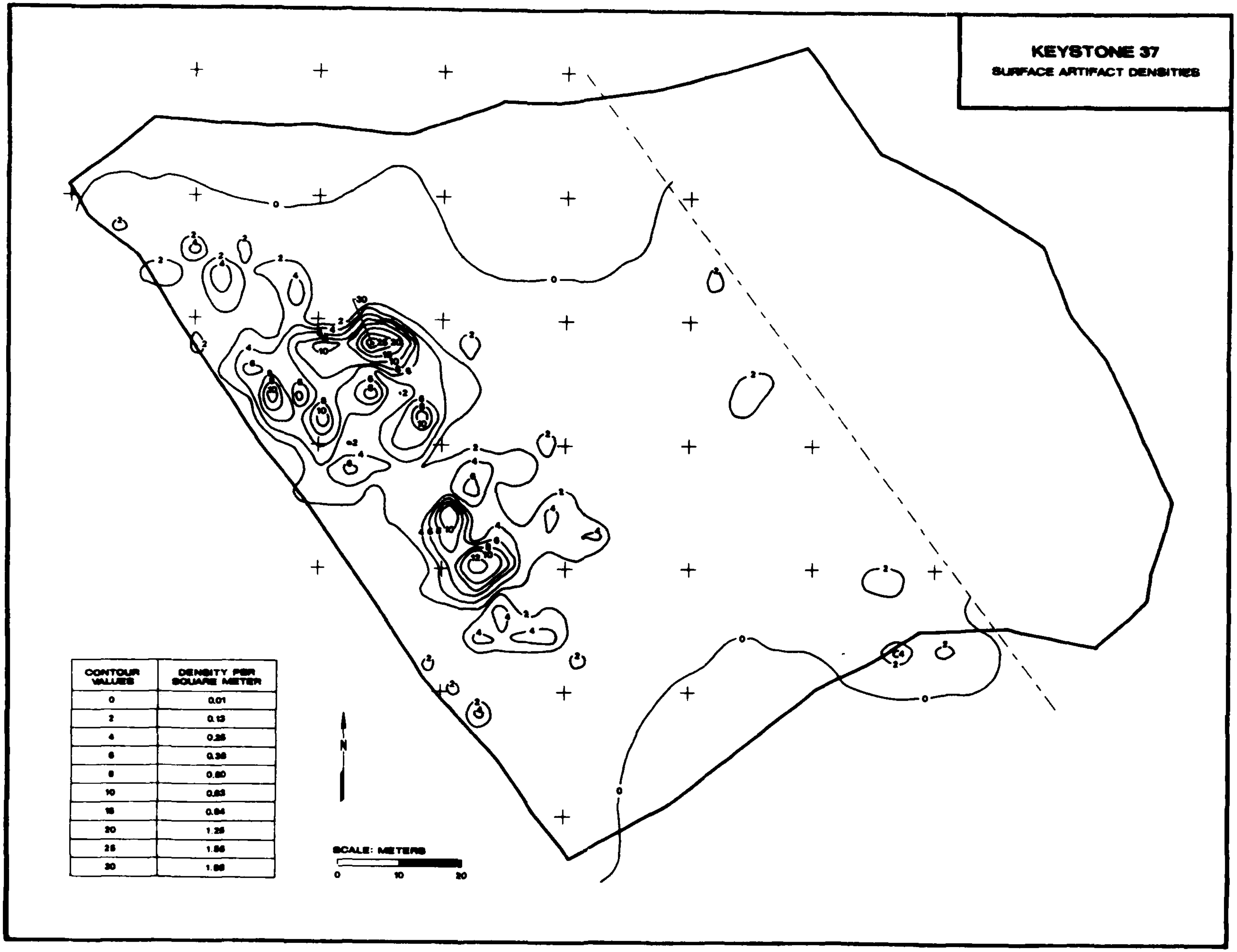


Figure 40. Surface artifact density contour map of Keystone 37.

43) and supports the related contention that the two feature groups reflect different functions.

The surface distributions of specific artifact types exhibit some subtle differences between the two sites in the degree of patterning present. Artifact type distributions at Site 36 are mapped in Figures 41 through 43. The flake distributions (Figure 41) correspond to the overall contours, reflecting the preponderance of flakes in the assemblage. The occurrence of utilized flakes corresponds (expectedly) with the high density contours, but note that they occur in small clusters throughout the site. The same pattern is exhibited by cores and hammerstones (Figure 42). Core reduction evidently took place in several small activity areas distributed throughout the site. So few tools were recorded that their distribution is difficult to interpret in terms of patterning (Figure 43). Surface ceramics were associated with Feature 7, a large roasting pit.

Once again, intrasite patterning is more easily defined at Site 37. Flakes are distributed throughout the site but utilized flakes are confined mainly to the high density scatters associated with domestic features (Figure 44). The pattern further supports the view that a wider range of tasks was carried out near the pit structures than in the vicinity of roasting features. The distribution of angular debitage, hammerstones and cores, indicates that most of the core reduction was carried out near pit structures or in the high density area around Feature 20 and 21 (Figure 44 and 47). Corroboration of the apparent dichotomy between domestic areas and roasting feature areas is provided by the cluster analysis of subsurface artifacts described below.

Site 37 Structures and Artifact Densities

The areas of highest surface artifact density are good predictors of the general location of the pit structures but a more detailed examination of the association reveals a more complex relationship. Even the surface data indicate that most pit structures are located near, or adjacent to, but not within the highest density lithic clusters. In other words, the highest artifact densities occur between structures rather than within them. The surface pattern to this effect is strongly supported by subsurface artifact densities.

Table 44 lists artifact densities recorded within and outside the excavated pit structures. The figures are based on the areas rather than volume of excavated units because the artifact-bearing horizon was generally shallow. It is clear that the density of artifacts inside features are usually very low. Even in some cases where fairly high interior densities are recorded (Features 39, 55, and 62) the exterior densities are still much greater. The density of artifacts immediately outside structures are generally three to fifteen times greater than inside the features.

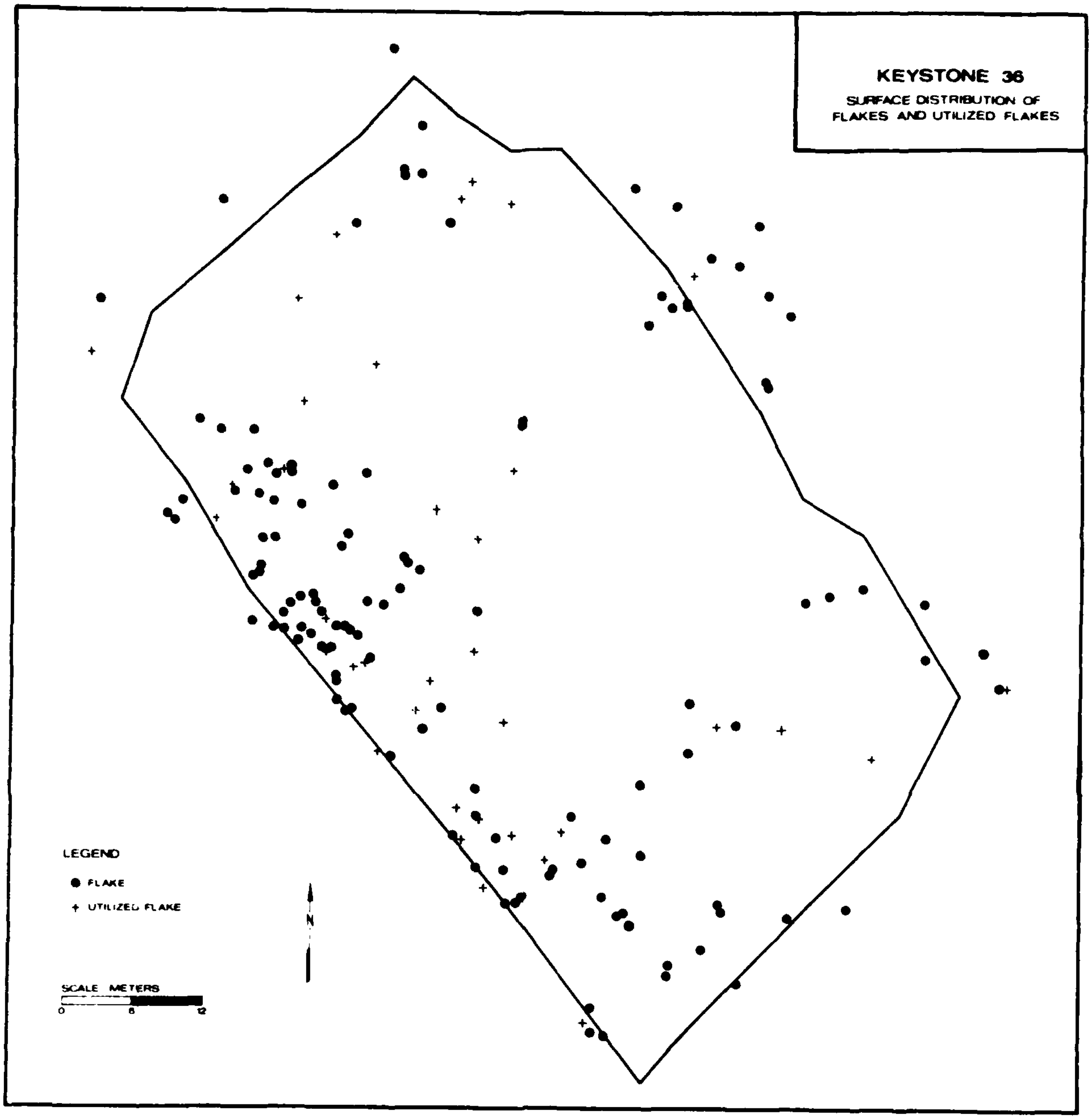


Figure 41. Surface distribution of flakes at Keystone 36.

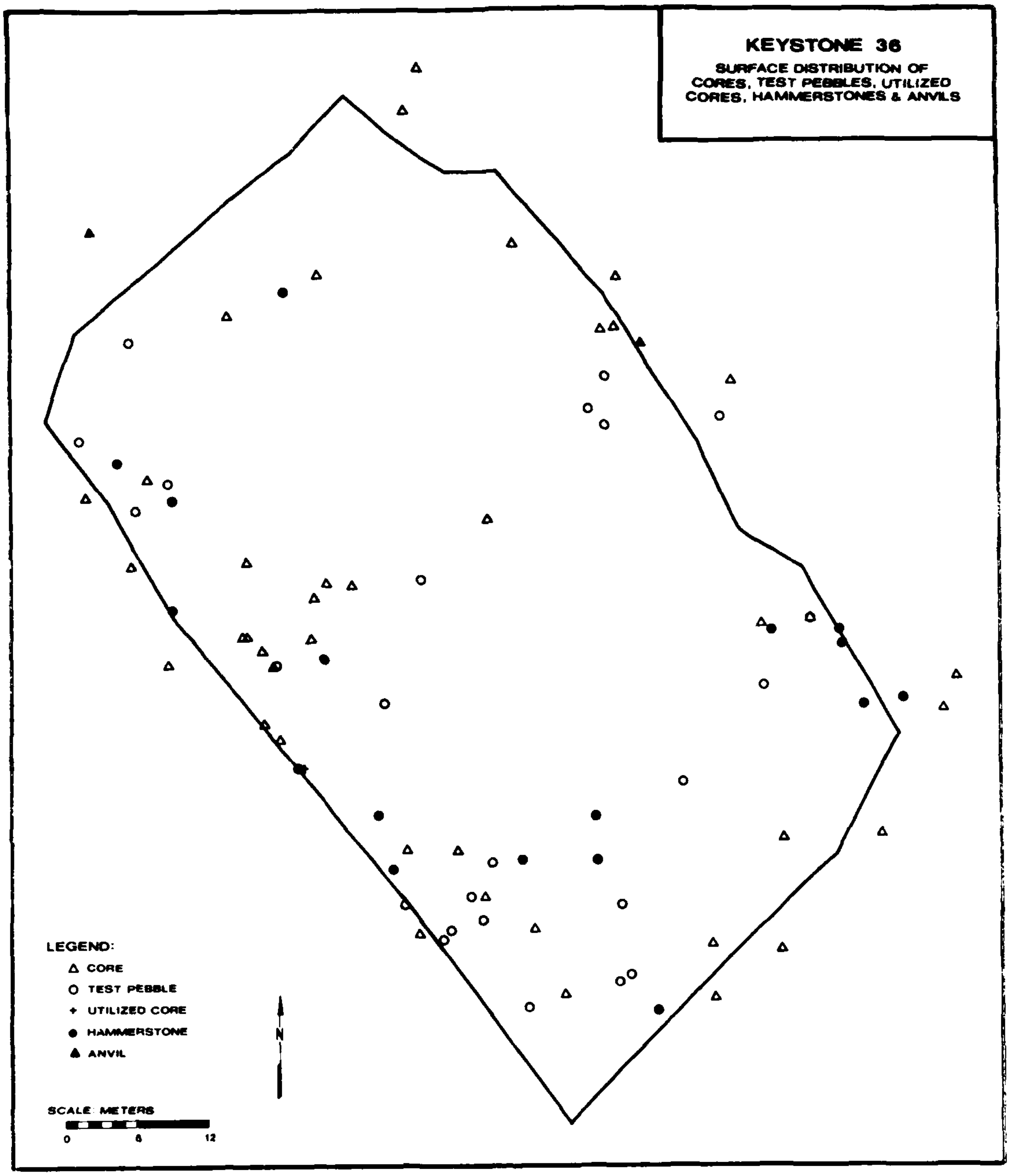


Figure 42. Surface distribution of cores, hammerstones, and anvils at Keystone 36.

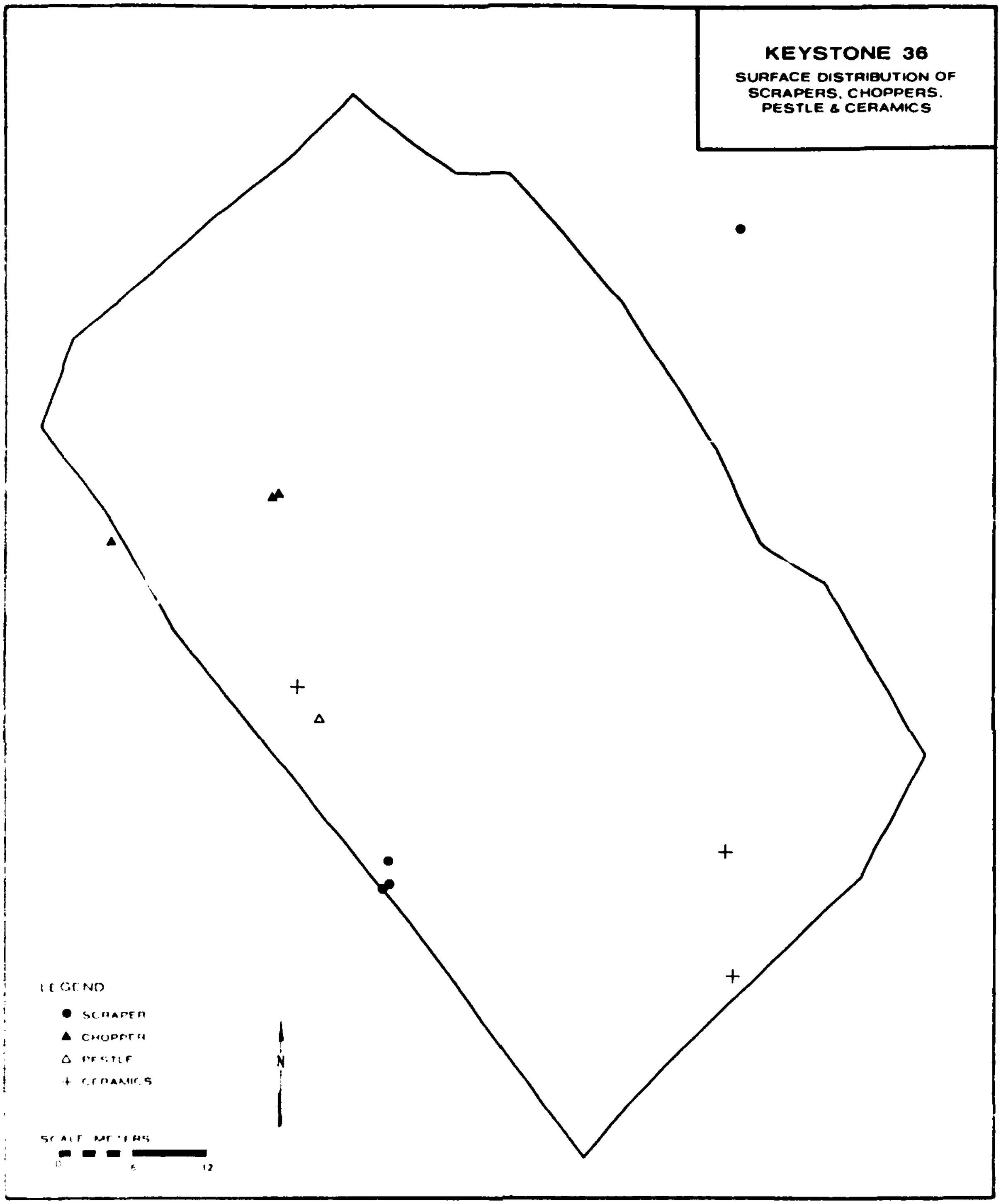


Figure 43. Surface distribution of tools and ceramics at Keystone 36.

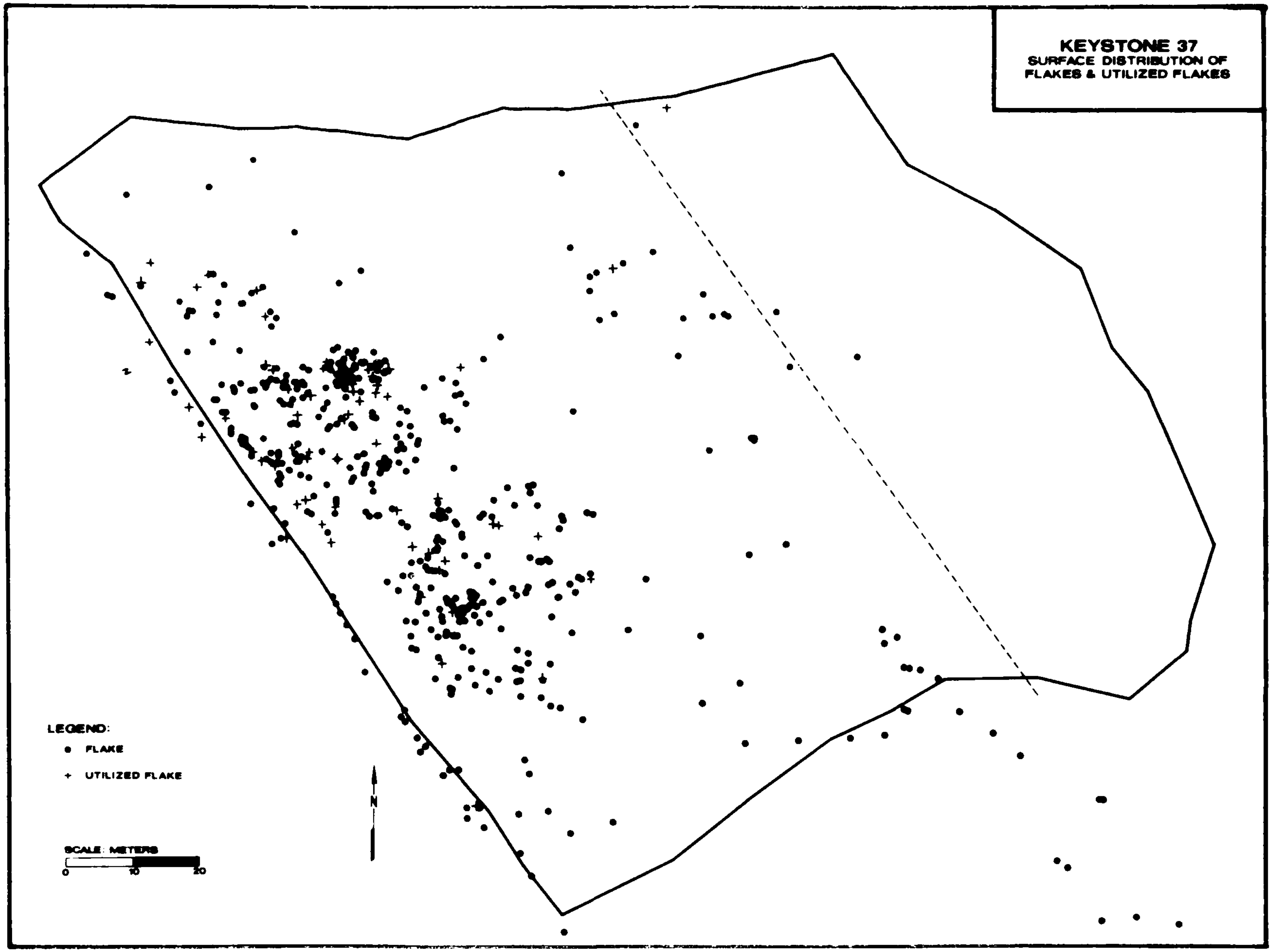


Figure 44. Surface distribution of flakes at Keystone 37.

The two exceptions exhibiting higher interior densities are Features 29 and 45. Overall, interior densities average 2.67 per square meter while exterior concentrations are almost three times as dense ($\bar{x}$ = 7.43). The difference between the two averages is significant at $p = .05$ ($t=-2.23$, $df=29$).

The relationship between the Site 37 pit structures and the artifact scatter has at least two important implications. First, the pit structures generally comprise gaps or holes in the otherwise continuous and relatively dense artifact scatter in the northwest portion of the site. It would appear that the structures and high lithic densities are located in relation to one another. That is, the holes in the artifact distribution probably indicate that the structures were present at the time of artifact deposition. If the artifacts had been deposited at a different period (i.e., later) than the structures, artifact densities could be expected to vary independently of feature locations. As in the case of the features, a consistent complementary distribution between high artifact densities and pit structures implies at least general contemporaneity.

This line of reasoning has important implications for dating the features at the site. If the artifact scatter is accepted as being roughly contemporaneous with the pit structures, then the obsidian dates obtained from artifacts in that scatter are applicable to the structures. Furthermore, if one accepts the complementary distribution of pit structures and roasting features as indicating general contemporaneity, then the obsidian dates are applicable to the latter features as well. This is a significant conclusion because of the discrepancies between the obsidian hydration dates and the radiocarbon dates obtained from some of the larger features (see Chapter 11). The organization of the features and artifacts into a single distributional pattern is an important aspect of the argument for the primacy of the obsidian dates.

A second implication of the artifact densities relates to feature function. If artifact density is in some way a measure of the intensity with which a space is used then it follows that most domestic activities were conducted outside the structures. This interpretation, combined with the lack of formal intramural hearths, suggests that Site 37 was a warm season occupation and that the pit structures may have functioned primarily as windbreaks, sunshades or sleeping shelters. Longer occupations, and winter occupations could be expected to indicate a greater concern for thermal characteristics of the structures and a greater number of artifacts would probably be recovered from within the structures. The evidence for the seasonal role of the site is discussed further in Chapter 13.

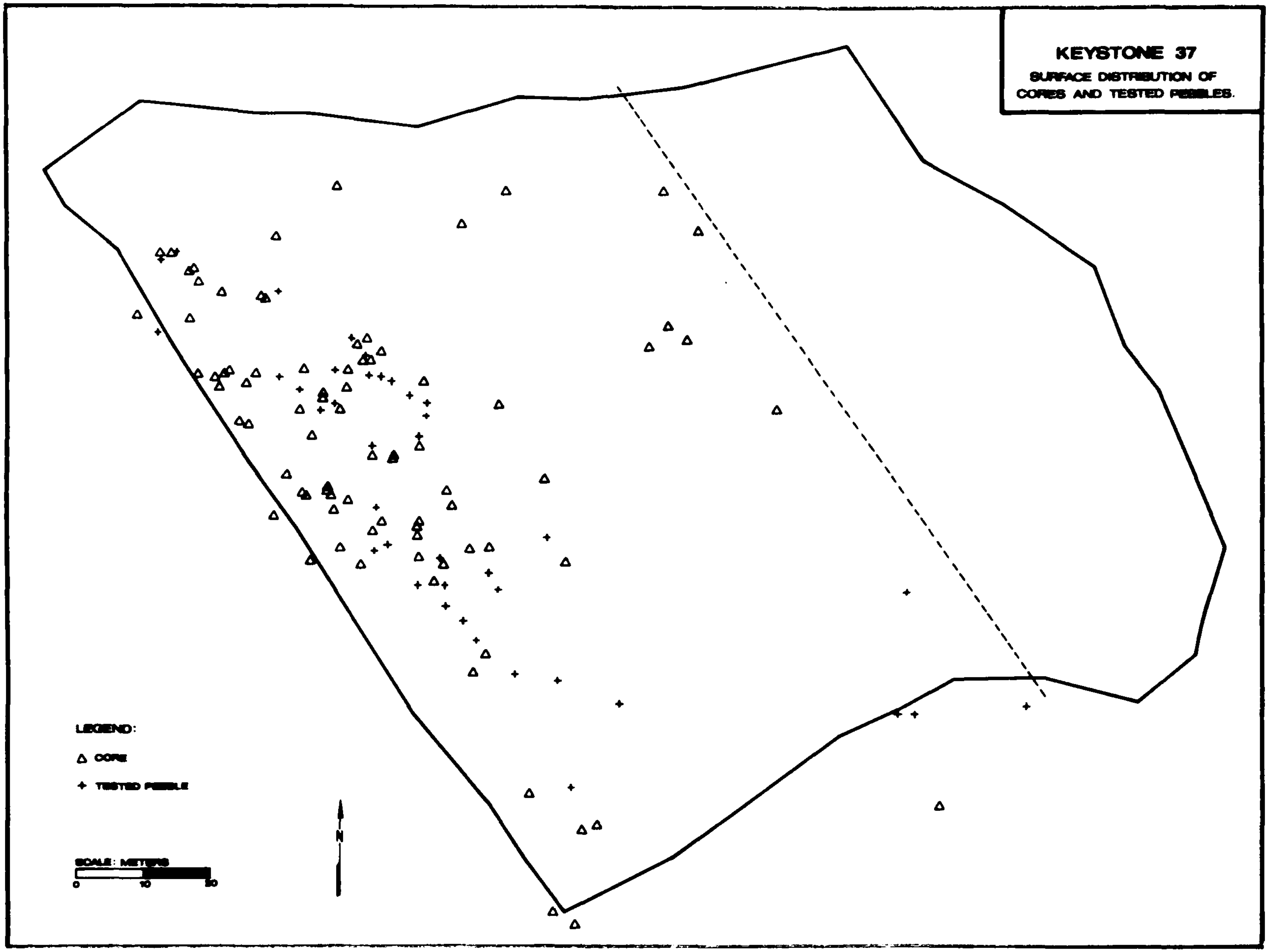


Figure 45. Surface distribution of cores at Keystone 37.

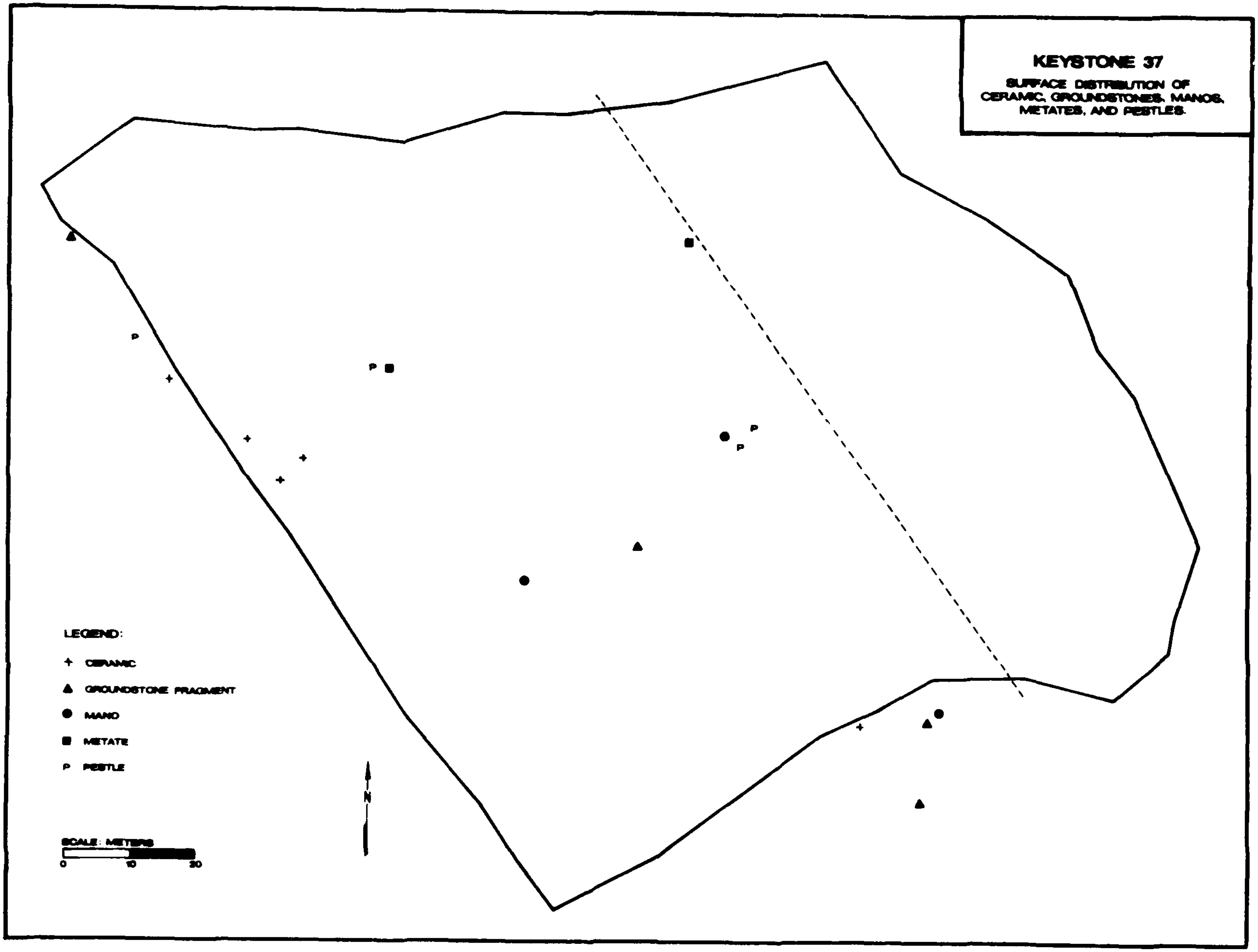


Figure 46. Surface distribution of groundstone and ceramics at Keystone 37.

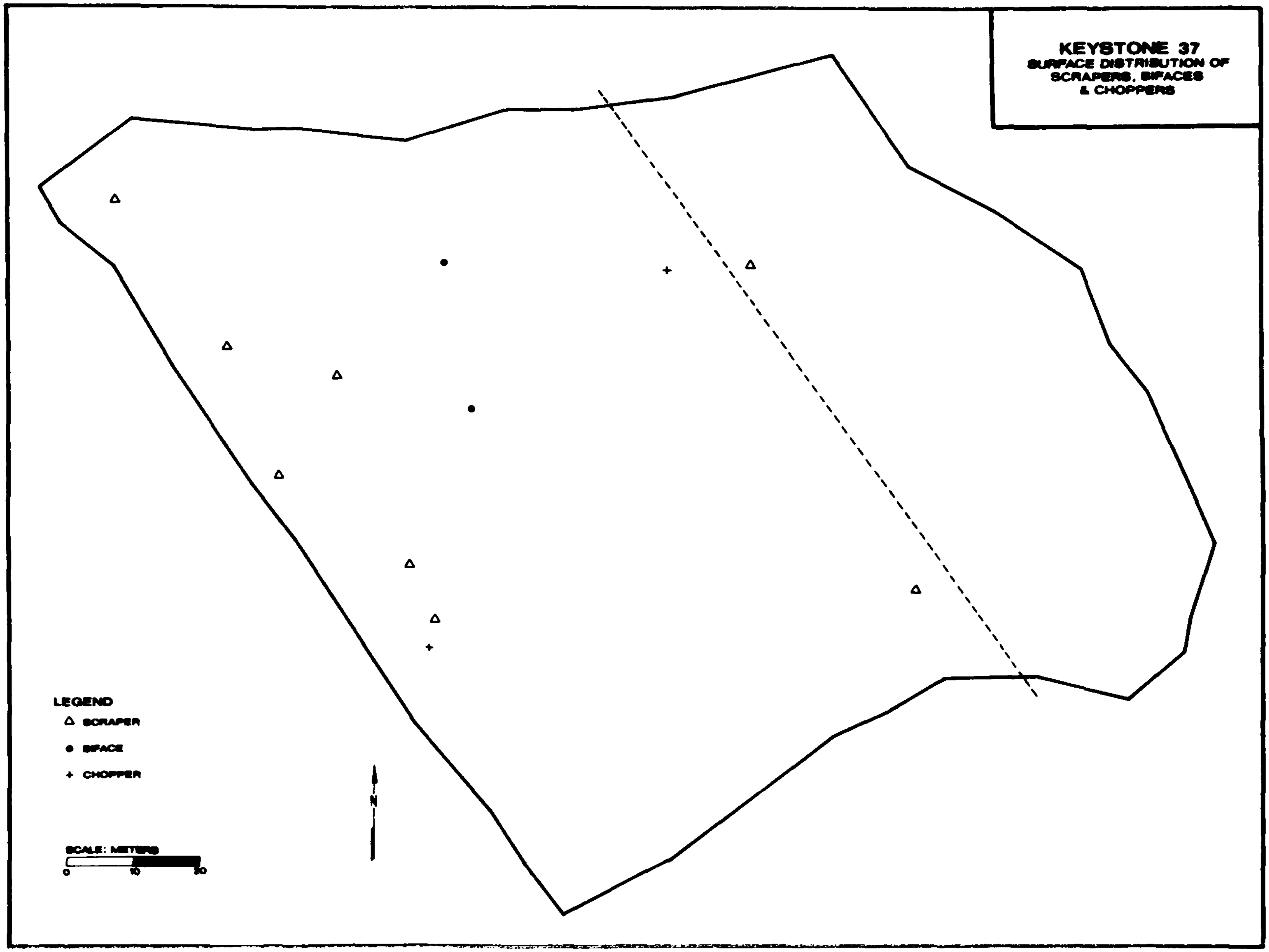


Figure 47. Surface distribution of flaked stone tools at Keystone 37.

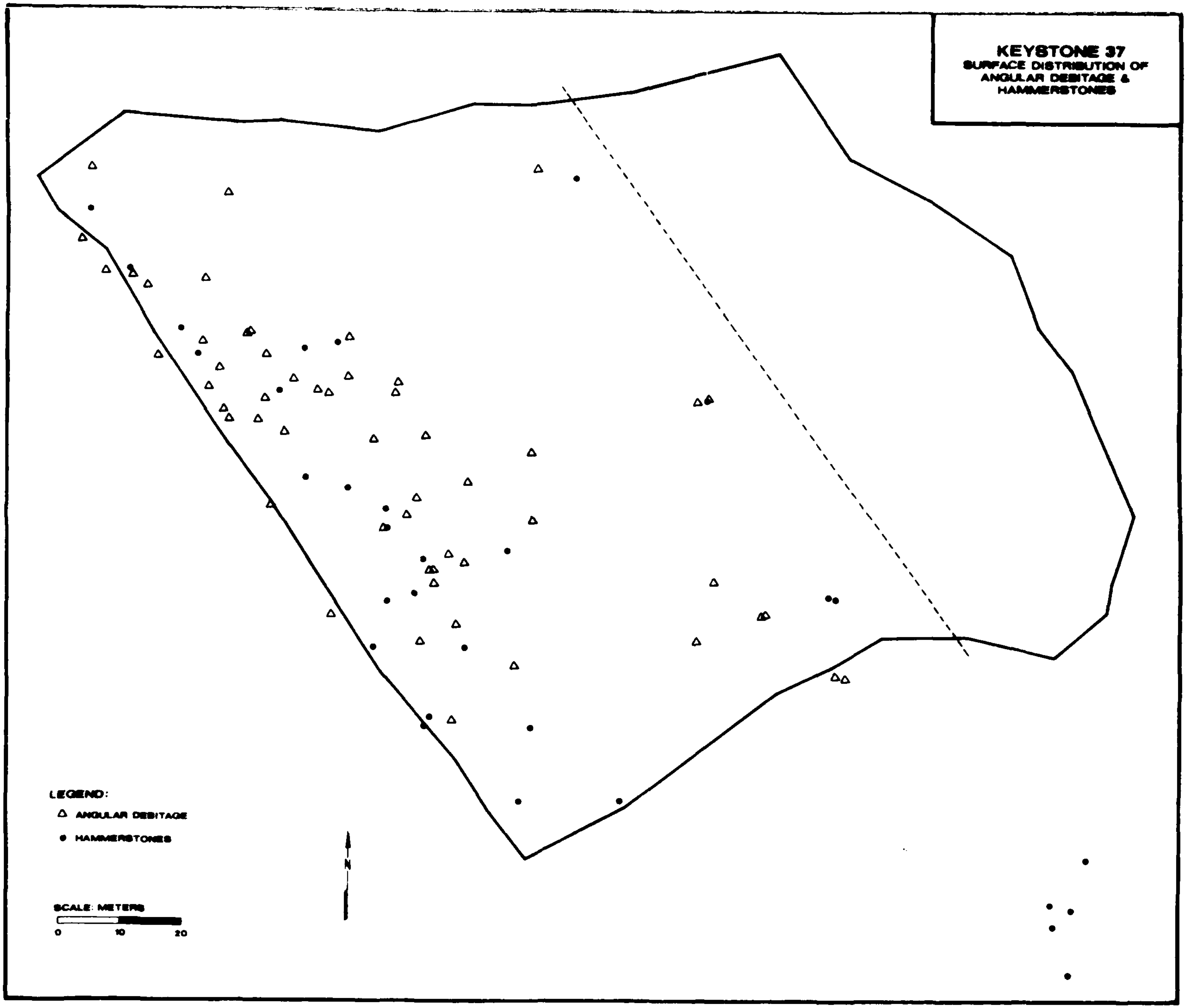


Figure 48. Surface distribution of angular debitage and hammerstones Keystone 37.

Table 44. Comparison of artifact densities inside and outside of pit structures at Site 37

FEATURE	DENSITY OF ARTIFACTS PER M^2 INSIDE	OUTSIDE
29	8.04	7.45
35	1.10	3.54
38	0	4.18
39	10.05	31.57
40	2.05	6.25
41	0.53	6.44
42	0	6.00
45	9.61	3.65
50/51	0	2.06
52/59/63	1.36	5.81
54	0.270	15.63
55	15.18	18.38
56	0.17	18.49
57	0	0
61	0	0
62	2.40	7.58
64	0	0.89
65	0	0.99
70	0	2.38
n=19	$\bar{x}$=2.67 σ=4.51	$\bar{x}$=7.43 σ=8.12

Cluster Analysis of Subsurface Artifacts

In the preceding sections, the search for structural regularities within Sites 36 and 37 has proceeded through the analysis of feature distributions and patterns in artifact densities. Even though regularities were found in both instances, the analysis would not be complete without taking into account the technological variability present within the artifact assemblage. In this section the results of an analysis designed to identify activity areas on the basis of a group of lithic technology variables are presented. The methods used follow closely those developed and tested at several sites in central Arizona (Rice and Dobbins 1981; Rice 1984). The strategy used here involves a cluster analysis of lithic artifacts recovered from excavation units in order to identify artifact associations. The clusters are then plotted back onto the site maps where concentrations of units grouped in the same cluster are indicative of activity areas.

The variables included in this analysis were chosen because of their common occurrence in the artifact assemblages and due to the information they provide on different stages of the lithic reduction process. The seven artifact types analyzed include: primary flakes, secondary flakes, tertiary flakes, angular debitage, cores, tested pebble cores and utilized flakes.

In order to provide a framework for the identification of clusters, all relevant artifacts were grouped within their 1 X 1 meter provenience units. With the aid of the computer, frequencies were determined by excavation unit for each artifact category. In order to control for the different numbers of artifacts in different units, the counts were normalized by calculating a unit vector. The variable exhibiting the highest frequency in each unit was assigned a value of 100 and all the other variables were designated as some proportion of 100. The use of percentages is a more common method for normalizing data but a vector is more suitable for use with the Euclidian distance measure built into the cluster routine (Rice and Dobbins 1981:45).

The unit vectors were clustered, separately for each site, using a cluster analysis of cases (BMDP, P2M). The cases are grouped on the basis of the Euclidian distances between vector values from different cases. A total of 322 cases were analyzed at Site 36 and 532 units were used at Site 37 and in each case seven clusters were generated. The use of seven clusters is somewhat arbitrary although the expectations were informed by Rice's (1984) results involving a similar range of variables. In retrospect, cluster seven appears to have functioned as a default grouping. Close examination of the cases assigned to that cluster indicates that if eight or ten clusters were specified, one or two more interpretable groupings would have been generated at Site 37. As an independent check on the separation of the clusters, discriminant analysis was applied to the unit vectors using a SAS routine. Unit membership within clusters was correctly predicted in 98% of the cases at both sites.

Interpretation of Clusters

The seven clusters identified at each site are summarized graphically in Figures 49 and 50. The histogram bars represent the cluster means for each variable, indicating which artifact types have contributed most heavily to each cluster. By reference to the heavily weighted artifact types it is possible to suggest general functional interpretations of the clusters. For example, Cluster 1 at Site 36 contains those units with high proportions of secondary and tertiary flakes, reflecting the importance of flake production. In contrast, Cluster 2 consists of 57 cases containing little else besides utilized flakes (Figure 49). Different clusters were generated at Site 37, reflecting different patterns of association among artifact types. Clusters 1, 4 and 7 have no counterparts at Site 36 and Site 37 lacks groups like Clusters 2, 4 and 6 at Site 36. However, the significance of variability among clusters for the interpretation of activity areas cannot be assessed without referring to their spatial distribution.

The distributions for each cluster at both sites are mapped in Figures 51 - 64. Two basic patterns of cluster distribution are evident at Site 36 but little internal partitioning of space seems to be indicated. Cluster 1 is distributed primarily at the west edge of the site in proximity to the cluster of small hearths (Figure 51). Small scatters including this cluster are also found adjacent to Features 8 and 17. The artifact types contributing most significantly to Cluster 1 are secondary flakes, tertiary flakes and cores (Figure 49), probably reflecting core reduction for the purpose of obtaining usable flakes. It is not surprising to find evidence of these general activities around the small hearths and somewhat removed from the specialized roasting features. It is interesting that Cluster 1 was not identified near Features 6, 11 and 12. The latter area is associated with clusters containing primary and secondary flakes and angular debitage (Clusters 5, 6 and 7) but lacks evidence for the latter stages of core reduction as represented by tertiary flakes.

Clusters 2-7 all exhibit a dispersed site-wide pattern of distribution, in contrast to Cluster 1. The materials contributing heavily to these clusters indicate a variety of activities, including initial core reduction (Cluster 6), production of useable flakes and associated angular debris (Clusters 3, 4, 5, and 7) and the use and discard of flake tools (Cluster 2). Some minor differences can be identified within the overall pattern of clusters. For example, Feature 7 is associated almost exclusively with the selection and utilization of flake

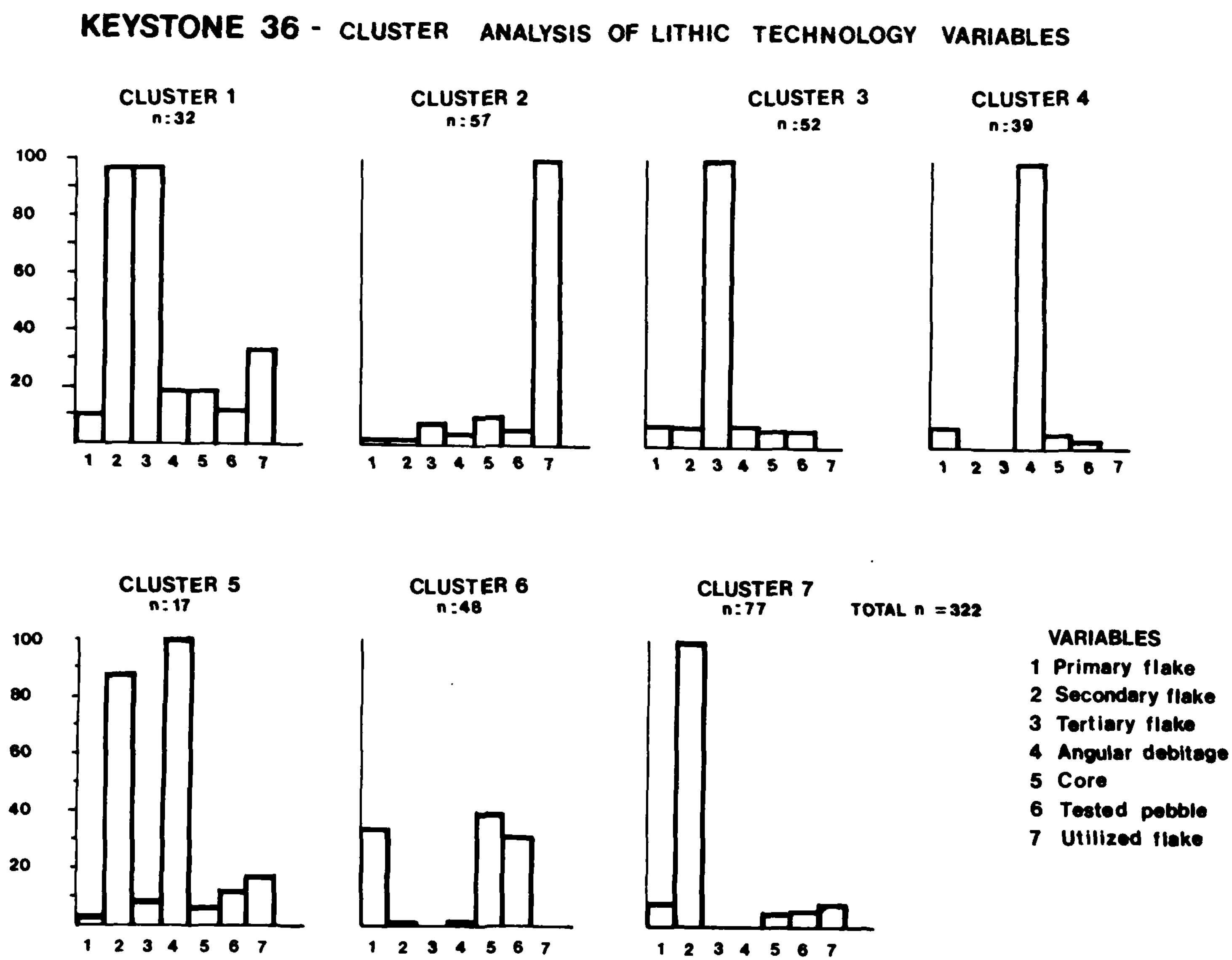


Figure 49. Results of cluster analysis of lithic artifact associations at Keystone 36.

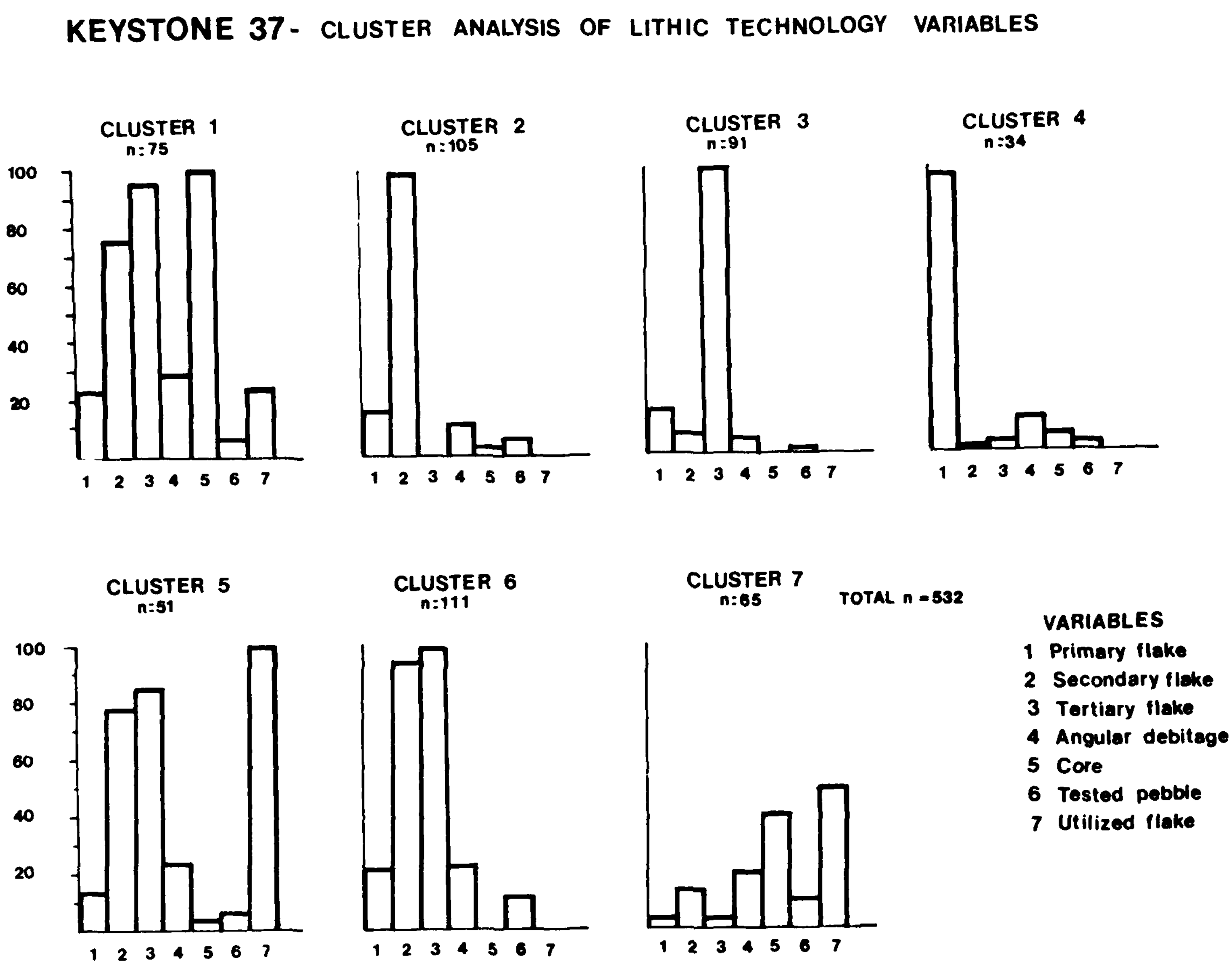


Figure 50. Results of cluster analysis of lithic artifact associations at Keystone 36.

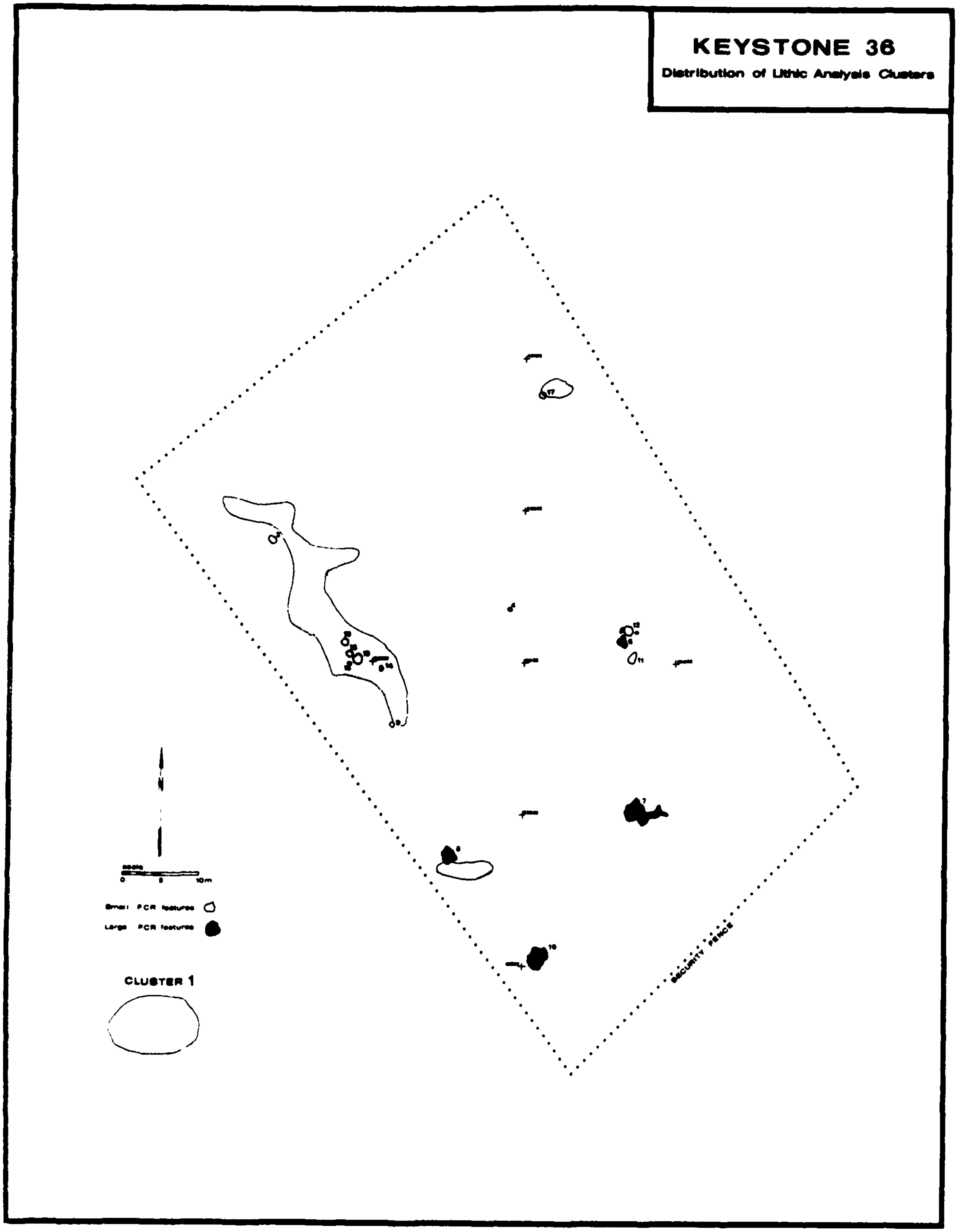


Figure 51. Distribution of lithic analysis Cluster 1 at Keystone 36.

Figure 52. Distribution of lithic analysis Cluster 2 at Keystone 36.

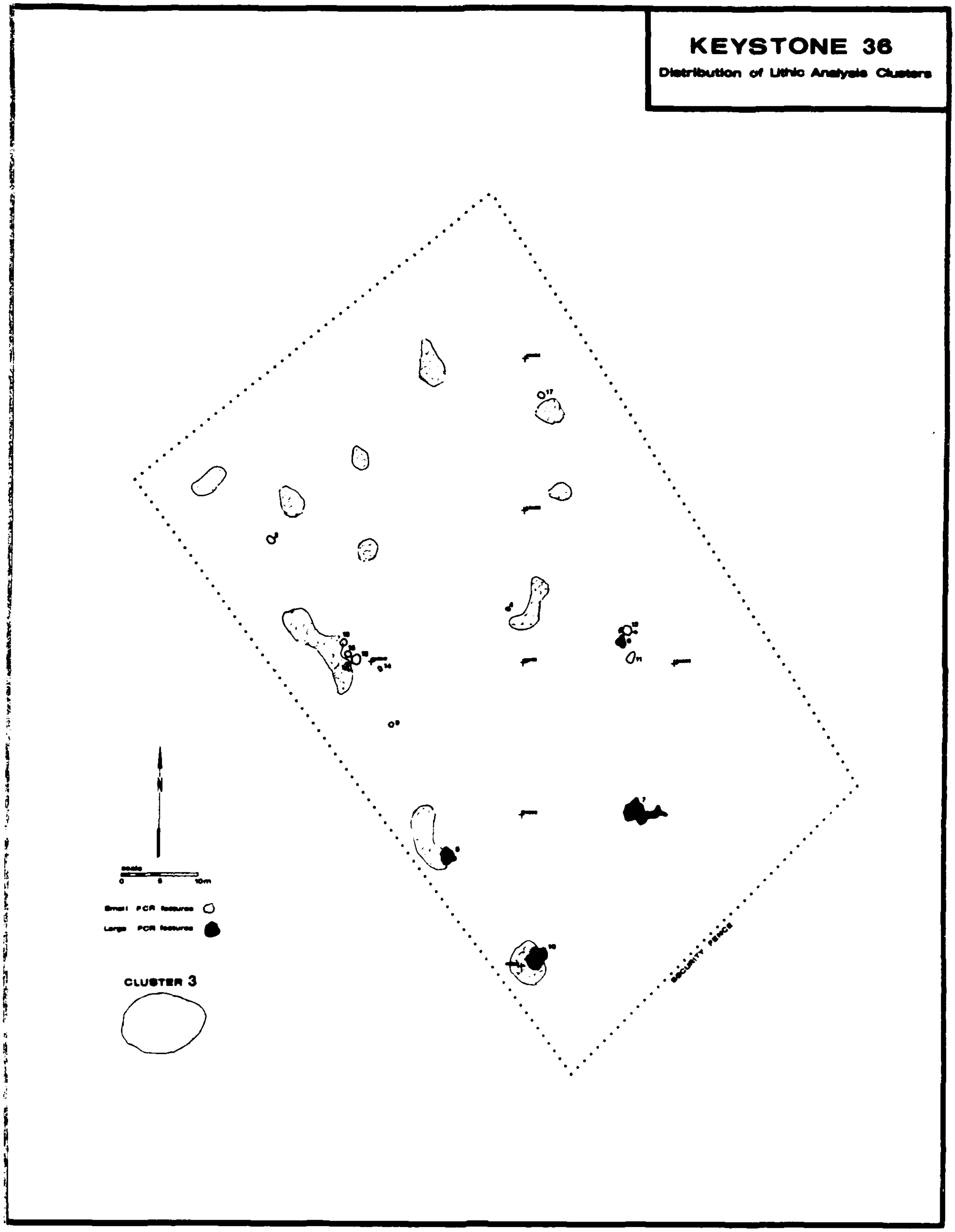


Figure 53. Distribution of lithic analysis Cluster 3 at Keystone 36.

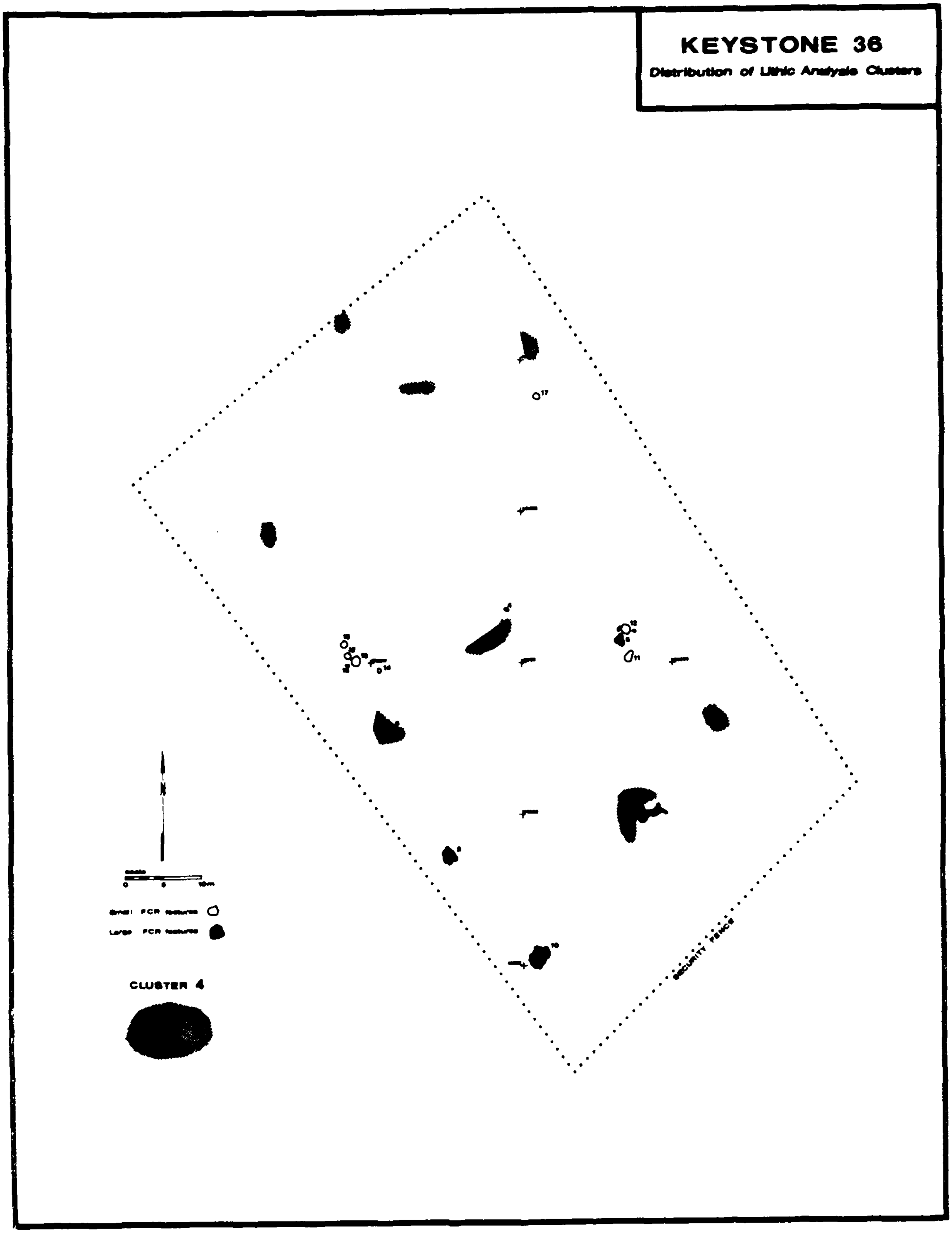


Figure 54. Distribution of lithic analysis Cluster 4 at Keystone 36.

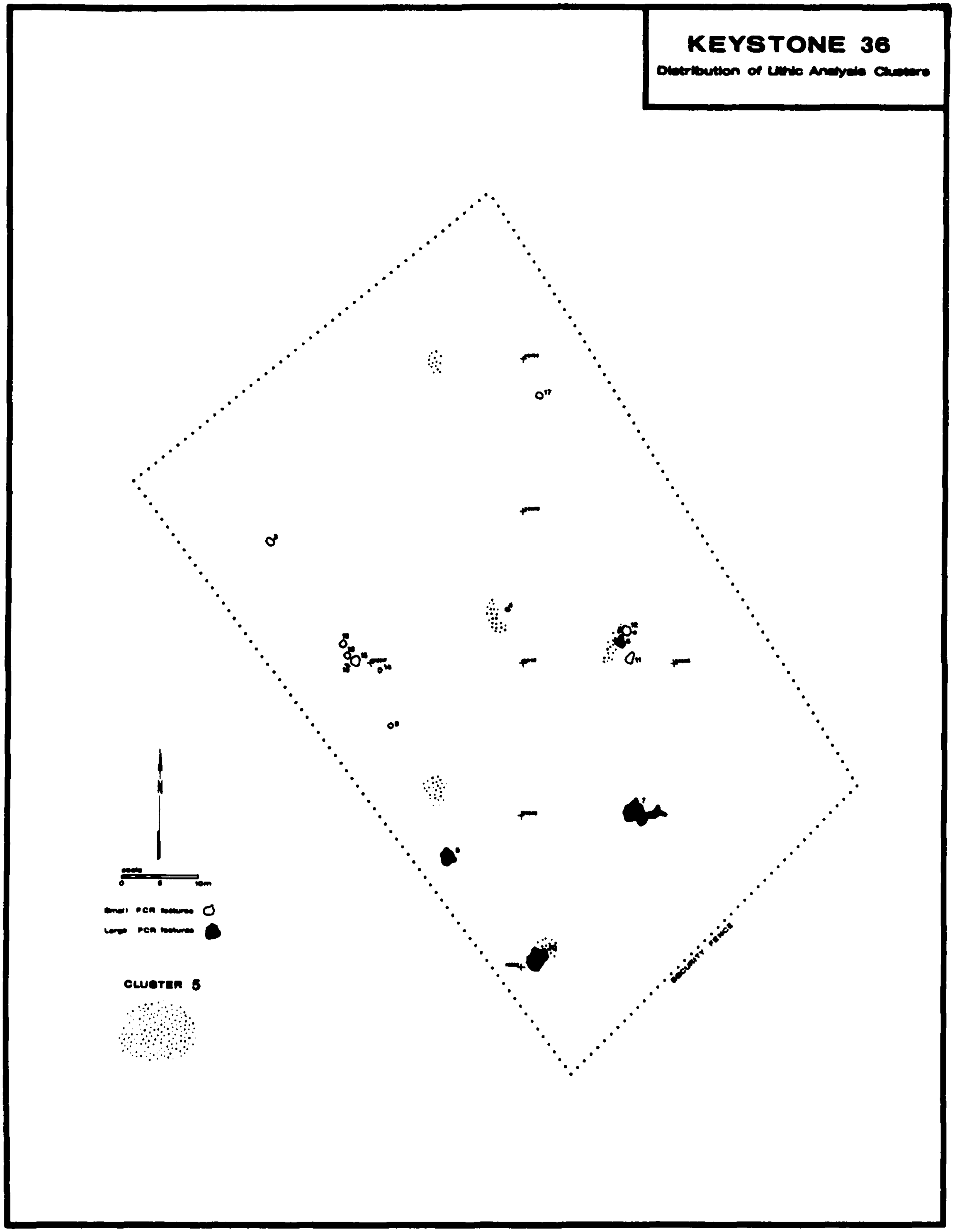


Figure 55. Distribution of lithic analysis Cluster 5 at Keystone 36.

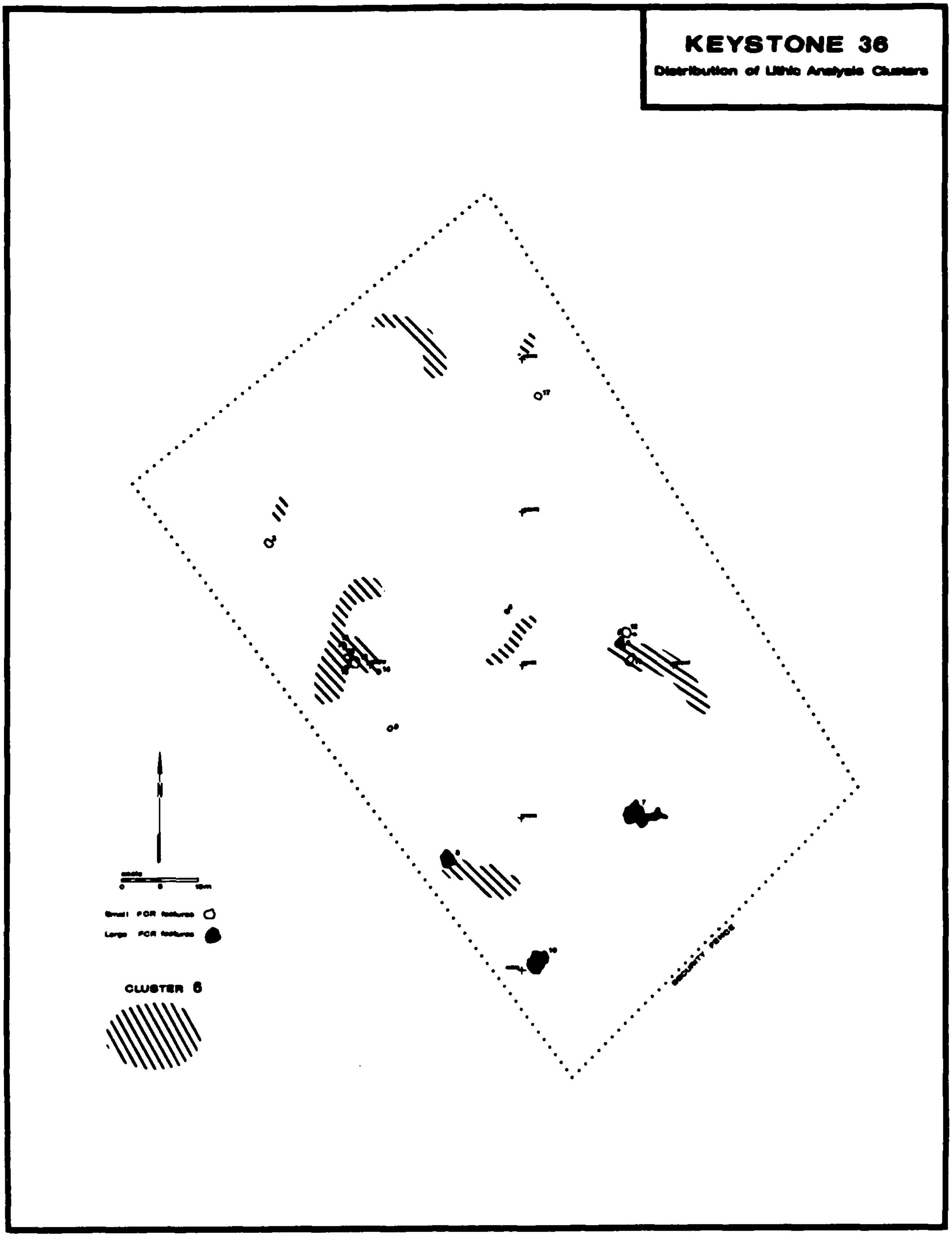


Figure 56. Distribution of lithic analysis Cluster 6 at Keystone 36.

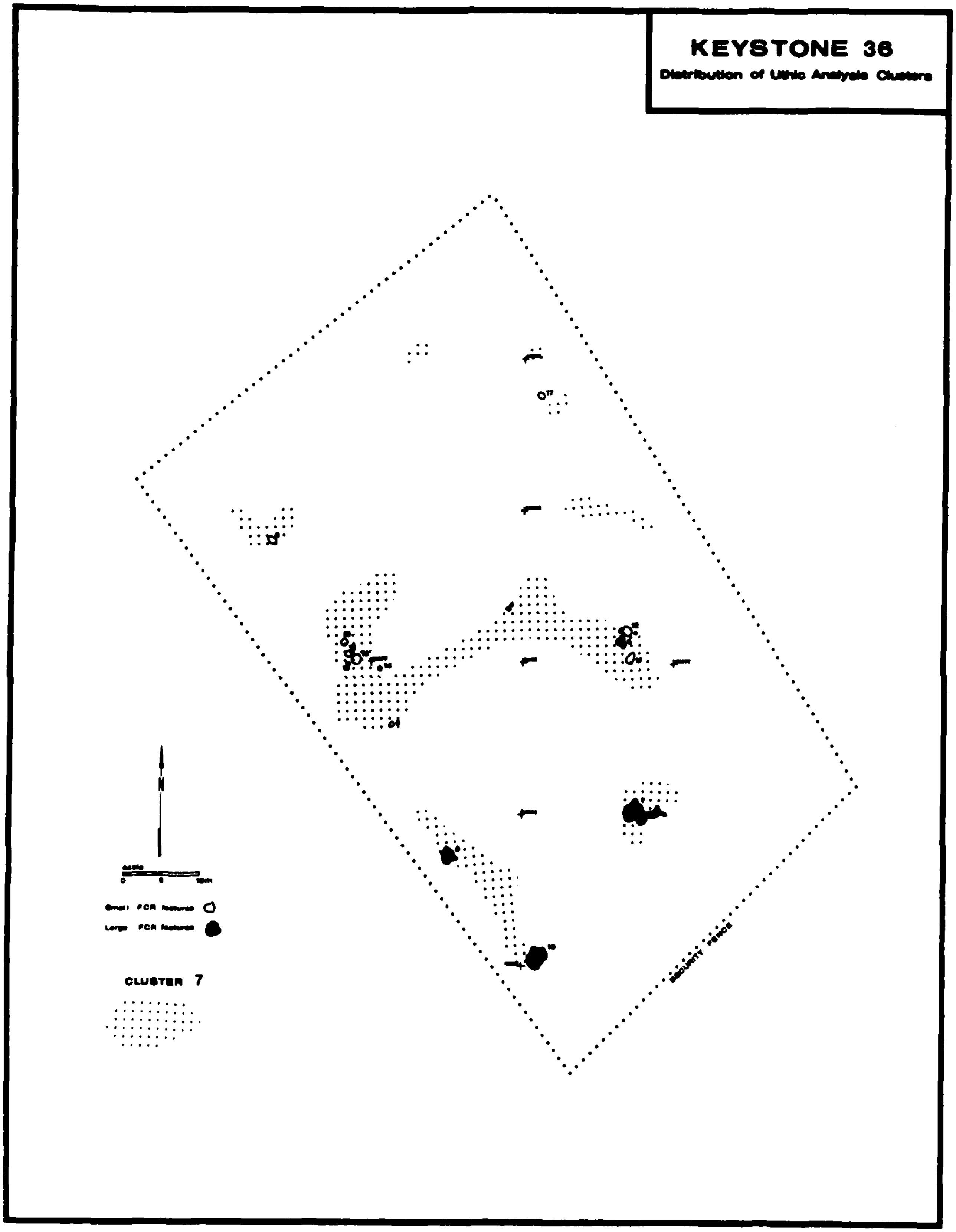


Figure 57. Distribution of lithic analysis Cluster 7 at Keystone 36.

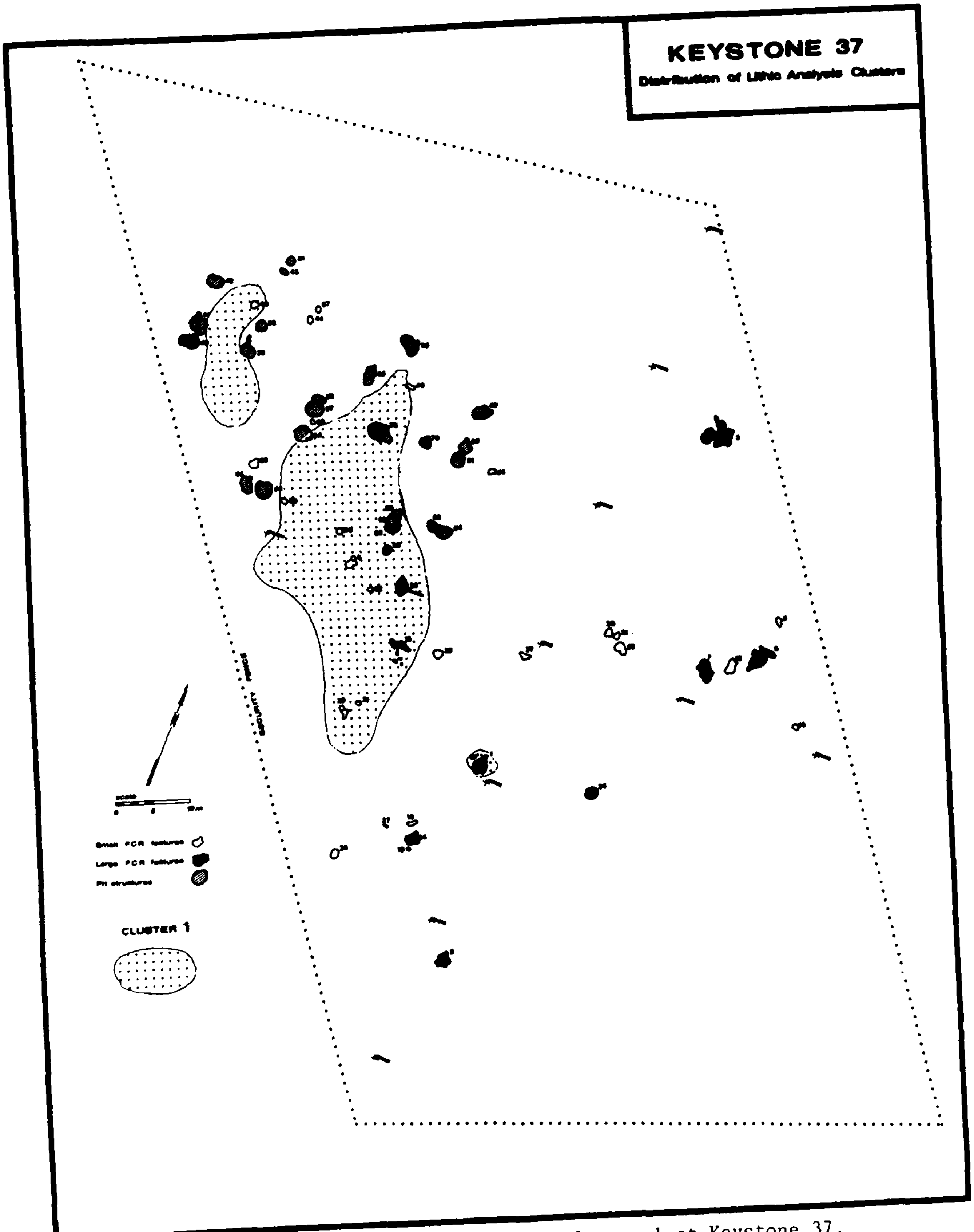


Figure 58. Distribution of lithic analysis Cluster 1 at Keystone 37.

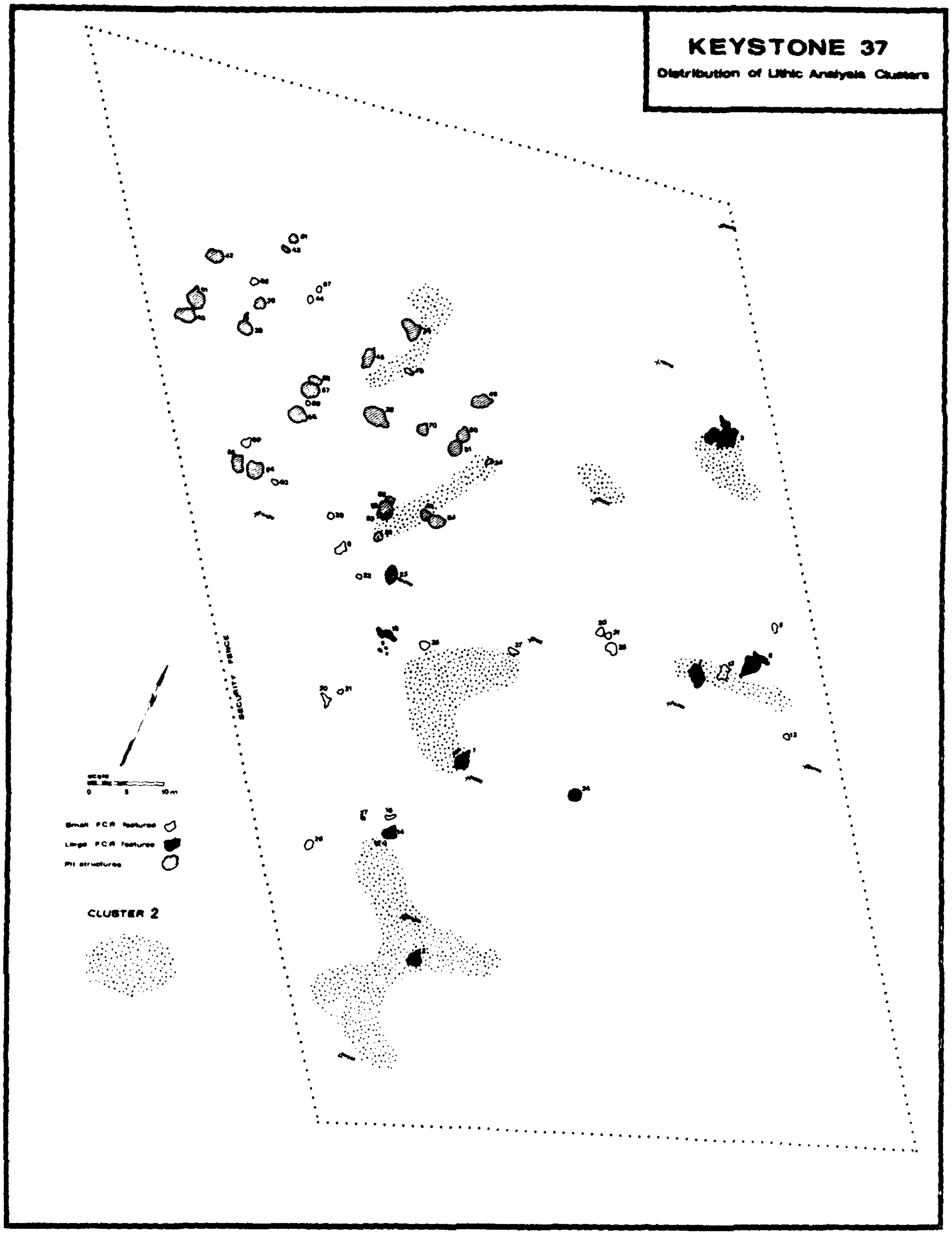


Figure 59. Distribution of lithic analysis Cluster 2 at Keystone 37.

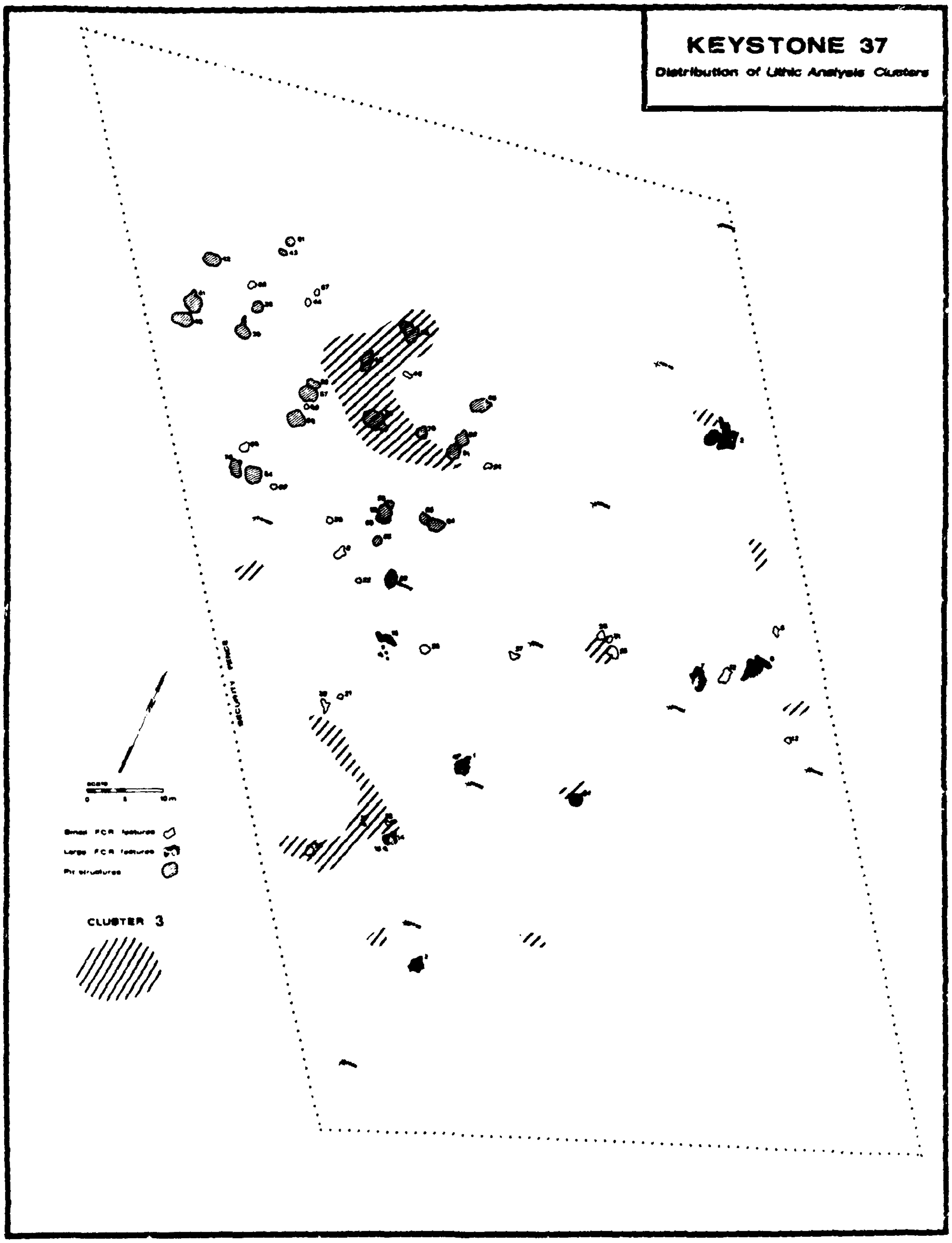


Figure 60. Distribution of lithic analysis Cluster 3 at Keystone 37.

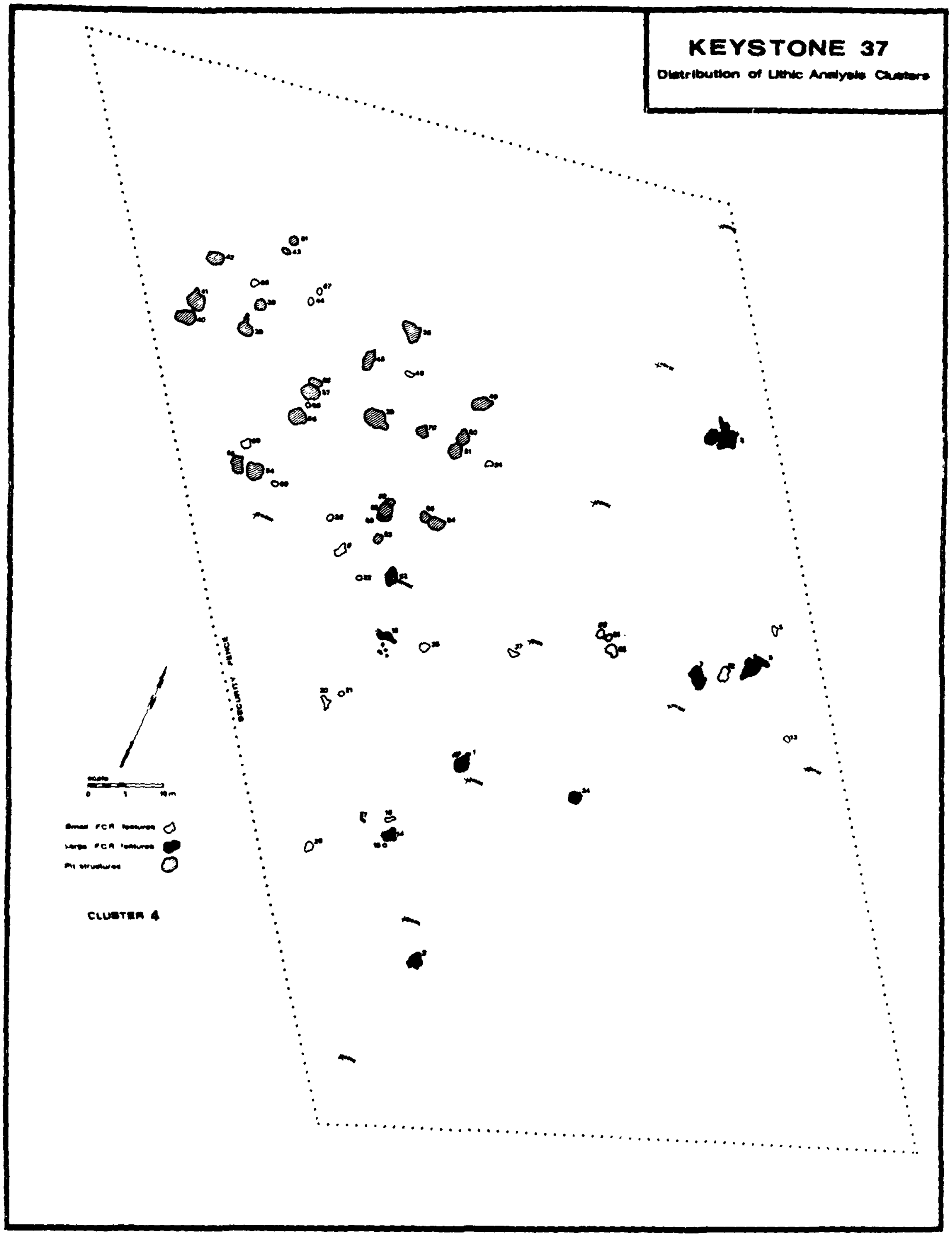


Figure 61. Distribution of lithic analysis Cluster 4 at Keystone 37.

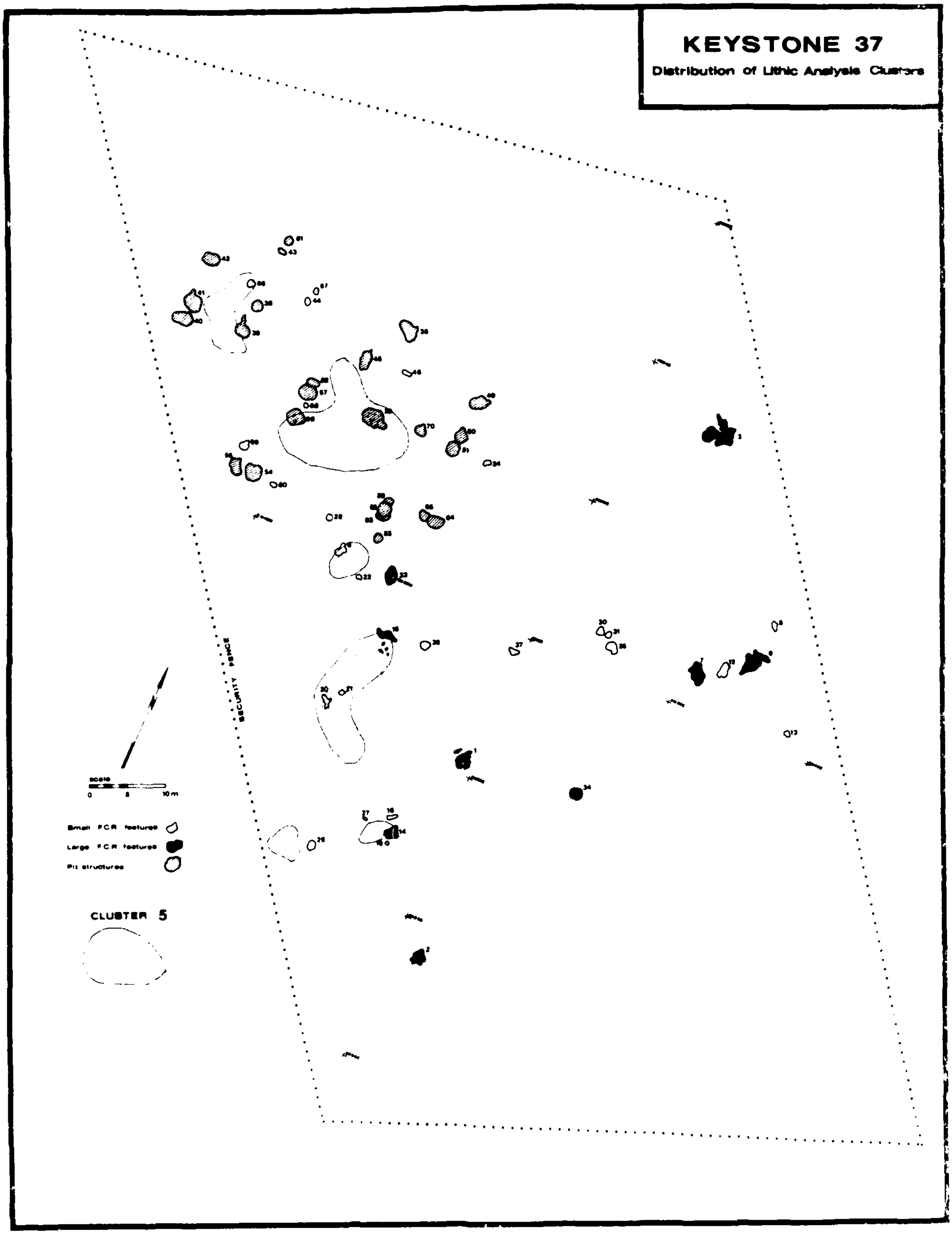


Figure 62. Distribution of lithic analysis Cluster 5 at Keystone 37.

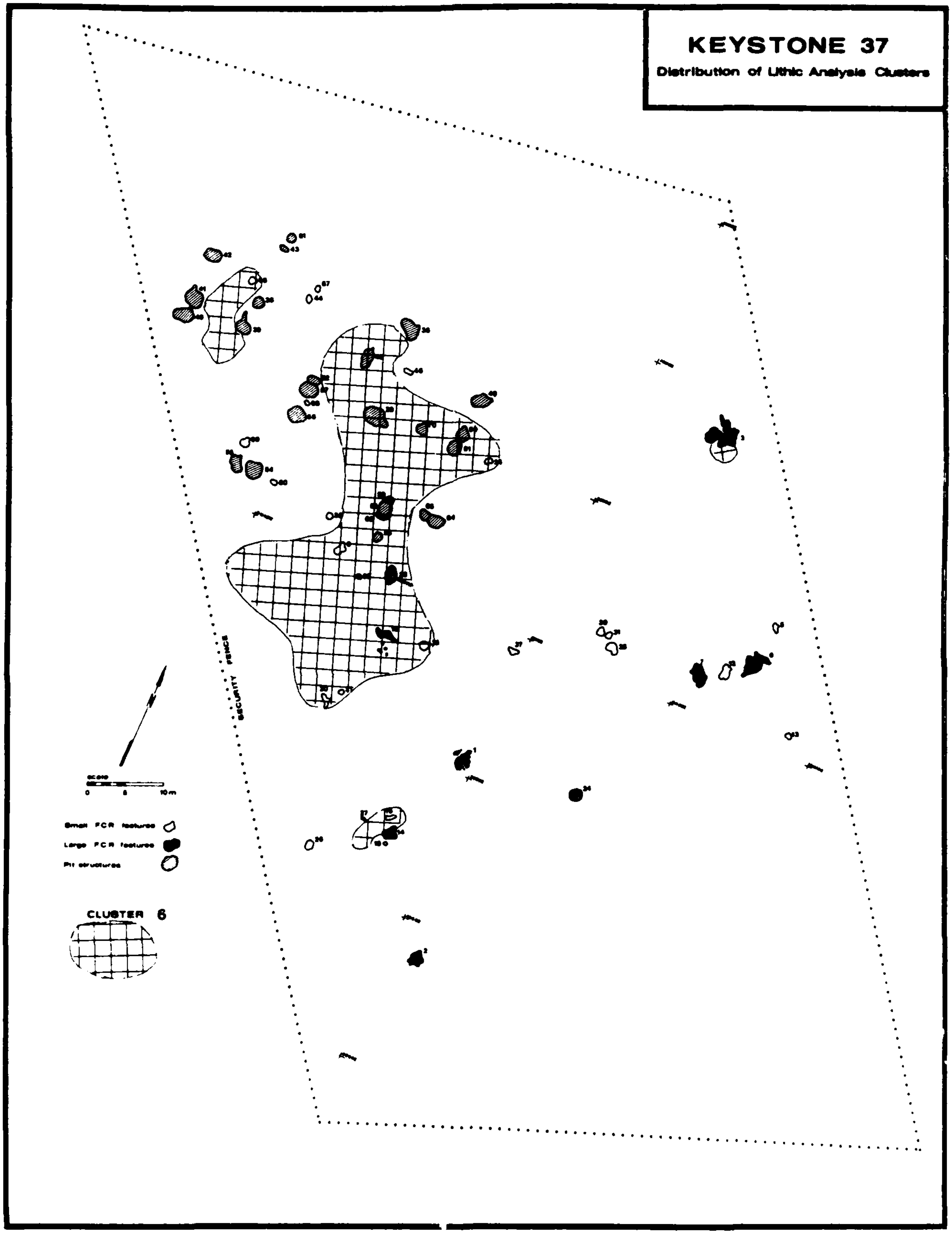


Figure 63. Distribution of lithic analysis Cluster 6 at Keystone 37.

tools (Clusters 7 and 2). Nevertheless, the larger impression gained from the spatial patterning of clusters is one of relative homogeneity in the distribution of activities. A variety of small discrete areas of the site appear to have been utilized in roughly equivalent ways (either during the same general period or over time). This redundancy of the same artifact associations throughout the site suggests that partitioning of space within the site was rather poorly developed. This conclusion presents a distinct contrast to the patterns identified at Site 37.

The distribution of artifact clusters at Site 37 indicates the presence of two, or possibly three, basic patterns of association. Two of the patterns are of special interest since they provide independent corroboration for the site partitioning inferred from artifact densities and feature distributions.

The first pattern is represented by Clusters 1, 5 and 6 (Figures 58, 62 and 63). These three clusters are confined almost exclusively to the northwestern portion of the site. Recall that this is the same area which exhibited the highest surface artifact densities (Figure 40) and within which the pit structures are located. Cluster 1 contains those units with high proportions of secondary flakes, tertiary flakes and cores. Clusters 5 and 6 also show high proportions of these flake types; both lack the high proportion of cores but Cluster 5 is dominated by utilized flakes. The concentration of these artifact types in and adjacent to the area containing structures corresponds well with impressions obtained during the fieldwork and with the surface occurrence of the same artifact types (Figures 44, 45).

The range of artifacts in this pattern would seem to indicate core reduction directed at flake production, the selection of suitable (cutting ?) flakes, and the use and discard of the flake tools. Clearly, core reduction was carried out elsewhere on the site, but the fact that cores were discarded mainly within one portion of the site should be indicative of the area where most of the flint knapping was undertaken. That significant numbers of cores were discarded in the vicinity of structures is further indicated by the fact that several expended cores were used as shims in the exterior post sockets, in lieu of fire-cracked rocks (see Chapter 8). The production, use and discard of expedient flake tools are all activities which can be expected in the context of general domestic maintenance and processing tasks. The spatial distribution of the clusters reflecting these activities provides additional support for the identification of a domestic activity area encompassing the structures and nearby small hearths.

The second basic pattern is indicated by Cluster 4, the distribution of which is virtually mutually exclusive of the clusters already mentioned. The units comprising Cluster 4 occur around the eastern and southern periphery of the site, closely

Figure 64. Distribution of lithic analysis Cluster 7 at Keystone 37.

following the distribution of large roasting features (Figure 61). The artifacts in these units are characterized by very high proportions of primary flakes. This could be indicative of the use of primary flakes in the context of tasks associated with the roasting features, or it could merely reflect the relative lack of any other associated artifact types. In either event, the dichotomous relationship between Cluster 4 and Clusters 1, 5 and 6 lends compelling support to the argument that activity patterning was an important factor in the distribution of features.

The remaining three clusters all exhibit distributions which cross cut the dichotomy to a greater or lesser degree. Cluster 2 is identified by a high proportion of secondary flakes. Its distribution throughout the site (Figure 59) is not very informative for the identification of activity areas. Cluster 3 is made up of those units dominated by tertiary flakes (Figure 50). Although tertiary flakes can be produced during all stages of core reduction (Stahle and Dunn 1982) they predominate in the later stages of tool production. Most instances of this cluster occur within the high density scatters adjacent to the pit structures or associated with the series of small hearths (Features 16, 18, 20, 21, 26 and 27) at the southwest edge of the site (Figure 60). The similarity between this distribution and the one for Cluster 6 should not be surprising, but it is noted that units assigned to Cluster 3 occur in isolated spots throughout the east side of the site. Cluster 7 appears to have functioned as a catch-all grouping. An examination of the individual units within the cluster shows that they probably represent two groups: cores and utilized flakes near the pit structures, and tested pebbles and angular debitage at the southern and eastern periphery. These distributions are in good general agreement with the patterns defined above.

The less common artifact types, such as ceramics, bifaces and groundstone, were not included in the cluster analysis. However, the distributions and associations of these artifact classes have been examined by other researchers in the El Paso area (O'Laughlin 1979, 1980; Hard 1983). Although the sample sizes of these artifact classes at Sites 36 and 37 do not permit statistical tests, it should be noted that many general similarities are apparent with other sites in the region.

Hard (1983) reports a low number of chipped stone tools in association with roasting pit features, a pattern which is reiterated in Sites 36 and 37 (see above). In addition he notes that groundstone tools are more common in or near hearth features (1983:68). A similar observation was made by O'Laughlin (1979) at the transmountain campus sites in northeast El Paso. The same could be said about the few groundstone tools at Sites 36 and 37 (Figures 43, 47), many of which were fire-cracked fragments. Strong associations were also noted between ceramics and fire-cracked rock features (Hard 1983:72; O'Laughlin 1980: 210, 215).

Although few ceramics were found at Sites 36 and 37, they appear to exhibit similar distributions, with groups of sherds recovered near Feature 7 at Site 36 and Features 3 and 69 at Site 37. Finally, O'Laughlin (1979, 1980:210) reports the association of bifaces, retouched flakes and utilized flakes, a pattern corresponding roughly to Cluster 5 at Site 37.

Discussion

The attempts to identify intrasite patterning at Keystone Sites 36 and 37 have proceeded through the examination of three different data sets, namely, surface artifact densities, feature distributions and lithic artifact cluster distributions. The results of all three approaches point to the same conclusion: at least at Site 37 the intrasite distributional patterns are most likely the result of prehistoric partitioning of space into activity areas. A strong case cannot be made for the same kind of patterning at Site 36.

The surface artifact distribution clearly indicates a high density area in the western and northwestern portions of the site. The high density area also coincides with the location of the pit structures and associated small hearths. The same area also contains the most evidence for tool production, use and discard. The area can best be interpreted as a domestic activity area, where a variety of tasks took place outside of, but adjacent to, a group of short-term houses. In contrast, the eastern and southern periphery of the site is characterized by low artifact densities, specialized roasting facilities and a predominance of primary reduction flakes.

Such a pattern is not clearly evident at Site 36. There is some evidence that large roasting features were located at the periphery of the site. However, artifact distributions do not coincide with the feature pattern as well as at Site 37. High density areas are associated both with a cluster of small hearths and with Feature 8, a large roasting pit. In addition, all the artifact types included in the cluster analysis occur throughout the site rather than being confined to specific areas. Much of the distinction between this site and Site 37 can probably be attributed to the lack of residential structures at Site 36. It seems as if, in the absence of the structures as a focal point, the general domestic activities were located at any convenient spot within the site.

The differences between the degree of patterning at the two sites suggests two important points. First, it would appear that different patterns of use and reuse of space are indicated. At both sites, the superpositioning of features indicates that the sites do not reflect a single episode of use. However, the lack of clear intrasite patterning at Site 36 suggests reoccupation by small groups whose activities were located irrespective of previous activities. In contrast, good evidence for the partitioning of intrasite space is preserved at Site 37, in spite of evidence for reoccupation. This is apparently due to a high level of redundancy in the use of site space (Binford 1982). Even though multiple occupations are indicated, they were probably close enough in time that the distributions of previous remains structured the location of subsequent features and activities.

This view leads to the second point involving the contemporaneity of features. At Site 37, three separate data sets exhibit spatial distributions reflecting the same intrasite organizational patterns. Even though not all the features (nor presumably, artifacts) were used at the same time, they are distributed as if they were located in relation to one another. It is difficult to conceive of a set of circumstances under which a series of temporally and functionally distinct occupations could fortuitously yield such completely redundant tool kits and activity locations that clear intrasite patterns would be preserved. It is far more plausible to interpret the complementary distribution of features and artifacts as an indication of at least general contemporaneity among site elements deposited in the context of a single adaptive strategy.

Of course, this interpretation of site structure is only one of several potential explanations. It is possible that the association of small hearths and high artifact densities is due to the coincidental juxtaposition of different components. Stratigraphic data on site formation processes is of little help since the entire cultural level is within a single homogeneous stratum. Even though there are several instances of feature superposition, the features are not associated with distinct identifiable occupation levels. Thus, it cannot be shown that the roasting features are stratigraphically lower or higher than the pit structures or hearth; the data are limited to spatial distributions and chronometrics (Chapter 11).

It was originally suspected (prior to the identification of the spatial patterns noted herein) that the roasting pits might indicate a separate component from the rest of the site. Such a situation would probably require that the earlier component be buried so that its distribution would not structure the later occupation, either through the patterning of activity areas or by providing materials which could be scavenged by later occupants. Following both occupations, erosion would have to occur at an appropriate intensity so as to mix the assemblages by deflation, while at the same time leaving the features from both occupations intact.

The authors do not intend to imply that the identification of intrasite patterns indicates the simple deposition of all artifacts in the context of use. Clearly, a number of intervening disposal and post-depositional processes play a role in archeological patterning. These factors not withstanding, it would appear that major portions of Site 37 were used in similar ways, over however long or short a time it may have been occupied. The greater the length of time separating two hypothetically distinct occupations, the less likely is the chance that their partitioning of space would coincidentally match. So, while granting that a coincidental association of surface artifacts, subsurface artifacts and three feature types is a logical possibility, the authors do not feel it is not an explanation with a high _a priori_ probability.

CHAPTER 11

CHRONOLOGY

Introduction

From the very start of this study, one of the primary research goals has been the development of improved chronological control over the archeological remains. Good temporal control is viewed as a necessity for addressing at least three of the broad topics identified in the research design. These are the reconstruction of site chronology and placement within the cultural historical framework, the interpretation of site function and the assessment of site context within an adaptive strategy.

Prior to this study, Keystone Sites 36 and 37 had been assigned, without the benefit of traditional diagnostic artifacts, to the late Archaic/early Formative range on the basis of general surface characteristics (e.g., a general lack of ceramics, a wide range of lithic raw material types, etc.). The idea of an Archaic date was superficially strengthened by the identification of dated Archaic components at the nearby Keystone Sites 33 and 32, and when the investigations began, it was expected that preceramic occupations would be demonstrated for Sites 36 and 37. However, the chronometric dates from this study largely postdate the Archaic, highlighting the need to reassess the local cultural systematic framework.

The interpretation of site function requires an analysis of the range of feature and artifact types present on a site. However, many of the larger camps in the El Paso area probably reflect multicomponent occupations by a series of small groups. In order to interrelate site functions inferred from features and artifacts, one must establish at least the general contemporaneity of the remains in question or separate out the various temporal components represented. At both sites, arguments can be made for the contemporaneity of the various features and assemblages. However, the patterned discrepancies between dates produced by two different chronometric techniques are very significant, as discussed below.

The various forms of settlement pattern analysis and the interpretation of the systemic context of sites carry similar requirements. One must be able to demonstrate at least approximate contemporaneity among sites if we are to model them as components of the same adaptive system. The results of this study indicate that neither site is Archaic in age, nor are they contemporaneous with each other.

This analysis relies heavily on the use of obsidian hydration and radiocarbon dating techniques. Due to the careful but extensive hand excavations called for in the research design, an unusually high number of datable samples were recovered for an open ephemeral site in this region. A total of 26 obsidian samples and 15 radiocarbon samples were successfully dated. Site 36 dates to the early Formative Mesilla phase and Site 37 falls within the range of the Pueblo period.

For reasons that will become clear shortly, greater reliability has been attributed to the obsidian hydration dates, in terms of directly dating human behavior. The emphasis on hydration dates has led to the identification of two major significant results. First, there are consistent discrepancies between sets of dates produced by the two procedures, with the charcoal dating earlier and more variable than the obsidian artifacts. Taken together with the temporal distribution of charcoal dates, the pattern suggests that Sites 36 and 37 are classic examples of the "old wood" problem identified elsewhere in the Southwest by Schiffer (1982, 1984). The old wood problem refers to a situation in which dead wood was collected for fuel, resulting in dates significantly older than the associated cultural behaviors.

Second, the majority of dates from Keystone 37 reveal an unexpectedly late occupation of the site. Even though it can be interpreted as a short-term residential camp produced in the context of a mobile adaptive strategy, it dates squarely in the range for the local Pueblo period. Nevertheless, <u>none of the artifactual or architectural characteristics of the site can be used to assign it to either the Doña Ana or El Paso phase</u>. The implication is that there may have been different adaptive strategies in operation in the El Paso area at roughly the same time period.

The first part of this chapter consists of a summary of the chronologies developed during previous Keystone Dam investigations. Then an overview of the soil stratigraphy at the two sites will be presented. Following that is a detailed discussion of the obsidian hydration technique employed in this analysis. The dates from the two sites are then discussed, with a major emphasis on evidence relevant to the old wood problem. A final section contains a summary of the rather uninformative results provided by an examination of relative chronological indicators.

Previous Keystone Chronologies

Previous chronological analyses of Keystone Dam sites have been most notable for their evidence of Archaic occupations. However, the 15 radiocarbon dates obtained by O'Laughlin at Sites 33 and 34 indicate both Archaic and early Formative components. Site stratigraphy disclosed the presence of a ceramic-bearing assemblage in Zone 2 and nonceramic materials in Zone 4, separated by the culturally sterile Zone 3. With the possible exception of two samples (from Site 33 South, Feature 1; Site 33 North, Feature 3), the distribution of dates generally supports the stratigraphic separation between the two assemblages. One sample from a nonfeature area of Zone 4 produced a date of A.D. 520+/-120 which was rejected as being unacceptably late (O'Laughlin 1980:48-49, 52).

If the rest of the radiocarbon dates are converted to 95% confidence intervals, all five of the Zone 4 dates fall within O'Laughlin's suggested best range of 1800-2500 B.C. (1980:49, Figure 14). Although the Zone 2 dates are somewhat more variable, eight of the remaining nine samples yield two sigma ranges which fall into the early Formative (i.e., A.D. 250-1100). Both groups of dates are compatible with general understandings of the ages of the associated artifactual materials. More important, however, is the fact that none of the dates from features are completely out of line with the stratigraphic or artifactual expectations. For example, none of the Zone 2 samples date to the Archaic period. As will be seen below, this condition presents a distinct and significant contrast to the situation recorded at Sites 36 and 37.

In addition to the radiocarbon samples, O'Laughlin submitted a total of 27 obsidian specimens from Site 33 for possible hydration rims (O'Laughlin 1980:Table 3). Unfortunately, it was not possible to calculate dates for the specimens because an appropriate hydration rate had not yet been determined. Now that experimentally induced rates are available for the El Paso area (see below), it has become clear that it is also necessary to determine the chemical source affinity of the samples. Thus, chemical analysis will be required before it is possible to calculate dates for the previously reported hydration rims.

Investigations at Site 32 have added relatively little to the understanding of chronology in the Keystone Dam area. The site stratigraphy is less informative than at Site 33 as all the cultural materials occur within the homogeneous sand designated stratum 4 (Fields and Girard 1983:18). Nevertheless, the vertical distribution of features within the deposit was used to subdivide the stratum into three sequential periods of occupation. The three substrata yielded radiocarbon dates of 2160+/-160 B.C., 650+/-120 B.C. and A.D. 520+/-70 respectively (Fields and Girard 1983:207). On the basis of these dates the authors conclude merely that Site 32 was occupied primarily during the Archaic and early Formative periods (Fields and Girard 1983:124). Obsidian hydration analysis was not attempted but the results of the projectile point typology are submitted as evidence in support of an Archaic occupation (ibid:215-218). The range of ceramic types reported also fits with the A.D. 520 date from the upper substratum.

The primary implication of these chronologies for the present study derives from the significance of the Archaic components. Archaic period remains are poorly studied in the El Paso area and the identification of two (apparently) functionally distinct sites in the same area raised the possibility that they, and the other

Keystone Sites, were parts of a single settlement system. Thus, a key question has been the potential contemporaneity of Sites 36 and 37 with Sites 32 and 33. The results of this analysis present a more complex situation. Site 36 is probably contemporaneous with the early Formative components at Sites 32 and 33. Site 37 is later than all of the previously studied Keystone sites, with the most likely period of occupation falling between A.D. 1100-1400. Since obsidian hydration dates have contributed heavily to these results, it is appropriate here to discuss the analytical techniques used in some detail.

OBSIDIAN HYDRATION DATING

Introduction

Recent advances in obsidian hydration technology have permitted New Mexico State University archeologists to date several lithic scatter sites over the past year and a half. The induced hydration technique is a relatively new procedure which is still undergoing refinement. Nevertheless, the methods involved are designed to avoid or compensate for the main problems associated with traditional hydration techniques. The determination of hydration rates is not based on the traditional linear correlation of rim thickness with a radiocarbon sequence. In fact, since the hydration rate is determined experimentally, calibration with other chronometric chronologies is unnecessary. The technique is also specifically designed to account for variability in the chemical composition of the obsidian samples. Bulk elemental analysis is used to assign the samples to chemical groups and a separate hydration rate is determined for each group (see below). The Keystone 36 and 37 results make up a part of the growing corpus of dates obtained from sites in the El Paso/Las Cruces region. The internal consistency of results from a variety of projects suggests that the techniques are reliable and that confidence can be placed in the resulting dates. A brief overview of the development of obsidian hydration will illustrate the applicability of the newer techniques to the field conditions in the Keystone area.

The process of obsidian hydration dating is based on the fact that a fresh fracture will adsorb water from the atmosphere and form a microscopic layer of hydration. During the hydration process Na, Li and Mg are leached out of the glass while hydrogen diffuses inward. This causes a mechanical strain at the glass surface and results in a measurable birefringent band or hydration rim. Since the formation of the hydration layer is a diffusion process, the thickness of the rim is a function of the length of time ($x=kt^{1/2}$) elapsed since the fracture. Assuming that an appropriate rate of hydration can be determined, the rim thickness can be translated into calendar years (Michels and Tsong 1983).

First developed in the 1960s, obsidian hydration analysis was quickly recognized to be a rapid and economical technique with which to address chronological problems in archeology. However, early research highlighted the difficulty of determining one or more suitable rates of hydration (Michels and Tsong 1980:415-418). The two main problem areas pertained to the need to control for natural variables affecting hydration and the need for independent calibration of the results.

Friedman and Smith (1960) identified chemical composition and temperature as the primary variables affecting the hydration rate. However, many of the problematical hydration analysis results were caused by a lack of control over these variables, especially composition. The traditional approach to obsidian hydration has involved the working assumption that obsidian sources are homogeneous throughout a given flow. However, multiple trace element characterizations from a single source have produced conflicting results. Gordus et al. (1968) report significant variation in chemical composition among samples taken from a single one inch cube. A group of obsidian artifacts of the same age on the same site will, if they differ chemically, exhibit different hydration rim thicknesses due to their distinct hydration rates. In areas like the Jornada, where a variety of obsidian sources were undoubtedly utilized, the inability to control for chemical composition will yield uninterpretable results (O'Laughlin 1980; Whalen 1980; Hard 1983). The induced hydration technique alleviates this problem by determining separate hydration rates for each chemically distinct source group (the ultimate geographical source for the local pebbles remains unknown).

In the traditional response to this problem some researchers focused on assemblages considered likely to represent a single source. Such an approach still did not alleviate the problem of within-source chemical variation or the need for independent calibration of the hydration results. Most often this amounted to comparing rim thicknesses from different contexts already dated by radiocarbon. Three fundamental difficulties are implicit in the calibration approach. First, the integrity of the association between an obsidian artifact and a radiocarbon date can always be questioned. Second, the calibrated rate necessarily contains the same degree of error as the radiocarbon chronology. Third, use of the hydration results requires the prior existence of a well developed radiocarbon chronology. Recent research by Michels and others (Michels and Tsong 1980; Michels, Tsong and Nelson 1983; Michels, Tsong and Smith 1983) has led to the development of induced hydration, a technique designed to address this and the other problems identified above.

Induced Hydration Technique

Use of the induced hydration technique responds to the difficulties mentioned above by providing separate, experimentally determined hydration rates for each chemically distinct source, and alleviating the need for independent calibration. The first step in the process is the chemical source analysis of the obsidian. At Keystone Dam, and elsewhere along the Rio Grande Valley, the obsidian originates as part of the "mixed rounded gravels" of the Santa Fe group exposed in valley margin geomorphic surfaces (see Chapter 5). To date, bulk element compositional analysis has been used to identify six distinct chemical groups (i.e., sources or varieties within sources) among obsidian pebbles from the Rio Grande gravels. The specimens submitted from Sites 36 and 37 were identified as belonging to Group I (4), Group II (17), Group III (1) and Group VI (5). The chemical compositions of these groups are listed in Appendix 3a. The Group III specimen is not yet datable because the hydration rate for that source has not been determined.

The rates are calculated by inducing hydration under experimental conditions. An unworked pebble of the appropriate group is freshly fractured and nine flakes are hydrated in a 1 liter thermoregulated reaction bomb at elevated temperature and pressure. (Michels, Tsong and Smith 1983:108). The flakes are hydrated for various lengths of time, up to several days. After thin sectioning, the hydration rims are measured and a regression of hydration depth versus time is used to determine the rate (ibid:108). The hydration rates for the three chemical groups identified at the Keystone Sites are shown in Table 45. Note that since each source group will have different rates, the dates provided by the different groups constitute independent tests of one another.

The final major variable needed to calculate chronometric dates is a value for the effective hydration temperature (EHT) at the site. An estimate of EHT is provided by Lee's (1969), temperature integration equation, relating the mean annual temperature and annual temperature range. These data have usually been estimated by substituting values from the official weather station nearest the site. Batcho (1984a) has discussed two likely sources of error in this approach, the effects of large population "heat islands" on temperature records and the relationship between temperature and elevation in the arid Southwest. In order to estimate the EHT for Keystone Dam, a polynomial regression analysis was carried out on temperature data from ten weather stations in southern New Mexico and west Texas, at similar latitudes and elevations, excluding El Paso. A fourth order polynomial provides the most satisfactory fit for the relationship between elevation and EHT (Batcho 1984a:14-15). The predicted EHT for Keystone Sites 36 and 37 is 293.256 (Table 45).

Table 45. Hydration rates for obsidian source groups identified at Keystone Sites 36 and 37.

Source Group	Hydration Rate
1	8.817 square microns/1000 yrs.
2	3.724 square microns/1000 yrs.
6	6.981 square microns/1000 yrs.

Effective Hydration Temperature for Keystone Sites 36 and 37: 293.256

Previous Applications of the Technique

Michels and Tsong have used the induced hydration technique to determine hydration rates for more than 25 chemically distinct obsidian sources from four different continents. Although this technique is still in its developmental stage, when both dating methods are available for comparison, the results of obsidian hydration and radiocarbon analyses are in general agreement. The two methods have yielded comparable dates for Upper Paleolithic and Neolithic horizons from Kenya, at a Mycenean quarry in Sardinia and at a quarry on Easter Island (Michels, Tsong and Nelson 1983; Michels et al. In press).

The technique has been further tested at a variety of NMSU project sites in New Mexico and West Texas involving approximately 75 samples. Corresponding obsidian and radiocarbon dates have been obtained from a Basketmaker II/III camp near Grants (Batcho 1984a) from the Archaic and Formative periods at Vista Hills in El Paso (Kauffman 1984), from Formative shelters at Peña Blanca in the southern Organ Mountains (Steadman Upham, personal communication, 12/5/84) and from the Doña Ana County Airport sites west of Santa Teresa, New Mexico (Batcho 1984b). The dates from these sites are presented in Appendix 3d except for those available in Kauffman (1984).

Induced hydration dates have also been tested against archeomagnetic dates from Pueblo period pithouses on Meyer Range, Fort Bliss (Scarborough 1984). The original determinations showed some significant discrepancies with the archeomagnetic dates but these problems were traced to the calculation of the EHT. Dates were recalculated at NMSU using the polynomial equation mentioned above, rather than the weather data from El Paso. The results are in close agreement with the archeomagnetic dates. Dr. Scarborough has kindly agreed to allow the inclusion of these independent test results in this discussion and the dates are listed in Appendix 3d.

NMSU has also run reliability checks on the laboratory methods by the blind resubmission of samples from several sites to Mohlab. The results obtained from separate submissions have been comparable for all but five (11%) samples (Kauffman 1984).

Further support for the validity and consistency of the technique comes from a comparison of dates assigned to specimens from different chemical groups. Recall that since each group is characterized by a distinct hydration rate, the dates provided by artifacts from different groups within an assemblage constitute independent estimates of the site date. Comparable dates have been produced by two source groups at the Peña Blanca and Rollerskate sites in the southern Organ Mountains, by three groups at Doña Ana County Airport Sites 20 and 24 and by the results at Keystone Sites 36 and 37 (see Appendix 3d). It may be concluded that "obsidian hydration dating...can now be said to have reached a stage of development in which it is a thoroughly operational chronometric technique (Michels, Tsong and Smith (1983:115-116)." Of course, on-going research continues to further test and refine the methods of induced hydration.

Keystone Obsidian Dates

A total of 26 datable obsidian specimens were recovered from the Keystone sites, with all but four of them coming from Site 37. Three chemical source groups are represented, as noted in Appendix 3a. Since the cultural horizon at both sites is essentially homogeneous (see Chapter 5) it is not possible to assign any of the dates to different strata. Nor is there any spatial clustering of dates from different periods which could be used to subdivide the assemblages into temporal components. As a result the range of dates are taken as applicable to the entire assemblage within each site. The hydration rim measurements and dates are listed in Appendix 3b. A graphic summary of all dates (with their two sigma ranges) is presented in Figures 65 and 66. Details of sample provenience for all chronometric dates at Sites 36 and 37 are provided in Appendix 3.

At Site 36 only four obsidian dates were obtained, but the remarkable similarity among them inspires confidence in their validity. The 95% confidence interval for all four dates falls between about A.D. 520-900 (Figure 65). Two samples (2 and 1008) even produced exactly the same date. On the basis of the tight cluster of obsidian dates, the suggested most likely period of occupation is within the A.D. 500-900 range. This date would place Site 36 squarely within the Mesilla phase. A Mesilla phase assignment is compatible with the type of ceramics found (see below) and with an inferred leaf succulent processing function (Whalen 1978; O'Laughlin 1980). The relationship between the obsidian and radiocarbon dates are discussed below.

Twenty-two obsidian dates derived from three different source groups were obtained at Site 37. Nevertheless, clustering of the dates is still clearly evident (Figure 66). In spite of the fact that three different hydration rates were used to calculate the dates, the 95% confidence intervals for all but two of the specimens fall within the range of A.D. 1100-1400. The intervals for half the specimens occur entirely within that time range. Assuming that all groups resident at the site utilized and deposited obsidian at comparable rates, the dates suggest that most cultural deposition at Site 37 occurred between A.D. 1100 and 1400. While the validity of this assumption is certainly open to testing, there is some support for the suggestion that it applies at least for the El Paso region. First, as noted in Chapters 5 and 9, all the obsidian on Sites 36 and 37 were obtained from the mixed-rounded gravels along the Rio Grande Valley margin. These

FIGURE 65: Distribution of 95% Confidence Intervals for Chronometric Dates from Keystone 36.

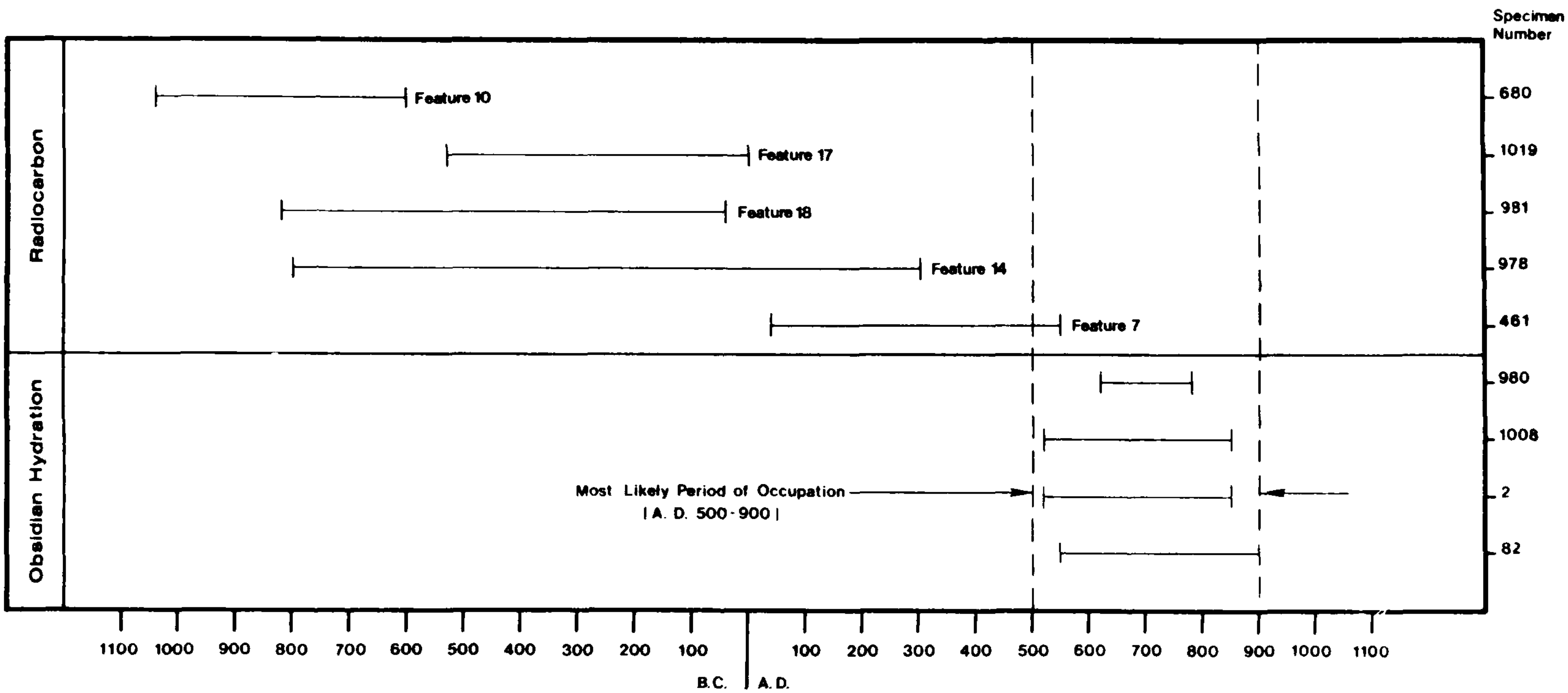
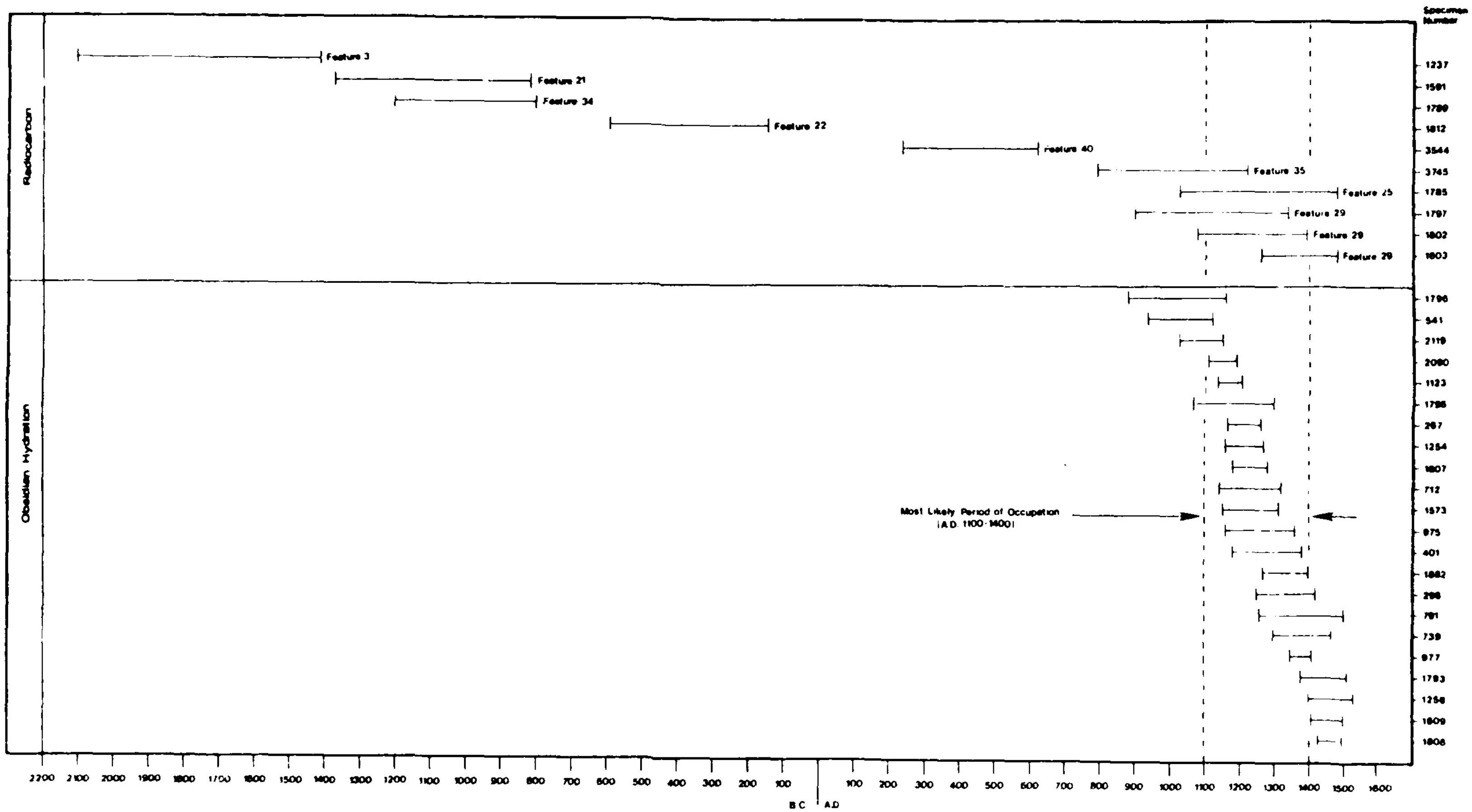


FIGURE 96 Distribution of 95% Confidence Intervals for Chronometric Dates From Keystone 37



resources would have been accessible to prehistoric inhabitants of all time periods (Chapter 5). Secondly, although obsidian is not commonly observed in Paleoindian assemblages in general, such use has been recorded in the El Paso area. A significant portion of the obsidian from Vista Hills was dated to the late Paleoindian period (Kauffman 1984) and obsidian pebble reduction was common at FB-1613, a Paleoindian camp on Fort Bliss near Fillmore Pass (Carmichael 1983a). The use of obsidian is well documented in Archaic and Formative period assemblages, so it would appear that, in the El Paso area at least, obsidian was available to and used by groups from all prehistoric periods.

The suggested range of dates for Site 37 is much later than had been predicted on the basis of gross feature and assemblage morphology. The period A.D. 1100-1400 corresponds roughly to the local Pueblo period, or Dona Ana and El Paso phases. However, unlike the previous case, Site 37 does not contain artifacts or other characteristics which would allow it to be identified as belonging to either of the Pueblo phases. This observation will be examined at length in Chapter 13. The comparisons of obsidian and radiocarbon dates are examined below, but several other points regarding the obsidian results deserve mention here.

First, it is obvious that there is essentially no overlap among the obsidian dates from the two sites. The earliest possible date at 37 and the latest at 36 meet at about A.D. 900, but the zones of major overlap among dates within sites are clearly distinct. This is the case even though the source group used to date Site 36 is also present on 37. Thus, the difference between the sites cannot be attributed to differences between material source groups.

Further examination of source groups at Site 37 is also instructive. Dates derived from the three different sources are mutually overlapping and there are no distinct clusters which can be attributed to specific chemical groups (Appendix 3a). Although all of the Group VI specimens fall at the late end of the range, their dates overlap significantly with those of Group II. Just as in the cases cited earlier, the calculation of similar dates derived from different source groups lends a high degree of confidence to the validity of the overall range of dates.

The Keystone data also provide another interesting result regarding the effects of depositional context on obsidian dating. At Site 36, specimen numbers 2 and 82 were recovered from the surface while the others were buried. Nevertheless, the samples yielded comparable dates with one subsurface piece producing a date identical to specimen 2 (Figure 65). The same phenomenon is evident at Site 37 where the seven surface specimens (numbers 541, 267, 712, 401, 296, 791 and 739) yield age ranges which are well intermixed with the subsurface results. This finding reiterates the view that hydration rim variability recorded in earlier studies in the region are attributable to chemical composition and not degree of burial as has been suggested by previous researchers (cf. Whalen 1980; O'Laughlin 1980; Hard 1983). All the above mentioned observations lead the authors to place a high level of confidence in the veracity of the Keystone obsidian dates. What remains now is to reconcile the obsidian results with the radiocarbon dates.

RADIOCARBON DATING

Keystone Radiocarbon Dates

A total of 15 radiocarbon samples were submitted from Sites 36 and 37 for dating at Beta Analytic, Inc.; all samples were wood charcoal recovered in situ from hand excavated features. The samples were pretreated by the removal of rootlets and then given a hot acid wash in order to eliminate carbonates. The samples were converted to benzene for counting and 10 of the samples were given an extended counting time due to their small size. The dating results in radiocarbon years were corrected for variations in the stable isotope ratio. The radiocarbon and adjusted dates are listed in Appendix 3c. The determinations were further corrected for variations in atmospheric carbon by using the calibrations provided by Klein et al. (1982). The corrected dates are shown at the 95% confidence level (two standard deviations) in Figures 65 and 66.

The intervals for the five dates at Site 36 range from about 1040 B.C. to A.D. 550 (Figure 65) with the period of maximum overlap at about 100-500 B.C. The earliest and latest dates are on wood from large roasting pit features at the southern end of the site. Feature 14 is a small pit dug into caliche at the same stratigraphic level as Feature 18, a rock hearth in the west-central portion of the site. Feature 17 is a small hearth at the north end of the site. All the dates except perhaps that from Feature 7 are earlier than would be expected from a Mesilla site and they are certainly earlier than the obsidian dates at the same site. Although the effects of multiple occupations cannot be ruled out at this site, the similar results at Site 37 suggest that there may be other factors operating to produce consistent discrepancies between the radiocarbon and obsidian dates.

The 10 radiocarbon samples dated at Site 37 are from all three main feature types: roasting pits, hearths and pit structures. Although some clustering of dates is evident during the Pueblo period, a very high degree of variability is recorded with dates ranging from about A.D. 1400 to 2100 B.C. (Figure 66). Of particular interest is the group of three samples within 2 cm of the floor of Feature 29. (Note: A location 2 cm above the floor could be argued to be not on the floor. Nevertheless, 2 cm is well within the range of thicknesses for artifacts which were found on the floor. Given the rapidity with which shallow depressions in sand begin filling, it is likely that these samples were deposited immediately after abandonment, at least in terms of the archeological time scale. See the discussion of Feature 40, Chapter 8, for an example of rapid filling covering artifacts at the floor followed by long-term filling and reworking of materials 10 cm or more above the floor). The fact that they cluster very tightly is reassuring evidence that the C14 dates are valid and internally consistent. These three dates, along with those from Features 25 and 35, cluster nicely within the Pueblo period, providing important corroboration for the obsidian dates. Nevertheless, there is still a rather striking discrepancy between the five earliest radiocarbon dates and the obsidian results.

The most obvious explanation for such a distribution of dates would be multiple occupations of the site throughout the late Archaic and early Formative periods. While such may be the case for Site 36, several lines of evidence argue against the validity of that interpretation for Site 37. Of the five earliest dates, two are from large roasting features (Features 3 and 34) two are from small hearths (Features 21 and 22) and Feature 40 is a pit structure. As was discussed in detail in the preceeding chapter, the spatial locations of all three feature types are part of a very well developed intrasite distributional pattern. The superpositioning of some pit structures is evidence for more than a single occupation at the site, but the well developed intrasite distributional patterns are good evidence for redundancy in the functional partitioning of space within the site (Chapter 3; Binford 1982). In other words, the occupations at Site 37 were most likely at least roughly contemporaneous in order for the location of one type of feature to have consistently conditioned the locations of the others. Multiple occupations occurring over a long period of time, and possibly involving different functional activities, could be expected to obscure intrasite patterns (Binford 1982). In light of the well defined spatial patterns, it is difficult to support an interpretation in which Features 3, 21, 22, 34 and 40 represent Archaic and early Formative components which coincidentally fit a tight spatial pattern defined for the remaining features. The implication is not that the radiocarbon dates are spurious but, rather, that they do not date the cultural behaviors which produced the associated features. Several lines of evidence support this latter reasoning.

First, four of the five dates obtained on charcoal from pit structures are late in time, well within the Pueblo period. The sample from Feature 40, the one exception, was recovered in redeposited fill 10 cm above the floor of the structure and would thus make a poor choice for dating the use of the structure. If the structures date to the Pueblo period, as is indicated by four radiocarbon dates, it is most logical that the features exhibiting a spatial distribution complementary to them are also attributable to the same time range.

Additional evidence that some of the radiocarbon dates are too early is provided by an examination of ceramic distributions at the site. Very few ceramics were recorded on the site and Feature 3 is one of only two features with which sherds were associated. The internal date of 1450-2100 B.C. is clearly far too early for ceramics in the Southwest. The only other feature containing ceramics on this site (Feature 25) yielded a date range of about A.D. 1040-1470 which is, of course, fully compatible with the accepted chronology of local ceramic manufacture.

Finally, if the earlier dates at the site were the result of an earlier component, one could expect a different temporal distribution among the dates. The only well dated Archaic site in the area is the lower component at Keystone Site 33. Recall that the dates from the Archaic horizon were relatively well clustered as might be expected for a group of features occupied at roughly the same time period (O'Laughlin 1980:48). The clustering presents a distinctly different pattern than the distribution at Site 37 where the dates are distributed over a range of about 3500 years with little evidence of clustering prior to the Pueblo period (Figure 66). Such a wide dispersal of dates would not be expected from an earlier component, and, again it is unlikely that five small discrete occupations over a period of 2500 years would produce remains so consistent with the tight internal patterns of feature and artifact distributions.

To summarize, the radiocarbon dates obtained from both sites are far more variable than the obsidian dates. The C14 dates have larger error factors and do not form convincing clusters except for the Pueblo period dates at Site 37. The earlier dates do not fit with the general contemporaneity of features as inferred from distributional patterns. The earliest date, from Feature 3, contradicts the temporal placement we would expect given the association of ceramics. Finally, the wide dispersal of radiocarbon dates is not the pattern which could be expected from earlier components. These results suggest that a higher level of confidence should be placed in the obsidian dates for the purpose of inferring probable periods of occupation at the sites (Figures 65 and 66). The most parsimonious way of reconciling the differences between the obsidian and radiocarbon chronologies is by reference to the "old wood" problem.

The "Old Wood" Problem

One of the main challenges in constructing radiocarbon chronologies is the need to adequately characterize the nature of the association between the date and cultural behavior. Clearly, the study of site formation processes are important in such an endeavor. While site formation processes have been considered by a variety of authors, in regard to artifact and feature deposition, the issue has not often been addressed in the context of radiocarbon analyses. Important exceptions are provided by Dean (1978) and Schiffer (1982, 1984). In a recent paper Schiffer (1984) argues convincingly that variability in rates of wood decay has skewed most radiocarbon chronologies in the direction of greater antiquity. This phenomenon is termed the "old wood" problem (Schiffer 1982, 1984:3).

Put another way, recognition of the old wood problem is a recognition that a variety of factors may lead to significant differences between the time a tree dies and the time it enters the archeological record as charcoal. One basic component of variability derives from the growth characteristics of the trees themselves. Most of the living cells in a tree are in the outer rings and the inner portion or heartwood is dead in terms of radiocarbon absorption (Hoadley 1980:6; Dean 1978). Thus, in long-lived species, charcoal from the inner and outer portions of a tree could produce dates differing by 500 or 600 years (Schiffer 1982:324). An even greater potential difficulty is caused by the likelihood that prehistoric groups gathered dead wood for use as fuel.

Particularly in the arid Southwest, there are several factors which could contribute to the availability of dead wood as a resource in the prehistoric (and modern) environment. The first of these is the range of species available and their relative degree of resistance to decay. When sapwood cells die and become heartwood, the transformation is accompanied by the production of extractives. In some species the extractives increase the density and reduce the permeability of the wood and are also toxic to fungi, making the wood resistant to decay (Hoadley 1980:6). Mesquite and juniper are recognized as two of the most decay resistant species (Hoadley 1980:36) and although not usually treated in wood technology texts, empirical evidence for the durability of ironwood is compelling (Schiffer 1982).

The other major factor favoring the accumulation of dead wood is an arid climate. A relative lack of moisture inhibits the activities of most biological agents of decay, including bacteria, fungi and insects (Hoadley 1980:33-37; Schiffer 1984). Throughout much of the Southwest, the decay resistance of dead wood from the above species is enhanced by the dry environment. Given that cutting greenwood from the desert hardwoods is a relatively difficult chore, it is likely that deadwood would be utilized whenever possible (Schiffer 1982:324). Three main sources for dead wood can be anticipated: dead branches on live trees, dead trees, either standing or as surface litter, and driftwood (Schiffer 1984).

As Schiffer (1982:324) notes, dead branches on living mesquite trees are collected for fuel by Papagos. Schiffer's experiments in collecting dead mesquite branches yielded a date of 970+/-430 B.P. on a composite sample containing 23 specimens (1984:29). Given that the sample was a composite, some individual specimens would likely produce even earlier dates.

Dead wood from the surface litter on the desert floor can also yield old dates indicative of significant accumulation. Two investigators working in the Sonoran Desert collected surface samples of ironwood and submitted them for radiocarbon analysis. The resulting dates, obtained from wood available on the present surface, range from 210+/-70 B.P. back to 1536 B.P. (cited in Schiffer 1982:325).

In areas adjacent to major drainages, such as the proximity of Keystone Dam to the Rio Grande, driftwood can be a significant source of fuel and of old wood (Schiffer 1982:325, 1984:30). Along the Colorado River Ferguson (1971) has used dendrochronology to date driftwood samples ranging from A.D. 500-1958 (Schiffer 1982:325). Furthermore the samples exhibited a 209 year difference between the mean inner and mean outer rim dates.

The use of any of these sources of dead wood can be expected to produce anomalously early radiocarbon dates, representing the time of death rather than the period of use. The magnitude of the error may be unpredictable for individual specimens, but Schiffer's (1982, 1984) analysis of Hohokam chronology identifies patterns which could be expected if the old wood problem is affecting other chronologies.

Variability among the radiocarbon dates is systematic rather than random. The dates are consistently earlier and more variable than would be expected on cultural grounds. Moreover, radiocarbon dates seem to be most variable during the late Archaic and early Formative periods. Schiffer (1984:32) suggests that by the Sedentary period much of the accumulated old wood had been consumed. Subsequent cutting of live wood could be expected to yield greater consistency among dates. While the timing of such a sequence of change can be expected to vary from place to place, its form could potentially be part of the archeological record wherever wood resources were under heavy stress.

Old wood dates can be expected to be problematical when small charcoal samples are involved. It is reasoned (Schiffer 1982:332, 1984:34) most small wood charcoal samples are the remains of gathered firewood, as opposed to the larger pieces which might reflect the reuse of structural wood. At sites where structural wood, annual plants, or other short-lived species were used for fuel, old wood dates should be less of a problem.

One final interesting pattern observed in the context of the old wood problem concerns the temporal distribution of radiocarbon dates. There is no way to assess the magnitude of error for any given single date. However, in a series of samples, some of the latest dates may pertain to cultural events. Schiffer (1984:39) uses this reasoning to interpret the dates for archeological phases but the same approach could apply to groups of dates from individual sites. Within such a group we could expect a few dates (clustered) at the end of the time range to accurately reflect the period of occupation, with the remaining samples dating to various (nonclustered) earlier periods. Recall that this is precisely the pattern which characterizes the radiocarbon dates from Keystone Site 37 (Figure 66).

Old Wood and the Keystone Sites

Site 37 appears to be a classic example of the effects of the old wood problem on radiocarbon dating. At least one date (specimen 1237) is unacceptably early if one accepts the association with ceramics. At least half the dates are unacceptably early if one accepts the argument that the complementary distribution of feature types reflects at least general contemporaneity (see Chapter 9). Further, the distribution of radiocarbon dates exhibits a cluster at the latest end of the range and a variable pattern of dates throughout the earlier three-fourths of the range (Figure 66). This distribution is quite unlike the clusters produced by multiple occupations at Site 33. It is, however, precisely what Schiffer predicts for a corpus of dates affected by the old wood problem. Finally, it is known that wood resources of appropriate durability were collected for use at Sites 36 and 37. Virtually all of the charcoal on the sites was identified as either mesquite or juniper (see Chapter 12). As noted above, these two species are among the most decay resistant and, as a result, are highly susceptible to old wood problems.

Even if the Keystone evidence were limited to the above data, the effects of old wood dates would be a plausible explanation for the radiocarbon results. It becomes even more parsimonious as a means of reconciling the discrepancies between the radiocarbon and obsidian chronologies. As discussed in the previous chapter, the artifact scatter at Site 37 appears to follow the same distributional pattern as the features. If the complementary distribution reflects approximate contemporaneity, then half the C14 dates are unacceptably early relative to the entire corpus of obsidian dates. Furthermore, half of the radiocarbon dates corroborate the late placement of the cluster of obsidian dates. At present, old wood problems appear to provide the most straightforward and satisfying explanation for the distribution of chronometric dates at Site 37. Although the situation is somewhat less complex at Site 36 (e.g., there is no clear cluster of C14 dates and little overlap with the obsidian dates), it may be due to having a smaller sample of dates. Given the overall similarity of the pattern of variability and distribution of dates with Site 37, the old wood problem is probably indicated at Site 36 as well. The results of this study suggest that, at least in this case, the obsidian hydration dates provide fewer opportunities for the introduction of error, both in the dating method and in the association of dated samples with cultural events. Thus, in dating Keystone Sites 36 and 37 primacy is lent to the obsidian hydration results.

Clearly, the effects of old wood radiocarbon dates are not the only possible explanation for the patterns observed at Sites 36 and 37, and, the fact that old wood is suggested does not mean that others have not been considered. The most obvious alternative is multiple occupations; various feature types and the artifact scatter could conceivably date to different periods. It has already been noted that the sites are indeed the result of reoccupation but it was suggested that such reuse would have been fairly close in time (i.e., in the same culture period). The radiocarbon dates at Site 37 range from the late Archaic through the late Formative period. If they are the result of separate components, one should expect to find evidence for two or three distinctive archeological assemblages.

As mentioned earlier, the lack of stratigraphy does not aid the evaluation of the possibility of multiple occupation levels. However, if some features were associated with each different occupation, one still might expect to see artifactual differences such as the occurrence of aceramic versus ceramic components, obsidian used only as small arrow points, etc. Such variability in the assemblages was not evident. In fact, the multiple occupation hypothesis would require a mechanism which thoroughly mixed the assemblages from distinct occupations without obscuring details such as the artifact density differences associated with pit structures. In addition, deflation would have to be sufficient to reduce features from different time periods to the same base level without disarticulating the fire-cracked rocks in them.

Another possibility might be that different types of features and different areas of the site were used during different time periods. For example, the pit structures could all date to the latest occupation (represented by obsidian) and the fire-cracked rock features to earlier occupations. There are at least two problems with this sort of argument. First, it requires that the location of different features, deposited a thousand years apart, coincidentally produced clear distributional patterns in the partitioning of intrasite space (see Chapter 10). Second, one would have to explain why obsidian was used only by the latest occupants when there is a strong record of its use in the immediate area throughout the Archaic and Formative periods (O'Laughlin 1980; Whalen 1980; Kauffman 1984).

Finally, it is noted that the range in radiocarbon dates at Site 37 is considerable. It can be argued that old wood problems do not account for such a wide range of dates, but such an argument is an essentially untested proposition. In Schiffer's (1984) research on modern dead wood, dates were obtained which were up to 1400 years too early when the error factors are figured in. Recall that he used an aggregate sample and that some trees probably contained old wood of even greater ages. Furthermore, if dead wood has been collected for significant periods of the prehistoric and historic past, its availability and hence, the potential range of ages, must be somewhat limited in modern samples. In any event, research has not yet progressed to the point where observed range of dates can be dismissed out of hand as being too great for old wood effects.

The application of the old wood argument to the dates at Keystone Sites 36 and 37 may not be comforting to all readers, especially in light of the implications for local cultural systematics (see below). There are possible alternative explanations. It is simply argued that alternatives, such as multiple occupations, require the occurrence of a rather improbable sequence of events. By reference to the principle of Occam's Razor, the old wood argument seems, at present, to offer the most parsimonious reconciliation of the dating results.

Further support for the utility of the old wood interpretation is provided by the fact that it also accounts for some chronological difficulties reported at other sites in El Paso area. At Castner Range Sites 71 and 80 a rather perplexing array of radiocarbon dates were reported (Hard 1983:5657). Three to five samples were analyzed from each of seven features. In each case, charcoal samples from the same feature yielded a wide range of dates. A typical example is provided by Feature 7 at Site 80, whose contents dated from 25+/-140 B.C. to A.D. 710+/-145. The distributional pattern of the dates is even more interesting. Each of the four features at Site 80 exhibit clusters of two to three dates at the late end of their distribution, with the remaining samples dating earlier by varying degrees (Hard 1983:Figure 19). The distributions are very similar to those recorded at Keystone Sites 36 and 37 and to the theoretical expectations discussed by Schiffer (1984). It seems likely that old wood dates are to blame for the variability among the Castner Range dates.

Schiffer notes (1984:2) that the traditional way of dealing with conflicting dates is to reject those which do not fit our prior expectations of the data. This approach was followed at Castner Sites 71 and 80, with at least nine dates being deleted. In one case the dates within a feature were so variable that they were all deleted (Site 71, Feature 3). In all other cases, however, it is the earlier dates which are deleted as unacceptable. In other words, it was the earlier dates which did not fit with a priori expectations relating to site form and content. Again, the systematic nature of the discrepancy suggests an old wood problem. For the purposes of estimating the age of cultural events, it is useful to give added weight to the latest dates in a series. Nevertheless, the earlier dates should not be deleted as spurious simply because they are problematical. They are only spurious if we expect radiocarbon ages to date cultural events rather than the biological ones they actually record.

However, a consistent search for similar discrepancies and patterns in chronologies may provide information on prehistoric behavior as it relates to site formation processes.

For instance, there are at least four excavated sites in the El Paso area which exhibit chronologic characteristics explainable as old wood dates (Keystone Sites 36 and 37, and Castner Sites 71 and 80). All four occur in bajada settings and they are inferred to have been occupied for the purpose of processing leaf succulents. Charcoal identification indicates the use of upland desert hardwoods (i.e., mesquite) and juniper for fuel. This set of traits contrasts with Keystone Site 33 for which evidence of an old wood problem is lacking. Site 33 is in a more riverine setting and shorter-lived riparian species such as cottonwood and desert willow are present in the botanical remains. The shorter-lived species, which are also less decay resistant, would be less likely to accumulate as deadwood. Thus, there may be evidence of a riverine/upland dichotomy in wood resource procurement which is reflected in the old wood problems at upland sites.

Further comparative data from excavations at the Doña Ana County Airport suggest a more complex picture. Like those discussed above, Sites FA20 and FA24 are also upland sites, located on a valley margin surface west of the Rio Grande but in a mesquite dune setting rather than a bajada. They are located within 100 m of each other and the radiocarbon and obsidian hydration dates show the sites to be contemporaneous (Appendix 3d). The crossmending of sherds from a large Ramos Polychrome jar found at both sites suggests they may actually have been used at precisely the same time. The sites consist of a small El Paso phase pithouse, several associated trash-filled pits and some small rock and caliche hearths (Duran and Batcho 1983; Batcho 1984b). No features are present which resemble the large fire-cracked rock features in the Keystone Dam and Castner Range areas.

In spite of the upland location and availability of desert hardwoods, there is no evidence of an old wood problem at FA20/FA24. The radiocarbon and obsidian hydration dates are in close agreement (see Appendix 3d). This is very likely due to the fact that the radiocarbon dates were obtained from the charcoal of annual plants. Dr. Wilma Wetterstrom (1984) has identified the charcoal as yucca stalks, maize cobs and reeds (phragmites). A different fuel procurement strategy appears to be indicated. The site may have functioned as a field house, so both the maize cobs and yucca may have been local resources. The presence of charred phragmites seems to indicate involvement in a riverine based procurement strategy.

In either case, there appears to have been no need to collect quantities of dead wood for fuel. The four sites exhibiting old wood problems are also those which are most clearly directed at the specialized processing of leaf succulents (recall that we interpret the large quantity of small hearths at Keystone 33 to be indicative of more generalized domestic functions, a view which is compatible with the evidence for substantial numbers of brush and mud houses at the site). It is possible that the large roasting features required great quantities of fuel which, in turn, were acquired by systematically collecting dead wood in the vicinity of the sites. If this is the case, we should expect to find further evidence that old wood dates are a problem primarily on sites with large roasting features in the upland bajada zones.

Relative Dating of Artifacts

Keystone Sites 36 and 37 both exhibit a relative lack of artifacts which would normally be identified as having temporal significance. Since so few artifacts were recovered, the observations regarding ceramic and projectile point typologies have been of little use in dating the sites. A brief overview of the typological results is included here mainly for the sake of completeness.

Ceramics

A total of 32 ceramic sherds were recovered from the two sites, three quarters of which were found at Site 36. All 24 sherds from Site 36 are derived from local plain brownware jars, but it is not possible to specify the pottery type. No rim sherds were recovered and none of the specimens were painted. The sherds are mostly small fragments which have been severely eroded. Due to the similarities in paste, temper, etc. between the local painted and unpainted wares, it has become customary to assign a designation of unspecific brownware (UB) when rims and decoration are lacking (Whalen 1978, 1980). All of the sherds from Site 36 are identified simply as UB. In terms of dating they are not useful; they do not contradict a Mesilla phase designation, nor do they preclude the presence of later components. Six sherds were recovered from within, or adjacent to, Feature 7 but, as discussed above, it is not clear that the radiocarbon date from the feature is reliable.

Only eight sherds were collected at Site 37. Of these, six are typical local unspecific brown body sherds from jar forms. One other jar sherd is not typical of local brownware. It is well polished on the exterior, has a very fine quartz sand temper and a dark chocolate brown paste color (7.5YR 3/2). Cultural and temporal affiliations of the specimen are unknown. The one remaining specimen is a small eroded bowl sherd. It is thin (3 mm), made of fine buff-colored paste with very fine sand temper and is well smoothed on the interior and polished on the exterior. The exterior surface retains one indistinct spot of thin dark red paint. The cultural and temporal significance of this sherd is not clear. The buff color might suggest a Chihuahuan ware but the sherd does not resemble any of the Casas Grandes materials in the CRMD reference collection. In short, the depauperate ceramic assemblages at Sites 36 and 37 do not contribute to the chronological analysis.

Projectile Points

The analysis of projectile points is every bit as inconclusive as the ceramic typology. A total of six bifaces were identified as projectile points (Figure 67). The only specimen from Site 36 is a good example of the Golondrina style (Figure 67). Its presence on the site contradicts the other chronological evidence presented above since this style is normally attributed to the late Paleoindian/early Archaic time range (Birmingham and Hester 1976). The point was recovered at the base of the cultural deposit adjacent to Feature 13. It could be argued that the point reflects an earlier component at the site but the dates obtained from Features 14 and 18, at approximately the same depth, are much later than would be expected for the Golondrina style (see Figure 66). Furthermore, it was suggested above that the dates from these two features are old wood dates. Thus, the presence of the point does not fit with the obsidian dating, nor does it provide convincing evidence for an early Archaic component. It is possible that the point was collected and redeposited by the site occupants.

The five projectile points collected at Site 37 are also illustrated in Figure 67. Specimens b, c, e, and f are all of chert and d is made of obsidian. The latter was recovered after the obsidian samples were submitted so the point has not yet been dated by obsidian hydration. In terms of formal characteristics, they are rather uninformative with regard to temporal placement. Points of this general size and form (side notched or corner notched) are commonly attributed to the late Archaic and/or Mesilla phase because later styles are often characterized as being small triangular arrow points (e.g., Lehmer 1948; O'Laughlin 1979:45-47). Specimens 67 c and d could both fall in the range of variability for San Pedro materials and 67 b would probably be identified as San Jose. The identity of the others is unclear but examples similar to f have been assigned to the late Archaic/early Formative in this region. Nevertheless, Lehmer illustrates points from the Alamogordo Sites (El Paso phase) which are similar to those from Site 37 (1948:65) and the specimens reported by O'Laughlin (1979:46) may be related to a variety of Formative period dates. In short, the projectile points from Site 37 appear to have little temporal significance. They do not contradict a late Archaic/early Formative placement, nor do they preclude a Pueblo period date.

This observation may be another example of a more general pattern in which archeologists are beginning to question the

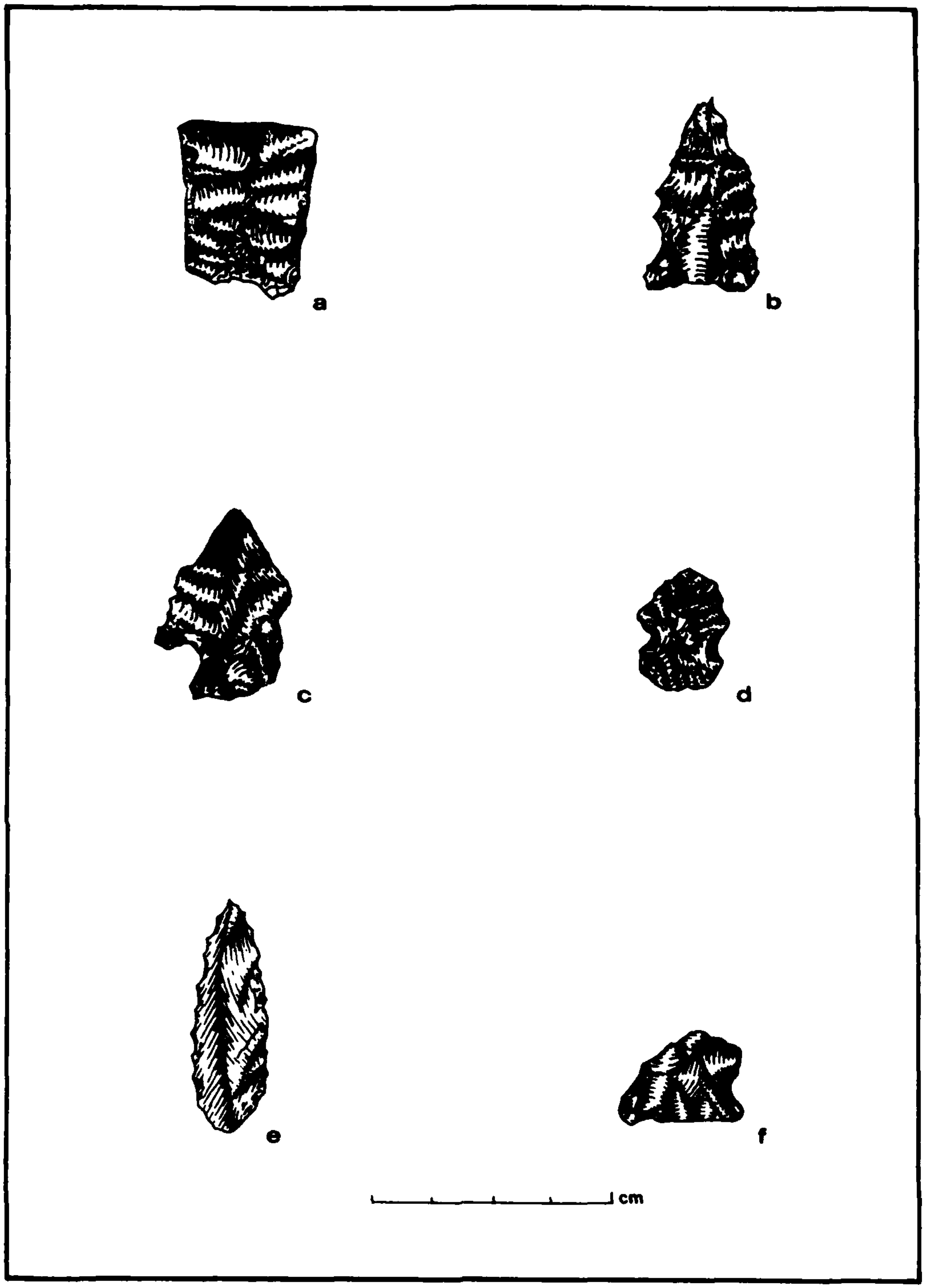


Figure 67. Projectile points collected at Keystone Sites 36 (a) and 37 (b-f).

immutable temporal significance of projectile point forms (e.g., Cordell 1979; Stuart and Gauthier 1981). While small corner and side notched points certainly do occur in preceramic contexts, they appear not to be confined to the preceramic. During recent NMSU field school excavations at Peña Blanca in the Organ Mountains, a number of corner notched points were recovered which resemble those from Fresnal Shelter, N.M. (Steadman Upham, personal communication). At Fresnal all materials are from the Archaic period but at Peña Blanca dates were from the late Formative (Appendix 3d). In addition, Formative period dates have been obtained on obsidian examples of "Archaic" points from western New Mexico (Batcho 1984a).

Perhaps the most significant aspect of the ceramic and point samples is the relative dearth of information they provide. Specifically, there are no artifacts present which can be used to assign Site 37 to either of the local Pueblo phases. In other words, the archeological variability contained at Site 37 is not adequately accounted for by the existing cultural-temporal framework in the Jornada area. The implications of this observation are explored further in Chapter 13.

Implications of the Chronology

The results of chronological analyses undertaken at Keystone 36 and 37 have important implication for at least four major issues. The issues are 1) the apparent generality of old wood problems, 2) the greater reliability of obsidian dating in some situations and the resultant dates for the Keystone sites, 3) the implication of the late dates for Site 37 in relation to problems with the local phase sequence, and 4) the likely effects of old wood problems on cultural temporal systematics in general.

Schiffer presents the case for the old wood problem on the basis of radiocarbon dates from the Hohokam area. However, he also suggests that the problem may be expected wherever long-lived, decay resistant species were important prehistoric sources of firewood. The results of this study support his contention and we can expect to find evidence for old wood dates throughout the Chihuahuan Desert region. In short, I agree with Schiffer's observation that the old wood problem is probably much more widespread than would be indicated by the little research undertaken in the arid Southwest.

Given the evidence for old wood dates at Keystone Sites 36 and 37, it can be argued that, at least in this case, the obsidian hydration dates are more reliable than radiocarbon. It is concluded that most of the C14 dates do not reflect the age of cultural behaviors at the sites. Neither site appears to be contemporaneous with the major occupations of the other Keystone Dam sites. The most likely period of occupation are A.D. 500-900 for Site 36 and A.D. 1100-1400 for Site 37. The Keystone results further suggest that in certain situations (i.e., where old wood dates can be expected), obsidian dating will continue to be the most reliable chronometric technique providing some basic assumptions regarding obsidian procurement and deposition are accepted. Among them would be factors such as equal availability of obsidian to groups from all prehistoric periods, evidence for the contemporaneity of obsidian artifacts and other characteristics of interest. The interesting results provided by obsidian hydration analysis at Keystone 36 and 37 should indicate the importance of continuing research on an application of the technique.

At the local level, perhaps the most significant result of the chronometric analysis is the late date indicated for the occupation of Site 37. The date is problematical because the site cannot be adequately placed within the traditional phase framework used in the Jornada area. The range of dates, from A.D. 1100-1400, falls directly in the Pueblo period, and, in terms of traditional systematics, the site should ideally be assignable to either the Doña Ana or El Paso phase. Yet there are no material characteristics of the site which can be used to relate it to either phase.

Pueblo architecture is lacking of course, but even the two recently described examples of El Paso phase pithouses do not resemble the structures at Site 33. There are almost no ceramics at the site and none of the sherds recovered can be assigned to a Pueblo period assemblage. The relative lack of ceramics is significant since many very small sites in the El Paso area do contain painted ceramics attributable to the El Paso phase (e.g., Carmichael 1983a). Furthermore, the lack of ceramics cannot be blamed on site function since sherds have been recovered from other analogous sites in the region (Whalen 1978; O'Laughlin 1979; Hard 1983). Finally, even the projectile points differ in style from the small triangular arrow points generally thought to characterize local Pueblo assemblages.

All of the characteristics of Site 37 most closely resemble those of other sites which have been assigned to the late Archaic or early Formative periods. The adaptations modeled for those periods are high mobility, generalized hunting-gathering strategies. We are thus faced with the very real possibility that such strategies persisted into later times when they were operating during the same general period as Pueblo-based strategies.

The evidence for late foraging sites at Keystone Dam also has broader theoretical significance. Schiffer (1984:41) makes the general argument that archeological chronologies based on wood charcoal will tend to yield dates which are too early, especially for the early Formative. Site 37 seems to be a local example of this general problem. In the absence of the obsidian results, the site would have been assigned a much earlier date. At the regional level, this process may be at least partly responsible for the progressively earlier date attributed to the beginning of the early Formative. The original Mesilla phase (A.D. 900-1100) has been repeatedly lengthened to account for new early radiocarbon dates associated with El Paso Brown ceramics (see Whalen 1980 for a detailed discussion of the ceramic chronology). The possibility that some of the earliest "ceramic-associated" dates may reflect old wood is a vital concern for future research.

Even more disturbing is the possibility that the old wood problem has contributed to the archeological invisibility of late forager sites. It is well known that the Jornada area was occupied by a variety of hunter-gatherer groups at the time of ethnographic contact. It is also well known that these groups remain largely undocumented archeologically. The problem is endemic to the analysis of short-term sites produced by mobile strategies, whether historic or prehistoric. A generalized foraging strategy can be expected to produce ephemeral lithic and ceramic scatters. Most of these are never assigned a phase affiliation. Many others are probably assigned to the late Archaic or early Formative on formal grounds. It is interesting to note that using the induced hydration dating method, Batcho (1984b) has recently identified a large campsite as dating firmly to the mid-16th century A.D. Prior to the use of chronometric dating, the artifact assemblage from the site "clearly" identified an "Archaic" occupation.

Sites like Keystone 37 fit comfortably within archeologists' traditional conceptualization of the late Archaic/early Formative. They would probably be assigned to that period even without the benefit of radiocarbon dates (e.g., O'Laughlin 1980; RFP). Yet the obsidian hydration dates indicate a much later placement. In the absence of the obsidian results, the radiocarbon dates would have allowed, and in fact required, us to assign most of the occupation to the pre-Pueblo time range; precisely the placement which would be most acceptable to the traditional sequence. In other words, radiocarbon chronologies of such sites have probably not received enough scrutiny because they conform to a priori conceptions of the developmental significance of ephemeral sites. The implication is that by not addressing the potential for old wood dates we could be consistently misidentifying late foraging sites, almost by definition. It is our contention that a concerted effort to identify late ephemeral sites will be fruitful and that the use of obsidian hydration will be central to that effort.

CHAPTER 12

POLLEN AND MACROFLORAL ANALYSES

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Introduction

Pollen and macrofloral analyses at Keystone Sites 36 and 37 were at least in part exploratory. Previous attempts to extract pollen from prehistoric sediments in this area have largely met with failure. Therefore, the pollen portion of this study was engaged in establishing whether or not sufficient pollen could be extracted from the samples to warrant further pollen sampling at similar sites.

Pollen and macrofloral analyses were directed primarily toward the recovery of subsistence data. Numerous pollen and macrofloral control samples were taken from the present ground surface for comparison with the archaeological data. Features that were sampled at these sites include large fire-cracked rock features that may have functioned as roasting pits, smaller domestic hearths, shallow pits containing ashy soil but few rocks, and the fill of four shallow, short-term pit structures.

The results of the analyses provide some tentative evidence for agave processing in the large fire-cracked rock features and for the processing of Cheno-ams in small hearths. Also, the identifications of charcoal and charred plant remains point to the use of upland wood resources for fuel. The remaining botanical materials yielded no further information on economic activities at the site. However, the successful efforts to extract sufficient pollen from the unconsolidated sandy soils is of methodological interest.

Methods

The pollen was extracted from soil samples submitted by the Cultural Resources Management Division of New Mexico State University. A chemical extraction technique based on heavy liquid separation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

A sample size of 100 grams was used, as a low pollen density was expected. Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. Zinc bromide (density 2.0) was used for the flotation process. All samples received a short (10 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for three minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of 100-200 grains at a magnification of 430x by Linda J. Scott. Pollen preservation in these samples varied from good to poor. Comparative reference material was used to identify the pollen to the family, genus, and species level, where possible. The identification of selected microscopic fibers contained within the pollen samples was also attempted using cross-polar microscopy. Specific evidence for the presence of Agave was sought. Fibrous remains of the agave plant were used as reference material to observe the morphology of the fibers, as well as the color refractions.

The macrofloral samples were floated at the Cultural Resources Management Division at New Mexico State University. The light fraction was examined for seeds and other botanical remains that may have been present as a result of the use of the features. The samples were sorted and the seeds identified using a stereoscope by Margaret Van Ness, macrofloral consultant to this laboratory.

Results

The extraction of pollen from the sediments at Keystone Sites 36 and 37 using a technique based on heavy liquid separation was successful. A total of 22 pollen samples were submitted for analysis, 18 (82%) of which contained sufficient pollen for analysis. The failure of digestive techniques to extract pollen from similar sediments has been noted by Horowitz et al. (1981). The major problem encountered during the extraction of pollen from the sediments from these two sites was the elimination of extraneous organic matter from the samples. It was this unwanted organic debris that hampered the concentration of pollen in the samples, rather than an actual insufficient quantity of pollen in the soil. Degradation of the pollen made identification difficult in some samples, and as Bryant and Holloway (1983) discuss, degradation of pollen cannot be assumed to be consistent with respect to all types. Rapid degradation of selected pollen types results in an incomplete pollen record for the interpretation of the paleoenvironment. Interpretation of the paleoenvironment was not, however, the object of this study. Negative evidence or the absence of a pollen type has not been used in this study to reconstruct past environmental conditions. The presence of charcoal within archeological hearth samples has also been cited by Bryant and Holloway (1983) as a problem in the concentration of pollen. It did not, however, constitute a problem in the concentration of a sufficient quantity of pollen for analysis in samples taken from hearth areas at these sites. In fact, the question of sampling hearths should be dealt with on the basis of evidence for intensity of the fire rather than the supposition that the presence of charcoal impedes the concentration of pollen to levels sufficient to facilitate counting. Laboratory processing techniques, including swirling and the use of a heated 5% potassium hydroxide solution, frequently make possible the concentration of adequate quantities of pollen for analysis from hearths and roasting pits.

Keystone Site 36

The vegetation in the vicinity of site KS-36 is dominated by Prosopsis (mesquite), Larrea (creosote), and Yucca, although some grasses (Graminae), Portulaca (purslane), Opuntia (prickly pear cactus), Mammalaria (fish-hook barrel cactus), and Javelina bush (a Solanaceae) are also noted. The nearest occurrence of Agave is approximately 300 m to the east of the site on gravelly ridges of the Tortugas surface. The pollen record at this site represents primarily the accumulation of background pollen. The arboreal pollen frequencies are low but include a mixture of pollen from the mountains to the east of the site, which contain scrub juniper and scrub oak, and the riparian communities along the Rio Grande. The primary contributors to the pollen record, both past and present, are the Cheno-ams.

The large quantities of Larrea (creosote) and Prosopsis (mesquite) pollen observed in the two samples from the present ground surface at this site are not observed in the subsurface archeological samples (Figure 67, Table 46). Neither creosote nor mesquite contribute extensively to background pollen rain. Instead, their presence in relatively large quantities is indicative of their presence directly at the locus being sampled. Low concentrations of creosote and mesquite pollen in the subsurface samples may indicate lower densities of those species prior to the last few centuries (York and Dick-Peddie 1969; Horowitz et al. 1981). It is also possible that these shrubs may have been locally cleared by the prehistoric occupants of the sites.

The very large quantities of Cheno-am pollen noted in the archeological feature samples are concentrated in samples from hearths and the small pit (#967). The roasting pit and one hearth sample exhibit smaller Cheno-am frequencies. This correlation of higher Cheno-am frequencies with hearths may represent the utilization of this natural resource by the occupants of the site. Cheno-ams are a resource noted to have been widely exploited by Indians of the American Southwest. The greens may be gathered and cooked, or the seeds collected and ground into a meal to be used alone or mixed with other meal, such as cornmeal (Robbins et al. 1916; Stevenson 1915; Whiting 1939).

Table 46. Provenience of Pollen Samples From KS-36

Sample No.	Level	Feature No.	Provenience	Pollen Counted
KS-36				
506	0	10	Surface control	100
625	1	10	Around roasting feature	200
967	3	14	Small pit	100
1368	0	18	Surface control	200
1374		13	Area around hearth	100
1382	4	13	Area around hearth	100
1403	2	15	Area of small hearth	100
1439	4	18	Area of small hearth	100
KS-37				
1222	1	20	Surface control	200
1271		3	Around roasting feature	100
1589	3	20	Area around small hearth	Insuff.
1834	0	22	Surface control	Insuff.
1836	4	22	Area around small hearth	100
3277		29	Pit structure fill	100
3333		34	Area around roasting pit	100
3350	0	34	Surface control	Insuff.
3362	0	29	Surface control	100
3504		53	Small narrow pit structure fill	200
3511		46	Pit associated with hearth	100
3523		43	Small narrow pit structure fill	Insuff.
3627		55	Pit structure fill	100
3780		35	Pit structure fill	100

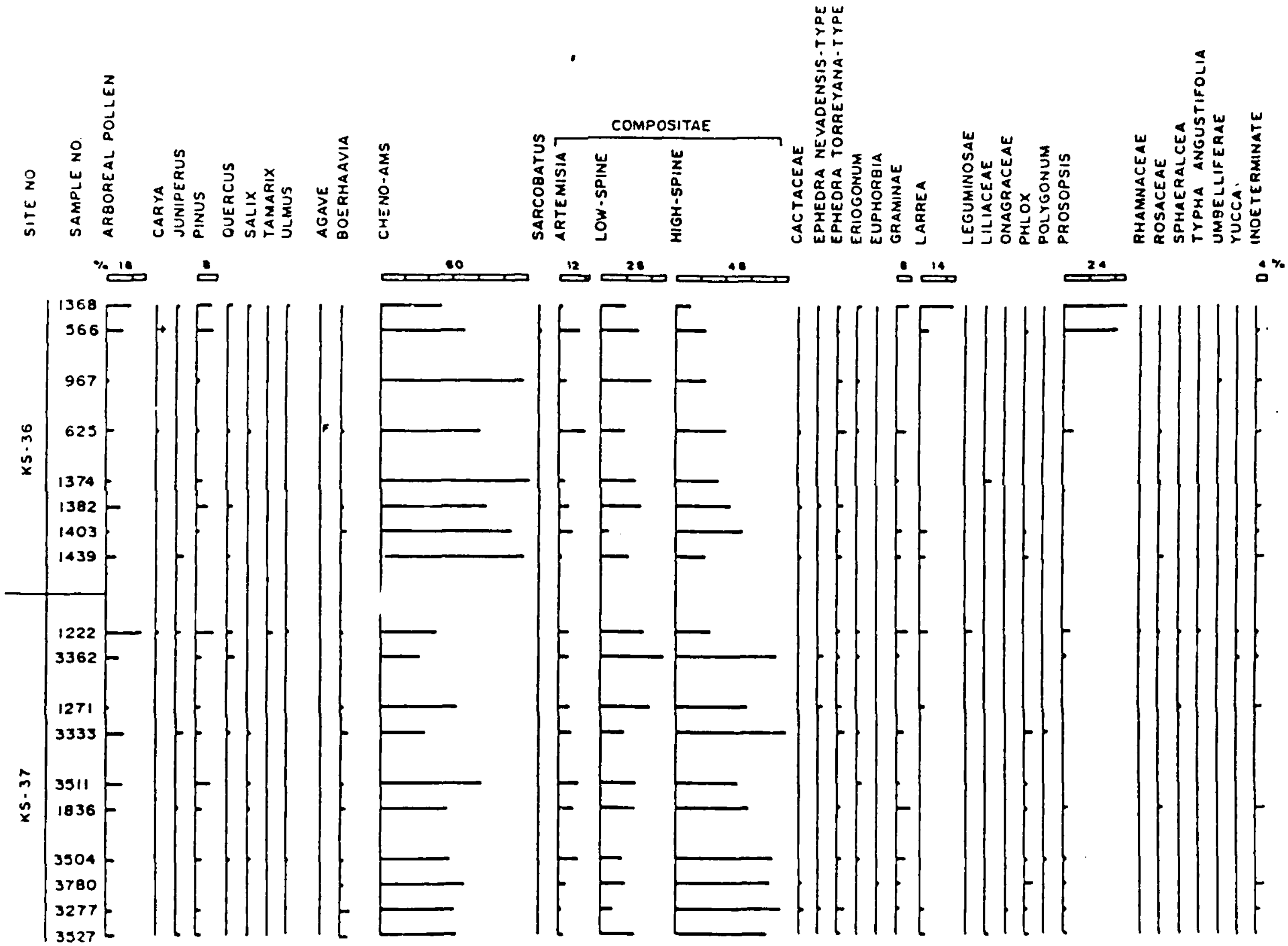

Figure 68. Pollen diagram from Sites 36 and 37.

Prosopsis pollen is noted only in the roasting pit sample, indicating the possibility that mesquite was used as a fuel in this feature. Mesquite beans were widely used for food by Native Americans in the Southwest (Bell and Castetter 1937; Bye 1972; Felger 1977). If these beans were being exploited as a food at Site 36, they would have had to have been roasted in their pods to introduce pollen into the roasting pit. Distilled water washes of various native foods indicates that legume pollen is transmitted only when the pod is present and not when shelled beans are used (Gish and Scott 1983).

Keystone Site 37

The vegetation at KS-37 is also dominated by *Prosopsis* (mesquite), *Larrea* (creosote), and *Yucca* (yucca). Other vegetation noted in the vicinity of this site includes some grasses (Graminae), *Portulaca* (purslane), *Opuntia* (prickly pear cactus), *Mammalaria* (fish-hook barrel cactus), and Javelina bush (a Solanaceae). Composites are noted to be abundant in the nearby arroyos. The pollen record at this site is defined by two samples from the present ground surface, which contain vastly differing quantities of High-spine Compositae pollen. The arboreal pollen reflects both the mountains to the east of the site and the riparian communities of the Rio Grande. Smaller quantities of mesquite and creosote pollen are noted in samples from the present ground surface at this site than at Site 36.

The archeological pollen record at this site is dominated by High-spine Compositae and Cheno-am pollen. The highest frequency of Cheno-am pollen observed at this site was noted in association with a hearth (#3511), indicating the possibility that this resource may have been exploited. *Typha* pollen was noted both in a present ground surface and a roasting pit sample, indicating that the presence of cattail pollen in this feature may represent wind transport of the pollen from the nearby riparian communities. No other pollen types suggestive of economic activity were noted in the pollen record from these features.

Four pollen samples from shallow pit structures that may represent wickiups or sleeping features contain almost identical pollen records to one another. No pollen within these structures is indicative of economic activity.

The identification of plant fibers using cross-polar microscopy is still being pursued. No pollen or macrofloral evidence of *Agave* was noted in samples from these two sites. *Agave* has been an important resource in the past, as is evidenced by the references to its utilization. Whiting (1939) notes that agave buds and leaves were baked in large earth ovens. Cushing (1920) also observed the baking of agave "hearts" or the tender base of the leaves in large roasting pits. The identification of fibers comparable to the reference specimens of agave have been made for Feature 10 (sample 625) at Keystone Site 36. The presence of these minute fibers in the sample taken from the supposed roasting feature suggests that agave may, indeed, have been processed at Site 36. Identification of fibers observed in other samples at both sites has not yet yielded other directly comparable material.

Analysis of the macrofloral remains from both sites was very disappointing. Virtually no charred remains and no charred seeds were noted from these samples (Tables 47 and 48). Minnis (1981) notes that a variety of factors may result in the presence of seeds that have no relationship to economic activity at archeological sites. Therefore, in the absence of mitigating circumstances, uncharred seeds are considered to represent potential contaminants within the site, and only charred seeds are interpreted as indicative of economic activity. The only charred material noted at these sites was a single charred juniper twig fragment in sample 3221, Feature 23, a roasting feature at Site 37. Uncharred juniper twig fragments were also identified in Feature 9 at Site 36 and Features 3, 8, 14, 21 and 28 at Site 37. The presence of a charred Juniperus twig fragment is important in that it establishes the utilization of a resource (juniper) that must be gathered some distance from the site. The present distribution of juniper is in the mountains to the east of the site. The pollen record from both sites indicate that the past distribution of juniper must have been very similar to that of today.

Analysis of charcoal from several roasting pits and hearths (Features 7 and 10 at Site 36 and Features 14, 22, 25, and 34 at Site 37) at these sites was only marginally productive. Generally speaking, two types of small charcoal fragments were observed in the six charcoal samples submitted. A ring porous wood type, probably representing mesquite was noted throughout the samples, as well as charcoal from an unidentified dicotyledenous shrub. The pieces of charcoal were too small in most of the samples to allow positive identification of the wood. Sample 1787, representing Feature 34, a roasting pit at Site 37, contained charcoal fragments large enough to identify positively as mesquite (Prosopsis). None of the charcoal present in these samples was identified as representing juniper.

Summary and Conclusions

Pollen and macrofloral analyses at Keystone Sites 36 and 37 were aimed at assessing the utility of pollen studies at these types of sites, and identifying the vegetable portion of the subsistence base. Extraction of pollen from samples taken from both sites was successful, yielding sufficient pollen for analysis from a total of 82% of the samples. The problem in attaining a sufficient concentration of pollen for analysis lay in ridding the

Table 47. Pollen Types Observed at KS-36 and KS-37

Scientific Name	Common Name
ARBOREAL POLLEN:	
Carya	Walnut
Juniperus	Juniper
Pinus	Pine
Quercus	Oak
Salix	Willow
Tamarix	Tamarisk
Ulmus	Elm
NONARBOREAL POLLEN:	
Boerhaavia	Spiderling
Cheno-ams	Includes amaranth and pigweed family
Sarcobatus	Greasewood
Compositae	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, etc.
High-spine	Includes sunflower, rabbitbrush, etc.
Cactaceae	Cactus family
Ephedra	Mormon tea
Eriogonum	Buckwheat
Euphorbia	Spurge
Graminae	Grass family
Larrea	Creosote
Leguminosae	Pea family
Lilizceae	Lily family
Onagraceae	Primrose family
Phlox	Phlox
Polygonum	Knotweed
Prosopsis	Mesquite
Phamnaceae	Buck-thorn family
Rosaceae	Rose family
Sphaeralcea	Globe mallow
Typha angustifolia	Cattail
Umbelliferae	Parsley or carrot family
Yucca	Yucca

Table 48. Provenience and Contents of Macrofloral Samples from KS-36

Sample No.	Level	Feature No.	Provenience	Contents
491	0	6	Surface control	Larrea (5) Poaceae (3) Yucca (1/1) Charcoal=trace
495	1a	6	Roasting fea. contents	Larrea (2) Poaceae (1) Charcoal=trace
565	1a	7	Roasting fea. contents 2nd area	Echinocactus (1) Larrea (2) Poaceae (2) Unknown frag. (1) Charcoal-trace
312	0	7	Surface control	Larrea (20) Poaceae (10) Yucca (1) Charcoal=none
480	1b	7	Roasting fea. contents	Charcoal=light
388	2	8	Roasting fea. contents	Charcoal=light
670	1a	9	Small ash-filled basin contents	Juniperus twigs (2) Charcoal=light
567	0	10	Surface control	larrea (3) Poaceae (1) Charcoal=light
662	1a	10	Roasting pit contents	polygonum (1) Yucca (1) Charcoal=light
664	1b	10	Roasting fea. contents	Charcoal=light
687	1c	10	Roasting fea. contents	Charcoal=light
1371	0	13	Surface control	Larrea (47+) Leguminosae cf. Prosopsis (5) Poaceae (11) Polygonum (1) Yucca (3/3) Charcoal=light
1473	3	13	Base of hearth	Charcoal=trace
1377	3	14	Small pit contents	Charcoal=light
1398	3	14	Small pit contents	Charcoal=light
1418	2	15	Small hearth contents	Polygonum (1) Charcoal=trace
1402	2	17	Small hearth contents	Portulaca (1) Charcoal=light
1454	4	18	Small hearth contents	Charcoal=light
1462	5	18	Small hearth contents	Charcoal=trace

Table 49. Provenience and Contents of Macrofloral Samples from KS-37

Sample No.	Level	Feature No.	Provenience	Contents
948	2	1	Roasting fea. contents	*Helianthus* (1) *Poaceae* (1) Solanaceae (1) Charcoal=trace
3279	0	2	Surface control	*Helianthus* (1/1) *Larrea* (1) *Polygonum* (1) *Solanaceae* (1)
3305	3	2	Roasting fea. contents	Charcoal=trace
3321	3	2	Roasting fea. contents	Charcoal=trace
1306	3	3	Roasting fea. contents	*Juniperus* twigs *Oxalis* (21) Poaceae (5) *Portulaca* (1) Charcoal=light
828	1	6	Possible control	*Larrea* (2) *Mentzelia* (20) *Opuntia* (1) Poaceae (17/12) *Polygonum* (3) *Yucca* (2) Charcoal=trace
849	2	6	Roasting fea. contents	Charcoal=light
3262	4	22	Small hearth contents	Charcoal=heavy/ abundant
3307	3	8	Poss. control for F. 22	*Juniperus* twig (1) *Pocaeae* (2) *Yucca* (/1) Charcoal=light
887	2	12	Small fcr fea. contents	*Echinocactus* (1) *Polygonum* (1) cf. *Physalis* (1) Charcoal=trace
3368	1	13	Ash stain	Charcoal=light
1241	1	14	Surface control	*Helianthus* (1) *Larrea* (2) Poaceae (10) *Yucca* (1/3) Charcoal=light
1282	1	14	Hearth fill	*Helianthus* (2/1) *Juniperus* twigs *Larrea* (3) Poaceae (13) Charcoal=light
1588	3	21	Small hearth contents	*Juniperus* twig

Table 49. Continued

Sample No.	Level	Feature No.	Provenience	Contents
				Poaceae (1) *Polygonum* (1) Charcoal=light
3221	2	23	Roasting fea. contents	*Juniperus* twigs (1*/1) *Oxalis* (1) Poaceae (1) Charcoal=light
3327	3	23	Roasting fea. contents	Charcoal=light
3225	0	25	Small hearth contents	*Cassia* (1) Charcoal=medium
3216	1	25	Small hearth contents	*Cassia* (1) *Oxalis* (1) Charcoal=medium
3490	profile	28	Hearth fill	*Juniperus* twig (1) *Oxalis* (1) Solanaceae (/1) Charcoal=light
3299		29	Pit structure fill	Charcoal=light
3332	2-4	34	Roasting pit contents	Charcoal=heavy/ abundant
3361		34	Roasting pit contents	Charcoal=abundant
3497	profile	40	Pit structure fill	Compositae (2) Charcoal=light
3513	profile	47	Hearth fill	Charcoal=light
3525	profile	54	Pit structure fill	Charcoal=light
3537	profile	60	Hearth fill	Charcoal=light

Legend:

Charcoal designations:
trace = less than 1 %
light = 1-10%
medium = 10-50%
heavy = 50-90%
abundant = greater than 90%
* indicates charred remains
/ followed by a number indicates seed is a fragment

samples of extraneous organic matter rather than an actual insufficient quantity of pollen.

The pollen record at both sites yielded extremely limited evidence of the exploitation of plants. Site 36, which appears to have been one or more task group camps, contains pollen evidence of the possible exploitation of Cheno-ams. The concentration of Cheno-am pollen in samples taken near hearths is suggestive of the processing of Cheno-ams at the site. A larger group of samples representing other features at this site would be necessary to test this supposition, as only a single nonhearth sample (a roasting pit) was analyzed. Limited exploitation of Cheno-ams is suggested at Site 37, as an increased Cheno-am frequency is noted only in one hearth sample. The use of mesquite as fuel is indicated at both sites by the small quantity of Prosopsis pollen in a roasting pit at Site 36 (#625) and the identification of mesquite charcoal in Feature 34 at Site 37, also a roasting pit. The remainder of the pollen at both sites appears to be indicative of the accumulation of background pollen and cannot be interpreted relative to economic activities at these sites.

A small quantity of microscopic fibers in the pollen samples are presently being analyzed. Fibers most comparable to Agave fibers in sample 625 suggest that agave may have been roasted in Feature 10 at Site 36.

The macrofloral record from both sites was particularly unproductive since no charred seeds were recovered. The only charred remains observed in the flotation samples was a single Juniperus twig fragment. The presence of a charred juniper twig suggests that juniper may have been collected from the mountains to the east of the site for use either as an additional fuel source or perhaps for exploitation of the berries. Analysis of charcoal from six features identified mesquite (Prosopsis) as a fuel source used regularly at these sites. In addition, an unidentified dicotyledenous shrub was also used as a fuel.

CHAPTER 13

DISCUSSION AND INTERPRETATIONS

In this chapter the results of the foregoing analyses are synthesized in an attempt to provide interpretations of the prehistoric occupations at Keystone Sites 36 and 37. The nature of their respective systemic contexts is also examined as a way of explaining the observed differences in material contents between the sites. Simple models are presented for settlement patterns and mobility strategies which could account for the differences. It is suggested that, although similar in function, Sites 36 and 37 were produced in the context of different mobility strategies, with the former representing a logistic task group camp and the latter a short-term residential base camp.

When combined with the results of the chronological analysis, these interpretations hold significant implications regarding traditional conceptualizations of the local archeological sequence. The implications are presented in terms of the problems associated with the use of a normative phase sequence. The three main topics to be considered below are site context settlement pattern models and cultural systematics.

Site Context

For the purposes of this discussion, site context is taken to be its role within an overall adaptive strategy (see Binford 1962) as distinct from its function (e.g., agave roasting camp, lithic quarry, etc.). As discussed in Chapter 3, individual components of an adaptive strategy can ideally be expected to exhibit variability in their artifact inventories and locations which reflect their resource procurement function. In addition, variability in artifact and feature contents among sites can also be expected to reflect their systemic context, or role relative to other components in the same adaptive strategy. Site function and site context are not viewed as identical concepts.

It has been argued above that Sites 36 and 37 both represent similar site functions. Large fire-cracked rock features are prominent aspects of both sites, and various lines of evidence suggest that they functioned as roasting facilities for the processing of leaf succulents. The features resemble ethnographic examples of agave ovens, and some have yielded remains of leaf succulents. The sites containing such features are located generally in the zones which produce leaf succulents, and intra-site distributional patterns support a specialized, perhaps communal, use of the features. It is safe to conclude that at least a major portion of the function of both sites involved the procurement and processing of plant resources such as agave. Nevertheless, the sites differ on a number of details relating to their feature inventories, degree of intrasite distributional patterning and the relative frequency of artifact types. The differences suggest that, in spite of their general similarity, Sites 36 and 37 may have articulated differently with their respective overall adaptive strategies.

Sites 36 and 37 are also generally comparable in terms of gross site typology. Certainly they would be classified similarly in the context of most archeological surveys; both were tentatively reported as short-term procurement camps (O'Laughlin 1980:247-249). During previous studies in the nearby Tularosa Basin, a series of traits were identified which can be expected to reflect prehistoric occupations of differing duration (Carmichael 1983a, 1983b). A basic distinction can be drawn between long-term habitation sites (i.e., villages, long-term base camps, etc.) and various types of shorter duration campsites. It was suggested that long-term residences should be characterized by some or all of the following: formalized trash disposal leading to the accumulation of a midden, greater variety and quantity of ceramics, greater variety of artifact types, larger dwelling sizes and greater numbers of storage features (Carmichael 1981, 1983b:101-102, 111). It was also predicted that long-term residences will generally be winter sites located in the proximity of reliable water supplies while the sites dispersed throughout the desert basins will likely represent summer occupations (ibid.:152-160; Carmichael 1983c).

These characteristics serve to distinguish long-term habitation sites from shorter term, limited activity sites. Again, using these criteria, Sites 36 and 37 both could be identified as short-term procurement camps within the same adaptive strategy. As such they can be seen as the result of occupations by relatively small and mobile groups. Nevertheless, the persistent, albeit subtle, differences between the sites suggest the existence of corresponding differences in their deposition. It is suggested that different types of mobility patterns can account for the observed differences between Sites 36 and 37.

Binford (1980) identifies two different types of movement expectable in the context of hunter-gatherer adaptations, residential mobility and logistic mobility. Residential mobility is seen as characteristic of foraging strategies where base camps are periodically moved to facilitate the exploitation of specific resources. Logistic mobility is the type of movement associated with the use of short-term procurement camps situated beyond the foraging radius of a base camp. Even if two sites are located with respect to the same set of resources, they might still be distinguishable on the basis of the type of mobility pattern reflected in their remains. As noted in the discussion in Chapter

3, the differences are expected to be related to length of occupation and the degree of functional and spatial redundancy among multiple occupations.

Duration of Occupation

The hypotheses discussed in Chapter 3 have been tested using data on artifact assemblage variability and intrasite distributional patterns. While not all of the hypotheses are confirmed, the most elementary results, relating to Hypotheses 2, 6 and 7, suggest that Sites 36 and 37 do represent occupations of differing duration, intensity and redundancy.

One of the main differences between the sites is the presence of house structures at Site 37 but not at 36. If the presence of structures were accepted as evidence for greater labor investment, it follows that they will more likely occur in the context of a longer occupation. As noted in Chapter 8, the Site 37 structures are the most ephemeral yet identified in the El Paso area. On this basis it can be suggested that the relative length of the occupation at Site 37 is probably greater than at Site 36 but less than most (or all) of the other structural sites listed in Table 17. The corollary expectation that the variety of features will vary directly with the length of occupation (Hypothesis 6) is also supported.

Some distinctions were also noted between the artifact assemblages at Sites 36 and 37. It was expected that the relative homogeneity of the assemblages would vary inversely with the duration of occupation (Hypothesis 1) but the hypothesis was not confirmed as written. Such variability as exists between the diversity of assemblages is likely due to the size of the collections rather than any significant difference in site function. What can be suggested with some degree of confidence however, is that the larger size, and hence, greater variety of the Site 37 assemblage is indicative of longer term (i.e., more intensive) occupation. The occurrence of functionally similar but longer term use of Site 37 accords well with the suggestion that differences between the sites reflect different logistic contexts.

Significant differences in the relative frequencies of some artifact types were demonstrated (Chapter 9). Site 36 contains higher proportions of tested cores, hammerstones, anvils and angular debitage, all indicative of the early stages of core reduction. An emphasis on initial reduction also fits the logistic model. It was argued that these artifact frequencies could be produced by the occupants of Site 36 collecting and selecting raw material nodules for removal to a more permanent residential base. Raw material distributions support the view that such selectivity was indeed taking place; Site 36 contains significantly higher proportions of fine-grained materials.

Hypotheses 3 and 5 relate to the intensity of manufacture and use of formal tools. They predict that long-term occupations should exhibit lower ratios of tools to debitage and greater intensity of utilization and modification. These expectations were not confirmed by the analysis. The tool to debitage ratios are nearly equal, with Site 37 having a slightly higher value (Site 36, 1:7.7; Site 37, 1:6.4). In addition, the percentage of utilized artifacts and degree of modification are similar at both sites. (Chapter 9, Tables 19, 31). It should be noted, however, that the predictions of these hypotheses are based on comparisons at the level of long-term residence <u>versus</u> short-term camp. Since both Sites 36 and 37 are interpreted as relatively short-term camps the similarity between their tool:debitage ratios is expectable.

The kind of variability predicted by the hypotheses is demonstrable in a comparison of Keystone 36 and 37 with other assemblages reported from the El Paso area (O'Laughlin 1980:221). The Trans-Mountain Campus sites and Public Free School Land sites are short-term camps which also have ratios very similar to Sites 36 and 37 (1:5.7 and 1:9 respectively). In contrast, several sites interpreted as long-term residences exhibit very much smaller tool to debitage ratios: Keystone 33 (1:17), the Sandy Bone Site (1:61) and Three Lakes Pueblo (1:37). Thus, the relationship specified by the hypotheses appears to hold. It merely serves to distinguish short-term from long-term sites rather than identifying differences between the two short-term sites.

Additional support for structural differences between Sites 36 and 37 is provided however by a comparison of the intrasite distributional patterns. It is expected that activity patterning will be more readily discernible on sites of longer duration (Hypothesis 7). As was detailed in Chapter 11, the expectation is borne out by the fact that a distinct partitioning of space is indicated at Site 37 but not at 36.

Taken together, these results suggest that Site 37 was occupied for longer periods (or perhaps by larger groups) than Site 36. Also, some of the important activities at Site 36 (raw material procurement) appear to have been related more to anticipated needs at other sites than to the immediate requirements of agave processing. This line of argument finds further support in some of the detailed artifact analyses.

Artifact Functions

Two main analyses of artifact function are presented in Chapter 9 which also bear on the distinction under consideration between Sites 36 and 37. These are the distributions of edge angles on utilized flakes and formal tools, and the types of modification and reduction sequences indicated. A very clear difference between the sites is documented on the basis of edge angle distributions. Site 37 exhibits a wider range of edge angles than 36, supporting the interpretation that a wider range of activities is indicated at 37. Furthermore, most of the edge angles at 37 fall into the range associated with light cutting and light scraping tasks. In contrast, the high edge angles characteristic of Site 36 most likely reflect an emphasis on heavy scraping and chopping. It is precisely this type of function which has been suggested for tasks involved in processing leaf succulents (O'Laughlin 1980). A greater degree of specialization toward the processing of succulents appears to be indicated for Site 36, with additional general domestic activities also represented at Site 37.

The assemblages at both sites can be characterized as primarily expedient in nature. However, subtle differences in the reduction sequences provide further support for the distinctions enumerated above. Specifically, Site 36 exhibits a procurement and reduction sequence which reflects a more logistic mobility pattern. Local gravels are the main source of raw materials at both sites, but a greater degree of selectivity for fine-grained cherts is suggested at Site 36. This observation comes not from the tool counts as much as from the relatively higher proportions of tertiary flake debitage and microdebitage. Biface manufacture and/or finishing is indicated by these proportions but few such tools were recovered at the site. The most likely explanation for this is that the resulting bifacial tools (or preforms, cores, etc.) became part of a curated technology and were removed from the site. In other words, one aspect of the lithic reduction sequence involved an embedded procurement (Binford 1979) of preferred materials. Debitage produced during reduction of these materials was deposited at the site but the tools were not.

In contrast, a more complete sequence of manufacture, use and discard is evidenced at Site 37. This again points to a greater variety of on-site behaviors associated with a somewhat longer duration of occupation. The latter pattern is more readily attributed to a strategy of residential mobility than logistic mobility. Different types of mobility are thus viewed as a useful way to model settlement patterns which could produce the types of differences observed between the two sites.

Settlement Models

It had originally been hoped that it would be possible to construct some rather explicit settlement models incorporating the other excavated sites in the El Paso area in general and at Keystone Dam in particular. Such an effort has been hampered by the lack of contemporaneity among the sites. Keystone 36 and 37 do not date to the same period as Sites 32, 33 and 34, nor are they contemporaneous with each other. Site 36 fits readily enough within the expected range of Mesilla phase sites. Its probable role as a short-term specialized procurement camp is reported from previous work in the El Paso area (Beckes 1977; Whalen 1977, 1978; O'Laughlin 1979, 1980; Carmichael 1983a; Hard 1983). Although the nature of the mobility strategy inferred for Site 36 is of interest, it is better handled as part of the more general discussion presented below. The bulk of the new information provided by this study comes from the discoveries made at Site 37.

Keystone 37 does not fit the traditional expectations for ephemeral lithic and ceramic scatters in the El Paso area. The most significant departure is the evidence for occupation late in the prehistoric sequence, at about A.D. 1100-1400 (see Chapter 11). As discussed earlier, the site dates to the Pueblo period but cannot be assigned to any of the Pueblo phases on formal grounds. It is difficult to discuss the settlement pattern relationships of the site since few other sites have been excavated which could be suggested as examples of complementary components within the same adaptive strategy. Some possible examples are mentioned in the later section on Mobility Strategy Models.

One section of the RFP called for an evaluation of the usefulness of a catchment analysis approach for interpreting the function of Sites 36 and 37. An attempt was made to see whether a catchment approach would be useful in defining the environmental potential of the site locations involved in this study. The approach proved to be of little use for several reasons. These include difficulties inherent in the catchment techniques as well as characteristics of the behaviors represented at the two sites.

In a critical review of the method of catchment analysis, Roper (1979) identifies a number of difficulties associated with the technique. Chief among these is the problem of defining and justifying the size of the catchment to be studied. Implicit in the use of catchments is the assumption that the territory defined relates in some way to the actual behavior of the site's occupants. However, most analyses utilize catchments of a standard size such as a circle of 5 km radius.

The range of resources observed within the arbitrarily defined catchment may or may not have been significant in conditioning prehistoric behavior. The appropriate size of a catchment for any given site will be greatly affected by the type of mobility strategy within which the site is formed. In general, it is probably the case that standard catchment radii underestimate the distances travelled in the context of logistic mobility. For example, at Fresnal Shelter in the Sacramento Mountains northeast of El Paso, a very direct relationship is indicated between the long-term base camp in the mountains and procurement areas in the Tularosa Basin. Indian rice grass (Orizopsis) was apparently collected in some quantity on the basin floor and then transported to the shelter for processing (parching and winnowing) (Human Systems Research 1973; Eidenbach and Wimberly 1981). The distance over which these activities were carried out is in excess of 10 km. A standard catchment zone circumscribed around the shelter would not identify rice grass as a significant resource.

A second major problem arises from the type of site under investigation. Catchment analysis was originally intended for use at relatively sedentary, long-term occupation sites, and most applications of the technique have continued in this vein. Estimation of the resource potential within such catchments refers essentially to to what Binford (1982) calls the foraging radius, or the area within which daily trips are made. It can be argued that for site types other than long-term residential bases, the range of resources available may be unimportant.

In the case of logistic camps and short-term base camps (Binford 1980; Tartaglia 1980) the distribution of a single target resource may be the most important factor in site location. In an analysis of site catchments within a hunting-gathering strategy in southern California, Tartaglia (1980:189-190) notes that fixed radii catchment estimates are poor predictors of site density. The importance of water sources and transport routes appear to override considerations of catchment productivity as measured by biomass. He suggests that comparable analytical results could probably be obtained without the formality imposed by the catchment zone.

Flannery (1976) has applied one example of a less formal approach to catchment analysis in Oaxaca, Mexico. The study was based on the empirical evidence, provided by botanical analysis, for the actual range of plants utilized prehistorically. The results indicated that standard catchment radii would tend to underestimate the range of resources utilized and the distances from which they were procured, at long-term residences. Conversely, logistic camps showed evidence for the use of a narrower range of species than would be predicted from a standard 5 km radius catchment. This latter situation also appears to be relevant to the discussion of Sites 36 and 37.

If a catchment area with a 5 km radius were drawn around Sites 36 and 37, the resulting circle would extend from the Franklin Mountains on the east to the edge of the La Mesa surface west of the Rio Grande (Figure 1). Nearly half of the area inside the circle would fall within O'Laughlin's riverine environmental zone (1980:15). Under the assumptions of catchment analysis one would expect riverine resources to have been important to the sites' occupants, and to comprise a significant portion of the remains recoverable from the archeological deposits. This suggestion could not be further away from the actual situation recorded at the sites.

There is no clear evidence at Sites 36 or 37 for the exploitation of riverine resources. Almost all of the botanical remains can be identified as pertaining to upland environmental zones. Mesquite is the dominant wood used for fuel, although juniper is also present. As discussed in the context of the old wood problem, driftwood could be a potential source for either species. However, if driftwood were being collected (i.e., if the riverine resource zone was being exploited), one could expect an admixture with riverine species like those utilized at Keystone 33 (cottonwood, tornillo, desert willow and Phragmites).

What appears to be indicated instead is the use of upland resources in the lower and bajada zones and perhaps the Franklin Mountain foothills. The resulting catchment area would be irregular in shape, extending north and south of the sites, east to the Franklin Mountains, but not west into the river valley.

It is interesting to note that Mescalero Apache procurement of agave follows a similar pattern. After choosing a location for the processing camp, an area within approximately 8 km of the site is searched for suitable plants. The area is not circular; however, it is confined to the environmental zone within which the agave are concentrated (Carmichael, unpublished field notes). In many places this translates into a foraging zone elongated north to south, with plant distributions restricted in the other directions by topography. The analogy to the Keystone Dam setting is clear.

In short, it can be argued that standardized circular catchments are not relevant for the analysis of exploitative patterns relative to limited activity sites. By definition, the sites are oriented with respect to a single primary resource, rather than the range of resources available within a catchment.

Mobility Strategy Models

It has been argued that Sites 36 and 37 are both relatively short-term camps located at least in part for procuring and processing leaf succulents. As such they are only one component of an adaptive strategy. Differences in their respective systemic context can be modeled in order to explain the observed differences in the archeological remains. Site 36 is best interpreted as a short-term logistic (or task group) camp and Site 37 is inferred to represent a short-term base camp. Schematic diagrams of their hypothetical systemic contexts are presented in Figure 69. The similar placement of Sites 36 and 37 within Figure 69a and b is intended to emphasize the fact that similar resources in similar locations could be exploited differently in the context of differing mobility strategies.

Site 36 is suggested to be an example of a logistic camp. In other words, it would be ancillary to a long-term residence but would occur beyond the daily foraging radius of that site. Occupations could be expected by task groups, or specialized segments of the population resident at the long-term residential base. Possible analogues for the longer term sites would include Mesilla phase pithouse sites such as Los Tules or the Roth Site, and several such bases might be involved in an annual round. The use of Site 36 would be for short periods of time (perhaps only days), and periodic reoccupations would tend to obscure any intra-site patterns. The short duration of occupation, smaller group size and more specialized function are indicated by the lower numbers of artifacts, lack of residential structures, smaller variety of edge angles and emphasis on lithic raw material selection.

Site 37 was apparently located with the same general function in mind, namely the procurement of leaf succulents. It is also viewed as one type of limited activity site, in contrast to longer term sites in the area such as Keystone 33. The differences between Sites 36 and 37 can be accounted for if Site 37 is modeled as originating within a different mobility strategy. The site is suggested as an example of a short-term residential base camp within a strategy of high residential mobility.

Within such a strategy short-term base camps would be occupied by a small but diverse population (i.e., families rather than specialized task groups). The more diverse composition of the groups, as well as a somewhat longer duration of occupation are seen as the source for the greater variability among edge angles and lithic artifact densities. A higher incidence of on-site processing and maintenance activities could be expected at a base camp and would account for the deposition of greater percentages of waste flakes and less specialized core reduction.

The duration of occupation would still be short as compared to sites like Keystone 33; in the case of agave processing, perhaps a stay of days to weeks would be a reasonable expectation. Other hypothetical sites representing different functional components (Figure 69) could exhibit quite variable durations depending on the nature of the resources exploited. The site was reoccupied with a high degree of redundancy in both function and internal structuring of activities. This could suggest a tightly organized logistic system (Binford 1982). It is unknown whether the sequence of occupations depicted in the model diagram would be tied into a longer term residence at some point. As shown, the high residential mobility follows a point-to-point pattern (Binford 1980) without the use of a (semi-) sedentary base. The addition of home bases to the diagram would produce a model like Biella and Chapman's Model II (1980:36) in which a long-term residence is occupied only seasonally with most resources being exploited through high residential mobility during other times of the year. Given the short duration inferred for

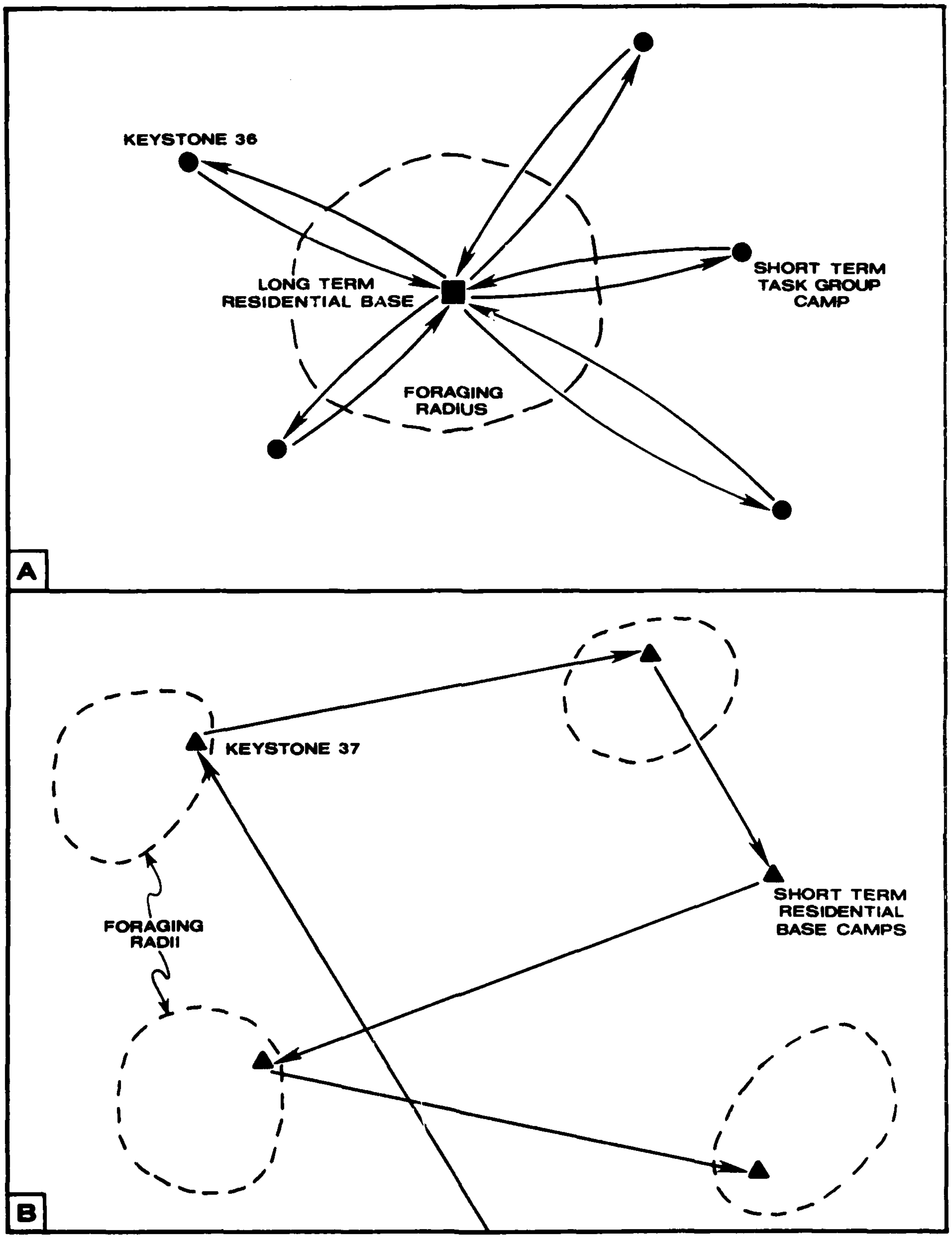

FIGURE 69: Hypothetical mobility patterns related to Keystone Sites 36 and 37.

Site 37, the latter model seems more likely but conclusive testing will have to await the investigation of additional sites representing other components of the local adaptive strategies.

Relatively few archeological sites in the El Paso region have been adequately excavated and dated. Even fewer exhibit the formal, temporal and distributional characteristics which would allow them to be modeled as components complementary to Site 37 in a mobile strategy. However, there is enough information available on hunter-gatherer settlement patterns to support some tentative predictions for additional components. Virtually all the available evidence on hunter-gatherers in the southern Southwest points to the importance of upland resources and settlements to the overall adaptive strategy. With this observation as a baseline, it is suggested that strategies of high residential mobility in the southern Jornada will be largely, or mostly, upland strategies (see also, Wimberly 1979).

Prior to the reservation period, local Indian settlements were not confined to the mountain zones as they have been for the past 100 years. Nevertheless, a variety of ethnographic accounts of the Apache (e.g., Whiting 1849; Basehart 1974) record the importance of seasonal movement between the lowlands and uplands. These two areas contain the major permanent water sources which have probably structured the settlement patterns of all mobile groups in the region. In the El Paso area, Apache settlement involved the use of winter base camps along the Rio Grande, with summer encampments in the Organ, Sacramento or Guadalupe Mountains.

Upland site locations were also important during the Archaic period. Norman Whalen (1971) notes that Cochise sites are larger and more numerous in the lower mountains and foothills in southeastern Arizona. A similar situation is suggested by survey data near the Franklin and Organ Mountains at Fort Bliss (Carmichael 1983b). Recent work at the mouth of Rhodes Canyon in the San Andres Mountains also identified substantial preceramic occupations (Eidenbach 1983) in the lower mountain zone. Higher mountain elevations are well known locally for their rock shelters and extensive hunting camps. In the southern Jornada, such sites are poorly reported but examples are provided by Fresnal Shelter (HSR 1973; Carmichael 1982) and the series of camps in Caballero Canyon (Southward 1978) on the west face of the Sacramento Mountains. It is noteworthy that several studies have recorded the juxtaposition of Archaic and Apache sites in upland areas (Southward 1978; Eidenbach 1983), supporting the generality of the pattern for hunter-gatherers.

Earlier views notwithstanding, it is becoming more widely acknowledged that the Mesilla phase also represents a hunter-gather adaptive pattern (O'Laughlin 1980; Carmichael 1983a; Hard 1983). During an intensive survey of the southern Tularosa Basin, it was found that the larger Mesilla sites occur in the upper alluvial fans near the Organ Mountains (Carmichael 1983a). The largest pithouse villages, such as the Hatchet Site, in the basin have been recorded at even higher elevations, in the mouths of canyons issuing from the Sacramentos (Marshall 1973; Beckes 1977). The occurrence of villages in mountain canyons has also been reported for the Hueco Mountains (Betancourt 1981) and the pattern is very likely a general one throughout the region. Long-term residential sites, such as those near Maynili in the southeastern Sacramentos, have long been known to occur in major drainages. This pattern remains rather poorly studied in the the southern Jornada, but a pithouse site near Mescalero (Del Bene and Rorax 1984) is a recently excavated example.

Although all the above sites are analogous to components that could be associated with Site 37, none are from the appropriate time range. The only local site which appears contemporaneous with Site 37 is Peña Blanca in the southern Organ Mountains. After several years' excavation by the NMSU Field School, preliminary indications are that a series of shelters in the low mountains served as late summer/early fall camps (Steadman Upham, personal communication). Despite its similarity to Archaic settlement patterns and the presence of Archaic-style dart points, Peña Blanca has been dated to the A.D. 1000-1300 range (Appendix 3d). While one or two sites certainly do not define a settlement pattern, it appears that some aspects of a late Formative hunting-gathering strategy may already have been documented. The main problem at present would appear to be the issue of archeological visibility, since both Peña Blanca and Site 37 resemble late Archaic and early Formative sites.

Note that while lowland riverine sites were a major component of Archaic mobility patterns (O'Laughlin 1980) the same settlement options may not have been available to post-A.D. 1000 groups. If portions of the Rio Grande Valley were periodically devoid of farming populations, riverine areas would be readily available within mobile strategies. At any point when this was not the case, it seems likely that some displacement would be involved. That is, the greater the area of the river valley exploited by sedentary farming strategies, the more likely that mobile hunting strategies would be displaced into upland settings. Thus, upland site locations may have become even more important, for certain strategies, after the Archaic period. Other local areas which should be investigated for evidence of late high mobility strategies include Soledad Canyon in the Organ Mountains, the Sierra Juarez and the East Potrillo Mountains.

One further point should be made regarding the potential for additional archeological variability produced as a result of seasonal changes in mobility strategies. Biella and Chapman (1980: Figure 2) model a point-to-point pattern of high residential mobility as if it were a consistent strategy throughout the yearly round. However, the use of one mobility strategy does not preclude the use of a different strategy during a different season. For example, a pattern of high logistical mobility might be used during the dry season when water resources are more localized, with a complementary pattern of high residential mobility characteristic of the moist season (Lee 1968; Binford 1982). Hard (1984) has suggested precisely this type of variability for the local Mesilla phase settlement pattern.

At present it is not possible to determine the season of occupation for Keystone 36 and 37 with any degree of confidence. However, it is possible to mention some possibilities which have been modeled for similar settings within Archaic and Mesilla phase strategies. Laumbach (1982) recently investigated an Archaic camp (NMSU 808) located just east of Las Cruces, New Mexico, in a bajada setting similar to that found in the Keystone area. He suggests that the site would have been repeatedly occupied primarily during the late fall, winter and early spring. Mesquite, saltbush and grass seeds are suggested as the targeted resources and the site is modeled as a logistic camp ancillary to a long term residential base located along the Rio Grande. Such an interpretation does not fit our view of Site 37, but a similar pattern may be appropriate for Site 36. However, NMSU 808 lacks any evidence of large roasting features, suggesting that a different set of resources, and quite possibly, a different season of occupation characterized use of the two areas. It should be noted that although favored during some seasons more than others, agave was available to, and used by, aboriginal populations during all times of the year.

Previous work in the southern Jornada has suggested that large portions of the landscape were identified as broadly homogeneous resource zones and were exploited primarily through the use of short-term camps (Carmichael 1983b). Examples of such resource zones would include the desert basin floor, probably used for grasses, and the bajadas and mountain foothills where concentrations of leaf succulents would be available (Applegarth 1976; Katz and Katz 1981; Carmichael 1981). Hard (1984) has suggested that within the local Mesilla phase a pattern of high residential mobility characterized the summer occupation of such resource zones.

Although it is not possible to demonstrate that either of the Keystone sites were in fact summer occupations, there is some evidence at Site 37 to support that view. Recall that the structures at the site contained few artifacts and no evidence for internal hearths, indicating that most of the activities were accomplished outdoors. That the structures' hearths were not required for warmth accords with, but does not demonstrate, a pattern of warm season occupation.

Referring back to the diagram, the two models are thus not viewed as stable yearly strategies. Site 36 could represent one segment of several different yearly or seasonal strategies. All that can be suggested is that the camp was ancillary to another site which was to some (undetermined) extent larger and more permanent.

Site 37 could also represent several different segments of a mobility strategy. It could be part of a yearly pattern of point-to-point mobility or one of several short-term base camps related to one or more long-term residences occupied only seasonally. Although the latter pattern seems more likely, other possibilities cannot yet be ruled out. What can be suggested is that the site indicates a different systemic context than Keystone 36. Site 37 reflects occupation by a somewhat larger and more diverse group, for a longer period of time, than is suggested by Site 36.

Cultural Systematics

One of the most significant results of this study is the identification of Site 37 as a product of high levels of residential mobility late in the local archeological sequence. The mobility pattern attributed to the site is not unusual; it is often attributed to Archaic and early Formative period sites in the Southwest. What is unusual is that the site is securely dated to the Pueblo period. The most likely occupation at Keystone 37 is within the range of A.D. 1100-1400 (see Chapter 11). Nevertheless, none of the structural or artifactual remains recovered at the site can be used to assign Site 37 to either of the local Pueblo phases. The difficulties encountered in trying to identify the cultural systematics of the site provide a classic example of the problems associated with the use of normative phase frameworks.

The normative characteristics of phase frameworks have already been discussed in Chapter 3, but the main points are reviewed here. Phase definitions are usually based on the series of traits identified at the larger and more visible sites in a region. Small lithic and ceramic scatters can be difficult to interpret within such a scheme since they often lack the key attributes necessary to identify phase affiliation. The developmental sequence implied by most phase frameworks also assumes a homogeneity of material culture for an area at a given time period (Plog 1983:290, 311). All sites in the region are assumed to be relevant to the developmental trajectory defined by the sequence of phases at the larger sites. Finally, phase sequences usually imply that directional culture change is shared by all inhabitants of a region (Cordell et al. 1983).

Recent work by Adams (1980) and Stuart and Gauthier (1981) recognizes the possibility that more than one adaptive strategy may have contributed to the archeological record, even within the same region. Cultural succession is viewed as the result of the interaction between two dichotomous evolutionary poses or adaptive strategies, referred to as stable and resilient strategies (or power and efficiency in Adams' terms). Stable poses are characterized by high rates of population growth and high rates of productivity and energy expenditure within an intensive adaptation (Stuart and Gauthier 1981:10). Resilient poses exhibit more stable levels of population and energy expenditure and are directed toward the maintenance of hemeostasis through the use of a generalized, extensive adaptation.

Although most cultural systems probably fall somewhere in between the extremes, local variability can be produced by at least two conditions. First, one must allow for the possibility that a system which is in a stable strategy at one point in time can oscillate toward the resilient pose during another period (e.g., Cordell and Plog 1979). Second, one must accept the potential for stable and resilient strategies to coexist at any time after the development of intensive sedentary strategies (Wimberly 1979; Plog 1983; Cordell et al. 1983).

The sites used to define phase sequences will most likely be those representing the remains of stable strategies while the remainder of the archeological record could pertain to both types of strategies. In areas where both stable and resilient strategies were present, either contemporaneously or sequentially, the more visible remains of the stable pose are likely to be emphasized at the expense of the resilient pattern. This is probably the reason that Apache occupations of the southern Jornada region remain largely invisible archeologically, and the argument applies to sites like Keystone 37 as well.

Prior to the initiation of the chronological analyses discussed in Chapter 11, Site 37 was interpreted as a late Archaic or early Formative campsite. The assignment was made primarily on the basis of the general formal characteristics evident in the surface scatter; it was readily acceptable in light of the traditional conceptualization that strategies of high residential mobility occur early in the prehistoric sequence. The late dates obtained from Site 37 require a reassessment of these traditional expectations. The evidence for residential mobility, noted above, and the lack of materials which can be identified as Puebloan suggest that the site was produced by a different strategy than the one characterizing the sites upon which the phase sequence is based.

There are several potential explanations for the general contemporaneity of different mobility strategies. The reader is reminded that the term strategy is employed with the explicit intent to avoid ethnic connotations. While different strategies could reflect different ethnic groups there are several possible explanations for variable strategies. First, a late mobile foraging strategy could be a previously unreported component of the local Pueblo-based strategy. This would imply a greater amount of variability within the strategy than has been identified to date. Indeed, the problem of identifying such sites as part of a Pueblo system would remain unresolved. Second, a high mobility strategy could periodically be adopted by some groups in lieu of a Pueblo-based strategy. In other words, high levels of residential mobility could indicate an oscillation in the direction of a resilient pose. Third, a highly mobile strategy could have coexisted in time and space with a more sedentary strategy. The cooccurrence of intensive and extensive (i.e., farming and gathering) strategies is commonly reported in the ethnographic literature but archeologists have been slow to address the potential effects of such a situation on the prehistoric record. Finally, the late occurrence of resilient strategies could represent the influx of different ethnic groups such as early Manso or some other mobile population.

It is not clear that present archeological methods and theory can settle the issue of ethnicity, especially among low visibility material remains. The matter of ethnicity is not yet the main issue, however. The point is that, through one or more of the above scenarios, resilient strategies were in operation in the southern Jornada. They have been poorly reported for a variety of reasons, including prominently the expectations derived from traditional systematics. The first necessary step is to recognize, as Mobley (1979) has for the Upper Pecos River drainage, that Archaic-like adaptive strategies and technologies need not be confined to the Archaic period. Similar remains can be expected to be produced by strategies with similar levels of residential mobility regardless of their age. An awareness of this possibility will not only enhance our understanding of late mobile adaptations but will bring a more critical perspective to the way relationships between villages and campsites have traditionally been modeled.

Summary and Conclusions

This report has presented the results of archeological excavations at Keystone Sites 36 and 37 on the west side of El Paso, Texas. Mitigation was required because of the anticipated destruction of the sites during construction of a flood diversion channel in connection with the Keystone Dam. The fieldwork was accomplished by crews from New Mexico State University between December, 1983 and March, 1984. A variety of significant substantive, methodological and theoretical findings have resulted from this study.

The preservation of features and the overall integrity of the site was better than had been expected and the resulting analyses have been more informative than is generally anticipated for ephemeral sites. A variety of excavation techniques were employed during the investigation, including judgmentally and

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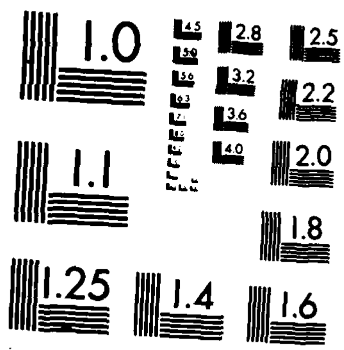

ICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

randomly selected hand excavation units, two phases of backhoe trenching and mechanical horizontal scraping of large areas of the sites. All the techniques played an important role in the recovery of useful data, but the use of backhoe trenches was especially critical since the residential structures discovered at Site 37 were first located by this method.

The structures are generally similar to features recorded on a number of southern Jornada sites, except that they are smaller and exhibit no evidence of burning. As a result they yield very subtle archeological manifestations which are very difficult to detect in standard horizontal excavation units. These kinds of features have very likely gone unrecognized in the past and further systematic use of backhoe sampling promises to disclose more examples in the future.

In Chapter 5 the topographic setting of the sites under investigation was discussed. It was possible to identify specific characteristics of the soils and clast lithologies associated with different geomorphic surfaces which appear to have been important to prehistoric occupants of the sites. The distinctiveness of the patterning should allow researchers to extrapolate the settlement/land use patterns identified at Keystone for a considerable distance upstream along the Rio Grande Valley.

The function of fire-cracked rock features was examined and, in accordance with previous investigators, the group of larger features is interpreted as representing specialized roasting facilities for processing leaf succulents. It is not felt that the small hearths are functional equivalents of the large features. Rather, the small fire-cracked rock features are most likely the result of small, general purpose, domestic hearths. This view is supported by distinct differences in distributional patterning and artifact associations between the two groups at Site 37.

Both sites are interpreted as relatively short-term occupations with similar functions. However, several aspects of the artifact analysis and spatial analysis indicate the likelihood of contextual differences between the sites. Site 36 evidences a more selective use of lithic raw material types, and evidence for a more logistically organized reduction strategy. It is interpreted as a very short-term, special function procurement camp. Site 37 has evidence for a wider range of activities and the distribution of features and artifacts indicates significant partitioning of intrasite space. The site is viewed as being the remains of a multicomponent short-term base camp.

The chronological analyses are very significant for several reasons. A new technique of obsidian hydration dating was successfully applied to two sites which traditionally would not have been expected to yield chronometric dates. In addition, the data from Keystone Sites 36 and 37 provide a classic example of the old wood problem. It is predicted that old wood dates will cause difficulties for archeologists in southern New Mexico, as well as in the Hohokam area where the problem was originally identified. The problem can be expected to be most evident at agave roasting camps and other upland sites where large amounts of firewood would have been required.

Botanical analyses yielded little information regarding economic activities at the sites. Perhaps the most interesting methodological result is the fact that the use of a non-destructive extraction technique made it possible to recover pollen from most soil samples. This is in marked contrast to the levels of success achieved by most previous investigators in the El Paso area.

Sites 36 and 37 are modeled as having been produced in the context of different mobility patterns. Site 37 is interpreted as an example of a short-term base camp reflecting high levels of residential mobility. This possibility is all the more provocative given the late dates obtained from the site. High levels of residential mobility have not generally been attributed to the pueblo-based systems identified in the Jornada area after A.D. 1100. The results of the present study provide strong evidence for a generalized, highly mobile strategy operating at roughly the same time as the Pueblo occupations which have traditionally been viewed as typical of the southern Jornada area. Great potential exists for further investigation of small ephemeral sites and a reassessment of traditional models of cultural systematics and culture change.

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APPENDIX I

Soil Analyses

A. Soil Sample Particle Size Analysis

B. Soil Phosphorous Content Analysis

SOIL, WATER, AND PLANT TESTING LABORATORY
BOX 3Q
NEW MEXICO STATE UNIVERSITY
LAS CRUCES, NEW MEXICO 88003

September 10, 1984

Dr. David Carmichael
CRMD Kent Hall
Box 5700
NMSU

Soil analysis (Lab #6586-6602)

	----------	----------	--------- %	---------	----------	----------
		------sand	fractions------			
Sample	CaCO3	VC	C	M	F	VF
JW 100	1.5	0	.76	12.09	68.26	14.33
101	2.9	1.25	4.38	15.93	56.47	15.01
102	7.2	6.34	4.45	16.06	47.79	15.61
103	7.0	3.34	5.78	19.32	49.01	14.74
104	2.7	2.28	3.73	18.23	56.70	11.69
105	4.4	1.54	3.20	15.86	56.87	14.71
106	12.6	0.76	2.11	3.12	11.49	8.50
108	2.3	1.24	0.60	18.61	68.26	5.92
109	0.3	0.40	1.65	21.27	64.71	8.53
110	4.3	10.05	1.93	15.89	56.46	9.41
120	4.4	0.43	1.61	17.87	65.65	8.37
121	0.7	0.42	1.63	12.34	63.95	14.10
122	3.6	1.16	1.89	10.38	58.26	13.45
123	8.0	1.98	1.75	9.37	56.17	19.30
124	11.7	0.64	1.71	9.40	53.63	20.80
125	10.4	0.53	1.40	9.81	54.63	21.81
126	11.4	0.40	1.49	9.50	54.12	22.33

	------------	% ------------		
Sample	Total Sand	Silt	Clay	Texture
JW 100	95.43	0.85	3.72	FINE SAND
101	93.04	1.75	5.22	FINE SAND
102	90.26	5.51	4.23	SAND
103	92.19	3.68	4.12	SAND
104	92.63	2.55	4.81	FINE SAND

Sample	Total Sand (%)	Silt (%)	Clay (%)	Texture
105	92.18	3.30	4.52	FINE SAND
106	25.98	32.06	41.96	CLAY
108	94.63	2.04	3.34	FINE SAND
109	96.55	0.81	2.64	FINE SAND
110	93.74	0.94	5.32	FINE SAND
120	93.93	1.49	4.58	FINE SAND
121	92.44	1.15	6.42	FINE SAND
122	85.14	1.42	13.44	LOAMY FINE SAND
123	88.57	1.84	9.59	LOAMY FINE SAND
124	86.18	2.05	11.77	LOAMY FINE SAND
125	88.19	3.11	8.70	LOAMY FINE SAND
126	87.84	1.61	10.55	LOAMY FINE SAND

SOIL, WATER, AND PLANT TESTING LABORATORY
BOX 3Q
NEW MEXICO STATE UNIVERSITY
LAS CRUCES, NEW MEXICO 88003

July 19, 1984

Dr. David Carmichael
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Soil analysis for k and P (Lab #6974-6984)

Sample	--------ppm-------- NaHCO3 P	NH4DAc K
KS36 28N 12 S.V. 7 F 8 Level 2 1-13-84 J.C. Tor, JE Sp #389	2.5	45.0
KS 36 20S 14E Level 1B Bottom inside F7 1-23-84 HH,LM,TG Sp #484	2.2	43.0
KS 36 42S 0E Level 1C (SV 14,15) 2-2-84 HH,TG,VZ Sp #688 F-10	2.8	54.7
KS 37 20S 4W S.O.G. inside F.1 1-24-84 Je,Jc,Es,MM Sp #1021, level 2	2.2	62.6

Sample	-------ppm------- NaHCO3 P	NH4DAc K
KS36 1S 26W Level 4 outside F.18 2-13-84 T.G., T.S. Sp #1442 J-10	2.2	84.1
KS 36 2S 24W level 2 inside F.15 2-9-84 TM,RY Sp #1453	1.9	70.4
KS 37 2N 8E outside F.25 level 1 2-21-84 VC,SO,RY Sp #3234 J-11	3.1	78.2
KS 37 47S 1E level 3 inside F.2 2-9-84 WH Sp #3283	2.2	43.0
KS 37 4S 29W F.22 level 4 (fill B) Sp #3316 2-7-84 JC,MM,ES	1.9	43.0
KS 37 18S 12E F.34 T-17 level 4 2-29-84 JE Sp #3333	2.8	56.7

Sample	--------ppm------- NaHCO3 P	 NH4DAc K
KS 37 2S 21W T-3/F-23 SV 9 level 3 Sp #3337 2-14-84	1.9	33.2

APPENDIX II

Lithic Analysis

A. Catalog of Artifacts, Keystone Sites 36 and 37

B. Lithic Computer Coding Information

C. Distributions of Raw Material Varieties in the Keystone Site 36 and Site 37 Lithic Assemblages

D. Descriptions and Computer Codes of Lithic Raw Materials

Catalog of Artifacts

Keystone Site 36

The following listings include all artifacts recovered during the surface collections and excavations undertaken at Keystone Site 36. Each row listing includes the catalog number of the artifact (specimen number), an abbreviated description of the artifact, and the number of specimens. Also included are the excavation quad and subunit proveniences.

The abbreviated descriptions of the artifacts are defined below:

flk 1	primary flaake
flk 2	secondary flake
flk 3	tertiary flake
ut flk (1,2,3)	utilized flake (primary, secondary, etc)
test peb	tested pebble
core	core
hs	hammerstone
deb	angular debitage
drill	drill
scraper	scraper (includes all types)
pestle	pestle
nonart	noncultural lithic specimen
point	projectile point
biface	biface
obsidian	obsidian artifact or untested pebble
fcr	fire-cracked rock
ceram	ceramic
ut chunk	utilized chunk
chopper	chopper
mano	mano
metate	metate
gs	groundstone (mano, metate, other)

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1	flk 2			1
2	obsidian			1
3	flk 2			1
4	deb			1
5	flk 2			1
5	flk 3			1
6	hs			1
7	flk 3			1
8	ut flk 3			1
9	flk 1			1
10	chopper			1
11	deb			1
12	test peb			1
13	core			1
14	test peb			1
15	deb			1
16	deb			1
17	flk 2			1
18	hs			1
19	core			1
20	flk 3			1
21	deb			1
22	flk 1			1
23	test peb			1
2[illegible]	flk 3			1
25	hs			2
26	ut flk 3			1
27	flk 3			1
28	flk 2			1
29	flk 1			1
30	flk 2			1
31	deb			1
32	flk 2			1
32	flk 2			1
33	flk 3			1
34	ut flk 3			1
35	ut flk 2			1
36	flk 2			1
37	flk 1			1
38	flk 2			1
39	flk 3			1
40	chopper			1
41	chopper			1
42	flk 2			1
43	core			1
44	flk 2			1
45	flk 1			1
46	core			1
47	flk 1			1
48	flk 2			1
49	deb			1
50	core			1
51	flk 2			1
52	flk 2			1
52	flk 1			1
53	core			1
54	flk 3			1
55	deb			1
56	core			1
57	flk 3			1
58	ut flk 2			1
59	hs			1
60	flk 2			1
61	ut flk 1			1
62	ut flk 1			1
63	flk 1			1
64	flk 2			1
65	core			1
66	flk 1			1
67	flk 1			1
67	flk 2			1
68	flk 2			1
69	core			1
70	ut flk 1			1
71	flk 1			1
72	flk 1			1
73	core			2
74	deb			1
75	test peb			2
76	flk 2			1
77	flk 2			1
78	flk			2
79	flk 1			1
80	core			1
81	ut flk 2			1
82	obsidian			1
83	flk 2			1
84	flk 2			1
85	flk 2			1
86	core			1
87	core			1
88	flk 2			1
89	ut chunk			1
90	flk 2			1
91	flk 2			1
92	flk 2			1
93	flk 2			1
94	flk 2			1
95	core			1
96	core			1
97	flk 1			1
98	flk 3			1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
99	flk 1			1
100	core			1
101	flk 3			1
102	flk 3			1
103	flk 2			1
104	flk 1			1
105	flk 2			1
106	flk 2			1
107	flk 1			1
108	ut flk 2			1
109	ut flk 3			1
110	ut flk 2			1
111	deb			1
112	flk 2			1
113	core			1
114	- deb			1
115	flk 1			1
116	scraper			1
117	flk 2			1
118	flk 2			1
119	flk 1			1
120	core			1
121	deb			1
122	flk 2			1
123	core			1
124	core			1
125	flk 2			1
126	flk 1			1
127	gs			1
128	flk 3			1
129	test peb			2
130	test peb			1
131	test peb			1
132	obsidian			1
133	ut flk 2			1
134	flk 2			1
135	flk 2			1
136	core			1
137	deb			1
138	test peb			1
139	flk 3			1
140	flk 2			1
141	deb			1
142	hs			1
143	deb			1
144	flk 2			1
145	hs			1
146	nonart			1
147	flk 2			1
148	flk 2			1
149	flk 2			1
150	deb			1
151	flk 1			1
152	test peb			1
153	deb			1
154	deb			1
155	test peb			1
156	test peb			1
157	flk 2			1
158	flk 1			1
159	flk 2			1
160	flk 1			1
161	core			1
162	deb			1
163	core			1
164	ceram			1
165	flk 2			1
166	core			1
167	flk 2			1
168	deb			1
169	core			1
170	hs			1
171	flk 2			1
171	flk 2			1
172	core			1
173	flk 2			1
173	flk 2			1
174	test peb			1
175	flk 2			1
176	nonart			1
177	test peb			1
178	core			1
179	hs			1
180	hs			1
181	flk 1			1
182	deb			1
183	deb			1
184	hs			1
185	flk 2			1
186	hs			1
187	flk 2			1
188	nonart			1
189	core			1
190	core			1
191	flk 2			1
192	ut flk 2			1
193	core			2
194	ut flk 2			1
194	ut flk 2			1
195	ceram			1
196	flk 1			1
197	test peb			1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
198	flk 2			1
199	ut flk 2			1
200	flk 2			1
201	hs			1
202	flk 2			1
203	flk			1
204	core			1
205	test peb			1
206	flk 2			1
207	ut flk 1			1
208	flk 1			1
209	flk 1			1
210	core			1
211	hs			1
212	core			1
213	flk 1			1
214	flk 2			1
215	glass			1
216	core			1
217	ut flk 2			1
218	ut flk 2			1
219	pestle			1
220	ut core			1
221	test peb			1
222	core			1
223	ut flk 3			1
224	flk 3			1
225	anvil			1
226	flk 2			1
227	flk 3			1
228	nonart			1
229	core			1
230	ut flk 2			1
231	ut flk 2			1
232	hs			1
233	test peb			1
234	ut flk 2			1
235	ut flk 3			1
236	nonart			1
237	flk 2			1
238	flk 3			1
239	ut flk 2			1
240	flk 3			1
241	test peb			1
242	glass			1
243	flk 2			1
244	ut flk 2			1
245	test peb			1
246	flk 2			1
247	flk 1			1
248	flk 2			1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
249	ut flk 2			1
250	ut flk 2			1
251	flk 3			1
252	hs			1
253	scraper			1
254	ut flk 2			1
255	scraper			1
256	flk 3			1
257	scraper			1
258	ut flk 1			1
259	hs			1
260	nonart			1
261	flk 2			1
262	core			1
263	ut flk 3			1
264	flk 2			1
265	ut flk 2			1
266	core			1
267	flk 3			1
268	test peb			1
269	ut flk 2			1
270	core			1
271	flk 2			1
272	ut flk 1			1
273	test peb			1
274	flk 2			1
275	flk 2			1
276	test peb			1
277	test peb			1
278	flk 2			1
279	test peb			1
280	flk 1			1
281	nonart			1
282	flk 2			1
283	core			1
284	flk 2			1
285	test peb			1
286	flk 2			1
287	ut flk 3			1
288	ut flk 2			1
289	ut flk 2			1
293	ut flk 2	28s12w		1
294	flk 3	28s12w		1
295	flk 2	28s12w		1
296	core	28s12w		1
297	deb	28s12w		1
298	flk 3	28s12w		1
299	flk 2	28s12w		1
300	ut flk 2	28s12w		1
301	fossil	28s12w		1
302	flk 2	28s12w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
303	deb	28s12w		1
304	deb	28s12w		1
305	ut flk 3	28s12w		1
306	ut flk 3	28s12w		1
307	flk 3	28s12w		1
308	deb	28s12w		1
318	deb	0n10w		1
319	nonart	0n10w		1
320	glass	0n10w		1
321	deb	0n10w		1
322	flk 2	4n4w		1
323	flk 2	4n4w		1
324	flk 2	4n4w		1
325	glass	4n4w		1
326	deb	4n4w		1
327	glass	4n4w		1
328	flk 2	4n4w		1
329	flk 3	4n4w		1
330	deb	4n4w		1
331	nonart	4n4w		1
332	deb	4n4w		1
342	scraper	4n4w		1
343	flk 2	0n10w		1
344	fossil	4n4w		1
345	ut flk 2	4n4w		1
346	test peb			1
347	glass	4n4w		1
348	flk 2	4n4w		1
349	flk 2	4n4w		1
350	deb	4n4w		1
351	glass	4n4w		1
352	ut flk 3	0n10w		1
353	core	0n10w		1
354	nonart	0n10w		1
355	flk 1	0n10w		1
356	flk 2	4n4w		1
357	glass	4n4w		1
358	deb	4n4w		1
359	flk 2	4n4w		1
360	ut flk 2	4n4w		1
361	glass	4n4w		1
362	flk 2	4n4w		1
363	flk 2	4n4w		1
364	deb	4n4w		1
365	deb	4n4w		1
366	glass	4n4w		1
367	ut flk 3			1
368	glass	4n4w		1
372	flk 3	28s12w		1
373	flk 2	28s12w		1
374	deb	28s12w		1
375	ut flk 3	28s12w		1
376	flk 1	28s12w		1
377	peb	28s12w		1
378	ut flk 2	28s12w		1
379	flk 3	28s12w		1
380	flk 2	28s12w		1
381	flk 1	28s12w		1
382	flk 3	28s12w		1
383	flk 2	28s12w		1
384	flk 2	28s12w		1
385	flk 3	28s12w		1
386	flk 2	28s12w		1
387	flk 3	28s12w		1
391	deb	28s12w		1
392	ut flk 2	4n4w		1
393	flk 3	4n4w		1
394	deb	4n4w		1
395	glass	4n4w		1
396	deb	4n4w		1
397	flk 3	4n4w		1
398	flk 2	4n4w		1
399	flk 2	4n4w		1
403	nonart	20s14e		1
404	deb	20s14e		1
405	flk 2	20s14e		1
406	nonart	20s14e		1
407	flk 2	20s14e		1
408	nonart	20s14e		1
409	flk 2	20s14e		1
425	nonart	20s14e		1
426	ceram	20s14e		1
427	deb	20s18e		1
428	ceram	20s18e		1
429	ceram	20s18e		1
430	hs	t-12		1
431	hs	t-12		1
432	ut flk 3	20s18e		1
433	flk 2	20s18e		1
434	hs	20s18e		1
435	hs	20s18e		1
436	flk 2	20s18e		1
437	ceram	20s18e		1
438	flk 1	20s18e		1
439	hs	20s18e		1
440	flk 1	20s18e		1
442	flk 2	24s14e		1
443	ceram	24s14e		1
444	ceram	24s14e		1
445	deb	24s14e		1
446	ceram	24s14e		1
447	ceram	24s14e		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
448	gs	20s18e		1
461	c14	20s14e		1
462	c14	20s14e		1
463	ceram	20s14e		1
464	flk 2	20s14e		1
465	flk 1	23s13e		1
466	flk 2	20s14e		1
467	flk 2	20s14e		1
468	ceram	21s13e		1
469	flk 2	24s14e		1
470	ceram	21s13e		1
471	ut flk 1	24s14e		1
472	ceram	24s14e		1
473	ceram	20s14e		1
474	ut flk 2	24s14e		1
475	ceram	24s14e		1
476	hs	24s14e		1
477	flk 2	23s13e		1
477	flk 2	23s13e		1
478	flk 1	24s14e		1
479	hs	24s14e		1
482	c14	20s14e		1
489	deb	20s13e		1
490	lith	20s13e		1
500	deb	0n10e		1
501	flk 2	0n10e		1
502	nonart	0n10e		1
503	nonart	0n10e		1
504	core	0n10e		1
505	hs	0n10e		1
506	flk 2	0n10e		1
507	flk 3	0n10e		1
508	flk 2	0n10e		1
509	deb	0n10e		1
510	bone	0n10e		1
511	nonart	0n10e		1
512	hs	0n10e		1
513	nonart	0n10e		1
514	flk 2	0n10e		1
515	glass	0n10e		1
516	test peb	0n10e		1
517	nonart	0n10e		1
518	bone	0n10e		1
519	bone	0n10e		1
520	bone	0n10e		1
521	c14	0n10e		1
526	chunk	0n10e		1
527	core	0n10e		1
528	flk 2	0n10e		1
529	flk 2	0n10e		1
530	flk 2	0n10e		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
531	test peb	0n10e		1
532	ut flk 2	0n10e		1
533	core	0n10e		1
547	test peb	0n10e		1
548	deb	0n10e		1
549	deb	0n10e		1
550	test peb	0n10e		1
551	flk 2	4n12e		1
552	deb	4n12e		1
553	flk 1	4n12e		1
554	flk 2	4n12e		1
555	deb	4n12e		1
556	deb	4n12e		1
557	ut flk 2	4n12e		1
558	c14	4n12e		1
559	c14	4n12e		1
568	flk 3	42s0e		1
573	flk 2	15n36w		1
574	ut flk 2	15n36w		1
575	ut flk 2	15n36w		1
576	ceram	20s14e		1
577	flk 3	15n36w		1
578	flk 2	15n36w		1
579	core	15n36w		1
580	ut flk 3	15n36w		1
581	deb	15n36w		1
582	flk 3	42s0e		1
583	flk 3	42s0e		1
584	flk 2	42s0e		1
585	c14	42s0e		1
586	c14	42s0e		1
587	c14	42s0e		1
588	nonart	15n36w		1
589	nonart	15n36w		1
590	nonart	15n36w		1
591	deb	15n36w		1
592	deb	15n36w		1
593	deb	15n36w		1
594	test peb	15n36w		1
595	ut flk 3	15n36w		1
596	obsidian	15n36w		1
597	deb	15n36w		1
598	core	15n36w		1
599	flk 3	15n36w		1
600	ut flk 3	15n36w		1
601	flk 3	15n36w		1
602	deb	15n36w		1
603	flk 2	15n36w		1
604	flk 3	15n36w		1
605	flk 2	15n36w		1
606	flk 3	38s0e		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
607	nonart	38s0e		1
608	flk 2	38s0e		1
609	deb	38s0e		1
610	flk 2	38s0e		1
611	nonart	38s0e		1
612	deb	38s0e		1
613	flk 1	38s0e		1
620	c14	42s0e		1
621	c14	42s0e		1
644	core	10s19w		1
645	deb	10s19w		1
646	ut flk 3	10s19w		1
647	flk 2	10s19w		1
648	ut flk 1	10s19w		1
649	flk 2	10s19w		1
650	scraper	10s19w		1
651	deb	10s19w		1
652	deb	10s19w		1
653	ut core			1
657	flk 2	42s0e		1
658	c14	42s0e		1
675	c14	42s0e		1
676	c14	42s0e		1
677	c14	42s0e		1
678	c14	42s0e		1
679	c14	42s0e		1
680	c14	42s0e		1
681	c14	42s0e		1
682	c14	42s0e		1
683	c14	42s0e		1
684	c14	42s0e		1
693	gs	42s0e		1
94	deb	10s19w		1
695	deb	10s19w		1
696	ut flk 2	10s19w		1
697	deb	10s19w		1
698	flk 2	10s19w		1
699	deb	10s19w		1
700	deb	10s19w		1
701	deb	10s19w		1
702	flk 2	10s19w		1
703	flk 2	10s19w		1
704	flk 3	10s19w		1
705	ut flk 2	10s19w		1
706	ut flk 2	10s19w		1
707	flk 2	10s19w		1
708	peb	10s19w		1
709	flk 2	10s19w		1
710	flk 2	10s19w		1
710	flk 2	10s19w		1
711	flk 3	10s19w		1
712	flk 2	10s19w		1
713	flk 2	10s19w		1
714	ut flk 3	10s19w		1
715	nonart	10s19w		1
716	flk 2	10s19w		1
717	deb	10s19w		1
718	test peb	20s16w		1
719	nonart	20s16w		1
720	flk 1	20s16w		1
721	test peb	20s16w		1
722	nonart	20s16w		1
723	deb	20s16w		1
724	deb	20s16w		1
725	nonart	20s16w		1
726	flk 3	20s16w		1
727	flk 2	20s16w		1
728	core	20s16w		1
732	flk 3	20s16w		1
733	flk 2	20s16w		1
734	flk 2	20s16w		1
735	nonart	20s16w		1
736	flk 2	20s16w		1
737	flk 3	20s16w		1
738	nonart	20s16w		1
739	ut chunk	20s16w		1
740	nonart	20s16w		1
741	flk 2	20s16w		1
742	ut flk 3	20s16w		1
743	deb	20s16w		1
744	flk 1	20s16w		1
745	deb	20s16w		1
746	deb	20s16w		1
747	deb	20s16w		1
748	flk 3	20s16w		1
749	core	20s16w		1
750	deb	20s16w		1
751	flk 3	20s16w		1
752	flk 2	20s16w		1
753	deb	20s16w		1
754	deb	20s16w		1
755	nonart	20s16w		1
756	flk 2	20s16w		1
757	nonart	20s16w		1
758	ut flk 2	20s16w		1
759	nonart	20s16w		1
760	flk 2	20s16w		1
761	deb	20s16w		1
762	flk 3	20s16w		1
763	nonart	20s16w		1
764	test peb	20s16w		1
765	core	20s16w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
766	ut flk 2	20s16w		1
767	test peb	20s16w		1
768	flk 2	20s16w		1
769	flk 3	20s16w		1
770	flk 2	20s16w		1
771	flk 2	20s16w		1
772	nonart	20s16w		1
773	deb	20s16w		1
774	nonart	20s16w		1
775	nonart	20s16w		1
776	deb	20s16w		1
777	nonart	20s16w		1
778	flk 3	20s16w		1
779	nonart	20s16w		1
780	deb	20s16w		1
781	nonart	20s16w		1
782	nonart	20s16w		1
783	nonart	20s16w		1
784	nonart	20s16w		1
785	nonart	20s16w		1
786	flk 2	20s16w		1
787	test peb	20s16w		1
788	nonart	20s16w		1
789	core	20s16w		1
790	nonart	20s16w		1
791	deb	20s16w		1
792	deb	20s16w		1
796	test peb	20s16w		1
797	nonart	20s16w		1
798	nonart	20s16w		1
799	flk 2	4n32w		1
800	flk 3	4n32w		1
801	flk 2	4n32w		1
802	flk 2	4n32w		1
803	flk 3	4n32w		1
804	ut flk 2	4n32w		1
805	flk 3	4n32w		1
806	flk 1	4n32w		1
807	test peb	4n32w		1
808	test peb	4n32w		1
809	flk 3	4n32w		1
810	flk 2	4n32w		1
811	nonart	4n32w		1
812	flk 2	4n32w		1
813	flk 2	4n32w		1
814	flk 1	4n32w		1
815	flk 2	4n32w		1
816	flk 2	4n32w		1
817	flk 3	4n32w		1
818	deb	4n32w		1
819	core	4n32w		1
820	flk 3	4n32w		1
821	flk 1	4n32w		1
822	ut flk 3	4n32w		1
823	ut flk 2	4n32w		1
824	ut flk 2	4n32w		1
825	flk 3	4n32w		1
826	flk 3	4n32w		1
827	flk 2	4n32w		1
828	ut flk 2	4n32w		1
829	flk 3	4n32w		1
830	flk 2	4n32w		1
831	flk 2	4n32w		1
832	flk 3	4n32w		1
833	flk 2	4n32w		1
834	flk 3	4n32w		1
835	flk 3	4n32w		1
836	flk 2	4n32w		1
837	flk 3	4n32w		1
838	flk 2	4n32w		1
839	ut flk 1	4n32w		1
840	deb	4n32w		1
841	flk 2	4n32w		1
842	flk 3	4n32w		1
843	core	4n32w		1
844	ut chunk	4n32w		1
857	core	4n32w		1
873	flk 3	8s27w		1
874	flk 2	8s27w		1
875	flk 1	8s27w		1
875	flk 2	8s27w		1
876	ut flk 2	8s27w		1
877	core	8s27w		1
878	scraper	8s27w		1
879	flk 1	8s27w		1
880	core	8s27w		1
881	test core	8s27w		1
882	ut flk 1	8s27w		1
883	ut flk 1	8s27w		1
883	ut flk 2	8s27w		1
884	core	8s27w		1
885	deb	8s27w		2
886	ut flk 2	8s27w		1
887	core	8s27w		2
888	scraper	20n44w		1
889	flk 3	20n44w		1
890	flk 3	20n44w		1
891	flk 3	20n44w		1
892	ut chunk	20n44w		1
893	flk 1	20n44w		1
894	flk 3	20n44w		1
895	core	20n44w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
896	ut flk 2	20n44w		1
897	ut flk 2	20n44w		1
898	flk 3	20n44w		1
899	flk 2	20n44w		1
909	flk 2	20n44w		1
910	ut flk 1	20n44w		1
911	flk 1	20n44w		1
912	deb	20n44w		1
913	flk 3	20n44w		1
914	flk 3	20n44w		1
915	scraper	20n44w		1
916	deb	20n44w		1
917	flk 2	20n44w		1
918	test peb	20n44w		1
919	flk 2	20n44w		1
929	scraper	24n24w		1
930	flk 2	24n24w		1
931	flk 3	24n24w		1
932	ut flk 2	24n24w		1
933	flk 3	24n24w		1
934	bone	16s12e		1
935	hs	32s16e		1
936	hs	32s16e		2
937	ut flk 1	32s16e		1
937	ut flk 2	32s16e		1
938	anvil	24n24w		1
939	obsidian	44n20w		1
940	core	5n5w		1
941	test peb	40n16w		1
942	ceram	2s16e		1
943	flk 3	2s16e		1
944	hs	44n20w		1
945	ut flk 3	44n20w		1
946	nonart	44n20w		2
947	deb	44n20w		1
948	flk 2	44n20w		1
949	test peb	40n16w		1
950	flk 2	40n16w		1
951	flk 2	40n16w		1
952	flk 3	40n16w		1
953	ut flk 1	40n16w		1
954	flk 2	20n4e		1
955	deb	20n4e		1
956	ut flk 2	20n4e		1
957	flk 3	20n4e		1
958	ut flk 2	20n4e		1
959	flk 2	20n4e		1
960	ut flk 2	20n4e		1
960	ut flk 3	20n4e		1
961	flk 3	20n4e		1
961	flk 3	20n4e		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
962	flk 1	20n4e		1
963	core	44n20w		1
964	point	2s22w		1
977	obsidian	8n0e		1
978	c14	2s22w		1
979	c14	1s26w		1
980	obsidian	40n0e		1
981	c14	1s26w		1
982	c14	42n26w		1
983	deb	8s24e		1
984	hs	8s24e		1
985	test peb	8s24e		2
986	deb	8s24e		1
987	ut chunk	8s24e		1
988	nonart	8s24e		1
989	deb	8s24e		1
990	nonart	8s24e		1
991	hs	8s24e		1
992	test peb	8s24e		1
993	flk 3	8s24e		1
994	nonart	8s24e		1
995	ut flk 2	8s24e		1
996	hs	8s24e		1
997	flk 2	8s24e		1
998	deb	8s24e		2
999	deb	8s24e		1
1000	hs	8s24e		1
1001	deb	8s24e		1
1002	flk 2	8s24e		1
1002	flk 2	8s24e		1
1003	nonart	8s24e		1
1004	deb	8s24e		1
1005	deb	8s24e		1
1006	test peb	8s24e		1
1007	deb	8s24e		1
1008	obsidian	12n22w		1
1019	c14	32n2e		1
1041	flk 2	12n22w		1
1042	ut flk 3	12n22w		1
1043	nonart	12n22w		1
1044	core	12n22w		1
1045	test peb	12n22w		2
1046	test peb	12n22w		2
1047	flk 1	12n22w		1
1048	test peb	12n22w		3
1049	test peb	12n22w		1
1050	flk 2	12n22w		1
1050	flk 2	12n22w		1
1050	flk 3	12n22w		1
1050	flk 2	12n22w		1
1050	flk 3	12n22w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1051	flk 2	12n22w		1
1051	flk 2	12n22w		1
1052	flk 2	12n22w		1
1053	flk 2	12n22w		1
1053	flk 3	12n22w		1
1054	flk 2	12n22w		1
1054	flk 3	12n22w		1
1055	test peb	12n22w		3
1056	flk 3	12n22w		1
1057	flk 3	12n22w		1
1058	flk 2	12n22w		1
1058	flk 2	12n22w		1
1058	flk 2	12n22w		1
1059	anvil	2s24w		1
1060	flk 2	17n15e		1
1061	deb	17n15e		1
1062	scraper	17n15e		2
1063	core	17n15e		1
1064	flk 3	17n15e		1
1065	flk 2	17n15e		1
1065	flk 3	17n15e		1
1066	flk 2	1s26w		1
1066	flk 3	1s26w		1
1066	flk 3	1s26w		1
1066	flk 3	1s26w		1
1067	flk 1	2s16e		1
1067	flk 2	2s16e		1
1068	core	2s16e		2
1069	flk 2	2s16e		1
1070	ut flk 2	2s16e		1
1070	ut flk 2	2s16e		1
1071	nonart	2s16e		1
1072	test peb	2s16e		3
1073	flk 3	32n2e		1
1074	ut flk 2	32n2e		1
1075	hs	32n2e		1
1076	flk 3	32n2e		1
1077	flk 2	32n2e		1
1078	flk 2	32n2e		1
1079	flk 1	32n2e		1
1079	flk 3	32n2e		1
1080	flk 2	32n2e		1
1080	flk 3	32n2e		1
1081	test peb	32n2e		1
1082	ut flk 1	32n2e		1
1082	ut flk 3	32n2e		1
1083	flk 2	32n2e		1
1084	deb	42n26w		1
1085	flk 3	42n26w		1
1086	nonart	42n26w		2
1087	deb	42n26w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1088	flk 2	42n26w		1
1088	flk 2	42n26w		1
1089	nonart	42n26w		1
1090	ut flk 1	42n26w		1
1090	ut flk 2	42n26w		1
1090	ut flk 2	42n26w		1
1091	flk 2	42n26w		1
1091	flk 3	42n26w		1
1091	flk 3	42n26w		1
1092	nonart	42n26w		1
1093	flk 2	42n26w		1
1093	flk 2	42n26w		1
1094	deb	42n26w		4
1095	flk 1	42n26w		1
1095	metal	42n26w		1
1096	hs	42n26w		1
1097	nonart	42n26w		1
1098	core	36n32w		1
1099	flk 3	8n0e		1
1100	flk 3	19n32w		1
1100	flk 3	19n32w		1
1101	flk 2	19n32w		1
1102	ut flk 2	19n32w		1
1103	flk 2	19n32w		1
1104	flk 3	19n32w		1
1105	flk 3	19n32w		1
1106	ut flk 1	2s16e		1
1107	flk 2	2s16e		1
1108	test peb	28n20w		1
1109	ut flk 2	28n20w		1
1110	ut flk 2	36n32w		1
1110	ut flk 2	36n32w		1
1111	flk 2	36n32w		1
1111	flk 2	36n32w		1
1112	flk 3	36n32w		2
1112	flk 2	36n32w		1
1113	ut flk 1	36n32w		1
1114	ut flk 3	2s22w		1
1115	core	2s22w		1
1116	nonart	2s22w		1
1117	nonart	2s22w		2
1118	nonart	2s22w		4
1119	flk 2	2s22w		1
1120	core	2s22w		1
1121	nonart	2s22w		2
1122	flk 2	2s22w		1
1123	scraper	2s22w		1
1124	flk 3	2s22w		1
1125	ut flk 1	2s22w		1
1125	ut flk 2	2s22w		1
1125	ut flk 2	2s22w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1125	ut flk 2	2s22w		1
1126	core	2s22w		2
1127	ut flk 2	2s22w		1
1127	ut flk 2	2s22w		1
1127	ut flk 2	2s22w		1
1128	ut flk 1	2s22w		1
1128	ut flk 1	2s22w		1
1129	flk 2	2s22w		1
1129	flk 2	2s22w		1
1129	flk 3	2s22w		1
1130	flk 2	2s22w		1
1131	flk 2	2s22w		1
1132	nonart	2s22w		3
1133	core	2s22w		2
1134	flk 2	2s22w		1
1134	flk 2	2s22w		1
1135	flk 2	2s22w		1
1136	test peb	2s22w		1
1137	nonart	2s22w		1
1138	flk 1	2s22w		1
1138	flk 1	2s22w		1
1138	flk 2	2s22w		1
1139	flk 2	2s22w		1
1140	ut flk 1	2s22w		1
1140	ut flk 2	2s22w		1
1140	ut flk 2	2s22w		1
1140	ut flk 2	2s22w		1
1140	ut flk 2	2s22w		1
1140	ut flk 2	2s22w		1
1140	ut flk 3	2s22w		1
1141	ut flk 1	2s22w		1
1142	nonart	2s22w		3
1143	core	2s22w		3
1144	nonart	2s22w		1
1145	flk 2	2s22w		1
1146	flk 2	2s22w		1
1147	nonart	2s22w		1
1148	ut flk 2	2s22w		1
1148	ut flk 3	2s22w		1
1148	ut flk 3	2s22w		1
1149	core	2s22w		1
1150	core	2s22w		1
1151	metate	2s22w		1
1152	core	2s22w		2
1153	nonart	2s22w		1
1154	ut flk 1	17n15e		1
1155	flk 3	17n15e		1
1156	flk 2	17n15e		1
1157	ut flk 3	17n15e		1
1158	flk 2	17n15e		1
1159	deb	36n16w		2
1160	deb	36n16w		2
1161	deb	36n16w		3
1162	flk 2	36n16w		1
1163	deb	36n16w		2
1164	hs	36n16w		1
1165	flk 2	32n2e		1
1166	scraper	32n2e		1
1167	flk 1	32n2e		1
1167	flk 3	32n2e		1
1168	flk 3	32n2e		1
1168	flk 3	32n2e		1
1168	flk 3	32n2e		1
1169	flk 3	32n2e		1
1170	ut flk 2	32n2e		1
1171	flk 3	32n2e		1
1172	flk 2	32n2e		1
1173	ut flk 3	32n2e		1
1174	flk 2	16s0e		1
1175	nonart	16s0e		1
1176	ut flk 3	16s0e		1
1177	deb	16s0e		1
1178	test peb	19n32w		1
1179	flk 3	19n32w		1
1179	flk 3	19n32w		1
1180	flk 2	19n32w		1
1181	flk 2	19n32w		1
1181	flk 3	19n32w		1
1182	test peb	19n32w		2
1183	core	19n32w		1
1184	flk 3	19n32w		1
1185	flk 2	19n32w		1
1186	ut flk 2	19n32w		1
1186	ut flk 3	19n32w		1
1186	ut flk 3	19n32w		1
1187	flk 1	40n0e		1
1188	flk 2	40n0e		1
1189	deb	40n0e		1
1190	hs	40n0e		1
1191	ut flk 2	40n0e		1
1192	nonart	40n0e		1
1193	flk 1	40n0e		1
1194	deb	40n0e		2
1195	metal	40n0e		2
1196	ut flk 1	40n0e		1
1196	ut flk 3	40n0e		1
1197	flk 3	40n0e		1
1198	test peb	40n0e		1
1199	shell	40n0e		1
1200	scraper	40n0e		1
1201	deb	40n0e		1
1202	flk 1	40n0e		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1202	flk 2	40n0e		1
1203	flk 2	40n0e		1
1203	flk 2	40n0e		1
1203	flk 2	40n0e		1
1204	core	40n0e		2
1205	ut chunk	40n0e		2
1206	nonart	40n0e		1
1207	test peb	40n0e		1
1208	deb	40n0e		3
1209	ut chunk	40n0e		1
1210	nonart	40n0e		1
1211	flk 3	40n0e		1
1212	nonart	40n0e		1
1213	test peb	12n22w		1
1214	flk 2	12n22w		1
1215	flk 2	12n22w		1
1216	flk 3	12n22w		1
1217	core	12n22w		1
1218	flk 2	12n22w		1
1218	flk 3	12n22w		1
1218	flk 3	12n22w		1
1219	flk 2	12n22w		1
1219	flk 2	12n22w		1
1220	flk 2	12n22w		1
1220	flk 3	12n22w		1
1221	core	12n22w		1
1222	core	12n22w		1
1223	core	32s4w		1
1224	hs	8n0e		1
1225	core	32s4w		1
1226	flk 1	8n0e		1
1226	flk 3	8n0e		1
1227	glass	8n0e		1
1228	flk 2	8n0e		1
1228	flk 3	8n0e		1
1229	flk 2	8n0e		1
1230	flk 3	8n0e		1
1231	flk 1	32s4w		1
1231	flk 1	32s4w		1
1232	flk 1	32s4w		1
1232	flk 2	32s4w		1
1232	flk 2	32s4w		1
1233	flk 1	32s4w		1
1233	flk 1	32s4w		1
1234	ut flk 1	32s4w		1
1234	ut flk 2	32s4w		1
1235	flk 2	32s4w		1
1235	flk 2	32s4w		1
1235	flk 2	32s4w		1
1236	flk 2	32s4w		1
1236	flk 2	32s4w		1
1237	flk 1	32s4w		1
1238	core	32s4w		3
1239	flk 3	32s4w		1
1239	flk 2	32s4w		1
1240	ut flk 2	32s4w		1
1240	ut flk 2	32s4w		1
1240	ut flk 2	32s4w		1
1240	ut flk 2	32s4w		1
1240	ut flk 2	32s4w		1
1241	scraper	32s4w		5
1242	flk 3	4n0e		1
1243	flk 3	4n0e		1
1244	glass	4n0e		1
1245	flk 2	4n0e		1
1246	core	4n0e		1
1247	flk 2	4n0e		1
1248	flk 2	4n0e		1
1249	glass	4n0e		1
1250	flk 1	4n0e		1
1251	ut flk 1	4n0e		1
1252	glass	0n4w		1
1253	nonart	0n4w		1
1254	nonart	0n4w		1
1255	glass	0n4w		1
1256	flk 1	0n4w		1
1257	ut flk 1	0n4w		1
1257	ut flk 2	0n4w		1
1258	flk 2	0n4w		1
1259	flk 2	0n4w		1
1260	glass	0n4w		1
1261	glass	0n4w		1
1262	deb	0n4w		1
1263	deb	44s8e		1
1264	flk 2	44s8e		1
1265	nonart	44s8e		1
1266	ut flk 2	44s8e		1
1267	hs	40s16e		1
1268	glass	1n0e		1
1269	flk 3	1s26w		1
1269	flk 3	1s26w		1
1270	nonart	1s26w		4
1271	flk 1	1s26w		1
1271	flk 3	1s26w		1
1272	flk 2	1s26w		1
1273	flk 1	1s26w		1
1274	flk 2	2s24w		1
1275	flk 2	2s24w		1
1276	ceram	24s18e		1
1277	flk 3	24s4e		1
1278	flk 2	24s4e		1
1279	hs	24s4e		2

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1280	flk 2	24s4e		1
1281	flk 2	12n22w		1
1281	flk 2	12n22w		1
1281	flk 2	12n22w		1
1281	flk 2	12n22w		1
1282	flk 1	32s4w		1
1282	flk 1	32s4w		1
1282	flk 1	32s4w		1
1282	flk 1	32s4w		1
1282	flk 2	32s4w		1
1283	hs	1s26w		1
1284	flk 2	1s26w		1
1285	ut flk 3	1s26w		1
1286	flk 2	1s26w		1
1286	flk 2	1s26w		1
1287	scraper	1s26w		1
1288	nonart	1s26w		1
1289	core	1s26w		2
1290	flk 2	1s26w		1
1290	flk 2	1s26w		1
1290	flk 3	1s26w		1
1291	flk 2	1s26w		1
1292	nonart	1s26w		1
1293	nonart	1s26w		1
1294	ut flk 2	1s26w		1
1294	ut flk 2	1s26w		1
1295	flk 2	1s26w		1
1296	flk 2	1s26w		1
1297	flk 3	1s26w		1
1297	flk 2	1s26w		1
1298	flk 2	1s26w		1
1299	deb	1s26w		1
1300	core	1s26w		1
1301	flk 3	1s26w		1
1302	flk 2	1s26w		1
1303	flk 3	2s24w		1
1304	flk 2	2s24w		1
1305	flk 2	2s24w		1
1306	flk 1	2s24w		1
1306	flk 2	2s24w		1
1306	flk 3	2s24w		1
1307	scraper	2s24w		1
1308	hs	2s24w		1
1309	flk 2	2s24w		1
1309	flk 2	2s24w		1
1310	flk 2	2s24w		1
1311	flk 1	2s24w		1
1311	flk 1	2s24w		1
1311	flk 1	2s24w		1
1311	flk 2	2s24w		1
1311	flk 2	2s24w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1311	flk 2	2s24w		1
1311	flk 2	2s24w		1
1311	flk 2	2s24w		1
1312	flk 1	2s24w		1
1313	flk 2	36n16w		1
1314	core	36n16w		1
1315	hs	2s22w		1
1316	nonart	2s22w		3
1317	core	2s22w		1
1318	nonart	2s22w		4
1319	flk 2	2s22w		1
1319	flk 2	2s22w		1
1319	flk 3	2s22w		1
1320	ut flk 2	2s22w		1
1321	flk 2	2s22w		1
1322	ut flk 1	2s22w		1
1322	ut flk 2	2s22w		1
1322	ut flk 3	2s22w		1
1323	nonart	2s22w		5
1324	test peb	2s22w		1
1325	flk 2	2s22w		1
1326	nonart	2s22w		1
1327	flk 1	2s22w		1
1328	ut flk 2	2s22w		1
1329	flk 2	36n16w		1
1330	deb	36n16w		1
1331	flk 3	36n16w		1
1332	flk 1	36n16w		1
1333	nonart	36n16w		1
1334	ut flk 2	36n16w		1
1335	nonart	36n16w		1
1336	flk 2	36n16w		1
1337	deb	36n16w		1
1338	flk 3	36n16w		1
1339	test peb	36n16w		1
1340	flk 3	36n16w		1
1341	flk 2	36n16w		1
1342	test peb	36n16w		1
1343	flk 3	36n16w		1
1344	flk 3	36n16w		1
1345	flk 3	36n16w		1
1346	test peb	36n16w		1
1347	flk 3	36n16w		1
1348	nonart	36n16w		1
1349	flk 2	36n16w		1
1350	ut flk 2	36n16w		1
1351	flk 3	2s24w		1
1351	flk 3	2s24w		1
1352	scraper	2s24w		1
1353	flk 1	2s24w		1
1353	flk 2	2s24w		1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1353	flk 2	2s24w		1
1354	flk 2	2s24w		1
1354	flk 3	2s24w		1
1355	flk 1	2s24w		1
1356	flk 1	2s24w		1
1356	flk 2	2s24w		1
1357	nonart	2s24w		1
1358	flk 2	2s24w		1
1358	flk 3	2s24w		1
1358	flk 2	2s24w		1
1358	flk 2	2s24w		1
1358	flk 3	2s24w		1
1359	flk 3	2s24w		1
1359	flk 2	2s24w		1
1360	hs	2s24w		1
1361	obsidian			1
2100	lith	36n16w		1
1282	ut core	32s4w		5
898	flk	20n44w		1
1500	core	20s16w		1

Catalog of Artifacts

Keystone Site 37

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1	ut flk 2		0	1
2	flk 2		0	1
3	flk 3		0	1
4	flk 2		0	1
5	flk		0	1
6	flk 2		0	1
7	flk 2		0	1
8	flk 2		0	1
9	flk 2		0	1
10	flk 2		0	1
11	ut flk 2		0	1
12	flk 2		0	1
13	flk 2		0	1
14	flk 1		0	1
15	test peb		0	1
16	flk 2		0	1
17	hs		0	1
18	ut flk 1		0	1
19	flk 1		0	1
20	ut flk 2		0	1
21	deb		0	1
22	flk 2		0	1
23	test peb		0	1
24	ut flk 1		0	1
25	hs		0	1
26	ut flk 2		0	1
27	flk 3		0	1
28	flk 1		0	1
29	flk 2		0	1
30	flk 3		0	1
31	flk 2		0	1
32	scraper		0	1
33	flk 1		0	2
33	flk 3		0	1
34	flk 2		0	1
35	test peb		0	1
36	flk 2		0	1
37	flk 3		0	1
38	core		0	1
39	flk 3		0	1
40	core		0	1
41	ut flk 2		0	1
42	flk 2		0	1
43	flk 3		0	1
44	flk 2		0	1
45	flk 3		0	1
46	flk 3		0	1
47	flk 1		0	1
48	flk 2		0	1
49	flk 1		0	1
50	hs		0	1
51	flk 2		0	1
52	flk 1		0	1
53	flk 3		0	1
54	core		0	1
55	test peb		0	1
56	ut flk 2		0	1
57	ut flk 2		0	1
58	flk 3		0	1
59	flk 2		0	1
60	ut flk 2		0	1
61	flk 3		0	1
62	flk 3		0	1
63	flk 2		0	1
64	test peb		0	1
65	flk 3		0	1
66	test peb		0	1
67	flk 3		0	1
68	flk 2		0	1
69	core		0	1
70	flk 2		0	1
71	flk 2		0	1
72	core		0	1
73	flk 2		0	1
74	flk 2		0	1
75	ut flk 2		0	1
76	ut flk 2		0	1
77	flk 2		0	1
78	flk 2		0	1
79	deb		0	1
80	flk 2		0	1
81	flk 3		0	1
82	flk		0	1
83	core		0	1
84	pestle		0	1
85	nonart		0	1
86	flk 2		0	2
87	nonart		0	1
88	ut flk 3		0	1
89	flk 3		0	1
90	metate		0	1
91	flk 2		0	1
92	flk 2		0	1
93	ut flk 3		0	1
94	flk 3		0	1
95	ut flk 3		0	3
96	test peb		0	1
97	test peb		0	3
98	ut flk 2		0	2
99	ut flk 3		0	1
100	flk 3		0	1
101	flk 3		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
102	core		0	1
103	flk 1		0	1
104	ut flk 1		0	1
105	deb		0	1
106	ut flk 2		0	1
107	test peb		0	1
108	nonart		0	1
109	ut flk 2		0	1
110	flk 1		0	1
111	flk 2		0	1
112	flk 3		0	1
112	flk 3		0	1
113	test peb		0	1
114	flk 2		0	1
115	flk 2		0	1
115	deb		0	1
116	flk 1		0	1
116	flk 2		0	1
117	flk 2		0	1
118	flk 2		0	1
119	core		0	1
120	core		0	1
121	flk 1		0	1
122	flk 2		0	1
123	flk 2		0	1
124	test peb		0	2
125	test peb		0	1
126	flk 3		0	1
127	flk 2		0	1
128	core		0	1
129	nonart		0	1
130	flk 2		0	1
130	flk 2		0	1
131	flk 3		0	1
132	ut flk 2		0	1
133	ut flk 2		0	1
134	deb		0	1
135	flk 1		0	1
135	flk 2		0	1
136	flk 1		0	1
137	flk 2		0	1
138	flk 3		0	1
138	flk 2		0	1
139	test peb		0	2
140	core		0	1
141	flk 2		0	1
141	flk 2		0	1
142	fcr		0	1
143	flk 2		0	1
144	nonart		0	1
145	deb		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
146	test peb		0	1
147	deb		0	1
148	nonart		0	1
149	ut flk 1		0	1
150	flk 3		0	1
150	flk 3		0	1
151	flk 1		0	1
151	flk 2		0	1
152	flk 2		0	1
153	flk 2		0	1
154	flk 2		0	1
155	test peb		0	1
156	core		0	1
157	flk 2		0	1
158	ut flk 2		0	1
159	flk 2		0	1
160	fcr		0	1
161	flk 2		0	1
162	flk 3		0	1
163	nonart		0	1
164	flk 3		0	1
165	deb		0	1
166	flk 2		0	1
167	flk 2		0	1
168	flk 2		0	1
169	flk 2		0	1
169	flk 3		0	1
170	flk 2		0	1
171	flk 2		0	1
172	flk 2		0	1
173	flk 1		0	1
173	flk 1		0	1
174	core		0	4
175	core		0	1
176	flk 1		0	1
177	flk 1		0	1
177	flk 3		0	1
178	flk 3		0	1
179	flk 2		0	1
180	flk		0	1
181	ut flk 2		0	1
182	test peb		0	1
183	deb		0	1
184	flk 3		0	1
185	flk 2		0	1
186	ut flk 1		0	1
187	core		0	1
188	ut flk 2		0	1
189	flk 3		0	1
190	flk 1		0	1
191	ut flk 2		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
192	flk 1		0	1
193	flk 2		0	1
194	nonart		0	1
195	flk		0	1
196	ceram		0	1
197	ut flk 2		0	1
198	flk 2		0	1
199	flk 3		0	1
200	flk 1		0	1
201	flk 2		0	1
202	deb		0	1
203	flk 2		0	1
204	flk 2		0	1
205	flk 1		0	1
206	flk 2		0	1
207	ut flk 3		0	1
208	flk 2		0	1
209	core		0	1
210	core		0	1
211	core		0	1
212	flk 2		0	1
213	biface		0	1
214	core		0	1
215	obsidian		0	1
216	ut flk 3		0	1
217	flk 2		0	1
218	flk 2		0	2
219	core		0	1
220	hs		0	1
221	core		0	1
222	nonart		0	1
223	ut flk 2		0	1
224	flk 3		0	1
225	flk 1		0	1
226	ut flk 1		0	1
227	deb		0	1
228	ut flk 2		0	1
229	flk 3		0	1
230	core		0	1
231	flk 2		0	1
232	test peb		0	1
233	hs		0	1
234	flk 2		0	1
235	flk 2		0	1
236	flk 2		0	1
237	flk 2		0	2
238	flk 2		0	2
239	core		0	1
240	core		0	2
241	hs		0	1
242	core		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
243	ut flk 3		0	1
244	flk 2		0	2
245	flk 2		0	1
246	deb		0	1
247	flk 3		0	1
248	flk 2		0	1
249	flk 2		0	1
250	ut flk 1		0	1
251	flk 2		0	1
252	flk 3		0	1
253	ut flk 1		0	1
254	hs		0	1
255	core		0	1
256	flk 3		0	1
257	deb		0	1
258	scraper		0	1
259	flk 1		0	1
260	flk 3		0	1
261	flk 2		0	1
262	flk 2		0	1
263	test peb		0	1
264	flk 2		0	1
265	test peb		0	2
266	flk 3		0	1
267	obsidian		0	1
268	core		0	1
269	ut flk 3		0	1
270	flk 2		0	1
271	ut flk 2		0	1
272	flk 3		0	1
273	test peb		0	1
274	flk 3		0	1
275	ut flk 3		0	1
276	flk 2		0	1
277	test peb		0	1
278	flk 1		0	2
279	flk 1		0	1
280	test peb		0	1
281	fcr		0	1
282	fcr		0	1
283	core		0	1
284	flk 2		0	1
285	flk 2		0	1
286	flk 2		0	1
287	flk 1		0	1
288	core		0	1
289	flk 3		0	1
290	core		0	1
291	nonart		0	1
292	flk 2		0	1
293	core		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
294	core		0	1
295	flk 2		0	1
296	ceram		0	2
297	flk 2		0	1
298	flk 2		0	1
299	scraper		0	1
300	flk 2		0	2
301	ut flk 2		0	1
302	flk 1		0	1
303	flk 2		0	1
304	ut flk 2		0	1
305	flk 3		0	1
306	flk 2		0	1
307	flk 3		0	1
308	core		0	1
309	flk 2		0	1
310	flk 3		0	1
311	flk 2		0	1
312	flk 1		0	1
313	ut flk 1		0	1
314	flk 2		0	1
315	deb		0	1
316	flk 3		0	1
317	flk 2		0	1
318	flk 1		0	1
319	ceram		0	1
320	flk 3		0	1
321	flk 2		0	1
322	core		0	1
323	flk 3		0	1
324	deb		0	2
325	test peb		0	2
326	flk 3		0	1
327	core		0	2
328	flk 3		0	1
329	deb		0	1
330	flk 1		0	1
331	core		0	1
332	deb		0	1
333	flk 1		0	1
334	flk 2		0	1
335	flk 2		0	1
336	flk 3		0	1
337	core		0	1
338	core		0	1
339	flk 2		0	1
340	flk 2		0	1
341	flk 2		0	1
342	deb		0	1
343	flk 1		0	1
344	flk 3		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
345	core		0	1
346	core		0	1
347	core		0	2
348	flk 1		0	1
349	flk 2		0	1
350	core		0	2
351	deb		0	1
352	flk 2		0	1
353	ut flk 2		0	1
354	flk 2		0	1
355	flk 1		0	1
356	flk 2		0	2
357	ut flk 2		0	1
358	core		0	1
359	hs		0	1
360	deb		0	1
361	flk 2		0	1
362	scraper		0	1
363	hs		0	1
364	flk 1		0	1
365	deb		0	1
366	ceram		0	3
367	flk 2		0	1
368	flk 2		0	1
369	ut flk 1		0	1
370	test peb		0	1
371	pestle		0	1
372	core		0	1
373	flk 2		0	1
374	flk 1		0	1
375	flk 1		0	1
376	fcr		0	1
377	core		0	1
378	core		0	1
379	test peb		0	1
380	core		0	1
381	core		0	1
382	test peb		0	2
383	ut flk 3		0	1
384	core		0	1
385	ut flk 2		0	1
386	ut flk 2		0	1
387	flk 2		0	1
388	flk 1		0	1
389	flk 2		0	1
390	flk 2		0	1
391	deb		0	1
392	core		0	1
393	flk 3		0	1
394	flk 3		0	1
395	flk 1		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
396	flk 2		0	1
397	ut flk 3		0	1
398	flk 2		0	1
399	core		0	1
400	flk 2		0	1
401	test peb		0	1
402	core		0	1
403	core		0	1
404	flk 2		0	1
405	flk 3		0	1
406	fcr		0	1
407	deb		0	1
408	deb		0	1
409	flk 2		0	1
410	ut flk 2		0	1
411	ut core		0	1
412	deb		0	1
413	flk 1		0	1
414	ut flk 3		0	1
415	flk 1		0	1
416	flk 2		0	1
417	flk 2		0	1
418	ut flk 2		0	1
419	deb		0	1
420	flk 1		0	2
421	hs		0	1
422	ut flk 2		0	1
423	deb		0	1
424	deb		0	1
425	nonart		0	1
426	flk 3		0	1
427	flk 2		0	1
428	flk 2		0	1
429	deb		0	1
430	gs		0	1
431	hs		0	1
432	deb		0	1
433	scraper		0	1
434	flk 3		0	1
435	ut core		0	2
436	flk 2		0	1
437	deb		0	1
438	flk 3		0	1
439	core		0	1
440	flk 1		0	1
441	flk 1		0	1
442	biface		0	1
443	core		0	1
444	flk 2		0	1
445	flk 1		0	1
446	flk 1		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
447	ut flk 2		0	1
448	core		0	1
449	flk 2		0	1
450	biface		0	1
451	flk 1		0	1
452	flk 1		0	1
453	flk 2		0	1
454	deb		0	1
455	flk 2		0	1
456	flk 3		0	1
457	flk 2		0	1
458	flk 1		0	1
459	ut flk		0	1
460	flk 3		0	1
461	flk 2		0	1
462	core		0	1
463	flk 3		0	1
464	ut flk 3		0	1
465	flk 3		0	1
466	flk 3		0	1
467	flk 3		0	1
468	flk 2		0	1
469	flk 2		0	1
470	flk 2		0	1
471	deb		0	1
472	core		0	1
473	flk 2		0	1
474	flk 3		0	1
475	flk 2		0	1
476	flk 2		0	1
477	flk 3		0	1
478	core		0	1
479	flk 3		0	1
480	core		0	1
481	flk 2		0	1
482	flk 1		0	1
483	test peb		0	1
484	deb		0	1
485	flk 1		0	1
486	flk 1		0	1
487	flk 2		0	1
488	flk 2		0	1
489	flk 3		0	1
490	flk 2		0	1
491	hs		0	1
492	flk 1		0	1
493	flk 2		0	1
494	flk 2		0	1
495	core		0	1
496	flk 2		0	1
497	flk 1		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
498	flk 3		0	1
499	flk 3		0	1
500	test peb		0	1
501	flk 3		0	1
502	flk 1		0	1
503	ut flk 2		0	1
504	flk 3		0	1
505	flk 2		0	1
506	flk 1		0	1
507	flk 3		0	1
508	flk 2		0	1
509	deb		0	1
510	deb		0	1
511	flk 3		0	1
512	flk 2		0	1
513	flk 3		0	1
514	ut chunk		0	1
515	flk 2		0	1
516	flk 2		0	1
517	flk 2		0	1
518	ut chunk		0	1
519	deb		0	1
520	flk 2		0	1
521	flk 2		0	1
522	flk 2		0	1
523	flk 1		0	1
524	test peb		0	1
525	flk 3		0	1
526	flk 1		0	1
527	flk 3		0	1
528	flk 3		0	1
529	flk 3		0	1
530	test peb		0	1
531	flk 3		0	1
532	hs		0	1
533	ut flk 1		0	1
534	flk 1		0	1
535	flk 1		0	1
536	flk 3		0	1
537	flk 2		0	1
538	flk 1		0	1
539	flk 1		0	1
540	chopper		0	1
541	obsidian		0	1
542	deb		0	1
543	flk 3		0	1
544	flk 3		0	1
545	flk 3		0	1
546	flk 3		0	1
547	core		0	1
548	flk 2		0	1
549	flk 3		0	1
550	deb		0	1
551	ut chunk		0	1
552	flk 1		0	1
553	flk 2		0	1
554	ut flk 2		0	1
555	flk 3		0	1
556	flk 3		0	1
557	deb		0	1
558	test peb		0	1
559	flk 2		0	1
560	flk 2		0	1
561	flk 3		0	1
562	flk 2		0	1
563	flk 1		0	1
564	flk 3		0	1
565	deb		0	1
566	flk 3		0	1
567	mano		0	1
568	hs		0	1
569	flk 3		0	1
570	flk 3		0	1
571	flk 3		0	1
572	flk 3		0	1
573	flk 3		0	1
574	flk 3		0	1
575	flk 2		0	1
576	ut flk 3		0	1
577	flk 1		0	1
578	core		0	1
579	deb		0	1
580	flk 2		0	1
581	flk 3		0	1
582	flk 2		0	1
583	flk 2		0	1
584	flk 2		0	1
585	flk 2		0	1
586	flk 1		0	1
587	test peb		0	1
588	ut flk 2		0	1
589	ut flk		0	1
590	ut flk 3		0	1
591	deb		0	1
592	flk 1		0	1
593	flk 3		0	1
594	flk 3		0	1
595	deb		0	1
596	deb		0	1
597	flk 2		0	1
598	deb		0	1
599	flk 3		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
600	flk 2		0	1
601	flk 3		0	1
602	flk 3		0	1
603	flk 3		0	1
604	core		0	1
605	flk 3		0	1
606	flk 2		0	1
607	flk 2		0	1
608	flk 2		0	1
609	flk 2		0	1
610	obsidian		0	1
611	flk 2		0	1
612	flk 2		0	1
613	flk 2		0	1
614	flk 2		0	1
615	test peb		0	1
616	scraper		0	1
617	hs		0	1
618	hs		0	1
619	flk 2		0	1
620	nonart		0	1
621	flk 3		0	1
622	ut chunk		0	1
623	flk		0	1
624	ut chunk		0	1
625	flk 1		0	1
626	flk 2		0	1
627	deb		0	1
628	ut chunk		0	1
629	pestle		0	1
630	hs		0	1
631	deb		0	1
632	core		0	1
633	pestle		0	1
634	flk 1		0	1
635	flk 2		0	1
636	flk 2		0	1
637	deb		0	1
638	mano		0	1
639	flk 1		0	1
640	flk 2		0	1
641	deb		0	1
642	flk 2		0	1
643	gs		0	1
644	flk 1		0	1
645	flk 2		0	1
646	flk 2		0	1
647	flk 2		0	1
648	flk 2		0	1
649	flk 3		0	1
650	flk 3		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
651	deb		0	1
652	deb		0	1
653	deb		0	1
654	ut chunk		0	1
655	flk 1		0	1
656	ut chunk		0	1
657	hs		0	1
658	ceram		0	1
659	flk 1		0	1
660	deb		0	1
661	flk 2		0	1
662	flk 2		0	1
663	flk 2		0	1
664	flk 2		0	1
665	flk 2		0	1
666	flk 1		0	1
667	flk 2		0	1
668	flk 2		0	1
669	mano		0	1
670	flk 2		0	1
671	gs		0	1
672	nonart		0	1
673	test peb		0	1
674	deb		0	1
675	test peb		0	1
676	ut core		0	1
677	flk 1		0	1
678	flk 3		0	1
679	test peb		0	1
680	flk 1		0	1
681	flk 3		0	1
682	flk 2		0	1
683	ut flk 2		0	1
684	flk 2		0	1
685	flk 2		0	1
686	flk 1		0	1
687	flk 1		0	1
688	core		0	1
689	flk 2		0	2
690	flk 2		0	1
691	flk 1		0	1
692	flk 2		0	1
693	obsidian		0	1
694	nonart		0	1
695	flk 1		0	1
696	deb		0	1
697	flk 2		0	1
698	flk 2		0	1
699	flk 3		0	2
700	ut flk 2		0	1
701	flk 3		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
702	flk 2		0	1
703	metate		0	1
704	flk 1		0	1
705	deb		0	1
706	flk 2		0	1
707	hs		0	1
708	flk 1		0	1
709	hs		0	3
710	obsidian		0	1
711	flk 1		0	1
712	obsidian		0	1
713	flk 2		0	1
714	flk 2		0	1
715	flk 2		0	1
716	flk 3		0	1
717	test peb		0	1
718	flk 1		0	1
719	flk 2		0	1
720	flk 2		0	1
721	deb		0	1
722	flk 1		0	1
723	flk 3		0	1
724	test peb		0	1
725	test peb		0	1
726	flk 3		0	1
727	test peb		0	1
728	flk 2		0	1
729	flk 1		0	1
730	nonart		0	1
731	flk 2		0	1
732	flk 3		0	1
733	flk 2		0	1
734	flk 2		0	1
735	core		0	1
736	flk 3		0	1
737	hs		0	1
738	flk 3		0	1
739	obsidian		0	1
740	flk 3		0	1
741	flk 1		0	1
742	flk 2		0	1
743	flk 1		0	1
744	flk 2		0	1
745	flk 2		0	1
746	flk 2		0	1
747	hs		0	1
748	flk 2		0	1
749	hs		0	1
750	deb		0	1
751	ut flk 2		0	2
752	flk 1		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
753	flk 3		0	1
754	flk 2		0	1
755	flk 2		0	1
756	flk 2		0	1
757	obsidian		0	1
758	flk 2		0	1
759	core		0	1
760	flk 1		0	1
761	ut core		0	1
762	hs		0	1
763	hs		0	1
764	flk 2		0	1
765	core		0	1
766	core		0	1
767	flk 2		0	1
768	flk 3		0	1
769	hs		0	1
770	flk 2		0	1
771	flk 3		0	1
772	flk 2		0	1
773	hs		0	1
774	bone		0	1
775	flk 3		0	1
776	flk 2		0	1
777	flk 2		0	1
778	scraper		0	1
779	core		0	1
780	chopper		0	1
781	flk 2		0	1
782	flk 3		0	1
783	ut core		0	1
784	core		0	1
785	hs		0	1
786	flk 2		0	1
787	ut flk 2		0	1
788	flk 2		0	1
789	flk 2		0	1
790	flk 2		0	1
791	obsidian		0	1
792	flk 3		0	1
793	flk 1		0	1
794	flk 3		0	1
795	flk 2		0	1
796	core		0	1
797	core		0	1
798	flk 2		0	1
799	core		0	1
800	ut flk 1		0	1
801	flk 1		0	1
802	deb		0	1
803	flk 1		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
804	core		0	1
806	flk 1		0	1
807	core		0	1
808	gs		0	1
809	flk 2		0	1
810	obsidian		0	1
811	flk 2		0	1
812	flk 1		0	1
813	flk 2		0	1
814	flk 2		0	1
815	hs		0	1
816	flk 2		0	1
817	core		0	1
818	hs		0	1
819	hs		0	1
820	core		0	1
821	core		0	1
822	hs		0	1
823	core		0	1
824	flk 2	6n26e	0	1
825	flk 1	6n26e	0	1
826	flk 2	6n26e	0	1
833	hs	2n20e	0	1
834	flk 2	2n20e	18	1
842	core	6n26e	12	1
843	obsidian	6n26e	10	1
844	flk 1	6n26e	15	1
845	flk 1	6n26e	4	1
846	deb	6n26e	14	1
851	flk 1		0	1
852	flk 3	2n20e	11	1
881	flk 2	5n24e	6	1
898	flk 2	20s4w	5	1
899	flk 3	20s4w	5	1
900	test peb	20s4w	1	1
901	nonart	20s4w	15	1
902	hs	20s4w	1	1
903	nonart	20s4w	10	1
904	nonart	20s4w	10	1
905	nonart	20s4w	10	1
906	flk 2	20s4w	1	1
907	nonart	20s4w	12	1
908	ut flk 3	20s4w	12	1
909	flk 2	20s4w	12	1
910	nonart	20s4w	11	1
911	flk 3	20s4w	4	1
912	flk 2	20s4w	4	1
913	flk 2	20s4w	14	1
914	flk 2	20s4w	12	1
915	nonart	20s4w	12	1
915	flk 2	20s4w	10	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
916	flk 2	20s4w	14	1
917	flk 2	20s4w	9	1
918	core	20s4w	8	1
919	nonart	20s4w	11	1
920	nonart	20s4w	11	1
921	flk 3	20s4w	12	1
922	flk 3	20s4w	10	1
923	flk 2	20s4w	16	1
924	core	20s4w	12	1
925	flk 2	20s4w	4	1
926	flk 2	20s4w	4	1
927	nonart	20s4w	4	1
928	nonart	20s4w	10	1
929	flk 1	20s4w	4	1
930	flk 2	20s4w	1	1
931	flk 2	20s4w	8	1
932	flk 3	20s4w	10	1
933	flk 3	20s4w	8	1
934	flk 3	20s4w	12	1
935	flk 3	20s4w	12	1
936	flk 3	20s4w	12	1
937	mano	20s4w	3	1
938	deb	20s4w	7	1
939	core	20s4w	10	1
940	flk 3	20s4w	6	1
941	deb	20s4w	12	1
942	flk 1	20s4w	7	1
943	nonart	20s4w	3	1
944	flk 1	20s4w	12	1
945	deb	20s4w	3	1
949	flk 3	20s4w	10	1
950	flk 2	10s20w	4	1
951	flk 3	10s20w	4	1
952	flk 2	10s20w	8	1
953	test peb	10s20w	8	1
954	ut chunk	10s20w	8	1
955	flk 2	10s20w	8	1
956	flk 3	10s20w	8	1
957	flk 3	10s20w	8	1
958	flk 3	10s20w	4	1
959	flk 2	10s20w	4	1
960	flk 3	10s20w	4	1
961	core	10s20w	2	1
962	nonart	10s20w	3	1
963	flk 1	10s20w	3	1
964	flk 3	10s20w	3	1
965	flk 1	10s20w	1	1
966	flk 2	10s20w	2	1
967	flk 1	10s20w	3	1
968	nonart	10s20w	3	1
969	flk 3	10s20w	3	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
970	flk 3	10s20w	1	1
971	flk 2	10s20w	4	1
972	flk 3	10s20w	3	1
973	flk 3	10s20w	2	1
974	flk 2	10s20w	3	1
975	obsidian	10s20w	0	1
976	flk 3	10s20w	3	1
977	lith	10s20w	1	1
978	flk 3	10s20w	3	1
979	flk 2	10s20w	3	1
980	flk 3	10s20w	3	1
981	nonart	10s20w	3	1
982	flk 3	10s20w	3	1
983	flk 3	10s20w	2	1
984	flk 1	10s20w	1	1
985	flk 2	10s20w	2	1
986	flk 1	10s20w	3	1
987	flk 3	10s20w	3	1
988	flk 1	10s20w	2	1
989	flk 2	10s20w	2	1
990	flk 2	10s20w	2	1
991	flk 3	10s20w	1	1
992	flk 1	10s20w	1	1
993	flk 2	10s20w	2	1
994	flk 3	10s20w	3	1
995	nonnart	10s20w	3	1
996	flk 3	10s20w	3	1
997	ut flk 2	10s20w	3	1
998	flk 3	10s20w	2	1
999	flk 2	10s20w	4	1
1000	flk 2	10s20w	4	1
1001	flk 3	10s20w	4	1
1002	flk 2	10s20w	4	1
1003	flk 3	10s20w	4	1
1004	flk 2	10s20w	4	1
1005	flk 2	10s20w	8	1
1006	flk 3	10s20w	8	1
1007	flk 1	20s4w	14	1
1008	deb	20s4w	13	1
1009	deb	20s4w	13	1
1013	nonart	20s4w	20	1
1014	nonart	20s4w	7	1
1015	nonart	20s4w	2	1
1016	nonart	20s4w	0	1
1017	nonart	20s4w	2	1
1024	flk 2	20s4w	3	1
1025	scraper	20s4w	7	1
1026	deb	20s4w	9	1
1027	flk 2	20s4w	3	1
1028	flk 3	20s4w	4	1
1029	flk 1	20s4w	8	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1032	lith	10s20w	5	1
1033	flk 2	10s20w	5	1
1034	core	10s20w	5	1
1035	flk 3	10s20w	5	1
1036	ut flk 1	10s20w	5	1
1037	flk 2	10s20w	5	1
1038	flk 2	10s20w	5	1
1039	flk 2	10s20w	5	1
1040	flk 2	10s20w	5	1
1041	flk 2	10s20w	5	1
1042	flk 2	10s20w	5	1
1043	flk 3	10s20w	5	1
1044	flk	10s20w	6	1
1045	flk 3	10s20w	6	1
1046	flk 1	10s20w	6	1
1047	flk 3	10s20w	6	1
1048	flk 3	10s20w	6	1
1049	flk 1	10s20w	6	1
1050	flk 3	10s20w	6	1
1051	flk 1	10s20w	6	1
1052	flk 1	10s20w	6	1
1053	flk 1	10s20w	6	1
1054	flk 1	10s20w	6	1
1055	flk 2	10s20w	6	1
1056	flk 1	10s20w	6	1
1057	flk 2	10s20w	6	1
1058	flk 1	10s20w	6	1
1059	flk 2	10s20w	7	1
1060	flk 2	10s20w	7	1
1061	flk 2	10s20w	7	1
1062	flk 1	10s20w	7	1
1063	flk 3	10s20w	9	1
1064	flk 2	10s20w	9	1
1065	obsidian	10s20w	9	1
1066	deb	10s20w	9	1
1067	flk 3	10s20w	9	1
1068	core	10s20w	9	1
1069	flk 1	10s20w	9	1
1070	flk 3	10s20w	9	1
1071	flk 3	10s20w	9	1
1072	flk 2	10s20w	9	1
1073	flk 2	10s20w	9	1
1074	flk 3	10s20w	9	1
1075	flk 3	10s20w	9	1
1076	flk 2	10s20w	9	1
1077	flk 2	10s20w	9	1
1078	flk 3	10s20w	9	1
1079	flk 2	10s20w	9	1
1080	flk 1	10s20w	9	1
1081	deb	10s20w	9	1
1082	flk 1	10s20w	9	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1083	deb	10s20w	13	1
1084	flk 3	10s20w	13	1
1085	flk 3	10s20w	13	1
1086	flk 3	10s20w	13	1
1087	flk 2	10s20w	13	1
1088	flk 3	10s20w	13	1
1089	flk 2	10s20w	13	1
1090	flk 3	10s20w	13	1
1091	flk 2	10s20w	13	1
1092	flk 2	10s20w	13	1
1093	flk 1	10s20w	13	1
1094	lith	10s20w	13	1
1095	flk 2	10s20w	13	1
1096	obsidian	10s20w	13	1
1097	flk 2	10s20w	13	1
1098	flk 3	10s20w	13	1
1099	flk 3	10s20w	13	1
1100	flk 3	10s20w	13	1
1101	flk 2	10s20w	13	1
1102	test peb	10s20w	13	1
1103	flk 2	10s20w	14	1
1104	flk 3	10s20w	14	1
1105	core	10s20w	14	1
1106	flk 2	10s20w	14	1
1107	flk 3	10s20w	14	1
1108	flk 3	10s20w	14	1
1109	flk 3	10s20w	14	1
1110	flk	10s20w	14	1
1111	flk 2	10s20w	14	1
1112	deb	10s20w	15	1
1113	flk 1	10s20w	15	1
1114	core	10s20w	15	1
1115	flk 2	10s20w	15	1
1116	flk 2	10s20w	15	1
1117	nonart	10s20w	15	1
1118	flk 2	10s20w	15	1
1119	flk 3	10s20w	15	1
1120	core	10s20w	16	1
1121	flk 2	10s20w	16	1
1122	flk 2	10s20w	16	1
1123	obsidian	10s20w	16	1
1124	ut flk	10s20w	16	1
1128	flk 2	32n8e	16	1
1129	flk 2	32n8e	12	1
1130	flk 1	32n8e	10	1
1131	flk 2	32n8e	14	1
1132	flk 3	32n8e	15	1
1133	flk 3	32n8e	13	1
1134	deb	32n8e	15	1
1135	flk 2	32n8e	16	1
1136	flk 3	32n8e	16	1
1137	flk 3	32n8e	12	1
1138	flk 3	32n8e	16	1
1139	flk 3	32n8e	16	1
1140	ut flk 2	10s20w	10	1
1141	flk 3	10s20w	10	1
1142	flk 2	10s20w	10	1
1143	flk 3	10s20w	10	1
1144	flk 2	10s20w	10	1
1145	flk 2	10s20w	10	1
1146	flk 2	10s20w	10	1
1147	flk 2	10s20w	10	1
1148	flk 2	10s20w	10	1
1149	flk 2	10s20w	10	1
1150	flk 3	10s20w	10	1
1151	flk 3	10s20w	10	1
1152	flk 3	10s20w	10	1
1153	flk 2	10s20w	10	1
1154	flk 1	10s20w	10	1
1155	flk 2	10s20w	10	1
1156	flk 2	10s20w	10	1
1157	flk 3	10s20w	10	1
1158	deb	10s20w	10	1
1159	nonart	10s20w	10	1
1160	flk 3	10s20w	10	1
1161	flk 2	10s20w	10	1
1162	flk 1	10s20w	10	1
1163	flk 2	10s20w	10	1
1164	deb	10s20w	10	1
1165	flk 3	10s20w	11	1
1166	core	10s20w	11	1
1167	nonart	10s20w	11	1
1168	flk 3	10s20w	11	1
1169	flk 1	10s20w	11	1
1170	deb	10s20w	11	1
1171	flk 2	10s20w	12	1
1172	flk 3	10s20w	12	1
1173	flk 1	10s20w	12	1
1174	flk 3	10s20w	12	1
1175	point	10s20w	12	1
1176	flk 2	10s20w	12	1
1177	nonart	10s20w	12	1
1178	flk 2	10s20w	12	1
1179	flk 3	10s20w	12	1
1180	flk 2	10s20w	12	1
1181	deb	10s20w	12	1
1193	flk 3	32n8e	19	1
1194	deb	32n8e	19	1
1195	deb	32n8e	19	1
1196	flk 2	32n8e	19	1
1197	flk 2	32n8e	1	1
1198	deb	32n8e	8	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1199	test peb	32n8e	3	1
1200	nonart	32n8e	3	1
1201	flk 2	32n8e	6	1
1202	flk 1	32n8e	5	1
1203	flk 3	32n8e	4	1
1204	ceram	32n8e	4	1
1205	flk 3	34s10w	2	1
1206	flk 2	34s10w	2	1
1207	ut flk 3	34s10w	5	1
1208	flk 3	34s10w	5	1
1209	flk 3	34s10w	5	1
1210	deb	34s10w	5	1
1211	flk 3	34s10w	6	1
1212	flk 2	34s10w	6	1
1213	flk 2	34s10w	11	1
1214	flk 2	34s10w	11	1
1215	flk 2	34s10w	11	1
1216	flk 3	34s10w	13	1
1217	flk 3	34s10w	14	1
1218	flk 3	34s10w	14	1
1219	flk 3	34s10w	15	1
1220	flk 1	34s10w	15	1
1221	ut flk 3	34s10w	16	1
1225	hs	34s10w	9	1
1226	flk 2	34s10w	6	1
1227	flk 2	32n8e	22	1
1228	flk 2	32n8e	23	1
1229	flk 3	32n8e	21	1
1230	flk 2	32n8e	29	1
1231	flk 2	32n8e	21	1
1233	flk 1	32n8e	30	1
1234	test peb	32n8e	23	1
1235	deb	32n8e	23	1
1236	deb	32n8e	30	1
1238	core	32n8e	21	1
1239	deb	32n8e	22	1
1243	flk 3	34s10w	19	1
1244	flk 3	34s10w	16	1
1245	flk 2	34s10w	17	1
1246	flk 2	34s10w	21	1
1247	deb	34s10w	21	1
1248	deb	34s10w	22	1
1249	flk 3	34s10w	17	1
1250	flk 2	34s10w	17	1
1251	flk 2	34s10w	24	1
1252	flk 3	34s10w	16	1
1253	flk 2	34s10w	16	1
1254	obsidian		0	1
1255	point		0	1
1256	biface		0	1
1257	scraper		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1258	obsidian		0	1
1259	flk 3	32n8e	21	1
1260	flk 1	32n8e	8	1
1261	flk 1	32n8e	11	1
1262	flk 2	32n8e	12	1
1263	nonart	32n8e	19	1
1266	flk 3	32n8e	21	1
1267	gs	32n8e	12	1
1276	flk 2	34s10w	24	1
1277	flk 3	34s10w	24	1
1278	flk 2	34s10w	20	1
1279	flk 3	34s10w	19	1
1295	flk 2	34s10w	16	1
1296	core	34s10w	17	1
1297	core	34s10w	17	1
1310	flk 2	20s24w	13	1
1311	flk 2	20s24w	13	1
1312	flk 2	20s24w	1	1
1313	flk 1	20s24w	2	1
1314	flk 3	20s24w	2	1
1315	flk 3	20s24w	3	1
1316	flk 2	20s24w	3	1
1317	flk 3	20s24w	3	1
1318	flk 2	20s24w	3	1
1319	ut flk 3	20s24w	3	1
1320	ut flk 3	20s24w	6	1
1321	ut flk 2	20s24w	6	1
1322	flk 3	20s24w	6	1
1323	flk 2	20s24w	6	1
1324	flk 3	20s24w	6	1
1325	flk 3	20s24w	6	1
1326	flk 2	20s24w	6	1
1327	lith	20s24w	6	1
1328	core	20s24w	6	1
1329	flk 2	20s24w	6	1
1330	flk 2	20s24w	7	1
1331	core	20s24w	7	1
1332	flk 2	20s24w	10	1
1333	flk 3	20s24w	10	1
1334	flk 2	20s24w	10	1
1335	flk 3	20s24w	10	1
1336	flk 3	20s24w	10	1
1337	flk 2	20s24w	10	1
1338	flk 2	20s24w	10	1
1339	flk 2	20s24w	10	1
1340	nonart	20s24w	11	1
1341	flk 2	20s24w	14	1
1342	flk 2	20s24w	1[illegible]	1
1343	flk 2	20s24w	14	1
1344	nonart	20s24w	2	1
1345	flk 1	20s24w	2	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1346	flk 3	20s24w	2	1
1347	flk 3	20s24w	2	1
1348	flk 2	20s24w	2	1
1349	flk 3	20s24w	4	1
1350	flk	20s24w	4	1
1351	flk 2	20s24w	4	1
1352	ang deb	20s24w	4	1
1353	flk 2	20s24w	5	1
1354	flk 2	20s24w	5	1
1355	ut flk 2	20s24w	3	1
1356	flk 3	20s24w	3	1
1357	flk 2	20s24w	3	1
1358	deb	20s24w	6	1
1359	flk 2	20s24w	6	1
1360	flk 2	20s24w	6	1
1361	flk 1	20s24w	6	1
1362	flk 2	20s24w	6	1
1363	flk 2	20s24w	6	1
1364	ut flk 3	20s24w	6	1
1365	flk 2	20s24w	6	1
1366	flk 2	20s24w	6	1
1367	flk 3	20s24w	7	1
1368	flk 2	20s24w	7	1
1369	flk 3	20s24w	7	1
1370	flk 3	20s24w	8	1
1371	ut flk 2	20s24w	8	1
1372	flk 2	20s24w	9	1
1373	scraper	20s24w	9	1
1374	flk 2	20s24w	9	1
1375	flk 3	20s24w	10	1
1376	flk 1	20s24w	10	1
1377	core	20s24w	10	1
1378	ut flk 2	20s24w	10	1
1379	flk 2	20s24w	10	1
1380	flk 2	20s24w	10	1
1381	core	20s24w	15	1
1382	ut flk 3	20s24w	10	1
1383	flk 3	20s24w	10	1
1384	flk 3	20s24w	10	1
1385	ut flk 2	20s24w	10	1
1386	flk 2	20s24w	10	1
1387	ut core	20s24w	12	1
1388	flk 3	20s24w	12	1
1389	flk 3	20s24w	12	1
1390	flk 2	20s24w	13	1
1391	flk	20s24w	13	1
1392	flk 1	20s24w	13	1
1393	ut flk 1	20s24w	16	1
1394	flk 2	20s24w	16	1
1395	scraper	20s24w	14	1
1396	flk 3	20s24w	14	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1397	flk 2	20s24w	14	1
1398	flk 2	20s24w	14	1
1399	flk 2	20s24w	14	1
1400	flk 2	20s24w	14	1
1401	flk 3	20s24w	14	1
1402	flk 1	20s24w	14	1
1403	flk 3	20s24w	14	1
1404	flk 3	20s24w	14	1
1405	flk 2	20s24w	14	1
1406	flk 3	20s24w	14	1
1407	flk 1	20s24w	14	1
1408	flk 2	20s24w	14	1
1409	flk 2	20s24w	14	1
1410	flk 1	20s24w	16	1
1411	flk 2	20s24w	16	1
1412	flk 2	20s24w	16	1
1413	flk 2	20s24w	16	1
1414	flk 2	20s24w	16	1
1415	flk 2	20s24w	5	1
1416	core	20s24w	16	1
1417	flk 2	20s24w	5	1
1418	ut flk	20s24w	3	1
1419	ut flk 2	20s24w	3	1
1420	flk 3	20s24w	3	1
1421	ut flk 2	20s24w	15	1
1422	flk 2	20s24w	15	1
1423	flk 2	20s24w	4	1
1424	flk 3	20s24w	1	1
1425	flk 2	20s24w	4	1
1426	ut flk 3	20s24w	4	1
1427	flk 1	20s24w	6	1
1428	flk 3	20s24w	6	1
1429	flk 2	20s24w	6	1
1430	flk 2	20s24w	8	1
1431	flk 3	20s24w	8	1
1432	flk 2	20s24w	8	1
1433	flk 3	20s24w	9	1
1434	flk 3	20s24w	10	1
1435	flk 2	20s24w	10	1
1436	flk 3	20s24w	11	1
1437	flk 3	20s24w	15	1
1438	flk 2	20s24w	15	1
1439	flk 3	20s24w	15	1
1440	flk 2	20s24w	11	1
1441	flk 3	20s24w	11	1
1442	flk 2	20s24w	12	1
1443	flk 2	20s24w	12	1
1444	flk 2	20s24w	12	1
1445	flk 3	20s24w	13	1
1446	flk 3	20s24w	13	1
1447	ut flk 2	20s24w	13	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1448	flk 3	20s24w	13	1
1449	flk	20s24w	13	1
1450	flk 2	20s24w	14	1
1451	flk 3	20s24w	14	1
1454	ut flk 2	20s24w	10	1
1455	flk 3	20s24w	3	1
1456	flk 1	20s24w	3	1
1457	flk 2	20s24w	3	1
1471	gs	4s29w	0	1
1472	test peb	4s29w	0	1
1473	flk 3	4s29w	22	1
1474	flk 2	4s29w	0	1
1475	flk 2	4s29w	22	1
1476	flk 2	4s29w	22	1
1477	flk 2	4s29w	0	1
1478	flk	4s29w	0	1
1479	flk 2	4s29w	0	1
1480	flk 2	4s29w	27	1
1481	flk 3	4s29w	22	1
1482	flk 3	4s29w	15	1
1483	deb	4s29w	17	1
1484	deb	4s29w	23	1
1485	flk 2	4s29w	14	1
1486	test peb	4s29w	22	1
1487	flk 2	4s29w	22	1
1488	test peb	4s29w	21	1
1489	flk 2	4s29w	29	1
1490	flk 3	4s29w	16	1
1491	flk 2	4s29w	23	1
1492	deb	4s29w	17	1
1493	test peb	4s29w	22	1
1494	flk 2	4s29w	21	1
1495	flk 3	4s29w	0	1
1496	test peb	4s29w	17	1
1497	flk 2	4s29w	14	1
1498	flk 1	4s29w	16	1
1499	flk 1	4s29w	16	1
1500	flk	4s29w	28	1
1501	scraper	4s29w	15	1
1502	flk 2	4s29w	34	3
1503	flk 2	4s29w	33	3
1504	flk 2	4s29w	21	1
1505	hs	4s29w	22	1
1506	flk 2	4s29w	28	1
1507	flk 1	4s29w	26	1
1508	gs	4s29w	28	1
1509	test peb	4s29w	16	1
1510	ut flk 2	4s29w	27	1
1511	flk 2	4s29w	27	1
1512	flk 3	4s29w	21	4
1513	knife	4s29w	27	1
1514	flk 2	4s29w	14	1
1515	core	4s29w	15	1
1516	scraper	4s29w	5	1
1517	hs	4s29w	28	1
1518	flk 1	4s29w	20	1
1519	flk 2	4s29w	22	1
1520	flk 2	4s29w	23	1
1521	ut flk 1	4s29w	23	1
1522	flk 2	4s29w	29	2
1523	scraper	4s29w	29	1
1524	core	4s29w	23	1
1525	flk 1	4s29w	35	2
1526	deb	4s29w	35	2
1527	flk 2	4s29w	17	3
1528	deb	4s29w	17	2
1529	scraper	4s29w	34	1
1530	flk 1	4s29w	34	1
1531	flk 3	4s29w	23	1
1532	deb	4s29w	23	1
1533	ut flk 2	4s29w	29	1
1534	ut flk 1	4s29w	29	1
1535	flk 3	4s29w	29	1
1536	flk 3	4s29w	29	1
1537	biface	4s29w	35	1
1538	ang deb	4s29w	28	1
1539	gs	4s29w	29	1
1540	flk 2	4s29w	28	1
1541	flk 2	4s29w	28	1
1542	flk 2	4s29w	34	1
1543	flk 2	4s29w	35	1
1544	flk 2	4s29w	27	1
1545	flk	4s29w	20	1
1546	flk 3	4s29w	35	1
1547	flk 2	4s29w	16	1
1548	flk 2	4s29w	34	1
1549	flk 3	4s29w	35	1
1550	deb	4s29w	35	1
1551	flk 3	4s29w	14	1
1552	ut flk 1	4s29w	14	1
1553	flk 2	4s29w	14	1
1554	flk 2	4s29w	35	1
1555	flk 3	4s29w	14	1
1556	flk 2	4s29w	35	1
1557	flk 2	4s29w	34	1
1558	flk 2	4s29w	34	1
1559	test peb	4s29w	35	[illegible]
1560	flk 2	4s29w	34	1
1561	test peb	4s29w	34	[illegible]
1562	flk 2	4s29w	23	[illegible]
1563	flk 3	4s29w	23	[illegible]
1564	flk 3	4s29w	[illegible]	[illegible]

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1565	flk 2	4s29w	28	1
1566	flk	4s29w	34	1
1567	flk 2	20s24w	9	1
1568	flk 3	20s24w	10	1
1569	flk 2	20s24w	10	1
1570	flk 3	20s24w	11	1
1571	flk 2	20s24w	11	1
1572	flk 3	20s24w	17	1
1573	obsidian	20s24w	17	1
1574	flk 1	20s24w	17	1
1575	flk 3	20s24w	17	1
1576	flk 2	20s24w	17	1
1577	flk 3	20s24w	17	1
1578	flk 2	20s24w	17	2
1579	flk 3	20s24w	17	1
1580	flk 2	20s24w	17	1
1581	scraper	20s24w	17	1
1582	flk 2	20s24w	17	1
1583	flk 3	20s24w	17	1
1594	ut flk 2	23s20w	1	1
1595	flk 2	23s20w	1	1
1596	flk 1	23s20w	3	1
1597	flk 3	23s20w	3	1
1598	flk 3	23s20w	3	1
1599	ut flk 2	23s20w	3	1
1600	nonart	23s20w	3	1
1601	flk 3	23s20w	3	1
1602	ut flk 2	23s20w	4	1
1603	core	23s20w	4	1
1604	ut flk 2	23s20w	4	1
1605	ut flk 2	23s20w	4	1
1606	flk 2	23s20w	4	1
1607	flk 3	23s20w	4	1
1608	flk 3	23s20w	4	1
1609	core	23s20w	4	1
1610	flk 3	23s20w	4	1
1611	flk 2	23s20w	4	1
1612	ut flk 3	23s20w	4	1
1613	flk 2	23s20w	3	2
1614	flk 3	23s20w	8	1
1615	flk 2	23s20w	8	1
1616	flk 2	23s20w	8	1
1617	scraper	4s29w	14	1
1618	flk 2	4s29w	28	1
1619	flk 2	4s29w	28	1
1620	flk 2	4s29w	28	1
1621	flk 3	4s29w	28	1
1622	flk 2	4s29w	29	1
1623	core	4s29w	20	1
1624	flk 2	4s29w	28	1
1625	flk 2	4s29w	27	1
1626	ang deb	4s29w	28	1
1627	flk 3	4s29w	28	1
1628	ut flk 2	4s29w	27	1
1629	flk 3	4s29w	27	1
1630	flk 2	4s29w	27	1
1631	deb	4s29w	35	1
1632	deb	4s29w	23	1
1642	flk 1	23s20w	8	3
1643	core	23s20w	8	1
1644	flk 2	23s20w	8	1
1645	flk 2	23s20w	8	1
1646	flk 2	23s20w	8	1
1647	flk	23s20w	8	1
1648	flk 2	23s20w	8	1
1649	flk	23s20w	8	1
1650	flk 2	23s20w	8	1
1651	flk 3	23s20w	7	1
1652	deb	23s20w	7	1
1653	ut flk 2	23s20w	7	1
1654	hs	23s20w	8	1
1655	flk 3	23s20w	7	1
1656	flk 2	23s20w	7	1
1657	flk 3	23s20w	7	3
1658	flk 1	23s20w	9	1
1659	flk 3	23s20w	9	2
1660	ut flk 3	23s20w	15	1
1661	ang deb	23s20w	13	1
1662	flk 3	23s20w	5	1
1663	ut flk 2	23s20w	14	1
1664	scraper	23s20w	16	1
1565	ut flk 2	23s20w	14	1
1666	core	23s20w	10	1
1667	flk 3	23s20w	6	1
1668	flk 3	23s20w	6	1
1669	flk 2	23s20w	12	1
1670	scraper	23s20w	14	1
1671	flk	23s20w	6	1
1672	flk	23s20w	6	1
1673	flk 3	23s20w	6	1
1674	flk 3	23s20w	5	1
1675	flk 2	23s20w	5	1
1676	ut flk 3	23s20w	12	1
1677	flk 2	23s20w	9	2
1678	deb	23s20w	15	2
1679	core	23s20w	7	1
1680	deb	23s20w	10	1
1681	flk 3	23s20w	12	1
1682	flk 1	23s20w	11	1
1683	flk 2	23s20w	11	1
1684	flk 2	23s20w	11	1
1685	flk 2	23s20w	13	4

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1686	flk 3	23s20w	10	1
1687	flk 3	23s20w	7	1
1688	flk 3	23s20w	5	1
1689	flk 1	23s20w	12	1
1690	ut flk 2	23s20w	12	1
1691	flk	23s20w	7	1
1692	core	23s20w	16	1
1693	flk 2	23s20w	11	1
1694	flk 2	23s20w	16	1
1695	flk 3	23s20w	11	1
1696	flk 3	23s20w	5	1
1697	flk 1	23s20w	11	1
1698	flk 3	23s20w	11	1
1699	deb	23s20w	11	1
1700	flk 2	23s20w	11	1
1701	flk 3	23s20w	11	1
1702	ut flk 2	23s20w	11	1
1703	flk 3	23s20w	11	1
1704	flk 2	23s20w	11	1
1705	core	23s20w	11	1
1706	deb	23s20w	12	1
1707	deb	23s20w	9	2
1708	flk 3	23s20w	11	1
1709	ut flk 1	23s20w	16	1
1710	flk 2	23s20w	11	1
1711	flk 3	23s20w	11	1
1712	ut flk 2	23s20w	11	1
1713	flk 1	23s20w	3	1
1714	ut chunk	23s20w	2	1
1715	ut flk 3	23s20w	9	1
1716	flk 3	23s20w	2	2
1717	ut flk 1	23s20w	1	1
1718	ut flk 2	23s20w	4	2
1719	ut flk 3	23s20w	4	1
1720	flk 2	23s20w	6	2
1721	flk 1	23s20w	5	1
1722	flk 1	23s20w	8	1
1723	flk 3	23s20w	7	2
1733	flk 2	42s2w	3	1
1734	flk 3	42s2w	8	1
1737	flk 3	46s3w	6	1
1738	ut flk 2	42s2w	11	1
1739	flk 1	42s2w	0	1
1741	flk 2	42s2w	10	1
1792	obsidian	17n33w	1	1
1793	obsidian	17n29w	5	1
1794	point	17n33w	12	1
1795	obsidian	10n44w	3	1
1796	obsidian	10n44w	2	1
1807	obsidian	0n40w	0	1
1808	obsidian	12n28w	16	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1809	obsidian	15n53w	2	1
1838	tool	4s29w	11	1
1843	flk 2	2n8e	3	1
1844	flk 1	2n8e	7	1
1845	scraper	2n8e	9	1
1846	flk 1	2n8e	14	1
1847	flk 3	22n58w	4	1
1848	flk 1	46s13e	14	1
1849	test peb	22n58w	1	1
1850	ut flk 1	22n58w	1	2
1851	ut flk 2	22n58w	1	1
1852	ut flk 1	22n58w	1	1
1853	flk 2	22n58w	1	2
1854	flk 1	22n58w	2	5
1855	core	22n58w	2	2
1856	flk 2	22n58w	3	2
1857	core	22n58w	4	1
1858	core	22n58w	5	1
1859	ut flk 2	22n58w	5	1
1860	flk 1	22n58w	6	2
1861	nonart	22n58w	6	1
1862	flk 1	22n58w	7	3
1863	flk 1	22n58w	8	2
1864	test peb	22n58w	9	2
1865	ut cob	22n58w	9	1
1866	ut flk 1	22n58w	10	1
1867	ut flk 1	22n58w	11	2
1868	flk 1	22n58w	12	1
1869	flk 2	22n58w	13	1
1870	flk 2	22n58w	14	2
1871	flk 1	22n58w	14	2
1872	flk 2	22n58w	15	2
1873	flk 2	22n58w	16	13
1874	hs	22n58w	16	1
1875	flk 3	41n54w	2	1
1876	flk 3	41n54w	9	1
1877	test peb	41n54w	11	2
1878	flk 2	41n54w	15	1
1879	flk 3	60s6e	8	1
1880	flk 1	60s6e	9	1
1881	test peb	60s6e	10	1
1882	obsidian	60s6e	11	1
1883	flk 2	60s6e	12	1
1884	flk 2	2s21w	1	1
1885	flk 2	2s21w	1	1
1886	flk 2	2s21w	1	1
1887	flk 3	2s21w	1	1
1888	flk 2	2s21w	1	1
1889	flk 33	2s21w	1	1
1890	flk 3	12n23w	1	1
1891	flk 3	12n28w	1	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1892	flk 2	12n28w	1	1
1893	flk 2	12n28w	1	1
1894	flk 3	12n28w	2	1
1895	flk 2	12n28w	2	1
1896	flk 3	12n28w	5	1
1897	flk 2	12n28w	5	1
1898	flk 3	12n28w	6	1
1899	flk 2	12n28w	7	1
1900	flk 3	12n28w	7	1
1901	ut flk 1	12n28w	7	1
1902	core	12n28w	7	1
1903	hs	12n28w	8	1
1904	flk 3	12n28w	8	1
1905	flk 3	12n28w	8	1
1906	test peb	12n28w	8	1
1907	flk 3	12n28w	10	1
1908	flk 3	12n28w	10	1
1909	flk 2	12n28w	10	1
1910	flk 2	12n28w	10	1
1911	flk 3	12n28w	10	1
1912	deb	12n28w	10	1
1913	tu flk 2	12n28w	10	1
1914	flk 3	12n28w	11	1
1915	flk 2	12n28w	11	1
1916	flk 3	12n28w	12	1
1917	flk 3	12n28w	12	1
1918	deb	12n28w	12	1
1919	nonart	12n28w	12	1
1920	flk 2	12n28w	13	1
1921	flk 2	12n28w	13	1
1922	flk 3	12n28w	13	1
1923	flk 2	12n28w	13	1
1924	flk 3	12n28w	13	1
1925	flk 2	12n28w	13	1
1926	flk 3	12n28w	15	1
1927	flk 3	12n28w	15	1
1928	flk 3	12n28w	15	1
1929	flk 2	12n28w	16	1
1930	flk 3	12n28w	16	1
1931	flk 2	45s8e	3	1
1932	flk 2	45s8e	3	1
1933	flk 1	45s8e	3	1
1934	flk 1	45s8e	9	1
1935	core	45s8e	13	1
1936	flk 2	45s8e	13	1
1937	flk 2	45s8e	13	1
1938	flk 2	46s18e	15	1
1939	chopper	10n44w	14	1
1940	ut flk 1	29n18e	1	1
1941	ut flk 2	29n18e	1	1
1942	flk 1	16n16e	5	1
1943	flk 2	16n16e	10	1
1944	flk 3	18s14e	9	1
1945	flk 3	29n18e	6	2
1946	flk 1	29n18e	7	1
1947	flk 2	29n18e	11	1
1948	flk 2	29n18e	12	1
1949	flk 3	6s3w	1	1
1950	flk 2	6s3w	2	2
1951	flk 2	6s3w	3	3
1952	flk 2	6s3w	3	1
1953	flk 3	6s3w	4	1
1954	core	6s3w	4	1
1955	flk 2	6s3w	5	1
1956	flk 2	6s3w	6	1
1957	flk 2	6s3w	7	1
1958	flk 2	6s3w	9	1
1959	flk 2	6s3w	10	1
1960	flk 2	6s3w	12	2
1961	biface	6s3w	12	2
1962	flk 2	6s3w	13	1
1963	flk 2	6s3w	14	1
1964	flk 3	6s3w	15	2
1965	flk 2	6s3w	16	1
1966	flk 1	2n8e	1	2
1967	flk 3	2n8e	5	1
1968	flk 2	2n8e	3	2
1969	flk 1	2n8e	12	1
1970	flk 1	2n8e	15	1
1972	scraper	38s22w	7	1
1973	ut flk 3	38s22w	7	1
1974	flk 3	38s22w	7	1
1975	flk 3	38s22w	9	1
1976	ut flk 3	38s22w	9	1
1977	flk 3	38s22w	10	1
1978	ut flk 3	38s22w	10	1
1979	flk 3	38s22w	10	1
1980	flk 2	38s22w	10	1
1981	ut flk 3	38s22w	13	1
1982	ut flk 2	38s22w	14	1
1983	flk 2	38s22w	14	1
1984	deb	38s22w	14	1
1985	flk 3	38s22w	15	1
1986	deb	38s22w	15	1
1987	flk 3	38s22w	16	1
1988	flk 3	17n29w	5	1
1989	flk 2	17n29w	5	1
1990	deb	12n29w	5	1
1991	flk	17n29w	7	1
1992	flk	17n29w	7	1
1993	ut flk 2	17n29w	7	1
1994	flk 3	17n29w	3	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1995	flk 2	17n29w	6	1
1996	flk 3	17n29w	6	1
1997	flk 2	17n29w	9	1
1998	flk 2	17n29w	10	1
1999	flk 3	17n29w	3	1
2000	flk 3	17n29w	8	1
2001	flk 3	17n29w	7	1
2002	deb	17n29w	10	1
2003	core	17n29w	1	1
2004	flk 3	17n29w	1	1
2005	deb	17n33w	1	1
2006	core	17n33w	1	1
2007	flk 1	17n33w	1	2
2008	flk 2	17n33w	1	3
2009	flk 2	17n33w	2	1
2010	flk 2	17n33w	2	1
2011	flk 2	17n33w	3	1
2012	scraper	17n33w	3	1
2013	flk 2	17n33w	3	2
2014	flk 2	17n33w	4	1
2015	flk 1	17n33w	4	2
2016	deb	17n33w	5	1
2017	deb	17n33w	5	2
2018	flk 2	17n33w	6	2
2019	flk 2	17n33w	6	3
2020	flk 3	17n33w	7	1
2021	flk 1	17n33w	8	1
2022	flk 1	17n33w	8	4
2023	flk 2	17n33w	9	1
2024	flk 2	17n33w	9	3
2025	ut flk 2	17n33w	9	1
2026	flk 2	17n33w	10	3
2027	flk 2	17n33w	11	2
2028	flk 2	17n33w	11	2
2029	flk 2	17n33w	12	2
2030	test peb	17n33w	12	1
2031	flk 1	17n33w	12	5
2032	core	17n33w	12	1
2033	nonart	17n33w	12	1
2034	flk 1	17n33w	13	1
2035	ut flk 3	17n33w	14	1
2036	flk 1	17n33w	14	1
2037	flk 1	17n33w	15	1
2038	flk 2	17n33w	15	6
2039	core	17n33w	15	1
2040	flk 2	17n33w	16	3
2041	ut flk 3	17n33w	16	1
2042	flk 2	17n33w	16	1
2043	flk 1	17n33w	16	2
2044	core	17n33w	0	1
2045	flk 1	17n33w	0	2

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2046	hs	17n33w	0	2
2047	flk 1	17n33w	0	1
2048	deb	42s12w	2	1
2049	flk 3	42s12w	3	1
2050	deb	42s12w	5	1
2051	flk 1	42s12w	8	1
2052	flk 1	42s12w	9	1
2053	flk 2	2n12w	2	2
2054	flk 2	2n12w	3	1
2055	deb	2n12w	7	1
2056	ceram	2n12w	9	1
2057	flk 2	17n33w	0	1
2058	flk 2	17n33w	0	2
2059	gs	18s12e	0	1
2060	gs	18s12e	0	1
2061	gs	18s12e	0	1
2062	ut flk 2	10n44w	7	5
2063	flk 2	10n44w	9	1
2064	core	10n44w	11	3
2065	flk 2	10n44w	12	2
2066	ut flk 2	10n44w	13	1
2067	ut flk 2	10n44w	14	2
2068	ut flk 2	10n44w	15	8
2069	core	10n44w	16	1
2070	nonart	10n44w	16	1
2071	scraper	10n44w	16	1
2072	flk 1	22n58w	1	1
2073	core	22n58w	4	2
2074	flk 2	22n58w	6	1
2075	flk 1	3n4e	16	1
2076	flk 1	2n8e	1	1
2077	core	2n8e	9	1
2078	flk 3	20n22e	3	2
2079	flk 3	20n22e	9	2
2080	deb	20n22e	11	1
2081	flk 3	22n6w	1	1
2082	core	22n6w	3	1
2083	core	22n6w	4	1
2084	flk 2	25n18e	6	1
2085	ut flk 2	25n18e	8	1
2086	flk 1	25n18e	9	1
2087	ut flk 3	25n18e	10	1
2088	ut flk 2	25n18e	13	1
2089	flk 2	25n18e	15	1
2090	obsidian	38s18w	9	1
2091	flk 3	38s18w	8	1
2092	flk 3	38s18w	9	1
2093	flk 3	38s18w	11	1
2094	flk 1	38s18w	11	1
2095	flk 3	25n18w	13	1
2096	flk 3	38s18w	13	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2097	flk 2	38s18w	13	1
2098	flk 3	38s18w	14	1
2099	flk 2	38s18w	15	1
2100	ut flk	2n8e	6	1
2101	ut flk 3	20n3e	0	1
2102	ut flk 2	20n3e	0	1
2103	flk	20n3e	6	1
2104	flk	20n3e	13	1
2105	flk	20n3e	14	1
2106	flk	20n3e	14	1
2107	flk	20n3e	14	1
2108	flk 3	5n34e	5	1
2109	flk 2	5n34e	6	1
2110	bone	5n34e	9	1
2111	flk 2	5n34e	9	1
2112	flk 3	5n34e	12	1
2113	flk 1	10s14w	1	2
2114	deb	10s14w	2	1
2115	flk 2	10s14w	3	1
2116	flk 2	10s14w	5	1
2117	flk 1	10s14w	6	1
2118	flk 2	10s14w	8	2
2119	obsidian	10s14w	6	1
2120	flk 2	10s14w	14	2
2121	flk 3	10s14w	15	2
2122	flk 3	10s14w	9	1
2123	flk 2	17n33w	9	1
2124	test peb	17n33w	9	1
2125	flk 2	17n33w	9	4
2126	flk 2	17n33w	10	1
2127	flk 3	17n33w	13	1
2128	flk 1	17n33w	13	1
2129	flk 1	17n33w	0	1
2130	hs	17n33w	0	1
2131	flk 2	17n33w	0	1
2132	flk 1	17n33w	0	1
2133	ut flk 2	2s12w	0	2
2134	flk 2	2s12w	5	1
2135	flk 3	2s12w	5	1
2136	ut flk 3	2s12w	5	1
2137	flk 2	2s12w	5	1
2138	flk 3	2s12w	9	1
2139	flk	2s12w	13	1
2140	flk 2	18s12e	5	1
2141	flk 3	18s12e	10	1
2142	flk 1	18s12e	10	1
2143	flk 3	18s12e	15	1
2144	flk 2	18s12e	16	1
2145	flk 2	17n29w	1	1
2146	flk 2	17n29w	5	1
2147	flk 2	17n29w	5	1
2148	flk 2	17n29w	5	1
2149	flk 3	17n29w	5	1
2150	ut flk 1	17n29w	5	1
2151	flk 2	17n29w	6	1
2152	flk 3	17n29w	6	1
2153	flk 3	17n29w	9	1
2154	flk 2	17n29w	9	1
2155	flk 3	17n29w	9	1
2156	flk 3	17n29w	10	1
2157	flk 3	17n29w	13	1
2158	flk 2	17n29w	13	1
2159	flk 3	17n29w	13	1
2160	flk 2	17n29w	14	1
2161	flk 3	17n29w	14	1
2162	core	17n29w	14	1
2163	deb	4s29w	11	1
2164	flk 1	4s29w	11	1
2165	flk 2	4s29w	11	1
2166	flk 3	4s29w	11	1
2167	flk 2	4s29w	11	1
2168	flk 2	4s29w	11	1
2169	deb	4s29w	11	1
2170	core	4s29w	22	1
2171	flk 2	4s29w	12	1
2172	flk 2	4s29w	12	1
2173	flk 1	4s29w	12	1
2174	flk	4s29w	12	1
2175	flk 2	4s29w	12	1
2176	flk	4s29w	12	1
2177	flk	4s29w	12	1
2178	flk	4s29w	12	1
2179	flk 2	4s29w	12	1
2180	scraper	4s29w	12	1
2181	flk 1	4s29w	12	1
2182	flk 3	4s29w	18	1
2183	deb	4s29w	18	1
2184	flk 2	4s29w	18	1
2185	flk 2	4s29w	18	1
2186	flk 1	4s29w	18	1
2187	flk 3	4s29w	18	1
2188	flk 2	4s29w	18	1
2189	deb	56s6w	3	1
2190	flk 2	56s6w	9	1
2191	flk 1	56s6w	9	1
2192	flk 2	56s6w	10	1
2193	flk 1	56s6w	12	3
2194	flk 2	56s6w	14	1
2195	flk 2	56s6w	16	1
2196	flk 1	38s22w	4	1
2197	scraper	38s22w	4	1
2198	flk 1	3n4e	7	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2199	flk 3	3n4e	8	2
2200	ut flk 1	3n4e	15	1
2201	flk 3	3n4e	15	2
2202	ceram	3n4e	16	1
2203	flk 3	15n53w	1	1
2204	flk 3	15n53w	1	1
2205	flk 3	15n53w	1	1
2206	core	15n53w	1	1
2207	flk 3	15n53w	1	1
2208	flk 2	15n53w	1	1
2209	flk 3	15n53w	1	1
2210	flk 3	15n53w	1	1
2211	flk 3	15n53w	1	1
2212	deb	15n53w	1	1
2213	ut flk 2	15n53w	2	1
2214	flk 3	15n53w	2	1
2215	flk 3	15n53w	2	1
2216	flk 2	15n53w	2	1
2217	flk 2	15n53w	2	1
2218	flk 2	15n53w	2	1
2219	flk 1	15n53w	2	1
2220	flk 2	15n53w	2	1
2221	flk 2	15n53w	2	1
2222	flk 2	15n53w	2	1
2223	flk 3	15n53w	2	1
2224	flk 2	15n53w	2	1
2225	chopper	15n53w	2	1
2226	scraper	15n53w	2	1
2227	core	15n53w	2	1
2228	flk 3	15n53w	2	1
2229	nonart	15n53w	2	1
2230	deb	15n53w	3	1
2231	flk 3	15n53w	2	1
2232	core	15n53w	2	1
2233	core	15n53w	3	1
2234	flk 3	15n53w	4	1
2235	flk 2	15n53w	4	1
2236	flk 1	15n53w	4	1
2237	flk 2	15n53w	4	1
2238	flk 3	15n53w	4	1
2239	flk 1	15n53w	4	1
2240	flk 3	15n53w	4	1
2241	flk 3	15n53w	4	1
2242	deb	15n53w	4	1
2243	flk 2	15n53w	4	1
2244	obsidian		0	1
2245	flk 2	15n53w	5	1
2246	flk 3	15n53w	5	1
2247	scraper	15n53w	5	1
2248	flk 2	15n53w	5	1
2249	flk 2	15n53w	5	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2250	chopper	15n53w	6	1
2251	flk 2	15n53w	6	1
2252	flk 2	15n53w	6	1
2253	flk 3	15n53w	6	1
2254	flk 3	15n53w	6	1
2255	flk 3	15n53w	6	1
2256	flk 2	15n53w	6	1
2257	flk 2	15n53w	6	1
2258	chopper	15n53w	6	1
2259	flk 2	15n53w	7	1
2260	deb	15n53w	7	1
2261	flk 1	15n53w	7	1
2262	flk 2	15n53w	7	1
2263	flk 3	15n53w	7	1
2264	flk 3	15n53w	7	1
2265	flk 3	15n53w	7	1
2266	flk 3	15n53w	7	1
2267	flk 3	15n53w	7	1
2268	flk 2	15n53w	7	1
2269	flk 1	15n53w	7	1
2270	flk 2	15n53w	7	1
2271	ut flk 2	15n53w	8	1
2272	deb	15n53w	8	1
2273	flk 2	15n53w	8	1
2274	flk 3	15n53w	8	1
2275	flk 1	15n53w	8	1
2276	flk 1	15n53w	8	1
2277	flk 2	15n53w	8	1
2278	flk 2	15n53w	8	1
2279	flk 2	15n53w	10	1
2280	flk 1	15n53w	10	1
2281	flk 2	15n53w	10	1
2282	ut flk 1	15n53w	10	1
2283	flk 3	15n53w	11	1
2284	flk 3	15n53w	11	1
2285	flk 3	15n53w	11	1
2286	flk 3	15n53w	11	1
2287	core	15n53w	11	1
2288	flk 3	15n53w	12	1
2289	flk 2	15n53w	12	1
2290	flk 2	15n53w	12	1
2291	deb	15n53w	13	1
2292	flk 3	15n53w	13	1
2293	deb	15n53w	14	1
2294	flk 3	15n53w	14	1
2295	ut chunk	15n53w	14	1
2296	flk 3	15n53w	14	1
2297	flk 3	15n53w	15	1
2298	flk 2	15n53w	15	1
2299	flk	15n53w	15	1
2300	flk 3	15n53w	16	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2301	flk 3	15n53w	16	1
2302	flk 2	15n53w	16	1
2303	flk 3	15n53w	16	1
2304	flk 1	15n53w	16	1
2305	flk 3	24s32e	6	1
2306	flk 3	24s32e	8	1
2307	flk 3	24s32e	10	1
2308	flk 3	24s32e	11	1
2309	flk 1	24s32e	16	1
2310	flk 3	38s14e	1	1
2311	flk 2	38s14e	3	1
2312	flk 3	38s14e	6	1
2313	flk 3	38s14e	8	1
2314	flk 3	17n33w	0	2
2315	core	17n33w	0	1
2316	flk 2	17n33w	0	3
2317	flk 1	17n33w	0	1
2318	core	17n33w	0	1
2319	flk 1	2n8e	11	1
2320	flk 1	24s46e	1	1
2321	core	24s46e	1	1
2322	flk 3	60s6e	2	1
2323	flk 2	60s6e	3	1
2324	core	10s14w	1	2
2325	test peb	10s14w	2	1
2326	flk 2	10s14w	5	3
2327	nonart	10s14w	5	1
2328	flk 1	10s14w	7	1
2329	flk 2	10s14w	10	3
2330	core	10s14w	11	1
2331	nonart	10s14w	12	1
2332	flk 2	10s14w	13	1
2333	flk 2	10s14w	14	1
2334	flk 2	10s14w	15	2
2335	scraper	10s14w	10	2
2336	hs	12n28w	1	1
2337	flk 2	12n28w	1	1
2338	flk 2	12n28w	1	1
2339	flk 1	12n28w	1	1
2340	flk 2	12n28w	1	1
2341	flk 2	12n28w	1	1
2342	flk 2	12n28w	1	1
2343	flk 3	12n28w	1	1
2344	flk 3	12n28w	1	1
2345	flk 3	12n28w	1	1
2346	flk 2	12n28w	1	1
2347	flk 3	12n28w	1	1
2348	deb	12n28w	2	1
2349	flk 3	12n28w	2	1
2350	flk 2	12n28w	2	1
2351	flk 3	12n28w	2	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2352	flk 3	12n28w	2	1
2353	deb	12n28w	2	1
2354	deb	12n28w	2	1
2355	flk 3	12n28w	2	1
2356	flk 2	12n28w	2	1
2357	flk 2	12n28w	2	1
2358	flk 1	12n28w	2	1
2359	core	12n28w	2	1
2360	flk 2	12n28w	3	1
2361	flk 3	12n28w	3	1
2362	flk 2	12n28w	3	1
2363	deb	12n28w	3	1
2364	ut flk 2	12n28w	3	1
2365	flk 2	12n28w	3	1
2366	flk 2	12n28w	3	1
2367	flk 3	12n28w	3	1
2368	flk 3	12n28w	3	1
2369	flk 2	12n28w	3	1
2370	flk 1	12n28w	3	1
2371	core	12n28w	3	1
2372	flk 2	12n28w	4	1
2373	flk 3	12n28w	4	1
2374	flk 2	12n28w	4	1
2375	ut flk 1	12n28w	4	1
2376	flk 3	12n28w	4	1
2377	flk 3	12n28w	4	1
2378	flk 2	12n28w	5	1
2379	flk 3	12n28w	5	1
2380	flk 2	12n28w	5	1
2381	flk 2	12n28w	5	1
2382	flk 2	12n28w	5	1
2383	flk 2	12n28w	5	1
2384	flk 2	12n28w	5	1
2385	nonart	12n28w	5	1
2386	flk 2	12n28w	6	1
2387	flk 2	12n28w	6	1
2388	ut flk 2	12n28w	6	1
2389	flk 2	12n28w	6	1
2390	flk 3	12n28w	6	1
2391	flk 3	12n28w	6	1
2392	flk 3	12n28w	6	1
2393	flk 3	12n28w	6	1
2394	flk 3	12n28w	6	1
2395	flk 2	12n28w	6	1
2396	flk 3	12n28w	6	1
2397	flk 3	12n28w	7	1
2398	flk 3	12n28w	7	1
2399	flk 1	12n28w	7	1
2400	flk 2	12n28w	7	1
2401	flk 3	12n28w	7	1
2402	flk 2	12n28w	7	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2403	flk 1	12n28w	7	1
2404	flk 2	12n28w	7	1
2405	ut core	12n28w	7	1
2406	flk 2	12n28w	7	1
2407	flk 2	12n28w	7	1
2408	flk 3	12n28w	7	1
2409	deb	12n28w	7	1
2410	flk 2	12n28w	7	1
2411	flk 2	12n28w	7	1
2412	flk 3	12n28w	7	1
2413	flk 2	12n28w	7	1
2414	flk 2	12n28w	7	1
2415	flk 3	12n28w	8	1
2416	flk 2	12n28w	8	1
2417	flk 3	12n28w	8	1
2418	flk 2	12n28w	8	1
2419	flk 2	12n28w	8	1
2420	flk 3	12n28w	9	1
2421	flk 2	12n28w	9	1
2422	nonart	12n28w	9	1
2423	flk 2	12n28w	9	1
2424	ut chunk	12n28w	9	1
2425	deb	12n28w	9	1
2426	flk 3	12n28w	9	1
2427	flk 3	12n28w	9	1
2428	flk 1	12n28w	9	1
2429	flk 3	12n28w	9	1
2430	ut flk 2	12n28w	9	1
2431	hs	12n28w	9	1
2432	hs	12n28w	10	1
2433	ut flk 1	12n28w	10	1
2434	flk 2	12n28w	10	1
2435	flk 3	12n28w	10	1
2436	flk 3	12n28w	10	1
2437	ut core	12n28w	10	1
2438	flk 1	12n28w	10	1
2439	flk 2	12n28w	10	1
2440	core	12n28w	10	1
2441	flk 3	12n28w	10	1
2442	flk 3	12n28w	10	1
2443	flk 3	12n28w	10	1
2444	flk 2	12n28w	11	1
2445	flk 2	12n28w	11	1
2446	flk 2	12n28w	11	1
2447	flk 3	12n28w	11	1
2448	flk 3	12n28w	11	1
2449	flk 1	12n28w	11	1
2450	ut flk 2	12n28w	12	1
2451	flk 1	12n28w	12	1
2452	ut flk 2	12n28w	12	1
2453	flk 2	12n28w	12	2
2454	flk 2	12n28w	12	1
2455	flk 2	12n28w	12	1
2456	flk 2	12n28w	12	1
2457	flk 2	12n28w	13	1
2458	flk 3	12n28w	13	2
2459	core	12n28w	13	1
2460	flk 3	12n28w	13	1
2461	flk 3	12n28w	13	1
2462	flk 3	12n28w	13	1
2463	test peb	12n28w	14	1
2464	flk 3	12n28w	14	1
2465	flk 3	12n28w	15	1
2466	flk 2	12n28w	15	1
2467	flk 1	12n28w	15	1
2468	flk 2	12n28w	15	1
2469	flk 1	12n28w	15	1
2470	flk 3	12n28w	16	1
2471	flk 3	12n28w	16	1
2472	core	12n28w	16	1
2473	flk 2	12n28w	16	1
2474	flk 2	12n28w	16	1
2475	flk 3	12n28w	16	1
2476	ut core	12n28w	16	1
2477	flk 3	12n28w	16	1
2478	nonart	7s40w	1	1
2479	flk 1	7s40w	1	1
2480	flk 3	7s40w	2	2
2481	core	7s40w	2	1
2482	flk 1	7s40w	2	2
2483	test peb	7s40w	3	1
2484	flk 2	7s40w	3	1
2485	flk 1	7s40w	3	3
2486	flk 1	7s40w	3	1
2487	ang deb	7s40w	3	1
2488	flk 2	7s40w	4	1
2489	flk 1	7s40w	4	1
2490	flk 2	7s40w	4	1
2491	flk 2	7s40w	4	3
2492	flk 1	7s40w	5	1
2493	flk 2	7s40w	6	1
2494	flk 2	7s40w	6	1
2495	flk 3	7s40w	7	1
2496	flk 1	7s40w	7	1
2497	flk 3	7s40w	8	1
2498	hs	7s40w	8	1
2499	flk 2	7s40w	8	2
2500	core	7s40w	8	1
2501	flk 3	7s40w	9	1
2502	ut flk 2	7s40w	9	1
2503	flk 2	7s40w	9	1
2504	core	7s40w	9	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2505	flk 1	7s40w	10	1
2506	flk 2	7s40w	10	4
2507	flk 2	7s40w	11	1
2508	flk 1	7s40w	11	1
2509	flk 1	7s40w	12	1
2510	flk 2	7s40w	12	2
2511	flk 1	7s40w	13	1
2512	flk 2	7s40w	13	4
2513	flk 2	7s40w	13	1
2514	hs	7s40w	14	2
2515	flk 1	7s40w	14	1
2516	flk 1	7s40w	15	1
2517	core	7s40w	15	3
2518	obsidian	7s4w	15	1
2519	flk 1	7s40w	15	1
2520	flk 1	7s40w	16	1
2521	flk 1	7s40w	16	2
2522	flk 2	47s1e	4	1
2523	flk 1	47s1e	14	1
2524	scraper		0	1
1971	scraper		0	1
2525	flk 3	4s29w	14	1
2526	flk 1	4s29w	14	1
2527	flk 2	4s29w	15	1
2528	flk	4s29w	15	1
2529	flk 2	4s29w	16	3
2530	deb	4s29w	16	1
2531	gs	4s29w	20	1
2532	flk 3	4s29w	20	1
2533	gs	4s29w	20	1
2534	flk	4s29w	21	1
2535	flk 3	4s29w	22	1
2536	flk 3	4s29w	23	1
2537	core	4s29w	26	1
2538	gs	4s29w	26	1
2539	core	4s29w	26	1
2540	flk 2	4s29w	26	1
2541	deb	4s29w	26	2
2542	chopper	4s29w	27	1
2543	flk 3	4s29w	28	2
2544	deb	4s29w	29	6
2545	flk 3	4s29w	29	1
2546	flk 2	4s29w	32	1
2547	core	4s29w	32	1
2548	deb	4s29w	33	2
2549	deb	4s29w	33	2
2550	flk 1	4s29w	34	1
2551	deb	4s29w	35	1
2552	gs	4s29w	35	1
2553	flk 2	4s29w	35	1
2554	flk 3	15n53w	1	1
2555	test peb	15n53w	1	1
2556	flk 2	15n53w	2	1
2557	flk 3	15n53w	2	1
2558	deb	15n53w	5	1
2559	flk 2	15n53w	5	1
2560	flk 3	15n53w	5	1
2561	test peb	15n53w	5	1
2562	flk 2	15n53w	5	1
2563	test peb	15n53w	6	1
2564	flk 2	15n53w	6	1
2565	flk 3	15n53w	6	1
2566	deb	15n53w	6	1
2567	flk 1	15n53w	9	1
2568	deb	15n53w	8	1
2569	flk 3	15n53w	9	1
2570	flk 3	15n53w	10	1
2571	core	15n53w	10	1
2572	core	15n53w	10	1
2573	core	15n53w	10	1
2574	flk 2	15n53w	10	1
2575	flk 3	15n53w	10	1
2576	flk 2	15n53w	11	1
2577	core	15n53w	11	1
2578	flk 2	15n53w	11	1
2579	flk 3	15n53w	11	1
2580	core	15n53w	12	1
2581	deb	15n53w	12	1
2582	flk 2	15n53w	12	1
2583	flk 3	15n53w	12	1
2584	deb	15n53w	13	1
2585	flk 3	15n53w	13	1
2586	flk 3	15n53w	13	1
2587	flk 3	15n53w	13	1
2588	flk 2	15n53w	13	1
2589	deb	15n53w	13	1
2590	flk 2	15n53w	14	1
2591	flk 2	15n53w	14	1
2592	flk 2	15n53w	14	1
2593	ut flk 2	15n53w	14	1
2594	flk 2	15n53w	14	1
2595	test peb	15n53w	14	1
2596	flk 3	15n53w	14	1
2597	flk 2	15n53w	14	1
2598	flk 3	15n53w	14	1
2599	flk 3	15n53w	14	1
2600	deb	15n53w	14	1
2601	deb	15n53w	15	1
2602	deb	15n53w	15	1
2603	nonart	15n53w	15	1
2604	flk 3	15n53w	15	1
2605	flk 3	15n53w	15	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2606	flk 2	15n53w	15	1
2607	flk 2	15n53w	15	1
2608	flk 1	15n53w	15	1
2609	core	15n53w	15	1
2610	deb	15n53w	15	1
2611	min	15n53w	15	1
2612	deb	15n53w	15	1
2613	flk 2	15n53w	15	1
2614	flk 3	15n53w	16	1
2615	flk 2	15n53w	16	1
2616	deb	15n53w	16	1
2617	flk 2	15n53w	16	1
2618	deb	15n53w	16	1
2619	flk 3	15n53w	16	2
2620	flk 3	15n53w	16	1
2621	core	56s6w	1	3
2622	deb	56s6w	7	1
2623	flk 1	56s6w	14	3
2624	flk 2	56s6w	15	3
2625	flk 2	2s21w	2	1
2626	flk 3	2s21w	2	1
2627	flk 2	2s21w	2	1
2628	flk 1	2s21w	2	1
2629	flk 3	2s21w	2	1
2630	flk 2	2s21w	2	1
2631	flk 2	2s21w	2	1
2632	flk 3	2s21w	2	1
2633	flk 2	2s21w	2	1
2634	gs	2s21w	2	1
2635	flk 1	2s21w	2	1
2636	flk 2	2s21w	2	1
2637	flk 2	2s21w	2	1
2638	flk 3	2sa21w	2	1
2639	chopper	2s21w	1	1
2640	core	2s21w	3	1
2641	flk 2	2s21w	3	1
2642	flk 2	2s21w	3	1
2643	flk 2	2s21w	3	1
2644	flk 2	2s21w	3	1
2645	core	2s21w	3	1
2646	flk 3	2s21w	3	1
2647	flk 3	2s21w	3	1
2648	flk	2s21w	3	1
2649	flk	2s21w	3	1
2650	flk 3	2s21w	3	1
2651	flk 3	2s21w	3	1
2652	core	2s21w	5	1
2653	gs	2s21w	5	1
2654	flk 3	2s21w	5	1
2655	flk 2	2s21w	5	1
2656	flk 2	2s21w	5	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2657	flk 3	2s21w	5	1
2658	flk 3	2s21w	5	1
2659	flk 2	2s21w	5	1
2660	flk 2	2s21w	5	1
2661	flk 2	2s21w	5	1
2662	flk 3	2s21w	5	1
2663	flk 1	2s21w	5	1
2664	flk 2	2s21w	5	1
2665	flk 3	2s21w	6	1
2666	flk 2	2s21w	6	1
2667	flk 3	2s21w	6	1
2668	flk 2	2s21w	6	1
2669	flk 3	2s21w	6	1
2670	flk 2	2s21w	7	1
2671	flk 2	2s21w	7	1
2672	flk 3	2s21w	7	1
2673	hs	2s21w	9	1
2674	flk 3	2s21w	9	1
2675	flk 2	2s21w	9	1
2676	core	2s21w	9	1
2677	flk 2	2s21w	9	1
2678	flk 3	2s21w	9	1
2679	flk 2	2s21w	9	1
2680	flk 3	2s21w	9	1
2681	flk 2	2s21w	9	1
2682	flk 2	2s21w	9	1
2683	flk 3	2s21w	9	1
2684	flk 3	2s21w	9	1
2685	flk 3	2s21w	9	1
2686	flk 2	2s21w	9	1
2687	flk 3	2s21w	9	1
2688	flk 2	2s21w	9	1
2689	flk 2	2s21w	9	1
2690	flk 2	2s21w	9	1
2691	flk 2	2s21w	9	1
2692	flk 1	2s21w	9	1
2693	flk 2	2s21w	9	1
2694	flk 2	2s21w	9	1
2695	flk 3	2s21w	9	1
2696	flk 3	2s21w	9	1
2697	flk 3	2s21w	9	1
2698	flk 3	2s21w	9	1
2699	flk 2	2s21w	9	1
2700	flk 3	2s21w	9	1
2701	flk 3	2s21w	9	1
2702	flk 2	2s21w	10	1
2703	flk 3	2s21w	10	1
2704	flk 2	2s21w	10	1
2705	flk 2	2s21w	10	1
2706	flk 2	2s21w	10	1
2707	flk 3	2s21w	10	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2708	ang deb	2s21w	10	1
2709	flk 2	2s21w	10	2
2710	flk 2	2s21w	11	1
2711	flk 3	2s21w	11	1
2712	flk 2	2s21w	11	1
2713	flk 2	2s21w	11	1
2714	flk 3	2s21w	12	1
2715	flk 3	2s21w	12	1
2716	flk 3	2s21w	12	1
2717	flk 3	2s21w	12	1
2718	flk 2	2s21w	13	1
2719	core	2s21w	13	1
2720	flk 3	2s21w	13	1
2721	flk	2s21w	13	1
2722	flk 2	2s21w	13	1
2723	flk 1	2s21w	13	1
2724	fossil	2s21w	13	1
2725	ang deb	2s21w	13	1
2726	flk 3	2s21w	13	1
2727	flk 3	2s21w	1	1
2728	flk 3	2s21w	13	1
2729	flk 3	2s21w	13	1
2730	scraper	2s21w	13	1
2731	flk 2	2s21w	13	1
2732	flk 2	2s21w	13	1
2733	flk 3	2s21w	13	1
2734	flk 2	2s21w	13	1
2735	flk 2	2s21w	13	1
2736	scraper	2s21w	14	1
2737	flk 3	2s21w	14	1
2738	flk 2	2s21w	14	1
2739	flk 3	2s21w	15	1
2740	flk 3	2s21w	15	1
2741	flk 2	2s21w	15	1
2742	flk 2	2s21w	15	1
2743	flk 2	2s21w	15	1
2744	flk 3	2s21w	15	1
2745	flk 3	2s21w	15	1
2746	flk 2	2s21w	16	1
2747	flk 3	2s21w	1	1
2748	flk 2	2s21w	1	1
2749	flk 3	2s21w	1	1
2750	gs	47s1e	10	1
2751	core	47s1e	6	1
2752	flk 3	47s1e	6	1
2753	nonart	47s1e	6	1
2754	deb	47s1e	8	1
2755	flk 2	47s1e	8	1
2756	test peb	47s1e	11	1
2757	gs	47s1e	13	1
2758	flk	47s1e	7	1
2759	flk 3	23s20w	2	1
2760	ut flk 3	23s20w	11	1
2761	flk 3	23s20w	11	1
2762	core	23s20w	12	1
2763	flk 3	23s20w	12	1
2764	flk 3	23s20w	12	1
2765	core	23s20w	16	1
2766	core	2s21w	0	1
2767	gs	2s21w	0	1
2768	gs	2s21w	0	1
2769	flk 3	2s21w	1	1
2769	flk	2s21w	1	1
2770	flk 1	2s21w	1	1
2771	flk	2s21w	4	1
2772	flk 2	2s21w	4	1
2773	flk 3	2s21w	4	1
2774	flk 1	2s21w	4	1
2775	flk 3	2s21w	4	1
2776	flk 2	2s21w	4	1
2777	flk 2	2s21w	4	1
2778	flk 3	2s21w	4	1
2779	flk 1	2s21w	4	1
2780	core	2s21w	4	1
2781	flk 3	2s21w	4	1
2782	flk 2	2s21w	5	1
2783	flk 2	2s21w	5	1
2784	flk 3	2s21w	8	1
2785	flk 3	2s21w	8	1
2786	flk 2	2s21w	8	1
2787	flk 2	2s21w	8	1
2788	flk 2	2s21w	8	1
2789	flk 3	2s21w	8	1
2790	flk 3	2s21w	8	1
2791	flk 2	2s21w	8	1
2792	flk 3	2s21w	8	1
2793	flk 3	2s21w	9	1
2794	flk 2	2s21w	9	1
2795	deb	2s21w	9	1
2796	flk 1	2s21w	9	1
2797	flk 2	2s21w	9	1
2798	flk 3	2s21w	9	1
2799	flk 3	2s21w	13	1
2800	flk 3	2s21w	13	1
2801	flk 1	2s21w	13	1
2802	flk 1	2s21w	13	1
2803	flk 2	2s21w	16	1
2804	flk 3	2s21w	16	1
2805	flk 2	2s21w	16	1
2806	flk 3	2s21w	16	1
2807	flk 1	2s21w	16	1
2808	ut flk 2	42n39w	3	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2809	flk 2	42n22w	3	1
2810	flk 3	42n22w	4	1
2811	ut flk	12n39w	7	1
2812	flk 2	42n22w	10	1
2813	flk 3	42n22w	10	1
2814	ut flk 1	42n39w	11	1
2815	test peb	10n44w	1	7
2816	ut flk 1	10n44w	1	1
2817	core	10n44w	1	1
2818	ut flk 1	10n44w	2	2
2819	flk 1	10n44w	2	6
2820	flk 1	10n44w	3	3
2821	ut flk 2	10n44w	3	2
2822	flk 1	42n22w	4	1
2823	ut flk 2	10n44w	4	8
2824	ut flk 1	10n44w	4	1
2825	core	10n44w	4	6
2826	ut flk 2	10n44w	5	1
2827	ut flk 1	10n44w	5	9
2828	core	10n44w	6	8
2829	core	10n44w	6	13
2830	ut flk 1	10n44w	7	2
2831	test peb	10n44w	7	1
2832	core	10n44w	8	14
2833	flk 1	10n44w	8	3
2834	core	10n44w	8	1
2835	flk 1	10n44w	9	1
2836	ut flk 1	10n44w	9	1
2837	ut flk 1	10n44w	9	2
2838	flk 1	10n44w	11	2
2839	core	10n44w	12	10
2840	flk 2	10n44w	13	4
2841	flk 2	10n44w	14	10
2842	test peb	10n44w	15	7
2843	flk 1	10n44w	16	3
2844	ut flk		0	1
2845	flk 2		0	1
2846	flk 2		0	1
2847	hs		0	1
2848	flk 3	46s3w	5	1
2849	flk 3	46s3w	5	1
2850	flk 3	46s3w	6	1
2851	ut flk 3	46s3w	6	1
2852	flk 3	46s3w	9	1
2853	flk 1	46s3w	11	1
2854	hs	46s3w	12	1
2855	flk 2	46s3w	15	1
2856	flk 2	47s1e	7	1
2857	flk 2	10n38w	1	4
2858	ut flk 2	10n38w	1	1
2859	flk 2	10n38w	2	1
2860	flk 1	10n38w	2	1
2861	deb	10n38w	3	1
2862	flk 2	10n38w	4	1
2863	flk 2	10n38w	4	1
2864	core	10n38w	5	15
2865	flk 2	10n38w	5	2
2866	ut flk 3	10n38w	6	1
2867	flk 1	10n38w	6	1
2868	flk 1	10n38w	7	1
2869	flk 2	10n38w	8	4
2870	flk 2	23n33w	1	1
2871	flk 2	23n33w	2	1
2872	flk 1	23n33w	5	1
2873	flk 3	23n33w	5	1
2874	deb	23n33w	6	1
2875	flk 1	23n33w	9	1
2876	flk 2	23n33w	9	1
2877	flk 3	23n33w	13	1
2878	flk 3	23n33w	13	1
2879	deb	23n33w	16	1
2880	flk 2	23n33w	16	1
2881	flk 3	20n3e	1	1
2882	flk 3	20n3e	2	1
2883	flk 3	20n3e	2	1
2884	flk 3	20n3e	2	1
2885	flk 3	20n3e	2	1
2886	flk 2	20n3e	3	1
2887	flk 2	20n3e	7	1
2888	flk 3	20n3e	7	1
2889	flk 3	20n3e	7	1
2890	flk 3	20n3e	7	1
2891	flk 1	20n3e	7	1
2892	flk 1	20n3e	11	1
2893	flk 3	20n3e	11	1
2894	flk 3	20n3e	11	1
2895	flk 3	20n3e	11	1
2896	flk 3	20n3e	11	1
2897	ceram	20n3e	12	1
2898	flk	20n3e	12	1
2899	flk 2	20n3e	15	1
2900	flk 1	20n3e	15	1
2901	flk 2	20n3e	25	1
2902	flk 2	20n3e	16	1
2903	flk 3	20n3e	16	1
2904	flk 2	20n3e	16	1
2905	flk 3	20n3e	16	1
2906	flk 3	20n3e	16	1
2907	ut flk 2	10n38w	1	1
2908	ut flk 2	10n38w	2	1
2909	flk 2	10n38w	3	3
2910	ut flk 1	10n38w	4	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2911	flk 2	10n38w	6	2
2912	flk 2	10n38w	7	2
2913	deb	10n38w	7	1
2914	ut flk 2	10n38w	8	1
2915	flk 2	10n38w	10	2
2916	ut flk 2	10n38w	10	1
2917	flk 2	10n38w	11	3
2918	ut flk 2	10n38w	12	1
2919	ut flk 2	10n38w	12	1
2920	flk 1	10n38w	13	1
2921	ut flk 2	10n38w	13	1
2922	ut flk 2	10n38w	14	1
2923	flk 2	10n38w	14	9
2924	ut flk 1	10n38w	15	1
2925	ut core	10n38w	15	1
2926	ut flk 2	10n38w	16	1
2927	ut flk	10n38w	13	1
2928	ut core	10n38w	1	1
2929	ut flk	10n38w	1	7
2930	core	10n38w	2	5
2931	flk 1	10n38w	2	1
2932	flk 2	10n38w	3	3
2933	scraper	10n38w	3	1
2934	core	10n38w	3	1
2935	ut core	10n38w	4	1
2936	core	10n38w	5	10
2937	flk 2	10n38w	6	2
2938	ut flk 2	10n38w	7	1
2939	ut core	10n38w	7	1
2940	ut flk 1	10n38w	8	1
2941	flk 2	10n38w	9	3
2942	flk 1	10n38w	9	1
2943	flk 2	10n38w	9	1
2944	blade	10n38w	9	1
2945	flk 1	10n38w	10	1
2946	core	10n38w	10	1
2947	flk 2	10n38w	10	3
2948	flk 2	10n38w	10	4
2949	core	10n38w	11	1
2950	ut flk 1	10n38w	11	1
2951	flk 2	10n38w	12	5
2952	core	10n38w	13	0
2953	test peb	10n38w	14	7
2954	flk 1	10n38w	15	1
2955	flk 3	10n38w	16	2
2956	core	10n38w	7	10
2957	core	10n38w	7	1
2958	flk 2	10n38w	8	1
2959	flk 1	10n38w	9	1
2960	flk 2	10n38w	11	4
2961	flk 2	10n38w	12	2

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2962	flk 2	10n38w	14	1
2963	flk 2	10n38w	15	4
2964	ut flk 2	10n38w	16	1
2965	flk 1	10n38w	16	1
2966	flk 2	16n18w	3	1
2967	point	16n18w	2	1
2968	flk 1	16n18w	6	1
2969	flk 2	16n18w	8	1
2970	flk 3	16n18w	8	1
2971	flk 3	16n18w	11	1
2972	flk 2	16n18w	16	1
2973	flk 2	16n18w	4	1
2974	flk 2	16n18w	4	1
2975	flk 2	16n18w	6	1
2976	flk 2	16n18w	11	1
2977	flk 2	16n18w	12	1
2978	flk 1	16n18w	12	1
2979	flk 2	16n18w	12	1
2980	flk 2	16n18w	12	1
2981	flk	16n18w	14	1
2982	flk 2	16n18w	15	1
2983	hist	16n18w	15	1
2984	flk 1	16n18w	13	1
2985	flk 3	16n18w	1	1
2986	flk 3	16n18w	6	1
2987	flk 2	16n18w	8	1
2988	flk 2	16n18w	8	1
2989	flk 3	16n18w	8	1
2990	flk 2	16n18w	12	1
2991	flk 2	16n18w	12	1
2992	flk 2	16n18w	13	1
2993	ut core	16n18w	16	1
2994	ut flk 1	16n18w	16	1
2995	flk 2	16n18w	9	1
2996	pestle	16n18w	10	1
2997	flk 3	2s21w	1	1
2998	flk 2	2s21w	1	1
2999	flk 2	2s21w	1	1
3000	flk 3	2s21w	1	1
3001	flk 2	2s21w	1	1
3002	flk 3	2s21w	2	1
3003	flk 2	2s21w	2	1
3004	flk 3	2s21w	2	1
3005	flk 2	2s21w	2	1
3006	flk 2	2s21w	2	1
3007	core	2s21w	2	1
3008	flk 2	2s21w	2	1
3009	test peb	2s21w	2	1
3010	flk 2	2s21w	3	1
3011	flk 2	2s21w	3	1
3012	flk 3	2s21w	3	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3013	flk 3	2s21w	3	1
3014	flk 2	2s21w	3	1
3015	flk 1	2s21w	3	1
3016	ut flk	2s21w	3	1
3017	flk 2	2s21w	3	1
3018	flk 3	2s21w	4	1
3019	flk 3	2s21w	4	1
3020	flk 2	2s21w	4	1
3021	ang deb	2s21w	4	1
3022	flk 2	2s21w	4	1
3023	ang deb	2s21w	4	1
3024	flk 2	2s21w	4	1
3025	flk 1	2s21w	4	1
3026	flk 1	2s21w	4	1
3027	flk 2	2s21w	4	1
3028	flk 3	2s21w	4	1
3029	flk 2	2s21w	4	1
3030	flk 3	2s21w	4	1
3031	flk 2	2s21w	4	1
3032	flk 2	2s21w	4	1
3033	flk 3	2s21w	4	1
3034	test peb	2s21w	4	1
3035	scraper	2s21w	6	1
3036	flk 3	2s21w	6	1
3037	flk 1	2s21w	6	1
3038	flk 3	2s21w	6	1
3039	flk 2	2s21w	6	1
3040	flk 2	2s21w	6	1
3041	flk 3	2s21w	6	1
3042	flk 2	2s21w	6	1
3043	flk 3	2s21w	6	1
3044	flk 2	2s21w	6	1
3045	flk 3	2s21w	6	1
3046	flk 1	2s21w	7	1
3047	core	2s21w	7	1
3048	flk 3	2s21w	7	1
3049	ang deb	2s21w	7	1
3050	flk 3	2s21w	7	1
3051	flk 2	2s21w	7	1
3052	flk 2	2s21w	7	1
3053	flk 3	2s21w	7	1
3054	flk 3	2s21w	7	1
3055	flk 2	2s21w	7	1
3056	flk 3	2s21w	7	1
3057	flk 3	2s21w	7	1
3058	flk 2	2s21w	7	1
3059	flk 2	2s21w	7	1
3060	flk	2s21w	7	1
3061	flk 3	2s21w	8	1
3062	flk 2	2s21w	8	1
3063	flk 2	2s21w	8	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3064	flk 2	2s21w	8	1
3065	flk 2	2s21w	8	1
3066	ang deb	2s21w	8	1
3067	flk 2	2s21w	8	1
3068	flk 2	2s21w	8	1
3069	flk 3	2s21w	8	1
3070	flk 3	2s21w	8	1
3071	flk 3	2s21w	8	1
3072	ut chunk	2s21w	10	1
3073	flk 2	2s21w	10	1
3074	flk 3	2s21w	10	1
3075	flk 3	2s21w	10	1
3076	flk 2	2s21w	10	1
3077	flk 2	2s21w	10	1
3078	flk 3	2s21w	10	1
3079	flk 3	2s21w	10	1
3080	flk 3	2s21w	10	1
3081	flk 3	2s21w	10	1
3082	flk 2	2s21w	10	1
3083	flk 1	2s21w	10	1
3084	flk 3	2s21w	10	1
3085	flk 2	2s21w	10	1
3086	flk 2	2s21w	10	1
3087	flk 2	2s21w	10	1
3088	flk 2	2s21w	10	1
3089	flk 2	2s21w	10	1
3090	flk 3	2s21w	10	1
3091	flk 3	2s21w	11	1
3092	flk 3	2s21w	11	1
3093	flk 1	2s21w	11	1
3094	flk 2	2s21w	11	1
3095	flk 2	2s21w	11	1
3096	flk 2	2s21w	11	1
3097	flk 3	2s21w	11	1
3098	flk 2	2s21w	11	1
3099	flk 2	2s21w	11	1
3100	flk 2	2s21w	11	1
3101	flk 3	2s21w	11	1
3102	flk 3	2s21w	11	1
3103	flk	2s21w	11	1
3104	flk 3	2s21w	11	1
3105	scraper	2s21w	11	1
3106	flk 2	2s21w	12	1
3107	flk 2	2s21w	12	1
3108	flk 2	2s21w	12	1
3109	flk 1	2s21w	12	1
3110	flk 2	2s21w	12	1
3111	flk 2	2s21w	12	1
3112	flk 3	2s21w	12	1
3113	flk 3	2s21w	12	1
3114	flk 1	2s21w	12	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3115	flk 3	2s21w	12	1
3116	flk 3	2s21w	12	1
3117	flk 2	2s21w	12	1
3118	flk 2	2s21w	12	1
3119	flk 3	2s21w	12	1
3120	flk 3	2s21w	12	1
3121	flk 3	2s21w	12	1
3122	flk 2	2s21w	12	1
3123	flk 3	2s21w	12	1
3124	flk 2	2s21w	12	1
3125	flk 1	2s21w	12	1
3126	flk 1	2s21w	12	1
3127	core	2s21w	14	1
3128	core	2s21w	14	1
3129	flk 2	2s21w	14	1
3130	flk 2	2s21w	14	1
3131	flk 3	2s21w	14	1
3132	flk 2	2s21w	14	1
3133	flk 3	2s21w	14	1
3134	flk 2	2s21w	14	1
3135	flk 2	2s21w	14	1
3136	flk 3	2s21w	14	1
3137	flk 2	2s21w	14	1
3138	flk 2	2s21w	14	1
3139	flk 3	2s21w	14	1
3140	flk 1	2s21w	14	1
3141	flk 2	2s21w	14	1
3142	flk 1	2s21w	14	1
3143	flk 2	2s21w	14	1
3144	flk 2	2s21w	14	1
3145	flk 1	2s21w	14	1
3146	flk 1	2s21w	14	1
3147	flk 3	2s21w	14	2
3148	flk 2	2s21w	14	1
3149	flk	2s21w	14	1
3150	flk 2	2s21w	14	1
3151	flk 1	2s21w	14	1
3152	flk 3	2s21w	14	1
3153	flk 2	2s21w	14	1
3154	flk 2	2s21w	14	1
3155	flk 2	2s21w	14	1
3156	flk	2s21w	14	1
3157	flk 3	2s21w	14	1
3158	flk 3	2s21w	14	1
3159	flk 2	2s21w	15	1
3160	flk 2	2s21w	15	1
3161	flk 3	2s21w	15	1
3162	flk 3	2s21w	15	1
3163	ang deb	2s21w	15	1
3164	flk 3	2s21w	15	1
3165	flk 3	2s21w	15	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3166	flk 2	2s21w	15	1
3167	flk 2	2s21w	15	1
3168	flk 1	2s21w	15	1
3169	flk 3	2s21w	15	1
3170	flk 2	2s21w	15	1
3171	flk 1	2s21w	15	1
3172	flk 2	2s21w	15	1
3173	flk 3	2s21w	15	1
3174	flk 3	2s21w	16	1
3175	flk 3	2s21w	16	1
3176	flk 3	2s21w	16	1
3177	flk 3	2s21w	15	1
3178	flk 3	2s21w	16	1
3179	flk 2	2s21w	16	1
3180	flk 3	2s21w	16	1
3181	flk 2	2s21w	16	1
3182	flk 1	2s21w	16	1
3183	flk 3	2s21w	16	1
3184	flk 1	2s21w	16	1
3185	flk 3	2s21w	16	1
3186	flk 1	2s21w	16	1
3187	flk 2	2s21w	16	1
3188	flk 2	2s21w	16	1
3189	flk 3	2s21w	16	1
3190	flk 3	2s21w	16	1
3191	flk 2	2s21w	16	1
3192	flk 2	17n33w	1	5
3193	flk 2	17n33w	1	1
3194	flk 1	17n33w	1	2
3195	flk 1	17n33w	10	1
3196	chopper	17n33w	1	1
3197	ceram	22n6w	14	1
3198	flk 2	22n6w	16	2
3199	flk 1	22n6w	11	1
3200	flk 2	22n6w	9	1
3201	flk 3	22n6w	15	1
3202	ceram	22n6w	16	1
3203	flk 2	22n6w	9	1
3204	flk 2	22n6w	9	1
3205	flk 2	22n6w	16	1
3206	flk 2	22n6w	16	1
3207	core	22n6w	13	1
3208	flk 1	22n6w	16	1
3209	flk 2	22n6w	14	1
3210	flk 3	22n6w	12	2
3211	flk 2	42n2w	9	1
3212	flk 2	42n2w	11	1
3213	flk 3	42n2w	14	1
3214	flk 3	42n2w	9	1
3215	flk 3	42n2w	15	1
3289	flk 2	16n18w	5	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3465	flk 2	seg3	8	1
3466	flk 3	seg3	8	1
3467	core	seg3	3	1
3468	hs	seg3	3	1
3469	core		0	6
3470	ceram		0	1
3471	deb		0	1
3472	core		0	1
3473	ut flk		0	1
3474	core		0	1
3475	scraper		0	1
3476	hs		0	1
3477	flk 1		0	1
3478	flk 3		0	1
3479	ut flk		0	2
3480	flk		0	2
3481	core		0	1
3482	core		0	1
3483	gs		0	1
3484	core		0	1
3485	anvil		0	1
3486	bone		0	1
3487	scraper		0	1
3488	gs		0	1
3489	anvil		0	1
3545	test peb		0	1
3546	flk 1		0	1
3547	core		0	1
3548	flk 2		0	1
3549	core		0	1
3550	core		0	1
3551	flk 2		0	1
3552	point		0	1
3553	flk 3		0	1
3554	flk 2		0	1
3555	test peb		0	1
3556	flk		0	3
3557	hs		0	1
3558	gs		0	1
3559	flk 2		0	1
3560	nonart		0	1
3561	flk 2		0	2
3562	flk 1		0	1
3563	flk 2		0	1
3564	ut flk 2		0	1
3568	gs	20s24w	0	1
3569	gs		0	1
3570	hs	4s29w	0	1
3571	lith	4s29w	0	1
3572	lith	20s24w	0	1
3573	lith	4s29w	0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3574	lith		0	1
3575	core		0	1
3576	tool	20s24w	0	1
3577	gs		0	1
3578	gs	20s24w	0	1
3580	pestle		0	1
3581	flk 3	seg9	1	1
3582	core	seg9	1	2
3583	flk 1	seg9	2	1
3584	flk 2	seg9	2	1
3585	flk 1	seg9	2	1
3586	flk 2	seg9	3	1
3587	flk 3	seg9	3	1
3588	scraper	seg9	4	1
3589	flk 2	seg9	4	1
3590	flk 2	seg9	4	1
3591	obsidian	seg9	5	2
3592	obsidian	seg9	6	1
3593	flk 2	seg9	7	1
3594	test peb	seg10	1	4
3595	flk 1	seg10	1	1
3596	flk 2	seg10	1	1
3597	flk 1	seg10	2	1
3598	nonart	seg10	2	2
3599	flk 2	seg10	2	1
3600	flk 1	seg10	3	2
3601	flk 3	seg10	3	2
3602	core	seg10	4	1
3603	flk 2	seg10	4	2
3604	flk 1	seg10	5	1
3605	flk 1	seg10	6	1
3606	flk 2	seg10	7	1
3607	flk 2	seg10	8	3
3608	chopper	seg10	10	1
3609	deb	seg5	1	1
3610	flk 2	seg5	2	1
3611	flk 1	seg5	3	1
3612	flk 3	seg5	4	1
3613	flk 2	seg5	7	2
3614	deb	seg5	8	1
3615	test peb	seg5	9	1
3616	flk 3	seg6	0	1
3617	deb	seg6	0	1
3618	flk 2	seg6	0	1
3619	core	seg6	2	1
3620	core	seg6	5	1
3621	chopper	seg6	4	1
3622	scraper	seg6	1	1
3623	flk 1	seg6	1	1
3624	flk 3	seg6	1	1
3625	hs	seg6	1	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3290	flk 3	16n18w	13	1
3291	core		0	5
3292	biface		0	1
3293	hs		0	1
3294	test peb		0	1
3295	test peb		0	1
3296	test peb		0	1
3370	scraper		0	4
3371	scraper	seg2	10	1
3372	core	seg2	9	9
3373	flk 1	seg2	8	1
3374	core	seg2	9	5
3375	chopper	seg2	10	1
3376	core	seg5	11	1
3377	flk 3	seg5	1	1
3378	min	seg5	2	1
3379	flk 2	seg5	5	1
3380	nonart	seg5	6	1
3381	flk 2	seg5	8	3
3382	flk 2	seg5	9	1
3383	flk 2	seg5	10	1
3384	flk 3	seg5	11	2
3385	flk 1	seg1	2	1
3386	core	seg1	3	1
3387	ut flk 1	seg1	6	1
3388	flk 2	seg1	7	2
3389	flk 2	seg1	8	2
3390	flk 2	seg3	5	1
3391	flk 2	seg3	1	1
3392	flk 2	seg3	1	1
3393	flk 3	seg3	4	1
3394	core	seg3	5	1
3395	core	seg3	6	1
3396	flk 3	seg3	7	1
3397	flk 2	seg3	7	1
3398	flk 2	seg4	1	1
3399	flk 2	seg4	1	1
3400	flk 2	seg4	1	1
3401	flk 2	seg4	1	1
3402	flk 2	seg4	2	1
3403	deb	seg4	2	1
3404	ut flk 2	seg4	3	1
3405	flk 2	seg4	3	1
3406	flk 1	seg4	3	1
3407	flk 3	seg4	4	1
3408	flk 2	seg4	4	1
3409	flk 3	seg6	1	1
3410	flk 2	seg6	1	1
3411	flk 2	seg6	1	1
3412	flk 2	seg6	2	1
3413	flk		0	1
3414	ut flk		0	1
3415	deb		0	1
3416	flk 2	seg1	1	1
3417	flk 1	seg1	1	1
3418	core	seg1	2	2
3419	flk 1	seg1	5	1
3420	flk 3	seg1	7	1
3421	hs	seg1	8	1
3422	nonart	seg2	1	1
3423	flk 2	seg2	1	2
3424	flk 2	seg2	2	1
3425	ut flk 1	seg2	3	1
3426	flk 2	seg2	3	2
3427	flk 1	seg2	4	1
3428	flk 2	seg2	4	1
3429	flk 2	seg2	5	1
3430	flk 3	seg2	6	2
3431	flk 1	seg2	6	1
3432	flk 1	seg2	7	2
3433	flk 1	seg2	7	1
3434	flk 2	seg2	8	4
3435	flk 1		0	1
3436	flk 2		0	1
3437	flk 2		0	1
3438	flk 2		0	1
3439	core		0	1
3440	flk 3		0	1
3441	flk 3		0	1
3442	flk 1		0	3
3443	scraper		0	1
3444	hs		0	1
3445	core		0	1
3446	flk 1		0	6
3447	flk 1		0	2
3448	flk 1	seg3	1	1
3449	flk 2	seg3	1	1
3450	flk 3	seg3	1	1
3451	flk 3	seg3	3	1
3452	nonart	seg3	3	1
3453	flk 3	seg3	3	1
3454	flk 3	seg3	3	1
3455	flk 2	seg3	4	1
3456	flk 3	seg3	4	1
3457	flk 2	seg3	4	1
3458	flk 2	seg3	5	1
3459	flk 3	seg3	5	1
3460	flk 3	seg3	6	1
3461	flk 3	seg3	6	1
3462	flk 3	seg3	6	1
3463	ut flk 2	seg3	7	1
3464	flk 2	seg3	8	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3626	flk 1	seg6	1	1
3627	flk 1	seg6	1	1
3628	flk 3	seg6	1	1
3629	test peb	seg6	2	4
3630	flk 2	seg6	2	1
3631	flk 1	seg6	2	1
3632	flk 2	seg6	3	1
3633	flk 2	seg6	3	1
3634	flk 1	seg6	3	1
3635	flk 1	seg6	3	1
3636	flk 1	seg6	3	1
3637	flk 2	seg6	3	1
3638	flk 1	seg6	3	1
3639	flk 1	seg6	3	1
3640	flk 3	seg6	3	1
3641	flk 1	seg6	3	1
3642	flk 1	seg6	3	2
3643	flk 1	seg6	4	1
3644	deb	seg6	4	1
3645	flk 1	seg6	4	1
3646	flk 2	seg6	4	1
3647	flk 2	seg6	4	1
3648	flk 1	seg6	4	1
3649	deb	seg6	4	1
3650	deb	seg6	4	1
3651	deb	seg6	4	2
3652	flk 1	seg6	6	1
3653	flk 3	seg6	6	1
3654	flk 2	seg6	6	1
3655	flk 1	seg6	6	1
3656	flk 2	seg6	7	1
3657	flk 3	seg6	7	4
3658	flk 1	seg6	7	1
3659	flk 3	seg6	8	1
3660	flk 3	seg6	8	1
3661	flk 3	seg6	8	1
3662	flk 3	seg6	7	1
3663	deb	seg6	7	1
3664	flk 1	seg6	8	1
3665	scraper		0	1
3666	ut flk		0	1
3667	flk 3		0	1
3668	ut flk		0	1
3669	flk 1		0	1
3670	flk		0	1
3671	flk		0	1
3672	ut flk		0	1
3673	ut flk		0	1
3674	flk		0	1
3675	ut flk		0	1
3676	biface		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3677	ut flk		0	1
3678	deb		0	1
3679	ut flk		0	1
3680	ut flk		0	1
3681	flk		0	1
3682	flk		0	1
3683	flk		0	1
3684	nonart		0	1
3689	ut flk		0	26
3690	core		0	4
3691	hs		0	1
3692	flk		0	1
3693	flk		0	1
3694	flk		0	1
3695	ut flk		0	3
3696	flk		0	1
3697	flk		0	1
3698	flk		0	1
3699	core	seg7	1	1
3700	flk 3	seg7	1	1
3701	flk 1	seg 7	2	3
3702	flk 1	seg7	2	3
3703	flk 1	seg7	2	3
3704	flk 1	seg7	3	7
3705	flk 2	seg7	3	1
3706	ut flk 1	seg7	3	1
0	core	seg7	4	1
3708	flk 2	seg7	4	4
3709	hs	seg7	4	1
3710	flk 1	seg7	4	1
3711	flk 2	seg7	5	1
3712	flk 1	seg7	7	2
3713	flk 2	seg7	6	2
3714	flk 2	seg7	7	3
3715	flk 2	seg7	8	2
3716	ut flk 2	seg7	8	1
3717	flk 1	seg7	8	2
3718	test peb	seg7	2	1
3719	core	seg7	2	1
3720	core	seg7	4	1
3721	core	seg7	8	2
3722	deb	seg5	7	1
3723	flk 1	seg8	1	2
3724	flk 1	seg8	1	1
3725	flk 3	seg8	1	1
3726	flk 2	seg8	1	[illegible]
3727	flk 2	seg8	2	1
3728	flk 2	seg8	2	2
3729	flk 1	seg8	2	2
3730	flk 1	seg8	3	1
3731	flk 3	seg8	3	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3732	scraper	seg8	3	1
3733	flk 3	seg8	3	1
3734	flk 2	seg8	4	2
3735	flk 1	seg8	4	1
3736	flk 1	seg8	7	1
3737	flk grab s		0	1
3738	flk 1	seg8	8	1
3739	flk 2	seg8	8	1
3740	hs	seg8	2	1
3741	core	seg8	2	3
3742	flk		0	1
3743	flk		0	2
3746	flk		0	1
3747	ut flk		0	1
3748	flk		0	1
3749	test peb		0	1
3750	flk		0	1
3751	flk		0	1
3752	ut flk		0	1
3753	flk		0	1
3754	test peb		0	1
3755	core		0	1
3756	core		0	1
3757	test peb		0	1
3758	core		0	1
3759	core		0	1
3760	core		0	1
3762	ut flk		0	1
3763	core	seg10	6	1
3764	flk 1	seg10	7	1
3765	flk		0	1
3766	flk	4s29w	35	1
3767	flk 1		0	1
3768	flk 1		0	9
3769	deb		0	2
3770	core		0	1
3771	core		0	1
3772	core		0	1
3773	core		0	1
3774	core		0	1
3776	nonart	2n8e	0	1
3777	flk 1	20s24w	0	1
3778	core	0n39w	0	1
3779	core	0n39w	0	1
218	flk 3		0	1
237	flk 2		0	1
238	flk 2		0	1
244	flk 1		0	1
260	flk 2		0	1
261	deb		0	1
264	flk 2		0	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
278	flk 1		0	1
285	flk 1		0	1
286	flk 3		0	1
300	flk 2		0	1
306	flk 3		0	2
306	flk 3		0	1
309	flk 1		0	1
352	flk 3		0	1
374	flk 3		0	1
395	flk 2		0	1
420	flk 3		0	1
458	flk 2		0	1
463	flk 3		0	1
413	flk 1		0	1
413	flk 3		0	1
486	flk 3		0	1
520	flk 3		0	1
582	flk 3		0	1
682	flk 3		0	1
690	flk 2		0	1
695	flk 2		0	1
699	flk 3		0	1
731	flk 3		0	1
745	flk 2		0	1
752	flk 2		0	1
752	flk 3		0	1
1004	flk 2	10s20w	4	1
3652	flk 1	seg 6	6	1
3652	flk 1	seg 6	6	1
3652	flk 2	seg 6	6	2
3652	flk 3	seg 6	6	2
3657	flk 3	seg 6	7	1
3657	flk 3	seg 6	7	1
3657	flk 3	seg 6	7	1
3699	flk 1	seg7	1	1
3699	flk 2	seg7	1	7
3699	flk 3	seg7	1	5
3699	flk 1		0	1
3699	flk 1		0	1
3699	flk 2		0	1
3699	flk 2		0	1
3699	flk 3		0	1
3699	flk 3		0	0
3699	flk 3		0	1
3699	flk 3		0	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3710	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 1	seg 7	2	1
3701	flk 2	seg 7	2	2
3701	flk 2	seg 7	2	1
3701	flk 2	seg 7	2	1
3701	flk 3	seg 7	2	1
3701	flk 3	seg7	2	10
3701	flk 3	seg 7	2	1
3701	flk 3	seg 7	2	1
3701	flk 3	seg 7	2	1
3701	flk 3	seg 7	2	1
3702	flk 2	seg7	2	2
3702	flk 3	seg7	2	1
3704	flk 1	seg7	3	1
3704	flk 1	seg7	3	1
3704	flk 1	seg7	3	1
3704	flk 1	seg7	3	1
3704	flk 1	seg7	3	1
3704	flk 1	seg7	3	1
3704	core	aeg7	3	1
3705	flk 3	seg7	3	1
3706	flk 2	seg7	3	1
3707	flk 1		0	1
3707	flk 1		0	1
3707	flk 1		0	1
3707	flk 1		0	1
3707	flk 1		0	1
3707	flk 2	seg7	4	1
3707	core	seg 7	4	1
3708	flk 1	seg7	4	1
3708	flk 1	seg7	4	1
3708	flk 1	seg7	4	1
3708	flk 3	seg7	4	1
3710	flk 1	seg7	4	1
3710	flk 2	seg7	4	1
3712	flk 1	seg7	7	1
3712	flk 1	seg7	7	1
3712	flk 1	seg7	7	1
3712	flk 1	seg7	7	1
3712	flk 1	seg7	7	1
3712	flk 1	seg7	7	1
3712	flk 2	seg7	7	4
3712	flk 3	seg7	7	3
3712	flk 3	seg7	7	1
3713	flk 1	seg7	6	1
3713	flk 3	seg7	6	2
3713	flk 3	seg7	6	1
3713	core	seg7	6	1
3723	flk 2	seg8	1	2
3724	flk 1	seg8	1	1
3724	flk 2	seg8	1	31
3724	flk 2	seg8	1	1
3729	flk 1	seg8	2	1
3729	flk 2	seg8	2	1
3729	flk 3	seg8	2	1
3734	flk 1	seg8	4	1
3734	flk 3	seg8	4	1
3736	flk 1	seg8	7	1
3736	flk 1	seg8	7	1
3736	flk 1	seg8	7	1
3736	flk 3	seg8	7	1
3764	flk 2	seg10	7	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 1		0	1
3768	flk 2		0	1
3768	flk 3		0	5
3768	flk 3		0	1
3768	flk 3		0	1
3768	flk 3		0	1
3376	8flk 3		0	1
3447	flk 1		0	1
3447	flk 1		0	1
3447	flk 1		0	1
3447	flk 1		0	1
3447	flk 2		0	1
3447	flk 2		0	1
3447	flk 2		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3447	flk 3		0	1
3373	flk 2	seg2	8	1
3373	flk 3	seg2	8	1
3385	flk 2	seg1	2	1
3385	flk 3	seg1	2	2
3388	flk 2	seg1	7	2
3389	flk 2	seg1	8	3
3423	flk 3	seg2	1	2
3419	flk 2	seg1	5	5

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3419	flk 3	seg1	5	1
3424	flk3		0	0
3424	flk 3	seg2	2	1
0			0	0
3426	flk 3	seg2	3	1
3427	flk 2	seg2	4	5
3427	flk 3	seg2	4	4
3428	flk 3	seg2	4	1
3429	flk 3	seg2	5	2
3431	flk 2	seg2	6	1
3432	flk 2	seg2	7	1
3432	flk 3	seg2	7	1
3433	flk 2	seg2	7	3
3433	flk 3	seg2	7	3
3434	flk 3	seg2	8	2
3434	deb	seg2	8	2
3435			0	0
3442	flk 2		0	4
3442	flk 3		0	1
0			0	0
3446	flk 2		0	11
3446	flk 3		0	7
3446	deb		0	7
3447	flk 2		0	6
3447	flk 3		0	7
3545	flk 2		0	3
3548	flk 3		0	3
3583	flk 2	seg9	2	1
3585	flk 3	seg9	2	1
3587	flk 2	seg9	3	1
3595	flk 2	seg10	1	2
3595	flk 3	seg10	1	2
3596	flk 3	seg10	1	4
3597	flk 3	seg10	2	6
3600	flk 2	seg10	3	4
3600	flk 3	seg10	3	2
3603	flk 3	seg10	4	1
3604	flk 2	seg10	5	2
3604	flk 3	seg10	5	1
3605	flk 2	seg10	6	1
3607	flk 2	seg10	8	3
3610	flk 3	seg5	3	1
3626	flk 2	seg6	1	1
3626	flk 3	seg6	1	1
3653	flk 2		0	0
3703	flk 2	seg7	2	2
3704	flk 2	seg7	3	4
3704	core	seg7	3	1
0			0	0
3715	flk 3	seg7	8	1
3717	flk 3	seg7	8	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
3730	flk 2	seg8	3	1
3730	flk 3	seg8	3	1
3736	flk 2	seg8	7	1
3736	flk 3	seg8	7	1
218	flk 3		0	1
314	flk 3		0	1
505	flk 3		0	1
1502	flk 3	4s29w	34	1
1503	flk 3	4s29w	33	6
1507	flk 2	4s29w	26	3
1507	flk 3	4s29w	26	4
1511	flk 3	4s29w	27	3
1518	flk 2	4s29w	20	3
1518	flk 3	4s29w	20	1
1520	flk 3	4s29w	23	1
1530	flk 2	4s29w	34	2
1530	flk 3	4s29w	34	2
1578	flk 3	20s24w	17	1
1595	flk 3	23s20w	1	4
1613	flk 3	23s20w	3	3
1642	flk 2	23s20w	8	5
1642	flk 3	23s20w	8	7
1609	ang deb	23s20w	4	1
1609	flk 1	23s20w	4	3
1609	flk 3	23s20w	4	2
1666	flk 1	23s20w	10	4
1666	flk 2	23s20w	10	2
1666	flk 3	23s20w	10	7
1713	flk 2	23s20w	3	1
1713	flk 3	23s20w	3	2
1720	flk 3	23s20w	6	1
1721	flk 3	23s20w	5	2
1722	flk 3	23s20w	8	3
1846	flk 3	2n8e	14	1
1854	flk 2	22n58w	2	1
1854	flk 3	22n58w	2	3
1856	flk 3	22n58w	3	1
1860	flk 2	22n58w	6	4
1860	flk 3	22n58w	6	1
1862	flk 2	22n58w	0	1
1862	flk 3	22n58w	7	3
1863	flk 2	22n58w	8	3
1863	flk 3	22n58w	8	1
1857	flk 1	22n58w	4	2
1857	flk 2	22n58w	4	1
1857	flk 3	22n58w	4	2
1692	flk 1	23s20w	16	1
1692	flk 2	23s20w	16	2
1692	flk 3	23s20w	16	1
1692	flk 3	23s20w	16	5
1699	flk 2	23s20w	11	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
1705	flk 2	23s20w	11	1
1706	flk 2	23s20w	12	1
1858	flk 1	22n58w	5	2
1858	flk 2	22n58w	5	3
1881	flk 1	60s6e	10	1
1881	flk 2	60s6e	10	2
1868	flk 2	22n58w	12	1
1868	flk 3	22n58w	12	1
1871	flk 3	22n58w	14	3
1873	flk 3	22n58w	16	2
1864	flk 1	22n58w	9	1
1864	flk 2	22n58w	9	2
1956	flk 3	6s3w	6	1
1962	flk 3	6s3w	13	1
1963	flk 3	6s3w	14	1
1966	flk 2	2n8e	1	2
2007	flk 2	17n33w	1	2
2007	flk 3	17n33w	1	2
2008	flk 3	17n33w	1	4
2009	flk 3	17n33w	2	2
2010	flk 3	17n33w	2	2
2015	flk 2	17n33w	4	1
2017	flk 2	17n33w	5	5
2017	flk 3	17n33w	5	4
2018	flk 3	17n33w	6	1
2019	flk 3	17n33w	6	3
2021	flk 2	17n33w	8	6
2021	flk 3	17n33w	8	1
2022	flk 3	17n33w	8	1
2024	flk 3	17n33w	9	7
2027	flk 3	17n33w	11	1
2028	flk 3	17n33w	11	1
2029	flk 3	17n33w	12	2
2031	flk 2	17n33w	12	1
2031	flk 3	17n33w	12	3
2034	flk 2	17n33w	13	2
2034	flk 3	17n33w	13	5
2036	flk 2	17n33w	14	3
2036	flk 3	17n33w	14	1
2037	flk 2	17n33w	15	2
2037	flk 3	17n33w	15	1
2038	flk 3	17n55w	15	6
2040	flk 3	17n33w	16	1
2043	flk 2	17n33w	16	5
2045	flk 2	17n33w	0	6
2045	flk 3	17n33w	0	4
2047	flk 3	17n33w	0	2
2053	flk 3	2n12w	2	1
2054	flk 3	2n12w	3	3
2058	flk 3	17n33w	0	2
2063	flk 3	10n44w	9	2

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2065	flk 3	10n44w	12	1
2076	flk 2	2n8e	1	2
2069	flk 1	10n44w	16	1
2069	flk 2	10n44w	16	2
2069	flk 3	10n44w	16	3
2073	flk 2	22n58w	4	2
2084	flk 3	25n18e	6	1
2113	flk 3	10s14w	1	1
2117	flk 2	10s14w	6	1
2125	flk 3	17n33w	9	8
2126	flk 3	17n33w	10	2
2128	flk 2	17n33w	13	5
2128	flk 3	17n33w	13	3
2129	flk 2	17n33w	0	1
2129	flk 3	17n33w	0	2
2132	flk 2	17n33w	0	3
2132	flk 3	17n33w	0	2
2193	flk 2	56s6w	12	2
2195	ut flk 3	56s5w	16	1
2316	flk 3	17n33w	0	4
2317	flk 2	17n33w	0	4
2317	flk 3	17n33w	0	2
2326	flk 3	10s14w	5	2
2328	flk 2	10s14w	7	2
2328	flk 3	10s14w	7	1
2329	flk 3	10s14w	10	1
2332	flk 3	10s14w	13	5
2333	flk 3	10s14w	14	1
2330	flk 2	10s14w	11	6
2330	flk 3	10s14w	11	5
2479	flk 2	7s40w	1	1
2480	ang deb	7s40w	2	3
2482	flk 2	7s40w	2	1
2485	flk 2	7s40w	3	2
2485	flk 3	7s40w	3	1
2486	flk 2	7s40w	3	2
2489	flk 2	7s40w	4	2
2491	flk 3	7s40w	4	5
2492	flk 2	7s40w	5	2
2492	flk 3	7s40w	5	2
2493	flk 3	7s40w	6	3
2494	flk 3	7s40w	6	2
2496	flk 3	7s40w\	7	6
2499	flk 3	7s40w	8	1
2503	flk 3	7s40w	9	1
2505	flk 3	7s40w	10	1
2506	flk 3	7s40w	10	3
2508	flk 2	7s40w	11	1
2508	flk 3	7s40w	11	6
2510	flk 3	7s40w	12	5
2511	flk 3	7s40w	13	1

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2511	ang deb	7s40w	13	1
2512	flk 3	7s40w	13	2
2515	flk 2	7s40w	14	6
2515	flk 3	7s40w	14	6
2516	flk 2	7s40w	15	5
2516	flk 3	7s40w	15	4
2516	ang deb	7s40w	15	1
2517	ang deb	7s40w	15	1
2517	flk 1	7s40w	15	1
2517	flk 2	7s40w	15	1
2520	flk 2	7s40w	16	2
2521	flk 3	7s40w	16	2
2529	flk 3	4s29w	16	1
2543	flk 3	4s29w	28	1
2546	flk 3	4s29w	32	3
2550	flk 2	4s29w	34	2
2550	flk 3	4s29w	34	3
2553	flk 3	4s29w	35	1
2530	flk 2	4s29w	16	1
2541	flk 1	4s29w	26	1
2544	flk 2	4s29w	29	5
2544	flk 3	4s29w	29	1
2548	flk 2	4s29w	33	2
2552	flk 2	4s29w	35	2
2551	flk 2	4s29w	35	1
2623	flk 2	56s6w	14	3
2624	ang deb	56s6w	15	1
2731	flk 3	2s21w	13	1
2807	flk 3	2s21w	16	1
2819	flk 2	10n44w	2	5
2819	flk 3	10n44w	2	1
2820	flk 2	10n44w	3	7
2820	flk 3	10n44w	3	1
2822	flk 3	42n22w	4	1
2833	flk 2	10n44w	8	9
2835	flk 2	10n44w	9	3
2838	flk 2	10n44w	11	3
2840	flk 3	10n44w	13	1
2843	flk 2	10n44w	16	3
2860	flk 3	10n38w	2	1
2867	flk 2	10n38w	6	1
2831	flk 1	10n44w	7	2
2831	flk 2	10n44w	7	8
2831	flk 3	10n44w	7	1
2842	flk 1	10n44w	15	1
2842	flk 2	10n44w	15	5
2842	flk 3	10n44w	15	1
2864	flk 2	10n38w	5	8
2864	flk 3	10n38w	5	1
2909	flk 3	10n38w	3	1
2917	flk 3	10n38w	11	1
2920	flk 3	10n38w	13	2
2920	flk 2	10n38w	11	4
2923	flk 3	10n38w	14	2
2931	flk 2	10n38w	2	2
2931	flk 3	10n38w	2	2
2932	flk 3	10n38w	3	1
2941	flk 3	10n38w	9	1
2942	flk 2	10n38w	9	5
2947	flk 3	10n38w	10	1
2951	flk 3	10n38w	12	1
2954	flk 2	10n38w	15	4
2954	flk 3	10n38w	15	1
2959	flk 2	10n38w	9	4
2959	flk 3	10n38w	9	1
2965	flk 2	10n38w	16	2
2952	flk 2	10n38w	13	7
3192	flk 3	17n33w	1	2
3194	flk 2	17n33w	1	3
3194	flk 3	17n33w	1	5
3200	flk 3	22n6w	9	2
253	ut flk 2		0	1
369	ut flk 3		0	1
1660	flk 2	23s20w	15	8
1660	flk 1	23s20w	15	2
1660	flk 3	23s20w	15	8
1665	flk 3	23s20w	14	2
1665	flk 2	23s20w	14	1
1685	flk 3	23s20w	13	4
1685	flk 1	23s20w	13	1
3716	flk 3	seg7	8	1
1715	flk 1	23s20w	9	1
1715	flk 2	23s20w	9	1
1717	ut flk 3	23s20w	1	7
1718	ut flk 3	23s20w	4	4
1850	ut flk 2	22n58w	1	1
1850	flk 3	22n58w	1	1
1866	flk 2	22n58w	10	3
1866	ut flk 3	22n58w	10	1
1867	ut flk 2	22n58w	11	2
1867	ut flk 3	22n58w	11	1
2066	flk 1	10n44w	13	2
2066	flk 2	10n44w	13	1
2067	flk 2	10n44w	14	5
2068	ut flk 3	10n44w	15	1
2816	ut flk 2	10n44w	1	7
2816	ut flk 3	10n44w	1	1
2818	ut flk 2	10n44w	2	15
2818	ut flk 3	10n44w	2	4
2821	flk 2	10n44w	3	9
2823	ut flk 3	10n44w	4	1
2826	flk 2	10n44w	5	4

CAT.NO	ITEM	QUAD	SUBUNIT	QTY
2836	ut flk 2	10n44w	9	6
2837	ut flk 2	10n44w	9	8
2841	flk 3	10n44w	14	3
2859	flk 3	10n38w	2	3
2866	flk 1	10n38w	6	3
28[illegible]	flk 2	10n38w	6	3
2866	flk 3	10n38w	6	3
2908	ut flk 3	10n38w	2	1
2908	flk 2	10n38w	2	2
2914	flk 2	10n38w	8	1
2914	flk 3	10n38w	8	3
2916	flk 3	10n38w	10	1
2919	flk 2	10n38w	12	1
2924	flk 1	10n38w	12	1
2919	flk 2	10n38w	12	1
2926	flk 2	10n38w	16	2
2926	flk 3	10n38w	16	1
2929	flk 2	10n38w	1	3
2929	flk 3	10n38w	1	2
2950	ut flk 2	10n38w	11	2
2950	ut flk 3	10n38w	8	7
2964	flk 2	10n38w	16	2
2964	flk 3	10n38w	16	2

Lithic Artifact Coding

Keystone Sites 36 and 37

Variables

Location

1. Site Number
2. Specimen Number
3. Unit Coordinates-Northing and Easting in meters from site datum
4. Subunit, numbered 01 to 16
5. Level- surface (0) through 8, missing data (9)
6. Feature Association-01 through 70

Size

7. Length (mm)
8. Width (mm)
9. Thickness (maximum in mm)
10. Weight (g)

Dorsal and Ventral Surfaces

11. Termination Type
    - 0=indeterminate
    - 1=feathered
    - 2=stepped
    - 3=hinged
    - 4=perverse
    - 5=other
12. Percentage Dorsal Cortex
    - 1=greater than 50%
    - 2=1% to 50%
    - 3=none
13. Number of Dorsal Scars (00 for 100% cortex)
14. Dorsal Scar Pattern
    - 0=indeterminate
    - 1=unidirectional
    - 2=bidirectional
    - 3=converging
15. Bulb of Percussion
    - 0=indeterminate
    - 1=prominant
    - 2=diffuse
16. Lipping
    - 0=indeterminate
    - 1=present
    - 3=absent

Platform

17. Shape

0=indeterminate	5=triangular
1=rectangular	6=gull wing
2=crescent	7=round
3=diamond	8=semi-circular
4=lenticular	9=irregular, other

18. Platform Thickness (mm)
(01)=1mm or less
19. Platform Remnant Surface Type
    - 0=indeterminate
    - 1=single flake scar
    - 2=2 to 3 flake scars
    - 3=faceted, series of smaller scars
    - 4=cortex
    - 5=mass of crushed and hinged scars
    - 6=ground surface
20. Number of Preparation Scars on Dorsal Surface from Platform
21. Platform Angle-nearest 5 angle on polar coordinate paper

Edge Modification

22. Number of Modified Edges, Utilized or Retouched
23. Edge 1 Edge Angle and Edge Modification
24. Edge 2 " " " " "
25. Edge 3 " " " " "

Edge Modification (Retouch and Wear Patterns)

01	No retouch,	Unifacial Microflakes
02	" "	Bifacial Microflakes
03	" "	Rounding or Blunting
04	" "	Striae
05	" "	Polish
06	" "	Attrition

21 to 26 Dorsal Retouch with above wear patterns (01-06)
31 to 36 Ventral Retouch with above wear patterns (01-06)
41 to 45 Bifacial Retouch with above wear patterns
50 Multiple wear patterns present on one edge
61 to 65 Platform Retouch with above wear patterns

Raw Material Type

26. Material Code (see Index II)
27. Material Texture
    - 1=coarse-grained
    - 2=medium-grained
    - 3=fine-grained

Artifact Type

28. Artifact Type
    01 Flake-whole
    02 Flake-proximal fragment
    03 Flake-medial fragment
    04 Flake-distal fragment
    05 Flake-lateral fragment
    06 Blade
    07 Rejuventaion Flake

    08 Angular Debitage
    09 Utilized Chunk

    10 Core-Tested or Split Pebble
    11 Core-Single Platform
    12 Core-Opposing Platform
    13 Core-Multiple Platform
    14 Core-Bifacial

    15 Hammerstone
    17 Untested Pebble
    18 Pebble Tool

    20 Projectile Point
    21 Thin Biface
    22 Knife
    23 Chopper
    24 Scraper
    25 Spokeshave Scraper
    26 Drill
    27 Burin/Graver
    28 Hinge Scraper
    29 Denticulated Scraper

    40 Groundstone Fragment
    41 Pestle
    42 Mano
    43 Metate
    44 Polishing Stone
    45 Anvil
    46 Large Pebble Tool

29. Condition
    1=complete
    2=fragmentary

30. Multiple Functions
    0=indeterminate
    1=yes
    2=no

31. Core Flake Scar Size (average estimated)

DISTRIBUTIONS OF RAW MATERIAL VARIETIES
Keystone Sites 36 and 37

CODE	MATERIAL	KS-36 N	KS-36 %	KS-37 N	KS-37 %
100	Sedimentary, Undifferentiated	1	0.2	2	0.2
110	Sandstone	2	0.3	8	0.7
120	Dolomite	56	9.7	181	15.9
130	Siltstone	9	1.6	9	0.8
200	Igneous, Undifferentiated	2	0.3	1	0.1
210	Obsidian	10	1.7	34	3.0
220	Basalt	--	---	9	0.8
230	Thunderbird Rhyolite-Red	25	4.3	47	4.1
231	Thunderbird Rhyolite-Black	14	2.4	42	3.7
232	Reworked Flow Thunderbird Rhyolite	1	0.2	21	1.8
234	Soledad Rhyolite	9	1.6	39	3.4
235	Rhyolite Tuff-Gray	--	---	6	0.5
236	Rhyolite Tuff-Red	2	0.3	3	0.3
237	Picacho Rhyolite	--	---	1	0.1
240	Other Rhyolites	13	2.2	29	2.6
250	Granites and Diorites	--	---	7	0.6
300	Metamorphic, Undifferentiated	1	0.2	1	0.1
310	Quartzitic Sandstone	2	0.3	5	0.4
311	Quartzitic Sandstone Conglomerate	--	---	2	0.2
320	Quartzite	44	7.6	54	4.7
330	Schist	--	---	2	0.2
340	Silicified Shale	1	0.2	3	0.3
350	Quartz	1	0.2	1	0.1
360	Silicified Siltstone-Red Banded	--	---	1	0.1
361	Silicified Siltstone-Pale Brown	1	0.2	5	0.4
362	Silicified Siltstone-Red	2	0.3	2	0.2
440	Silicified Wood	2	0.3	17	1.5
409	Jasper	--	---	1	0.1
410	'	--	---	2	0.2
411	'	3	0.5	2	0.2
412	'	1	0.2	1	0.1
413	'	2	0.3	6	0.5
414	'	1	0.2	1	0.1
415	'	1	0.2	3	0.3
416	'	2	0.3	1	0.1
417	'	--	---	3	0.3
418	'	--	---	1	0.1
419	'	--	---	1	0.1
420	Chalcedony	9	1.6	--	---
421	'	1	0.2	3	0.3
422	'	2	0.3	10	0.9
423	'	4	0.7	4	0.4
424	'	2	0.3	1	0.1
425	'	14	2.4	26	2.3
426	'	3	0.5	6	0.5

		N	%	N	%
427	Chalcedony	3	0.5	3	0.3
428	'	1	0.2	1	0.1
429	'	2	0.3	2	0.2
430	'	4	0.7	1	0.1
431	'	4	0.7	3	0.3
432	'	1	0.2	1	0.1
433	'	2	0.3	2	0.2
434	'	--	---	--	---
435	'	1	0.2	6	0.5
436	'	1	0.2	9	0.8
437	'	1	0.2	2	0.2
438	'	--	---	4	0.4
439	'	--	---	4	0.4
700	'	--	---	4	0.4
701	'	1	0.2	1	0.1
702	'	--	---	1	0.1
703	'	1	0.2	3	0.3
704	'	1	0.2	1	0.1
705	'	--	---	5	0.4
706	'	--	---	8	0.7
707	'	--	---	1	0.1
708	'	--	---	4	0.4
709	'	--	---	1	0.1
710	'	--	---	1	0.1
400	Cherts, Undifferentiated	26	4.5	--	---
450	Rancheria Black/Brown Banded	19	3.3	40	3.5
451	Rancheria Black Porous	14	2.4	29	2.6
452	Rancheria Brown Porous	19	3.3	13	1.1
453	Rancheria Black/Brown Mixed	33	5.7	60	5.3
454	Chert	--	---	3	0.3
460	'	--	---	2	0.2
461	'	1	0.2	--	---
462	'	1	0.2	1	0.1
463	'	2	0.3	4	0.4
464	'	4	0.7	--	---
465	'	3	0.5	--	---
466	'	1	0.2	--	---
467	'	1	0.2	2	0.2
468	'	2	0.2	2	0.2
469	'	1	0.2	2	0.2
470	'	3	0.5	2	0.2
471	'	1	0.2	--	---
472	'	4	0.7	1	0.1
473	'	2	0.3	--	---
474	'	5	0.9	2	0.2
475	'	7	1.2	11	1.0
476	'	7	1.2	5	0.4
477	'	5	0.9	1	0.1
478	'	3	0.5	--	---
479	'	2	0.3	--	---

		N	%	N	%
480	Chert	15	2.6	4	0.4
481	'	2	0.3	--	---
482	'	2	0.3	4	0.4
483	'	3	0.5	4	0.4
484	'	3	0.5	1	0.1
485	'	10	1.7	3	0.3
486	'	4	0.7	1	0.1
487	'	5	0.9	2	0.2
488	'	8	1.4	2	0.2
489	'	4	0.7	1	0.1
490	'	8	1.4	2	0.2
491	'	3	0.5	--	---
492	'	4	0.7	5	0.4
493	'	2	0.3	3	0.3
494	'	2	0.3	--	---
495	'	2	0.3	--	---
496	'	2	0.3	2	0.2
497	'	2	0.3	2	0.2
498	'	4	0.7	3	0.3
499	'	1	0.2	--	---
500	'	3	0.5	2	0.2
501	'	4	0.7	3	0.3
502	'	3	0.5	2	0.2
503	'	3	0.5	--	---
504	'	3	0.5	4	0.4
505	'	3	0.5	3	0.3
506	'	1	0.2	1	0.1
507	'	2	0.3	3	0.3
508	'	2	0.3	6	0.5
509	'	2	0.3	10	0.9
510	'	2	0.3	10	0.9
511	'	2	0.3	3	0.3
512	'	1	0.2	3	0.3
513	'	1	0.2	2	0.2
514	'	2	0.3	2	0.2
515	'	1	0.2	11	1.0
516	'	1	0.2	7	0.6
517	'	1	0.2	8	0.7
518	'	1	0.2	3	0.3
519	'	1	0.2	--	---
520	'	1	0.2	2	0.2
521	'	1	0.2	2	0.2
522	'	1	0.2	--	---
523	'	--	---	5	0.4
524	'	1	0.2	--	---
525	'	1	0.2	--	---
526	'	1	0.2	1	0.1
527	'	1	0.2	--	---

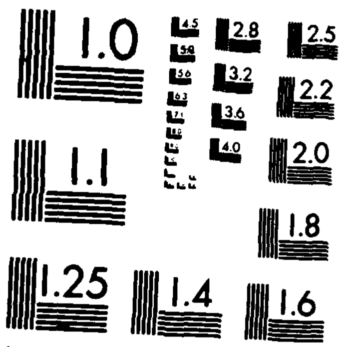
		N	%	N	%
528	Chert	--	---	2	0.2
529	'	--	---	5	0.4
530	'	1	0.2	3	0.3
531	'	1	0.2	7	0.6
532	'	--	---	3	0.3
533	'	--	---	4	0.4
534	'	--	---	5	0.4
535	'	--	---	4	0.4
536	'	--	---	6	0.5
537	'	--	---	1	0.1
538	'	1	0.2	1	0.1
539	'	1	0.2	--	---
540	'	1	0.2	7	0.6
541	'	1	0.2	2	0.2
542	'	1	0.2	--	---
543	'	--	---	1	0.1
544	'	--	---	1	0.1
545	'	--	---	1	0.1
546	'	--	---	2	0.2
547	'	1	0.2	--	---
548	'	--	---	1	0.1
549	'	--	---	2	0.2
550	'	--	---	3	0.3
551	'	--	---	2	0.2
552	'	--	---	4	0.4
553	'	--	---	6	0.5
554	'	1	0.2	1	0.1
555	'	1	0.2	4	0.4
556	'	--	---	5	0.4
557	'	--	---	2	0.2
558	'	1	0.2	1	0.1
559	'	--	---	7	0.6
560	'	--	---	4	0.4
561	'	--	---	2	0.2
562	'	--	---	9	0.8
563	'	1	0.2	2	0.2
564	'	--	---	2	0.2
565	'	--	---	3	0.3
566	'	--	---	4	0.4
567	'	--	---	4	0.4
568	'	--	---	1	0.1
569	'	1	0.2	--	---
570	'	--	---	1	0.1
571	'	--	---	1	0.1
572	'	--	---	1	0.1
573	'	--	---	2	0.2
574	'	--	---	1	0.1

		N	%	N	%
575	'	--	---	1	0.1
576	'	--	---	1	0.1
577	'	--	---	1	0.1
578	'	--	---	1	0.1
579	'	--	---	1	0.1
580	'	--	---	1	0.1
581	'	--	---	1	0.1
582	'	--	---	1	0.1
583	'	--	---	1	0.1
584	'	--	---	3	0.3
585	'	--	---	1	0.1
586	'	--	---	1	0.1
587	'	--	---	1	0.1
588	'	--	---	1	0.1
589	'	--	---	1	0.1
590	'	--	---	1	0.1
591	'	--	---	--	---
592	'	--	---	1	0.1
593	'	--	---	1	0.1
594	'	--	---	1	0.1
595	'	--	---	1	0.1
	Total Number of Varieties	130	100%	184	100%

	KS-36		KS-37	
	N	%	N	%
Rhyolites	64	11.0	188	16.5
Dolomite	56	9.7	181	15.9
Quartzite	44	7.6	54	4.7
Obsidian	10	1.7	34	3.0
Jaspers	10	1.7	22	2.1
Chalcedonies	58	10.1	118	10.9
Cherts	311	54.0	463	40.2
Rancheria Cherts	85	14.7	142	12.5

27% of KS-36 cherts are rancherias
31% of KS-37 cherts are rancherias

AD-A174 038   ARCHEOLOGICAL EXCAVATIONS AT TWO PREHISTORIC CAMPSITES   6/6
NEAR KEYSTONE DAM (U) NEW MEXICO STATE UNIV LAS CRUCES
CULTURAL RESOURCES MANAGEMEN   D CARMICHAEL ET AL
UNCLASSIFIED   19 JUL 85 NMSU-14 DACW47-84-C-0006   F/G 5/6   NL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4.5
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2.0
1.1
1.8
1.25
1.4
1.6

LITHIC RAW MATERIAL CODES

100 Sedimentary, undifferentiated
110 Sandstone
120 Dolomite
130 Siltstone
200 Igneous, undifferentiated
210 Odsidian
220 Basalt
230 Thunderbird Rhyolite- red
231 Thunderbird Rhyolite- black

232 Reworked Flow-Banded Thunderbird Rhyolite

234 Soledad Rhyolite- fine grained, light gray to gray brown

235 Rhyolite Welded Tuff- light gray(10YR,7/1) with phenocrysts gray(10YR,5/1) and areas of white(10YR,8/1).

236 Rhyolite Welded Tuff- pale red(10R,3/6) with dark red gray(10R,3/1) phenocrysts.

237 Pichacho Rhyolite, weak red(10R,5/3) with red(10R,5/6) banding.

240 Rhyolite, undifferentiated
250 Granites and Diorites
300 Metamorphic, undifferentiated
310 Quartzitic Sandstone

311 Quartzitic Sandstone- conglomerate dark gray(5Y,4/1) with black hornblend.

320 Quartzite
330 Schist
340 Silicified Shale
350 Quartz

360 Silicified Siltstone- fine grained, drk red (2.5YR, 3/6) with dark red bands.

361 Silicified Siltstone- medium to fine grained, with pale brown (10YR, 8/3 to 7/3).

362 Silicified Siltstone-medium to fine grained, with red (2.5YR, 5/6).

400 Cherts, undifferentiated.

410 Jasper

411 Mustard Red Jasper

409 Jasper, fine grained, yellow-brown(10YR,5/6) with dusky red(2.5YR,3/2) mottling.

412 Jasper, fine grained, brown(7.5YR,5/8) with dark brown (7.5YR,4/2) banding.

413 Jasper, fine grained, red(10R,4/8) with dark gray(2.5YR, 3/0), reddish yellow(7.5YR,7/8), and, pale red(10R,6/4) and white bands.

414 Jasper, fine grained, red(10R,4/6) with white(2.5Y,8/2) bands.

415 Jasper, fine grained, dark yellow-brown(10YR,4/4) with brown-yellow(10YR,6/8) mottling.

416 Jasper, fine grained, red-yellow(7.5YR,6/8) with a band red-yellow and an area of black.

417 Jasper, fine grained, dark red(10R,3/6) with dark red-gray(10R,3/1) bands and white(2.5,8/0) to pale red(10R,

418 Jasper, fine grained, red-brown(2.5YR,5/4 to 4/4) with white(2.5YR,8/2) bands.

419 Jasper, fine grained, red(2.5YR,4/6 to4/8) with silicious white inclusions.

420 Chalcedony

421 Chalcedony, fine grained, dark gray(10YR,4/1) with white(10YR,8/1) inclusions and black(10YR,2/1) veins.

422 Chalcedony, fine grained, dark gray(7.5YR,3/0) with white(7.5YR,8/0) inclusions and white patina.

423 Chalcedony, fine grained, light olive brown(2.5Y,5/4) with very dark gray(2.5Y,3/0) and white patina.

424 Chalcedony, fine grained, light red(10R,6/6).

425 Chalcedony, fine grained, clear with yellow-red(7.5YR, 6/8) and black inclusions.

426 Chalcedony, fine grained, clear with white(2.5Y,8/0).

427 Chalcedony, fine grained, clear with pale brown(10YR,8/3).

428 Chalcedony, fine grained, weak red(2.5YR,2.5/2) with red-yellow(7.5YR,7/8).

429 Chalcedony, fine grained, dark yellow-brown(10YR,4/6) and strong brown(7.5YR,5/8) with black areas.

430 Chalcedony, fine grained, white with red(10R,5/8) veins and dark red(10R,3/6) mottling.

431 Chalcedony, fine grained, pale brown(10YR,6/3) with dusky red(10R,3/3) mottling and white(2.5Y,8/2) bands.

432 Chalcedony, fine grained, pale red(10R,6/2).

433 Chalcedony, fine grained, pale brown(10YR,7/2) with gray(10YR,5/1) veins.

434 Chalcedony, fine grained, light gray(10YR,7/2) with dark brown(10YR,4/3) banding and black areas.

435 Chalcedony, fine grained, white(10YR,8/2) with black areas.

436 Chalcedony, fine grained, white(10YR,8/1) with brown-yellow(10YR,6/6) mottling and black areas.

437 Chalcedony, fine grained, white(5YR,8/1) with a brown cortex.

438 Chalcedony, fine grained, gray(10YR,6/1) with light red(10R,6/8) inclusions.

439 Chalcedony, clear with dark yellow-brown(10YR,5/6 to 4/6) inclusions.

700 Chalcedoney, fine grained, brown-yellow(10YR,6/8) with dark yellow-brown(10YR,4/6) bands.

701 Chalcedony, porous, white(10YR,8/1) with dark brown inclusions.

702 Chalcedony, clear with brown-yellow(10YR,6/6).

703 Chalcedony, fine grained, light gray(5YR,7/1) with yellow(5YR,6/8) mottling and black areas.

704 Chalcedony, fine grained, red-yellow(5YR,6/6) with light gray(5YR,7/1).

706 Chalcedony, fine grained, dark brown(2.5Y,2.5/2) with white areas.

707 Chalcedony, fine grained, dark red-brown(5YR,3/2) and white mottling.

708 Chalcedony, fine grained, white(7.5YR,8/0 to 7/0) with black mottling.

709 Chalcedony, fine grained, light gray(10YR,7/1) with dusky red(10R,3/3) veins and dark gray(7.5YR,3/0) areas.

710 Chalcedony, fine grained, white(5YR,8/1) with dark brown(7.5YR,3/2) areas.

440 Silicified Wood

450 Rancheria Chert, black and brown banded

451 Rancheria Chert, black porous.

452 Rancheria Chert, brown porous

453 Rancheria Chert, black and brown (or grey) mottled or mixed

453 Rancheria Chert, black and red-brown.

460 Chert, fine grained, very dark gray-brown(10YR,3/2) with very pale brown(10YR,6/1) banding.

461 Chert, fine grained, gray(10YR,6/1) with very pale brown(10YR,8/4) patina.

462 Chert,fine grained, light brown-gray(2.5Y,6/2) with pale red(10R,6/4) and very dark gray-brown(2.5Y,3/2) bands.

463 Lake Valley Chert, medium gray with black or tan bands.

464 Chert, fine grained, dark gray(2.5Y,4/0) with very dark gray(2.5Y,3/0) bands.

465 Chert, fine grained, light gray(2.5Y,6/0) with dusky red(10R,3/4) mottling.

466 Chert, fine grained, fossiliferous, fissury, strong brown(7.5YR,5/6) and red(10R,4/6) with black(2.5YR, 2.5/0) bands.

467 Chert, fine grained, light gray(5Y,7/1) with gray (5Y,6/1) banding.

468 Chert, fine grained, olive gray(5Y,4/2) with black (5Y,2.5/1) banding and gray(7.5YR,5/0) areas with white(5Y,8/0) and black mottling.

469 Chert, fine grained, red-yellow(7.5YR,7/8) with light gray(10YR,7/1) mottling.

470 Chert, fine grained, very dark gray(2.5YR,3/0) with light gray(10YR,7/1) mottling.

471 Chert, fine grained, fissury, gray(10YR,5/1) with red-gray(10R,6/1) banding.

472 Chert, fine grained, olive(5Y,5/3) with dark red(10R, 3/4) mottling.

473 Chert, fine grained, yellow-brown(10YR,6/6) with dark red(10R,3/6) banding, and an area of olive(5Y,5/3) with black mottling.

474 Chert, fine grained, gray(10YR,6/1) with dark gray(10R, 4/1) bands and very pale brown(10YR,8/3) areas.

475 Chert, fine grained, very dark gray(7.5YR,3/0).

476 Chert, fine grained, light gray(10YR,7/1) with brown-yellow(10YR6/6) mottling.

477 Chert, fine grained, dark gray(10YR,4/1) with gray(2.5YR, 6/0) and white(10YR,8/1) banding.

478 Chert, fine grained, dark gray-brown(2.5Y,4/2) with very dark gray(5YR,3/1) bands and mottling.

479 Chert, porous, gray(7.5YR,5/0) with dark gray(10YR,3/1) banding.

480 Chert, fine grained, light gray(5Y,6/1) with dark gray (7.5YR,4/0) bands and mottling.

481 Chert, fine grained white.

482 Chert,porous, gray (5Y, 6//1) with dark red (2.5YR, 3/6), red-yellow(7.5YR,7/8), and gray(7.5YR,5/0) mottling.

483 Chert, porous, light gray(10YR,7/1) with gray(10YR, 6/1) mottling.

484 Chert, fine grained, dark gray(2.5YR,4/0) with white (10YR,8/2) bands or patina.

485 Chert, fine grained, light gray(10YR,6/1).

486 Chert, fine grained, fissury, light gray(7.5YR,6/0) with very dark gray(10YR,3/1) areas.

487 Chert, fine grained, brown(7.5YR,5/2)

488 Chert, fine grained, light gray(5Y,7/1) with white (5Y,8/2) mottling and banding.

489 Chert, fine grained, light gray(5Y,7/1) with white (10YR,8/2) mottling and banding.

490 Chert, fine grained, light brown-gray(2.5Y,6/2) with yellow-red(5YR,4/6) mottling and bands.

491 Chert, fine grained, dark gray(7.5YR,4/0) with black (7.5YR,2/0) bands and mottling.

492 Chert, fine grained, dark gray(2.5YR,4/0).

493 Chert, fine grained, olive gray(5Y,5/2).

494 Chert, fine grained, red-brown(2.5YR,4/4) with white (2.5Y,8/0).

495 Chert, fine grained, light red(2.5YR,6/6).

496 Chert, fine grained, strong brown(7.5YR,5/6) with black mottling.

497 Chert, fine grained, light brown-gray(2.5Y,6/2) with black and yellow-red(5YR,5/8) mottling.

498 Chert, fine grained, dark yellow-brown(10YR,4/6).

499 Chert, fine grained, very dark gray(10YR,3/1).

500 Chert, fine grained, white(5Y,8/2).

501 Chert, pale red(10R,6/3) with dusky red(10R,3/2) mottling.

502 Chert, fine grained, weak red(2.5YR,5/2) with light-brown red(2.5YR,6/4).

503 Chert, fine grained, light gray(2.5Y,6/0) with black mottling.

504 Chert, fine grained, weak red(10R,4/4) with dusky red(10R,3/3) areas.

505 Chert, fine grained, dark gray(2.5YR,4/0) with black areas.

506 Chert, fine grained, yellow-red(5YR,5/8) with light gray(5YR,7/1), and, red-yellow(5YR,6/8), areas, and red(10R,5/8), white(5Y,8/1) and dark gray(7.5YR,4/0) bands.

507 Chert, fine grained, dark red-gray(5YR,4/2) with light gray(7.5YR,7/0) mottling, very dark gray(7.5YR,3/0) and very pale brown(10YR,8/3) areas.

508 Chert, fine grained, fossilferous, dusky red(10R3/3) with light red(10R,6/8) mottling and banding.

509 Chert, fine grained, light gray(2.5Y,6/0) with yellow (10YR,7/6), white(10YR,8/1), and dark gray(10YR,4/1) mottling.

510 Chert, fine grained, white(10YR,8/1) with red-yellow (5YR,7/6), white(10YR,8/1), and dark gray(10YR,4/1) mottling.

511 Chert, fine grained, very dark brown(10YR,2/2) with dark brown((7.5YR,3/4) and white inclusions.

512 Chert, fine grained, fossiliferous, dark gray(7.5YR,4/0).

513 Chert, fine grained, fossiliferous, yellow(10YR,7/6).

514 Chert, fine grained, light brown to light pink-gray(7.5YR, 6/2-6/4) with red-yellow(5YR,6/8) areas and black mottling.

515 Chert, fine grained, pale red(10R,6/3) with dusky red(10R, 3/3) bands and areas, dark gray(2.5YR,4/0) and light yellow-brown(2.5Y,6/4) areas.

516 Chert, fine grained, gray-brown(2.5Y,5/2) with dark olive-gray(5Y,3/2) and red-yellow(7.5YR,6/8) areas.

517 Chert, fine grained, pink-gray(5YR,6/2) with red-brown (5YR,4/4) bands and black areas.

518 Chert, fine grained, light gray(2.5YR,6/1) with red-yellow (5YR,7/6), and red(10R,4/6) bands, dusky red(10R,3//4) mottling and banding.

519 Chert, fine grained, light olive-brown(2.5Y,5/4) with silicious white(10YR,8/0) inclusions.

520 Chert, fine grained, white with gray(10YR,6/1) mottling.

521 Chert, fine grained, dark red-brown(5YR,3/4) with brown-yellow(10YR,6/8) and brown(7.5YR,5/4) banding and black mottling.

522 Chert, fine grained, dark red(10R,3/6) with brown-yellow (10YR,6/6) mottling.

523 Chert, grainy, gray-brown(2.5Y,5/2) with dark gray areas.

524 Chert, fine grained, red-gray(5YR,5/2) with very dark gray (7.5YR,3/0) banding and patina.

525 Chert, fine grained, fossiliferous, dark gray(5Y,4/1).

526 Chert, porous, dark gray(7.5YR,4/0).

527 Chert, fine grained, dark brown(7.5YR,3/2) with black bands.

528 Chert, fine grained, dark yellow-brown(10YR,4/6) with red (10R,4/6) banding.

529 Chert, fine grained, gray-brown(10YR,5/2).

530 Chert, porous, white(2.5Y,8/2).

531 Chert, fine grained, very dark gray(2.5Y,3/0) with gray (2.5Y, 5/0) and porous brown mottling and white inclusions.

532 Chert, fine grained, dark yellow-brown (10YR, 3/4) with small faint yellow bands.

533 Chert, grainy, dark yellow-brown(10YR,4/6).

534 Chert, fine grained, pale brown(10YR,6/3).

535 Chert, fine grained, dark yellow-brown(10YR,4/4 to 3/4) with red(2.5YR,5/8) and dark gray areas.

536 Chert, fine grained, fossiliferous, dusky red(2.5YR,3/2).

537 Chert, fine grained, fossiliferous, dark gray-brown(2.5Y, 4/2) with pale red(2.5YR,6/2) and black areas.

538 Chert, fine grained, fissury, dark gray(10YR,4/1) with brown(7.5YR,5/4) banding and patina, and black mottling.

540 Chert, fine grained, pale brown(10YR,6/3) with yellow-brown(10YR,5/6) and white(10YR,8/2) mottling, and very dark gray(7.5YR,3/0) areas.

541 Chert, fine grained, pale red(10R,6/4) with red-gray(10R, 6/1), weak red(10R,4/3) and light red(10R,6/8) banding.

542 Chert,fine grained, light gray(10YR,7/2) with pink-gray (5YR,7/2) and light red(2.5YR,6/6) banding.

543 Chert, fine grained, weak red(2.5YR,5/2) with dark gray(10YR, 4/1) and light gray-brown(10YR,6/2) areas, and yellow-brown (10YR,6/6) banding.

544 Chert, grainy, olive-brown(2.5Y,4/4) with black and pale yellow areas.

545 Chert,fine grained, dark red-brown(2.5YR,3/4) with black mottling.

546 Chert, fine grained, dark red-brown(5YR,3/3) with gray (2.5YR,6/0) mottling.

547 Chert, fine grained, pink(7.5YR,7/4).

548 Chert, fine grained, dark red-brown(5YR,3/3).

549 Chert, porous, black(5YR,2.5/1) with dusky red(10R,3/4) and pale yellow dolites.

550 Chert, fine grained, very dusky red(10R,2.5/2) with gray (2.5YR,5/0) mottling and pale red(2.5YR,6/2) areas, and white to pale yellow inclusions.

551 Chert, fine grained, pale red(2.5YR,6/2) with light gray (10YR,6/0) and dark gray banding.

552 Chert, fine grained, dark gray(10YR,4/1) with dark red (10R,3/6) areas.

553 Chert, fine grained, fossiliferous, black(7.5YR,2/0).

554 Chert, fine grained, fossiliferous, light olive-gray (5Y,6/2).

555 Chert, fine grained, dark gray(7.5YR,4/0) with gray(7.5YR, 5/0) mottling and red(10R,4/8) areas.

556 Chert, fine grained, dusky red(2.5YR,3/2).

557 Chert, fine grained, very dusky red(2.5YR,2.5/2) with very dark gray(2.5YR,3/0) bands.

558 Chert, fine grained, strong brown(7.5YR,5/8) with pale yellow(5Y,8/4) bands.

559 Chert, fine grained, dark gray(10YR,4/1).

560 Chert, fine grained, fissury, very dark gray(2.5YR,3/0) with light gray(10YR,7/1) mottling and pale yellow areas.

561 Chert, fine grained, dusky red(10R,3/3) with red-black (10R,2.5/1), pale red(10R,6/3), and small black areas.

562 Chert, fine grained, white(10YR,8/2) with yellow-brown (10YR,5/4) and, light brown-gray(10YR,6/2) and strong brown(7.5YR,5/8) mottling.

563 Chert, fine grained, pale red(10R,6/3) with light gray (10YR,7/1) bands and dark gray(5YR,4/1) areas.

564 Chert, fine grained, dark gray(10YR,4/1) with pale red (10R,6/3), very dark gray(7.5YR,3/0), and pale yellow, with yellow-brown(10YR,6/8) bands.

565 Chert, grainy, brown-yellow(10YR,6/6).

567 Chert, medium grained, gray-brown(10YR,5/2) with dark gray(10YR,4/1) and dark red-brown(2.5YR,2.5/4) bands, and white areas.

568 Chert, fine grained, olive-brown(2.5Y,4/4) with dark red(10R,3/6) mottling.

569 Chert, grainy, light gray to white(10YR,8/2 to 7/2) with dark red(10R,3/6) and brown-yellow(10YR,6/6) areas, and black mottling.

570 Chert, fine grained, dark gray(5YR,4/1) with brown-yellow(10YR,6/8) and pale yellow to very pale brown mottling.

571 Chert, fine grained, dark red-gray(5YR,4/2) with very dark gray(2.5YR,3/0) mottling and banding, and strong brown(7.5YR,4/6) areas.

572 Chert, fine grained, dark red-brown(5YR,3/2) with very dark gray(2.5YR,3/0) banding and very dark gray(5YR,3/1) areas.

573 Chert, grainy, dark red(10R,3/6) with gray inclusions and mottling.

574 Chert, fine grained, white(10YR,8/1) with gray(10YR, 6/1) mottling and dark red(10R,3/6) banding.

575 Chert, fine grained, white(10YR,8/1) with pale red (2.5YR,6/2) and, dark red-gray(10R,3/1) banding.

576 Chert, fine grained, brown(10YR,5/3) with yellow (10YR,7/6) mottling and gray(10YR,6/1) banding.

577 Chert, fine grained, weak red(10R,4/2) to dusky red (10R,3/4).

578 Chert, fine grained, porous, very dark gray(7.5YR,3/0) with black banding and white areas.

579 Chert, fine grained, pale brown(10YR,6/3) with strong brown(7.5YR,5/6) patina.

580 Chert, fine grained, weak red(10R,5/3).

581 Chert, fine grained, pink-gray(7.5YR,7/2) with black mottling.

582 Chert, fine grained, very pale brown(10YR,8/4) with red-brown(2.5YR,4/4), and red-brown(2.5YR,4/4 to 5/4) and light red-brown(2.5YR,6/4) mottling.

583 Chert, fine grained, gray(10YR,6/1) with white(10YR,8/1) yellow(10YR,8/6) and yellow-brown(10YR,5/6) inclusions.

584 Chert, fine grained, dark red(10R,3/6) with yellow-red (5YR,5/6 to 5/8), pale brown(10YR,6/3), and light brown(7.5YR,6/4) areas.

585 Chert, fine grained, gray to dark red-gray(5YR,4/2 to 5/1).

586 Chert, fine grained, very dark gray(7.5YR,3/0) with gray (2.5YR,6/0).

587 Chert, fine grained, dark gray(2.5YR,4/0) with dark red (10R,3/6) lines.

588 Chert, grainy, gray(5YR,5/1) with red-yellow(5YR,6/6) lines and areas.

589 Chert, medium grained, light red-brown(2.5YR,6/4) with very pale yellow(10YR,8/4) mottling and dark gray(2.5YR, 4/1) banding and mottling.

590 Chert, fine grained, gray(10YR,5/1) with red(10R,4/6) and dark gray(2.5YR,4/0) mottling, with pink(5YR,8/4) and white(5YR,8/1) brecciated inclusions.

591 Chert, grainy, dark red-gray(10R,3/1) with fine grained bands.

592 Chert, fine grained, light gray(10YR,7/2) to very pale brown(10YR,7/3) with gray(7.5YR,5/0) mottling.

593 Chert, grainy, black(7.5YR,2/0).

594 Chert, fine grained, white(10YR,8/1) to light gray(10YR, 7/1) with very pale brown(10YR,8/3) inclusions.

595 Chert, grainy, pink-gray(7.5YR,7/2).

APPENDIX III

Chronology

A. Source Groups of Keystone Sites 36 and 37 Obsidian

B. Obsidian Hydration Dates, Keystone Sites 36 and 37

C. Radiocarbon Dates, Keystone Sites 36 and 37

D. Radiocarbon and Obsidian Hydration Dates from other Sites Southwestern New Mexico

MOHLAB
1188 Smithfield Street
State College, Pa. 16801
(814)237-8681

February 3, 1984

Invoice No. 169

P.O. No. 9140

SOURCE AFFINITY TEST ON OBSIDIAN ARTIFACTS FROM KEYSTONE

Sample No.	K_2O(%)	$Fe_2O_3^T$(%)	CaO(%)	Rio Grande Group
169-36-002	4.42	1.20	0.25	II
169-36-082	4.34	1.15	0.30	II
169-36-132	4.26	0.82	0.36	I
169-37-037	0.10			(not obsidian)
169-37-215	4.30	0.82	0.35	I
169-37-267	4.35	1.03	0.22	II
169-37-296-1	4.41	1.03	0.24	II
169-37-366-1	4.32	0.83	0.27	I
169-37-401	4.27	1.01	0.28	II
169-37-541	4.38	1.19	0.23	II
169-37-610	4.58	0.75	0.32	I
169-37-693	0.17			(not obsidian)
169-37-710	4.39	1.22	0.22	II (unworked pebble)
169-37-712	4.43	1.14	0.22	II
169-37-739	4.24	1.05	0.26	II
169-37-757	4.04	0.83	0.29	I
169-37-791	4.29	1.14	0.27	II
169-37-810	4.21	0.81	0.31	I

MOHLAB
1188 Smithfield Street
State College, Pa. 16801
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May 1, 1984

Invoice No. 183

SOURCE AFFINITY TEST FOR ARTIFACTS FROM KEYSTONE

Sample No.	Al_2O_3	Na_2O	K_2O	$Fe_2O_3^T$	CaO	MgO	Source Affinity
183-K36-1008		4.47		1.02	0.20		Group 2
183-K36-977		4.06		0.63	0.30		Group 6
183-K36-980		4.45		1.32	0.23		Group 2
183-K36-596		0.24		0.37			not a glass
183-K37-975		4.25		1.15	0.20		Group 2
183-K37-1258		4.15		0.77	0.29		Group 6
183-K37-1807		4.77		0.76	0.27		Group 1
183-K37-1796		4.45		1.21	0.23		Group 2
183-K37-1795		4.47		1.11	0.21		Group 2
183-K37-1808	11.60	4.18	4.63	0.75	0.25	0.06	Group 6
183-K37-1809	12.01	3.88	4.85	0.73	0.28	0.07	Group 6
183-K37-1793		3.82		0.60	0.30		Group 6
183-K37-1792		4.11		1.02	0.67		Group 3
183-K37-2119	11.54		4.39	1.09	0.19	0.05	Group 2
183-K37-977		4.06		0.63	0.30		Group 6
183-K37-1573				0.96	0.25	0.05	Group 2
183-K37-2090		4.45		0.76	0.27		Group 1
183-K37-1882		4.44		1.03	0.22		Group 2
183-K37-1254		4.63		0.86	0.34		Group 1
183-K37-1123		4.54		0.80	0.35		Group 1

Joseph W. Michels, Ph.D.
Consulting Archaeometrist

Results of Obsidian Hydration Analysis

Keystone Site 36

Sample	Source Group	Rim (u)	SDEV(+/-)	Date	95% Conf. Int.
0002	II	2.13	.06	AD 679 +/-75	AD 529-829
1008	II	2.13	.06	679 +/-75	AD 529-829
0082	II	2.10	.07	715 +/-86	AD 543-887
0980	II	2.11	.03	703 +/-37	AD 629-777

Keystone Site 37

Sample	Source Group	Rim (u)	SDEV(+/-)	Date	95% Conf. Int.
1796	II	1.90	.07	AD 1015 +/-73	AD 869-1161
0541	II	1.89	.04	1025 +/-41	AD 943-1107
2119	II	1.83	.03	1085 +/-29	AD 1027-1143
2090	II	2.73	.03	1139 +/-18	AD 1103-1175
1123	I	2.69	.03	1164 +/-19	AD 1126-1202
1795	II	1.73	.06	1181 +/-57	AD 1067-1295
0267	II	1.71	.03	1199 +/-27	AD 1145-1253
1254	I	2.63	.05	1200 +/-30	AD 1140-1260
1807	I	2.60	.04	1218 +/-24	AD 1170-1266
0712	II	1.69	.05	1218 +/-46	AD 1126-1310
1573	II	1.68	.04	1227 +/-37	AD 1153-1301
0975	II	1.66	.06	1245 +/-55	AD 1135-1355
0401	II	1.63	.06	1271 +/-53	AD 1165-1377
1882	II	1.56	.04	1331 +/-34	AD 1263-1399
0296	II	1.56	.05	1331 +/-42	AD 1247-1415
0791	II	1.51	.07	1372 +/-58	AD 1256-1488
0739	II	1.51	.05	1372 +/-41	AD 1290-1454
0977	VI	2.22	.05	1382 +/-17	AD 1348-1416
1258	VI	1.90	.06	1467 +/-33	AD 1401-1533
1793	VI	1.94	.06	1445 +/-33	AD 1379-1511
1808	VI	1.90	.03	1467 +/-16	AD 1435-1499
1809	VI	1.92	.04	1456 +/-22	AD 1412-1500

Provenience and Context of Obsidian Hydration Samples

Site No.	Sample No.	Unit	Level	Artifact Type	Associations* or Remarks
36	596	15N36W	1	Flake	Assoc. Fea. 3
36	977	8N0E	1	Flake, util.	4 m NE of Fea. 4
36	980	40N0E	1	Flake	
36	1008	12N22W	2	Flake	
37	267	25N20W	surface	Flake	Adjacent to Fea. 51
37	296	2S42W	surface	Flake	
37	401	33N45W	surface	Pebble Core	Adjacent to Fea. 44, 67
37	541	31S19W	surface	Flake	
37	712	22S19.5W	surface	Scraper	3 m south of Fea. 20
37	791	27N3E	surface	Flake	
37	975	10S20W	surface	Scraper	Assoc. Fea. 1
37	977	10S20W	1	Flake	Assoc. Fea. 1
37	1123	10S20W	1	Flake	Assoc. Fea. 1
37	1254	13N32W	surface	Flake	4 m south of Fea. 29
37	1258	0N40W	surface	Pebble Core	5 m south of Fea. 54, 60
37	1573	20S24W	2	Flake	Assoc. Fea. 21
37	1793	17N29W	1	Flake	Fea. 29
37	1795	10N44W	1	Pebble Core	Assoc. Fea. 15
37	1796	10N44W	1	Pebble Core	Assoc. Fea. 15
37	1807	0N1W	surface	Flake	1 m north of Fea. 37
37	1808	12N28W	2	Flake	in dense scatter SE of Fea. 29
37	1809	15N53W	surface	Flake	4 m south of Fea. 39
37	1882	60S6E	1	Pebble Core	
37	2090	38S18W	4	Pebble Core	Assoc. Fea. 26
37	2119	10S14W	1	Flake	Assoc. Fea. 36
37	739	33S12W	surface	Flake	5 m SW of Fea. 14, 18

Radiocarbon Dates

Keystone Site 36

Sample	Feature Association*	C-14 Adjusted	95% Confidence Interval for Tree-Ring Calibration (Klein, et al 1982)
0680	10 (LFCR)	2660 +/-80 BP	1045-600 BC
1019	17 (SFCR)	2110 +/-80 BP	525-15 BC
0981	18 (SFCR)	2320 +/-140 BP	785-35 BC
0978	14 (SFCR)	2240 +/-200 BP	780 BC-AD 190
0461	7 (LFCR)	1740 +/-100 BP	AD 40-550

Keystone Site 37

Sample	Feature Association*	C-14 Adjusted	95% Confidence Interval for Tree-Ring Calibration (Klein, et al 1982)
1237	3 (LFCR)	3410 +/-160 BP	2125-1420 BC
1591	21 (SFCR)	2890 +/-90 BP	1375-825 BC
1789	34 (LFCR)	2780 +/-50 BP	1210-805 BC
1812	22 (SFCR)	2170 +/-100 BP	595-155 BC
3544	40 (Pitstr)	1570 +/-80 BP	AD 235-615
3745	35 (Pitstr)	1050 +/-90 BP	AD 780-1210
1797	29 (Pitstr)	860 +/-130 BP	AD 895-1340
1785	25 (SFCR)	760 +/-150 BP	AD 1025-1410
1802	29 (Pitstr)	740 +/-90 BP	AD 1070-1390
1803	29 (Pitstr)	560 +/-100 BP	AD 1260-1485

* LFCR Large Fire-Cracked Rock Feature
SFCR Small Fire-Cracked Rock Feature
Pitstr Pitstructure

Provenience of Radiocarbon Samples

Site No.	Sample No.	Unit	Depth or Level	Extended Counts	Associations and Contexts
36	461	20S14E	1A	+	Fea. 7, depth 20 - 30 cm BSD weight= 1.7 grams
36	680	42S0E	1C		Fea. 10, in ash conc., 35-47 cm BSD 8.5 grams
36	978	2S22W	3	+	Fea. 14, 20-30 cm BSD 1.1 grams
36	981	1S26W	5	+	Fea. 18, main conc., 47 cm BSD 3.9 grams
36	1019	32N2E	2A		Fea. 17, 25-30 cm BSD 5.6 grams
37	1237	32N8E	2	+	Fea. 3, 30 cm BSD Within FCR scatter 1.2 grams
37	1591	20S24W	3		Fea. 21, base of Fea., 20 cm BSD 7.4 grams
37	1785	2N8E	2,3	+	Fea. 25, 25-36 cm BSD in undisturbed ashy layer, 4.2 grams
37	1789	18S12E	2-4		Fea. 34, dense conc., 30-53 cm BSD, 19.6 grams
37	1797	17N33W	62 cm	+	Fea. 29, 62 cm BSD in fill 2 cm above floor, 2.7 grams
37	1802	17N33W	55 cm	+	Fea. 29, 55 cm BSD in fill 3 cm above floor (sloping) 3.9 grams

Provenience of Radiocarbon Samples - Continued

Site No.	Sample No.	Unit	Depth or Level	Extended Counts	Associations and Contexts
37	1803	17N33W	52 cm	+	Fea. 29, 51 cm BSD in fill 3 cm above floor (sloping), 7.9 grams
37	1812	4S29W	82 cm		Fea. 22, large solid sample in base of fea. 11.1 grams
37	3544	Fea. 40		+	Fea. 40, fill stratum 3, 2-3 cm above floor, 2.7 grams
37	3745	Fea. 35	40 cm		Fea. 35, on floor in slight depression, 4.3 grams

Analysis of Radiocarbon and Obsidian Hydration Dates from Other Sites in Southwestern New Mexico

Grants Prison Sites, Valencia County, Central New Mexico
NMSU 1341 (Batcho 1984a:21-22)

Radiocarbon Dates	95% Confidence Interval
1650 +/-70 BP	AD 160-440
1740 +/-160 BP	110 BC-AD 530
1610 +/-90 BP	AD 160-520

Average Date (Long and Rippeteau 1974 Method): AD 303 +/-52 years
Tree-Ring calibrated average dates, 95% confidence interval:
AD 230-570 (Klein et al. 1982)

Obsidian Dates	95% Confidence Interval
AD 212 +/-51	AD 110-314
AD 233 +/-73	AD 89-377
AD 261 +/-64	AD 133-389
AD 338 +/-55	AD 228-448
AD 379 +/-34	AD 311-447
AD 427 +/-54	AD 319-535
AD 453 +/-46	AD 361-545
AD 467 +/-47	AD 373-561
AD 506 +/-66	AD 374-638
AD 506 +/-39	AD 428-584
AD 519 +/-46	AD 427-611
AD 545 +/-65	AD 415-675
AD 780 +/-60	AD 660-900

Sites FA 20 (NMSU 1386) and FA 24 (NMSU 1393), Doña Ana County, New Mexico

Site	Radiocarbon Dates	95% Confidence Interval
FA 20	550 +/-50 BP	AD 1300-1500
FA 20	690 +/-40 BP	AD 1180-1340
FA 20	590 +/-50 BP	AD 1260-1460
FA 24	1000 +/-50 BP	AD 850-1050
FA 24	870 +/-50 BP	AD 980-1180
FA 24	590 +/-60 BP*	AD 1240-1480*
FA 24	570 +/-50 BP*	AD 1280-1480*
FA 24	530 +/-50 BP*	AD 1320-1520*
FA 24	200 +/-110 BP	AD 1530-1970

*Determined to be most accurate (David Batcho, personal comm.)

Obsidian Hydration Dates

Site	Source Group	Rim(u)	SDEV(+/-)	Date	95% Confidence Interval
FA 20		1.53	.07	AD 327 +/-61	AD 1205-1449
FA 24		1.54	.05	AD 1318 +/-44	AD 1230-1406
FA 24		1.52	.04	AD 1336 +/-35	AD 1266-1406
FA 24		1.51	.07	AD 1344 +/-61	AD 1222-1466
FA 24		1.51	.08	AD 1344 +/-70	AD 1204-1484
FA 24		1.51	.06	AD 1344 +/-52	AD 1240-1488
FA 24		1.46	.03	AD 1386 +/-25	AD 1336-1436

Peña Blanca Rock Shelter, Doña Ana County, New Mexico
(Steadman Upham, Personal Communication, 12/5/84)

Obsidian Hydration Dates

Source Group	Rim (u)	SDEV(+/-)	Date	95% Confidence Interval
II	1.76	.07	AD 963 +/-83	AD 797-1129
II	1.72	.05	AD 1009 +/-57	AD 895-1123
II	1.61	.07	AD 1130 +/-76	AD 978-1282
II	1.59	.06	AD 1151 +/-64	AD 1023-1279
II	1.49	.09	AD 1253 +/-92	AD 1069-1437

Radiocarbon Dates

Site	Sample	Radiocarbon Dates	95% Confidence Interval
Peña Blanca	21	630 +/- 50 BP	AD 1230-1430
Peña Blanca	46	520 +/- 60 BP	AD 1300-1540
Peña Blanca	30	800 +/- 70 BP	AD 1010-1290
Peña Blanca	45	800 +/- 50 BP	AD 1060-1260

Meyer Range Pithouse Village, Fort Bliss
(Vernon Scarborough, personal communication)

Archeomagnetic Dates

Provenience	Date
Pithouse # 1	AD 1160-1300
Pithouse # 2	AD 1150-1235
Pithouse # 3	AD 1175-1225
Piehouse # 4	AD 1175-1200

Obsidian Hydration Dates

Source Group	Rim	SDEV(+/-)	Date	95% Confidence Interval
II	1.69	.07	AD 1182+/-67	AD 1115-1249
II	1.71	.07	AD 1163+/-68	AD 1095-1231
II	1.73	.07	AD 1144+/-69	AD 1075-1213
II	1.82	.07	AD 1054+/-73	AD 981-1127
II	1.74	.09	AD 1134+/-90	AD 1044-1224

END

12-86

DTIC