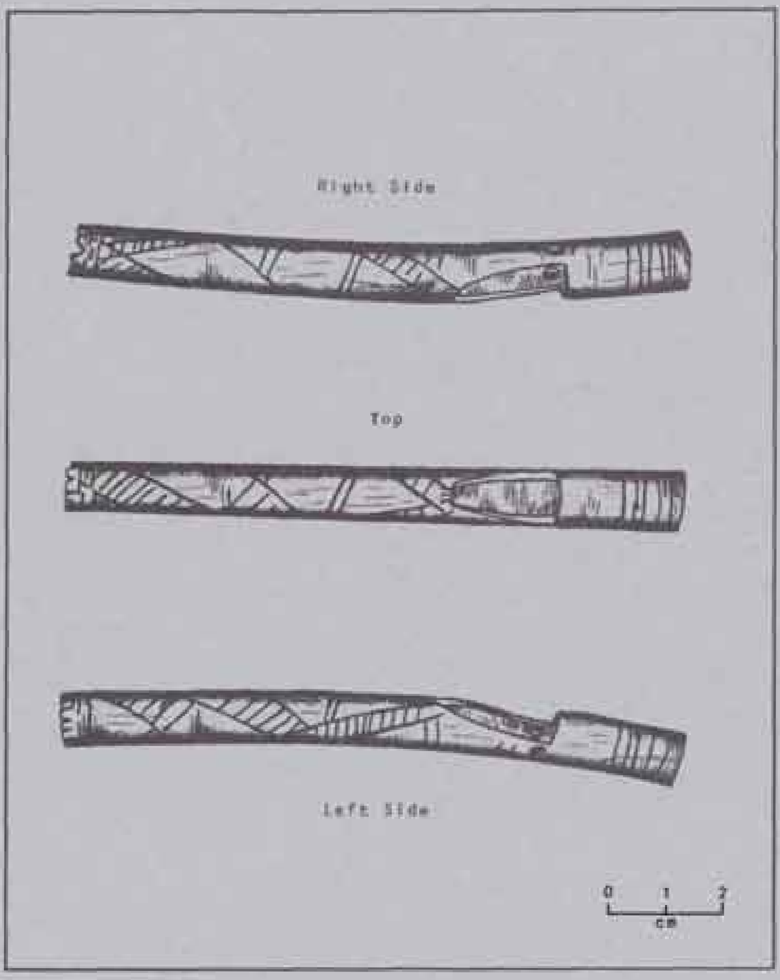
UTAH ARCHAEOLOGY
1989



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Utah Statewide Archaeological Society
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Utah Division of State History

UTAH ARCHAEOLOGY 1989

UTAH ARCHAEOLOGY 1989 is an annual publication of USAS, UPAC and the Utah Division of State History. The purpose of this publication is to disseminate information relevant to archaeological research, both historic and prehistoric, in the state of Utah. Subscriptions are available through memberships in the USAS, UPAC or the Publication Department of the Utah Division of State History. Authors interested in publishing contact the editors for a manuscript guide.

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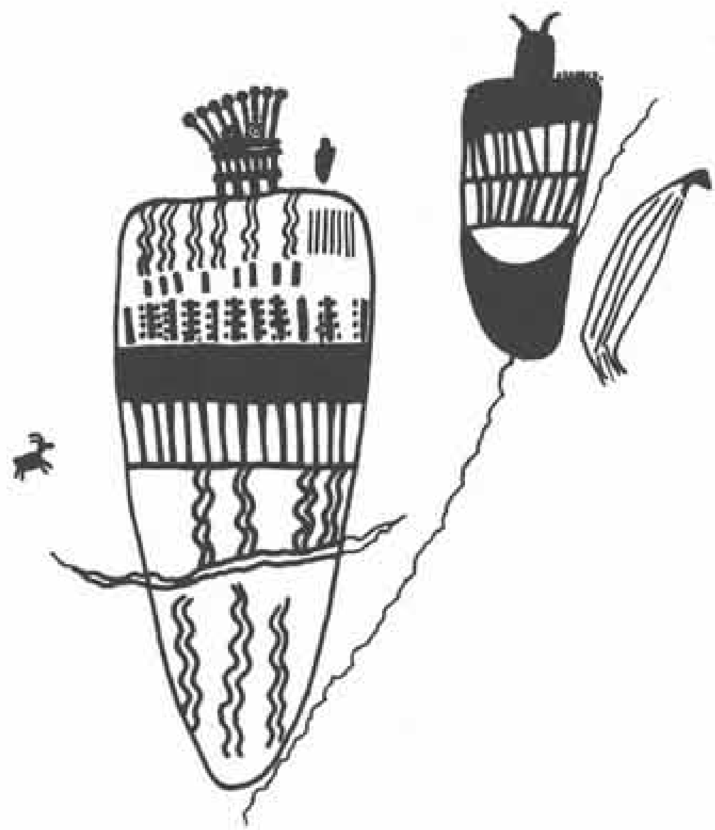

Barrier Canyon Style

NOTE: The theme of the small figures throughout this edition is: variation in anthromorphic form. These drawings taken from prehistoric rock art, illustrate the diversity in shape and form of human figures throughout Utah.

UTAH ARCHAEOLOGY 1989

Editors: Joel C. Janetski, Utah Professional Archaeological Council
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Vol. 2 | 1989 | No. 1

CONTENTS

Front Cover: Bone Whistle from West Warren 2 (see pages 48-55).

MESSAGE FROM THE EDITORS

We are pleased to present to the members of Utah Statewide Archaeological Society (USAS) and Utah Professional Archaeological Council (UPAC) as well as the general readership *UTAH ARCHAEOLOGY 1989*, the second volume of this new journal. The articles in this issue cover a broad spectrum of topics and report on very interesting and important work that has been done in Utah.

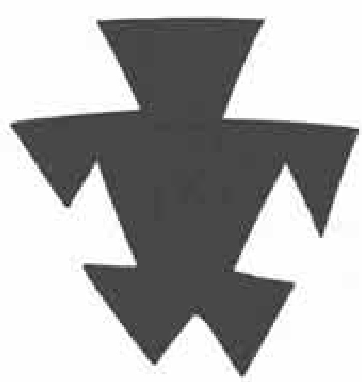
The editors would like to acknowledge the willing support we have received from the archaeological community when asked to review papers submitted for publication. The review process helps to ensure a quality publication and changes the stature of published pieces from non-refereed to refereed--an important distinction in the world of research. Each of the articles in *UTAH ARCHAEOLOGY* is reviewed by at least three individuals chosen for their background on the topic of the submitted paper. Such an effort can be considerable and often is done anonymously. So we sincerely thank all who have assisted us in this work.

UTAH ARCHAEOLOGY 1989 continues to be dedicated to meeting the needs and interests of amateurs and professionals as well as the more general public. To echo a theme presented in volume I, archaeology done without publishing is archaeology not done at all. If important discoveries are made, either from survey, excavation, or other research, but the information is never disseminated and in time is lost, then it is the same as if the discoveries were never made, or the site was destroyed. Publication of information is a primary difference between the professional or dedicated amateur and the looter. The promotion of publication of archaeological information was a fundamental purpose behind the founding of USAS as well as UPAC. We especially entreat the amateur community to submit articles for publication. Avocationalists have made substantial contributions to archaeology, and they continue to make contributions today. The article that you submit may not only be interesting now to all of us, but may provide the basis for significant advances in the future. Toward that end we encourage the submittal of summary articles on regions or specific cultural groups and descriptive reports of archaeological research as well as more analytical works.

We are very pleased with the number of articles submitted for inclusion in the journal, but we need more. We encourage professionals and amateurs alike to submit. If you have an idea about an article, give one of the editors a call and discuss it.

Suggestions from the memberships on the content or format of *UTAH ARCHAEOLOGY* are welcome.

Joel C. Janetski, editor for UPAC
Steven J. Manning, editor for USAS



Zion Canyon

GIVING FORM TO THE FORMATIVE: Shifting Settlement Patterns in the Eastern Great Basin and Northern Colorado Plateau

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ABSTRACT

Analysis of over sixty radiocarbon and tree-ring dates from structures at Five Finger Ridge, in central Utah, suggests that periods of increased and decreased building and occupational activity characterized the history of the site. Similar analysis of dates from reported Fremont sites in Utah, Colorado, and Nevada shows nearly identical patterns, representing periods of increased and decreased human settlement activity throughout the Fremont area. This temporal pattern is translated into a spatial analysis of settlement, showing periods of aggregation and disaggregation at particular sites. In addition, the patterns provide evidence of expansion and contraction of long-term occupation sites from a central "core area" along the Great Basin/Colorado Plateau Transition Zone. This diachronic view of flux in Formative settlement patterns provides a new perspective of Fremont culture history and socio-economic adaptations.

INTRODUCTION

In this article we review radiocarbon and other dates from the Fremont region to establish a chronological framework for an assessment of shifting Formative settlement patterns through time. We utilize dated sites and evidence of settlement shifts, defined by the presence or absence of long-term habitation structures such as pithouses. Defining a sequence of events from the data lays the groundwork for constructing a regional chronology. This, in turn, allows for a discussion of the ebb and flow of Formative demographics and site distributions in the Fremont region.

BACKGROUND

The impetus for this article was an analysis of over 60 radiocarbon and tree-ring dates from the Five Finger Ridge site in Clear Creek Canyon, central Utah (Figure 1). This site contained evidence of several long-term Fremont occupations between A.D. 700 and 1350. All radiocarbon and tree-ring dates from Five Finger Ridge were used (Tables 1 and 2), although (when compared to other site data,) several are considered too old to accurately reflect the site's initial occupation. The dates are calibrated for calendrical conversion (Klein et al. 1982), and the midpoint of the calibrated 95% confidence interval is used as an index of each date. This process (using the midpoint of the calibrated date) is conceptually no different, although it is more accurate in terms of calendrical time, than the use of mean radiocarbon dates for comparisons, as was done by Berry (1982). A generational span of 30 years centered on the midpoint date (i.e., ± 15 years) is assigned as a convenient range for comparison[1]. Thirty years was added to tree-ring dates, since these are considered cutting or building dates.

The results of the Five Finger Ridge date analysis can be seen in Figure 2a, with each square representing a 10 year radiocarbon period and each dot representing a 10 year tree-ring span. All dates prior to A.D. 900 are inconsistent with other evidence for the first occupations at the site. Still, two date-cluster peaks occur at approximately A.D. 780 and 830. Additional peaks occur at A.D. 950 and 1010. Then, as can be seen, a dramatic rise, perhaps representing a building phase associated with population aggregation at the site, occurs between A.D. 1040 and 1070. This is followed by a major decline at A.D. 1100 and another impressive rise culminating at A.D. 1160. For some reason the record is practically devoid of dates between A.D. 1190 and 1250. Apparently little datable material was collected by the site's occupants during this time, suggesting that few, if any, structures were built or inhabited for around 60 years. A rapid rise

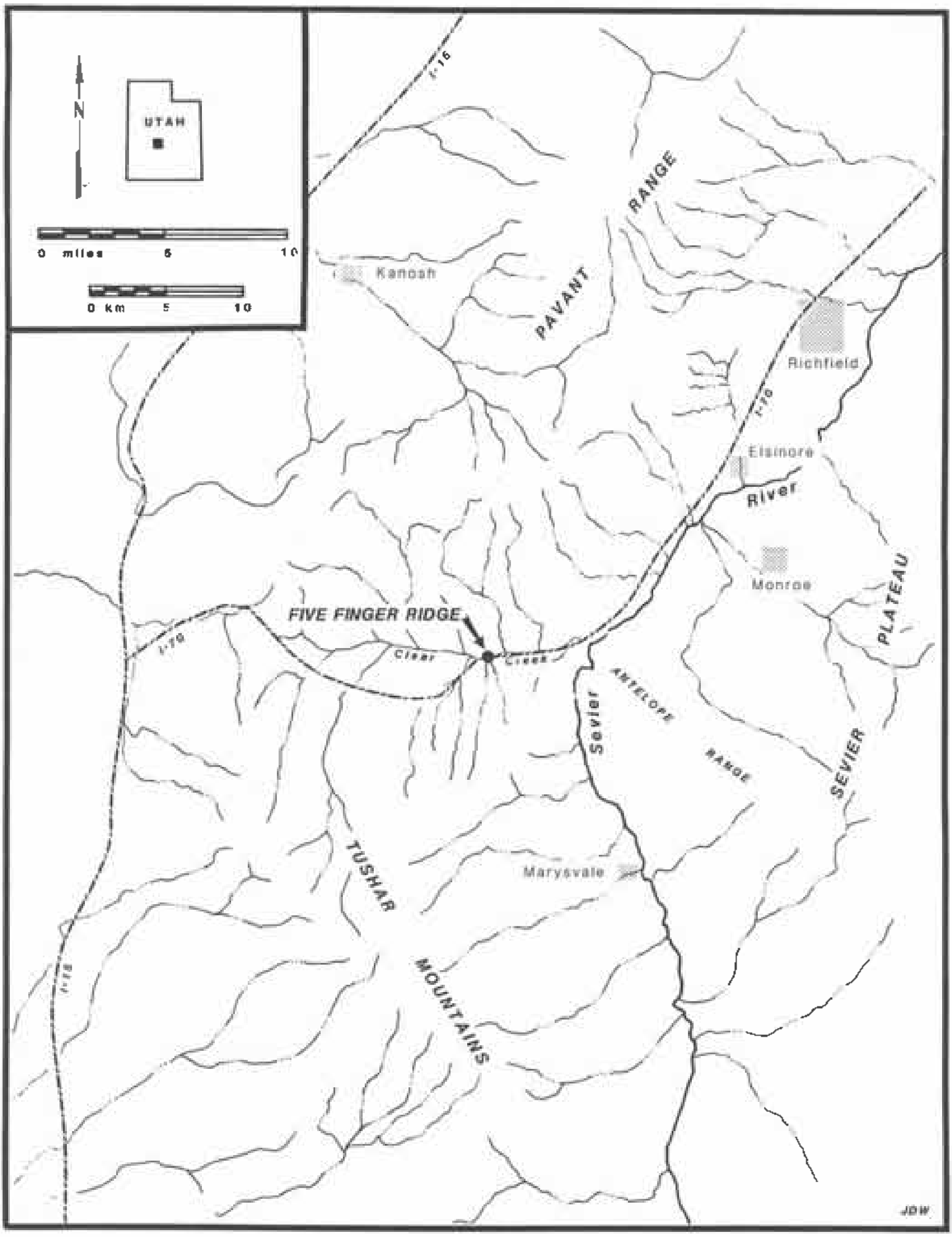

Figure 1. Location of Five Finger Ridge, Clear Creek Canyon, central Utah.

Table 1. Radiocarbon Dates from Five Finger Ridge, 42Sv 1686.

Time Period	Radiocarbon Date (B.P.)	Calibrated Date (95%)	Sample Number
Pre-A.D. 700	1800±120 B.P.	A.D. 213±213	Beta-9221
	1440±130 B.P.	A.D. 563±308	Beta-11324
	1400±60 B.P.	A.D. 660±95	Beta-9222
A.D. 700-880	1290±80 B.P.	A.D. 743±158	Beta-15029
	1180±90 B.P.	A.D. 825±205	Beta-15026
	1170±50 B.P.	A.D. 785±135	Beta-11316
	1170±50 B.P.	A.D. 785±135	Beta-11322
	1170±60 B.P.	A.D. 785±135	Beta-11323
	1160±70 B.P.	A.D. 833±178	Beta-15028
	1140±60 B.P.	A.D. 845±175	Beta-15025
A.D. 880-1040	1120±50 B.P.	A.D. 903±128	Beta-11330
	1090±60 B.P.	A.D. 948±93	Beta-15033
	1070±60 B.P.	A.D. 960±90	Beta-15034
	1070±60 B.P.	A.D. 960±90	Beta-11342
	1040±50 B.P.	A.D. 1010±130	Beta-10904
	1040±60 B.P.	A.D. 1010±130	Beta-11344
	1030±50 B.P.	A.D. 1020±135	Beta-9223
A.D. 1040-1190	990±50 B.P.	A.D. 1053±153	Beta-9224
	990±60 B.P.	A.D. 1053±153	Beta-11335
	990±80 B.P.	A.D. 1055±180	Beta-11336
	990±90 B.P.	A.D. 1055±180	Beta-10905
	980±70 B.P.	A.D. 1055±155	Beta-11325
	980±70 B.P.	A.D. 1055±155	Beta-11326
	950±80 B.P.	A.D. 1070±180	Beta-10900
	930±60 B.P.	A.D. 1080±155	Beta-11338
	920±50 B.P.	A.D. 1083±153	Beta-10898
	910±90 B.P.	A.D. 1085±180	Beta-11315
	900±60 B.P.	A.D. 1135±110	Beta-15031
	870±50 B.P.	A.D. 1145±110	Beta-11314
	870±50 B.P.	A.D. 1145±110	Beta-11329
	860±60 B.P.	A.D. 1150±110	Beta-9225
	860±60 B.P.	A.D. 1150±110	Beta-11332
	860±70 B.P.	A.D. 1150±110	Beta-15030
	850±90 B.P.	A.D. 1125±190	Beta-11321
	840±50 B.P.	A.D. 1158±108	Beta-9226
	840±70 B.P.	A.D. 1158±108	Beta-10906
	840±80 B.P.	A.D. 1173±148	Beta-11313
	830±80 B.P.	A.D. 1175±150	Beta-10897
	820±70 B.P.	A.D. 1168±108	Beta-11319
	820±70 B.P.	A.D. 1168±108	Beta-15027
	810±70 B.P.	A.D. 1175±110	Beta-11318
	810±60 B.P.	A.D. 1175±110	Beta-11343

Table 1 (cont.). Radiocarbon Dates from Five Finger Ridge, 42Sv 1686.

Time Period	Radiocarbon Date (B.P.)	Calibrated Date (95%)	Sample Number
A.D. 1190-1250	800+50 B.P.	A.D. 1228+68	Beta-11317
A.D. 1250-1350	760±50 B.P.	A.D. 1265±60	Beta-11331
	750±50 B.P.	A.D. 1270±60	Beta-10902
	750±50 B.P.	A.D. 1270±60	Beta-10901
	740±50 B.P.	A.D. 1273±58	Beta-11328
	730±110 B.P.	A.D. 1280±115	Beta-11320
	730±110 B.P.	A.D. 1280±115	Beta-11327
	730±60 B.P.	A.D. 1278±58	Beta-15032
	710±50 B.P.	A.D. 1285±55	Beta-11333
	700±50 B.P.	A.D. 1290±55	Beta-10907
	700±90 B.P.	A.D. 1303±103	Beta-11337
	690±60 B.P.	A.D. 1295±55	Beta-9220
	690±60 B.P.	A.D. 1295±55	Beta-11334
	690±50 B.P.	A.D. 1295±55	Beta-11341
	650±70 B.P.	A.D. 1328±73	Beta-9219
	640±60 B.P.	A.D. 1330±75	Beta-11339
	640±60 B.P.	A.D. 1330±75	Beta-11345
	630±60 B.P.	A.D. 1333±73	Beta-11340
Post-A.D. 1350	550±100 B.P.	A.D. 1378±113	Beta-11317

Table 2. Tree-Ring Dates from Five Finger Ridge, 42Sv 1686

Time Period	Date
A.D. 1040-1190	A.D. 1057r
	A.D. 1064v
	A.D. 1067+vv
	A.D. 1070+r
	A.D. 1108r
	A.D. 1110r
	A.D. 1110v
	A.D. 1153r
	A.D. 1153v

can be seen again between A.D. 1260 and 1290, followed by a gradual decline to site abandonment around A.D. 1350.

We decided to see if assemblages of dates from other Fremont sites reflect similar patterning. All available dates[2] from Fremont sites containing long-term, labor intensive pit or surface habitation structures (herein called "permanent habitation sites" [see discussion of site permanence below]) between A.D. 400 and A.D. 1450 are illustrated in the same manner (Figure 2b). Dates from rockshelters, caves or other Fremont-affiliated sites lacking "permanent" pit or surface structures ("non-permanent sites") are illustrated separately (Figure 2c). It is immediately apparent that both patterns are similar to each other and to the pattern seen at Five Finger Ridge.

Vertical over-representation of certain sites is not a major problem in the graphs. Only four sites add significant vertical height to Figure 2b. These include two sites in central Utah (Round Spring [Rood et al. 1988] and Point Pithouse [DeBloois 1982]), which represent approximately 50% of the A.D. 750 rise, and several A.D. 1040-1075 dates from Nawthis Village (Jones and Metcalfe 1981). In addition, numerous tree-ring dates from Sky House (Ferguson 1949; Schulman 1948) contribute to the cluster between A.D. 1055-1090. Removal of the Round Spring/Point Pithouse dates results in a mid-A.D. 700s peak nearly equivalent to that of the mid-A.D. 800s. Taking out the Nawthis dates has little impact on the very high mid-A.D. 1000s peak, and removal of the Sky House dates emphasizes the valley between A.D. 1090 and 1130.

These patterns are remarkably similar to those seen by Berry (1982) in the northern Anasazi area. Our concern is different than Berry's, however, as we focus less on large scale population movements between major physiographic regions as he did, and more on increases and decreases in numbers of dated habitation sites within the Fremont area. The intent is to focus on settlement shifts as seen primarily in the changing distributions through time of permanent habitation sites. This allows us to propose a scheme of Formative demographic flux in relatively long-term settlement through time and across space.

We assume that peaked clusters of dates are indicative of population increase, habitational intensity, and aggregation into larger settlements throughout the Fremont region. We also assume that periods of population decline or dispersal can be seen in the valleys between peaked clusters, when few dated remains occur. One might expect the patterns of dates from non-permanent sites to reflect their occupation during times of few dates in permanent sites. Figure 2c shows that this is not the case, however, a fact that poses an interesting problem for future research.

FORMATIVE DEMOGRAPHICS

Chronology

Our approach of comparing temporal patterns to spatial distributions of sites relies on the definition of cultural periods based on observed fluctuations in the displayed dates (Figure 2). These patterns are assumed to represent periods of stability and flux in the Fremont area. The chronological framework corresponds to peaks and valleys in the dating record: Period 1: Pre-A.D. 700; Period 2: A.D. 700-880; Period 3: A.D. 880-1040; Period 4: A.D. 1040-1190; Period 5: A.D. 1190-1250; Period 6: A.D. 1250-1350; Period 7: Post-A.D. 1350.

Demography

Locations of sites associated with radiocarbon and tree-ring dates displayed in Figure 2a and 2b are plotted in Figures 3 - 9. A few sites with pre-A.D. 700 and post-A.D. 1350 dates that are likely in error have not been included in the figures, as discussed below.

The following analysis of Fremont settlement distribution, as mentioned above, relies on the presence or absence of dated sites containing *permanent pit or surface habitation structures*[3] (hence the use of the Figure 2a and 2b dates only, in the spatial distribution figures that follow). Again, the term "permanent" is used here to describe sites with labor intensive structures such as pithouses and surface habitations with obvious hearth and other domestic features that suggest the site was occupied through two or more seasons. It is also used more generally to separate open structural sites containing substantial architecture (pithouses and/or surface structures) from caves, rockshelters, or open sites containing only short-term architectural features such as low-labor-cost habitations (e.g., Topaz Slough [Simms 1986] and Injun Creek [Aikens 1966]), open hearths, and isolated storage structures.

Period 1 (Pre-A.D. 700; Figure 3): The first period is represented by an accumulation of dates occurring prior to A.D. 700. For the most part, these dates are considered suspect by their reporters, since they conflict with other dates, ceramics, or site-specific evidence. It is interesting to note, however, that many of the midpoints cluster in the mid-A.D. 400s and the mid-A.D. 600s. Sites represented by these dates include portions of Five

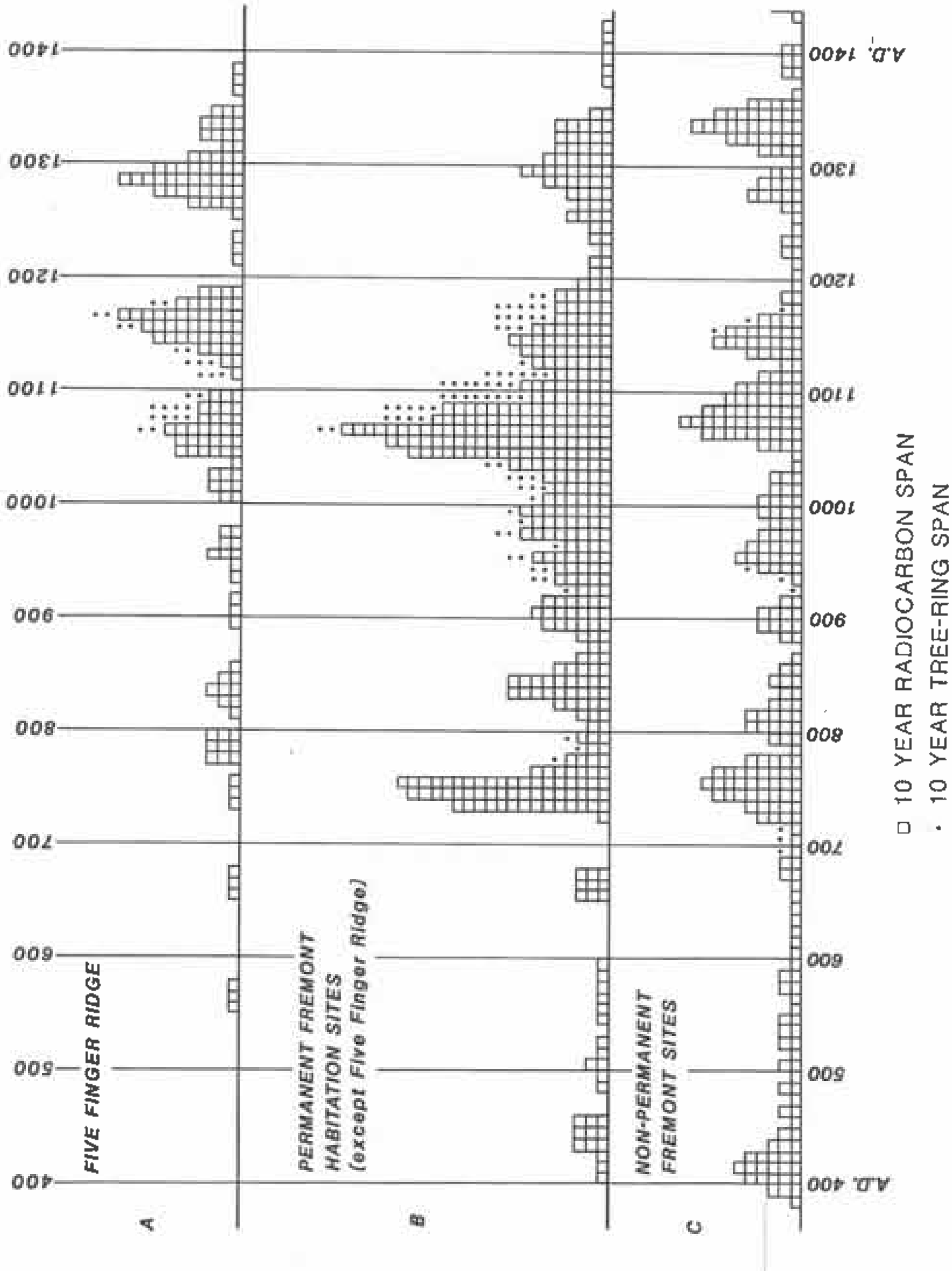

Figure 2. Plots of radiocarbon and tree-ring dates from Five Finger Ridge and other Fremont sites.

Finger Ridge, Icicle Bench (Janetski et al. 1985), Mukwitch Village (Talbot and Richens 1989), Pharo Village (Marwitt 1968), Round Spring (Rood et al. 1988), Snake Rock Village (Aikens 1967), and Point Pithouse (DeBloois 1982)--all within an area concentrated in or near the Sevier Valley in central Utah. For this reason they have been included in the figure.

Mid-to-late A.D. 500s dates from Bear River 3 (Shields and Dalley 1978) and Caldwell Village (Ambler 1966) seem unlikely, although it may be premature to discount these dates. Not included in this analysis are even earlier dates (ca. 80 B.C--A.D. 295) from Evans Mound (Adovasio 1970; Dodd 1982), Radford's Roost (Janetski et al. 1985), Apryll's Bench (Jacklin 1988), and Grantsville (Shields 1968), which are probably not associated with permanent occupation at these sites. Only Icicle Bench, containing a large, aceramic pit structure well-dated to the first or second century A.D. (Janetski et al. 1985), can be reliably placed in a pre-A.D. 700, Early Formative context.

In sum, limited evidence suggests that the Sevier Valley/central Wasatch Plateau region may have contained permanent settlements during the Early Formative period. This area may also provide the best evidence for understanding Archaic/Formative transitions, as the Late Archaic becomes increasingly better known as it has at such sites as Pahvant Park (Talbot and Richens 1989), Icicle Bench (Janetski et al. 1985), and the Elsinore Burial (Wilde et al. 1986; Wilde and Newman 1989).

Period 2 (A.D. 700 - 880; Figure 4): A significant increase in the number of permanent habitation sites occurs in the A.D. 700-880 period. Permanent settlements extend almost the entire length of the Basin and Range/Colorado Plateau (BR/CP) Transition Zone as well as into the Uinta Basin and western Colorado Plateau. Two occupational peaks occur during this period, suggesting fluctuating settlement patterns. However, it must be stressed that many of the dates, especially the mid-A.D. 700 dates, come from sites that apparently date much later, such as Five Finger Ridge, Evans Mound (Berry 1972; Dodd 1982), Hinckley Mounds and Woodard Mound (Don Forsyth, personal communication, 1988; Richens 1983), and Radford's Roost (Janetski et al. 1985). The reuse of old wood may account for at least some of these early dates, but the possibility that some are correct must also be considered.

Period 3 (A.D. 880 - 1040; Figure 5): This period marks a critical transition in Fremont development. Geographically, the occupation of the BR/CP Transition Zone apparently continues as before, although with increased intensity. However, in the Uinta Basin, especially toward the latter half of this period, the small sample of dates suggests that a general settlement shift occurred *away* from the Basin interior, south and eastward into the Book Cliffs--Roan Plateau area. Pioneering parties may have reached as far south as the Paradox Valley in Colorado (Crane 1977). Such an excursion into Anasazi country alludes to significant changes in material culture and architecture. The dotted line on the figure reflects a fluid cultural boundary suggested by the amount of exchange (especially in ceramics) that appears to have occurred between the two Formative groups beginning in early to middle Pueblo II times. Anasazi influence may have been more heavily felt along the eastern edge of the BR/CP Transition Zone, where Fremont sites from Castle Valley southward seem to take on some architectural traits characteristic of Anasazi sites.

Period 4 (A.D. 1040 - 1190; Figure 6): The geographical extent of Formative sites during this period is impressive. Permanent settlements (possibly beginning in the latter part of the A.D. 880-1040 period) may have expanded westward from the long-occupied BR/CP Transition Zone into the western deserts of Utah. Undated, but architecturally late, habitation sites can be found from the Tooele Valley on the north (Gillin 1941; Shields 1968), to the lower Sevier River sites southwest of Delta (Judd 1926), and possibly toward Minersville and Milford on the south. Still further west, permanent Fremont settlements sprang up in the area between the Deep Creek and Clover mountains (Leavitt 1988; Lindsay and Sargent 1979; Taylor 1954). The Escalante and Sevier Deserts may have been sparsely inhabited zones between these western settlements.

On the southern frontier, apparent excursions into the Harris Wash (Fowler 1963) and general Kaiparowitz Plateau region (McFadden 1988), the architecture and relatively high proportion of Kayenta and Virgin Anasazi ceramics in the Bull Creek area (Jennings and Sammons-Lohse 1981), and continued light occupation in the Paradox Valley (Crane 1977) indicate persistent and probably even greater contact with Anasazi groups. Like the western Utah deserts, the San Rafael Desert was sparsely inhabited. To the northeast, expansion of long-term settlement was maintained

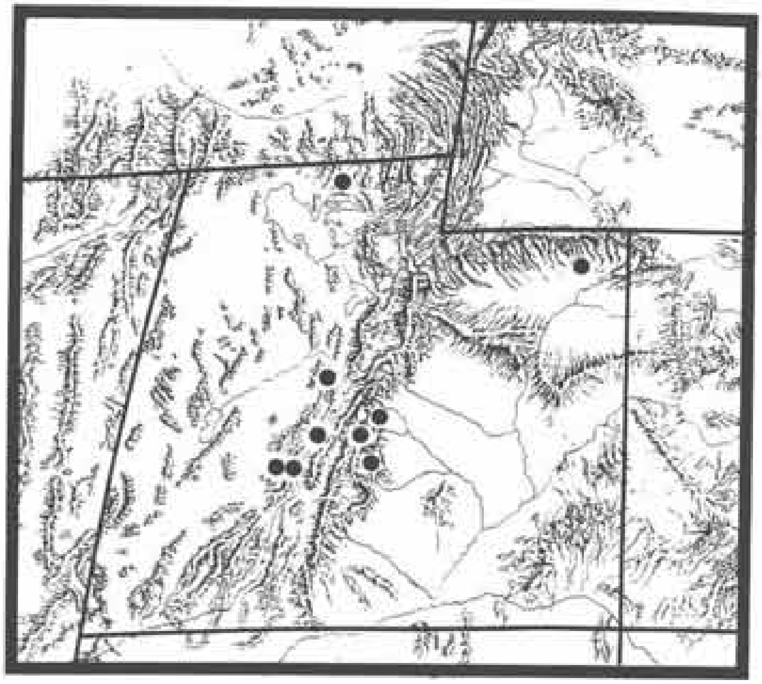

Figure 3. Period 1: Pre-A.D. 700, habitation site distribution.

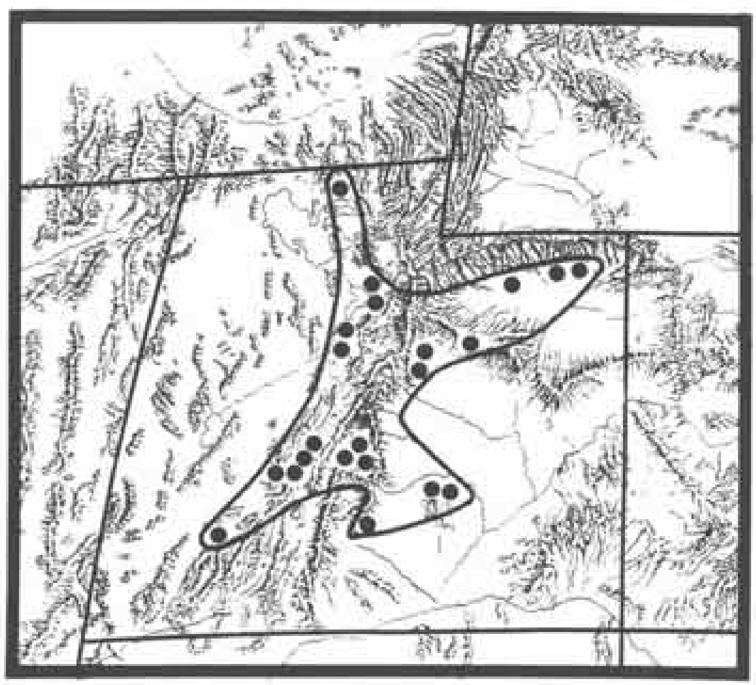

Figure 4. Period 2: A.D. 700 - 880, extent of site distribution.

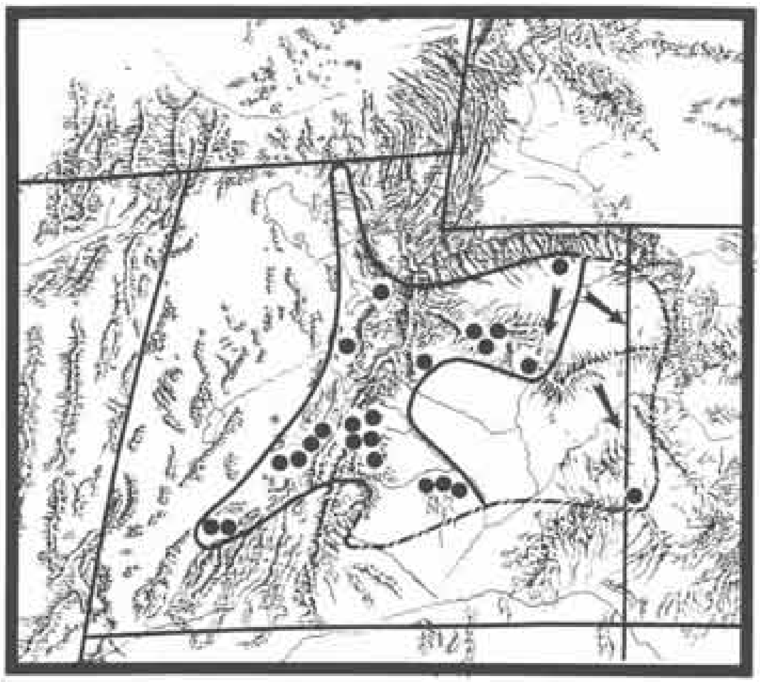

Figure 5. Period 3: A.D. 880 - 1040, site distribution showing eastward expansion.

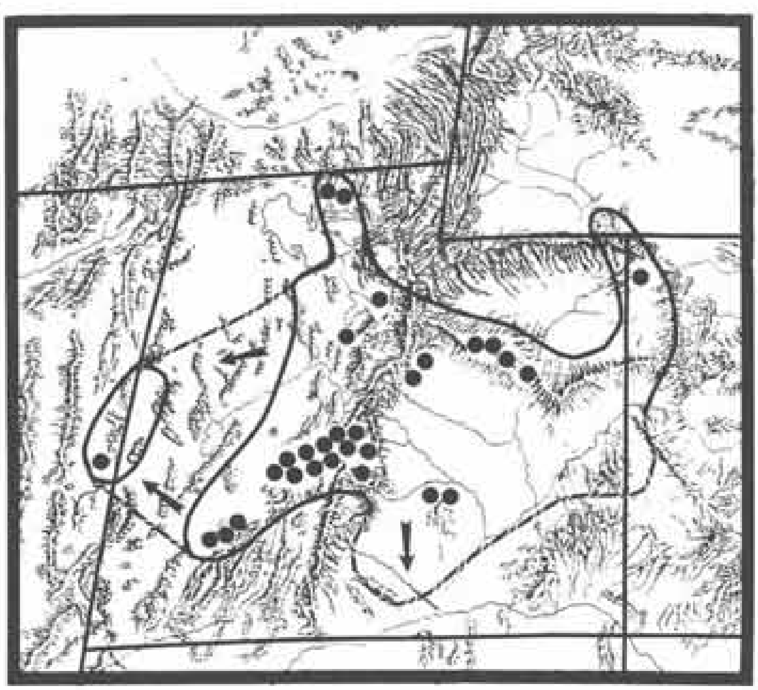

Figure 6. Period 4: A.D. 1040 - 1190, site distribution during period of greatest habitational expansion.

away from the central Uinta Basin. Limited settlement following the Green River into southwestern Wyoming and some movement into southern Idaho may also have occurred at this time.

Period 4 may be divided into two sub-periods of intense settlement separated by a significant but short-lived decline between A.D. 1090-1130. It appears that the initial occupation peak between A.D. 1040-1090 was interrupted by a short period of disaggregation followed by a return to more permanent settlements that lasted until around A.D. 1190-1200.

Period 5 (A.D. 1190 - 1250; Figure 7): A comprehensive disaggregation beginning in the latter half of the 1100s resulted in an almost total abandonment of permanent settlements within the Fremont area by approximately A.D. 1190-1200. This apparent depopulation lasted from 40 to 60 years. Midpoint dates of A.D. 1196 at Evans Mound (Berry 1972) and A.D. 1203 at Pharo Village (Marwitt 1968) probably represent last remnants of the previous expansion. Conversely, a date of A.D. 1243 at Nawthis Village (Jones and Metcalfe 1981) may represent the beginning of Period 6. This leaves only two dates centered at A.D. 1228, from single structures at Five Finger Ridge and the Alice Hunt site (Jennings and Sammons-Lohse 1981), that might represent occupation during this period.

Period 6 (A.D. 1250 - 1350; Figure 8): Renewed aggregation and expansion began around A.D. 1250. This focused primarily upon the *western half* of the BR/CP Transition Zone. However, consistent with Lindsay's (1986) observed fragmentation during this time, settlements appear to have been concentrated in a few choice areas within the north-south trending zone. To the east, Hogan Pass (Rood et al. 1988) and the Bull Creek area (Jennings and Sammons-Lohse 1981) continued to be lightly occupied. Pockets of settlement may also have reappeared in northwestern Colorado, where numerous non-habitation sites dating to this period occur (see Creasman 1981; Liestman 1985). Whether settlements were again established in eastern Nevada and western Utah during this period is questionable, given the lack of precise dating (although the presence of corrugated sherds at habitation sites could very well indicate occupation during this time). If resettlement in the region did occur, sites were probably isolated from the main group along the Wasatch Mountains, just as were those in northwestern Colorado.

Aggregation and limited expansion continued until around A.D. 1300, and then declined. By A.D. 1350 the Fremont area was all but devoid of permanent habitation sites.

Period 7 (Post-A.D. 1350; Figure 9): Little evidence for Fremont settlement occurs anywhere in the region after A.D. 1350. The Edge Site in northwestern Colorado dated to A.D. 1380 (Creasman 1981), while similar dates from several nearby rockshelter or other temporary sites (see e.g., Creasman 1981; Liestman 1985) suggest localized occupation by Fremont groups past this date. A smattering of post-A.D. 1350 dates from various Fremont sites, including Five Finger Ridge, Backyard Village (Robert Leonard, personal communication, 1986), Apryll's Bench (Jacklin 1988), Median Village (Marwitt 1970), Nephi Mounds (Sharrock and Marwitt 1967), and Hinckley Mounds (Don Forsyth, personal communication, 1988), are inconsistent with other data in each site, and are usually either dismissed by the excavators, or attributed to later groups. In sum then, the end of permanent settlements, and, by extension, the Fremont, had occurred by A.D. 1350, with the possible exception of an extended occupation in the already isolated area of northwestern Colorado.

DISCUSSION AND IMPLICATIONS

Spatial distributions correlated with temporal analysis indicate that permanent or semi-permanent settlements occurred throughout much of the Basin and Range/Colorado Plateau Transition Zone between A.D. 700 and 1350. During periods of flux, this zone was likely the last abandoned and the first reoccupied. Fremont settlements in the zone were the most intensive and long-lasting of any in the region. It is also well known that most of the larger sites in the Fremont area occur within this zone. The majority of sites outside the zone are much smaller and were occupied for much shorter periods of time than were those within it.

The BR/CP Transition Zone appears to have been a "core" or primary area (see also Marwitt 1980) for the development and maintenance of the Fremont phenomenon (Figure 10). The advantages of this zone are obvious: it contains verdant valleys and fresh and salt water lakes and marshes fed by a large number of streams and rivers draining the Wasatch uplands. It contains a great variety of elevational resources within short horizontal dis-

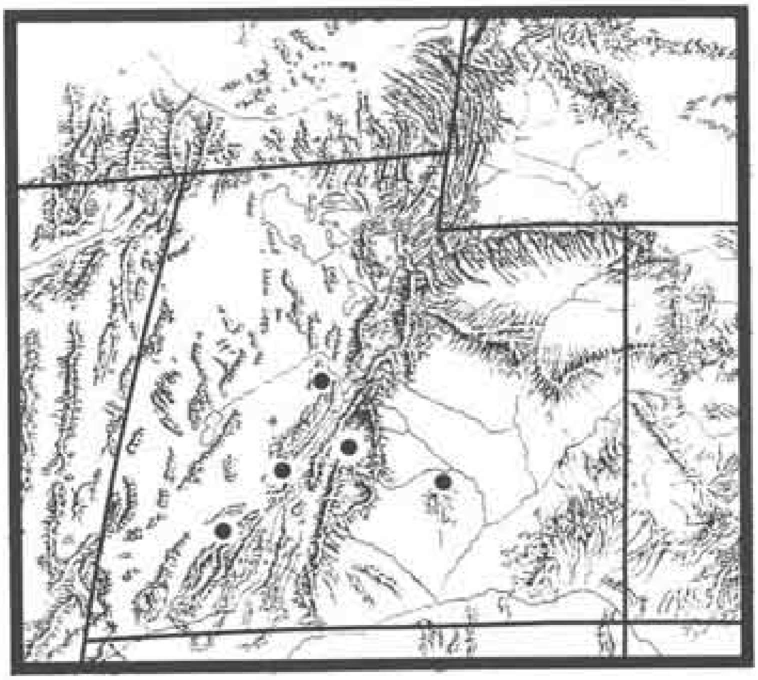

Figure 7. Period 5: A.D. 1190 - 1250, site distribution in southern core area during period of habitational retraction.

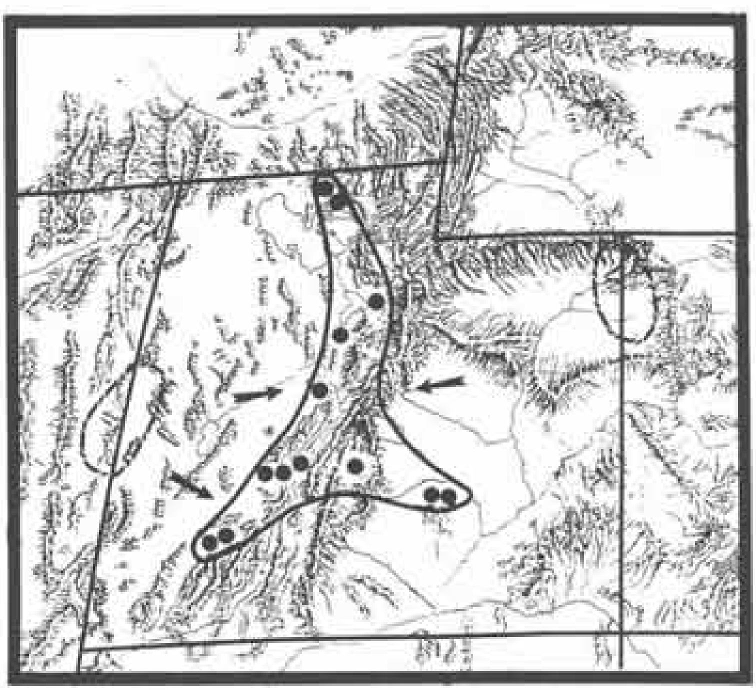

Figure 8. Period 6: A.D. 1250 - 1350, final expansion northward of habitation sites in Great Basin/Colorado Plateau Transition Zone. Figure shows areas of possible settlement in isolated portion of eastern Nevada and northwestern Colorado.

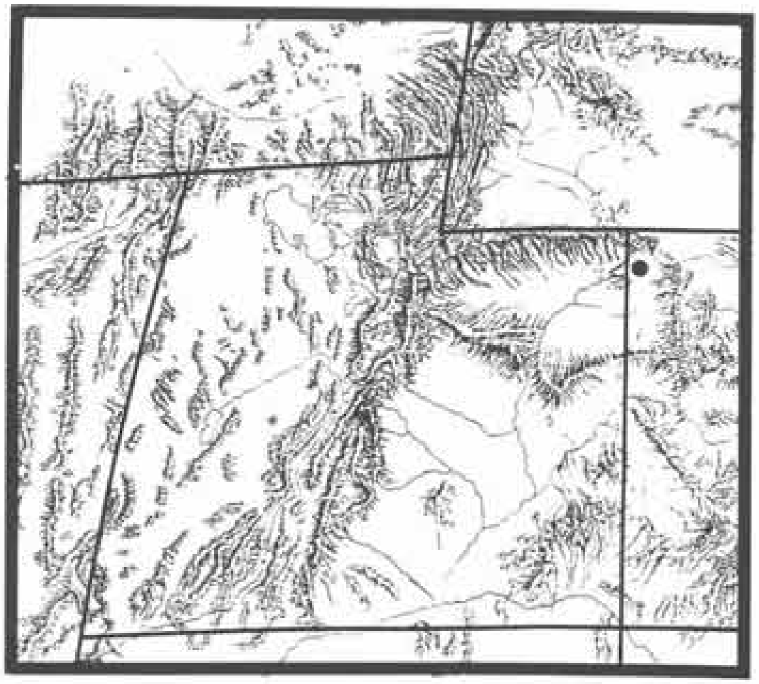

Figure 9. Period 7: Post A.D. 1350, location of only dated habitation site after A.D. 1350.

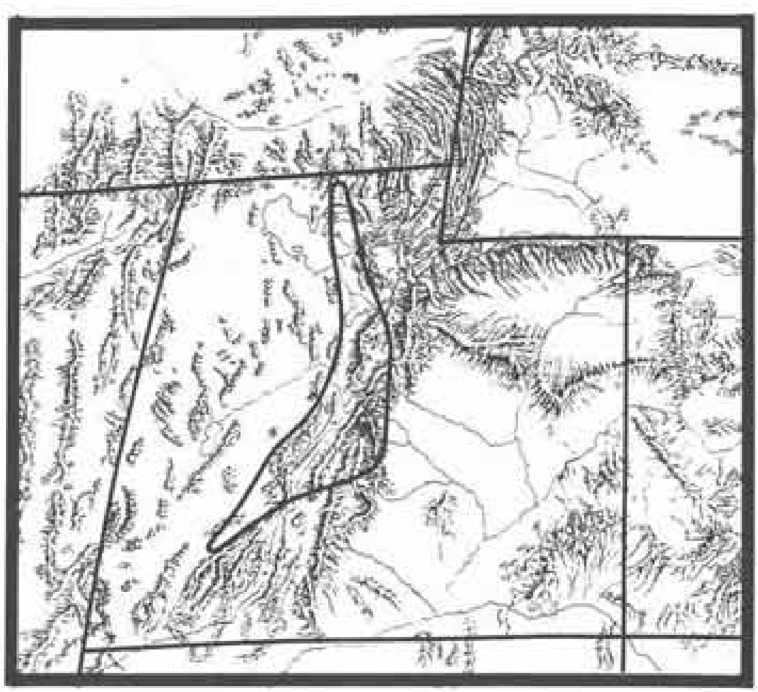

Figure 10. Great Basin/Colorado Plateau Transition Zone core area.

tances, and offers some of the best horticultural lands in the region.

Simms (1986) has suggested three possible Formative adaptive strategies in the Fremont area: 1) localized foraging to supplement horticultural production; 2) a variable strategy represented by periodic shifts from farming to foraging concomitant with shifts between sedentary and mobile settlement; and 3) groups of distinct horticulturalists and hunters occupying the same territory. The data presented here may be interpreted as reflecting most closely the second of Simms' general adaptive stances: aggregation by population groups into permanent settlements when conditions warranted, and disaggregation into smaller, probably more mobile groups when conditions changed. The overall population may or may not have increased during times of expansion.

Chóices made in response to changing physical and social environments were probably not between two drastically different modes, however, but were more likely to have been between increasing or decreasing already existing behaviors. That is, a portion of the population may have been participating in either adaptive stance at any given time. The decision, then would have been between intensifying the commitment to one behavior, say foraging, over another, such as horticulture. The argument over what the Fremont ate, as if their unchanging commitment to corn or foraged plants represented their total and only adaptation through time, severely restricts discussion of their cultural ecology.

The Fremont, of course, did not simply disappear at A.D. 1350. The challenge comes in recognizing archaeologically how and where they were living during periods of disaggregation and retraction. We can then focus on reasons for these periodic shifts in settlement, and, ultimately on questions of their fate after A.D. 1350.

The extent of external (Anasazi, Plains, etc) influence on the Fremont has long been a source of controversy, and this analysis has only approached the subject as it relates to temporal shifts in settlement. The evidence suggests Fremont sedentism was well established prior to the beginning of extensive Anasazi influence, and that it continued after evidence of contact between the two groups diminished. The data also suggest that the boundary between the two cultures became quite fluid between A.D. 880 - 1190, permitting extensive interaction. It seems likely that the rapidly expanding Fremont boundaries during this same period also resulted in increased interaction with other groups to the east in northern and central Colorado, in southwestern Wyoming, southern Idaho, and central and eastern Nevada. Still to be addressed, however, are the natures of these contacts, as well as their ultimate effects on the Fremont.

CONCLUSIONS

This review of radiocarbon and tree-ring dates from sites with evidence of permanent occupation suggests that a central core area along the Wasatch Mountains was occupied by relatively sedentary Fremont groups for most of the Formative period. The results indicate that aggregation into larger sites in the core area, and expansion of permanent settlements into the hinterlands, was periodic. Each of these episodes was punctuated by dispersal and retraction. Settlement boundaries representing the extent of long-term habitations away from the core area were nearly constantly expanding and contracting in response to cultural, environmental and other pressures or opportunities. The overall cultural response appears to have been a high degree of adaptability and flexibility to meet changing needs and conditions.

ACKNOWLEDGMENTS

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NOTES

1. It should be noted that the range around each individual midpoint has low statistical probability; however, we believe the patterns shown by the suites of dates suggest non-random distributions of dates, and indicate the validity of the method for suggesting periods of more or less intensive habitation. It must be stressed again, that this method is really no different than Berry's (1982) display of lab-reported, uncalibrated dates for the Anasazi area.

2. Lists of dates used herein from permanent and non-permanent Fremont sites may be obtained from the authors.

3. The question of site permanence is far from settled, especially given Gilman's (1987) recent work. We feel that some Fremont sites, such as the lower Bear River sites, may have been occupied by more transient groups than previously thought, although the issue has yet to be investigated.

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Oquirrh Mountains
(Great Salt Lake)

REDEFINING FREMONT SUBSISTENCE

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ABSTRACT

Both description and explanation of Fremont subsistence have proved elusive for several reasons, including the typological emphasis of earlier approaches, and a lack of reliable subsistence data from Fremont sites. Recently developed theoretical and analytical frameworks establish the relevance of extant faunal data to understanding Fremont subsistence, and the possibility of more detailed interpretation and comparison of Fremont faunal exploitation. These positive developments are balanced by increasing awareness of the range of cultural, taphonomic, and recovery processes affecting faunal assemblages. The problems and potential of current approaches are illustrated by comparison of faunal data from 17 Fremont sites, and an examination of the small artiodactyl assemblage from Nawthis Village in central Utah.

INTRODUCTION

Almost ten years ago David Madsen (1980) noted that very little information existed to support arguments about resource exploitation at Fremont sites. Although Madsen's review of Fremont subsistence clearly established substantive goals for Fremont research, virtually no new data have been published in the last decade, and little progress appears to have been made in describing subsistence patterns during the Fremont period. Thus, an evaluation of "Fremont subsistence" at this point can be little more than a restatement of the problems and possibilities outlined by Madsen.

There have, however, been changes in the approach to Fremont research that mean the data we have may be more useful than we thought. And there have been theoretical and methodological advances in the analysis of subsistence data, particularly faunal assemblage data, that mean the information we have is still much less than we need. In this paper, I wish to focus especially on current problems in the analysis of faunal assemblages, and their implications for studies of Fremont subsistence.

Until recently our understanding of Fremont Culture(s) has been strongly influenced by culture-historical assumptions of homogeneity within relatively well-defined time-space boundaries (e.g., Steward 1933; Ambler 1966; Marwitt 1970). This influence has also been apparent in discussions of Fremont subsistence that emphasized homogeneous adaptive units, either for the Fremont region as a whole, or within regional variants (e.g., Dalley 1970). Aside from the absence of data, Madsen (1980) noted that extant definitions of Fremont subsistence assumed both a consistent agricultural strategy and a persistent contrast between Fremont and Anasazi in the degree of dependence on agriculture. In other words, both Fremont and Fremont subsistence were defined as homogeneous units; the concept of variability played a part in Fremont studies only insofar as it served to define more homogeneous subunits within the whole.

There are two aspects of this approach that are particularly problematic for subsistence studies: First, given the paucity of subsistence data, it is not clear that descriptions of "dominant" patterns of Fremont subsistence are accurate even for some sites during some time periods. Second, as long as Fremont subsistence is defined in terms of these dominant patterns, both the variability in human behavior, and the variability in environmental and social contexts that might serve to explain such behavior, are excluded from analysis. From an evolutionary perspective, it is exactly this variability that is of interest (cf. Dunnell 1980; O'Connell, Jones, and Simms 1982; Simms 1987).

Madsen's (1979, 1980, 1982) argument that there is no such thing as "Fremont subsistence", but at least two major patterns of resource exploitation within Fremont time and space, focused attention on variability rather than homogeneity. Simms' (1986) suggestion that settlement and subsistence patterns within the Great Basin (Sevier) area may have varied both locally and temporally in response to fluctuations in resource abundance clearly reflects a selectionist approach. The empirical and methodological issues for current research are clear: What is the diversity of subsistence behavior

UTAH ARCHAEOLOGY 1989
pp. 19-31 (1989)

for the Fremont, and what underlying conditions can account for this variability? For the faunal analyst, more specific issues generated by the focus on variability are also clear: What kinds of information can Fremont faunal assemblages provide about temporal and spatial variation in subsistence strategies, and perhaps more importantly, what can they not provide?

FREMONT FAUNAS AND FREMONT SUBSISTENCE

We know that there are differences in attributes of faunal assemblages from Fremont sites in the Great Basin and on the Colorado Plateau (see Figure 1 for locations of sites that have provided quantifiable data on faunal assemblages; Table 1 lists sources for these data). Sites on the Plateau yield, on average, much smaller collections of bone, with fewer numbers of species represented (Table 2). However, even though we have reason to believe that the range of species exploited may be a significant aspect of human foraging behavior (see Christenson 1980 and Simms 1987 for discussions based on economic and ecological models, respectively), the richness of these assemblages cannot be linked in a straightforward manner to decisions made by Fremont hunters (Grayson 1984; Sharp 1987). For Fremont sites as a whole, the richness of faunal assemblages (the number of species represented) is tightly correlated with the number of bones recovered (Figure 2). Thus, assemblage richness may simply reflect variation in the size of samples excavated from Fremont sites rather than variation in prehistoric hunting strategies.

Differences in assemblage size may well be significant: that is, both the range of species and the absolute number of animals exploited by a group should reflect the relative value of resources in the subsistence system. Thus, if agriculture were more stable and more productive on the Colorado Plateau than in Great Basin Fremont sites, as Madsen (1980, 1982) suggests, we would expect to see exactly these differences in Fremont faunal assemblages from the two areas.

Consider, however, the relationship between richness (the number of species exploited) and evenness (the distribution of specimens across species, here measured using the Shannon Index [Pielou 1975]) in faunal assemblages from Great Basin Fremont sites (Figure 3; Sharp 1988). It has been suggested that this relationship reflects changes in both mobility and resource specialization (Christenson 1980; Clark and Yi 1983), and the pattern shown by these sites does seem to conform to interpretations based on other lines of evidence (e.g., Berry 1972, 1974; Madsen 1979, 1980; Madsen and Lindsay 1977). All of the assemblages fall within the range expected for relatively sedentary occupations, but differ in the degree of resource specialization, from the generalist pattern shown at Backhoe Village to the specialized subsistence base at Median Village, Nephi and the Great Salt Lake sites. This variability suggests (not too surprisingly) that the situation is more complicated than a single dichotomy between Plateau and Basin subsistence patterns.

Interpreting Assemblage Attributes

Unfortunately, differences in assemblage size, or in derived measures of resource exploitation such as richness and evenness, may or may not allow an accurate assessment of differences in resource selection at Fremont sites. Archaeologists have become increasingly aware of the variety of processes that affect the material with which we work--not only the behavior which we hope to document, but attritional agents that may selectively alter assemblages, and recovery strategies that determine the sample available for analysis. The link between assemblage attributes and particular past behaviors requires an assessment of the impact of each set of processes.

Interpreting differences in the size of faunal assemblages from Fremont sites founders at the recovery level. That is, we cannot rule out the possibility that differences in recovery procedures have created the observed variation in these assemblages, and we cannot do so because information on recovery is lacking from site reports. The difficulty can be illustrated by a simple enumeration of the kinds of information needed and the number of sites for which that information is available (Table 3). We know the excavated area for four of the 17 sites; we know that one site was screened with one-fourth inch screens. We do not know the excavated volumes; what proportion of excavated deposits were troweled, shoveled, or removed with a backhoe; how much of the excavated sediment was screened; or whether all recovered bone was retained for analysis. Thus, the effects of different recovery strategies cannot be adequately evaluated for any Fremont site.

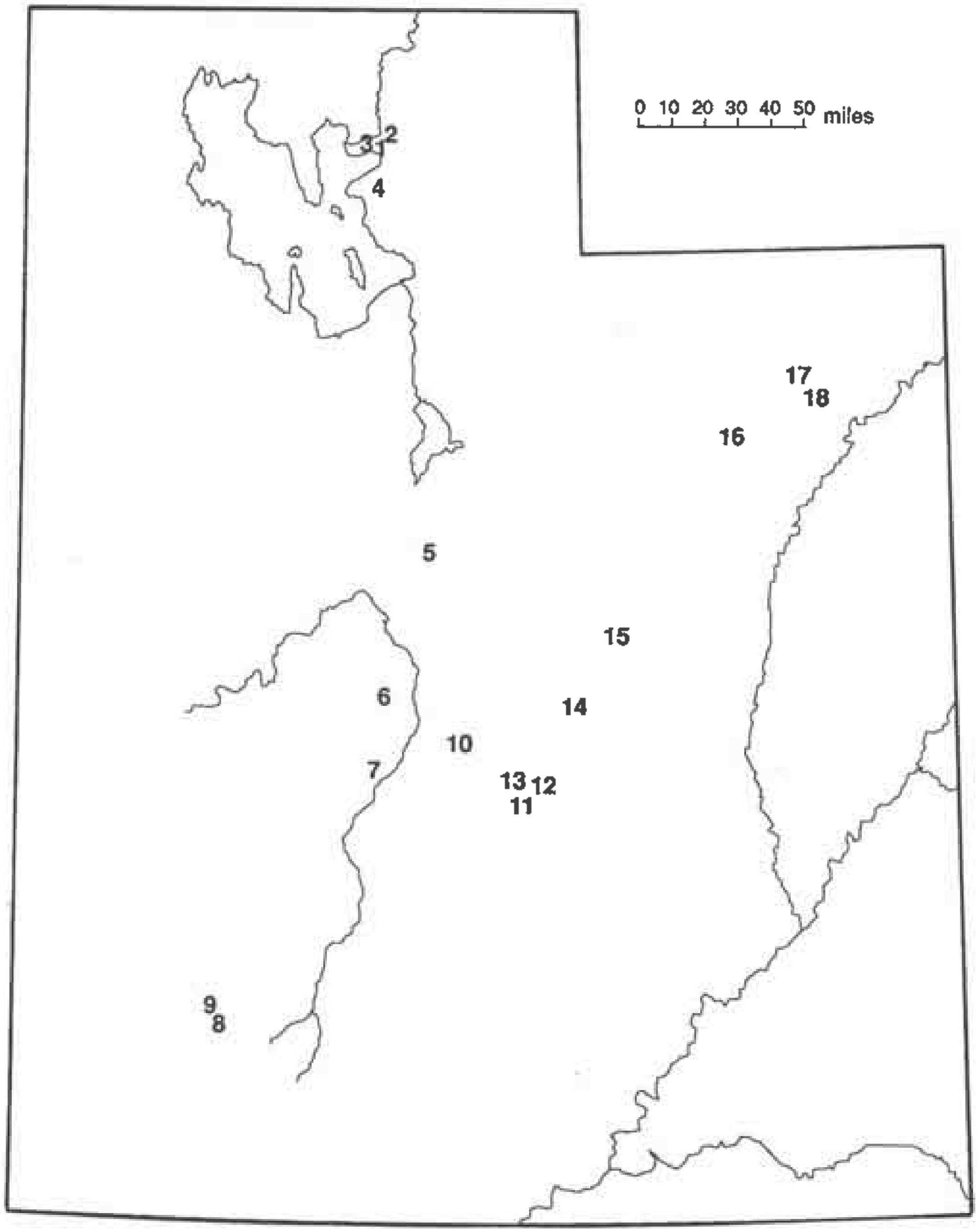

Figure 1. Map of Utah showing locations of Fremont sites with quantifiable faunal assemblages (see Table 2 for site identification).

Table 1. Fremont Faunal Assemblages (Map numbers keyed to locations shown on Figure 1).

Map Number	Site	Reference for Faunal Data
1	Bear River 1	Aikens 1966
2	Bear River 2	Aikens 1967
3	Bear River 3	Shields and Dalley 1978
4	Injun Creek	Aikens 1966
5	Nephi	Sharrock and Marwitt 1967
6	Pharo Village	Marwitt 1968
7	Backhoe Village	Madsen and Lindsay 1977
8	Median Village	Marwitt 1970
9	Evans	Berry 1972
10	Nawthis Village	Sharp 1989
11	Old Woman	Taylor 1957
12	Snake Rock	Aikens 1967
13	Poplar Knob	Taylor 1957
14	Innocents Ridge	Schroedl and Hogan 1975
15	Windy Ridge	Madsen 1975
16	Felter Hill	Shields 1967
17	Whiterocks Village	Shields 1967
18	Caldwell Village	Ambler 1966

Table 2. Assemblage Size and Richness at Colorado Plateau and Great Basin Fremont Sites.

Region	Number of Sites	Mean Number of Specimens	Mean Number of Species
Colorado Plateau	8	151.1	5.8
Great Basin	9	1613.8	12.1

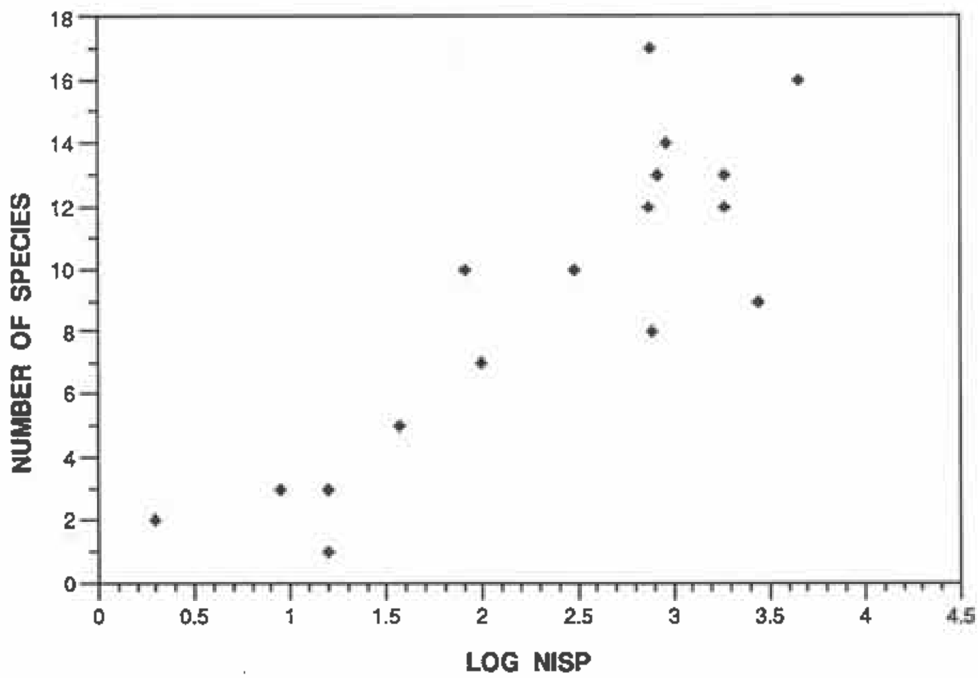

Figure 2. Relationship between faunal assemblage size and richness at 17 Fremont sites.

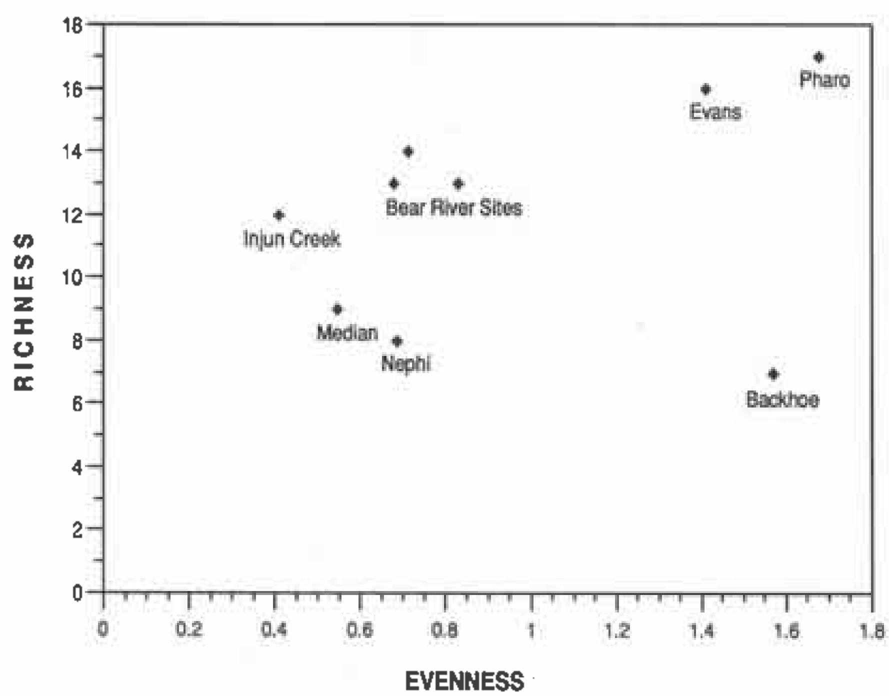

Figure 3. Relationship between faunal assemblage richness and evenness at nine Great Basin Fremont sites.

Table 3. Recovery Information for 17 Fremont Faunal Assemblages with Species Level Identifications.

Recovery Information	Number of Sites for Which Information is Reported (of 17 Sites)
Site Area	6
Percent Excavated	0
Excavated Area	4
Excavated Volume	0
Screen Size	1
Percent Screened	0
Sampled for Analysis	0

There is a significant rank order correlation ($r_s = .5456$; $p < .05$) between the number of features excavated and the number of bones recovered from the 17 Fremont sites considered here. Not surprisingly, "the more you dig, the more you get." The correlation is significant, but not especially strong: the number of features excavated accounts for some but not all of the variation in assemblage size. It remains to be demonstrated whether the unexplained variation reflects past human behavior or contemporary archaeological practice.

Even where measures of resource diversity (richness and evenness) are not correlated with the size of the recovered assemblage (and this is the case for Great Basin or "Sevier" sites as a group), it is not clear that these measures assess food selection alone. If skeletal elements of certain species undergo differential destruction by attritional agents, or if human decisions about carcass processing are applied differentially across prey species, then assemblage diversity will reflect these processes as well as selection of species from the range of available resources. Thus, although the relationship between richness and evenness measures in Great Basin sites seems to allow a straightforward interpretation of differences in resource exploitation, as well as an underlying similarity in occupational stability, we require detailed knowledge of the assemblages themselves to assess differential effects of taphonomic processes, both natural and cultural.

THE SMALL ARTIODACTYL ASSEMBLAGE AT NAWTHIS VILLAGE

The faunal assemblage from Nawthis Village (42SV633), located at the eastern edge of the Great Basin at an elevation of 2025 meters (see Figure 1), illustrates some of the difficulties of interpretation and comparison. Portions of Nawthis Village were excavated by the University of Utah from 1978 to 1982 (Jennings 1978b; Metcalfe and O'Connell 1979; Jones and O'Connell 1981; Jones and Metcalfe 1981; Metcalfe 1983). The faunal assemblage from these excavations totals over 21,000 specimens. Here I discuss only the remains of small artiodactyls --deer, mountain sheep and pronghorn--recovered from the site: first, because these are among the prey species generally considered important to Fremont hunters, and second, because they provide an example of the complex interaction of resource selection, cultural and natural taphonomic processes, and archaeological recovery.

Of the three species of small artiodactyl, mule deer are by far the most abundant at Nawthis, making up 74 percent of the small artiodactyl remains (Figure 4). Seventeen percent of the identifiable specimens are pronghorn; nine percent are mountain sheep. The abundance of mule deer at Nawthis seems to support the argument that Fremont hunters focused whenever possible on deer, substituting antelope and mountain sheep where those species were abundant (Dalley 1970). The distribution of small artiodactyl specimens

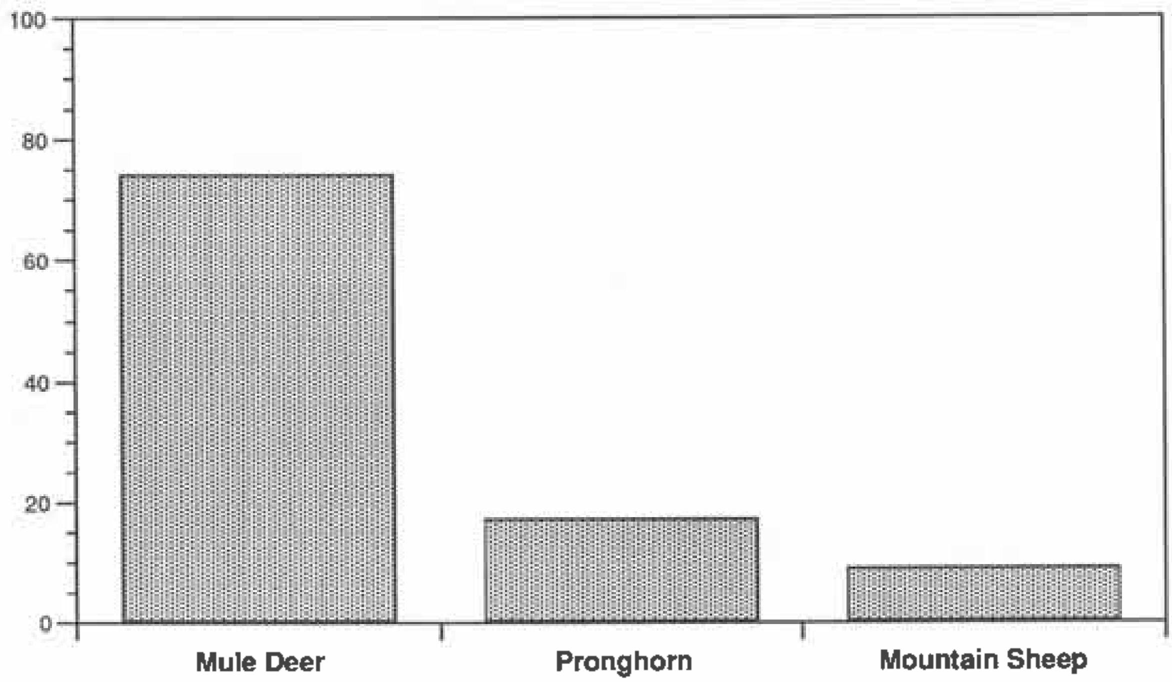

Figure 4. Relative abundances of small artiodactyl species at Nawthis Village (percent of all small artiodactyls).

across species at Nawthis is similar to Fremont (or "Sevier Fremont") sites to the west (with the exception of Backhoe Village), less similar to nearby sites situated on the Colorado Plateau (Figure 5).

But all small artiodactyl remains comprise a relatively small proportion of the total assemblage recovered from Nawthis - approximately 25 percent of all specimens identified to the species level. When specimens identified only as "small artiodactyl" are added to the species-level identifications, the total comprises only about 34 percent of mammalian specimens identified to any taxonomic level. The low relative abundance of small artiodactyls at Nawthis Village differs from other Fremont faunas (Figure 6), many of which are composed primarily of these species. Indeed, high proportions of artiodactyl remains have led archaeologists to conclude that Fremont hunting focused especially on larger game animals (see Dalley 1970; Jennings 1978a). If this is the case, then Nawthis Village (with Backhoe Village and the Old Woman site) is an exception to the rule.

However, the differences shown here may not be due to selection by prehistoric hunters. The recovery of subsistence data, including faunal remains, was a primary objective of the Nawthis Village excavation: both structure and midden deposits were systematically sampled, all deposits were screened through at least 1/4 inch mesh, and all faunal specimens were retained for analysis. Again, the harder you look, the more you get - in this case the recovery strategy at Nawthis not only produced a large sample, but a sample that probably contains a much higher percentage of small animal bone than has been recovered from other Fremont sites. For reasons discussed above, it cannot be demonstrated that differences in recovery strategy actually produced the pattern illustrated here. I would be reluctant to attribute differences in the relative abundances of artiodactyl remains in Fremont sites to choices made by Fremont hunters, however, unless I were convinced that smaller species are accurately represented in all assemblages. Further, without this assurance, the assumption that artiodactyls were a primary focus of

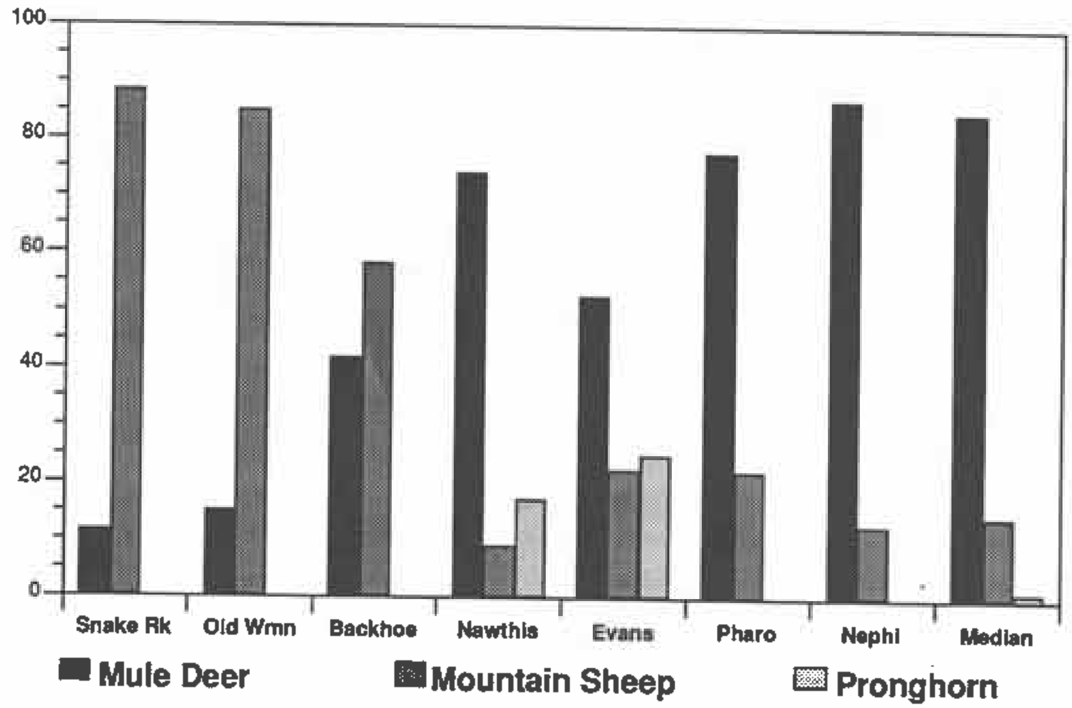

Figure 5. Relative abundances of small artiodactyl species at eight Fremont sites (percent of all small artiodactyls).

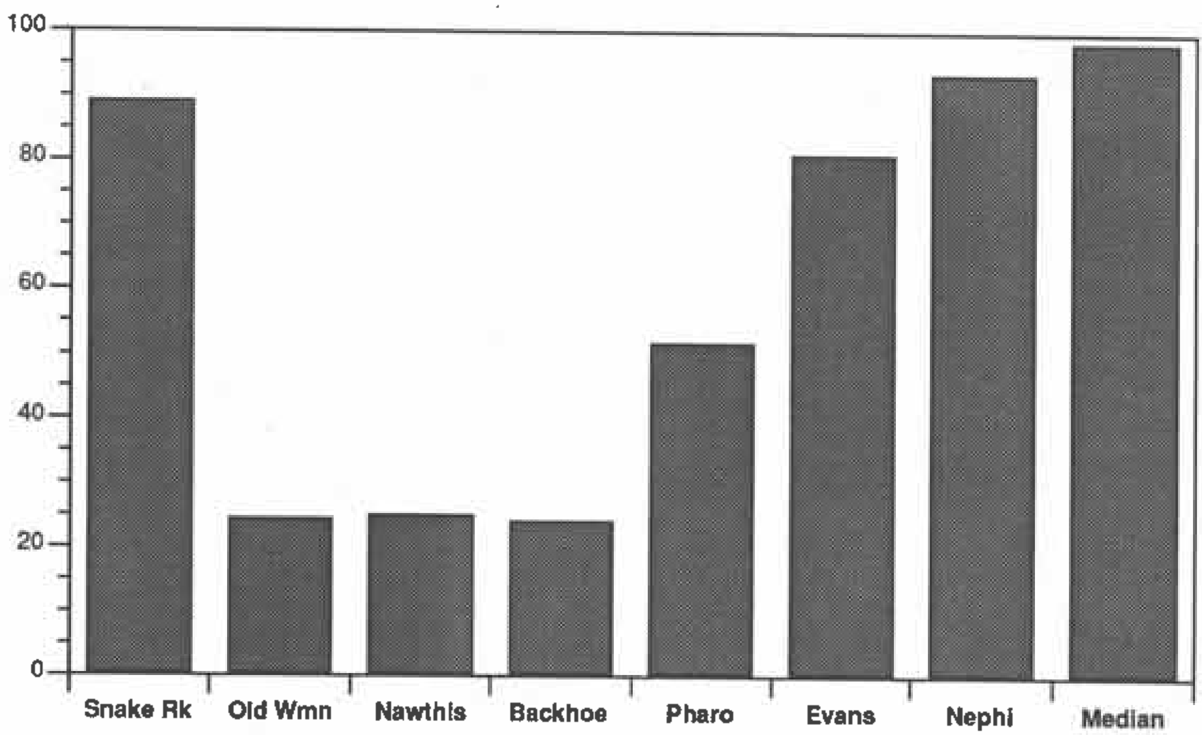

Figure 6. Relative abundances of all small artiodactyls at eight Fremont sites (percent of NISP).

faunal exploitation over most of the Fremont area seems questionable.

Small Artiodactyl Processing at Nawthis Village

A more detailed analysis of the small artiodactyl assemblage can provide information on selection and processing of these species by Fremont hunters at Nawthis Village. The use of body part distributions to examine patterns of resource procurement and processing (Binford 1978) is becoming a standard technique in the faunal analyst's repertoire; to date this technique has been applied primarily to assemblages from short-term, special purpose locations (e.g., Speth 1983; Thomas and Mayer 1983). At Nawthis Village, body part distributions for deer, mountain sheep and pronghorn are similar; because sample sizes for two of the species are small, I have combined all of the small artiodactyl specimens in Figure 7, which plots the relationship between relative part representation (%MAU) and part utility (MGUI). Rank order correlation of the two values shows a significant, but not especially strong, association ($rs = -.5230$, $p < .01$). Note that this is an inverse relationship, or "reverse utility curve" - one that might occur at a butchering site where high utility parts are prepared for transport to a residential base (Thomas and Mayer 1983). The expected distribution at Nawthis Village is certainly not a reverse utility curve; at a residential site selection should be for, rather than against, high utility parts. It appears that some factor other than food utility better accounts for the distribution of small artiodactyl parts at Nawthis.

An obvious candidate here is bone density, since density-mediated attrition has been shown to produce part distributions that mimic reverse utility curves (Lyman 1985; Grayson 1988). Plotting relative body part frequencies against bulk density (Figure 8) shows a positive association between the two values; the rank order correlation here is weaker ($rs = .4346$), but still significant at the .05 level ($.01 < p < .05$). Body part frequencies in the small artiodactyl assemblage may tell us as much about the impact of attrition on the faunal assemblage as about processing decisions made by occupants of Nawthis Village.

There is one additional attribute of the small artiodactyl bone that suggests a third factor accounting for the distribution of body parts, and that is the number of tools in the Nawthis assemblage. There are over 400 specimens of small artiodactyl-size bone shaped by splitting or flaking, and polishing, including 276 awls (Figure 11). Body parts from which tools were manufactured can be definitely identified for only about a quarter of these, but in every identifiable case that part is a metapodial. Note that in both plots of body part representation (Figures 7 and 8), proximal metacarpals (PMc) and metatarsals (PMt) contribute significantly to the associations. Further, metapodials may have been transported with more distal elements, so that systematic selection for metapodials also selected for carpals, tarsals and phalanges, elements that are well represented in this assemblage. By removing the distal limb elements, we also remove any correlation between part frequency and food utility, and between part frequency and bulk utility.

A reasonable argument can be made that the body part distribution for small artiodactyls at Nawthis Village is influenced by differential selection of parts for tool material; these parts were not only selectively transported but, quite possibly, curated by the site occupants. If we had a true measure of the economic utility of small artiodactyl skeletal parts, a measure that includes both utility as food and utility as raw material, the Nawthis small artiodactyl distribution might approach the expected utility curve for a residential base. Whether or not Nawthis is unique in the selection and use of small artiodactyls can be demonstrated only by similar analyses of other Fremont faunas.

CONCLUSIONS

This paper should perhaps have been titled "Undefining Fremont Subsistence." I have summarized some of what we do know, and more of what we do not know about Fremont faunal exploitation. Several conclusions should be clear from this brief review of the evidence. First, a new theoretical framework, no matter how potentially powerful, will be useful only if valid and reliable observations can be generated from the archaeological record: observations that are relevant to the theory in question. It is the issue of validity that has been addressed here, and while measures of faunal assemblage size and diversity may be valid indicators of resource selection, we have, as yet, no way to determine if this is the case for most Fremont assemblages. Second, although "middle-range research" such as Binford's (1978) observations of body part distributions produced by particular transport and processing decisions can

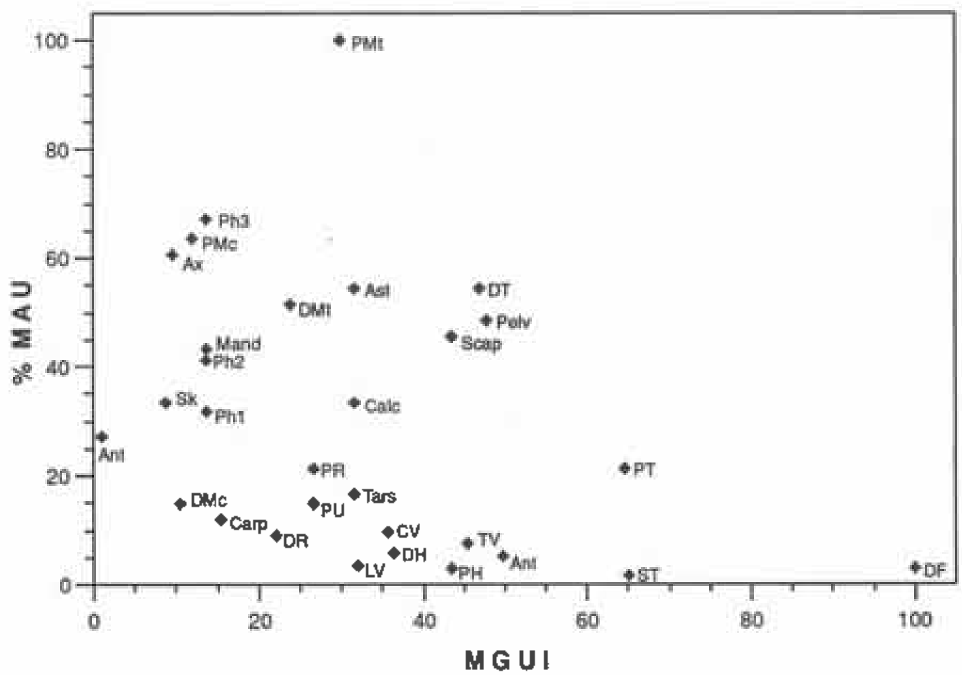

Figure 7. Relationship between small artiodactyl body part frequencies (%MAU) and food utility (MGUI) at Nawthis Village.

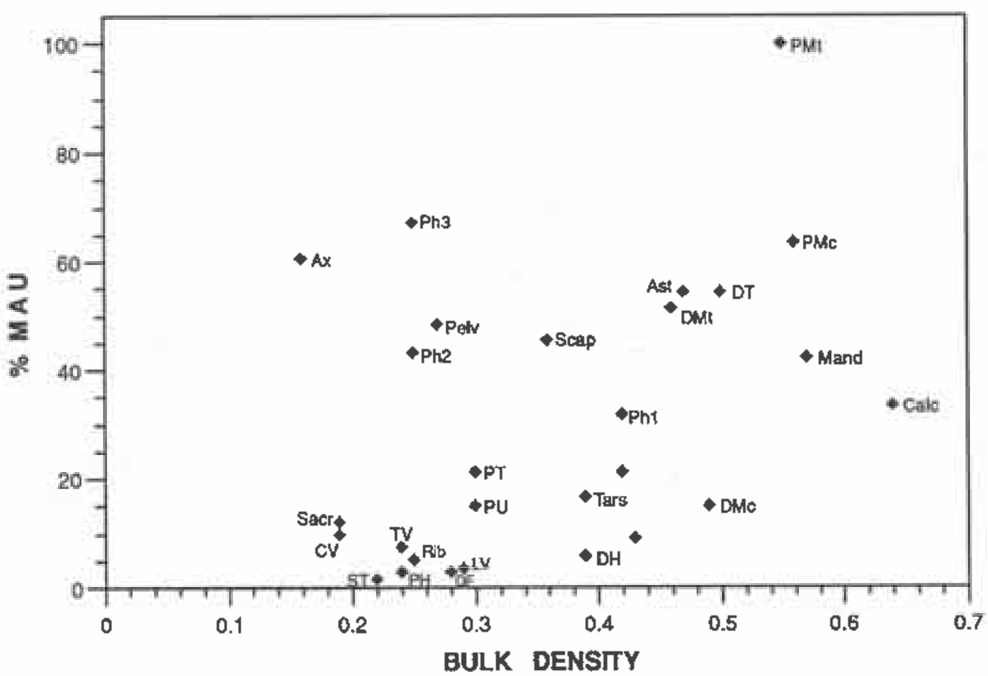

Figure 8. Relationship between small artiodactyl body part frequencies (%MAU) and bone bulk density at Nawthis Village.

provide valuable analytic tools, the results can by no means be uncritically applied to explain attributes of archaeological assemblages. Neither of these difficulties is confined to Fremont subsistence studies.

Finally, although much of this paper has focused on the methodological rather than the substantive, and much of it may appear negative rather than positive, I believe it is very heartening that what we don't know today is much more than what we didn't know ten years ago. We are not simply looking for the answers to the same questions; rather, we have generated a new and larger set of questions, and the potential for substantial progress in understanding subsistence strategies during the Fremont period.

ACKNOWLEDGMENTS

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Uinta Basin

IMPLICATIONS OF EARLY BOW USE IN GLEN CANYON

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ABSTRACT

The concept of a Proto-Fremont, terminal Archaic culture is proposed to distinguish **in situ** *populations occupying portions of the northern Colorado Plateau from contemporaneous, but culturally unrelated, Basketmaker II populations of the southern Colorado Plateau. One key difference between these groups was early (ca. A.D. 100) use of the bow by the ancestral Fremont, while the ancestral Anasazi continued to employ the atlatl. The time lag for diffusion of bow technology to the Anasazi could be attributable to competitive relationships. The bow might have been the competitive advantage that allowed local ancestral Fremont populations to maintain occupancy of their traditional territories in the face of expanding Basketmaker II agriculturalists. In order to understand the Archaic-Formative transition on the northern Colorado Plateau, it is important to know whether local Archaic populations existed at the time that agriculture was introduced. The processes involved in this transition and the particular nature of its historical expression depends on whether farming was transferred to Archaic populations or involved the spread of cultural systems already somewhat dependent on agriculture.*

INTRODUCTION

In the spring of 1986, archaeologists from Northern Arizona University test excavated a site known as Sunny Beaches (42KA2751) in the Glen Canyon National Recreation Area (Bungart and Geib 1987). Rose Spring Corner-notched arrow points were recovered from a buried cultural stratum radiocarbon dated to the first few centuries A.D. This find clearly presents an anomaly since traditional culture history has the Glen Canyon region occupied until about A.D. 400 by Basketmaker II populations who used the atlatl-and-dart; only during the seventh century A.D., during Basketmaker III, did the Anasazi start using the bow (cf. Lipe 1978:368-369). Evidence from Unit V of Cowboy Cave is reviewed and shown to corroborate that the bow was used in portions of southeast Utah contemporaneous with Basketmaker II use of the atlatl. The concept of a Proto-Fremont, terminal Archaic culture is proposed to distinguish *in situ* populations of the northern Colorado Plateau from contemporaneous but culturally unrelated Basketmaker II populations of the southern Colorado Plateau.

SUNNY BEACHES (42KA2751)

Location and Setting

Sunny Beaches is located in the northeast portion of Kane County, Utah, in the heart of the Glen Canyon National Recreation Area (Figure 1). It is situated in a canyon that drains the extreme southwestern portion of the Waterpocket Fold and empties into the Colorado River. The canyon has vertical walls of Navajo Sandstone and is floored by the Kayenta Formation at an average elevation of 4000 feet. Groundwater discharged from the Navajo provides a permanent water supply and supports a lush riparian community. The canyon has been partially filled and flushed of alluvium several times during the past millennia (Agenbroad et al. n.d.; Anderson 1988).

The main portion of Sunny Beaches (Locus A) is situated on a peninsula of alluvium on the west side of the canyon. The peninsula was formed by the erosive action of the main drainage on the east and an intermittent wash on west (Figure 2). Arroyo cutting exposed a single cultural stratum in profile, and deflation of this stratum deposited a variety of lithic artifacts, burned bone, and fire-cracked rock across the surface of the peninsula (Figure 3). Two other artifact loci (B and C) occur 15-30 m west of Locus A; both are severely deflated and probably lack buried remains. The focus of our testing program and the point of departure for this paper is the buried cultural stratum of Locus A.

UTAH ARCHAEOLOGY 1989
pp. 32-47 (1989)

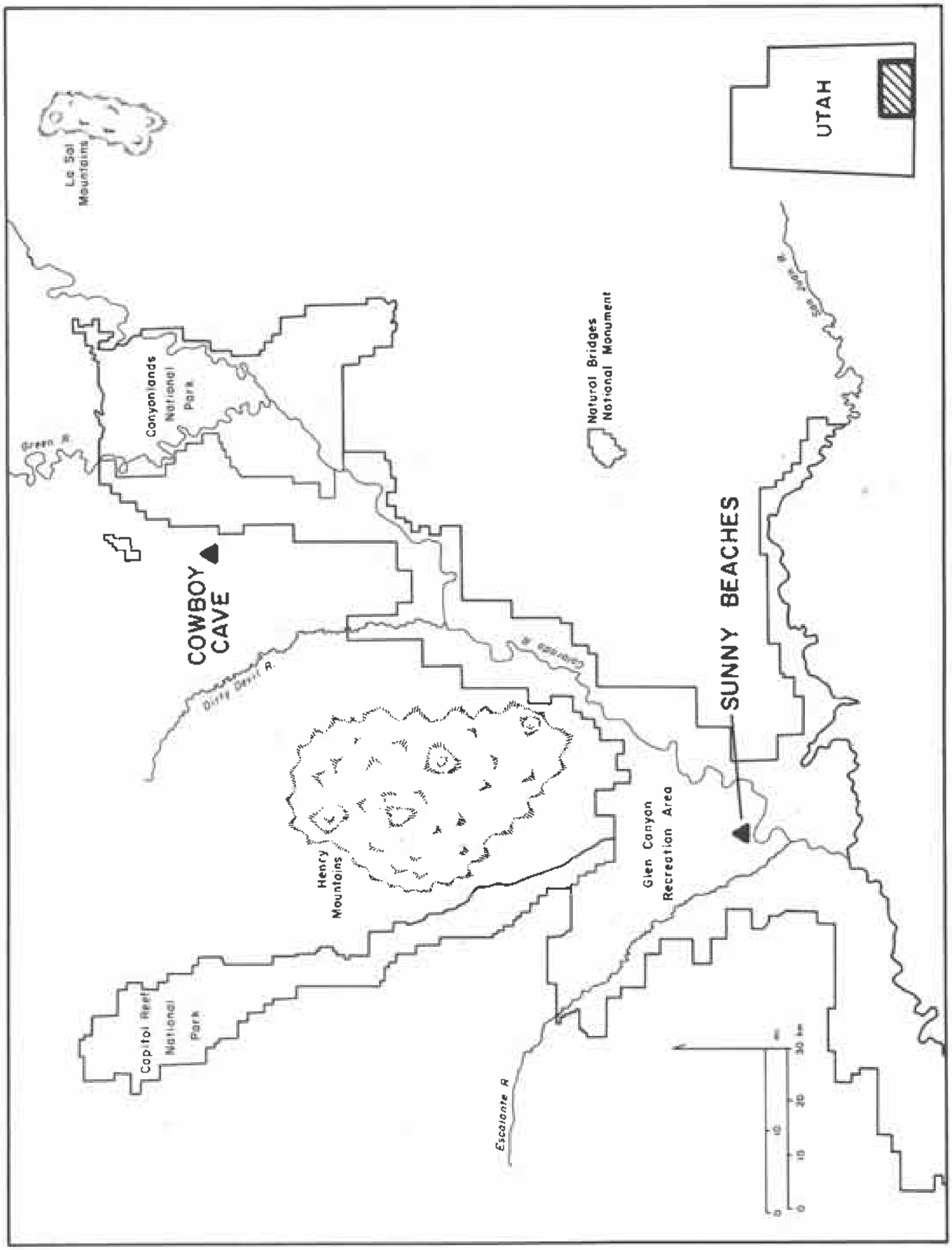

Figure 1. General location of Sunny Beaches in the Glen Canyon National Recreation Area of Southeast Utah, and location of Cowboy Cave.

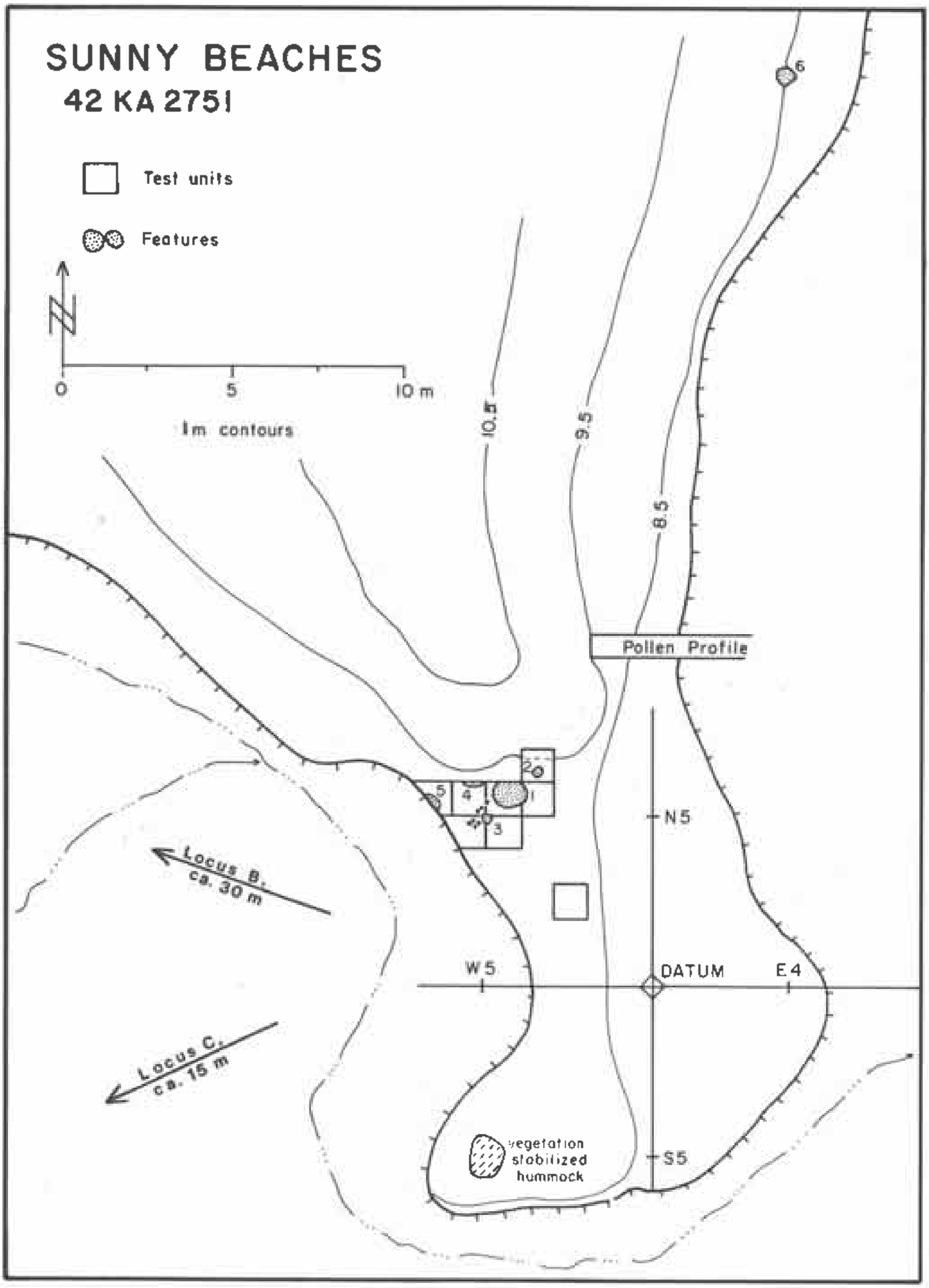

Figure 2. Plan map of Sunny Beaches (42KA2751). All features but number 3 are hearths.

Figure 3. View of the deflated surface of Locus A at Sunny Beaches (42KA2751) prior to excavation. Alluvial entisol covering the cultural stratum is clearly evident along left edge. Arrow in upper left corner marks location of the Basketmaker III site 42KA2752 that overlays the dune sand covering the entisol and the cultural stratum.

Stratigraphy and Features

After establishing stratigraphic control, excavation was done by natural levels, and all fill, aside from pollen and flotation samples, was sieved through one-eighth inch screens. Four noncultural strata and one cultural stratum were recorded during the excavation (Figure 4). Stratum 1 was an entisol about 20 cm thick, consisting of fine sand stained dark gray from the decay of vegetation (Anderson [1988] presents a detailed discussion of canyon alluvium and soils). Stratum 2 was culturally sterile yellow-red alluvial sand approximately 30-35 cm thick. Stratum 3 is the cultural layer consisting of charcoal-stained fine sand 20-60 cm thick. Numerous lithic artifacts and bone fragments, as well as five hearths, were found in this layer. Below this was Stratum 4, a culturally sterile alluvial sand followed by a series of noncultural strata exposed in the arroyo cut but not excavated. Strata 1-3 are deflated across most of the peninsula, while Stratum 4 forms the surface of this peninsula. Strata 1-3 are intact to the north and become progressively buried beneath a substantial layer of eolian sand--part of a large falling dune. Immediately below Stratum 4 is a relatively well-cemented layer known as the gray clay unit that represents a ponding event and is a marker bed near the top of most alluvial deposits throughout the canyon (Anderson 1988:74, 91). It will be important to later discussion of Sunny Beaches chronology.

Five unlined, basin-shaped hearths, oval to circular in plan, were found buried in the cultural stratum. They ranged from 35 to 80 cm in diameter and from 8 to 25 cm deep, and were filled with charcoal-stained sediment and small pieces of charcoal. All but one contained small lithic artifacts and most contained burned bone fragments. A few carbonized seeds of Indian ricegrass (*Oryzopsis hymenoides*), hackberry (*Celtis reticulata*), and goosefoot (*Chenopodium* sp.) were recovered from

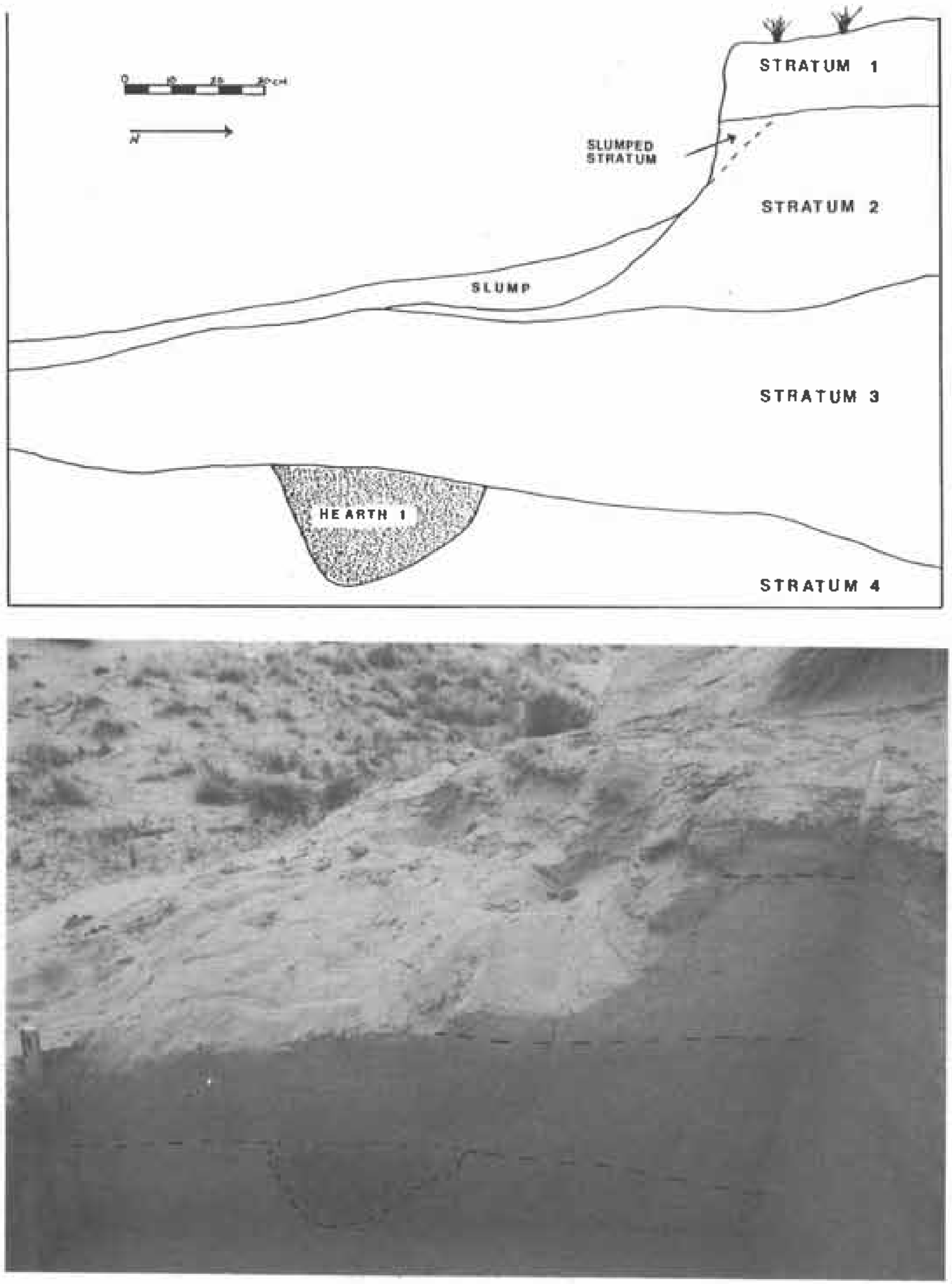

Figure 4. Stratigraphic profile of Sunny Beaches strata encountered in the first test unit, and photo of the same. A small portion of Hearth 1 is seen in section.

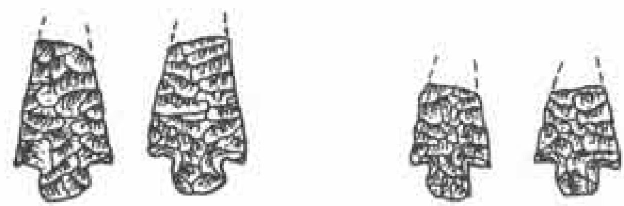

Figure 5. The two most complete specimens of Rose Spring Corner-notched projectile points from Stratum 3 of Sunny Beaches (42KA2751). Points are shown actual size.

these features (Van Ness 1987). A cluster of fire-cracked sandstone adjacent to one hearth might represent heating stones. A sterile pit found next to these rocks is of unknown function.

Lithic Artifacts

No ceramics were found at Sunny Beaches. The subsurface sample of lithic artifacts from Locus A includes 21 chipped stone tools and 806 pieces of debitage, predominantly from late-stage biface reduction, including pressure flaking. Other remains were found on the surface of Locus A, but to avoid any question of association only subsurface remains are considered here. Nine small projectile points of chert were recovered from the cultural stratum: two nearly complete points (Figure 5), three distal portions, and four proximal portions. Both of the nearly complete points are readily classifiable as Rose Spring Corner-notched (e.g., Holmer and Weder 1980:56-59, Figure 9). All of the proximal fragments are clearly stems from Rose Spring points that broke across the notches. The distal fragments are similar in size to the nearly complete specimens, and of similar morphology and flaking quality--small and narrow, finely pressure flaked, with relatively straight blade margins that converge to form a sharp tip. The arrow points, along with a quantity of pressure flakes, were found around and in the hearths. No dart points were recovered from the stratum or from the deflated surface of Locus A.

Other flaked lithic tools recovered from Stratum 3 include: three fragmentary items classified as projectile point blanks, five fragments of percussion flaked chert bifaces from late reduction stages, and five used flakes. The point blanks are small, bifacially worked, and well suited for making arrow points.

Dating

The Sunny Beaches cultural stratum is buried by two layers of alluvium, then by a variable amount of eolian sand. This sand is part of a large falling dune formed along the western wall of the canyon. About 300 m north of Sunny Beaches there is an open sherd and lithic scatter (42KA2752) on the surface of this dune were it meets and overlies the alluvial terrace containing the Sunny Beaches deposit (see Figure 3). Basketmaker III sherds from this site are identical to pottery fragments from site 42KA2756 further up canyon (Geib and Fairley 1986:121, 131). This latter site has a radiocarbon date of 1290±75 (Agenbroad et al. n.d.), which gives a calibrated two sigma age range of A.D. 620-890 (Stuiver and Reimer 1986). This age range corresponds quite well with the tree-ring dated Basketmaker III occupation of Cedar Mesa

Table 1. Radiocarbon Dates for Sunny Beaches (42KA2751). Calibrated Calendrical Ages Based on the 1987 CALIB Program and 20 Year Data Set (Stuiver and Reimer 1986).

	Hearth 1	Hearth 2
Sample ID	Beta-16272	Beta-21235
Years B.P. ± 1σ	1800 ± 100	2260 ± 230
Uncalibrated Midpoint	A.D. 150	310 B.C.
Uncalibrated 2σ Age Range	50 B.C. - A.D. 250	770 B.C. - A.D. 150
Calibrated Midpoint	A.D. 227	379 B.C.
Calibrated 2σ Age Range	A.D. 0-430	892 B.C. - A.D. 230

east of Glen Canyon (A.D. 650-725, Matson et al. 1988:247). Since Sunny Beaches is stratigraphically below the Basketmaker III site and separated from it by two alluvial strata and an unknown amount of dune sand, the cultural stratum must predate the Basketmaker III occupation by at least several hundred years.

Radiocarbon samples were collected from each of the hearths and from the cultural stratum. Wood charcoal from hearths 1 and 2 was submitted to Beta Analytic for radiocarbon analysis. Results are given in Table 1. Averaging the dates might appear justified in light of the apparent stratigraphic contemporaneity, but contextual association aside, these dates appear anomalously disparate. Despite a 230 year overlap between the calibrated two sigma age ranges, the probability for such an overlap appears remote and seems due to the large error factor associated with the Hearth 2 sample. Because of greatly unequal variances, a t-test to statistically evaluate contemporaneity is not appropriate (Long and Rippeteau 1974). If the error factor of the Hearth 2 date was similar to that of Hearth 1, then the t-value would support non-contemporaneity.

Two plausible alternative explanations for the difference between the two dates are: (1) the site was occupied on several occasions during a span of 500 years or so and the dates correspond to early and late episodes of site use; or (2) the Hearth 2 date vastly overestimates the age of site use due to the "old wood" problem (e.g., Schiffer 1986; Smiley 1985). Contamination can be discounted except for inclusion (through bug activity) of more recent organics from the overlying entisol. This would bias the dates towards underestimation and would not change the argument of this paper.

The alluvial chronology (Agenbroad et al. n.d.; Anderson 1988) was examined to see if it could help resolve which alternative presented above might be more correct. Key in this regard is the gray clay unit which underlies the cultural stratum of Sunny Beaches. A charcoal sample obtained from this unit further up canyon produced a radiocarbon date of 1970±90 B.P. (Anderson 1988:25, Table 25). This date is consistent with two older dates (3000±145 B.P. and 2510±80 B.P.) that come from strata immediately below the clay unit (Anderson 1988:91). The clay unit has a calibrated two sigma age range of 190 B.C. - A.D. 230, revealing that the Hearth 1 date is chronostratigraphically consistent, but that the Hearth 2 date is well out of line. We conclude, therefore, that the Hearth 1 date most accurately represents the time of site occupation, and that old wood was burned in Hearth 2.

DISCUSSION

The Timing of Bow Use on the Colorado Plateau

The dating of bow-and-arrow introduction to the eastern Great Basin and Utah has been an issue of debate (Aikens 1976; Madsen and Berry 1975; Madsen 1978; Webster 1980). Much of the discussion has centered around the origins of the Fremont, specifically, whether or not a developmental relationship exists between Archaic and Fremont cultures. In support of an Archaic-Fremont hiatus, Madsen and Berry (1975:393-394) maintained that the adoption of bow-and-arrow technology was contemporaneous with the introduction of pottery at about A.D. 450. Evidence for earlier use of the bow-and-arrow from Danger and Hogup Caves was discounted on the premise of stratigraphic mixture. In the larger context of criticizing Madsen and Berry's concept of a hiatus, Aikens (1976:548) cited evidence from the excavation of Dirty Shame Rockshelter that supported bow use in extreme southwestern Oregon by about 800-600 B.C. Webster (1980:64) raised doubts about the Dirty Shame evidence, but substituted his own findings from Dry Creek Rockshelter in western Idaho that supported bow-and-arrow use by 2090±80 B.P. (140 B.C., uncalibrated) (Webster 1980:65, Table 1). Based on findings from Cowboy Cave, Holmer and Weder (1981:60) maintained that Rose Spring Corner-notched (or Rosegate) points date as early as A.D. 300. Holmer (1986:106) repeated this conclusion in a later report, stating that "The replacement of the atlatl-and-dart by the bow-and-arrow apparently began in the Intermountain West at about A.D. 300 and was complete by A.D. 600." Cowboy Cave is clearly the essential site that supports Holmer's position; as shown below, the evidence from this cave supports even earlier bow-and-arrow use.

There seems little doubt about when the bow-and-arrow was adopted by the Anasazi of southern Utah and adjacent states. Considerable excavation evidence (Guernsey and Kidder 1921; Kidder and Guernsey 1919; Lindsay et al. 1968; Nusbaum 1922) has shown that Basketmaker II populations used the atlatl-and-dart, and there has never been any suggestion that they used the bow-and-arrow. Radiocarbon and tree-ring age determinations indicate that the Basketmaker II occupation of Cedar Mesa lasted until about A.D. 400 (Matson et al. 1988:247), an age that is undoubtedly applicable to the Basketmaker II occupation of the Red Rock Plateau (see Lipe 1967:112-152, White Dog Phase) and the Rainbow Plateau (Lindsay et al. 1968:101-102,364; Schilz 1979)[1]. In other words, the atlatl-and-spear was being used until about A.D. 400 across a broad region immediately south and east of the Sunny Beaches site. Not until almost A.D. 600, during Basketmaker III, did the Anasazi adopt the bow-and-arrow (Cordell 1984:102; Plog 1979:114). This was contemporaneous with their first use of ceramic technology. Dating of bow use by the Anasazi is highly accurate since Basketmaker III chronology is based on numerous tree-ring samples from structures (e.g., Berry 1982:35-89). The Basketmaker III occupation of Cedar Mesa is tree-ring dated A.D. 650-725 (Matson et al. 1988:247), while the Basketmaker III occupation of the canyon where Sunny Beaches is located has a calibrated radiocarbon age range of A.D. 620-890. Thus, Anasazi use of bow technology in the Glen Canyon region did not begin until about A.D. 650.

Sunny Beaches is markedly anomalous with respect to current conceptions of regional culture history. Rose Spring Corner-notched points, which are accepted markers of bow-and-arrow technology, were found in a buried, single component, cultural stratum radiocarbon dated to what is customarily considered the Basketmaker II period in Glen Canyon. Treatment of dating anomalies depends in part upon how wedded a person is to the existing chronological frameworks. Anomalies can engender productive evaluation of existing constructs, including their reformulation to account for the new evidence, or the anomalous evidence can be dismissed. Dismissal is certainly valid if potential errors in chronometric technique have not been adequately controlled for, including the overestimation bias inherent in radiocarbon dating of wood charcoal. If problems and biases have been controlled, then flat dismissal of new evidence is a sterile approach. We have attempted to evaluate critically the radiocarbon dates from Sunny Beaches, and have marshalled additional chronological evidence that corroborates the Hearth 1 date and supports concluding that the bow-and-arrow was indeed used at Sunny Beaches during the first few centuries after Christ. While the evidence is provocative, it is a single case. Other aceramic sites with Rose Spring points are known from Glen Canyon, but chronometric dates are not available from them. Fortunately, a critical comparative data base is available from the excavation of Cowboy Cave (Jennings 1980).

Unit V of Cowboy Cave

In comparing the findings from Sunny Beaches with those from the upper levels of Cowboy Cave, we must evaluate how the Cowboy Cave data compare with Jennings' interpretive statements. Unit V, the uppermost cultural component of this

Table 2. Radiocarbon Determinations for Unit V of Cowboy Cave as Presented in Table 3 of Jennings (1980:24).

Lab Number	FS Number	Material Assayed	B.P.	B.C. or A.D.	Unit or Stratum	Comment
SI2425	1940	Charcoal	1495±60 B.P.	A.D. 455	Va	From pit (F183) in red windblown sand layer.
UGa1548	1517-1*	Corn	1555±70 B.P.	A.D. 395	Prob. V	Cached in skin bag.
SI2426	1683	Bark of *Juniperus* sp. and stalks of *Artemisia* cf. *dracunculus*	1580±60 B.P.	A.D. 370	Vc	Associated with semicircular arc of stones and small stone cist in stratum of Unit V, marking terminal occupation of the cave.
SI3012R**	1517*	Corn	1670±70 B.P.	A.D. 280	Prob. V	Cached in skin bag found in a shallow pit in ashy midden layer. dC^{13} estimated as -12.0%.
SI3172	1517-1*	Corn	1855±70 B.P.	A.D. 95		
SI2423**	1516	*Sporobolus* cf. *giganteus*	1840±65 B.P.	A.D. 110	Prob. V	From a fiber pad overlying the cache of shelled corn, FS1517. dC^{13} = -15.6%.
UGa1053		Charcoal	1890±65 B.P.	A.D. 69	Vb? (NP)	
SI2422	1517*	Corn	2075±70 B.P.	125 B.C.		Shelled corn cache. Same as UGa1548, SI3012R, and SI3172.

*Assays from same shelled corn cache.

**These ages are corrected for C^{13} fractionation.

cave, is "... marked by the introduction of Rose Spring points and the bow-and-arrow at about 1600 B.P. The unit ends at an unknown time after 1500 B.P." (Jennings 1980:148). The unit is interpreted as "... literally a terminal Archaic transition or base out of which the classic Basketmaker II as defined finally developed" (Jennings 1980:147).

Radiocarbon determinations for lower units at Cowboy Cave are quite consistent and fairly easy to use for chronological inferences, but the dating of Unit V is not straightforward. Eight determinations are available for this unit (Table 2), but only two of these have secure provenience. The two dates selected to delineate the duration of the cultural occupation for the unit are 1495±60 and 1890±65 (Jennings 1980:19). The uncalibrated one sigma deviations are given as representing the "extreme" range of occupation: A.D. 5 to 515. The more recent date is from the bottom of Unit V, while the older date is unprovenienced but suspected to be from Stratum Vb. The magnitude of the date reversal, plus the lack of secure provenience for one of the dates, raises serious doubts about their utility as the temporal brackets for the unit.

The two Unit V dates with provenience control (SI2425 and SI2426) also occur in reverse order, but this might not be significant since it could be due to statistical error. A test for contemporaneity using calibrated dates (Long and Rippeteau 1974) yielded a t-value of 1.46, which is greater than a 10% probability. This could mean that the strata of Unit V accumulated at a fast rate, and that radiocarbon dating is too coarse a chronometric technique to adequately differentiate the fine temporal intervals that separate the strata. As such, an average of the two dates would perhaps best represent the occupation span, and averaging is statistically appropriate in this case ($t=1.46<1.96$; $f=2.4<3.84$). The pooled date is 1538±42, with a calibrated two sigma age range of A.D. 417-610 (mean age is A.D. 540). It could be concluded, therefore that Unit V was deposited sometime in the sixth century A.D. This would accord well with traditional Basketmaker III dating for bow introduction to the Anasazi or with Madsen and Berry's (1975:393-394) proposed date of bow introduction to the Fremont.

Since the SI2425 date is on wood charcoal while the SI2426 date is on juniper bark and sage twigs, the problem of old wood must be considered. Extrapolating from Smiley's (1985:386) research, there could be an 80% chance that the SI2425 date applies to a cultural event over 200 years more recent, and about a 20% probability that it is over 500 years more recent. This highly likely possibility would make stratigraphic reversal unacceptable. In which case, either one of the dates is in error, or the pit from which sample SI2425 was obtained actually originated from the top of Unit V, and the charcoal of this feature is associated with the last use of the cave.

The corn cache dates can help resolve the issue of Unit V chronology because there is a clear link between the dated event and the cultural event (see Dean 1978:245). Four of these dates were on the corn itself and one date is on a grass pad that covered the bagged corn; these five dates should provide a relatively tight date cluster. What should be true in theory is not apparent in the five radiocarbon determinations as reported; they range from 1555±70 to 2075±70. Various authors (Smiley 1985:377-378; Wilde and Newman 1989) have grappled with this confounding series of dates but could not reach any firm conclusion as to the corn's age. In order to clarify the situation, we tracked down the original radiocarbon results. William Cox of the Smithsonian Institution Archives located the original data for the samples processed by the Smithsonian Radiocarbon Laboratory (Accession 87-035) and sent us photocopies. Upon receipt of these data it became clear that the confusion stems from Jennings' failure to report all of the dates that were corrected for C^{13} fractionation and laboratory application of different correction factors. All of the Smithsonian corn dates had been corrected for isotopic fractionation based on an assumed delta C^{13} value of -12.0%; 220 years was added to two dates, but 310 years were added to SI2422. The only corndate not corrected was UGa1548; this was confirmed by Stan De Filippis (personal communication 1989) of the Center for Applied Isotope Studies, University of Georgia.

The five corn dates are summarized in Table 3 and corrected dates are plotted in Figure 6; 220 years have been added to each date to provide a standard correction factor for isotopic fractionation. There is a clear discrepancy between the earliest and latest dates (SI3012R and SI2422), while the other three are clustered between the extremes. The five dates were pooled, resulting in a mean of 1826±31. The criterion of Chauvenet (Long and Rippeteau 1974:208) allows rejection of dates that are greater than 1.65 times the pooled sigma, which in this case means dates outside the range 1877 to 1775 B.P. Thus, SI3012R and SI2422 are deleted, and the mean is recalculated as 1824±39. The calibrated one sigma age range for this mean date is A.D. 126 to 237 and the two sigma age range is A.D. 84 to 320. There is a 97% probability that the two sigma age range is A.D. 86-255.

Two chronological conclusions can be drawn from this mean date, one bearing on the timing of agriculture in the region and the other on the dating of Unit V. As concerns the first conclusion, it is inappropriate to use the earliest corn date from Cowboy Cave to support a ca. 200 B.C. introduction of agriculture to the region (cf. Berry 1982:28, Table 6; Berry and Berry 1986:285, Table 2). The corn at this cave probably does not date earlier than

Table 3. Radiocarbon Determinations on the Cowboy Cave Corn Cache.

Sample Number	Uncorrected Date[1]	Corrected Date[2]	Standard Correction[3]
SI3012R	1450±70	1670±70	1670±70
SI2422	1765±70	2075±70	1985±70
SI3172	1635±70	1855±70	1855±70
UGa1548	1555±70	none	1775±70
SI2423	1595±65	1840±65	1840±65

1. Uncorrected dates are the radiocarbon counts obtained by the laboratories; only the UGa1548 value was reported in Jennings (1980:24).

2. Corrected dates are how the Smithsonian determinations were revised by the laboratory to compensate for C^{13} fractionation. These values were reported by Jennings, although SI3012R was the only one specified as having been corrected, leaving the impression that the other corn dates were uncorrected. Note that the Smithsonian Laboratory added 220 years to two of the corn dates, but that 310 years were added to SI2422.

3. Two hundred-twenty years were added to each of the corn dates to provide a standard correction factor for purposes of statistically evaluating the dates.

100 A.D. This is not to imply that corn was not being used in the Fremont region by about 200 B.C. (Wilde and Newman 1989), just that the Cowboy Cave corn cache does not support such early use.

The bearing of the mean corn date on the chronological placement of Unit V is more problematical since a stratum association for the corn is unknown. There is a similarity between UGa1053 (1890±65) and the corn mean, but since the former sample was obtained during the 1973 test trenching of the cave, only a probable provenience (Stratum Vb) is known. The corn has to be associated with either strata Vb or Vc rather than the sterile Stratum Va. As a present best guess, supported by the 1580±60 date for the top of Stratum Vc, we assign the corn date to Stratum Vb; if the corn actually derives from Stratum Vc, this would not alter the argument presented here. The occupation of Strata Vb and Vc is bracketed by 1824±39 (the corn mean) and 1580±60 (SI2426). Taking the two sigma deviations on the calibrated ages of these dates to represent the probable range of occupation, we conclude that Unit V was first used around A.D. 84 and abandoned around A.D. 610. Ironically, this is hardly different from the A.D. 5 to 515 range that Jennings gives based on the clearly bad SI2425 date and the poorly provenienced UGa1053 date.

Strata Vb and Vc both contain Rose Spring Corner-notched points (Holmer 1980:34 35, Table 6); consequently, there is a high probability that the bow-and-arrow was used at the cave by the start of the second century A.D. The early dating of bow use at Sunny Beaches is consistent, therefore, with the findings from Cowboy Cave.

The proposal that Unit V represents the Archaic base out of which the Basketmaker II developed (Jennings 1980:147) is not supported by the chronology or material culture of this unit. Dates on classic Basketmaker II remains from sites such as White Dog Cave and Kin Biko Caves I and II have shown that Basketmaker II populations were occupying the Kayenta Anasazi region at least by about 550 B.C. (Smiley et al. 1986). Dates on Basketmaker II remains from the southern portion of Glen Canyon document that this region was occupied by about 400 B.C. (Geib 1989; Nickens

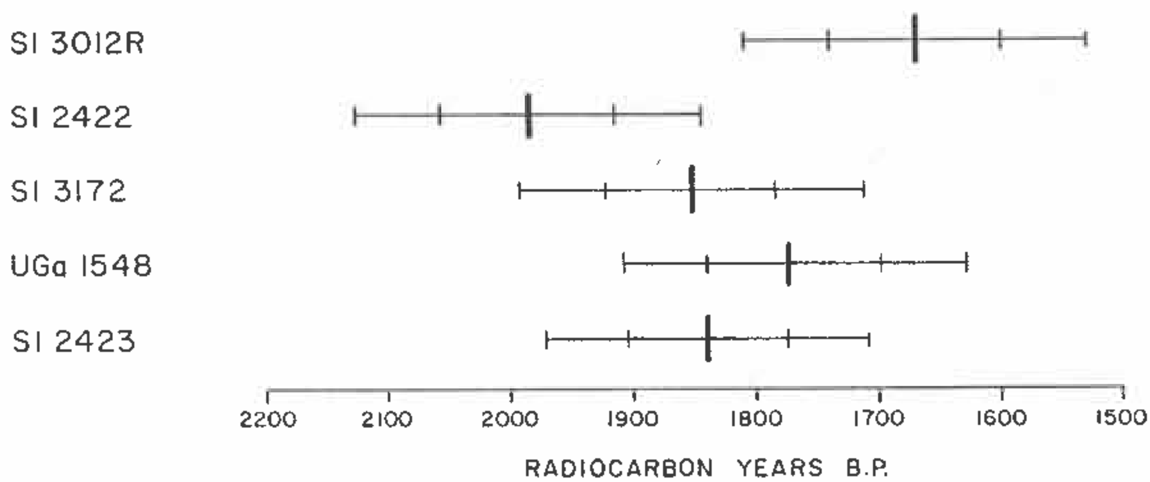

Figure 6. Plot in years B.P. of the five radiocarbon dates from the Cowboy Cave corn cache; dates have been corrected for C^{13} fractionation using an assumed delta value of -12 percent and the addition of 220 years.

et al. 1988). Besides the bow-and-arrow, which is clearly not a Basketmaker II trait, the basketry technology from Unit V is dominated by variations on a one-rod foundation (Hewitt 1980:50, Table 12). Typical Basketmaker II basketry is characterized by a two-rod-and-bundle foundation (e.g., Guernsey and Kidder 1921:55-58; Kidder and Guernsey 1922:90). The Unit V basketry is directly comparable with basketry from earlier deposits of the cave, and the sequence of construction techniques mirrors the developmental sequence of Archaic-Fremont basketry technology for Utah (Hewitt 1980:57; see Adovasio 1970). Indeed, Hewitt (1980:57) speculates that the occurrence of one-rod-and-bundle basketry at the cave may ". . . represent the transition to the Fremont culture". Given the continuity of material culture between Unit V and later remains classified as Fremont, and the chronological placement of this unit at least half a millennia after Basketmaker II populations were living on the southern Colorado Plateau, we maintain that Unit V does not represent a base out of which Basketmaker II culture developed as originally proposed, but rather represents a base out of which the Fremont developed.

CONCLUSIONS

In their concluding statements to the Elsinore Burial in central Utah where corn was dated to about 175 B.C. (calibrated), Wilde et al. (1986:33-34) propose a series of hypothetical questions. One query relates to the present discussion:

"If Berry [1982] is correct in proposing that corn was introduced by Formative people moving into the northern Plateau area from the southern Basin and Range province, then their associated lithic industries should be significantly different than those of the indigenous Archaic folk" (Wilde et al. 1986:33).

Based on the findings presented here, we would not hesitate to say that indeed there was a significant difference, at least during the first half of the Christian era, between the lithic technologies of *in situ* Archaic populations on the northern Colorado Plateau and the Basketmaker II populations of the southern Colorado Plateau. The former used the bow-and-arrow while the latter used the atlatl-and-dart. Additional distinctions are seen in other aspects of material culture, such as basketry. Berry and Berry (1976:33) have argued that the only real difference between early agricultural populations of the southern and northern Colorado Plateau is the labels that archaeologists apply to them. That is, Basketmaker II populations are preceramic groups in areas where Anasazi remains occur and terminal Archaic populations are preceramic groups where Fremont remains occur. We have tried to demonstrate that this issue can not be reduced to such an argument since there are important material culture differences that are difficult to reconcile with the concept of a unified cultural entity.

We propose that certain portions of the northern Colorado Plateau were occupied by bow-and-arrow using ancestral Fremont populations who were contemporaneous with Anasazi Basketmaker II populations occupying the southern Colorado Plateau. Along the Colorado River of southeastern Utah there was a broad boundary zone between these two groups. Further to the west, sites such as Cave du Pont (Nusbaum 1922), Heaton Cave (Judd 1926), and Antelope Cave (Janetski and Hall 1983) reveal that this boundary was north of the Colorado River. Sunny Beaches provides an example of a site in the heart of Glen Canyon that was occupied by terminal Archaic, Proto-Fremont populations. Unit V of Cowboy Cave provides an example of a site further north that was occupied by this same culture.

The Cowboy Cave corn cache reveals that the Proto-Fremont were growing this domesticate, although the extent of agricultural dependency is unknown. Theories about the introduction of agriculture to the Colorado Plateau include transmission of crops and concepts to *in situ* Archaic populations or territorial expansion of horticulturalists. Each involves different processes and has different ramifications concerning the nature of the Archaic-Formative transition and the particular historical expression of Formative cultures. It is therefore important to identify which mechanism of agriculture introduction applies to a particular study area. Corn could have been introduced to the northern Colorado Plateau by Basketmaker II populations, but the crop was transferred to local Archaic populations who adopted it. Wilde and Newman (1989) suggest that the transition to agriculture in central Utah preceded by many centuries the arrival of ceramics and that, besides pottery, there are few remains that differentiate the Fremont from their ancestral populations. In addition to corn agriculture, pithouse architecture, and storage, which Wilde and Newman highlight, the bow is another aspect of the Proto-Fremont lifeway on the northern Colorado Plateau. Contrary to the Anasazi sequence of cultural development, bow technology clearly predates the arrival of ceramic technology for the Fremont.

One might reasonably question why the bow was not adopted by the Anasazi at an earlier time since it was being used in portions of southeast Utah by about 100 A.D. In a recent review of the timing of bow-and-arrow introduction for North America, Blitz (1988:135-137) proposes that the pattern of transmission of this technological innovation must be understood in the context of intergroup contact and competition. In such a light, the time lag for diffusion of bow technology to the Anasazi could be attributed to competitive relations between different ethnic groups. If Basketmaker II represents an influx of horticultural populations (Berry and Berry 1986:319) who spread across the Colorado Plateau filling in agricultural niches, then the bow might have been the competitive advantage that allowed local Proto-Fremont populations to maintain occupancy of their traditional territories.

As a final comment, Rose Spring Corner-notched points at aceramic sites in Utah might well indicate preceramic occupation. Such sites need to be investigated to test the culture history propositions presented here. In so doing, additional light will be shed on the mechanisms, processes, and consequences of agricultural introduction.

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NOTE

1. Lindsay et al. (1968:102) have proposed that the Basketmaker II period lasted until about A.D. 700 on the Rainbow Plateau immediately south of Glen Canyon. This suggestion was based on the numerous tree-ring dates on hearth charcoal at Sand Dune Cave, the latest being A.D. 701++vv (Harlan and Dean 1968:381). Michael Berry (personal communication 1985) questions associating the tree-ring dates with the Basketmaker II materials from the cave. Given the presence of Kana-a Black-on-white pottery at the cave and sizeable Pueblo I habitations on the southern margin of the Rainbow Plateau (Fairley 1989), the hearth charcoal is more than likely associated with a temporary Pueblo I use of the site. We concur with Berry and find it highly doubtful that a Basketmaker II lifeway lasted until A.D. 700 on the Rainbow Plateau.

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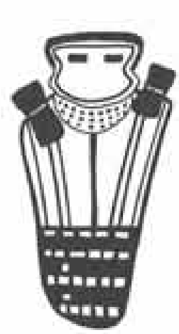

Salt Creek
Canyonlands National Park

REPORTS

BONE WHISTLES OF NORTHERN UTAH

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INTRODUCTION

The Great Salt Lake Fremont peoples made extensive use of the bone refuse from the various wild game they hunted as is evident from the numerous bone awls and other tools that have been recovered. Knives and saws made from deer and mountain sheep scapulae are also fairly common, although they are rare in other parts of the state. In addition, Great Salt Lake Fremont sites are somewhat unusual in that they contain large numbers of bison and waterfowl bones. From the latter the Fremont made bone whistles, an artifact considered to be characteristic of this variant (Marwitt 1970:145).

BACKGROUND

The purpose of this paper is to present locational information and speculate on possible uses of bone whistles from Fremont sites in northern Utah. The paper focuses on whistles recovered at professionally excavated sites and documents several surface finds from unexcavated, but recorded sites.

Whistles, sometimes called flageolets (Strong 1969:95), are widely distributed in prehistoric North America. Usually made from sections of varying lengths of the tubular long bones of large birds or rodents, they have a single hole drilled, reamed, or cut in one side near one end or even in the center of the tube. Some whistles were engraved while others were just polished. It is believed that when one used the single hole whistle, the whistling sound was produced by holding the thumb and index finger over opposite ends of the bone tube while blowing across the hole (Barnett 1973:112). However, some whistles had a large vent hole section cut and removed. It has been demonstrated that the end used for the mouthpiece was then fitted with a reed or semi-plugged with beeswax or pine gum. This allowed for a change in air flow through the tube and out the vent hole causing a high pitch whistling sound.

The use of the whistle apparently varied. Some were used as game calls to attract birds and certain animals while hunting (Barnett 1973:112). Some may have been used as signaling or communication devices, while others were noisemakers used by shamans while treating their patients or as musical instruments during ceremonies (Miles 1986:195)

An extension of the whistle is the flute. This is the long cylindrical instrument played by the humpbacked flute player, usually called *Kokopelli*, often depicted in rock art panels in the San Juan River gorge (Barnes 1979:221). The flute was produced by adding additional vent holes to the whistle. A variation on this was to place a sliding stopper over the main vent hole. Several whistles of varying pitch and tone were also sometimes fastened together in a row forming a panpipe (Miles 1986:112).

STUDY AREA

As noted above, the focus of this paper is of that section of northern Utah along the Wasatch Front from Provo to the northern shores of the Great Salt Lake and from Hogup Cave in the Hogup Mountain Range to the eastern shores of the Great Salt Lake (Figure 1). This area covers most of the Great Salt Lake variant of the Fremont culture and the northern portion of the Sevier Fremont variant as defined by Marwitt (1970).

Sevier Fremont sites are commonly small villages located on or near alluvial out-wash fans near canyon mouths and convenient to dependable sources of water such as perennial streams. Great Salt Lake Fremont sites contain evidence of horticultural activities where the soil saline concentration would permit. However, when located in close proximity to the lake (Figure 2), site contents reflect the hunting of bison, waterfowl, and the gathering of various wetland resources.

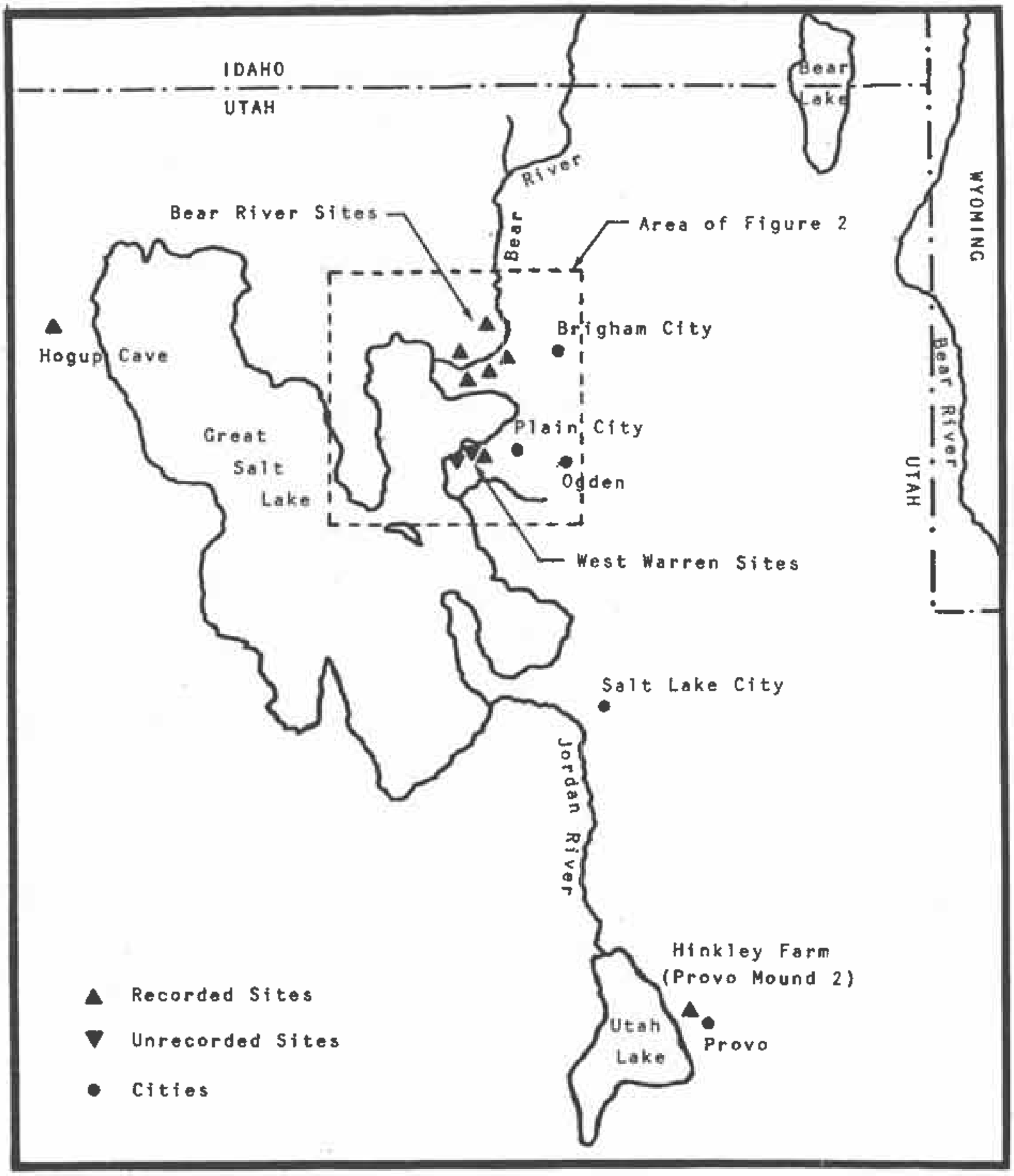

Figure 1. The Area of Great Salt Lake Fremont and Sevier Fremont Cultures in Northern Utah. Location of the Study Area in Northern Utah.

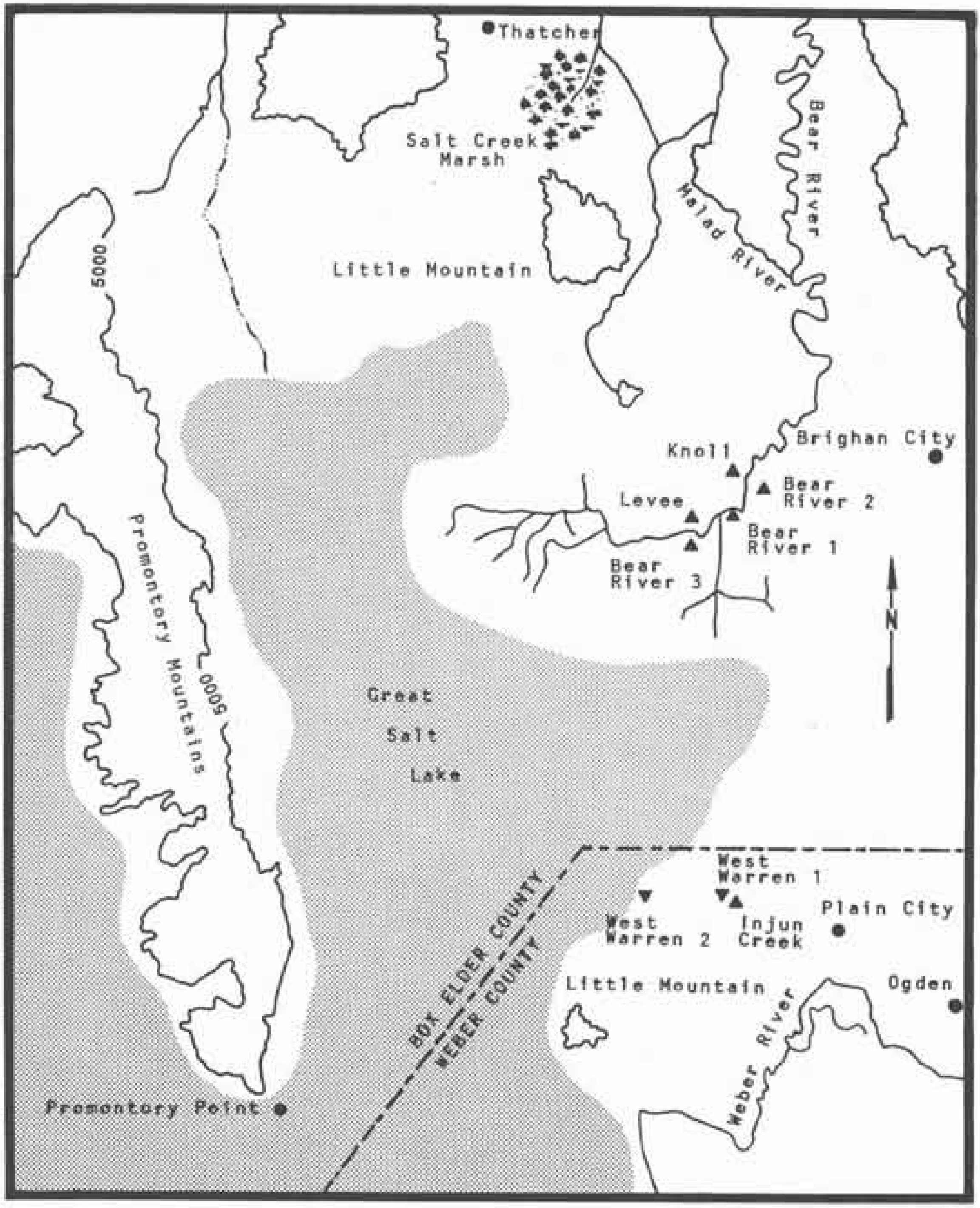

Figure 2. Great Salt Lake Fremont Sites.

West of the lake, sites such as Hogup Cave seemingly were used for transient seasonal occupation and seed harvesting activities (Marwitt 1970:147; Aikens 1970).

The sites discussed in this study include the Bear River 1 and 2 sites (Aikens 1966, 1967), the Bear River 3 site (Shields and Dalley 1978), and the Levee and Knoll sites (Fry and Dalley 1979), all located west of Brigham City. West of Ogden in the West Warren area are Injun Creek (Aikens 1970) and two areas known to local collectors that will be referred to here as West Warren 1 and West Warren 2. Hogup Cave (Aikens 1970) is well known and is located on the western side of the Hogup Mountains west of the Great Salt Lake. Provo Mound 2 (Steward 1936) is located in west Provo on the Hinckley farm.

THE LEVEE SITE

At the Levee site five whistles were recovered (Fry 1979:50). All five specimens were sections of unidentified bird long bone with a small hole cut or drilled into the tube near one end. On the four largest whistles, the proximal end is rough. On two of these, the roughening may represent an unsuccessful attempt to cut a hole. The distal end opposite the hole on three of the whistles is square cut and smoothed. One hole was made by sawing across the longitudinal axis of the bone tube and one was neatly drilled. The method of construction for the hole for the remaining three whistles could not be determined. The four largest whistles range in length from 8.3 to 10.7 cm and in diameter from 0.7 to 0.8 cm. The fifth whistle is a fragment 2.3 cm long. It was reported to have been broken across its vent hole. These whistles from the Levee Site are similar in appearance, length, and diameter to those from West Warren 1 (Figures 3 and 4).

Several complete bone tubes with square cut and smoothed ends, but lacking any holes were also recovered here. These tubes ranged in size from 1.0 to 9.5 cm in length and from 0.5 to 1.2 cm in diameter.

THE KNOLL SITE

One whistle was recovered at the Knoll site (Fry 1979:76). It is 8.0 cm in length and again made from a section of unidentified bird long bone. The distal end is square cut and smoothed while the proximal end is broken and jagged. The hole is small and sawed transversely into the tube 1.0 cm from the broken end. The tube diameter is 0.7 cm and the hole diameter is 0.1 cm. This whistle is similar in appearance, length, and diameter to the West Warren 1 example (Figure 4).

One complete section of bird long bone with square cut and smoothed ends and three broken bone tubes were also recovered. The complete tube was 4.0 cm long, while the diameters of all tubes ranged from 0.5 cm to 0.8 cm.

THE BEAR RIVER NO. 1 SITE

At this site, only one whistle was reportedly found (Aikens 1966:72). Made from a bird long bone, it has a 0.5 cm square opening cut into the surface at 0.5 cm from one end. The length of the tube is 11.9 cm, but no mention of the diameter was given. No bone tubes were reported. Neither bone whistles nor tubes were apparently recovered at the Bear River No. 2 site (Aikens 1967).

THE BEAR RIVER NO. 3 SITE

No bone whistles were found at this site, although two bone tubes were recovered (Shields 1978:94). One of these is complete while the other is apparently broken. Both were made from bird long bone. The ends have been evenly cut and smoothed and both were reported to have been slightly polished, probably due to handling. The complete tube is 10.0 cm long and 0.75 cm in diameter. Its function, like that of other tubes, was not determined. It lacks a vent hole and is similar in appearance to the West Warren 1 whistle (Figure 3).

THE INJUN CREEK SITE

No definite bone whistles were found at this site, although eight bird long bone tubes were again recovered (Aikens 1966:51). These bone tubes were square cut and smoothed on their ends. Their lengths range from 2.7 to 10.9 cm. Diameters were not given. Two of the tubes resemble the West Warren 1 whistles (Figures 3 and 4) except that holes were absent.

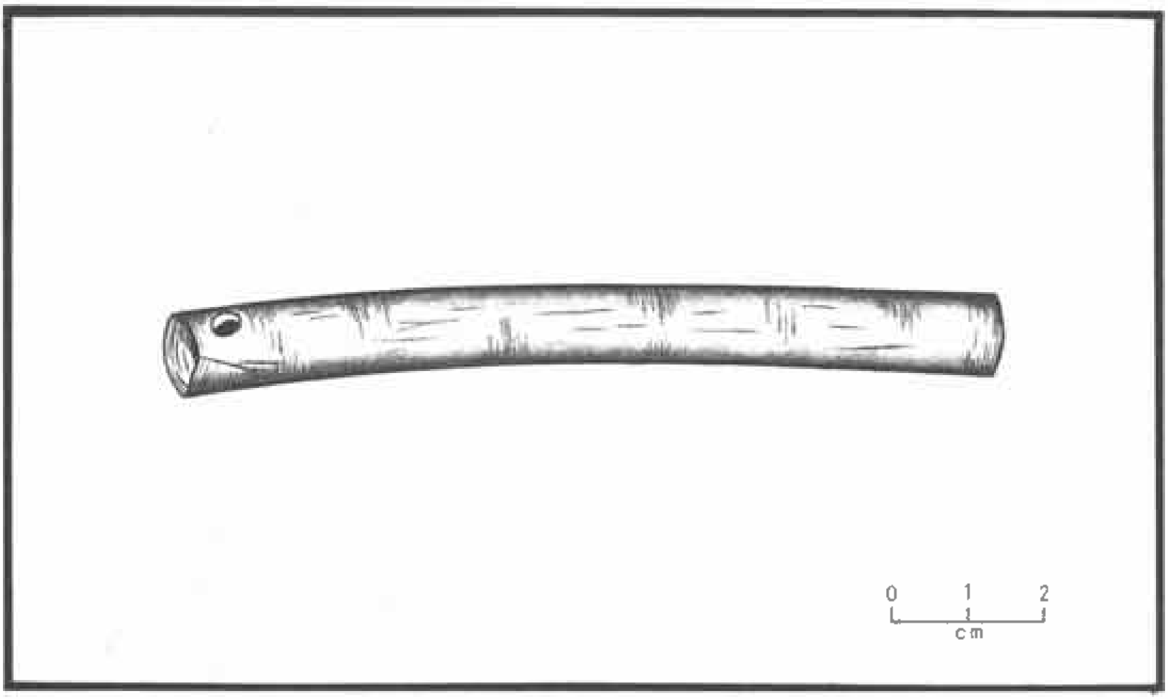

Figure 3. Bone Whistle from West Warren 1.

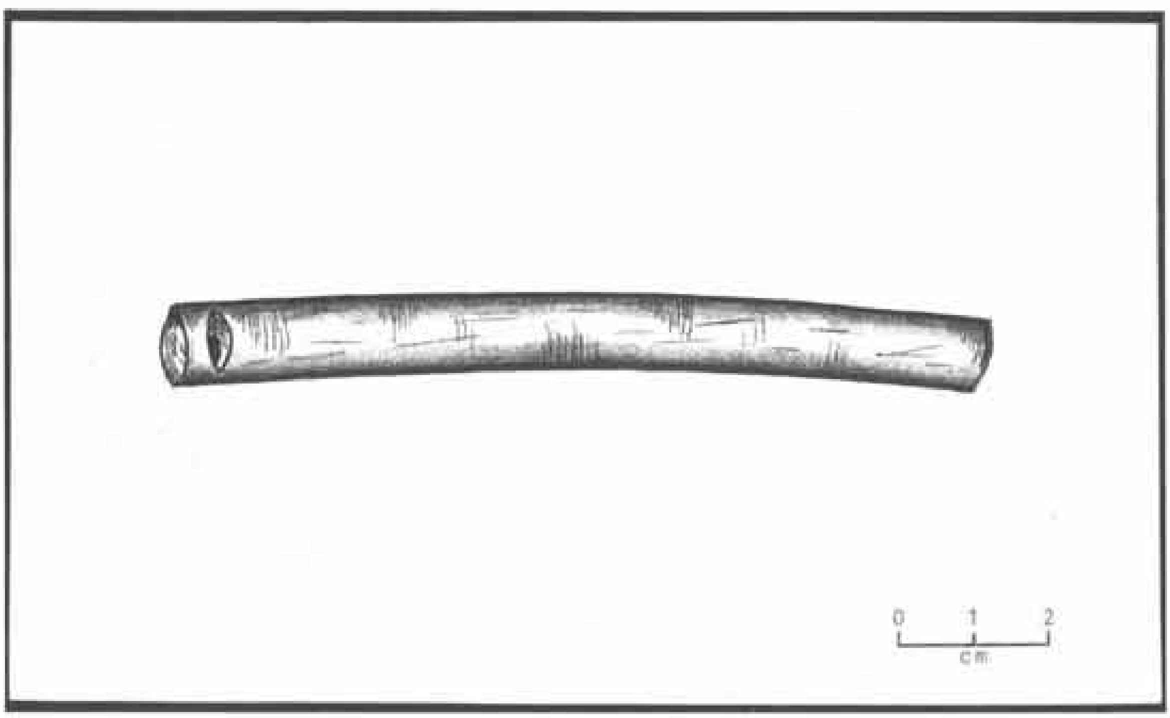

Figure 4. Bone Whistle from West Warren 1.

HOGUP CAVE

One bone whistle fragment was recovered at Hogup Cave (Aikens 1970:90). The whistle was made from a bone tube from an unidentified animal. It is cut and smoothed on one end, with a broad, deep notch cut near its broken end. The length of the tube fragment is 6.5 cm with a diameter of 2.7 cm. Two complete and five partial bone tubes were also recovered. All were cut and smoothed at one or both ends, and all were apparently sections of mammal long bone. One of the complete specimens contains two deeply incised lines spaced 2.1 cm apart. A small, well polished fragment has three incised lines 0.2 cm apart, while another fragment is streaked on one side with red pigment. These specimens differ from the tubular beads found at the site in that the beads are much smaller (Aikens 1970:88). Lengths of the complete tube specimens are 5.1 and 11.3 cm and their diameters are 1.0 and 1.5 cm respectively.

PROVO MOUND 2

One whistle made from a bird wing long bone was recovered at this site (Steward 1936:34). It is 10.7 cm long and 1.3 cm in diameter. The vent hole is placed 2.7 cm from the mouth end and a small hole is located just below the vent hole on both sides of the tube. No dimensions on the vent hole or the holes below it were given. Although the whistle was not illustrated, the description suggests that its construction is similar to the one shown in Figure 5.

WEST WARREN 1

This area has been recorded on IMACS forms and includes several individual sites. These consist of a series of naturally raised mounds containing darkened soil, "camp rock," ground stone, sherds of predominantly Great Salt Lake Gray ceramics, Uinta Side-notched and Bear River Side-notched projectile points, and chert, quartzite, and obsidian lithics. Two complete bird long bone whistles were found on the surface in this area. The first (Figure 3) is in the author's collection. Both ends are square cut and smoothed. It is 10.65 cm in length and 0.85 cm in diameter. A hole 0.25 cm in diameter is drilled 0.4 cm from one end. The second (Figure 4) is in the collection of Mark Stuart, Ogden, Utah. It is 10.8 cm in length and 0.9 cm in diameter. Its ends are also square cut and smoothed. It has an irregular hole 0.3 cm by 0.7 cm cut transversely into the tube at 0.4 cm from one end. Several bone tubes of approximately the same size and shape as these whistles have been seen on the surface in this same area by the author, but were left in place.

WEST WARREN 2

This area has also been recorded on IMACS forms and similarly includes several individual sites. These are characterized by the same features and materials as those noted at West Warren 1. One complete whistle (Figure 5) made from bird long bone was found on the surface and is in the collection of Greg Russell, Roy, Utah. Both ends of the tube have been square cut with one end serrated. At the mouth end, five individual rings were engraved running radially around the entire tube. The remainder of the whistle body is also engraved. It is 10.7 cm in length and 0.85 cm in diameter. The vent hole is cut 3 degrees from perpendicular into the tube at 2.0 cm from the base. It then angles up at 90 degrees from perpendicular toward the far end. It intersects the tube surface at 4.1 cm from the base, yielding an overall vent hole angle of 93 degrees. There is one hole drilled below the vent hole on each side of the whistle. The left hole is located 2.3 cm from the base and the right hole is 2.15 cm from the base. Both holes are 0.2 cm in diameter.

DISCUSSION

The majority of the whistles reported here were made from bird long bone, as were most of the bone tubes. This is not surprising since there would have been an abundant supply of waterfowl and other large birds along the shores of the Great Salt Lake and Utah Lake. Although the birds involved were not identified, it seems probable that the bird species were most likely goose, crane, pelican, hawk, eagle, or other similarly sized bird.

Most of these whistles appear to be of the simplest form, consisting of a bone tube with a hole cut or drilled near one end. These were probably used as game calls or signaling devices associated with hunting (Fry 1979:3). However, the whistle shown in Figure 5 is unique. The extensive engraving may indicate that it was a highly prized possession, possibly a gift to someone of importance or an item owned by a shaman. This whistle is also

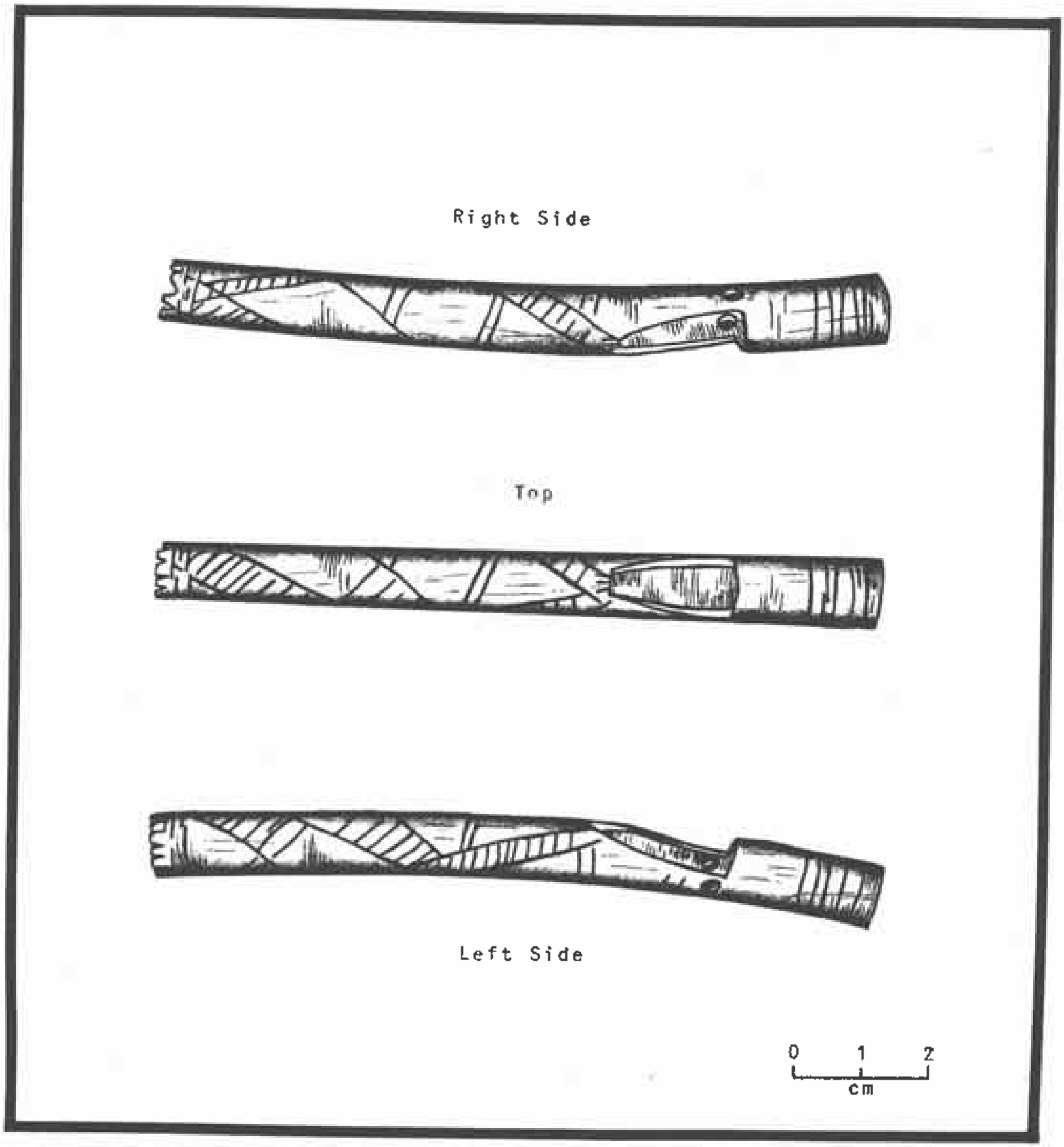

Figure 5. Bone Whistle from West Warren 2.

constructed differently than most of the others reported. The two additional holes possibly allowed for the fastening of an adjustable stop over the vent hole, thus varying the pitch of the whistle and making it function as a flute. This type of whistle is seemingly similar to the one reported from Provo Mound 2 (Steward 1936:34). However, it is also possible that the holes were used to thread a sinew string or twine through so the whistle could be hung around the neck. The tube could then be plugged and fitted with a reed, pine gum, or beeswax to create the whistling sound.

The numerous bone tubes also present some interesting questions. Were these intended to be cut into smaller sections and used as tubular beads? This seems unlikely, except for those that were systematically incised, as with those from Hogup Cave. However, it is possible that these tubes were used for ornamental purposes, especially those under 10.0 cm (Marwitt 1970:103). Although it was not reported, many of the tubes appear to be of the same bone type, length, and construction as the whistles, lacking only the distinguishing vent hole. Therefore, it is possible they represent unfinished whistles.

It seems clear that bone whistles recovered at several excavated sites along the Great Salt Lake marshes were an integral part of the Great Salt Lake Fremont variant cultural package. However, their exact role is not known. Were they part of their daily life? Were they special use tools, or for ceremonial purposes only? As more sites are found and recorded in the study area, more whistles may be recovered. Analysis of these and their associations could answer this functional question, but as for now, one can only speculate.

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42MD300, AN EARLY HOLOCENE SITE IN THE SEVIER DESERT

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INTRODUCTION

Two radiocarbon dates retrieved in 1985 from 42Md300, a site in the Sevier Desert of western Utah (Figures 1 and 2), indicate that typologically early cultural material was probably deposited between 7,700 and 9,500 years ago and possibly between 7,710 - 10,430 years ago. Located about 35 km (22 miles) southwest of Delta, the site was recorded in 1976 by La Mar Lindsay and Kay Sargent of the Utah Division of State History. It was nominated to the National Register of Historic Places by Bruce Hawkins and Walter Dodd, Jr. in 1979 and reported in Janetski and Holmer (1982:Appendix D). The significance of this site is based on the presence of typologically early lithic materials (e.g., Figure 3a) including single specimens of Folsom, Meserve, Plainview, and two lanceolate specimens resembling Agate Basin points. They were observed by Lindsay in the personal collection of Milton McQueary of Delta. The most common points at the site (Figure 3b) are those of the Western Stemmed Tradition, a large category appropriately lumped into one unit by Bryan (1980). Stemmed points have been reported from the area by Janetski and Holmer (1982) and we have observed these kinds of points while visiting the site. Dozens of Western Stemmed Points (which include subtypes such as Silver Lake and Lake Mohave among others) from 42Md300 and other sites in the are in the personal collection of Jay Gustaveson as well as that of Mr. McQueary. Mr. Gustaveson also owns a small, resharpened Clovis point that may be from 42Md300 although its provenience cannot be absolutely established. In addition to the points, the site has yielded crescentics (Figure 3b), large quantities of chipping debris, stones likely transported to the site, and fire-cracked stones.

The significance of 42Md300 has been well established, and validated by inclusion on the National Register of Historic Places. However, when the site was nominated its chronology was entirely dependent on typological cross-dating. Given the broad time span suggested by the artifacts from the site, some attempt to obtain absolute ages seemed appropriate prior to more intensive investigation. This paper reports on fieldwork conducted in 1985 by Simms, which was designed to ascertain bracketing ages for the cultural material at the site. All of the material appeared to be eroding from one stratigraphic zone which suggested the possibility of obtaining samples of shell and sediment for radiocarbon dating from deposits bracketing the level of origin of the cultural material.

SITE DESCRIPTION

42Md300 is a large, 625 m north-south by 400 m east-west, teardrop-shaped depression created by wind erosion into sediments associated with various past habitats of the Sevier River floodplain (Figures 1 and 2). Large sand dunes have accumulated along the northeast and southeast rims of the site, and smaller dunes ring the remainder of the depression. The south rim of the depression is at an elevation of 1,388 m and it slopes there to a maximum depth of 3.5 m (Figure 4). The depression itself is barren except for a few mounds of greasewood-stabilized sediment found primarily along the eastern slopes. Vegetation above and surrounding the depression is a saltbush (*Atriplex confertiflora*) and greasewood (*Sarcobatus vermiculatus)* association extending for several kilometers in all directions. Other depressions and playas occur in the Sevier Desert and while typologically early lithic material from them abounds in private collections, no systematic work has attended to these cases.

At 42Md300, cultural material is most common along the southern slopes of the depression, but smaller concentrations occur in the northeast corner of the site and on a remnant mound of sediment near the center of the depression (Figure 4). A very diffuse scatter of artifacts occur as lag deposits on the ancient lacustrine sediments of the depression floor as well. Artifact density is lowest along the eastern slopes of the depression where it is possible that erosion has not yet progressed to the level of artifact-bearing sediments.

Level of Origin of Cultural Material

Artifacts at 42Md300 appear to originate in, or immediately below, a dark deposit of silty-clay loam,

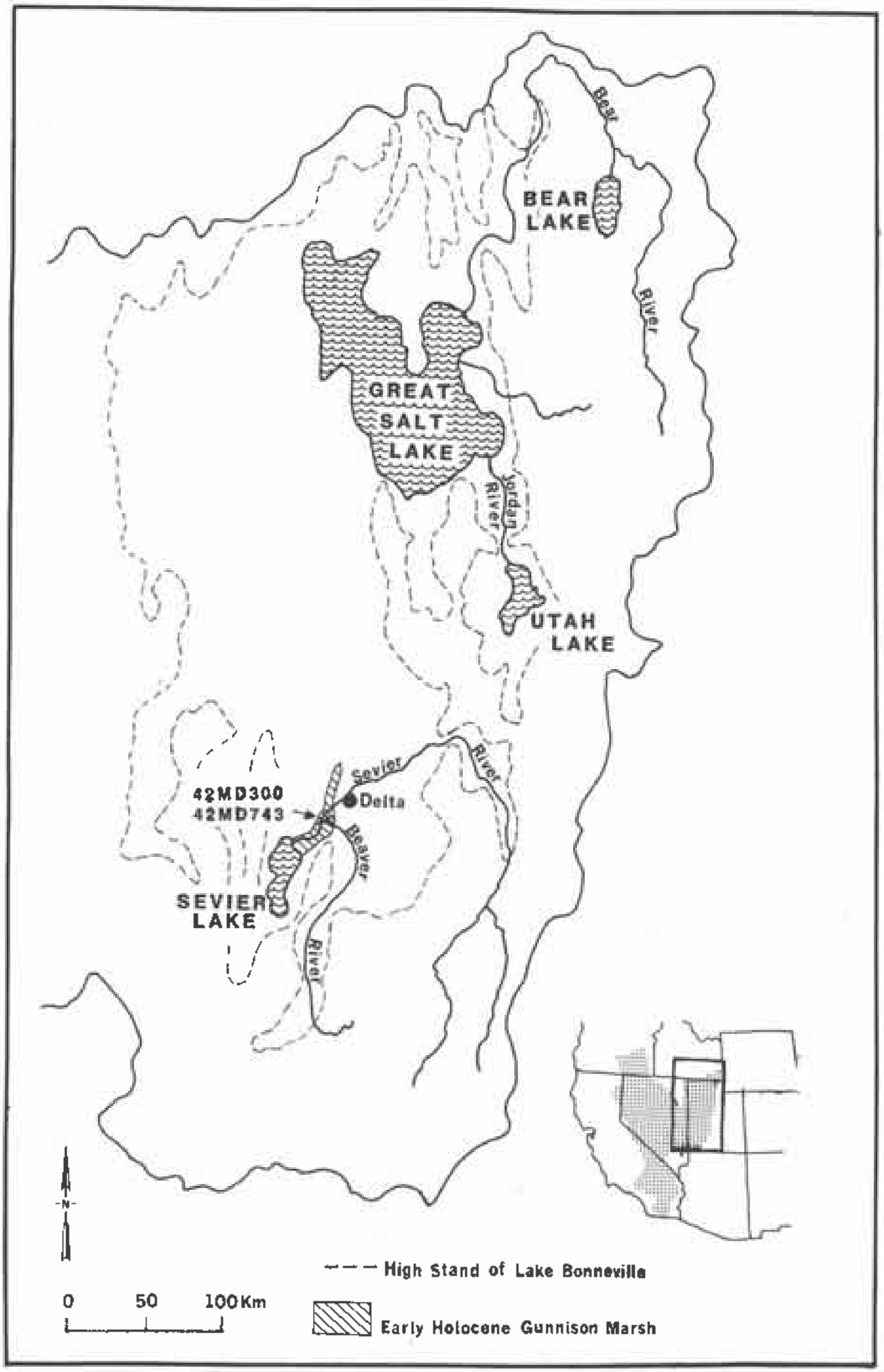

Figure 1. Map of the eastern Great Basin showing the location of 42Md300 and related features.

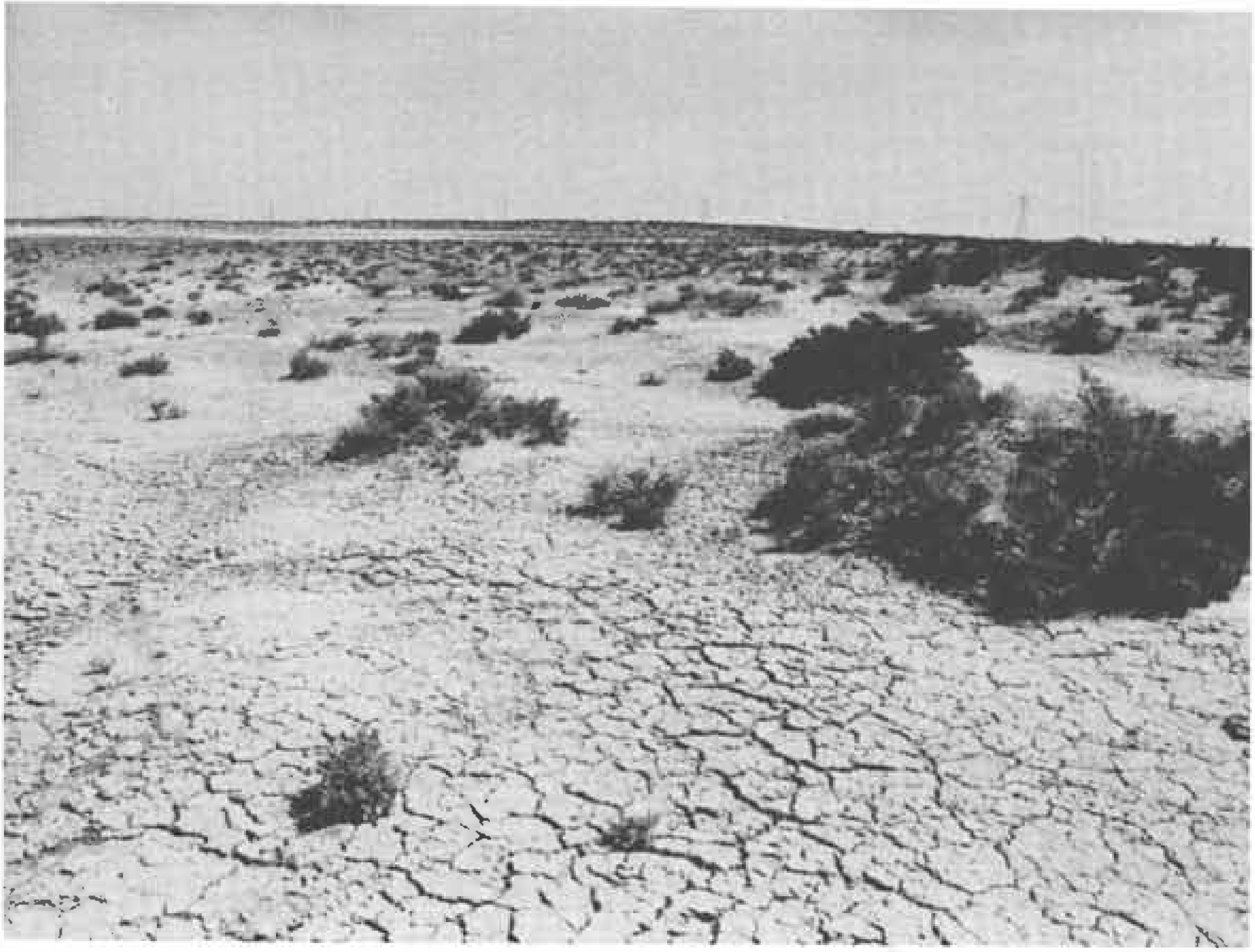

Figure 2. The site depression looking to the northeast. The Folsom Point was proportedly recovered from the surface in the near foreground.

containing an organic fraction, or possibly stained by organic material. This deposit is most prominent and extensive along the southern margins of the depression (Figure 4). Over the course of eight visits to the site between 1982 and 1985, new artifacts were observed eroding out no higher than the level of the dark sediment and occurring with deposits of pea gravels along the southern margins of the depression. The 1985 test excavations revealed that the level of origin of the pebbles was adjacent to and stratigraphically below the dark, organic deposit. Thus, the deposition of cultural material may have post-dated the deposits of pea gravel and been associated with the dark sediments above. A similar situation was observed near the center of the depression where an exposure of dark, organic sediment and artifacts are exposed. Another exposure of the dark sediment and artifacts was found in the northeast corner of the depression (Figure 4), with a dense lag deposit of broken gastropod shells. The zone of dark sediment is the highest point along the slopes of the depression where artifacts are visible and we know of no typologically late material that has come from the slopes of the depression, although late Archaic and Late Prehistoric projectile points have been found above on the surrounding modern surface.

Depositional History and Early Holocene Situation at 42Md300

The above evidence suggests that the artifacts occurring with the dark sediments are from a

Figure 3a. Recent photograph of the Folsom and other heavily patinated obsidian points from the site (scale in cm).

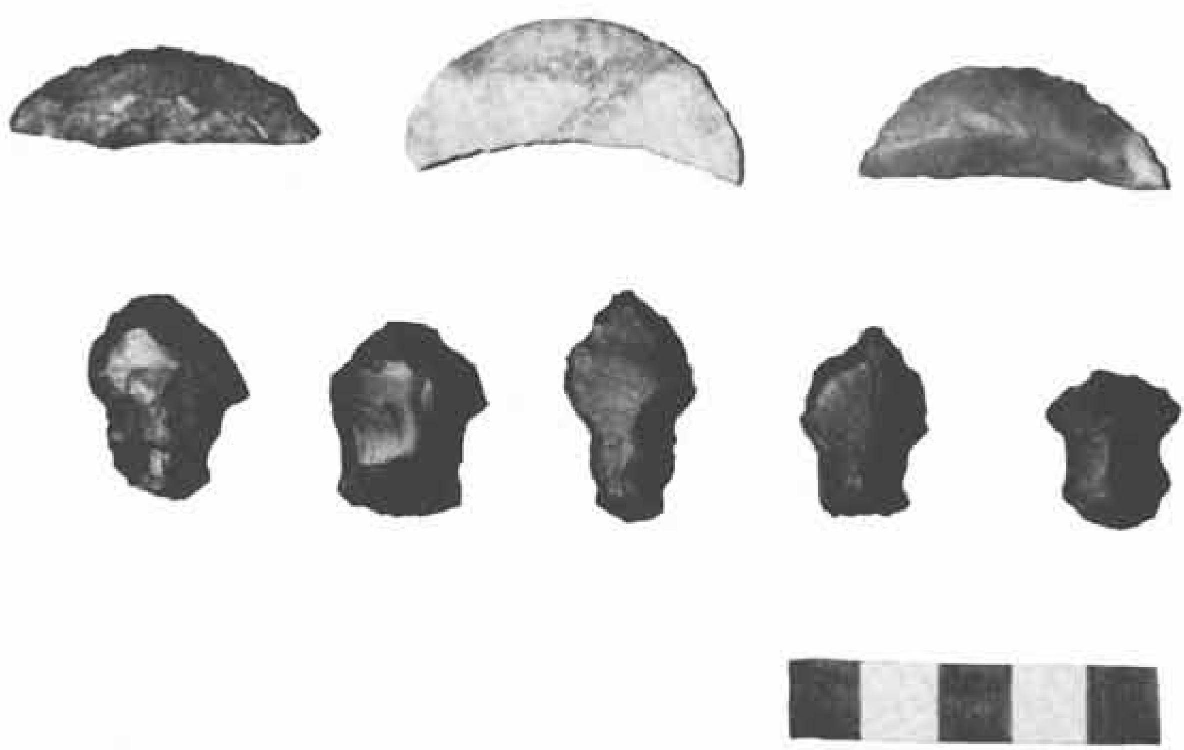

Figure 3b. Recent photograph of some Western Stemmed Tradition points and crescents obtained from the site (scale in cm).

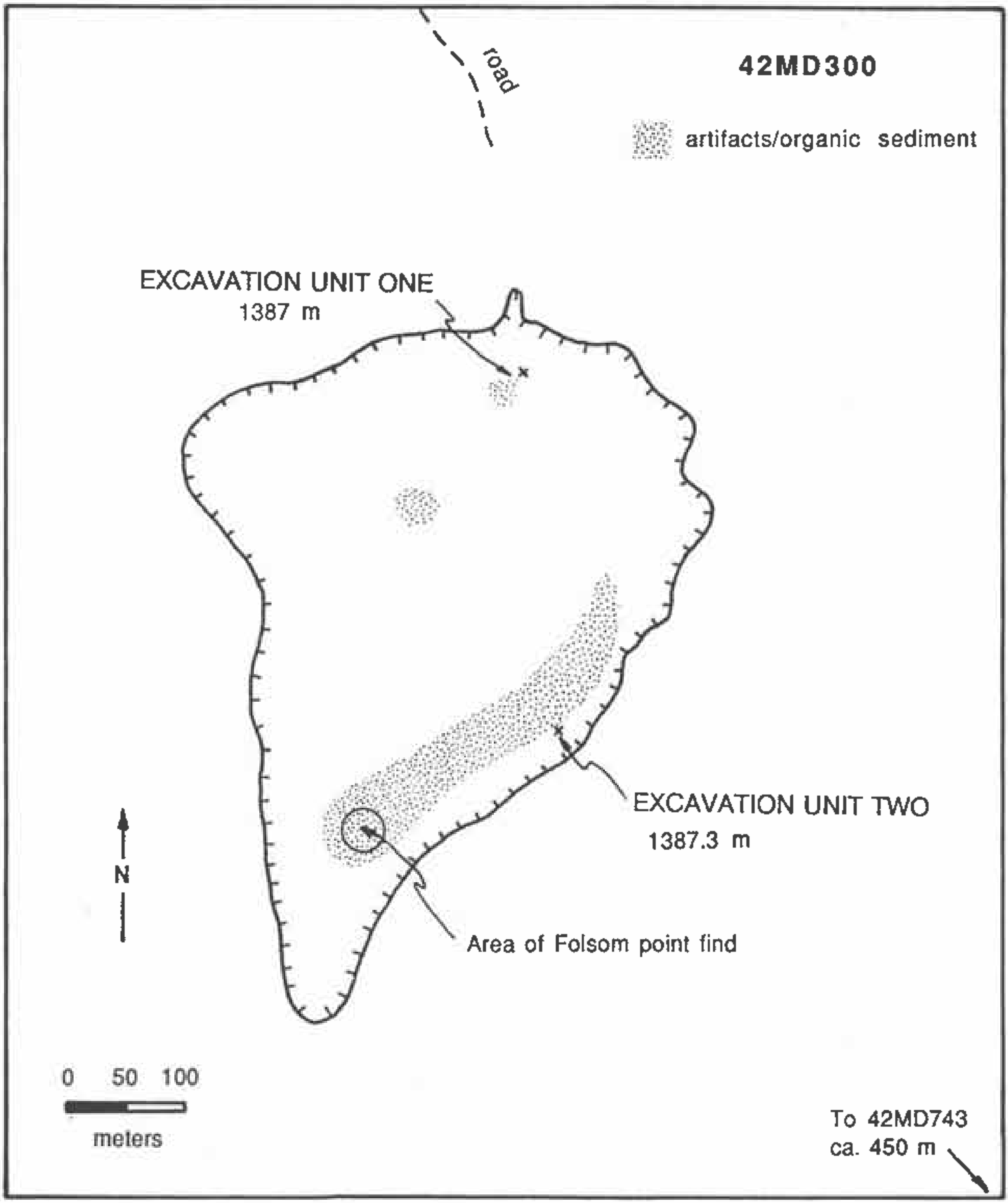

Figure 4. Map of 42Md300 showing locations of test excavation units and exposures of dark sediment and artifacts. Elevations are for ground surface.

temporally discrete unit, buried by later sediments and finally eroded into view. Oviatt (1988) reports on recent as well as past fieldwork on the lacustral history of the Sevier Desert. Present evidence indicates that the area of 42Md300 was under an open body of water (the transition from Gunnison to Sevier Lakes) until shortly after 10,000 B.P. During the early to middle Holocene, Sevier Lake did not rise above 1,381 m (Oviatt 1988), about 5.5 meters lower than the floor of the 42Md300 depression. While the area of 42Md300 was apparently not under lake waters after about 10,000 B.P., the sediments show that it contained wetlands at various times. Research at site 42Md743, only 900 meters south of 42Md300 suggests that this stretch of the Sevier River floodplain was characterized by complex channels, ponds, and periods of high biomass in the millennia prior to ca. 6,000 B.P. (Simms and Isgreen 1984:398-402). Evidence at 42Md743 also shows that dune formation commenced in early Holocene times in the area (Simms and Isgreen 1984:398). Thus, early Holocene habitats probably included sand dunes, marsh vegetation in ponds and channels along the Sevier River, and areas of high biomass such as salt grass meadows subject to intermittent inundation. An analogy for the prehistoric habitat may be found in the written accounts of the Escalante expedition in 1776 (Bolton 1972) and from mountain man Daniel Potts, who was in the area in 1827 (Bagley 1964). They clearly state that the vicinity of the Sevier and Beaver rivers below the modern town of Delta was extensive marshland, heavily vegetated, nearly impassable due to the maze of ponds and channels, and contained many fish.

Activities during the twentieth century, including agriculture, well digging, and dam construction in the Sevier watershed, lowered the water table of the lower Sevier River enough to cause desiccation of the entire floodplain except for a narrow band of marsh vegetation along entrenched channels. The Beaver River is now completely dry along its lower reaches. While the evidence for early to mid-Holocene aeolian activity suggests that formation of the 42Md300 depression could be early, the apparent occurrence of the artifacts in a temporally discrete unit, distinct from the late Holocene artifacts of the surrounding floodplain suggests that the depression was formed recently. Currently, it is not possible to demonstrate precisely when the depression was formed.

At present, our understanding of the nature of human occupancy at 42Md300 is based entirely on surface data. There are no cultural features, although stones (5 - 20 cm in diameter) which may not have been naturally deposited can occasionally be found scattered across the artifact bearing areas. These may have once been part of cultural features, but since the surface has deflated, the form of these features would have been destroyed. Definition of intact cultural features, if present, must await more extensive excavation. The range of debris reported from the site, which not only includes finished tools, but manufacturing debris of several material types, suggests that the site represents at least temporary field camps or locations (*sensu* Binford 1980), possibly occupied repeatedly.

1985 TEST EXCAVATIONS TO OBTAIN RADIOCARBON SAMPLES

Fieldwork was conducted on June 3, 1985, and consisted of two small test excavations along with instrument surveying to ascertain absolute elevations of the exposed strata. Exposures that could yield datable material had been identified on previous trips to the site. One (Excavation Unit One) was in the northeast corner of the depression (Figure 4), the area of dark sediment, shell, and a few artifacts. Artifact collecting has apparently decreased the density of cultural material in this area because it is closest to the road. Tire tracks have been observed at the south end of the site as well. In this exposure, the organic sediment thought to be associated with the artifacts appeared to extend into buried contexts up slope from the exposure. A second exposure (Excavation Unit Two), was in the area of greatest artifact concentration along the southern slope of the depression. It was west of here where Mr. McQueary showed Lindsay where the Folsom point has been collected. This exposure represents the highest point on the site where the dark sediment and artifacts have been observed and presented the opportunity to obtain a terminal date of artifact deposition.

Exposure/Excavation Unit One

An exploratory trench 35 cm wide by 3.1 m long (Excavation Unit One) was excavated in the area where the dark sediment and shells were most common (Figure 4). It extended up slope toward a low mound of intact deposits. The maximum depth of the trench was 36 cm, and excavation followed the contact between the dark sediment (Strata 1-2 and 1-3) and lighter deposits below (Stratum 1-1). Deposits were not screened and no cultural material was recovered from the trench. Figure 5 illustrates the exposed profile and provides brief descriptions of the strata encountered. The contact between Stratum 1-1 and Stratum 1-2 above was abrupt and undulating. Stratum 1-2 above was a 10 - 15 cm thick deposit of gastropods, extending the entire length of the trench. Stratum 1-3 extends to the ground surface. It contains no shells, is lighter in color than Stratum 1-2 and has a larger fraction of sand possibly introduced from above via desiccation cracks some of which are visible in profile.

The shells from Stratum 1-2 were pinkish in color, many sizes were represented, and most were whole specimens while *in situ*. However, they were encrusted with the damp silty/clay matrix and fragmented upon removal. Taxa observed included *Helisoma*, *Lymnaea*, and *Physa*, all typical of the zone of rooted vegetation (Simms and Isgreen 1984:373-374). A sample (FS 1: Figures 4, 5 and Table 1) of these gastropods was recovered for radiocarbon dating. This sample should date the beginning of Stratum 1-2 deposition, the dark, organic sediments hypothesized to be associated with the artifacts. Thus, an age on the shell should be in excess of a maximum age for the cultural material observed on the deflated surface nearby.

Exposure/Excavation Unit Two

Excavation Unit Two, near the south rim of the site, was placed at the upper limit of the exposed, dark sediment associated with artifacts and presented the opportunity to date the upper levels of observable organic deposition. A date from this exposure should provide a minimum age, if not the actual age, of the cultural material. It was noted previously that the dark sediments in the vicinity of Excavation Unit Two may have been subject to post-depositional staining by organic material. While this does not appear to have been the case, it remains a possibility. Contamination of artifact-bearing sediments by later organic debris would cause this sample to err on the young side. Nevertheless, this sample still provides a minimum age for the cultural material.

The small test excavation, 30 cm by 30 cm by 35 cm deep, was made to obtain a sediment sample and to locate the base of the organically rich deposit in this area (Figure 4). Figure 5 shows the sediments and stratigraphy encountered in Excavation Unit Two. The excavation proceeded 10 cm into Stratum 2-1, which consists of sands with many small gravels. Stratum 2-2 above is a darker, finer-grained deposit. A sediment sample (FS 5) thought to contain enough organic material for radiocarbon dating was recovered from a thin vertical section (less than 5 cm thick x 25 cm diameter) within Stratum 2-2.

Elevations and Correlations

An opportunity to obtain absolute elevations at 42Md300 was available due to the proximity of the Intermountain Power Project transmission line. After the excavations were completed, elevations were determined using a contractors level and stadia rod, measuring to a known elevation. The elevations are shown on Figures 4 and 5.

Sediments in the two excavations were morphologically different enough, and distant enough from each other to preclude confident stratigraphic correlation. It is possible that the sample of dark, organic sediment, Stratum 2-2 in Excavation Unit Two, represents the upper levels of Stratum 1-3 observed in Excavation Unit One. However, given the differences in elevation, they could represent different depositional events as well. While caution requires that no correlations be made on the basis of present evidence, the relative elevations of the radiocarbon samples make them useful for determining bracketing ages for the cultural material, regardless of how many depositional events occurred within that time span.

RESULTS AND COMPARISONS

Two samples were submitted for radiocarbon dating including one sample of shell (FS 1) from Stratum 1-2 in Excavation Unit One and one sample of sediment (FS 5) from Stratum 2-2 in Excavation Unit Two. The sediment was processed for a humic acid date on the organic fraction of the sample. Bulk carbon content was low as is often the case with sediment samples and extended counting time was employed. The shell sample was difficult to clean because of infilling. The loss of shell during cleaning left a small, but usable sample which was given extended counting time and corrected for C-12/C-13 fractionation, an unnecessary procedure for humic acid dates on sediment. Table 1 shows the results.Both dates are consistent with the depositional model of the site in that they are in chronological sequence, consistent with the elevations, and consistent with sedimentary and radiometric evidence relevant to the lacustral history

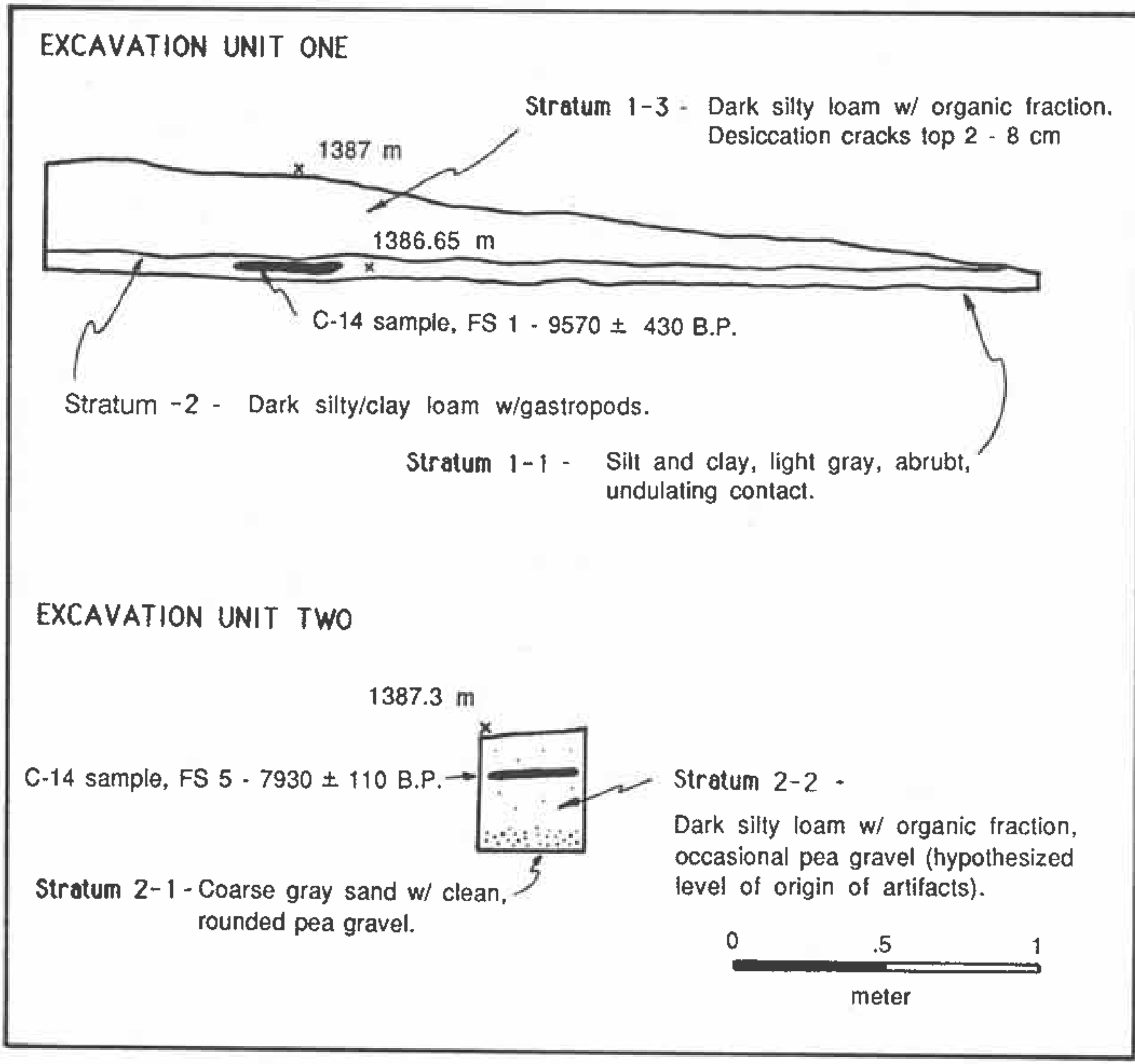

Figure 5. Profiles of test excavations, looking south at Excavation Unit One and east at Excavation Unit Two.

TABLE 1. Radiocarbon Dates from 42Md300.

	C-14 Age	C-13 Adjusted Age	95% Confidence Interval
Excavation 1 (FS 1)	9,340 ± 420 years (Beta-12987)	9,570 ± 430 years	10,430-8,710 B.P.
Excavation 2 (FS 5)	7,930 ± 110 years (Beta-12988)	Not applicable	8,150-7,710 B.P.

of the lower Sevier River (Oviatt 1988). The dates are also consistent with the expected typological ages of much of the cultural material. However, if the level of origin is in fact the elevation of the date from Excavation Unit Two, the age presses the later time periods for some of the material such as the Folsom point.

The shell date from exposure one can be seen as a maximum age for the cultural material. Paleoenvironmental data indicate that the age of the shell from Excavation Unit One is coeval with the period the site was first exposed by the receding waters of Sevier Lake (Oviatt 1988). At that time, the gastropods found in Excavation Unit One may have inhabited shallow water associated with either the Sevier River or near the actual lake edge.

Other evidence suggests a more precise chronological placement of the cultural material within the dated range may be possible. The hypothesized level of origin of the artifacts, the elevations and the fact that the shell from Excavation Unit One was clearly below the hypothesized level of origin suggest that they are more likely to be associated with the date of 7,930 B.P.

The dates and elevations are also consistent with work done at 42Md743 (Figure 1) and reported in Simms and Isgreen (1984). There, an organically rich layer at an elevation of 1,387 m contained an *in situ* Pinto point, and dated to 5,930 ± 220 B.P. This date was thought to be stratigraphically associated with surface concentrations 300 m away, yielding lithic debris, several points of the Western Stemmed Tradition, fire-cracked rock, and grinding stone fragments. These materials rested on an organically rich, dark soil horizon exposed at the surface and occurring at an elevation of 1,388 m. This stratum undulated across the site and despite the differences in elevation between the two exposures 300 m apart, the morphology and stratigraphic sequence were identical in each area. Available evidence indicated that both exposures were the same stratum (Simms and Isgreen 1984:154-186, 398-402).

The association of a Pinto point (typically mid-Holocene in the eastern Great Basin) with other points which can be generally ascribed to Bryan's (1980) Western Stemmed Tradition may seem unlikely to some. However, it can also be seen as consistent with mounting evidence that the category "stemmed points" (including such common Utah versions as Silver Lake and Lake Mohave) is a general one that begins as early as any other point type known in the western United States, but persists through middle Holocene times, if not later (e.g., Bryan 1980; Holmer 1986).

The continuing debate over point types and the appropriate application of typological cross-dating notwithstanding (cf. Flenniken and Wilke 1989), it is apparent several organically rich strata are present in the vicinity of 42Md300, and that a sequence ranging from 6,000 - 10,000+ B.P. is in evidence. The 1983 field work at 42Md743, suggested then that deposits at 42Md300 may be later than an age inferred only through a strict application of typology (Simms and Isgreen 1984:401). The radiocarbon dates from 42Md300 are consistent with this suspicion. Despite the consistency among these lines of evidence we emphasize the indirect nature of the inferences. We acknowledge that the dates only provide a basis for hypothesizing the age of the cultural material in general. The possibility remains that ages of *particular* point styles within the total collection could be different from one another, but probably within the range reported here. We note that most "particular point styles" for the early Holocene in the Great Basin have little basis in direct radiometric evidence for specific dating. While some of the Plains types found at 42Md300 appear to be confined to very specific time periods in dated contexts outside of the Basin (e.g., Folsom), the various stemmed points seem to be less temporally diagnostic as evidence accumulates.

CONCLUSIONS

The range of the two radiocarbon dates of 7,710 - 10,430 B.P. (using a 95% confidence interval) gives the broadest and most conservative estimate for the age of the cultural material at 42Md300. A conservative interpretation is in order given the absence of extensive excavations at this site and the complexity of the stratigraphy on the Sevier River floodplain. However, we would be remiss to underestimate the value of evidence reported above suggesting that the cultural material appears to occur toward the end, rather than the beginning of the most conservative range. To summarize, the most compelling evidence is: 1) the site was probably submerged and hence inhabitable until sometime after 10,000 B.P. and; 2) the artifacts are more confidently associated with the radiocarbon date of 7,930 B.P. from Excavation Unit Two than with the earlier date from Excavation Unit One. *Thus a more precise, but adventurous interpretation would be that people were using 42Md300 between about 7,700 - 9,500 years ago.*

Investigations at 42Md300 show that it is the oldest *radiocarbon dated open site* of human occupancy in Utah. Earlier dates on human occupation are known only from cave sites, but early open site situations are essential to understand the range of characteristics of early human occupation.

This important site should be examined further because vandalism is steadily destroying the archaeological record. Perhaps the only management alternative to excavation would be to completely bury the site with wind resistant sediments to preserve it. Vandalism from surface collecting and erosion from off-road vehicles continues at the site and this impact may even be related to improved access along the Intermountain Power Project transmission line. There has been a noticeable decrease in surface artifact density in the past few years suggesting either the site is being collected frequently or there is not much left to erode into view. It would be unfortunate to be in possession of a site on the National Register that through a lack of attention and investment no longer exists.

ACKNOWLEDGMENTS

The fieldwork to recover radiocarbon samples and map 42Md300 was supported by the Bureau of Land Management and Weber State College. This paper is based on a technical report submitted to the Bureau of Land Management in 1985. Many people have visited 42Md300 in recent years and have contributed to its documentation. Among those deserving thanks and not mentioned in the text include James Dykman, Utah Division of State History and Joel Janetski, Brigham Young University. Thanks also to geologists Charles G. Oviatt, Kansas State University and Joseph Schuldenrein, Gilbert/Commonwealth, Inc., for visiting the site on different occasions and offering comments about the stratigraphy and paleoenvironmental possibilities. Rebecca Rauch volunteered her experienced assistance during the 1985 fieldwork. Lastly, special thanks is due Mr. McQueary for having alerted us to the site a number of years ago and for allowing us to photograph his collection.

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THE LIME RIDGE CLOVIS SITE

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INTRODUCTION

In 1985 Abajo Archaeology conducted archaeological investigations at the Lime Ridge Clovis site, located 15 kilometers southwest of Bluff, Utah (Figure 1). The site, designated 42SA16857, is the first known Clovis site on the northern Colorado Plateau documented with chronologically distinctive artifacts (W. Davis and Brown 1986; Green 1978). Figure 2 illustrates the location of the Lime Ridge site with respect to other documented Clovis finds and Pleistocene mammoth remains in the greater Southwest. On Map B, the black dots mark documented Clovis sites, while the open circles indicate isolated Clovis projectile points (Agenbroad et al. 1986; Copeland and Fike 1988).

SITE DESCRIPTION

The Lime Ridge Clovis site consists of a fairly light, dispersed artifact scatter extending 108 meters north-south by 78 meters east-west, with one moderate 50 meter square concentration (Figure 3). The site is an elevation of 5,160 feet (1,573 m) above mean sea level. It is situated on a high finger-ridge which offers an uninterrupted 360-degree view and, notably, overlooks a canyon head to the west. This canyon drains south-southeast towards in the confluence of Comb Wash and the San Juan River 4 km away. Drainages such as these were probably corridors for the movement of animals between the Lime Ridge upland and the lower riparian ecozone. The present vegetation in the vicinity consists of desert scrub species dominated by blackbrush on the ridge slopes and sparse grasses and low sagebrush on the ridge top and valley floors.

Archaeological investigations at the site consisted of laying out a grid of 2 m x 2 m square across the site surface and recording the point provenience of each artifact. Each artifact was then collected and bagged separately. In order to test for possible buried cultural materials, four 2 m x 2 m test units were excavated. These revealed a 3 to 5 cm thick eolian mantle overlying decomposing Halgaito Formation limestone. Four lithic debitage flakes were recovered, from these tests.

DESCRIPTION OF STONE TOOLS

The Lime Ridge assemblage consists of 294 lithic artifacts. With the exception of the four flakes recovered during subsurface testing, all artifacts were recovered from the site surface. Together the remains are believed to represent close to a 100 percent inventory, and it is strongly believed that this surface assemblage has not been seriously

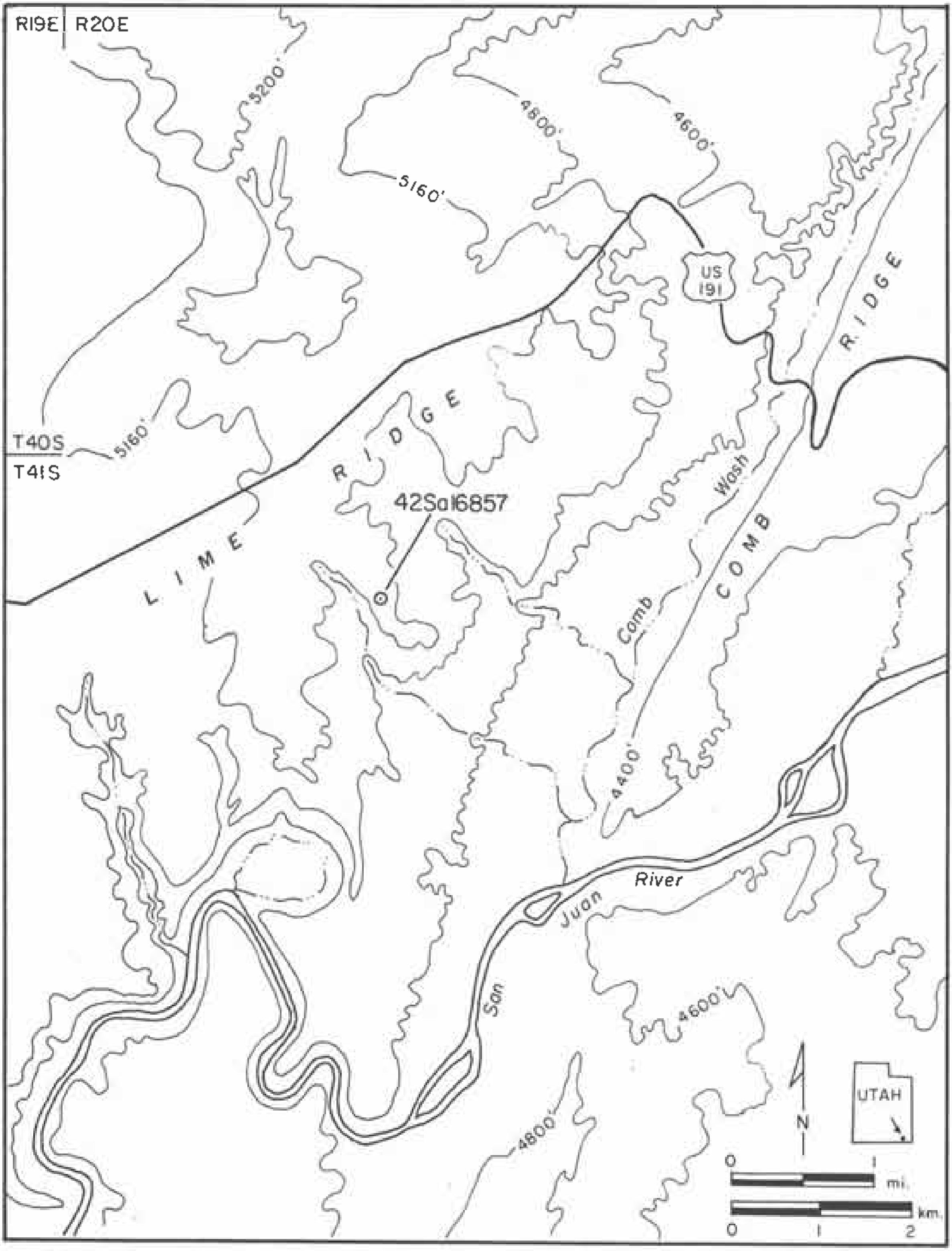

Figure 1. 42Sa16857: Site Location Map

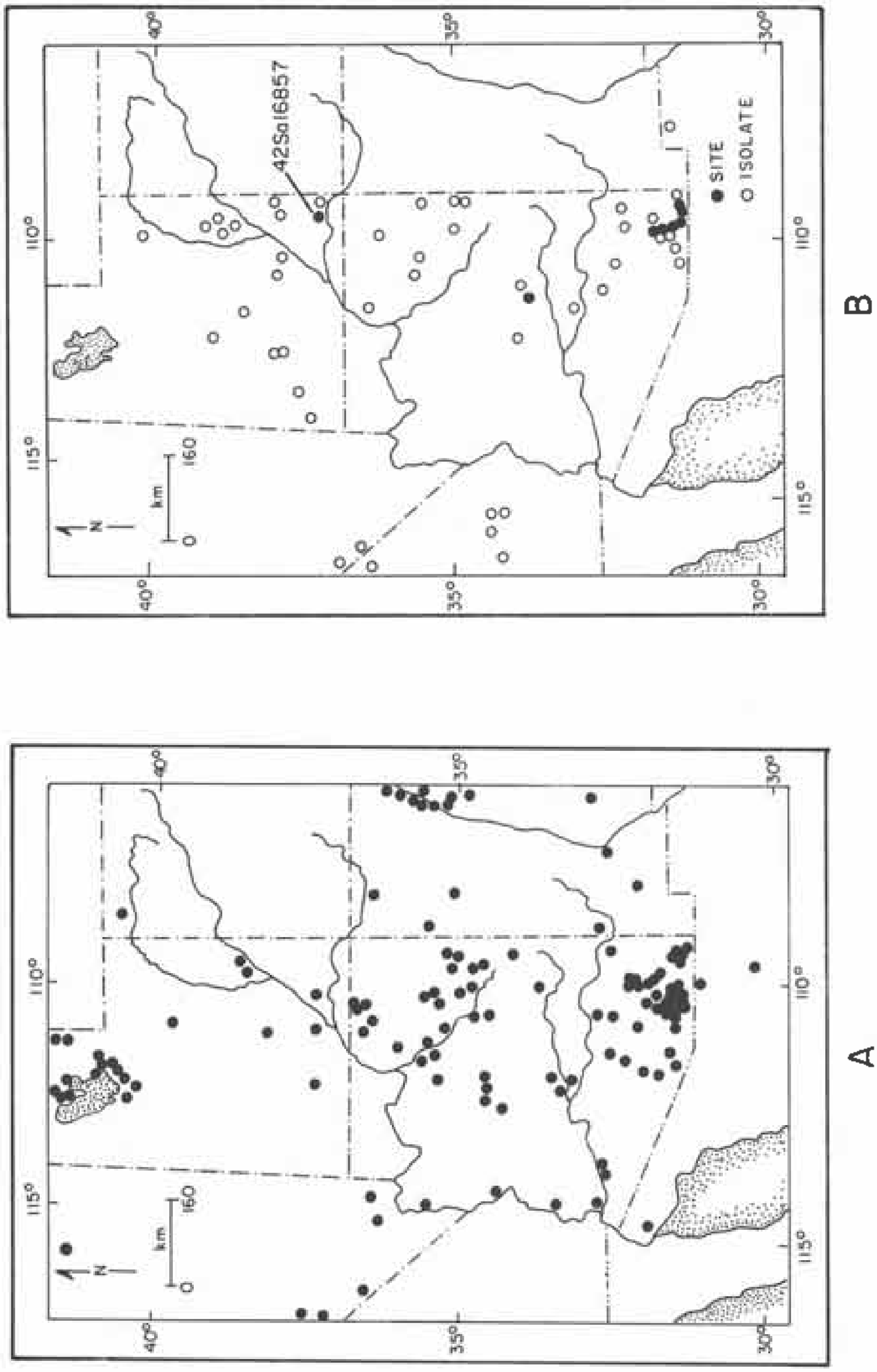

Figure 2. Two maps of the greater Southwest with the locations of Mammoth *Mammuthus* sp. (A), and Clovis sites and isolated finds of Clovis projectile points (B). (After Agenbraod et al. 1986; Copeland and Fike 1988.)

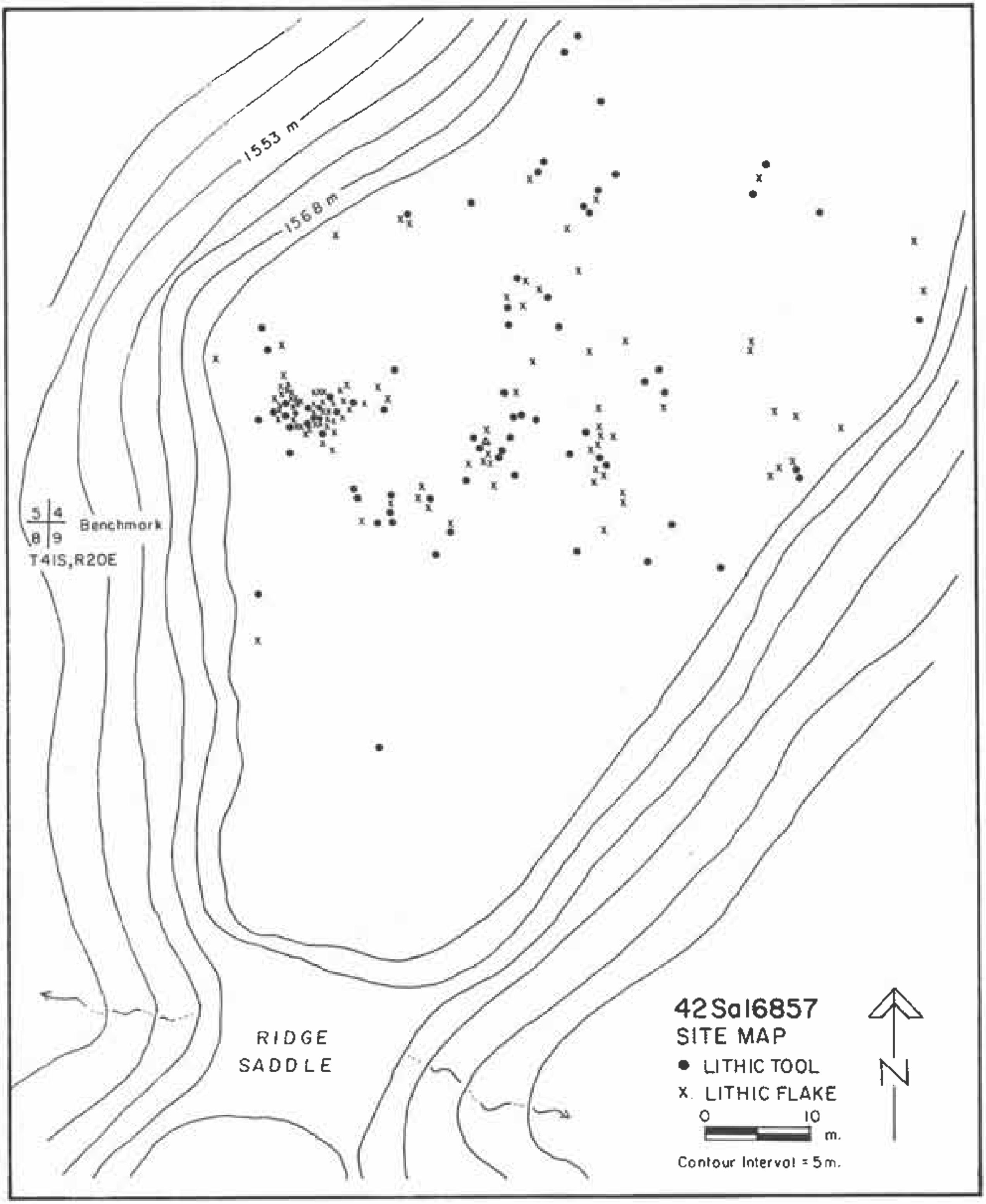

Figure 3. 42Sa16857: Site Map.

disturbed or mixed with later cultural materials. To date, only a preliminary analysis has been performed on the artifacts; more detailed attribute analysis will be completed in the near future. The assemblage is characterized by a high ratio of tools and implements to debitage. Non-utilized debitage makes up only 60% of the collection, simple flake tools account for 25%, formal tools comprise 12% and the remaining 3% consists of 10 cores.

Formal tools include six projectile point fragments, three bifaces, nine end scrapers, twelve unifacial tools, three notched flake tools and two wedges. Two of the projectile point fragments are bases which have been previously described in an earlier report by Copeland and Fike (1988:26-27). The bases are made from gray, fine-grained quartzite and are bifluted (Figure 4e and f). Both specimens exhibit basal and lateral edge grinding. In addition to the two Clovis point bases, the distal end of a lanceolate biface made of the same gray quartzite was found (Figure 4c) along with another distal segment from an agatized wood point which bears the remnant of a step-fractured channel flake termination (Figure 4d). Two chert tip fragments were probably also derived from broken points (Figure 4a and b). Additional biface fragments include two small pieces and a "pie"-shaped fragment from a large, radially fractured biface (Figure 6a).

As with most PaleoIndian scrapers, those from the Lime Ridge site are quite standardized (Figure 5). All of the end scrapers were made on expanding flake blanks, generally thicker toward the distal end. Blanks differing from this morphology were retouched into this shape. Abrupt dorsal retouch formed the primary working edge of the tools, generally convex. Three of the end scrapers have pronounced corners, but the classic spurred end scraper is lacking at Lime Ridge. Examination of edge damage on the end scrapers followed Odell's (1980) low-power approach which focuses primarily on microflaking and abrasion on the edges of tools. Use-wear patterns on eight of the nine end scrapers display extreme crushing, abrasion, and step-flaking, which is suggestive of bone, antler or wood working.

Other flake tools from the assemblage consist of non-specialized flakes which were either utilized just as they came off the core or were retouched to produce the working edges needed for specific tasks. Retouched flakes include those which have been unifacially retouched along one or more lateral margins creating a slight to moderate convex working edge (Figure 6b, c and d). Other tool types include three notched tools or "spokeshaves" (Figure 7a) and two wedges (Figure 7b). Both of these tool types are believed to have been used for precise working of bone, antler or wood and reflect non-subsistence craft activities. Non-retouched simple flake tools number 72; however, recent edge damage and thousands of years of exposure have served to make their identification less than certain.

One interesting trait not previously reported in Clovis assemblages is a tranchet technique represented by four large flakes struck obliquely from the edge of large, thick bifaces (Figure 7c). Although one of the flakes exhibits use retouch, they appear to be debitage from manufacturing tranchets or similar tools (Schafer and Hester 1983). This technique is a highly efficient method of creating an effective edge or bit suitable for use as a chisel, depending on the edge angle and morphology (Schafer and Hester 1983:524).

Certain knapping modes appear to be more highly represented in the 176 pieces of debitage than others. Generally, it appears that most of the debitage is the result of flake production from a core, with a smaller proportion derived form unifacial tool retouch and manufacture. What is surprising is the low percentage of biface reduction flakes, a trait that is acknowledged as the critical part of the Clovis lithic technological system. Initial examination of the debitage reveals that biface reduction, typified by thin, expanding flakes with bifacially faceted striking platforms is represented by fewer than 10 flakes. One reason for the low proportion of biface debitage could have been the morphological restrictions inherent to the relatively small size of agatized wood nodules which comprise the parent material of the majority of the debitage.

The material types represented in the Clovis assemblage consist of agatized woods (57%), fine grained quartzites (37%), and red jasper (6%). All of these materials are of local origin. It is believed that the agatized woods and quartzites were derived from the San Juan River Valley Pleistocene gravel terraces in the form of cobbles and pebbles. The red jasper appears in a tabular form and comes from the Gypsiferous Facies of the Cedar Mesa Sandstone Formation. This source is exposed in Comb Wash two kilometers east of Lime Ridge. Agatized woods are also present in the Pleistocene gravel terraces in small quantities. The nodules characteristically display a water-worn, white to buff

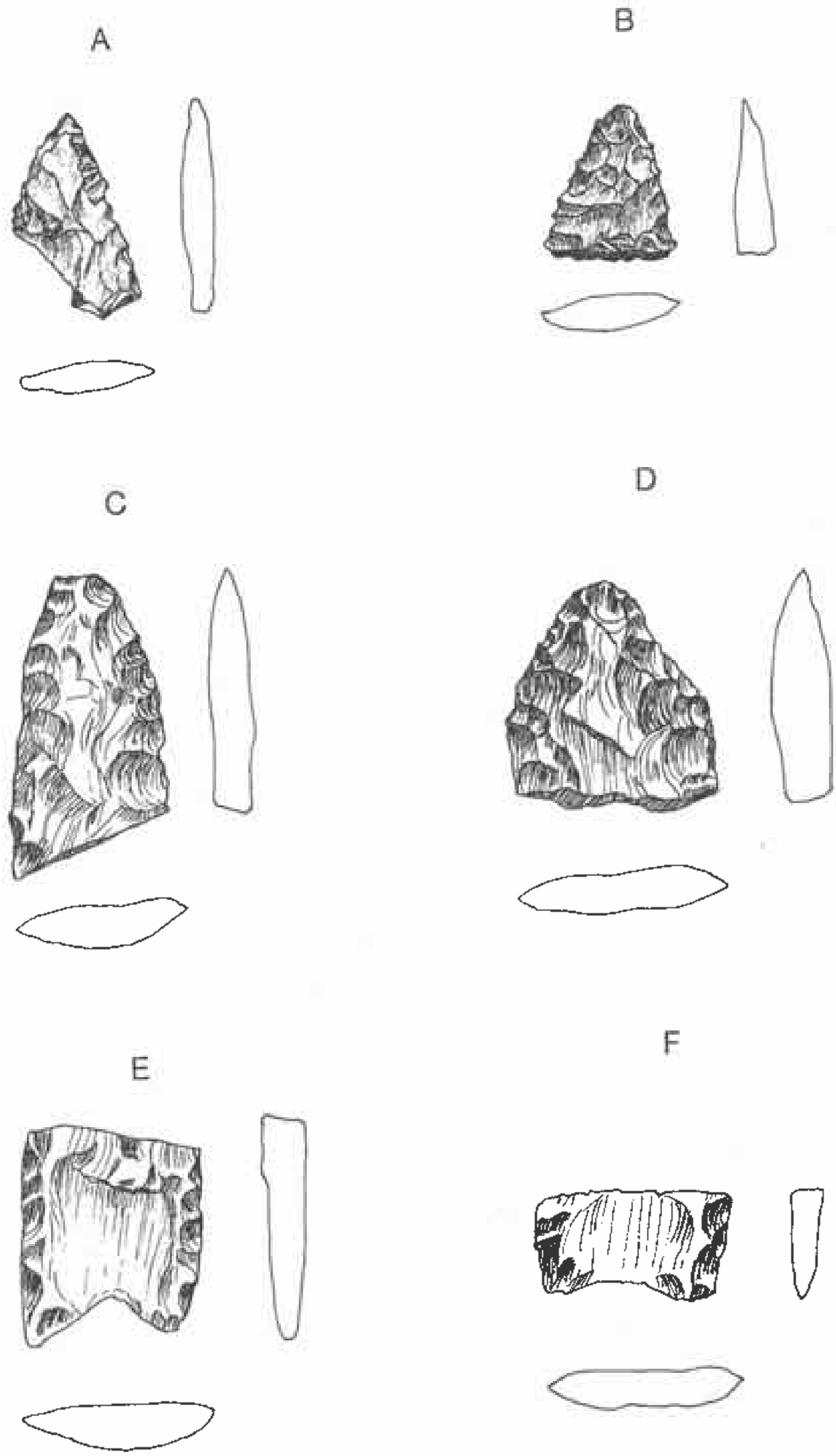

Figure 4. Projectile point fragments. Actual size.

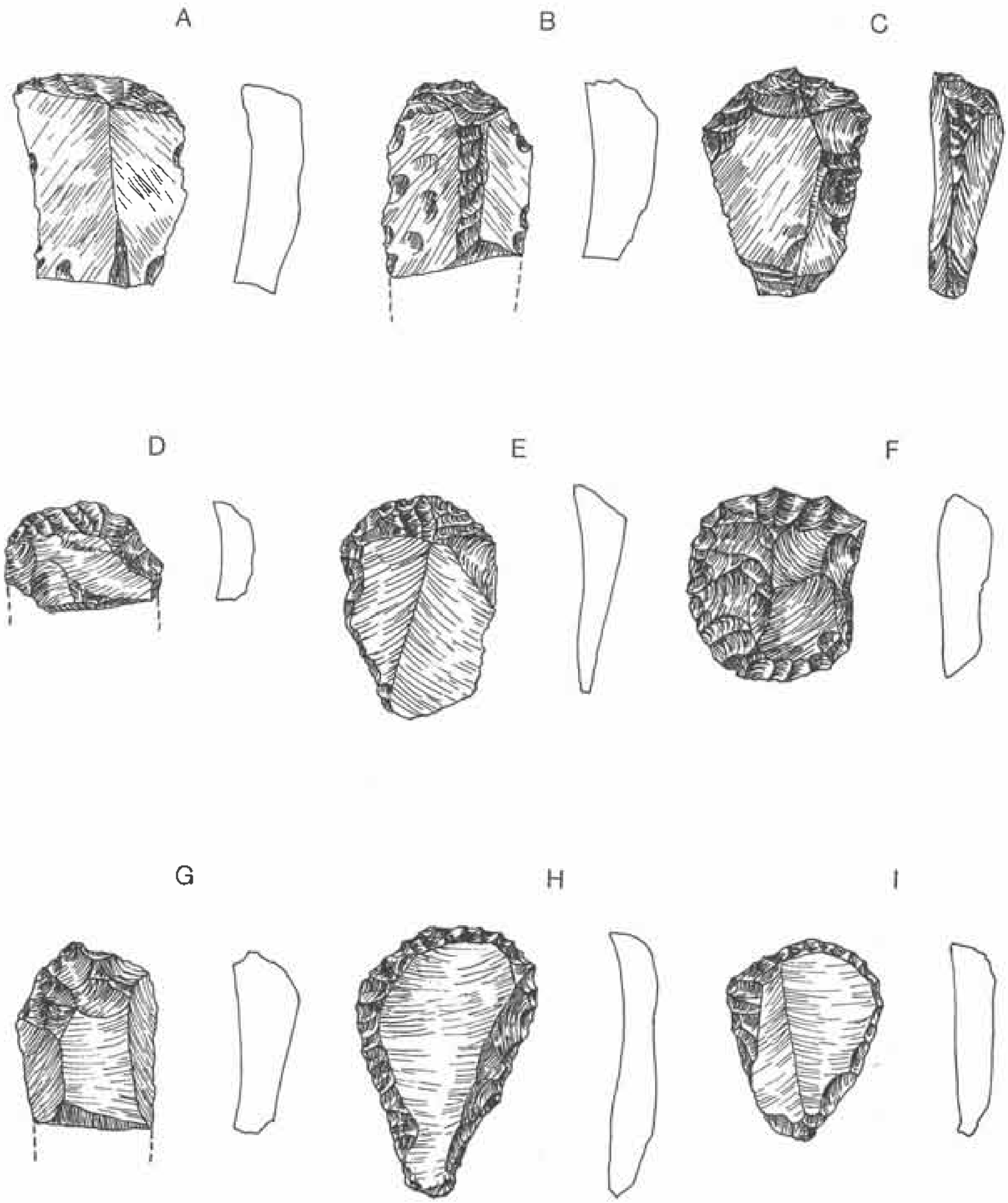

Figure 5. End scrapers. Actual size.

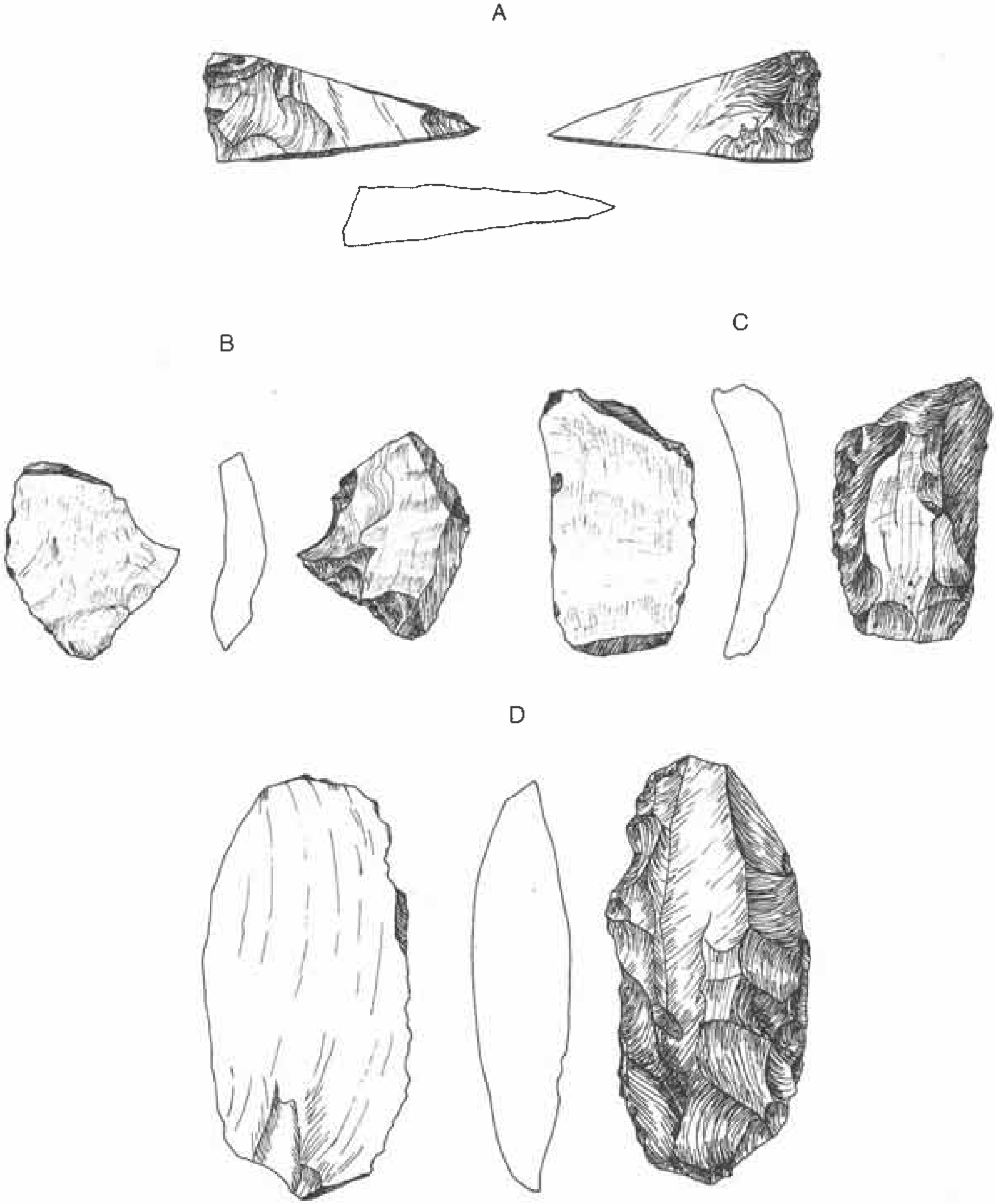

Figure 6. A: Radially fractured biface fragment; B, C and D: unifaces. Reduced 10 percent.

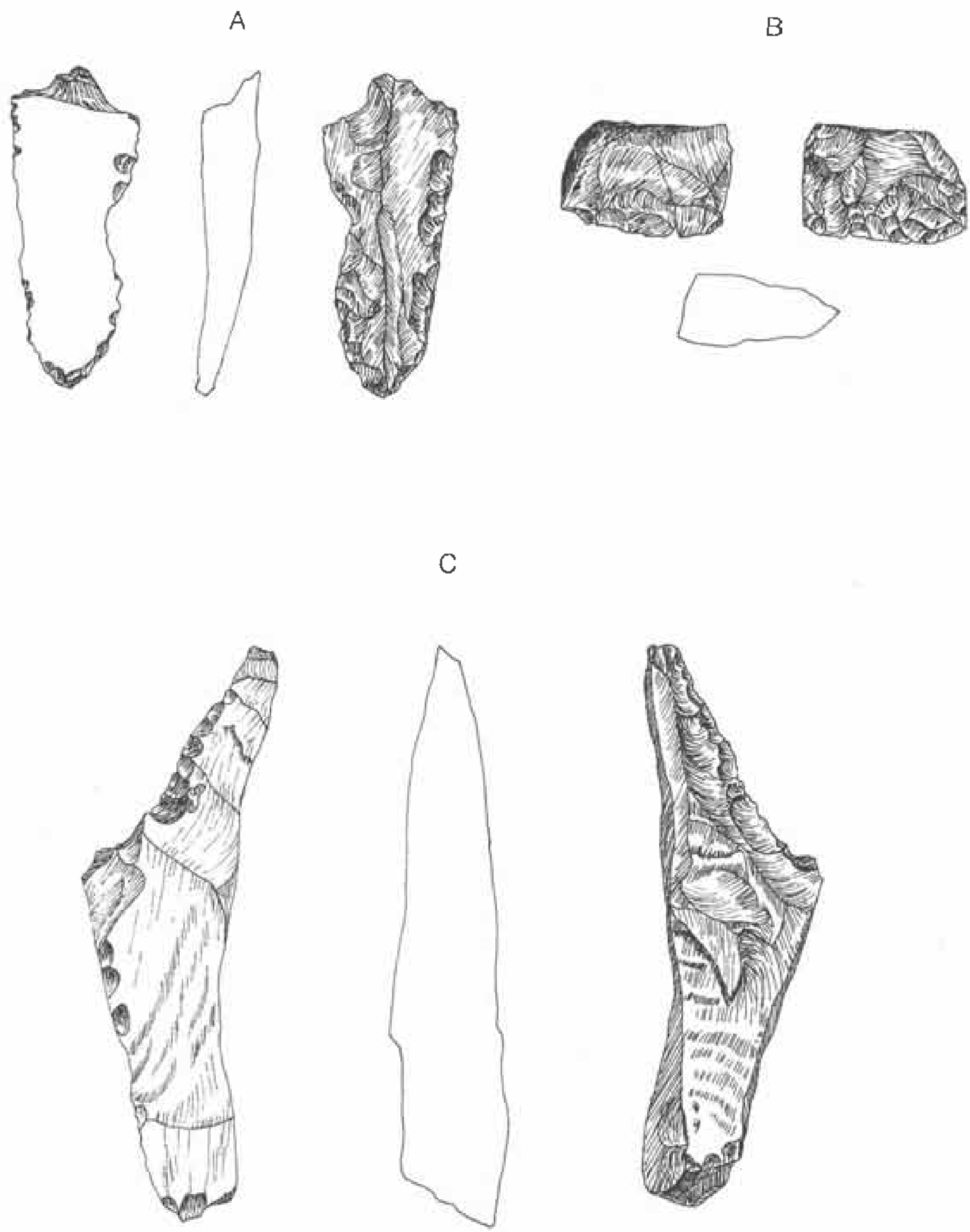

Figure 7. A: Composite Notched tool; B: Wedge; C: Tranchet flake. Actual size.

colored cortex, and upon fracture exhibit multiple colors and a waxy texture.

An analysis by Phil Shelley of Eastern New Mexico University on the relative frequencies of rock types from sample transects along the San Juan River gravel terraces revealed that quartzites, andesites, granite and sandstone were the most common rock types, while agatized woods accounted for only 1.2% (Shelley, personal communication, 1986). Shelley also noted that the agatized wood nodules are quite small, ranging from 2 to 7 cm in length. However, inspection of agatized wood nodules present in several modern day gravel quarry sites revealed nodules that were up to fist size.

It would appear from the Lime Ridge Clovis assemblage that there was an emphasis on the selection of agatized woods for the manufacture of unifacially retouched tools, while fine-grained quartzites seems to have been the preferred material for projectile points.

DISCUSSION AND CONCLUSIONS

One interesting facet of the Clovis assemblage is the absence of material types that are otherwise dominant in later Archaic and Anasazi sites on the mesa uplands. Some 20 - 30 kilometers north of the San Juan River Valley, numerous outcrops of large, fine-grained Brushy Basin Formation cherts and Burro Canyon Formation quartzites occur. The absence of these materials from the Lime Ridge Clovis site may suggest that the Clovis people did not consider these sources as desirable material for stone tool production or it may imply that the movements of the Clovis people were mainly confined to the San Juan River Valley. The latter statement is supported in part by two independent, but complementary lines of evidence provided by Larry Agenbroad of Northern Arizona University and Julio Betancourt of the U. S. Geological Survey. Agenbroad's research has focused on the occurrence and distribution of Pleistocene mammoth sites and packrat midden localities which have allowed reconstruction of Pleistocene environments as far back as 40,000 B.P. (O. Davis et al. 1984; Mead et al. 1986). Betancourt's research has focused on Late Pleistocene environments in southeastern Utah dating back to 13,000 B.P. (Betancourt and Biggar 1985).

Bechan Cave near the Colorado River in southeast Utah has yielded Pleistocene mammoth dung dated from 11,670 to 16,000 years B.P. (O. Davis et al. 1984; Mead et al. 1986). Pollen and macrofossil remains in the dung unit consisted of mixed riparian and upland species, including red-osier dogwood, blue spruce, birch, rose, wolfberry, saltbush, sagebrush, cactus, and grass. The mammoth bolus itself is dominated by grasses, sedge, and rushes. These data suggest that mammoths in the late glacial period in southern Utah may have concentrated along streams and other mesic sites in an otherwise arid landscape.

Betancourt (1985) has obtained data on late glacial environments from several packrat midden localities in southern Utah. One locality, Fishmouth Cave, is a large alcove situated at 5,200 feet (1,585 m) above sea level, and is located 25 kilometers north of the Lime Ridge Clovis site. The single oldest pleistocene midden from Fishmouth Cave dated at 12,770 years B.P. Dominant trees and shrubs from this midden include blue spruce, limber pine, red-osier dogwood, rose, Rocky Mountain juniper and dwarf juniper. None of these species appear at the site today, and they do not co-occur locally at elevations lower than 8,000 feet (2,440 m) (Betancourt and Biggar 1985).

Two early Holocene middens from Fishmouth Cave which date at 10,360 years B.P. and 9,700 years B.P. record vegetation changes during the Pleistocene-Holocene transition. Blue spruce, dwarf juniper and rose were no longer at the site. The middle and late Holocene middens from Fishmouth Cave approximate the modern flora, with only a few exceptions (Betancourt and Biggar 1985). These data from Fishmouth Cave are complemented by the late glacial paleoenvironmental record from Cowboy Cave and Allen Canyon Cave in Utah as well as the Bechan Cave Pleistocene plant record. The Fishmouth Cave Pleistocene plant record perhaps best reflects late glacial environmental conditions for the Lime Ridge vicinity.

Because of cooler summer temperatures and a greater percentage of precipitation at lower elevations during the late glacial period of the Pleistocene, excellent aquifers such as the Navajo Sandstone had perennial springs in almost every alcove (Betancourt and Biggar 1985). Wet alcoves, such as Fishmouth Cave, and streamsides would have supported blue spruce and a host of riparian elements such as red-osier dogwood, rose, and waterbirch. Such conditions may have supported a population of mammoths in the Lime Ridge vicinity, therefore attracting Clovis hunters to the area.

In conclusion, the Lime Ridge Clovis assemblage appears to be less specialized than those reported from kill and butchering sites. The low ratio of debitage to tools might suggest a special-use site, but the composition and character of the tool assemblage does not indicate butchering activity. Nearly all of the debitage is wastage from hard-hammer core reduction and unifacial tool manufacture and retouch. Therefore, we feel that the site was occupied briefly as an encampment, perhaps used as a hunting stand.

Further analysis will entail comparison of the Lime Ridge Clovis assemblage with those from other Clovis localities in the Plains and Great Basin. Lastly, further investigations at Fishmouth Cave which holds a high potential for Clovis age perishables may yield significant additional information about the Clovis occupation of southern Utah.

ACKNOWLEDGMENTS

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SANDY RIDGE: An Aceramic Habitation Site in Southeastern Utah

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INTRODUCTION

The Sandy Ridge site (42Sa 18500) is located in the northeastern portion of Dry Valley, south of Moab, Utah and the La Sal Mountains, at an elevation of 1,860 m (6,100 feet). This area is dominated by low sage and grasses, with pinyon and junipers abundant only around mesa edges and on mesa tops. The site was first encountered in 1987 during seismic explorations in the area. While cutting a road down a high narrow ridge top extending outward from a high and imposing, steep-walled sandstone mesa (Figures 1 and 2), the bulldozer operator noticed a small metate fragment and very light ash-staining in the cut. An archaeologist from the Office of Public Archaeology (OPA) at Brigham Young University visited and recorded the site. Two small test pits were dug into the ash-stained area to confirm cultural depth. Upon receipt of an ARPA permit in late spring, 1988, excavation was initiated at the site.

Ultimately, excavation revealed a rather large circular pit house containing at least one very large bell-shaped pit and several small subfloor pits. A large, partially slab-lined hearth was also present as were numerous artifacts. Macrobotanical samples retrieved from the floor and subfloor features indicated high percentages of Cheno-Ams and another plant type tentatively identified as St. Johnswort. In addition, charcoal samples submitted for radiocarbon dating indicated that occupation occurred at about A.D. 200.

SITE AND FEATURE DESCRIPTIONS

As originally recorded, the Sandy Ridge site occupies a rather limited space on a narrow ridge top, with a total site area less than 30 m diameter. This small area is a reflection of the few scattered artifacts encountered in or near the dozer cut. However, this part of Dry Valley contains numerous natural chert outcroppings which were utilized extensively during prehistoric times. The site itself is surrounded by such outcroppings and occasional flakes can be found among the natural chert not only in the immediate site area, but throughout the entire region. This makes site boundary definition difficult, although it would probably be safe to include not only the ridge top itself, but the drainage areas below the ridge as part of the general site area. Therefore, the outer site boundaries probably stretch to 150 m in diameter, with these outer areas generally representing lithic quarrying activities.

Excavation and Stratigraphy

An initial inspection of the site indicated three distinct ash stains in the bottom of the dozer cut. One stain was quickly determined to be dozer-dispersed ash. The remaining two stains, however, showed greater promise, and a 50 cm wide trench was placed between the two, as well as stretching well to the north and south. Generally, subsurface soils were a homogenous fine orange sand. However, between the two ash stains, the orange sand extended down only 20 cm. Below was a gray ashy sand 30-40 cm thick containing small pieces of sandstone, and then a distinct black charcoal-laden stratum 10 cm thick. These latter strata were within the distinct boundaries of a basin-shaped feature approximately 5 meters diameter.

The area was gridded out in 1 meter squares and the fill removed in natural stratigraphic levels. Due to time constraints, only the lower charcoal level down to the feature surface was screened, utilizing 1/4 inch mesh screens. Still, the upper strata, which represented obvious post-occupation structural collapse and natural deposits, were carefully observed during removal, and were noted as containing only sparse cultural materials. All artifacts on or within 5 cm of the floor were point-plotted on the structure map.

As mentioned above, the only feature encountered on the ridge top was the pit structure. The bulldozer destroyed the original ground level, and no evidence of additional subsurface features was noted. The pit structure and associated internal features are described below.

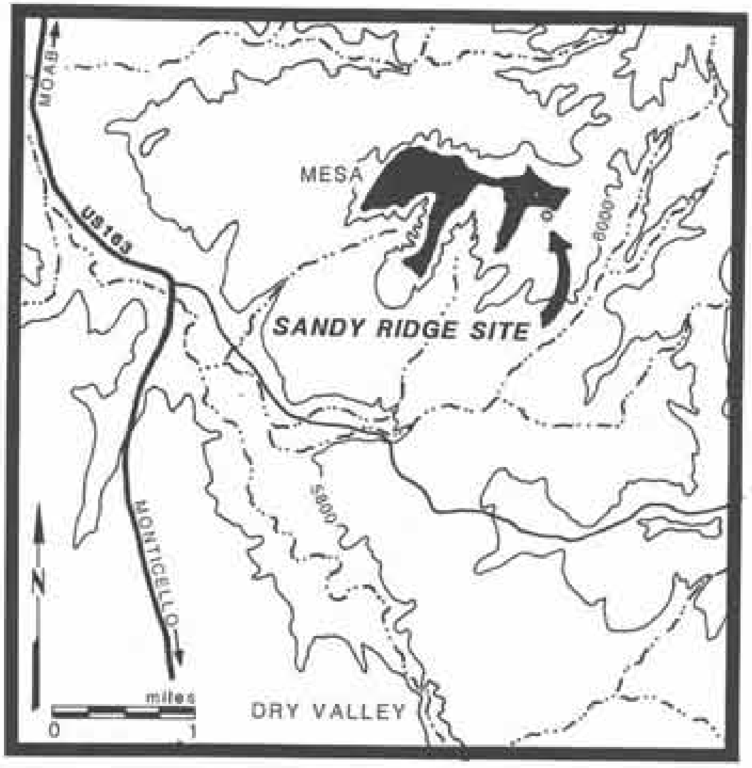

Figure 1. Location of Sandy Ridge Site, southeastern Utah.

Figure 2. Topographic setting of the Sandy Ridge Site.

Pit Structure

The pit structure (Figure 3) measures 5.05 m north-south by 4.75 m east-west. Maximum depth is 60 cm below the level of the dozer cut, which is perhaps 10-20 cm below modern ground level. The ridge top in this area is less than 5 m wide, so the east and west walls erode out to the very edges of the ridge, and are much lower than the north and south walls. The walls are unprepared and definition was made primarily by following a slight color and compaction differentiation. The floor, on the other hand, was covered by ash less than 1 cm thick in some areas, but over 10 cm thick in other areas. Often the sand below the ash had been burned to a dark red color and was quite hard. Numerous small (<10cm diameter) burned beam fragments were also found, especially in the southeastern floor area.

The floor was unprepared but moderately use-compacted. Lithic debitage was scattered across the floor area, although somewhat sparsely in the western half. Bone was centered primarily around the hearth. Tools encountered on the floor included several small projectile points, a large drill, several large chert cores, two hammerstones and a chopper. A large sandstone slab metate fragmented into four pieces, and a larger unshaped sandstone slab were located 15 cm above the floor near the northern wall.

Features

In addition to the artifacts described above, a large hearth and numerous subfloor pits were located on the floor. These are as follows:

Hearth. Slightly north of center in the structure floor, a large circular hearth was uncovered. As originally constructed the hearth consisted of a hearth basin surrounded by a 20 cm high ring of sand and several vertical slabs. However, *in situ* slabs were found only on the west and south sides during excavation. A vertical slab on the east side had been pushed somewhat out of place, and several slab fragments were found lying on the floor just to the east of the hearth.

The hearth measured 1 m N-S by 1.05 m E-W. Maximum depth was 35 cm from the top of the slabs. The bottom of the hearth, composed of sterile orange sand, was covered by 10-20 cm of a brownish sand with light ash, and occasional patches of highly oxidized tan sand. Numerous bone fragments and lithics were present in the hearth. The outer edges of the vertical slabs were covered with a sloping, heavily oxidized gray sand.

Subfloor Pits. A total of nine subfloor pits were found in the structure. Most were small and relatively shallow, although one important exception--Pit 1--was found, which deserves greater description.

Pit 1 - This pit was by far the largest and most significant of the subfloor features uncovered. From floor level it appeared as an oval (80 by 56 cm) opening abutting and slightly undercutting the north wall. Set slightly back from the southern edge was a line of vertical slabs (some broken into numerous smaller fragments). A vertical slab on the western edge of the pit opening suggests this slab-alignment originally surrounded the pit. Slabs extended a maximum of 20 cm above the floor.

Fill in the pit was extremely black with charcoal-stained sand from floor level downward, decreasing in intensity only in the bottom 20-40 cm. Occasional flakes, two large burned chert cobbles, a chert core, several smaller sandstone slab fragments, and numerous red, heavily-burned patches of sand were noted in the fill. Fragments of large burned beams were also found throughout the fill.

The pit bottom was encountered at a depth of 90 cm below the structure floor. At this point several randomly placed horizontal slabs lay above sterile orange sand, and in a gray ashy sand matrix. The lower pit walls bell outward near the pit floor, to approximately 120 by 160 cm. Several large burned beams were pushed back into the recesses of the pit bottom - areas where they could not possibly have fallen from above - and patches of the pit walls appeared heavily burnt. The above evidence suggests intentional burning within the pit. The interpretation reached by the excavators was that the final usage of the pit was as a large heating pit--possibly for heat-treating large chert cobbles and cores. Whether it had another usage (for example, storage) prior to the burning episode(s) could not be determined. However, either the metate or large unworked sandstone slab near the pit opening could have served as partial covering for the pit.

Pit 2 - This small pit is oval in shape, measuring 25 by 35 cm in diameter, and approximately 15 cm

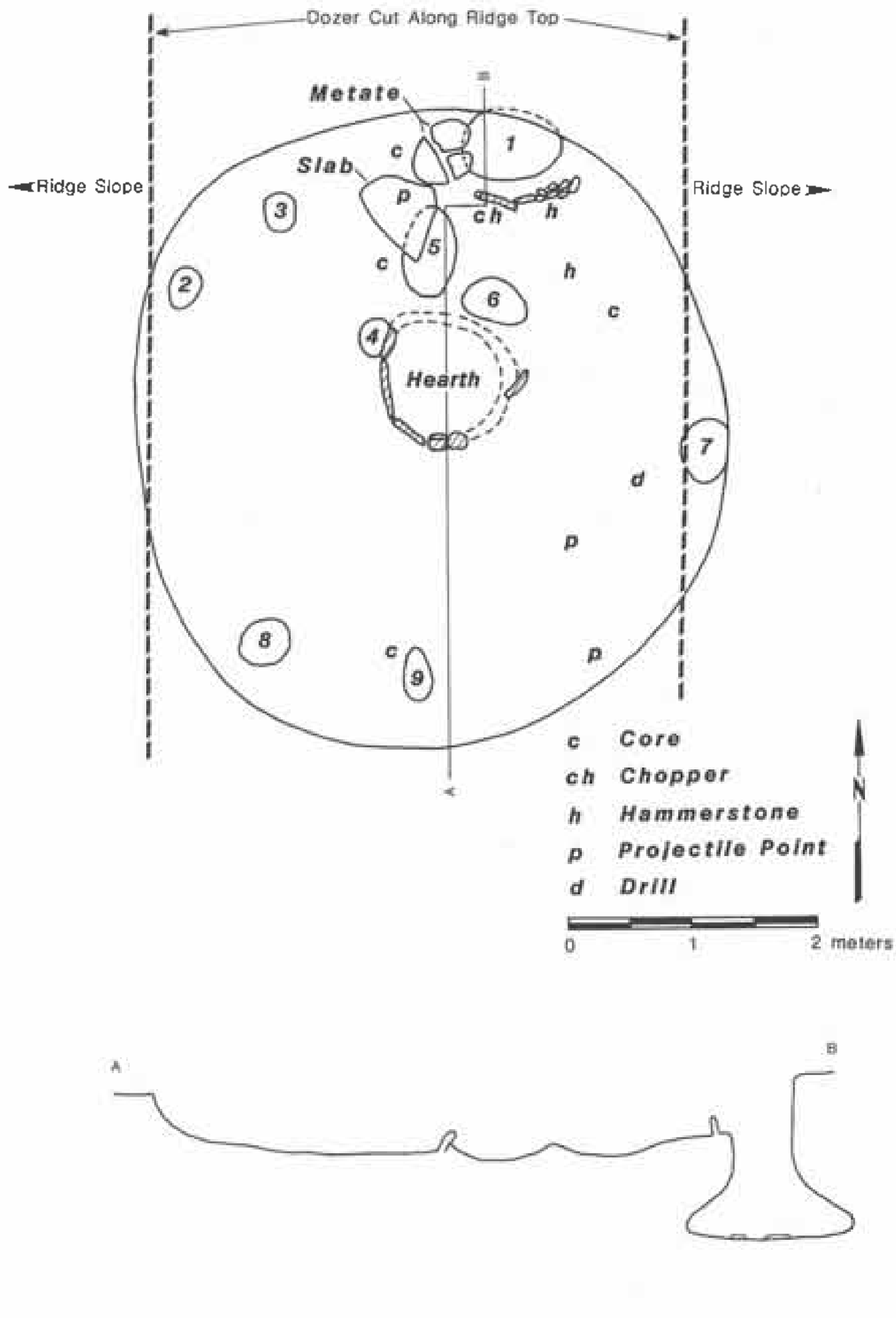

Figure 3. Plan and profile of Pit Structure.

Table 1. Radiocarbon Dates from Sandy Ridge

Beta Number	Provenience	Calibrated C-14 Years B.P.	Calibrated Range A.D.	Midpoint A.D.
Beta-26786	Floor	1790+100	10-430	220+210
Beta-26787	Floor	1760+60	55-415	235+180
Beta-26788	Floor Zone	1830+80	-15-405	195+210

deep. Walls were vertical except on the west side, which was slightly undercut. The pit bottom was flat. Fill was an ashy gray sand. Pit function is undetermined.

Pit 3 - This pit was circular, 30 cm diameter feature 12 cm deep with a basin shape. Fill was an ashy gray sand. Pit function is undetermined.

Pit 4 - This feature was 30 by 20 cm diameter, 10 cm deep, and abutts one of the hearth slabs. The sides were steep and the bottom was flat. Fill was an ashy gray sand. Function is undetermined, although it was likely related to hearth use.

Pit 5 - This large pit was 60 by 70 cm diameter and 22 cm deep, with a basin shape. Given its proximity to the hearth, and a heavy black charcoal, sandy fill, the feature probably was an ash pit.

Pit 6 - This pit was a maximum of 45 by 40 cm diameter, although appearing more oval in shape. The sides slope steeply down to a level of naturally occurring rocks at 15-20 cm. Fill was a dark ashy sand. Function is undetermined, although the pit appears to be associated with the hearth.

Pit 7 - This oval pit was 50 by 40 cm diameter, and 50 cm deep. It abutts the east wall and has vertical sides except on the north, which undercuts the floor. Fill was ashy gray sand. Function is undetermined.

Pit 8 -This circular, 40 by 42 cm diameter pit was 22 cm deep, with steep sides and a flat bottom. Two small slabs, one of which was a groundstone fragment, were lying on the pit floor. Fill was an ashy gray sand. Function is undetermined.

Pit 9 - This pit was 45 by 22 cm diameter, with a sloping floor 10 to 20 cm deep. Sides were vertical to steeply sloping. Fill was an ashy gray sand. Pit function is undetermined.

CHRONOLOGY

Three carbon samples from charred roofbeams on or very near the floor were submitted for radiocarbon dating. The results are presented in Table 1. The three dates are not statistically different at P=0.05 (Thomas 1976:249-251) and can be averaged (Long and Rippeteau 1974) to 1785±43 B.P., with a calibrated range (Klein et al. 1982) of A.D. 43-388, and a midpoint of A.D. 216±173.

In addition to the radiocarbon samples, four charred beam samples were submitted to the Laboratory of Tree-Ring Research at the University of Arizona, for dendrochronological analysis. Of these four, three were juniper and the fourth pinyon. Unfortunately, chronological data from this area and period are weak, and no cross-dating with comparable age specimens could be obtained. Neither could cross-dating be established between the tree-ring the samples (William Robinson, personal communication 1988).

Despite the failure to obtain tree-ring dates, the tight clustering of radiocarbon dates are convincing enough to infer an occupation around A.D. 200. The absence of ceramics at the site supports this early occupation date.

Table 2. Chipped Stone and Ground Stone by Material Type

ARTIFACT TYPE	Felsite	CCS*	SLS**	Sandstone	Quartzite	Other	TOTAL
	MATERIAL TYPE						
Projectile Point		4					4
Biface		13					13
Uniface		2					2
Core		5			1		6
Cobble	2	12			2		16
<60° Flake		31					31
>60° Flake		6					6
Unworn Flake		845	3	4	85	31	938
Mano				3			3
Metate				11			11
TOTAL	2	918	3	18	88	1	1030

*CCS: Cryptocrystalline silicate
**SLS: Silicified limestone

MATERIAL CULTURE

Chipped Stone

A total of 1016 chipped stone artifacts was collected from the site (Table 2). The assemblage is composed of six different types of raw materials, including felsite, cryptocrystalline silicates, silicified limestone, sandstone, quartzite, and an as yet unidentified stone. Nearly all of the material is from either lower fill, floor, or subfloor pit contexts.The majority of the chipped stone artifacts from the site are composed of cryptocrystalline silicates. The assemblage includes 5 cores, 12 cryptocrystalline silicate cobbles (a category which includes unused nodules, hammerstones, choppers, etc.) as well as over 900 flakes and small tools. The next most important material, in terms of relative abundance, is quartzite, represented by two cobbles, one core, and 85 unworn flakes. The remaining material types are represented by relatively few artifacts. All represented materials are available in outcrops and stream cobbles within the general catchment area of the site.

Four small projectile points (Figure 4a-d) were retrieved from the floor and lower fill. Projectile point typology for this part of Utah is not well established, but all four specimens appear to be small side-notched points of an unnamed variety.

Other tools at the site include 13 bifaces (including one drill; see Figure 4e-h), 2 unifaces, 16 cobbles, 6 cores, and 37 edge-worn flakes. The latter were divided into two categories according to edge angle: low angle, less than 60°; and high angle, greater than 60°. These two categories generally correspond to sharp tools and steep edged, scraper-like tools. As the table shows, sharp-edged tools dominate the utilized flake assemblage, comprising around 84% of the total. This suggests that activities requiring sharp, rather than steep edges were more commonly undertaken by the site's inhabitants. The nature of wear on these sharp edges suggests that relatively soft materials , such as tissue, hide, and bark were being cut. Heavier and more extensive edge wear associated with cutting harder materials is not well represented in the assemblage.

Other activities represented in the lithic assemblage include hunting/butchering, core reduction/flake production, and biface thinning. The two unifaces and several steep edge-worn flakes also suggest that hide preparation and wood/bone working may have occurred at the site.

Ground Stone

All of the ground stone (see Table 2) recovered from the site is sandstone and includes three mano fragments, 5 small metate fragments, and two broken metates. All of the mano and metate fragments are from the structure fill and floor except for one fragment which was found in the bottom of Pit 8. Of the two broken metates, one was found on the surface of the ridge approximately 1.5 m north of the structure. It is shaped, 30 cm by 22 cm and 5 cm thick and has a shallow pecked and ground surface. The other metate was found in the lower structural fill near the northern end of the structure. It is a large, shaped, slab metate 56.5 cm long, 43 cm wide, and 3 cm thick. The surface is pecked and ground.

Bone

Bone remains recovered from the site consist of 86 small splinters and fragments. The majority appear to be from long bones of large mammals, and only a few are obviously from medium or small-sized animals. Only three bone fragments were identifiable. One is cottontail rabbit (Sylvilagus spp.), one jackrabbit (Lepus spp.), and one is a partially decomposed, distal right tibia fragment from an unidentified artiodactyl - possibly mule deer. All of the bone recovered from the site was found on or near floor level within the structure and over 80% of this total was located in two areas adjacent to the hearth. Nearly half (44%) of the bone is burned to some degree.

PALEOBOTANICAL REMAINS

Several pollen samples from the floor of the structure were processed, but preservation was poor and none contained sufficient pollen grains for counting and analysis. Much better results were obtained from floated soil samples which contained abundant charred plant remains. Six soil samples from the structure produced several hundred charred seeds representing nine plant taxa. Plant species are dominated by Cheno-Ams and an unknown plant type (Unknown A) tentatively identified as St. Johnswort (Hypericum sp.). Other plant species are present in very small amounts and are listed in Table 3. Sample locations are as follows: Sample 1 - northwest of hearth; Sample 2 - western edge of hearth exterior; Sample 3 - hearth interior; Sample 4 - eastern edge of hearth exterior; Sample 5 - between hearth and east wall; Sample 6 - near southern wall.

Most of these plants are known from ethnographic literature to have been utilized as food or for medicinal purposes by Indian groups of the Great Basin and Southwest. Most have also been recovered from Anasazi Basketmaker II structures (Ford 1984). Cheno-Ams were an important food resource in the past and are one of the most common plant remains recovered from Archaic and Formative sites in the region. Hypericum sp. is not a commonly recovered plant, but is known to have been utilized for food, as a medicinal plant, and for a yellow dye (Sweet 1962; Train et al. 1941).

SUMMARY AND CONCLUSIONS

Archaeological investigations of an exposed ash deposit led to the unearthing of an aceramic pit house representing a single occupation at ca. A.D. 200. The pit house is circular and has a central slab-lined hearth. No indications of an entryway or wing walls were noted. Several subfloor pits within the structure are present, but no specific function could be determined for most. However, one large bell-shaped pit was possibly utilized for heat-treatment of raw chert materials, while a second appears to have been used as an ash pit.

Artifacts associated with the structure include stone tools and debitage, bone fragments, and

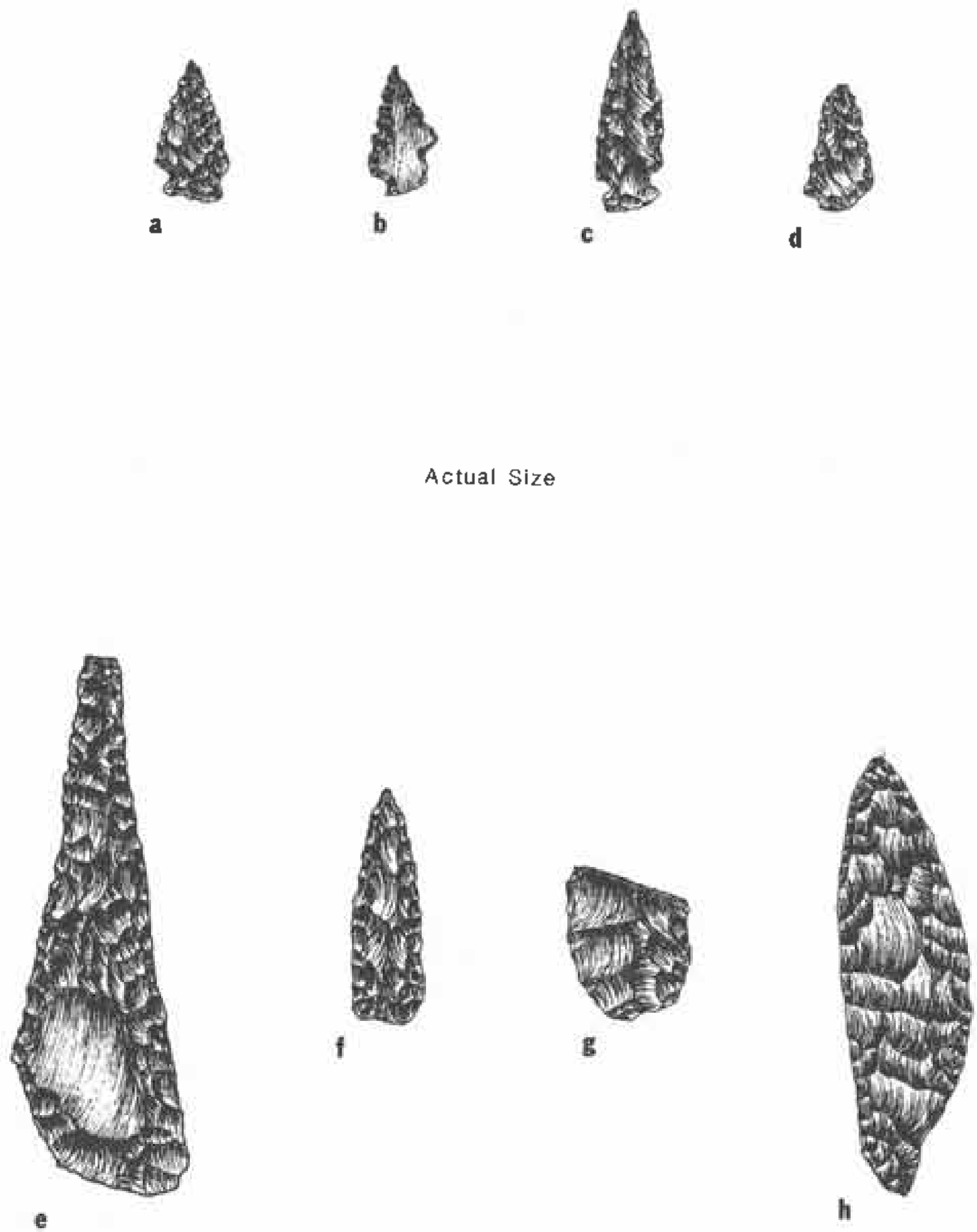

Figure 4. Projectile points and chipped stone tools from Sandy Ridge.

Table 3. Sandy Ridge Macrobotanical Flotation Results

TAXA (SD=Seed; CH=Charred; UCH=Uncharred)	SAMPLE 1	2	3	4	5	6	TOTAL
Amaranthus SD,CH	0	0	0	1	0	0	1
cf. *Astragalus* SD,CH	0	0	0	0	1	0	1
Cheno-Am SD,CH	30	61	5	163	172	55	486
Cheno-Am SD,UCH	0	0	0	0	1	0	1
cf. *Descurainia* SD,CH	0	2	1	6	1	2	12
cf. *Eriogonum* SD,CH	0	0	0	0	1	0	1
cf. Euphorbiaceae SD,CH	0	0	0	0	0	2	2
Gramineae SD,CH	0	0	0	0	1	2	3
cf. *Mammillaria* SD,CH	0	0	0	1	0	0	1
cf. *Polygonum* SD,CH	1	0	0	0	0	0	1
Portulaca SD,CH	0	1	0	1	0	1	3
cf. *Sporobolus* SD,CH	0	0	1	1	0	0	2
Unidentifiable (*Hypericum* sp.) SD,CH	0	1	0	3	0	4	8
Unknown A SD,CH	33	104	2	151	73	20	383
Unknown B SD,CH	4	3	0	1	3	0	11
Unknown C SD,UCH	0	0	0	0	1	0	1
SUM OF TAXA	5	7	5	10	10	8	45
SUM OF BOTANICAL ITEMS	157	178	12	341	278	95	917

ground stone. Activities indicated by artifactual remains include quarrying of local cherts for production of stone implements, processing of wild plant resources, and animal procurement, butchering and cooking.

Subsistence information recovered from the structure suggests intensive utilization of wild edible plants, and procurement of large and small game. Although no domesticates were recovered from the site, their absence may simply be a result of poor

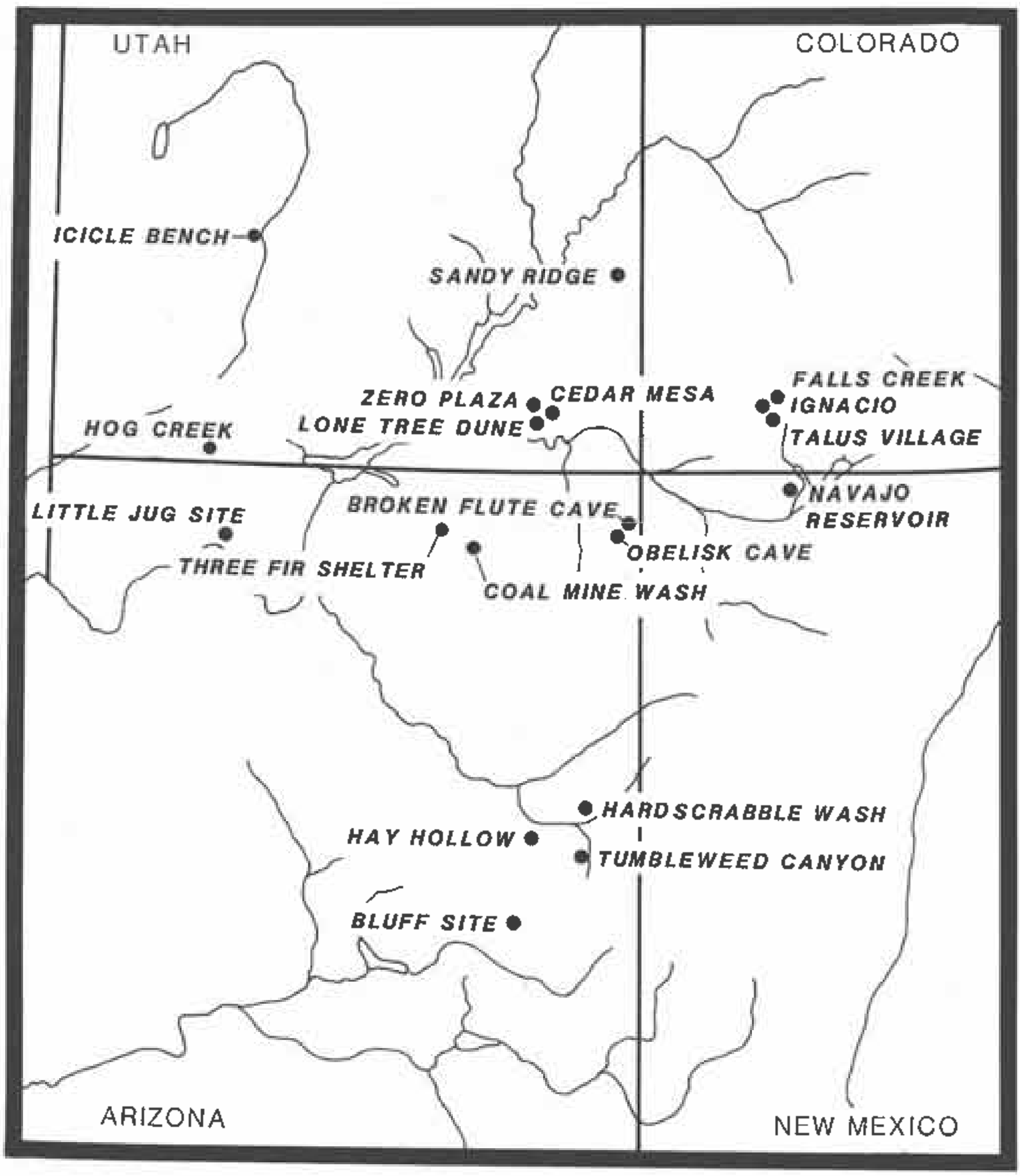

Figure 5. Locations of Basketmaker II Period sites in the Southwest.

preservation. Alternately, it may reflect either a lack of successful maize cultivation, or a seasonal or functional use of the site not involving maize production. Even dry farming in the area would have been very risky unless climatic conditions were more favorable than they are at present. There are no permanent water sources in the vicinity of the site and the modern average annual precipitation in the area is only ca. 22 cm, well below the 32 cm minimum required for Hopi dry-farming (Hack 1942). Runoff from the large mesa adjacent to the site, however, may have provided the extra moisture needed to sustain crops, which could have been planted along the arroyo bottoms.

Small projectile points recovered from the structure suggest that the bow and arrow may have been in use in this area of southeastern Utah at least by A.D. 200. This date is consistent with Geib and Bungart's (this volume) estimate for the arrival of the bow and arrow in the Glen Canyon Area. Their suggestion that terminal Archaic/proto-Fremont peoples utilized the bow and arrow, while the contemporaneous ancestral Anasazi continued to utilize the atlatl until Basketmaker III (ca. A.D. 600) times is especially intriguing from the perspective of the Sandy Ridge Site. Although Sandy Ridge is on the northern edge of the traditionally recognized Anasazi area, it is farther still from established early Fremont occupations (Figure 5 illustrates the location of Sandy Ridge in relation to other Basketmaker II habitation sites, including those discussed in Berry [1982], Hog Creek [Schleisman and Neilson 1987] and Three Fir Shelter [Smiley et al. 1986], and the transitional Archaic/Fremont site of Icicle Bench). Architecturally, the pit house is similar in many respects to Basketmaker II structures in southeastern Utah (see Matson et al. 1988 and Berry 1982). Although we feel the evidence is stronger for a Basketmaker II occupation, the site presents interesting data for future research on contacts between, or development of, early Fremont and Anasazi groups of the northern Colorado Plateau.

The single pit house unearthed at the Sandy Ridge site was a fortuitous and unanticipated find of particular interest both because of its date of occupation and location. The presence of small arrow points, and the lack of ceramics or domesticates also present significant comparative information for future study. Perhaps most significant and disturbing is the inconspicuous surficial appearance of the site, supporting the suggestion of Matson et al. (1988) that lack of early (Basketmaker II) sites in southeastern Utah may be a problem of visibility. This in turn has implications for future site classification and significance determinations.

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A PRELIMINARY REPORT OF ARCHAEOLOGICAL EXCAVATIONS AT ANTELOPE CAVE AND ROCK CANYON SHELTER, NORTHWESTERN ARIZONA

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INTRODUCTION

Archaeological research on the Arizona Strip generally and the Uinkaret Plateau specifically has been sparse (see Altschul and Fairley n.d. and Westfall 1987 for reviews). The reasons for this are not clear but are likely related to the geographical and political isolation of the region. The majority of the recent work done in this portion of the Arizona Strip has been survey related to development activities such as transmission line and road construction (e.g., Davis 1982; Moffitt et al. 1978; Wade 1967) and Bureau of Land Management (BLM) surveys related to mineral and range programs (Aline LaForge, personal communication 1989). Excavations at Antelope Cave have been the exception (see section below on Antelope Cave). In 1983 Brigham Young University (BYU) entered into a cooperative agreement with the BLM, Arizona Strip District, to assess several sites deemed significant by BLM personnel and to complete analyses of data recovered from Antelope Cave in the 1950s. Research interests behind these investigations consisted of fundamental questions related to chronology, subsistence and settlement. The tests at Antelope Cave and Rock Canyon Shelter have been made under this ongoing agreement and with these general issues in mind. The data presented here are preliminary only. Complete data sets and stratigraphic profiles will be included in the final reports currently in preparation.

ROCK CANYON SHELTER

Rock Canyon Shelter (AZ A:3:20 BLM) is located at the head of Rock Canyon just west of the confluence of Clayhole Wash and Short Creek in the northwestern portion of the Uinkaret Plateau

(Figure 1). The canyon was carved by Short Creek, an intermittent stream draining the Vermillion Cliffs and Canaan Mountain region south of Zion National Park. Short Creek flows through Canaan Gap, which separates Little Creek and Lost Spring mountains, both of which contain significant concentrations of Anasazi sites (Thompson 1980, Heid 1982). About one hundred meters to the west of the shelter the canyon deepens dramatically as it slices through the Hurricane Cliffs to Hurricane Wash, 350 m lower than rock Canyon Shelter and four and a half km to the west. The view down canyon from the shelter mouth is spectacular (Figure 2). Rock Canyon is one of only two major canyons that cut through the Hurricane Cliffs. The other is Cottonwood Canyon about three km to the south of Rock Canyon.

No professional work had been done at the site previous to the BYU visit in 1985, although it was clearly well known to collectors. The BYU work was aimed at site assessment, i.e., determining whether intact sediments were present and, if possible, establish the span of occupation. Both of these goals were met.

The site is small, ca. 25 m wide by 7.5 m deep with maximum headroom about two meters (Figure 3). A pictograph is present on the cliff face that forms the shelter dripline. Probably 90% or more of the site surface inside the dripline was disturbed. At the time of our visit, vandalism had generated a general scatter of prehistoric rubbish, e.g., sherds, cordage, corncobs, chipped stone, etc, as well as some historic trash. The presence of sandstone slabs and juniper bark on the surface suggested that the site at one time contained slab-lined cists. A considerable berm of spoil dirt from vandal digging, and spall and colluvium from the cliff face partially obscures the shelter entrance. A ragged profile in a looters hole roughly paralleled the dripline for about half the width of the shelter. Preliminary cleaning of this profile revealed clearly stratified sediments of spall, ash, and matted vegetation. The BYU investigations established that undisturbed deposits were present just inside and appeared to continue outside the shelter dripline. All deposits inside the dripline were dry.

Excavations

Excavations were limited to the profile cleaning mentioned above and tests to sterile to sample the stratigraphy and obtain dates. Once cleaned it was apparent the sediments were well stratified with clear banding of ashy deposits interspersed with vegetal material, and small, angular limestone spall derived from the shelter roof. Excavations proceeded by natural stratigraphy and all sediments were screened on site with quarter inch sieves. Excavations were confined to an expansion of the existing looters pit. Test A sampled only lower level deposits as the profile was cleaned and exposed to sterile sediments. Test B excavated a .5m by .5m column to sterile which was reached at 1.7m below current ground surface.

Features

Excavated features include a small, shallow hearth in the lower deposits and a basin-shaped hearth in the upper levels. Other hearth-like features were visible in the profile but were not explored. As noted above, sandstone slabs on the surface of the shelter suggests that cists may have been present prior to the looting activity; none were documented during our short visit, however.

Material Culture

The excavations at Rock Canyon Shelter were limited and artifact yield was small, although the amount of prehistoric cultural material on the surface suggested that site use was intensive. Surface collections and excavations produced some ceramics, including a clay figurine fragment, abundant lithic detritus and some chipped and ground stone tools, cordage, a sandal fragment, and considerable floral and faunal remains. These are described briefly below.

Ceramics

The majority of the few ceramics (58 total) collected at the site were unprovenienced. Sherds were restricted to the upper 30 cm of the deposits. The sample suggests that the site was visited throughout the Anasazi period from Basketmaker III (represented by Mesquite Black on Gray) to Pueblo II (evidenced by the presence of North Creek Corrugated). Most abundant were North Creek Gray wares. Other types present were Boulder Gray, Sevier Gray (a Fremont type), Virgin Series Black on Gray, Trumball Black on Gray and a single San Juan redware sherd. The figurine fragment of unfired clay was found on the surface

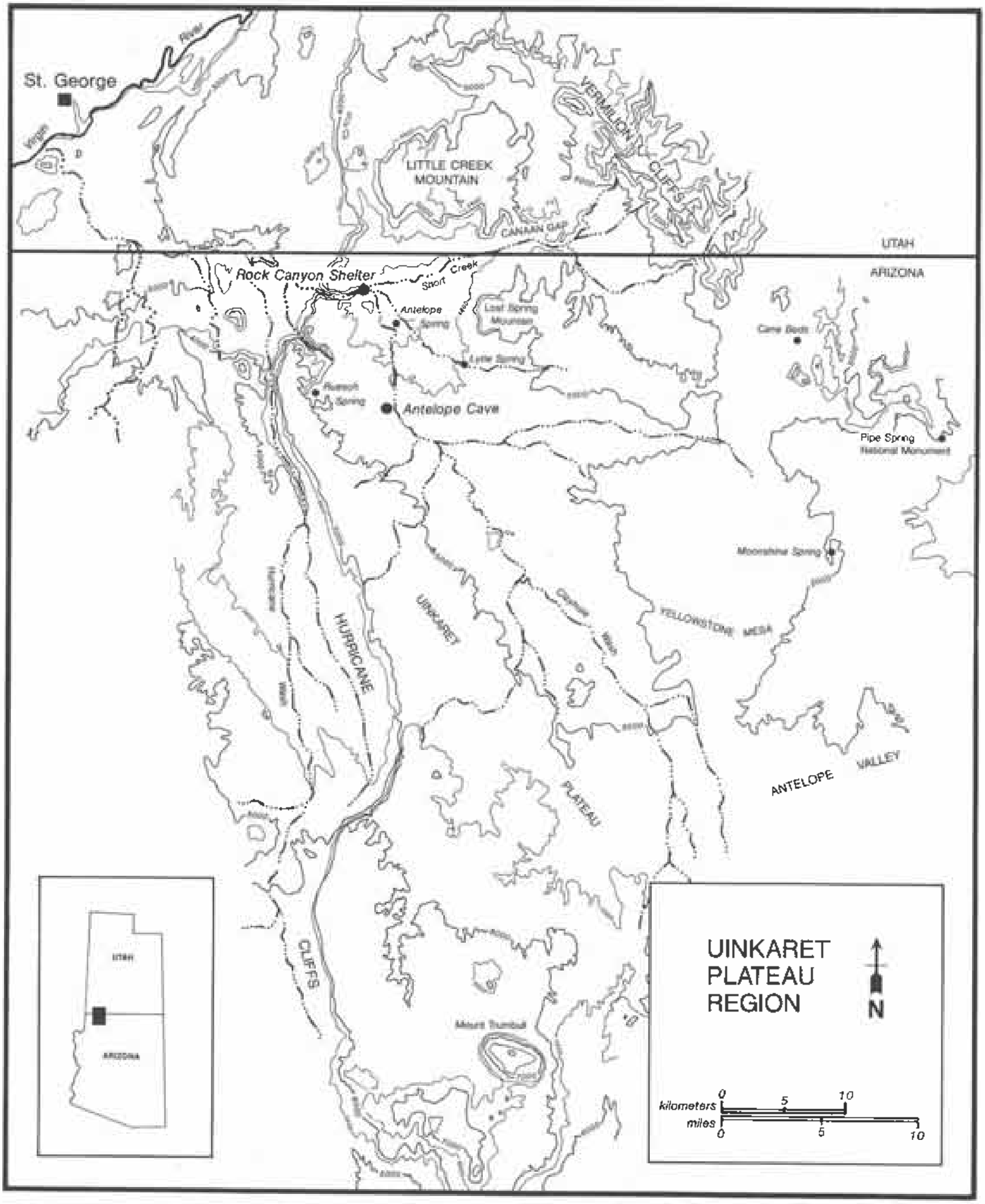

Figure 1. Map of the Uinkaret Plateau Region.

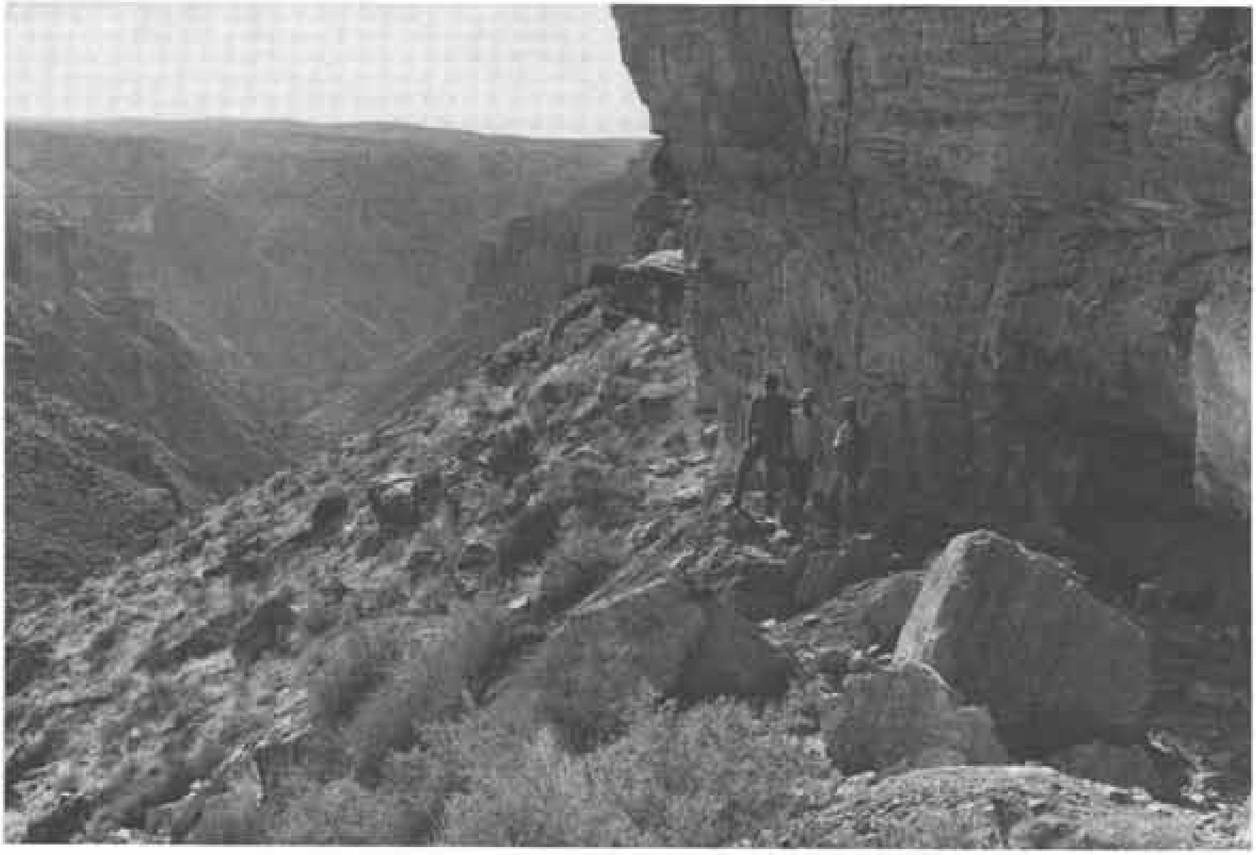

Figure 2. The view down Rock Canyon. Shelter is to the right of the photo.

about a year after BYU's test (Greg Woodall, personal communication 1986).

Lithics

A total of 4426 lithic artifacts was collected from the tests and wall cleanings at Rock Canyon Shelter. This assemblage was composed of over 95% unworn cryptocrystalline silicate flakes, made of locally available material. Less than one percent of the total was obsidian, and the remaining items were made of either quartzite, limestone, or sandstone. Less than one percent of the total collected assemblage showed evidence of edge wear, while nearly two percent of the items were retouched, or modified in some way.

Eight pieces of groundstone were also collected. Two were sandstone slab metates, two were small manos of sandstone and limestone, and the remainder were fragments of manos, handstones, or metates. Several were fire-blackened and heat-spalled.

Nine projectile points were recovered from the tested areas. These included an Elko Corner-notched/Gypsum (Gatecliff Contracting-stem, cf. Thomas 1981) point (Figure 4a), a reworked Elko Side-notched (Figure 4c), two Elko Corner-notched (Figure 4d,h), three Rocker Side-notched (cf. Holmer 1978:55) (Figure 4b,e,f), and a San Rafael Side-notched (cf. Holmer 1978:53) point (Figure 4g). The latter, and one Elko Corner-notched point are whole. All are made of variously colored chert.

Dates associated with these points correspond well with radiocarbon dates from the shelter. Recovered projectile points are considered Archaic or late Archaic, and all were found below the Anasazi sediments in the shelter. Gypsum points date between 4500 and 1500 B.P. in the eastern Great Basin and northern Colorado Plateau

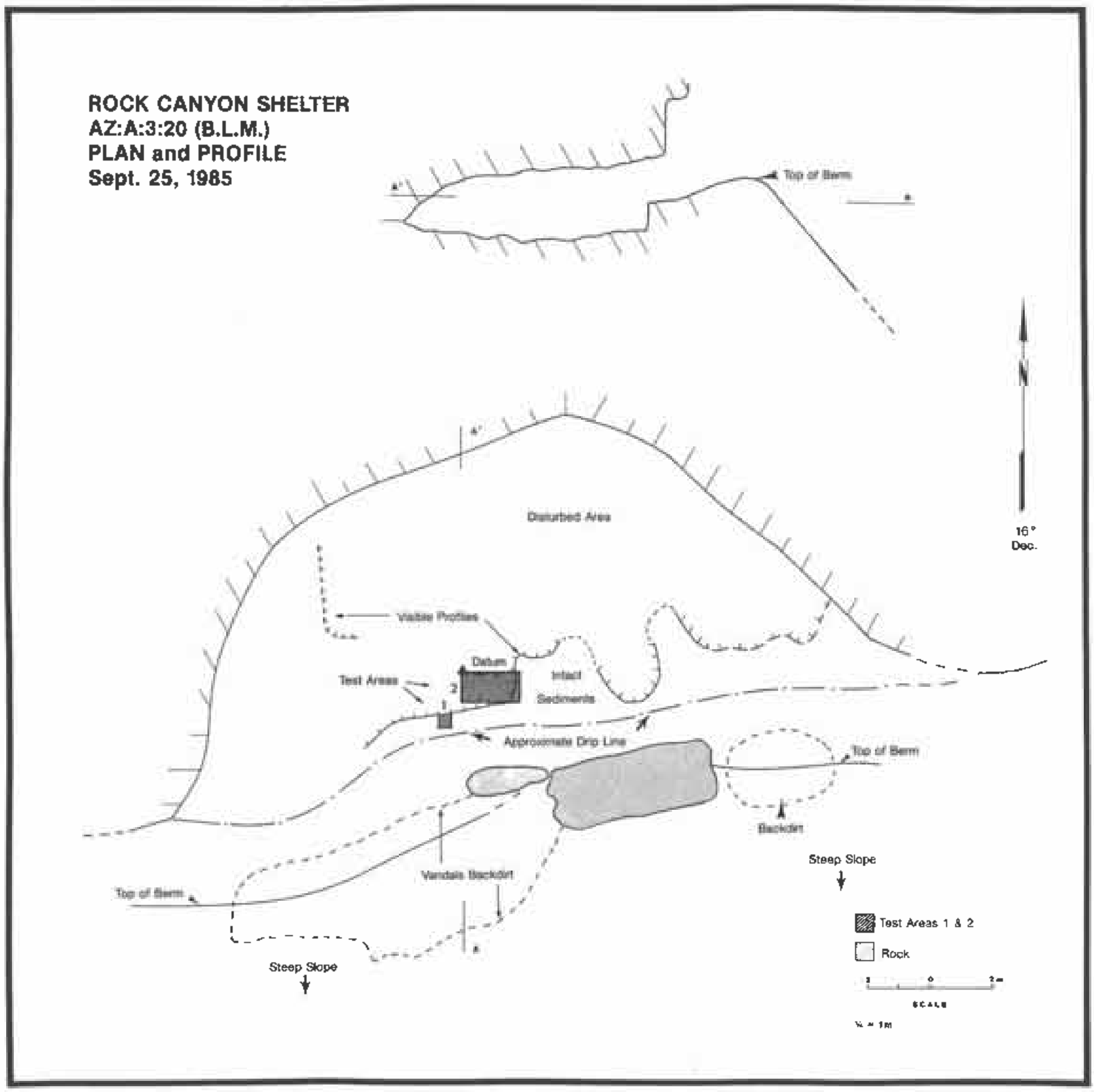

Figure 3. Plan view of Rock Canyon Shelter.

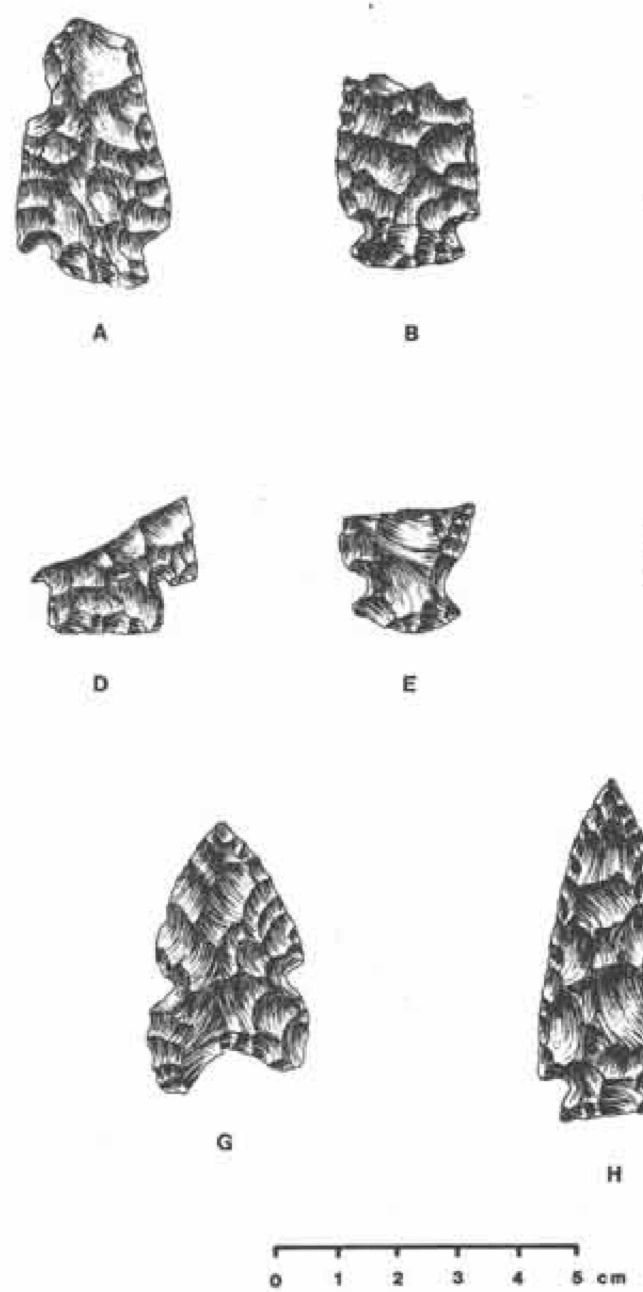

Figure 4. Projectile Points from Rock Canyon Shelter (Elko Corner-notched/Gypsum: A; Rocker Side-notched: B, E, F,; reworked Elko Side-notched: C; Elko Corner-notched: D, H; San Rafael Side-notched: G).

(Holmer 1978:70), and between 2400 and 3700 B.P. in the central and southern Great Basin (Wilde 1985:144). Holmer (1986:112) notes that these points appear earliest in the southeastern Basin, and they have been recognized as part of a late Archaic cultural complex on the northern Colorado Plateau (Schroedl 1977). Another Colorado Plateau point, the San Rafael Side-notched style, tends to occur between 4600 and 3700 B.P. (Holmer 1978:69). Elko Side- and Corner-notched points are generally poor temporal markers, but usually occur in eastern Basin and northern Colorado Plateau Archaic contexts dated after about 7,600 years ago (Holmer 1978:62). Rocker Side-notched points are considered by Holmer (1978:68) to date to between 6800 and 5300 B.P. in the eastern Basin.

Perishables

Organics were present on the surface of the site inside the dripline where deposits were dry. Several fragments of 2-ply, s and z twist *Yucca* sp. cordage were collected. In addition, a multi-warp, yucca fiber sandal fragment was found in a pack rat midden on the east edge of the shelter (Greg Woodall, personal communication 1989). The sandal is a Basketmaker style. Reddish colored fibers exposed in a break suggest the presence of design elements, but none was visible with rudimentary cleaning.

Subsistence Data

Faunal Remains

Faunal remains were common at the site. Large mammal remains, including mountain sheep and deer were the most abundant followed by small mammals, especially cottontail and black tail jack rabbits. There is a strong tendency for large mammal bones to be more abundant in the preceramic levels at the site, while small mammals dominate the faunal record for the later Basketmaker and Pueblo occupations. Jack rabbit and cottontail numbers are about equal throughout the deposits. Birds remains were also present as evidenced by both feathers and bones, but were few in number.

Botanical Remains

Macrobotanical materials were abundant with 43 taxa represented (Edwards 1987; Deborah Newman, personal communication 1988). Most were wild species available a short distance from the shelter. The most common taxa important for subsistence were yucca, opuntia, grasses, pine nuts, Cheno-Ams, wild gourd, and corn. Importantly, corn was found associated with early levels in the shelter.

Dating

Six radiocarbon dates were returned from charcoal samples collected from Rock Canyon Shelter. These are shown in Table 1. Calibrations were run using CALIB (Stuiver and Reimer 1987).

These dates make a nearly perfect ladder of time up through the sediments, and they correspond well with artifactual and other evidence of culture history in the shelter. Anasazi artifacts, including basketmaker and pueblo sandals and ceramics, are associated with the sediments dated A.D. 668 and later. Archaic artifacts were dominant in deposits dated earlier.

Corn remains were found in good association with dates A - C. The earliest (C), calibrated between B.C. 204 - A.D. 119, corroborates the ca. 175 B.C. dates on corn at the Elsinore Burial Site in central Utah (Wilde and Newman 1989), and other early corn dates in the region (e.g., Cowboy Cave [Jennings, 1980]; Clydes Cavern [Winter and Wylie 1974]; and dates from northeastern Arizona [see Smiley, et al. 1986 for a review]).

Discussion

The BYU test of Rock Canyon Shelter, although very limited, clearly demonstrated the usefulness of this site for understanding the prehistory of the Arizona Strip region. Intact sediments were present at the time of the test as demonstrated by the clean laddering of carbon 14 dates. The site contained evidence for occupation from Late Archaic times (ca. 4000 BP) well into the Anasazi period

Table 1. Radiocarbon Dates and Calibrated Ranges, Rock Canyon Shelter, Northwestern Arizona.

Laboratory Number	Radiocarbon Age	Calibrated Range	Sigma	Probability*
A Beta 14602	1270 ± 60 B.P.	A.D. 668 - 794	1	1.00
B Beta 14603	2020 ± 60 B.P.	B.C. 105 - A.D. 28	1	0.96
C Beta 14604	2030 ± 70 B.P.	B.C. 204 - A.D. 119	2	0.99
D Beta 14600	2880 ± 60 B.P.	B.C. 1260 - 916	2	1.00
E Beta 14599	3310 ± 60 B.P.	B.C. 1742 - 1495	2	0.97
F Beta 14601	4130 ± 70 B.P.	B.C. 2896 - 2570	2	0.96

* Probability of target date falling within range shown

(1200 BP). The dates as well as the ceramic distribution suggest the bulk of the occupation was during Archaic and early Basketmaker times. The considerable Late Archaic and Basketmaker presence was something of a surprise, although, as Altschul and Fairley (n.d.:IV 20) have noted, Late Archaic materials are "relatively abundant [on the Arizona Strip] compared to preceding periods." San Raphael Side-notched and Gypsum dart points, for example, appear regularly across the area (Altschul and Fairley n.d.: IV 22), although dates are limited to the Grand Canyon region (e.g., Schroedl 1977). The occurrence of a Rocker Side-notched projectile point at the site hints at a mid-Archaic use.

Evidence of Basketmaker use of the site includes corn, the multi-warp sandal and probably by the cist remains. The corn date is of particular interest as it establishes the presence of this cultivar in this region during the last millennium B.C. as has now been done elsewhere in the Great Basin (cf. Wilde and Newman 1989) and the Colorado Plateau (Berry 1982, Jennings 1980, Smiley et al. 1986). These data reinforce the gradual nature of the transition from Archaic hunting and gathering strategies to the horticultural focus of the Formative.

Because of the small sample little can be said about the Pueblo occupation except that the site was used during this period. It is likely that the site was a hunting station during the Archaic and Anasazi periods and also functioned as a cache site during the later periods.

ANTELOPE CAVE

Antelope Cave (NA 5507) is a large collapse and solution cavern in the upper levels of the Kaibab limestone formation near Clayhole Wash on the open rolling plain of the Uinkaret Plateau. Rock Canyon Shelter lies about nine km to the north. The cave entrance is at the head of a small draw draining into Clayhole and is partially obscured by large limestone boulders that have fallen in front of the cave. The shape of the cave interior is hemispherical with the area immediately inside the entrance dominated by a field of large blocks of limestone spall, some of which weigh many tons. The floor descends rapidly to the rear in a series of distinct terraces corresponding to roof spalling events (Figure 5). Along the west wall and to the rear of the cave the floor is dirt covered and the ceiling is heavily smoke blackened. At the extreme back of the cavern is a sink marked by concentric bands of limestone rock and formed by the slow, spiraling and sinking of the cave deposits into a solution cavern that likely lies below (Maxfield 1983).

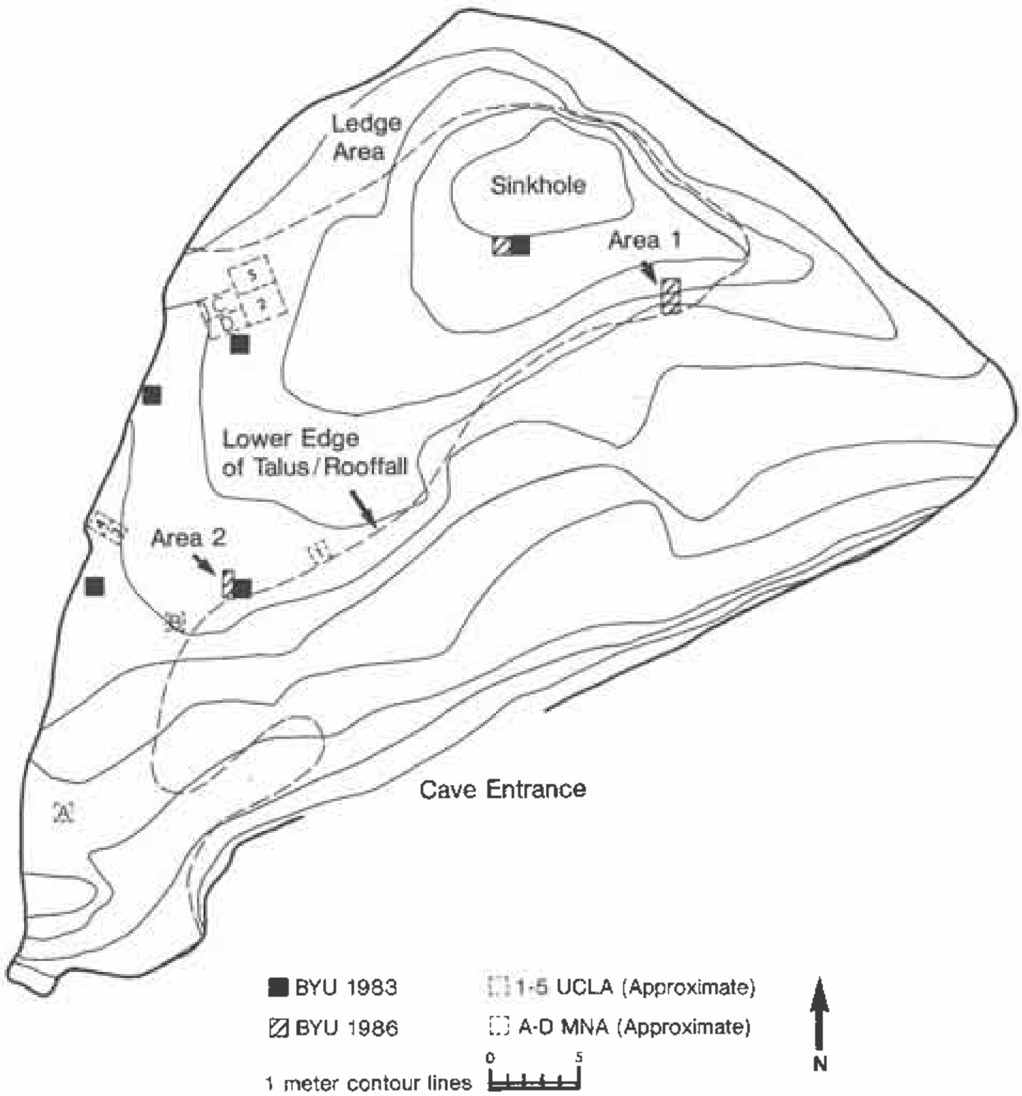

Figure 5. Plan view of Antelope Cave showing locations of tests by Brigham Young University and approximate locations of tests by the University of California, Los Angeles and the Muscum of Northern Arizona (after Janetski and Hall 1983; Robert Euler, personal communication 1983).

According to local informants the cave was discovered in 1923 by William Atkin of St. George (Floyd Atkin, personal communication 1986). The reputation of the site as a rich source of prehistoric artifacts spread quickly and attracted numerous collectors. The total scope of the material recovered from the site will never be known, but certainly includes hundreds of sandals (both Basketmaker and Pueblo styles), whole ceramic vessels, basketry, and many miscellaneous perishable items (Robert Euler, personal communication 1985). The looting continues to this day despite the efforts of BLM to seal the site. The dry cave interior now resembles a bombing range as it has been subject to almost continuous looting during the past 50 years. Potholes and piles of spoil dirt pock the portion of the cave not covered by roof fall.

Professional archaeological work in Antelope Cave began with a visit in 1949 by Jack Rudy of the University of Utah. Rudy did no serious excavating and, in fact, reported that even then the cave was badly vandalized (Jesse Jennings, personal communication 1986). The first professional excavation was done in 1954 by Robert Euler of the Museum of Northern Arizona (MNA). He excavated a series of test pits and mapped the cave (see Figure 5 for locations of all test excavations). By far the most extensive excavations, however, were carried out by University of California, Los Angeles (UCLA) between 1959 and 1960 under the direction of Keith Johnson and David Pendergast. Light testing was done in 1956 and 1957 while UCLA was working at the Paragonah sites in Parowan Valley (Johnson and Pendergast 1960). Responding to a need to salvage remaining information in the cave, UCLA excavated to bedrock seven five feet square test areas in 1958 and 1959 (Keith Johnson, personal communication 1986). The substantial collection recovered through this work is now at the Museum of Cultural History at UCLA on loan to Keith Johnson at the Museum of Anthropology, California State University, Chico.

No professional work was done at the cave after the work of UCLA until Moffit et al. (1978) of the Museum of Northern Arizona visited the site during the survey of the Navaho-McCullough transmission line. They made a small surface collection of ceramics and projectile points (Moffit et al. 1978:166-167). In 1983 BYU in a cooperative agreement with the Arizona Strip BLM visited the site to determine whether intact deposits remained and to assess the stability of the roof (Janetski and Hall 1983). Some surface collections were made and a small test placed in the midden in the sink area to recover datable materials. Janetski and Hall concluded that intact deposits remained at the site and BYU returned to the site in 1986, again under contract with the BLM, and excavated two additional test pits. A primary goal of this work was to obtain datable materials from basal deposits to determine when the site was first occupied and to recover systematic samples of the sediments for faunal and paleoenvironmental data. Our recent work at Rock Canyon Shelter suggested the possibility of Archaic use of Antelope Cave as well.

BYU is currently analyzing the material recovered during the 1986 work as well as the collections recovered by Euler in the 1950s. A final report on all professional work including that by UCLA and MNA is being coordinated by the BLM.

1986 Excavations

The 1986 excavations focused on two areas: 1) the sinkhole midden to the rear and at the bottom of the cave and 2) along the edge of the heavy roof fall area where it was felt intact deposits were present based on observations made during the 1983 work (Figure 5). Area 1 excavations removed a block of sediments ca .5 m by 1.5 m by .9 m deep in the midden area where the 1983 test had been made. The deposits in the midden area consisted of vegetal material (sticks, grass, corn cobs and shucks, etc.) interspersed with small spall and some sediment making the stratigraphy difficult to follow at times (Figure 6). Excavations in Area 2 consisted of cleaning out the looters pit profiled in 1983 to document the stratigraphy. A sediment block measuring .5 m by 1.5 m was then excavated to sterile (1.25 m below the cave floor) following the natural stratigraphic levels.

All excavated material was bagged in bulk, tagged with provenience information and taken to St. George where the local Utah Statewide Archaeological Society (USAS) chapter, under the direction of a BLM archaeologist, the late Jennifer Jack, screened, sorted, and rebagged all of the recovered material by artifact class.

Features

No features were found at Antelope Cave during the 1986 work nor have other researchers documented any features, such as cists, hearths, etc.

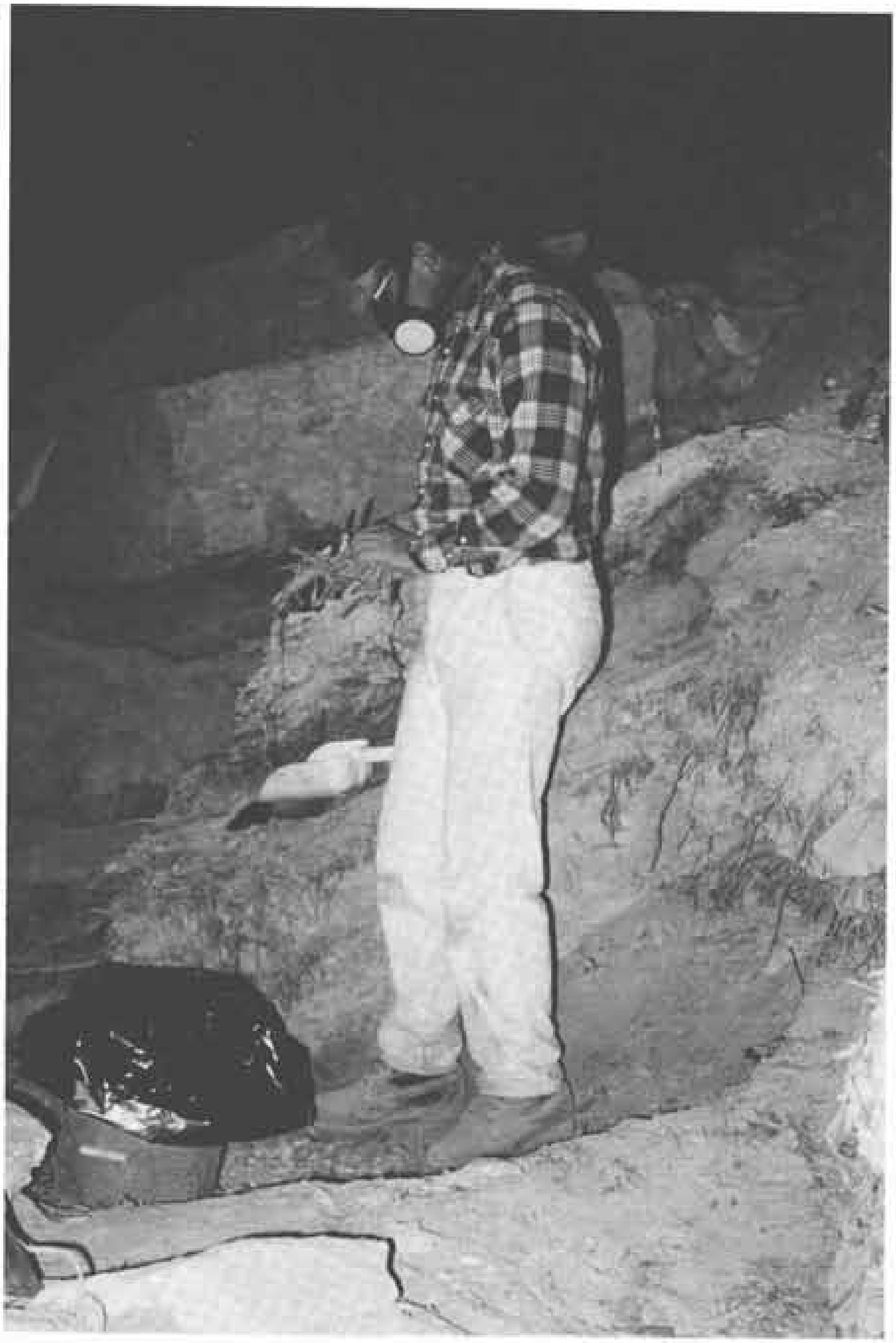

Figure 6. Excavator working in the sinkhole at the rear of the cave. Note the matted vegetal material in the exposed profiles.

Nor were any slabs observed on the surface that would suggest the presence of vandalized cists such as those observed at Rock Canyon Shelter. Surely hearths existed given the smoke-blackened condition of the ceiling, but those portions of the cave where fires were likely built are now largely destroyed and were not tested.

Material Culture

Antelope Cave was rich in artifacts. As noted above, looters have ransacked the site for over 50 years. Their persistence is evidence of the success of those activities. Reported work and museum collections verify this richness. The UCLA excavations, for example, recovered numerous sandals, thousands of cordage and miscellaneous fiber fragments, ceramics, chipped stone, wood and cane artifacts, and thousands of faunal and botanical specimens. The small tests placed in the cave by BYU in 1986 recovered several thousand field specimens, mostly faunal and floral material, but ceramics, lithic detritus and tools, and miscellaneous perishables artifacts were also recovered. The current heavily looted condition of the cave, however, suggests that few intact sediments remain other than the areas near the front of the cave covered by the large heavy boulders from the roof.

Ceramics

Ceramics seem generally more abundant in Antelope Cave than in Rock Canyon Shelter. The Vilate Hardy collection attributed to Antelope Cave and photographically documented by Euler contains several complete vessels including painted bowls and small and large mouthed grayware jars (Robert Euler, personal communication 1985). Excavations by professionals have recovered quantities of ceramics, although none have yet been reported. Preliminary sorting of the MNA and BYU collections shows a strong Pueblo I presence represented by Washington Black-on-gray sherds and slight to moderately everted rim forms. Pueblo II ceramics, e.g., corrugated wares and more sharply everted rim forms are fewer in number and suggest a lighter use of the site during this time.

Lithics

As with all the data, two different sets of lithic material were analyzed from Antelope Cave. The first was the assemblage collected during the MNA work in the cave during the 1950s. The second was collected during our testing in the fall of 1986. The MNA collections contained relatively few pieces of debitage, as the focus seemed to have been on tools.

The MNA collection analysis was on 92 lithic artifacts. Of this total, 53% were cryptocrystalline silicate debitage. Three percent were quartzite and sandstone debitage, and one flake was of obsidian. Fourteen percent of the total assemblage were made up of utilized flakes, most of which were of cryptocrystalline silicate. Wear on these items consisted of about equal numbers of sharp and steep (scraper-like) edges. The modified portion of the assemblage contained 26 specimens. Of this total, 85% were of cryptocrystalline silicate, while the remaining 15% were quartzite and sandstone. The modified items included scrapers, drills, cores, bifaces, and projectile points. The latter consisted of one Elko Corner-notched (Figure 7e), one large, possibly Elko Side-notched point (Figure 7d), two Rose Spring Corner-notched points (Figure 7c,f) and a broken Elko Series point (Figure 7b).

Six pieces of groundstone were also included in the MNA collection analysis. These were all small, shaped slabs of sandstone, generally rectangular in plan. They ranged between 11 and 19 cm in length, and between 2 and 4 cm in thickness.

The collection made in 1985 by BYU contains 364 chipped stone items and one piece of groundstone. A total of 96% of the chipped assemblage was cryptocrystalline silicate debitage. Three percent were modified tools of cryptocrystalline silicate, and the remainder was made up of obsidian, marl, quartzite and slate items. The modified portion of the assemblage consisted of bifaces, cores, scrapers, and only one projectile point. The latter was an Elko Corner-notched point that was reworked into a stemmed point after its basal tines were broken (Figure 7a). No utilized flakes were recovered in 1985. The single groundstone specimen was a slab metate fragment with evidence of light wear on one surface.

Perishables

Perishable artifacts were abundant in the cave. Most common were cordage fragments (over 600 recovered and identified by MNA researchers) and wads of fibers. The BYU collection has not yet been analyzed. Yucca was clearly the preferred

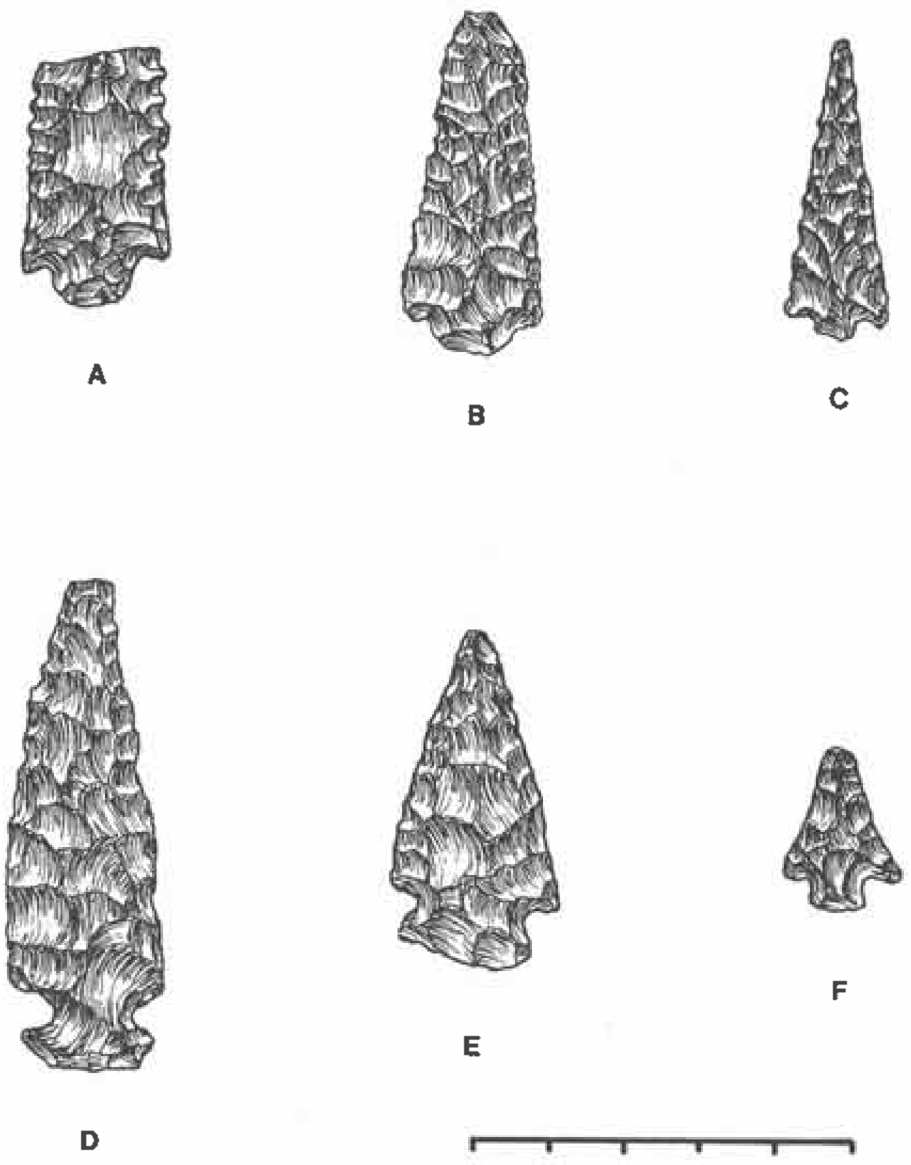

Figure 7. Projectile points from Antelope Cave (Rose Spring Corner-notched: C, F,; Reworked Elko Corner-notched: A; Elko Corner-notched: E; Elko Side-notched: D; Elko Series: B).

Table 2. Radiocarbon Dates and Calibrated Ranges, Antelope Cave, Northwestern Arizona.

Laboratory Number	Radiocarbon Age	Calibrated Range	Sigma	Probability*
A Beta 24432	3290 ± 60 BP	B.C. 1699 - 1444	2	0.98
B Beta 24432	3490 ± 60 BP	B.C. 1891 - 1744	1	1.00
C Beta 24433	3590 ± 50 BP	B.C. 2028 - 1893	1	1.00

* Probability of target date falling within range shown

material for cordage along with milkweed, dogbane, nettle, bitter brush and cliff rose. Sagebrush and juniper bark, along with human hair, and rabbit fur were also used. Cordage manufacture is dominated by 2-ply z-twist styles, although s twist and braiding were also common techniques. Human hair cordage was braided with up to 15 strands of 2-ply yarns.

As noted, many sandals have been found at the site. Johnson and Pendergast (1960) report finding 95 sandals, 79 of which were the 4 - 6 warp, round-toed, Pueblo style, 13 were multiple warp, square-toed, Basketmaker type and two were 2-warp wickerwork. They state that the sandals provided a good time marker as the Basketmaker styles were found in the lower levels while the Pueblo variety was found in the upper strata. The MNA collection includes 26 complete and 30 fragments of round-toed sandals and one nearly complete square-toed example (Figure 8). All of the MNA specimens are made of yucca fiber and have toe and heel loops with connecting ties made of both twisted and braided cordage. The BYU excavation uncovered a pair of partially burned, round-toed sandals. Lengths of complete sandals in the various studied collections varied from 24 to 31 cm.

Miscellaneous perishable artifacts include worked wood and cane, knotted yucca leaves, and net fragments. Several artifacts consist of cordage integrated with other material such as feathers (Figure 9) (see Janetski and Hall 1983:figure 22 for illustration of a similar artifact).

Subsistence Data

Faunal Remains

Faunal material recovered from Antelope Cave includes bones, fur, some of which were both mummified and articulated portions of individuals, mummified stomachs and intestines, and feathers. Rabbit remains, especially black-tailed jackrabbit, dominate the faunal record at Antelope Cave, although mountain sheep and antelope also present. Janetski and Hall (1983:41) report the presence of deer, turkey, and various rodents (packrat and gopher) in addition to rabbit and sheep. No change through time has been detected during preliminary sorting. Bird is represented by numerous feathers many of which cannot be assumed to be from cultural sources. Nonetheless, these include great horned owl, turkey, pinyon jay, and thrasher.

Botanical Remains

The dry deposits of the cave preserved plant materials in large quantities. The midden, for example, was primarily vegetal matter, miscellaneous sticks, especially *Atriplex* sp. and sage, grass parts, yucca, juniper and sagebrush fibers, cattail or tule stalk fragments, abundant corn cobs and stalks, as well as numerous seeds. The latter include corn kernels, beans, squash seeds and rind fragments, pine nut hulls, hackberry seeds as well as bark, juniper berries, etc.

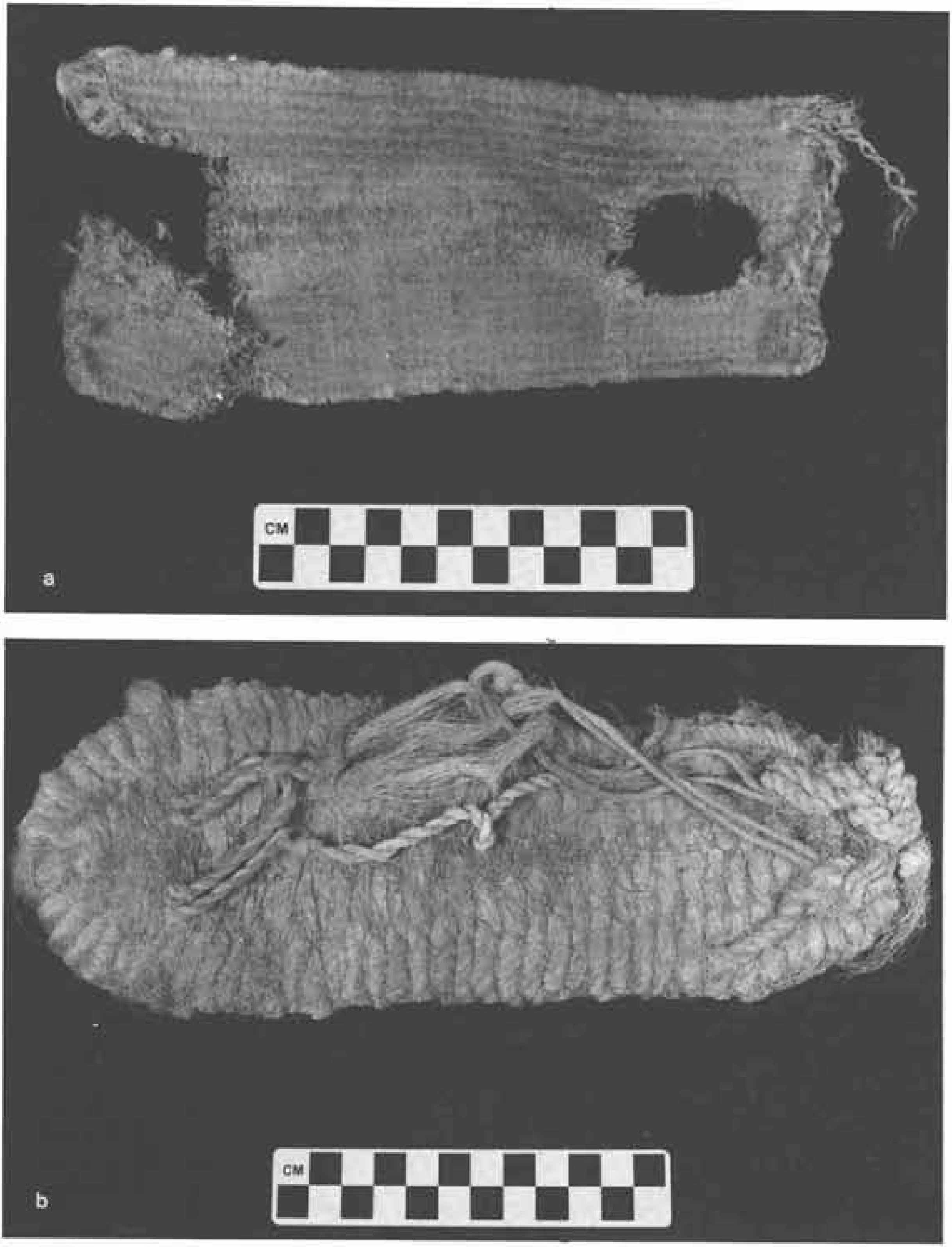

Figure 8. Yucca sandals from Antelope Cave: a) Square-toed Basketmaker style, b) Round-toed Developmental Pueblo style.

Figure 9. Owl feathers attached with cordage.

Dating

Three radiocarbon ages were assayed from Antelope Cave samples collected in 1986. All were on wood charcoal from lower levels of the deposit. Those ages and their calibrated ranges (Stuiver and Reimer 1987) are shown in Table 2. The dates correspond well with late Archaic artifacts found in the lower sediments of the test units, and corroborate the evidence from Rock Canyon Shelter for a heretofore barely visible Archaic occupation on the Arizona strip.

DISCUSSION

The importance of Antelope Cave has been recognized for some time, but the few reports produced so far have focused only on limited tests within, or data from, the site with little attempt to synthesize or integrate the data into the regional prehistory. At present Antelope Cave can be said to have contained significant evidence of lat Archaic, Basketmaker, and early Pueblo occupations or use. The exact nature of these occupations remains unclear, especially for the Archaic period, however, and can only here be partially inferred. As noted, the primary goals of the BYU study were to determine whether intact Archaic deposits might be found, and to obtain samples of material of various ages for subsistence and environmental assessment. These goals have for, the most part, been met as described above and the information gathered allows a few preliminary statements about the site's culture history and possible use.

Radiocarbon dates and temporally diagnostic artifacts recovered during the two BYU tests (1983 and 1986) of Antelope Cave demonstrate that the site was occupied sporadically over several thousand years beginning around 3,500 years ago until ca. A.D. 1100. The period of maximum use seems to have been during Pueblo I, ca. A.D. 900 - 1000, but, because of the small samples excavated by BYU and MNA, and the extensive damage to the cave's deposits by vandals, very little can be inferred about the Anasazi occupations. It is likely that the cave served as a hunting camp and processing station throughout the period of prehistoric use. It certainly appears to have served as a cache location for sandals and perhaps other items such as nets and raw material for sandal and tool manufacture as well as foodstuffs, e.g., corn, various grasses, etc., during the Basketmaker and Pueblo occupations. In these regards, Antelope Cave seems to exhibit a history of use similar in outline, but probably more intensive and varied in its particulars, to that seen at the considerably smaller Rock Canyon Shelter.

Although a fairly wide variety of animals are represented in the small number of samples analyzed, no change through time has been detected in relative abundance or utilization of particular species. Analysis still underway may alter these statements, but the data suggest that, in terms of faunal procurement, the site was used in similar ways through several succeeding periods of occupation. Plant foods and industrial materials were also represented by a wide variety of species. In general, wild food species, such as yucca, tule, pinyon, hackberry, and others were relatively well represented throughout the deposits, but, predictably, corn and other domesticates were only found in the upper levels associated with Basketmaker and Pueblo materials. Analysis of pollen from early Pueblo deposits by Lindsay (1983) suggests that, like today, neither juniper or pinyon were in the vicinity; however, both *Populus* and *Quercus* were represented in the samples. Several of the species represented in the macrobotanical and pollen record (hackberry, oak, cottonwood, pinyon) are not now present in the immediate vicinity. The closest sources of pinyon, for example, are the Lost Spring and Little Creek mountains several kilometers to the north. The occurrence of these plant remains at Antelope Cave suggests the use of a relatively large catchment area by prehistoric peoples. It is also possible that a more stable, perhaps perennial streamflow was present in Clayhole Wash in the past and could have supported species such as cottonwood and hackberry. In general, however, the faunal and botanical data suggest that the local environment did not change much during the last 3,500 to 4,000 years.

The implications of the occurrence of caches of utilitarian items and the absence of architectural features suggest persistent but transient use of the site for at least the past 4,000 years. During the Anasazi period this use was likely related to movement along Clayhole Wash between the Mount Trumbull highlands to the south and the Little Creek Mountain/Vermillion Cliffs regions and Virgin River lowlands to the north. Future archaeological research could explore these possibilities.

CONCLUSIONS

Preliminary comparisons of Antelope Cave and Rock Canyon Shelter suggest several similarities and differences. Both have comparable culture histories; that is, both were occupied from the mid to late Archaic into Pueblo II times and likely both served as temporary stopover or cache locations. Rock Canyon Shelter does not appear to have been as intensively used during the Pueblo period as was Antelope, however. The Archaic and early Formative periods, which are well represented at Rock Canyon Shelter, are not well represented at Antelope Cave perhaps due to the covering of these deposits by the massive rock fall just inside the cave entrance.

More specifically, the preliminary analyses suggest distinctive differences in faunal exploitation at the two sites. Rock Canyon Shelter inhabitants at any one time appear to have had more success in procuring large mammals than the people utilizing Antelope Cave. The greater use of large mammals is especially apparent during the Archaic and early Formative occupations at Rock Canyon; unfortunately, comparisons are difficult because of the very small sample of faunal material from this period available from Antelope Cave. During the Pueblo period rabbits and other small mammals are more common in the faunal record at both sites. These apparent differences are best explained by contrasting environmental settings of the two sites. Other possibilities, such as a shift away from large animal hunting due to a decrease in mobility to accommodate such activities as crop care and turkey raising, will be explored in the final reports when data are more complete.

Perhaps most importantly, these tests have demonstrated that despite devastating looting activities, both Antelope Cave and Rock Canyon Shelter contain significant information about the prehistoric use of the Uinkaret Plateau. The continuing protection of these and other vandalized sites in the area by the BLM is extremely important to preserve the information they contain.

ACKNOWLEDGMENTS

This project has been supported by the BLM personnel over the past several years. Instrumental in this support have been BLM archaeologists Rick Malcomson, Aline LaForge and the late Jennifer Jack. We thank them for their patience and encouragement on this project.

Thanks are also due to Robert Euler, Keith Johnson and Aline LaForge for their helpful comments on the paper.

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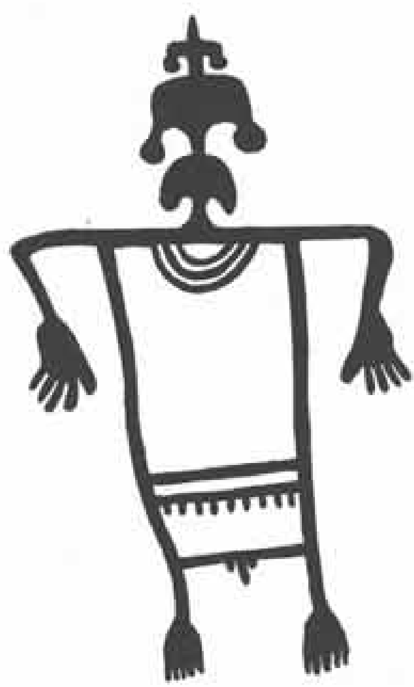

San Juan River

REVIEW

The Practical Archaeologist, by Jane McIntosh, Facts on File Publications, New York and Oxford, England, 1986, 192 pages, $18.95 (hard).

The Archaeologists Handbook, by Jane McIntosh, Bell and Hyman, London, 1986, £12.95 (hard).

Reviewed by: **Robert B. "Bob" Kohl**
President (1989-90), Jennifer Jack-Dixie Chapter
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"Only the name has been changed," perhaps to confuse the purchaser, but there the dissimilarity ends. These two books, with only a slight change in jacket design, are both printed in Milan, Italy, from the identical plates. Both contain 192 pages of photographs, charts and graphics with excellent color reproduction.

Subtitled *How We Know What We Know About the Past*, McIntosh does a remarkable job at the outset in condensing the worldwide history of archaeology without missing a crucial person, place or period. Then she gets down to the nitty-gritty.

This is basically a "how-and why" book in contrast to the typical "what-and-where" archaeological report. The terminology is sometimes Old World and British archaeologese, but not confusing. McIntosh may call it "field-walking" while we call it mitigation or salvage archaeology. And there may be some disagreement with her premise that the baulk method of excavation is favored while the "the grid method is no longer commonly used."

The western United States reader will not find a discussion of the IMACS (Intermountain Archaeological Computer Service) form, of course, but the accent on copious and complete field notes in other forms makes the point that only the written and graphic record will remain after the backfill.

McIntosh gives us clear descriptions of processing, preserving and analyzing techniques for all types of artifactual and organic remains. Whether it be how to determine male from female skeletal remains, or soil and pollen analysis as clues to climatic and human dietary change, or the preservation of artifacts for proper museum curation, she excels in the simple and concise.

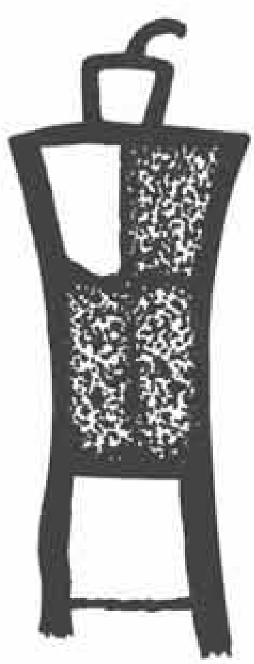
Her explanations of laboratory analysis and dating techniques are probably the most lucid in any archaeological text. Descriptions of X-ray fluorescence spectrometry, neutron activation analysis, amino acid racemization, archaeomagnetism, thermoluminescence, and even stratigraphy and seriation and radiocarbon dating all tend to avoid verbosity in favor of reader comprehension. She also covers the ground--and the air and the water--in brief, but fully informative sections on remote sensing.

In fact, this book compresses many shelves full of lengthier archaeological texts into just 192 pages. It is remindful of the Sergeant Joe Friday television series of yesteryear, "Just the facts, Ma'am!"

Author McIntosh journeys us through the reconstruction of the past from the Old to the New World and doesn't ignore the Mousterian, the Maya, the Incan or Mesa Verde. There is clearly no sensationalism here, just an honest effort to make as much as possible of archaeology both accurately informative and enjoyably readable.

This book is not a "Bible" of archaeology; there are many other "New and Old Testaments" on the market. For example, the excellent college Text, *Field Methods in Archaeology*, (Hester, Heizer and Graham, 1975, sixth edition, Mayfield Publishing Company, Palo Alto, California) has been excerpted by Dr. James Wilde, Brigham Young University, for the Utah Statewide Archaeological Society (USAS) Avocational Archaeologist Certification course. It is, unfortunately, out of print and unavailable to those USAS Chapter members not enrolled in the course. If a used copy can be found, it and the McIntosh book could well be the best two-volume library available on archaeological fundamentals.

Meantime, the McIntosh book alone can be instrumental in establishing a sound understanding of the language of Chapter program speakers.



Nine Mile Canyon

UTAH ARCHAEOLOGY 1989

Editors: Joel C. Janetski, Utah Professional Archaeological Council
Steven J. Manning, Utah Statewide Archaeological Society

Editorial Assistant: Kathy Driggs

Vol. 2 1989 No. 1

CONTENTS

ARTICLES

REPORTS

REVIEW

Front Cover: Bone Whistle from West Warren 2 (see pages 48-55).