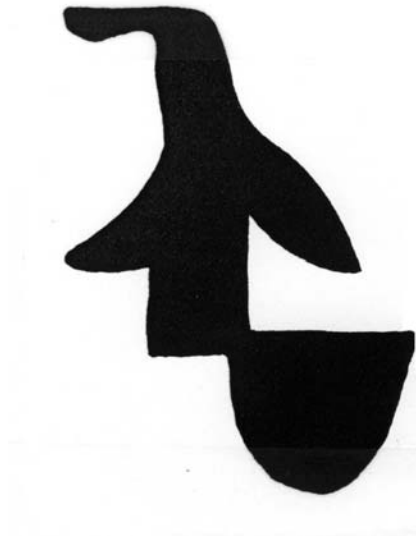


Exploring Anasazi Origins; The Cedar Mesa Basketmaker II

Report on the 1991/2 Fieldwork



(Basketmaker II Pictograph, North Road C9-5)

R.G. Matson and Michael Brand, Editors.

June 30, 1995

Report to
Bureau of Land Management
Monticello, Utah

Laboratory of Archaeology
Department of Anthropology and Sociology
University of British Columbia
6303 N.W. Marine Drive
Vancouver, B.C.
V6T 1Z1

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Exploring Anasazi Origins;
The Cedar Mesa Basketmaker II

Chapter 1

INTRODUCTION

R.G. Matson and Michael Brand

In 1990 the Cedar Mesa Project II (CMP II) was initiated to further explore the origins of the Anasazi tradition on Cedar Mesa, southeast Utah. Research focussed on the Basketmaker II occupation of the mesa. As the initial members of the Anasazi tradition, now represented by the modern Pueblo Indians, the origins of the Basketmaker II remains a topic of debate (Matson and Dohm 1990: 11; Matson 1991). Cedar Mesa has an abundance of Basketmaker II material (Matson, Lipe, and Haase 1988), which includes two variants (Matson 1991), canyon rockshelter sites belonging to the White Dog Phase (500 BC - AD 50) and later mesa top sites dating to the Grand Gulch Phase (AD 200 - 400). The primary goal of the Cedar Mesa Project II is to develop a better understanding of the Basketmaker II occupation of Cedar Mesa. As such the project addressed a number of questions relating to the early use of agriculture in the American Southwest. The project also produced data relevant to the origins of the Basketmaker II culture. To date two main competing theories have been advanced, the Oshara Model and the San Pedro Migration Model, respectively proposing an in situ development and a

northern migration of southern populations (Matson 1991:267-268).

Fieldwork for the Cedar Mesa Project II was undertaken mainly in July and August of 1991, with a much smaller component in July 1992. The project consisted of three parts: (1) excavation of Basketmaker II sites in the Hardscrabble drainage (CMP field numbers HS 4-1, HS 4-2, HS 5-2, HS 5-3, HS 11-1, HS 11-2 and HS 15-1), (2) limited test excavations at site NR C9-5 in the North Road drainage, and (3) block survey in the North Road drainage (Matson and Dohm 1990:14-15). The sites selected for excavation, all at elevations of approximately 1700m, are well below the average elevation for mesa top Basketmaker II habitation sites on Cedar Mesa. Excavations were undertaken to provide data which could identify these sites as being related to the earlier White Dog Phase Basketmaker II, the later Grand Gulch Phase Basketmaker II occupation, or to a previously unrecognized Late Archaic occupation. Test excavations at NR C9-5 were done to obtain dates which would allow classification of this unique site into one of the two Basketmaker II cultures. The purpose of the block survey was to establish the extent of the Grand Gulch Phase habitation site aggregations and to determine if dispersed Basketmaker II villages existed.

Cedar Mesa is a highland area located in southeastern Utah (Figure 1-1). The mesa has an area of approximately 800 square kilometers and is bounded by Elk Ridge in the north, White Canyon to the northwest and the Red House Cliffs in the west, the San Juan Valley to the south, the Lime Creeks to the

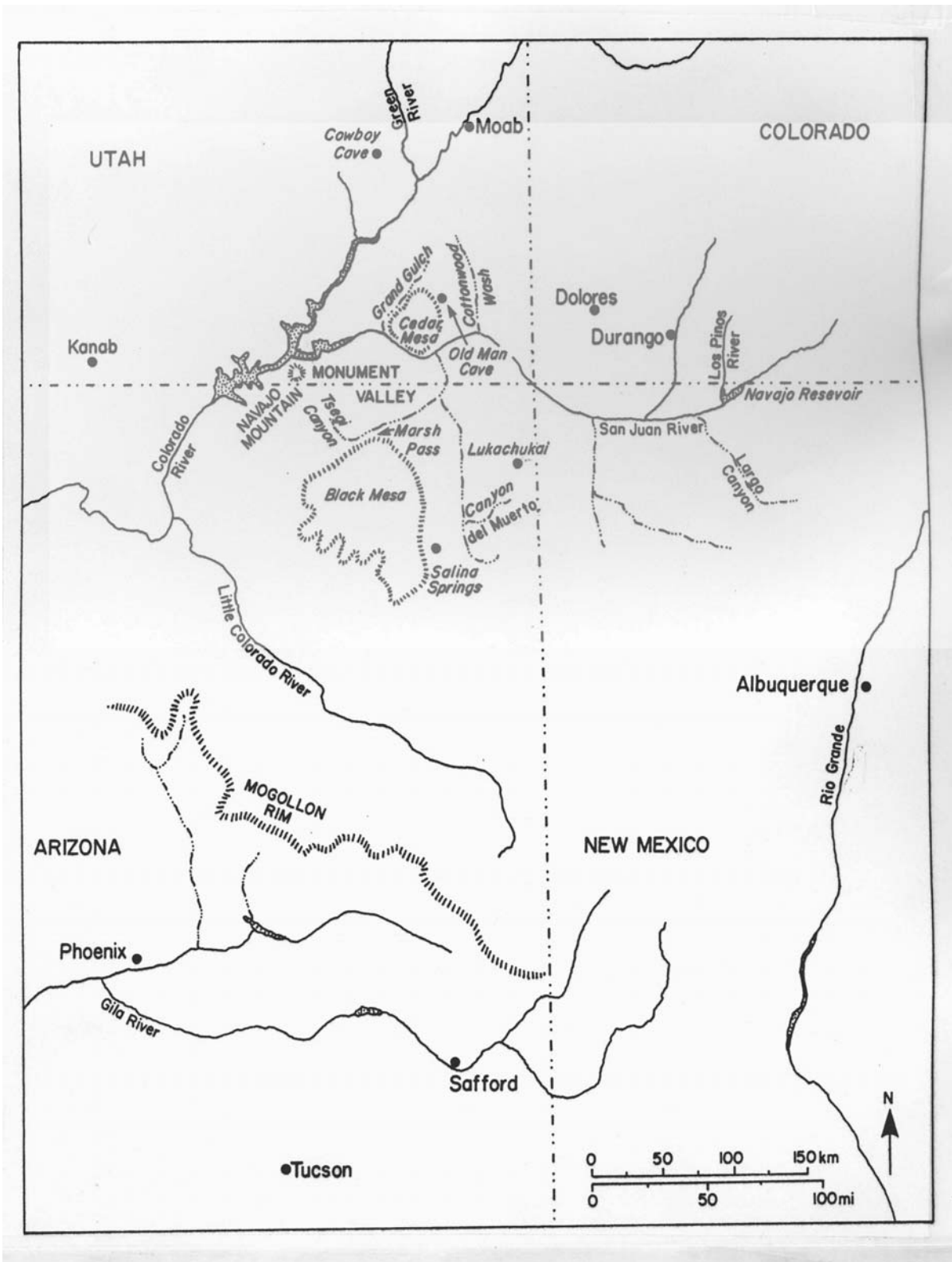


Fig. 1-1 Cedar Mesa and environs

southeast and Comb Ridge to the east (Matson, Lipe, and Haase n.d.: I-5). A central divide runs north - south on the mesa at an average elevation of 1980m. From here the mesa slopes to Grand Gulch in the west and Comb Wash in the east, with lower elevations of the mesa top at approximately 1700m. The surface of Cedar Mesa is cut by a number of deeply entrenched canyons.

The only permanent sources of water on the mesa are found in these canyons. The mesa is composed almost completely of Cedar Mesa Sandstone which is a good aquifer, hence there are a number of springs in many of the canyons (Matson, Lipe, and Haase n.d.: I-7). Natural tanks in the slickrock on the mesa's surface also hold limited amounts of water after a rain shower.

Precipitation on Cedar Mesa increases with elevation. Annual precipitation for the higher elevations averages approximately 32cm, whereas the lower areas of the mesa receive less than 25cm annually (Matson, Lipe, and Haase 1988:247).

The mesa surface is covered by a fine sandy loam which can be quite deep near the central divide (>3m), but thins significantly towards the edges of the mesa (Matson, Lipe, and Haase n.d.: I-8). The higher, deep soil areas of the mesa are dominated by pinyon-juniper forest mixed with a few sage flats near the heads of the canyons (Matson, Lipe and Haase 1988:247). These deep aeolian sandy silts were important prehistorically for dry-farming. The lower elevations of the mesa are characterized by sage shrublands with occasional patches of blackbrush and native grasses.

Archaeological research on Cedar Mesa began in the 1890's; it

was during this period that Richard Wetherill recognized the Basketmaker II culture (McNett 1968). The abundance of Basketmaker II material lead Lipe (1978) to begin research on Cedar Mesa in 1969 and 1970. In 1971 Lipe and Matson initiated the original Cedar Mesa Project, a regionally based survey of five selected drainages on the mesa. The project survey design is described in Lipe and Matson (1971) and in Matson and Lipe (1975;1978). Both mesa top quadrat and complete canyon surveys were conducted resulting in a total of 340 mesa top sites and 90 canyon sites (Matson, Lipe, and Haase 1988: 248). The results of the survey and the phase sequence which was developed for Cedar Mesa are summarized in Matson, Lipe, and Haase (1988). The Basketmaker II (BM II) period on Cedar Mesa is represented by the Grand Gulch Phase, dated between A.D. 200 and A.D. 400. Following a hiatus the Moss Backs Phase, a Basketmaker III occupation, begins at A.D. 650 and lasts until approximately A.D. 720. The next occupation of the mesa occurs in the late Pueblo II period with the Windgate Phase, A.D. 1050 - 1100. The following Clay Hills Phase, A.D. 1100 - 1150, is characterized by the predominance of Kayenta ceramics. There is a possible hiatus between the Pueblo II and Pueblo III occupations of Cedar Mesa. The Pueblo III occupation is represented by the Woodenshoe Phase, A.D. 1170 - 1220, and finally the Red House Phase, A.D. 1220 - 1270.

The Cedar Mesa Project quadrat survey recorded a total of 130 sites with Basketmaker II components. These sites were divided into four different site types: habitations (52), limited

activity sites (38), campsites (36) and lithic reduction loci (4) (Matson, Lipe, and Haase 1988:248-250). Basketmaker II sites were identified by the following characteristics: the presence of pit-structures with slab lined entrance ways, absence of ceramics, abundant "manuported" limestone, presence of large side- or corner notched projectile points and a relative abundance of one hand manos. The four different types of sites are differentiated on the basis of artifact and feature profiles.

Habitation sites tend to have slab-lined hearths, cists, a large number of artifacts and artifact types. Approximately half of the Basketmaker II habitation sites located in the quadrat survey had surface evidence of a pithouse, but only two such "sites" had evidence of more than one. These sites were generally located above the median elevation for the mesa. Although they tend to occur in the higher areas of the mesa, they do not occur in the highest areas, that is, above 2025m. Habitation sites are generally located in areas of dense pinyon-juniper forest.

Non-habitation sites (campsites, limited activity sites and lithic reduction loci) are believed to have served various short term activities undertaken away from habitation sites. On the basis of features present, such as hearths and slab-lined cists, campsites are believed to have been used for activities which required people to be away from their primary residential site for more than a day. These sites tend to be found at elevations below that of habitation sites and limited activity sites, in areas with less trees. Limited activity sites generally lack

features and have small numbers of artifacts and a limited number of artifact types. Although limited activity sites also tend to be found in areas with a lower tree density, their median elevation is slightly higher than that of the campsites. Activities believed to have been undertaken at non-habitation sites include gathering and processing wild plants, hunting or tending agricultural fields.

The association of corn agriculture with the Basketmaker II culture is well established (Matson and Chisholm 1991; Matson 1991). Recent research on the Cedar Mesa Basketmaker II material has done much to demonstrate its importance in the diet of these people. Analysis of settlement patterns have shown that Basketmaker II habitation sites are commonly located in areas with arable soil and higher levels of precipitation. The remains of maize have been found in excavations on Cedar Mesa (Matson, Lipe, and Haase 1988:248; Dohm 1988; Matson 1991:90-101), and analysis of human coprolites from a Basketmaker II site in Grand Gulch, found maize to be the most abundant class of food remains (Aasen 1984). Recent stable carbon isotope analysis (Matson and Chisholm 1986,1991; Chisholm and Matson 1994), has indicated that the Basketmaker II populations on Cedar Mesa shared a similar reliance on maize with the later Pueblo occupants.

The the mesa-top pithouse occupation is relatively securely dated between A.D. 200 and A.D. 400. Prior to the 1991 fieldwork radiocarbon dates from three different pithouse sites fell into this period and 26 tree-ring dates from four features, only one of which was also radiocarbon dated, were also in this

period (Matson 1991:91-92). In addition four other tree-ring dates from West Johns 12-6 are reported by Dohm (1988:194) for this time period, adding another pithouse site. These seven different sites are scattered over the mesa, indicating that the mesa-top pithouse occupation dates everywhere to the same time period between A.D. 200 and A.D. 400.

This report is organized into chapters, the first of which is this introduction. The second chapter is a descriptive summary of the 1991 testing of archaeological sites including a discussion of their ages. The third is a report on the block survey in the North Road Drainage and the evidence for BM II habitation sites being aggregated into "Hamlets." The fourth chapter reports on recent analyses of stable carbon and nitrogen isotope samples and their implications for BM II diets. The fifth chapter is a comparison of BM II and later Anasazi lithic technology as found on Cedar Mesa. The sixth chapter describes the faunal material recovered during various investigations on Cedar Mesa, including 1991. The seventh chapter is a report on the lithic analysis of the Rock Island Site (NR C9-5). The last chapter is a summary and synthesis of the 1991 project results to date.

Chapter 2

ANOMALOUS BASKETMAKER II SITES ON CEDAR MESA: NOT SO ANOMALOUS AFTER ALL.

R.G. Matson

Introduction

If we are to understand the Origins of the Anasazi we need to carefully examine the first Anasazi culture, the Basketmaker II. The current evidence, as I review in Origins of Southwestern Agriculture (Matson 1991), is consistent with a Basin and Range San Pedro Cochise origin for the "Western" or San Juan BM II. This inference arises partly from the lack of known late Archaic remains in areas with substantial BM II remains such as Cedar Mesa, Utah. The argument can be made-and is- that material classified as BM II really includes non-BM II, that is, pre-BM II material. During the summer of 1991 we investigated this possibility for the mesa-top BM II on Cedar Mesa.

As reviewed in the introduction, five of the twenty drainages on Cedar Mesa, located between the 5600 (1700m) and 6800 (1980) ft contour intervals, which delimited about 800 square km, were sampled in the original Cedar Mesa Project (Lipe and Matson 1971; Matson, Lipe, and Haase 1988). These, in turn, were subsampled by 9 to 22 quadrats, and all sites were mapped and completely collected in the survey portion of this project (Matson, Lipe, and Haase 1988). During our quadrat survey (76 quadrats, 400m on a side) in the 1970's we located and collected 123 sites having separable components (and seven BM II

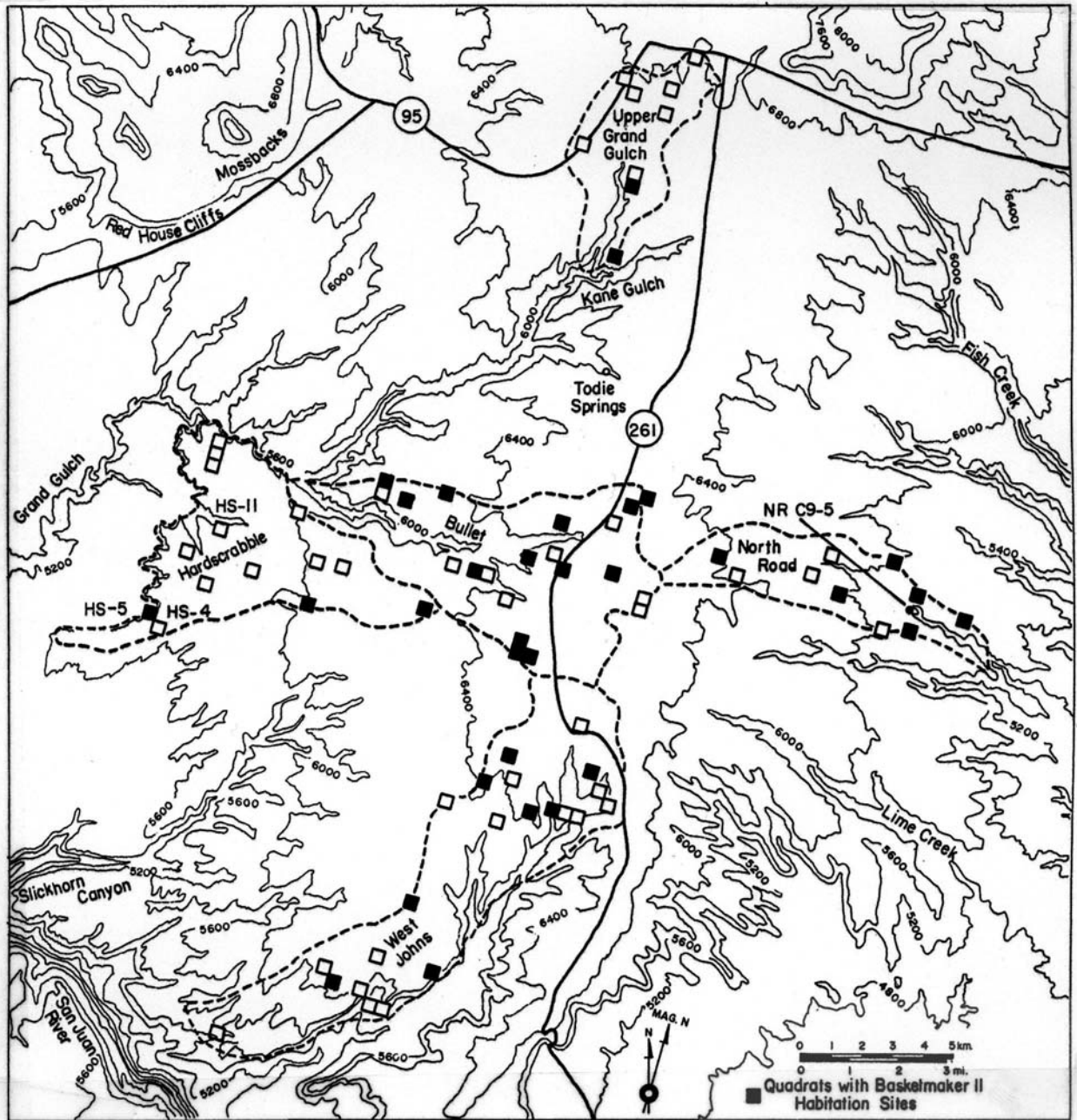


Fig. 2-1 Cedar Mes quadrats with BM II habitations and SS 4&5 designations

occupations without separable components) which we classified as BM II, and we called the Grand Gulch Phase (Matson and Lipe 1975; 1978; Matson, Lipe, and Haase 1988). This amount contrasts with the lack of any identified Archaic components and only a half dozen Archaic points collected during the survey. As reviewed in the previous chapter the Grand Gulch Phase is dated on the basis of previous tree-ring and radiocarbon dates from seven different pithouse sites to A.D. 200-400.

In investigating the possibility that significant amounts of pre-BM II material are present in the material we previously classified as BM II, we could not afford to excavate all 123 sites, nor would all sites be expected to yield useful dating information. Thus our object was to test sites previously classified as BM II that had the maximum potential to be Archaic by differing significantly from the dated BM II sites, yet still had a high probability that they would yield dates and artifacts.

As it turns out, there is a single low lying area, in the western portion of the survey area, which had sites that met these two criteria, along with other attributes that made it a likely Archaic location. Particularly, within the Hardscrabble Quadrats 4 and 5 (HS 4 and HS 5) are a cluster of sites identified as BM II that appeared to be anomalous (Fig. 2-1). These included HS5-2, the lowest elevation site, by far, classified as a habitation (Fig. 2- 2). Further, neither quadrat had significant amounts of deep soil pinyon-juniper, our proxy measure for arable dry farming land (Fig. 2-3) which is

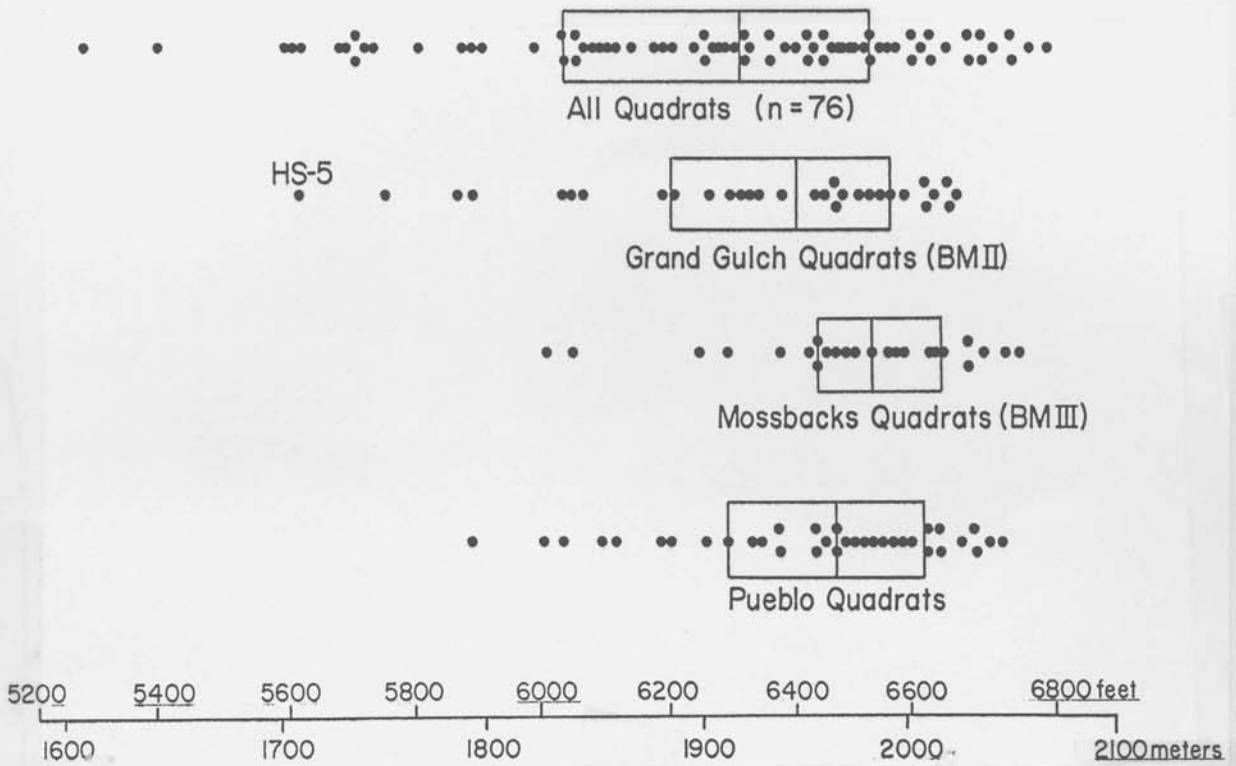


Fig. 2-2 Elevation of habitation quadrats for all periods

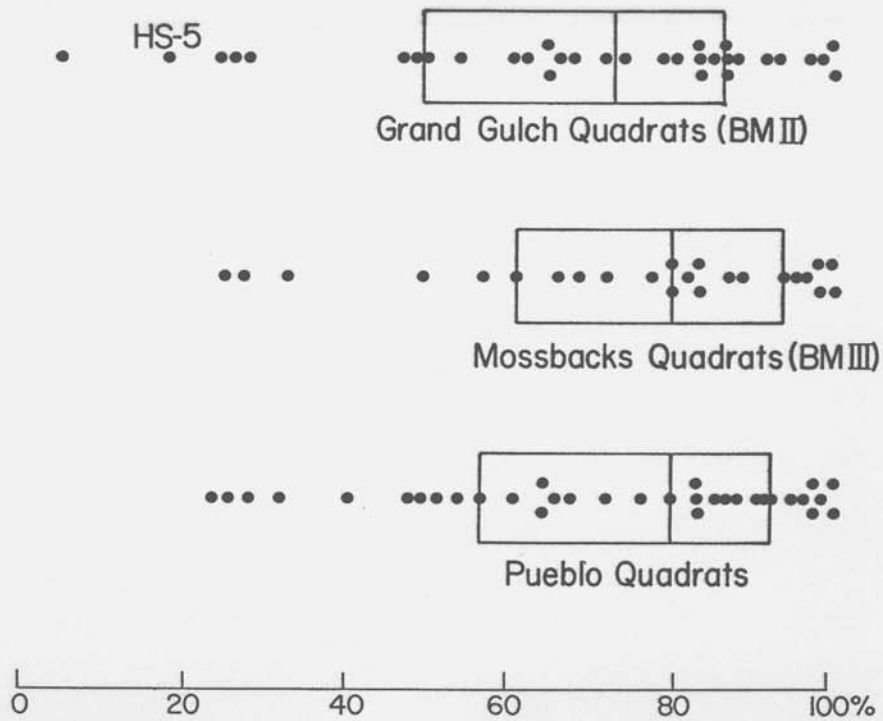


Fig. 2-3 Percent coverage by dense pinyon-juniper, habitation quadrats, all periods

highly correlated with BM II habitations elsewhere on Cedar Mesa. Nearby in an unlikely farming area is HS 11 which contains three members, including the largest, of the BM II "campsite" class (Matson 1991: 81-82). Since the campsite class was undated, one could question whether this class of preceramic sites were BM II.

Further, the HS 4 and 5 area is near the heads of canyons, with a good spring noted during survey, and has the largest dune field within the survey area-in short is the closest thing to Arroyo Cuervo on Cedar Mesa (Irwin-Williams 1973). If we were mistakenly classifying late Archaic material as BM II, these sites have a high potential to be late Archaic (Fig. 2-4).

We thus have the alternative possibilities that this material is part of the mesa-top BM II occupation, the Grand Gulch Phase A.D. 200-400, as we classified it, or that it is Archaic. There is also a third possibility, that the material belongs not to the mesa-top Grand Gulch Phase, but instead is related to the earlier, canyon rockshelter White Dog Cave variant (Matson 1991:124). When Lipe and I first began the Cedar Mesa Project, Lipe hypothesized that BM II habitations would be located on the rims so as to have access both to mesa top and canyons (Lipe and Matson 1971). This idea assumed that all BM II material dated to the same period. We actually found that BM II habitations tended to be located way from the canyon rims, and on the mesa-top divides (Matson and Lipe 1978; Matson, Lipe, and Haase 1988). Smiley et al. (1986) since then have demonstrated that the Canyon Rockshelter BM II is more than 2000

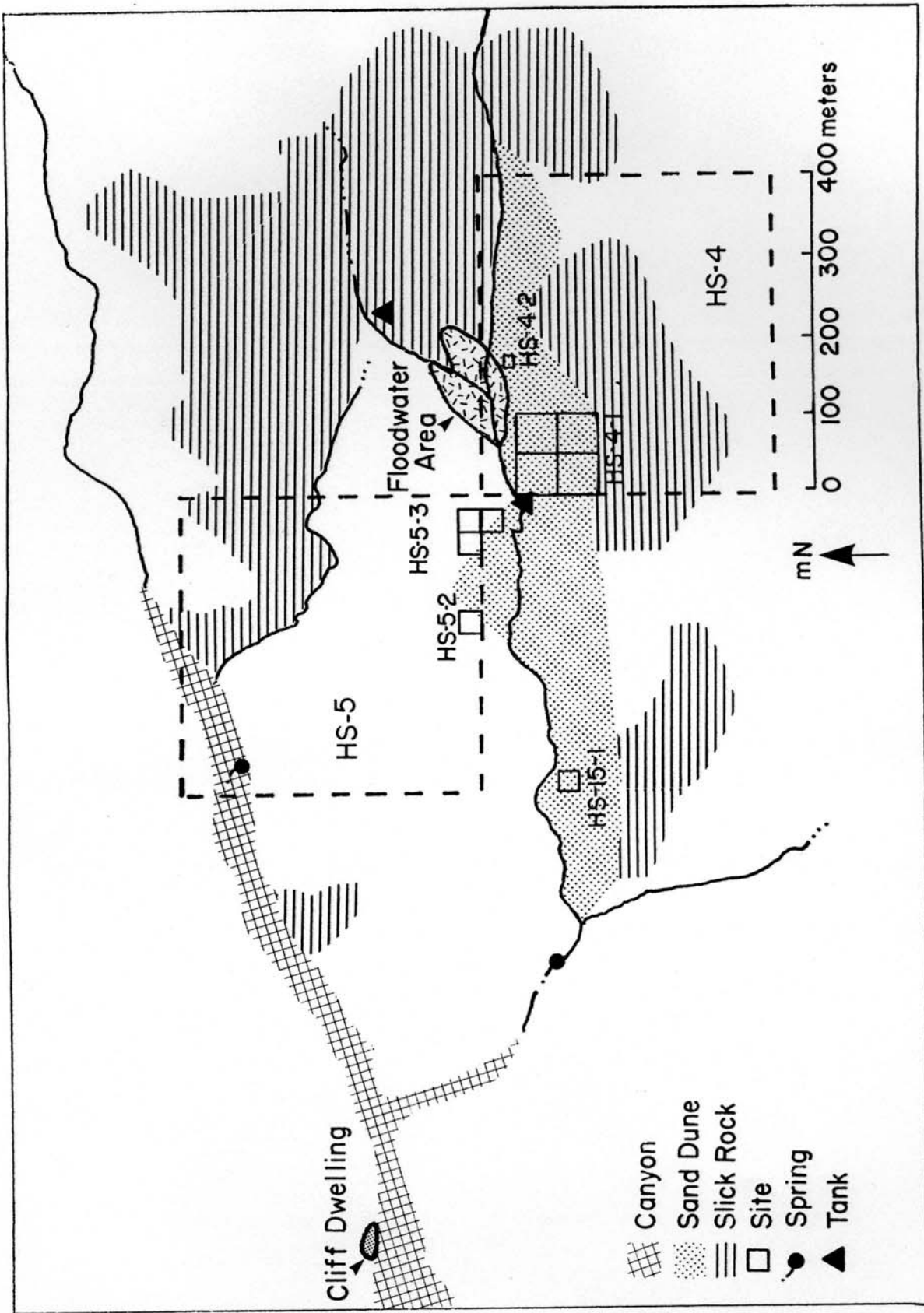


Fig. 2-4 The Dos Tanques-Dos Fuentes Locality, HS 4&5

years old and dates back to 500 B.C. Further, our dates from Turkey Pen Cave in Grand Gulch confirm the priority of the Rockshelter BM II for Cedar Mesa as well (Matson and Chisholm 1991). Thus, it might be that Lipe's hypothesis could be correct, not in general, but for mesa-top sites related to the Canyon Rockshelter BM II.

Before turning to describing the archaeological information recovered, I wish to reiterate the main point. That is, if all these anomalous sites turn out to be good BM II, it is unlikely that there is a significant amount of Archaic material mixed with the sites classified as BM II on the basis of surface collection on Cedar Mesa.

Summary of Archaeology.

Dos Tanques-Dos Fuentes Locality

Although the feature that struck the survey crews the most about the HS 4 and 5 locality was the presence of large dunes, I do not think this is actually the most important feature, although the size and abundance of dunes is unique within the survey area (Fig.2-4). Also noted in the survey was a good spring in the canyon, to which this summer we located another outside the quadrats resulting in the name Dos Fuentes, or two springs. We also found two tanks, one of which I think had water throughout the spring, and the other filled during the summer monsoon, thus the Dos Tanques.

These tanks filled during the summer monsoon because of a half moon of slickrock which collected the water into the main wash. Between the two tanks is a 4725 square meter area

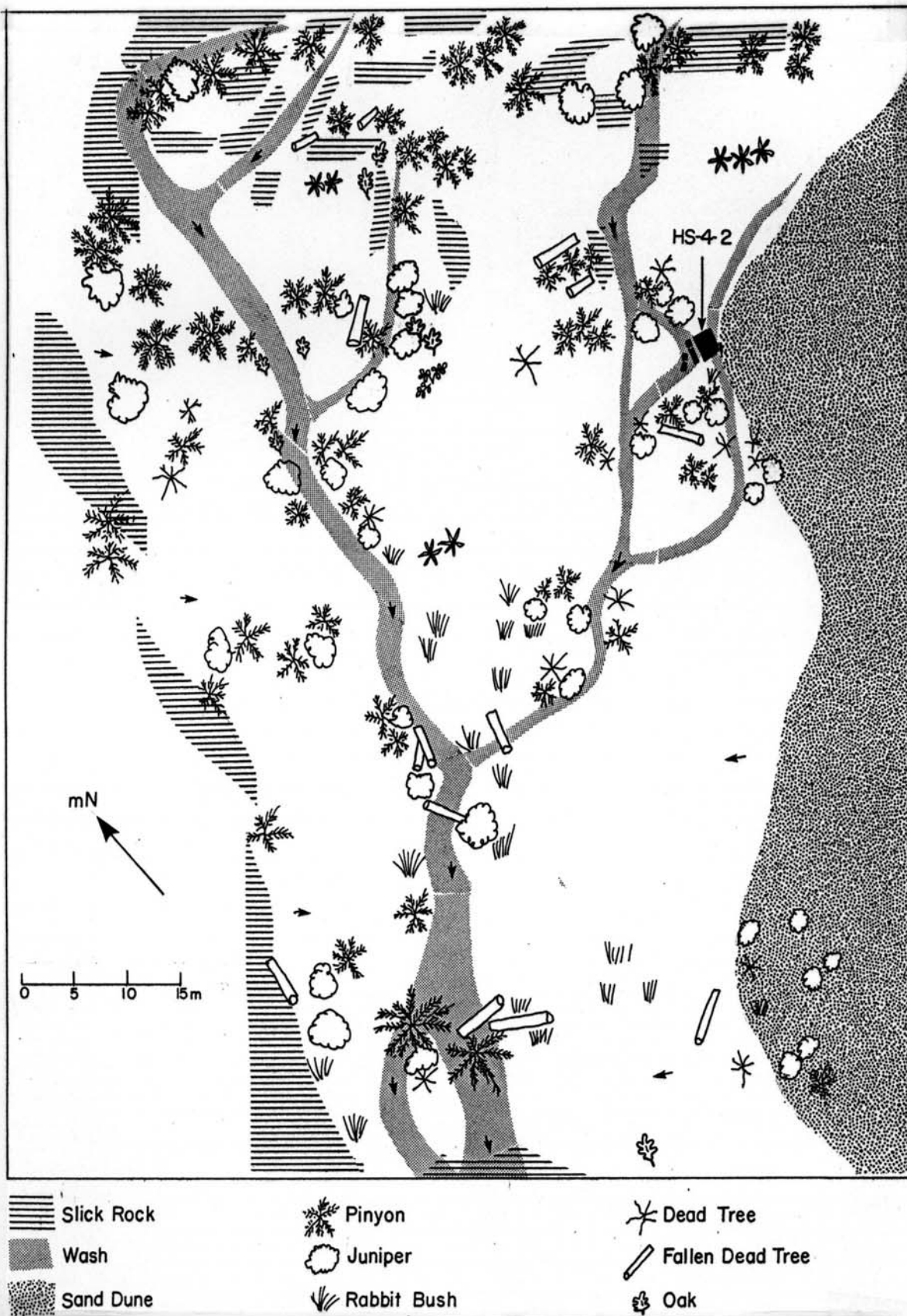


Fig. 2-5 Probable floodwater farming location with Dos Tanques

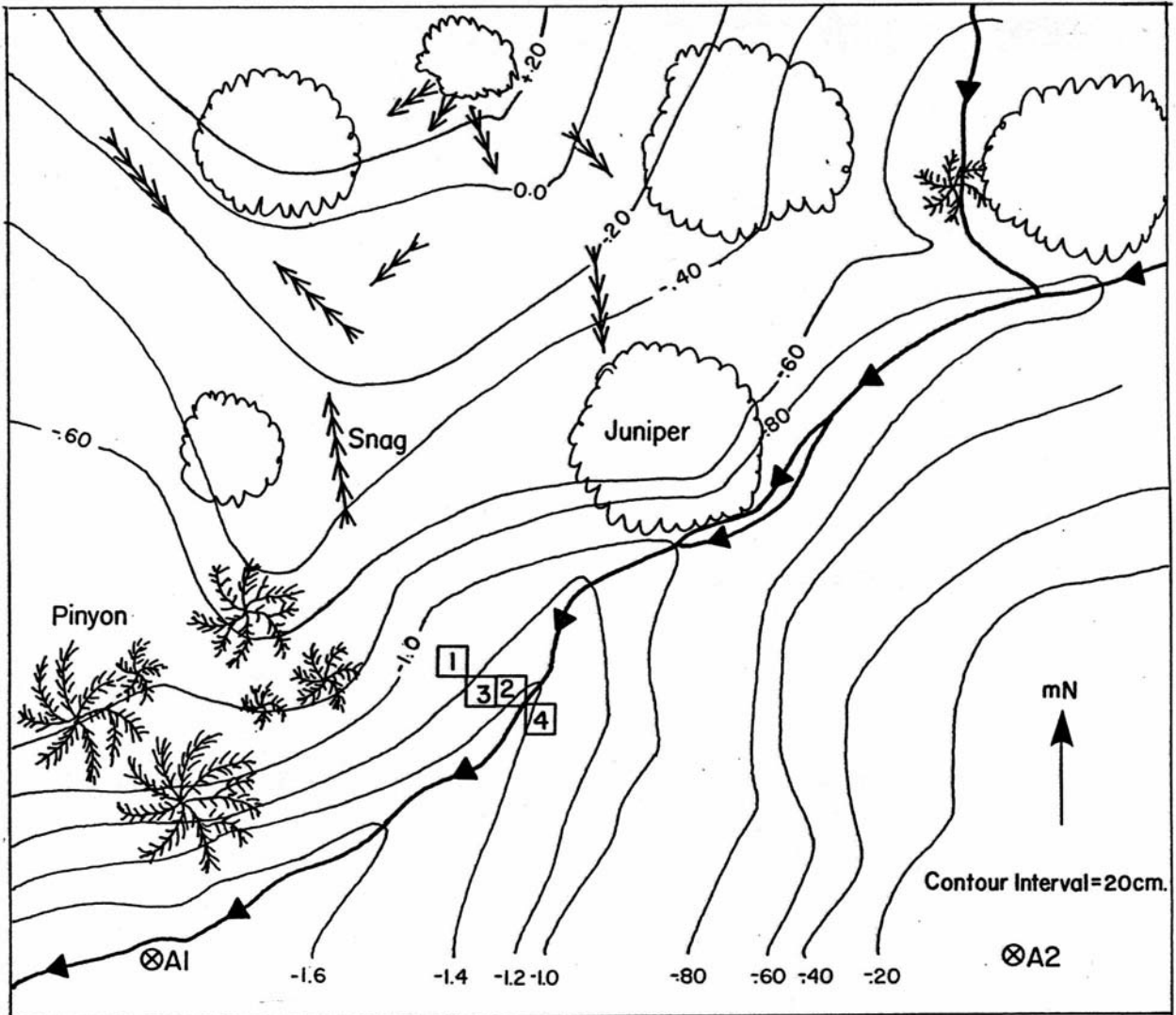


Fig. 2-6 Hardscrabble 5-2 (HS 5-2) Contour Map

(slightly more than one acre) with a rock sill and contains from 1 to 2m of soil. It is this potential floodwater farming area, unique to my knowledge of Cedar Mesa, that I think is the most important attribute of the Dos Tanques-Dos Fuentes locality (Fig. 2-5). To be fair this slickrock rock located above the dunes would also recharge the storage capacity of some of the dunes as well. The abundant water sources, the plot with the floodwater potential and the sand dunes might explain the attractiveness of this very low area to farmers, if in fact that is who produced the archaeological remains recovered.

At this locality we tested what I believe are the remains of three different pithouses. HS 5-2 is the site identified from the survey collections as a habitation, although no structural remains were noted. Upon putting in 4 1x1m units we found a well preserved pitstructure 4.2-5m in diameter cut 70 cm into the caliche (Fig. 2-6). Interestingly enough, only a single sandstone slab was found, possibly indicating that they were robbed or that this structure varied from those found higher on the mesa top in the Grand Gulch Phase. The structure appears to have been burned sometime after abandonment (Fig. 2-7).

The artifacts present appear to correspond closely to Grand Gulch Phase types, with the projectile points being indistinguishable (Fig. 2-8). Of interest was the presence of a bead industry based on a grey chert. HS 5-2, then, is a pithouse, typologically BM II, confirming the "BM II habitation site" inference made on the basis of surface collection.

About 250m across the wash, on top of a dune, and outside of the surveyed quadrat, was another site we infer was a BM II pithouse habitation site. This site, denoted as HS 15-1, was mapped collected, and tested with a single 1x1m unit. Besides the numerous sandstone slabs on the surface, the test unit showed that they outlined the walls, and curve to the flat bottom of the pit. These slabs may simply be the result of putting a pitstructure into loose dune sand. The abundant sandstone slabs on the surface, along with burnt jacal, indicate that substantial features are present here, along with at least one pithouse. The lithic artifacts present are consistent with, but not diagnostic of BM II.

The third site, HS 5-3, interpreted as the remains of pithouse, did not have any intact cultural matrix remaining, at least that was found with the two 1x1m units put into it (Fig. 2-9). The original surface appears to have been higher on the dune, which had since eroded; thus the archaeological material is now lying on a lower surface.

In addition to these three pithouse sites, 2 limited activity sites were investigated in the Dos Tanques-Dos Fuentes locality, both adjacent to the presumed floodwater farming area. HS 4-1 is a site with a very small BM III loci, two small, localized Pueblo II/III loci, and a much larger aceramic area inferred to be BM II situated on and around a large dune. Three 1x1m units were placed near the crest of the dune, but no intact cultural matrix with significant artifactual content were found although one unit did show a fairly concentrated charcoal

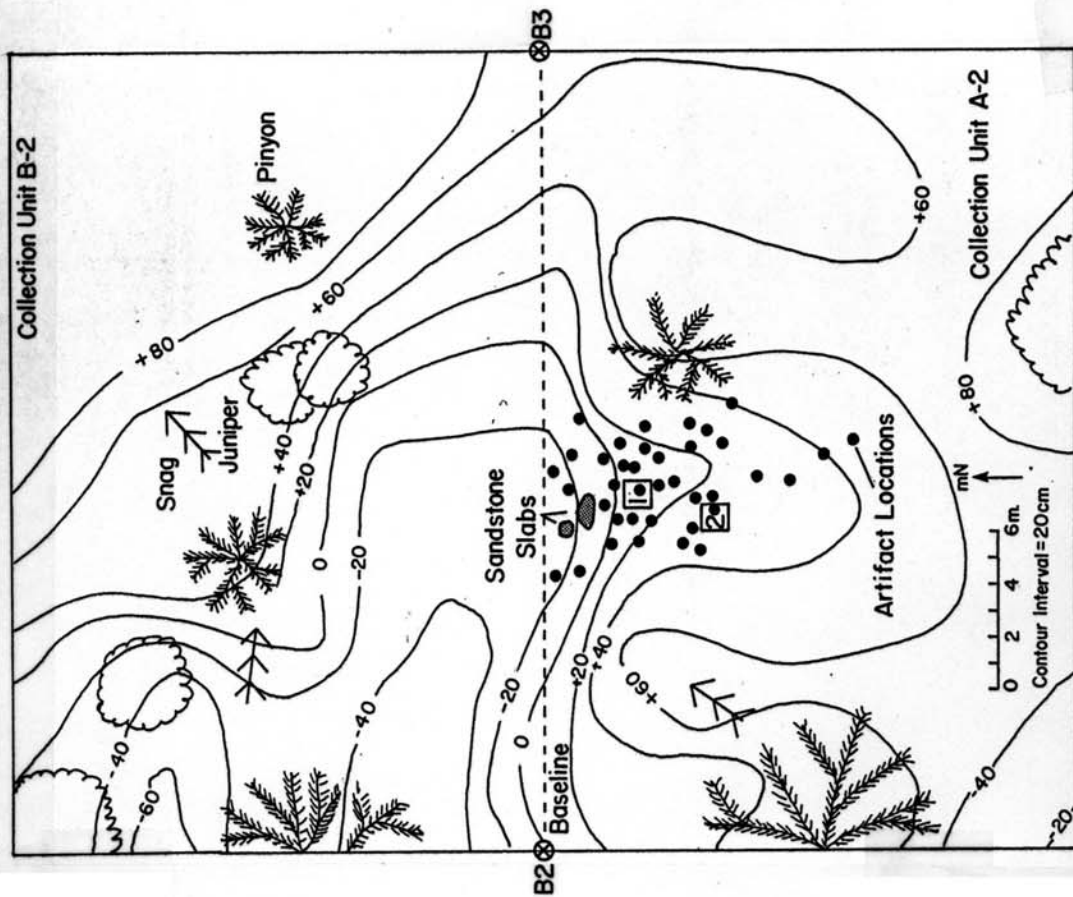


Fig. 2-9 Hardscrabble 5-3 Contour Map

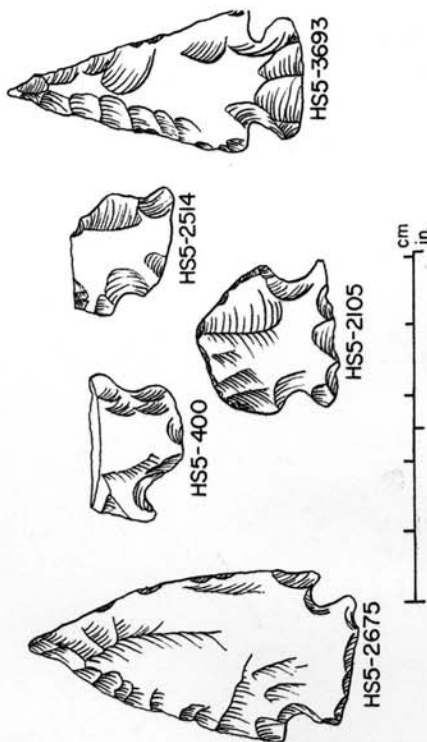


Fig. 2-8 Hardscrabble 5-2 projectile points

colored area.

The final site (HS 4-2) had 2 features, one a sandstone slab feature with a heavy concentration of charcoal but no lithic artifacts. The second feature appears to be a slightly bell-shaped pit about 70 cm deep and circa 1.5 meters in diameter, and include both halves of a deep basin metate that had been broken prior to being placed in the pit. No other lithic artifacts, beyond a few flakes were present in the 1x1m unit placed in this pit.

Hardscrabble 11

Quadrat HS 11 is 4 km to the northeast from the Dos Tanques-Dos Fuentes locality and had three sites classified as BM II campsites, including the the two largest of the campsite class. This area is also low elevation (circa 5700ft (1740m) and has no obvious arable characteristics, although today abundant Indian Rice grass is found next to the quadrat. Upon investigation some nice natural tanks were found adjacent to these sites (Fig. 2-10) one of which was found to have water present before the summer monsoon in late June of 1992. Further a fourth site similar to the three inside HS 11 was found 150 meters to the east directly below a ledge with at least five sandstone slab cists, complete with juniper bark tempered mortar, a diagnostic BM II trait. This association suggests that all the HS 11 sites are indeed BM II. HS 11-1 and 2 were minimally tested for charcoal and float samples which yielded maize.

North Road -The Rock Island Site

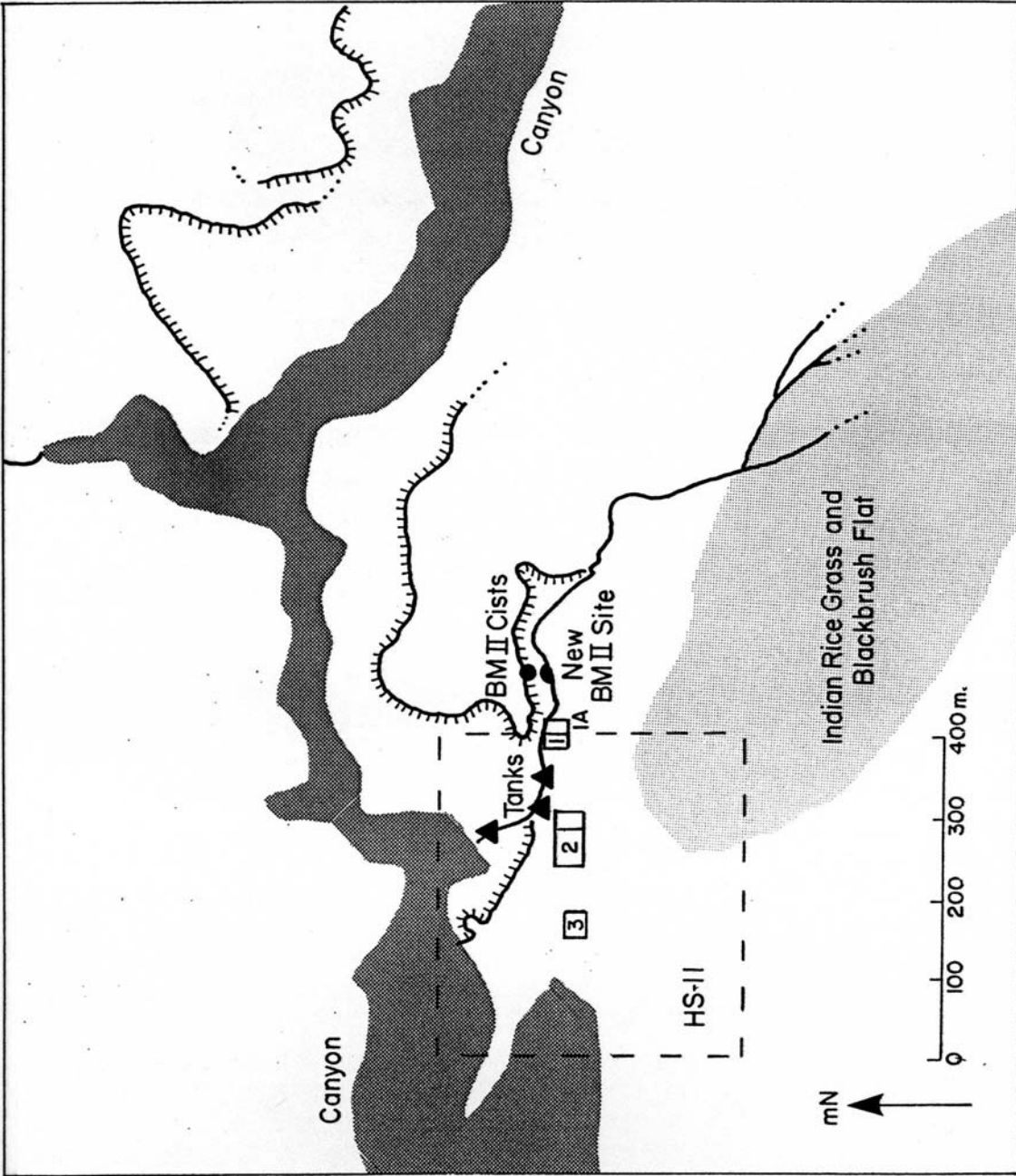


Fig. 2-10 Quadrat Hardscrabble 11 and surrounding area

The third area which we investigated, was on the eastern slope of the mesa, in the North Road drainage, near the area block surveyed by Karen Dohm (this volume). During the Canyon Inventory Survey portion of the Cedar Mesa Project, a BM II site (NR C9-5) was noted on the promontory between the branches of North Road Canyon. This side of the mesa, although relatively low, is wetter than the west slope, because of its northeast exposure. Be that as it may, there is no soil on this promontory, nor any adjacent to it (Fig. 2-11).

When this site was first located and partially collected in 1974, we really did not know what to make of it. In 1991, upon reinspection, Dr. Dohm and I concluded that it is a concentrated pithouse village, with a minimum of 5 pithouses, including one which had a floor partially exposed in one of the two small test pits excavated in 1991. Since no other BM II concentrations of such size were found during the quadrats survey, we previously were unable to comprehend its nature. A collection of approximately 40% of the area in 1974 produced 8800 catalogue entries, suggesting that this site has as many-if not more-lithic artifacts as any site on the mesa-top.

This site is in an obvious defensive location and may even have the remains of a defensive wall, near the only point of easy access. The interpretation of this as a defensive site - hence the name of the Rock Island Site - fits with recent interpretations of BM II rock art illustrating trophy heads (Cole 1985;1990) and burial remains (Hurst and Turner 1990).

Dating

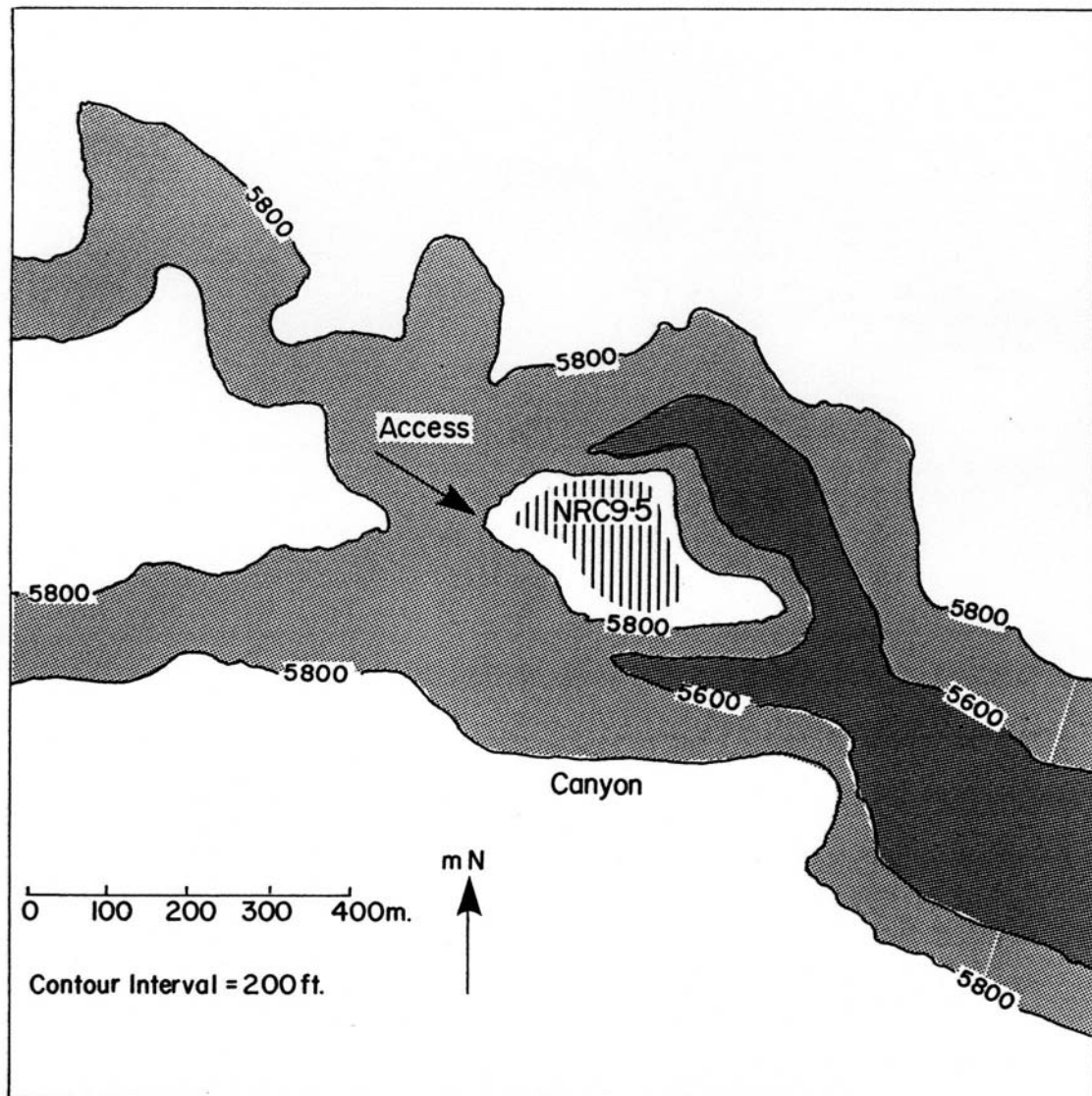


Fig. 2-11 North Road C9-5 (Rock Island site) and surrounding area

From the 1991 work we currently have five radiocarbon dates, ranging from 1670 \pm 90 to 2490 \pm 80 BP, all within the broader BM II period. No significant Archaic presence is noted, even among these anomalous BM II sites. Inspection of the radiocarbon dates (Table 2-1, Fig. 2-12) shows that the one date from North Road C9-5 appears to be an outlier, and disjunct from the dates from Hardscrabble. In fact, an F test results in 12.81 significant at 0.001, indicating that these five dates can not be considered to be dating the same event. The remaining four Hardscrabble dates have a F ratio of 5.41, not significant at 0.001 but is at 0.01. These remaining four dates average 2265 \pm 43 BP, more in accordance with the earlier canyon bottom, rockshelter White Dog Cave BM II than the mesa-top pithouse Grand Gulch Phase which we have dated to A.D. 200-400.

Table 2-1. Cedar Mesa 1991 Basketmaker II Radiocarbon and Tree-ring dates

<u>Site</u>	<u>Field Sample</u>	<u>Lab Number</u>	<u>Date</u>
HS 5-2	(#52)	WSU 4342	2060 \pm 90 B.P.
HS 4-2	(#15)	WSU 4343	2490 \pm 80 B.P.
HS 11-1	(#2)	WSU 4344	2310 \pm 80 B.P.
HS 15-1	(#61)	WSU 4346	2110 \pm 95 B.P.
NR C9-5	(#66)	WSU 4345	1670 \pm 90 B.P.
HS 15-1	(#62)	CML-448*	A.D. 140-206vv
HS 15-1	(#63)	CML-447*	A.D. 150-241vv

•CML-447 and CML-448 are dendrochronological dates.

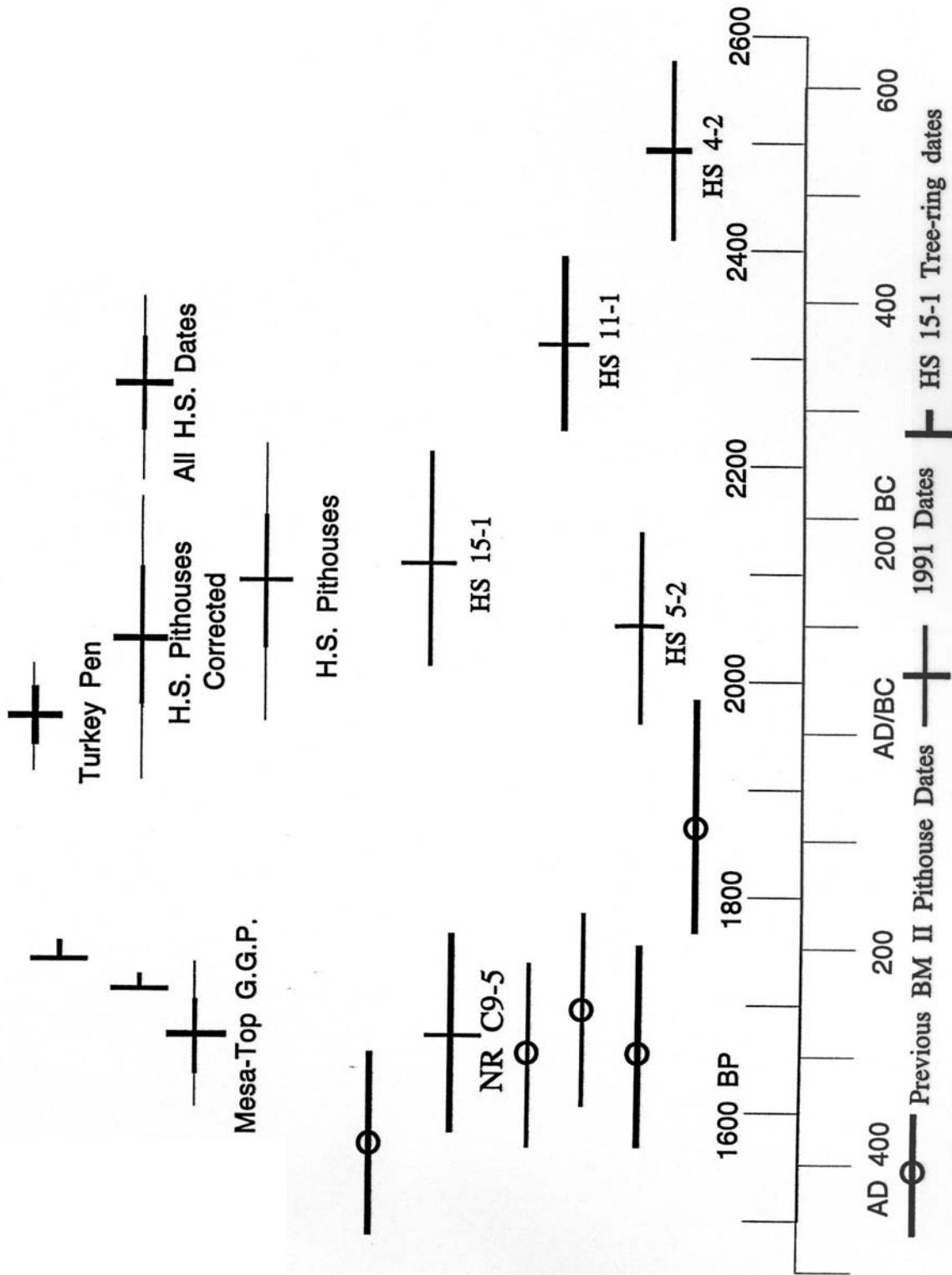


Fig. 2-12 Cedar Mesa Basketmaker II radiocarbon dates and tree-ring dates from Hardscrabble 15-1

If we plot all our Cedar Mesa mesa-top BM II radiocarbon dates (Matson 1991:92-3), (Fig. 2-12) we find a relatively tight group of dates for the non-Hardscrabble pithouses on the left, and a relatively loose group of Hardscrabble dates on the right. The North Road C9-5 date (WSU 4345) corresponds well with other mesa-top pithouse dates. In fact if we run an F test on that group of dates we find an value of 1.34, not significant at 0.05, and a group average of A.D. 276 \pm 35. This average fits well within the expected A.D. 200-400 period argued elsewhere for the dating of the mesa-top Grand Gulch Phase pithouse occupation, (Matson, Lipe, and Haase 1988, Matson 1991) and only about 50 years younger than our 30 BM II tree-ring dates (Matson 1991:91,93). This figure suggests that structural wood from pithouses on Cedar Mesa yields radiocarbon dates that add about 50 years to the actual calendrical dates.

The two sets of radiocarbon dates are clearly distinct according to three procedures, visually comparing the two average bars, using a two sample empirical test of the means (.026), and the t test (0.001) (Fig. 2-12). Thus, we appear to have two separate BM II phenomena on Cedar Mesa; the Hardscrabble Dos Tanques-Dos Fuentes floodwater area dates significantly earlier than the other mesa-top pithouses of the Grand Gulch phase.

From Smiley's (1985,1994) work it is clear that non-structural wood increases the discrepancy between radiocarbon and tree-ring dates. With this in mind, the non-pithouse dates from HS 11-1 (2310 BP) and HS 4-2 (2490 BP) would be expected to

be older than the pithouse dates from HS 5-2 and HS 15-1, and that is the case. Thus the best estimate of the Hardscrabble occupation would be the average of the two Pithouse dates (2084 \pm 65 BP or 134 BC) minus 50 years or 84 \pm 65 BC. This date is still very different from the other mesa-top radiocarbon pithouse dates (A.D. 326 \pm 35). The date of 84 BC, however, is very close to the average of 17 \pm 25 BC I reported (Matson 1991:117) from Turkey Pen based on five maize and twig dates (Fig. 2-12).

The close correspondence between the two sets of radiocarbon dates from Hardscrabble pithouses and that from Turkey Pen, and the difference between that set and the other mesa-top dates, supports the notion that the Hardscrabble floodwater farming locality is related to the earlier White Dog Cave occupation rather than to the later mesa-top rainfall dry-farming Grand Gulch Phase. This pattern would indicate that Lipe's (1971) hypothesis about the use of rim areas is correct for the White Dog Cave Phase, although it is not for the dominant mesa-top BM II Grand Gulch Phase. At the time this idea was put forward in 1971, though, as mentioned above, Smiley et al. (1986) had yet to show that BM II was not a unitary temporal phenomena.

The caveat to this analysis is that Smiley (1985) has also shown that radiocarbon dates can be many hundred years too old. Although this does not appear to be the case with the previous Grand Gulch pithouse dates, the lower elevation of the Hardscrabble Dos Tanques-Dos Fuentes locality, may lead to

different results. And in fact this is the case. After the foregoing analysis of radiocarbon dates was completed, the Tree Ring laboratory reported that they were able to date two pinyon charcoal samples from HS 15-1, at A.D. 140-206vv and 150-241vv, (CML-448 and CML-447) clearly placing this site into the Grand Gulch Phase of A.D. 200-400.

At least some of the BM II material at Dos Fuentes-Dos Tanques dates to the dominant BM II mesa-top phase. One wonders whether all the material does. One distinction between the pithouse found at HS 5-2, and those at HS 5-3, HS 15-1 and all other known mesa-top Cedar Mesa BM II pithouses is the lack of sandstone slabs at the former. Since the pithouses found at Black Mesa during the early BM II, also lack sandstone slabs-as do the "Milagro" San Pedro pithouses-HS 5-2 may, indeed, date prior to the Grand Gulch Phase.

Possible solutions to this unsatisfactory dating situation are running more conventional dates or AMS dating of some of the maize specimens reported in float samples from the excavations now undergoing analysis (D. Lepofsky, L. Huckell, Pers. Comm.). All the potential dendrosamples have been examined.

Conclusions

All the material recovered appears to be good representatives of the BM II culture. North Road C9-5, the Rock Island Site, appears to be concentrated BM II site in a defensive location, and dates to the Grand Gulch mesa-top BM II pithouse occupation.

The Hardscrabble material, both the HS 11 campsites, and the Dos Tanques-Dos Fuentes sites are also good BM II. The assignment of HS 5-2 to a habitation site class on the basis of surface artifacts is confirmed by the presence of a pithouse there. A second pithouse is definitely confirmed and dated, and another probably present. The adaptation was almost certainly oriented to floodwater and sand dune farming in this area, unique in the Cedar Mesa area. Habitations in the White Dog Cave variant are very scarce, with the Three Fir example (Smiley et al. 1986) being the best known. If the HS 5-2 pithouse is confirmed to date to this time, it will be the first to be found away from the canyon-rockshelter environment, although Gilpin (1994) also reports on two other likely candidates.

Although the conclusions that these sites fall well within what has been predicted for the Cedar Mesa Grand Gulch BM II, the Dos Tanques-Dos Fuentes varies in two ways. First the emphasis on floodwater farming, and second, the possible association with with earlier White Dog Cave BM II, rather than the later Grand Gulch Phase.

So the anomalous BM II sites are in fact BM II sites, but they do widen the range of known adaptation and site settings, and lead to a potential better understanding of the development of the Anasazi. The defensive nature of NR C9-5 agrees with recent interpretations of conflict in the BM II period.

The Dos Tanques-Dos Fuentes occupation may represent an early attempt at floodwater farming on the mesa tops, which is followed by the Lolomai BM II floodwater farming adaptation on

Black Mesa, and which in turn was followed by the mesa-top dry-farming of the Grand Gulch Phase on Cedar Mesa (Matson 1991). Flood water farming continued to be practiced where practical, such as at Durango, and in the Navajo Reservoir area (Eddy 1961), during the Los Pinos Phase. This pattern is consistent with the San Pedro flood water farming Cochise (Huckell 1990) expanding up onto the plateau (Berry and Berry 1986) by utilizing potential floodwater farming areas, although it may also fit other explanations as well.

Chapter 3

SURVEY EVIDENCE FOR BASKETMAKER II VILLAGES

Karen Dohm
Department of Anthropology
Smithsonian Institution

The Basketmaker II sometimes may have lived in villages, or at least clustered communities, on Cedar Mesa, southeastern Utah between A.D. 250 and A.D. 400. These communities contain few houses, the houses are loosely clustered, and the duration of occupations may have been brief. There is no evidence to suggest long-term occupation nor to suggest hierarchical social organization. I suggest that the house clusters represent mostly contemporaneous occupations because individual household areas within such communities have coherent spatial layouts. The communities are themselves part of larger neighborhoods with individual or isolated homesteads and other dwelling clusters. Scale and circumstance of the small-scale house clusters may be part of the origins of later Anasazi villages.

Basketmaker II (BM II) house clusters on Cedar Mesa would not be the earliest aggregated communities in the Southwest. Clustered Cedar Mesa BM II houses date between A.D. 250 and A.D. 400. Elsewhere, people constructed homes close together much earlier. Early villages are known especially from southern Arizona (Huckell 1984a; Huckell 1987; in [Matson 1991]:190-192,

202), but also from Colorado (Stiger 1991, personal communication). Contemporaries of Cedar Mesa Basketmaker II probably lived in villages in Colorado (e.g., Morris and Burgh 1954:43), New Mexico (Eddy 1961;; Dittert et al. 1963; Fritz 1974;), and Arizona (Haury and Sayles 1947;Smiley 1985:15, 22, 285). The immediate importance of Cedar Mesa communities, if any can be verified through excavation as representing villages, is especially in their corroboration of other finds pushing this final characteristic of later periods of the Anasazi tradition back to BM II times. Domestic architecture and layout of BM II residential sites are already known to be part of the later Anasazi tradition. It is likely that multi-household organization is also part of the tradition. Second, their importance is their implication of greater than previously predicted regional population.

The Cedar Mesa Natural and Cultural Area

As briefly described in the introduction, Cedar Mesa is a highland area in southeastern Utah, covered by pinyon-juniper and cut by narrow canyons. Cedar Mesa is geographically near the center of BM II culture (see Cummings 1910; Berry 1982; Figure 19; McGregor 1965:173). Previous survey by William Lipe and R.G. Matson records substantial BM II settlement on Cedar Mesa, accounting some 123 BM II sites in the equivalent of 12.2 sq km (4.7 sq miles). Seventeen of the 76 surveyed quadrats (400m on a side) included remains of two or more BM II sites of some description. Thirty-two quadrats had remains of BM II

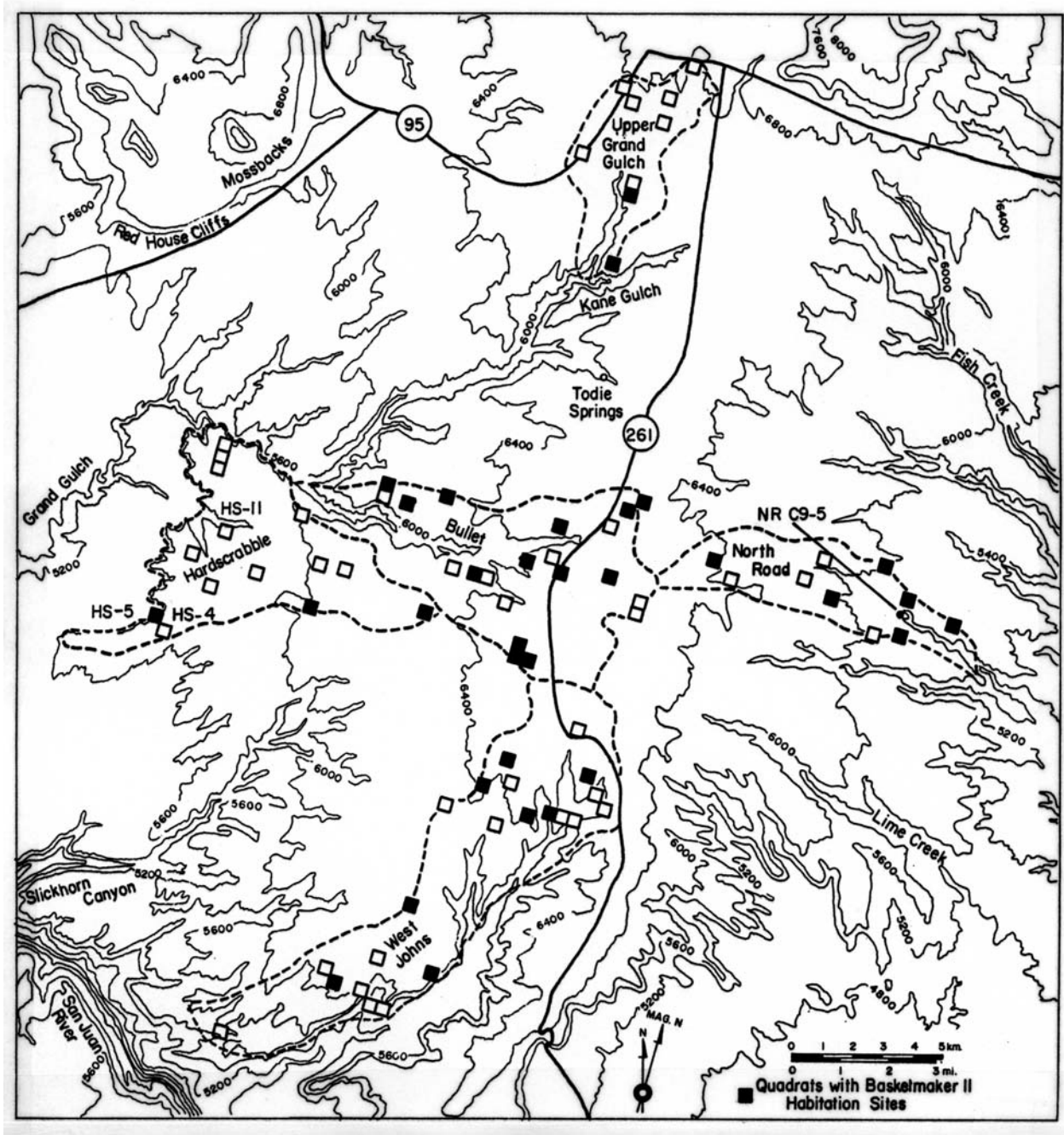


Fig. 3-1 Cedar Mesa quadrats with BM II habitations and with North Road Drainage designated

habitations sites. They found as many as 8 BM II sites in one 400-by-400 meter quadrat (Table 3-1; Quadrat site and pithouse counts). In total, they identified 123 BM II sites in 53 of their 76 quadrats (Fig. 3-1).

Evidence for BM II Villages in the 1972-1974 Survey

The 1972-74 surveys showed that BM II sites cluster together and that an important percent of dwellings are near each other. Of the 49 probable BM II habitation sites identified by the original Cedar Mesa Project (Matson 1991:80), between 31 and 33 are in quadrats with other BM II habitation sites. That is, less than 1/3 of the BM II habitation sites are necessarily isolated residences.

Of course, it is a jump to go from "not-isolated residences" to "community," much less to "village." Further, even if all BM II sites in any quadrat are absolutely contemporaneous, "village" may be an extravagant description for most. None of the Cedar Mesa BM II communities has houses even so clustered as those in Eddy's Valentine Village (see Eddy 1961). Still, some Cedar Mesa communities may have as many contemporaneous houses aggregated together as do the Navajo Reservoir District villages.

Of the 17 Lipe and Matson quadrats containing two or more BM II sites, six quadrats enclosed three or four BM II habitation sites (Table 3-1). The 1991 survey documented the area between two of these quadrats with relatively numerous

dwelling sites: North Road 5 and North Road 6. The 1991 survey was to find whether the North Road 5 and North Road 6 quadrat sites are part of a larger "village." We found that the pithouse count does climb beyond the randomly selected quadrat boundaries. However, the number of contemporaneous houses in any 400-by-400m area may not be greater than in the North Road 5 or North Road 6 quadrats. Pithouses are in small clusters that may be better described as "communities" than as "villages."

Table 3-1. Cedar Mesa Survey 1972-1974. Site and Pithouse Counts in 400-by-400m Quadrats with Multiple BM II Sites.

<u>Quadrat</u>	Total BM II <u>Sites</u>	Pure BM II <u>Sites</u>	Probable BM II <u>Pithouses</u>
Bullet 5	3	2	2
Bullet 9	3	3	0
Bullet 10	7	7	4
Bullet 20	3	3	2
Bullet 21	6	6	4
Hardscrabble 5	3	3	2
Hardscrabble 11	3	3	0
North Road 2	4	4	0
North Road 5	6	4	2-3
North Road 6	4	3	3
North Road 8	3	3	2
North Road 10	3	3	2
Upper Grand Gulch 7 8	8	8	3
West Johns 4	5	3	0-1
West Johns 9	4	3	2
West Johns 10	4	4	0
West Johns 15	4	2	0
West Johns 19	7	7	4

The 1991 Survey

The 1991 survey covered an 800m east-west by 500 north-south area. We surveyed this area as though it was four partial 400m quadrats on the original Cedar Mesa Project. We mapped every artifact, every sandstone or limestone cluster, every ash concentration, and all the trees, drainages, and bedrock exposures in the areas with Basketmaker II materials. With the previous survey of North Road 5 and North Road 6, the total intensively covered area is about 0.72 square km or 0.28 square mile.

Within this area of slightly more than one-quarter square mile, there are 24 BM II sites including 15 or 16 pithouse dwellings. The 1991 survey subset was 14 BM II sites including 10 probable pithouses. If pithouses each have 15 residents and all were contemporaneous (an unlikely scenario) we are accounting 225 to 240 local residents in the North Road 5-to-6 area.

The Relation of Cedar Mesa Survey to Excavation Results

On survey, we identified BM II pithouses by presence of sandstone slabs, a large ash concentration and, rarely, a depression. The slabs that once lined an entryway (Fig.3-2;-3: also see Lipe 1978:395-396) are often all but hidden by sediment and buffaloberry bushes or juniper trees (Fig. 3-3;photo 1991). We searched hard for an array of materials that would suggest a pithouse when there was considerable limestone manuports

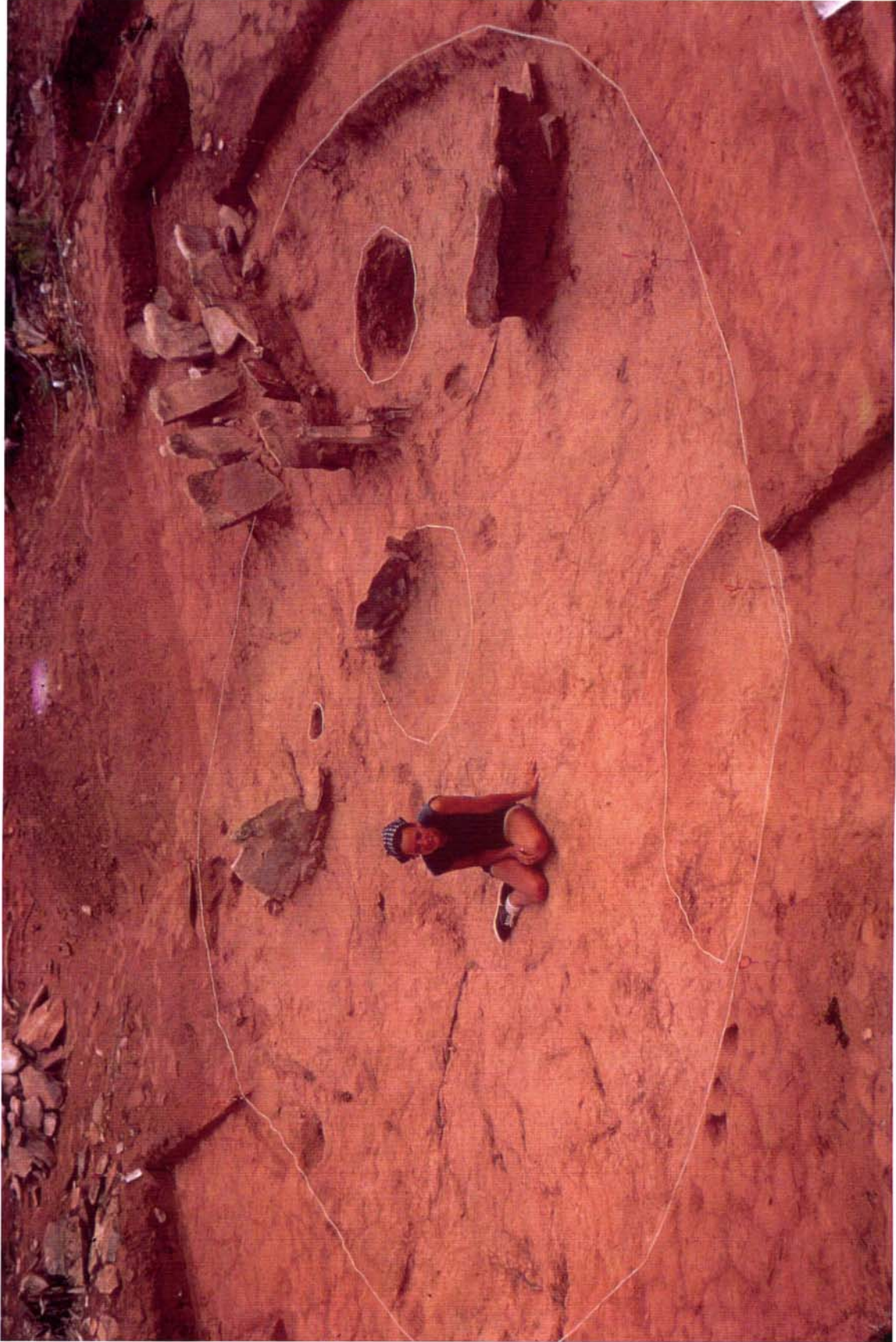


Fig. 3-2 Excavated BM II house showing entrance way (GG69-18)

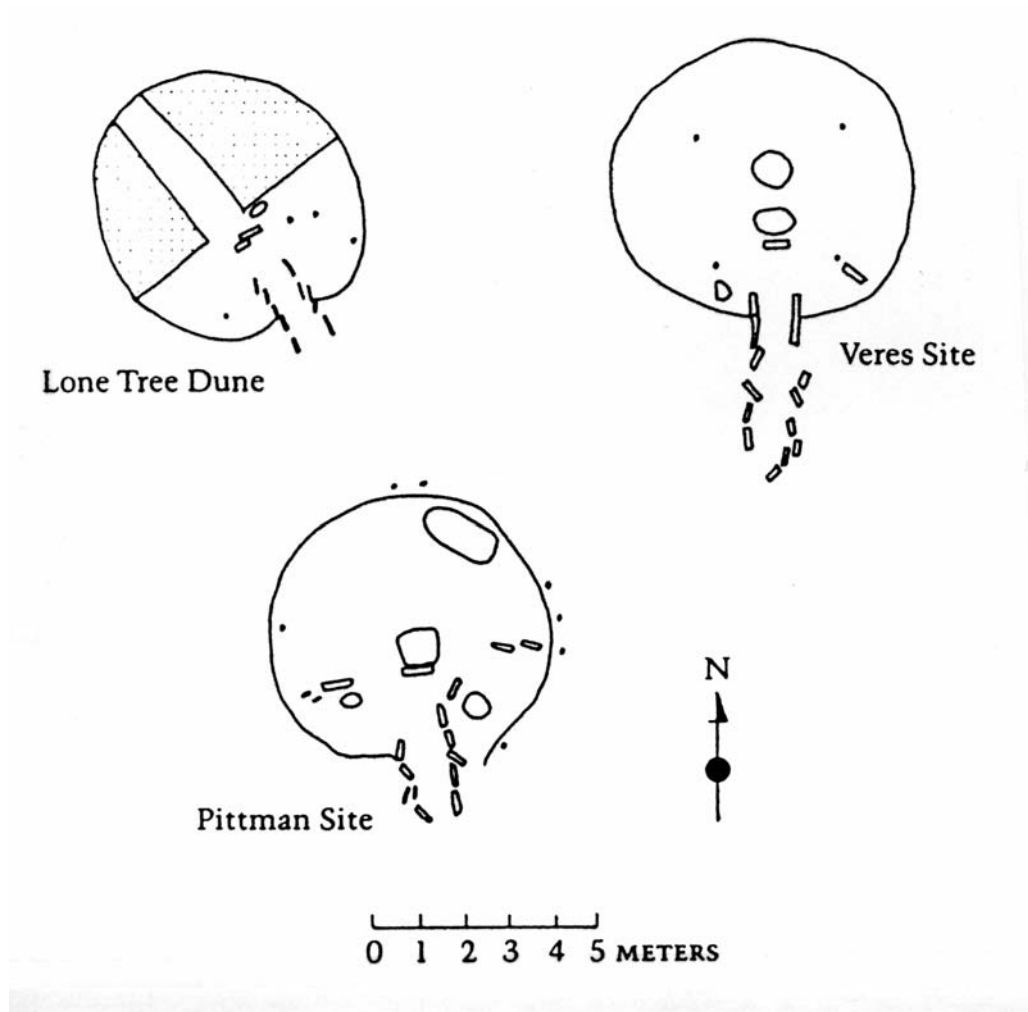


Fig. 3-3 Cedar Mesa BM II house forms

present on the site. We searched because I believe that presence of substantial amounts of burned limestone is a good indicator of BM II residential sites.

Basketmaker materials identified on the Cedar Mesa surveys are a good, if conservative, proxy for architectural remains. Excavation among the pithouse aggregations is likely to show more substantial architecture, rather than less substantial. Excavation in 1984 on a West John's Basketmaker site showed that every feature defined in the original Cedar Mesa Project survey identified some activity area or architectural unit (Dohm 1988:191-197, 232-236). Therefore, I count even small or diffuse scatters of sandstone, limestone, and artifacts as features. The 1991 descriptions have slab or sandstone features, mixed sandstone-and-limestone concentrations with artifacts (as probable trash), limestone concentrations, ash spots as storage or as hearths, and probable pithouses. In some general sense, these correspond to hearths and cists, trash deposits of various sorts, and pithouses.

Both the 1973-74 tests and the 1984 excavation revealed more formal architectural remains than were recognizable by survey. Simple decay, of course, accounts for invisibility of some features. As well, microenvironmental aggradation hides some features. Reuse of habitation site locations by later Basketmakers and pueblos hides others.

Broadly speaking, Cedar Mesa probably is part of an erosional environment with some local depositional environments (Arrhenius and Bonatti 1965; Agenbroad 1975; Salkin 1975). At



Fig. 3-4 North Road 15-6, showing juniper growing out of structure and slab-lined entrance way

the microenvironmental level, a common location for sediment accumulation probably is within pithouses where trapped moisture may aid tree growth. Increased tree roots might then trap additional sediment that would otherwise be carried off by wind or water. Ancient pithouses commonly boast a resident juniper (Fig. 3-4; juniper growing out of pithouse on NR 15-5 or 15-7). Microenvironmental aggradation, along with re-use of BM II site locations by later Anasazi probably cause some underrepresentation from survey. Together, they almost certainly promise lowered representation of pithouses.

In previous study of BM II habitation sites, using isolated residences, I noted a recognizable spatial layout. Pithouses were generally in the northwest one-third of the artifact distribution (Dohm 1981). Furniture was left immediately around the BM II pithouses (Dohm 1988:269-270). Storage facilities were predominantly north of the pithouse, but some places extended northwest or northeast of the dwelling. In isolated dwelling sites, at least, storage facilities are usually 8-10 meters from the north edge of the pithouse (Dohm 1988:245-250). In contrast to furniture, trash, and storage, hearths had unpredictable locations. Burnt limestone concentrations (which I use as a proxy for hearths, thinking limestone was probably not carried far from where it was used) have the same spatial distribution around the pithouse as do slab-lined hearths or ash hearths. All are sometimes recorded in storage areas or in unspecified directions away from the pithouses.

Habitation sites may be rarely reused during the BM II

period on Cedar Mesa because the classic BM II time range is brief. Five C-14 dates and 30 tree-ring dates from previous Cedar Mesa excavations show mesa-top construction between A.D. 250 and A.D. 400 and most construction between A.D. 250 and A.D. 350 (Matson 1991:91-92). This 100-to-150 year period is too brief for regeneration of local pinyon-juniper woodland, if individual BM II dwellings were abandoned because of exhaustion of wood resources (Haase 1983). It seems unlikely to me that they would instead have been abandoned because of soil depletion (Dohm 1988:59-61). Elsewhere in the Anasazi area, people are known to have continued farming plots long after the best crop yields declined (Hogan 1987:254). However, if residences were abandoned either because of soil depletion (Matson et al. n.d.) or because of short-term drought or a succession of too-brief growing seasons (Haase 1983), house clusters may not identify absolutely contemporaneous neighborhoods. We might expect reoccupation in the BM II period. While returning homesteaders and new residents need not reuse exactly earlier house locations their archaeological remains might be confused (especially see Camilli 1983 for a discussion of probable palimpsest problems with Cedar Mesa BM II data).

Cedar Mesa BM II sites are not likely to be mistaken for earlier or later occupations, although they may be hidden by later occupations. There is little evidence for Archaic remains or for earlier (pre-classic) BM II habitations in the usual BM II mesa-top locations (Matson and Lipe 1978; Matson 1991; also see Matson, this volume, on anomalous BM II remains on Cedar

Mesa). These would be the remains most likely confused with classic BM II habitations. This is important to gauge whether sites, known only from survey, may be actually contemporaneous instead of reflecting only within-period reoccupation or architectural contemporaneity.

I have reviewed survey evidence for contemporaneity by comparing the clustered 1991 surveyed homesteads with spatial layouts of homesteads that are thought to be isolated single component sites. In at least one house cluster recorded in 1991 (in North Road 15, described below), each pithouse and its associated features and artifacts have the same spatial organization as other previously described BM II homesteads. Its clustered homesteads may have formed a neighborhood ("village"). That is, its component homesteads may have been truly contemporaneous. Homesteads in other aggregations have apparently different spatial layouts than each other and than layouts of isolated homesteads. Individually, their layouts appear either confused or truncated. Two house groups that may be argued as communities purely from survey evidence are described; these are North Road 13 and North Road 15¹. This is a preliminary and not a statistical or even formal review of site spatial organization.

Review of Specific BM II Sites

In 1991 survey we identified three possible pithouse clusters (Fig. 3-5). The best defined is in North Road 15. It consists of three BM II homesteads, each with apparently well-defined boundaries. The second is in North Road 13. It also

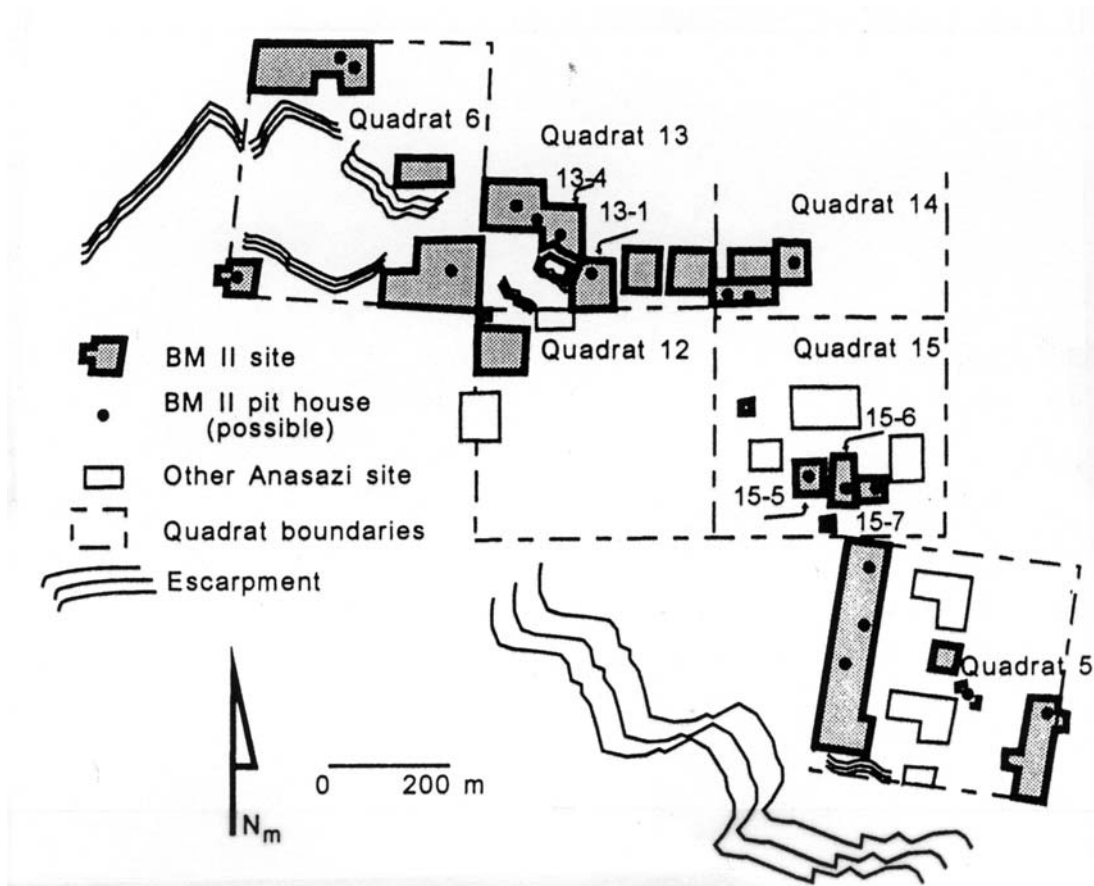


Fig. 3-5 North Road Neighborhood, showing survey quadrats and prehistoric sites

includes three BM II homesteads but their boundaries are partially obscured by numerous burnt limestone dumps and artifact scatters that I infer may be from later occupations. Some artifacts are from BM III and Pueblo use of the area and, I believe, some artifacts and limestone are from later BM II re-occupations. Boundaries of the homesteads are further obscured by a modern dirt road and its historic antecedent ("Mormon Trail" or "Emigrant Trail" on U.S.G.S. maps). The third possible cluster, in North Road 14, is even less well defined. There are only two well-defined pithouses. A third or fourth dwelling may be implied by large burnt limestone dumps. Boundaries and site layout are obscured both by post-BM II occupation and by sediment cover. The North Road 15 and North Road 13 house clusters are described below.

North Road 15 Quadrat Sites

Three possibly contemporaneous dwellings in North Road 15 have well-defined spatial layouts. The sites are side-by-side on the south facing slope of a long, low ridge. The orientation of each site is the same and distribution of artifacts and features do not seem to overlap one-another. Their discovery is partly due to their location on a slope dropping off to north Road Canyon. That is, today they are in a wholly erosional environment. Many architectural features are clearly visible.

Each North Road 15 site has spatial attributes expected on BM II dwelling sites (Fig. 3-6). For instance, ash and sandstone features are north of the pithouse. These possibly or

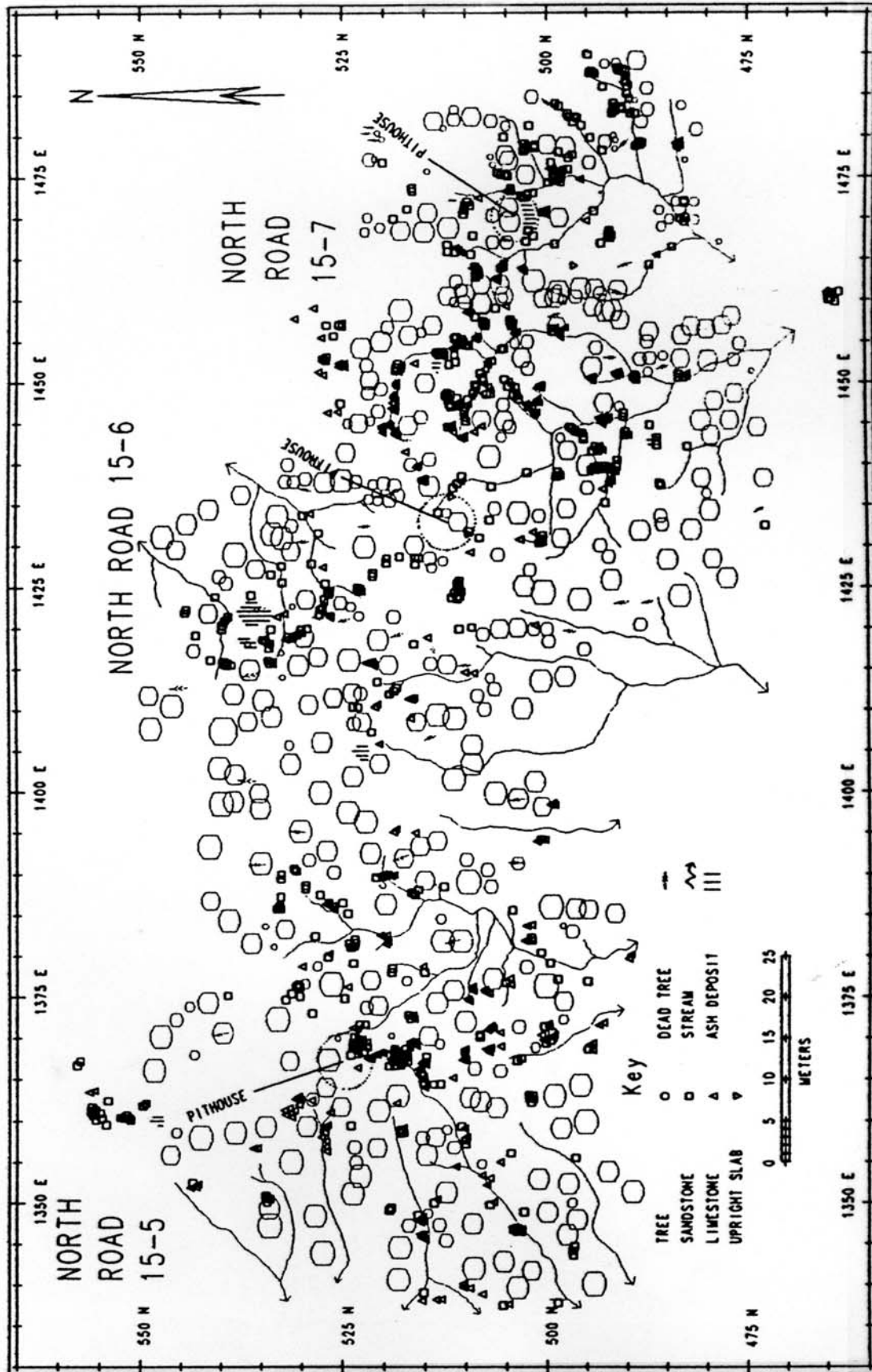


Fig. 3-6 North Road 15 dwelling cluster. Plant and physiographic features are in gray, archaeological in black.

even probably mark storage units. Most artifacts are southeast of the pithouse (Fig. 3-6). The pithouse is not in the center of the distribution, although it is in the most dense part of the distribution. Instead, the pithouse is in the northwest third of the total artifact scatter. And, as with previously reviewed dwellings, most "furniture" is very near the pithouse (Fig. 3-6).

North Road site 15-5, furthest west on the "village plan," has essentially the same plan as site 15-7, if I am correct in my pithouse attribution. Its artifact distribution is also heaviest southeast of the possible pithouse. Furniture again clusters near the pithouse.

Site 15-6 is similar; It is not the same. Some features marked by intensely burned spots are unusually distant from the pithouse. The burned spots are one- to-three meters in diameter. Based on their size, these are probably either burned storage facilities or very large hearths. Site 15-6 has another distinction, as well. Its map shows an unusually large number of features east of the pithouse. These may be partly associated with site 15-7, immediately to the east.

Despite those differences in feature locations, the site 15-6 artifact distribution is the same as the distribution on site 15-5 and site 15-7. The size of each is about 25-to-30m East-West by 35-to-40m North- South.

North Road 13 Quadrat Sites

Together, two adjacent sites on North Road 13 have three

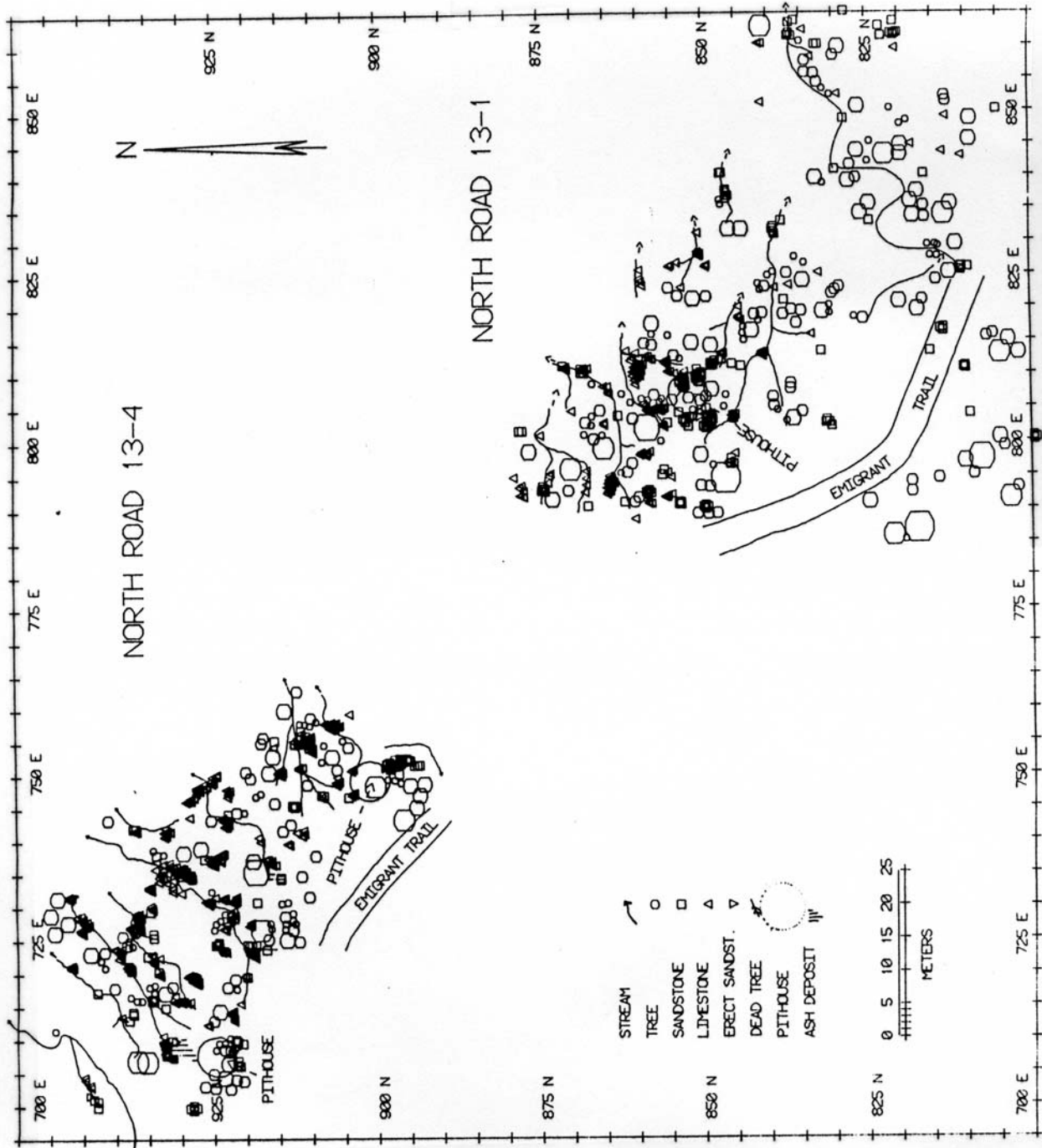


Fig. 3-7 North Road 13 dwelling cluster. Plant and topographic features are in gray, prehistoric material in black.

probable pithouses (Fig. 3-7). Site 13-4 has two well-defined pithouses and site 13-1 has the third pithouse. None of the homesteads has the expected distribution of either features or artifacts. Construction or use of the road (the Emigrant Trail on U.S.G.S. maps) probably has removed or obscured many artifacts and features. Still, expected storage features north and west of the pithouses are missing. On the one hand, they could be partly buried; this site may be in a locally aggradational environment because a nearby butte may be either a sediment source or trap. On the other hand, there are far more limestone dumps than are present on other apparently single component BM II sites. These dumps argue for reoccupation. As well, there is clear evidence of later Anasazi occupation, including some pueblo construction and about two dozen potsherds in the site 13-1 pithouse area. This quadrat is provisionally addressed among the possible "villages" or neighborhoods because of the proximity of the three homesteads. They are close together and maintain the expected 25-to-30m east-west by 35-to-40m north-south dimensions. While the plethora of limestone supposes palimpsests, it is as likely that these postdate all of the recognized homesteads as that any one is later than the others.

Results

Cedar Mesa Basketmakers tended to homestead in some kind of clustered communities. No neighborhood or community that we have identified so far is as large as any "village" defined by

researchers in New Mexico or Arizona. Nor is there any evidence for integrative structures in any Cedar Mesa BM II community. All of the apparent pithouses are about the same size. However, the simple fact of residential clustering may suggest supra-kin group residence. This is the important point for discussing depth of the Anasazi village tradition. Further, it is unfounded to suppose that all clusters in the North Road 5 and North Road 6 area represent temporally discrete occupations. However, survey evidence can only support contemporaneity of proximate residences. The survey argues well for contemporaneity of North Road 15 homesteads; it argues less well for contemporaneity of North Road 13 or North Road 14 homesteads.

In North Road 15, the three adjacent BM II sites are oriented in the same direction and each has essentially the same layout. This is partly caused by their location on a northwest-southeast trending ridge (Fig. 3-7). Still, topographic considerations in reoccupied sites would not account for the absence of overlapping features. And, each is about the same size.

It is possible that some noise is by palimpsests, particularly north and west of the site 15-6 pithouse and between the site 15-6 and site 15-7 pithouses. While they do not have the shared midden that Navajo Nation Archaeological Department (e.g., Werito 1989) expects for BM II villages², they present the appearance of a cohesive whole.

Homesteads in other site clusters identified during last

summer's survey are less likely to be contemporaneous. The North Road 13 sites are a good example. Like North Road 15, the North Road 13 quadrat has at least three pithouses. However, they may result from reoccupations or have overwhelming palimpsest problems with other, unidentified occupations. Of the three BM II components defined in North Road 13, only the site 13-1 Basketmaker homestead has the expected distribution of features and artifacts.

The survey evidence for contemporaneous BM II "villages" on Cedar Mesa is first that most pithouses are near other pithouses. Second, some neighboring pithouses have a congruence of spatial organization in which layout of dwelling, storage, and trash are the same for all. These neighborhoods are small to be called "villages." Perhaps only two to five neighboring households were occupied at once. Whether neighboring clusters - that is any of those within the North Road 5 to North Road 6 area were contemporaneous is less easily addressed by survey.

Acknowledgements

The 1991 Cedar Mesa survey and excavation was funded wholly by a grant from Social Sciences Research Council of Canada to R.G. Matson and myself. I am especially grateful to S.S.R.C.C. and R.G. Matson. Our totally excellent crew was Grant Beattie, Mike Brand, Gordon Matson, Julian Matson, Reid Nelson, Paul Prince, and Lisa Rankin. Susan Matson fed us and managed us and the camp. I believe the season would have been impossible without her. Bruce Louthan and Dale Davidson, Bureau of Land Management, loaned a laser transit, which allowed us to make precise maps. Brian Chisholm, University of British Columbia, kindly loaned a portable computer. Analysis since the field work has been made possible by the efforts of Jane Sandoval, who has verified and transcribed transit coordinates and artifact notes and by Mark Nagel, who has produced the artifact density maps presented here. Mike Brand has been responsible for our IMACS forms. I am grateful to W.D. Lipe and R.G. Matson for freely providing access to their earlier survey and excavation data, and to Frank Michaels for his various assistance and kindness.

Footnotes

1) Site numbering is dependent on the quadrats. The quadrats are 400-by-400m areas. North Road quadrats 1- to-11 were part of the Cedar Mesa Project stratified random sample survey of 1972 to 1974 (Lipe and Matson 1975; Lipe and Matson 1978). Quadrats 12- to-15 were judgmentally chosen for the 1991 survey but otherwise use the same general survey technique. Especially, sites are numbered by survey sequence. Only habitation sites that form part of clusters or "villages" are described here.

2) Only NNAD has provided a descriptive definition for expected BM II villages.

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Chapter 4

CARBON AND NITROGEN ISOTOPIC EVIDENCE ON BASKETMAKER II DIET AT CEDAR MESA, UTAH

BRIAN CHISHOLM
R.G. MATSON

Department of Anthropology and Sociology
University of British Columbia
Vancouver, B.C., Canada

The composition of Anasazi diets, particularly Basketmaker II, is still not fully established, with interpretations ranging from that of a mixed hunting-gathering and horticultural economy, to that of a fully horticultural one (Berry 1982:31-33). For example, Kidder and Guernsey (1919:154) stated that the Basketmaker II people used corn, like their Pueblo successors. Amsden (1949:97-105) saw the Basketmaker II as transitional between a hunter-gatherer and an agricultural Pueblo economy. Hough (1930:69) indicated that Basketmaker people cultivated both maize and squash, as well as hunting and collecting wild plants. He estimated the Pueblo peoples diet as being 85% cereal, 5% animal and 9% vegetable. Berry (1982:33) clearly views the Basketmaker II as committed to full time agriculture.

These interpretations can be contrasted with one suggesting that the Basketmaker II were mainly hunters and gatherers, who also grew some corn, but were not heavily dependent on it (Amsden 1949, Irwin Williams 1973). In this case we might

reasonably place the reliance on maize at about 30%. It is perhaps noteworthy that Schiffer (1972) made an estimate of 50% maize in the diet for the succeeding Basketmaker III period, based on a theoretical discussion using a series of assumptions and calculations involving the number of storage facilities, the estimated population size etc. Minnis (1985), using ethnographic analogy and coprolite data, also suggested a 50% maize intake for the Anasazi.

While the degree of the Anasazis reliance on maize is not yet clearly established, there is no doubt that maize was used in Basketmaker II times, as it has been noted from the earliest publications about that period (Kidder and Guernsey 1919, Pepper 1902). On Cedar Mesa maize has been found in storage cists (Lipe and Matson 1971, 1975; Matson and Lipe 1975, 1978; Matson, Lipe and Haase nd). A relatively recent analysis by Aasen (1984) on Basketmaker II coprolites from Turkey Pen Cave in Grand Gulch on Cedar Mesa (Fig. 4-1) showed both macrofossil and pollen evidence of maize. The question is how much did it contribute to the local diet?

In order to determine this, we collected Cedar Mesa Basketmaker II and Pueblo human bone samples for isotopic measurement and comparison. It would have been ideal to also have Archaic samples from Cedar Mesa. However, since the Archaic is so faint there as to be effectively absent, a sample was obtained from Sand Dune Cave (Burial 2) near Navajo Mountain (Lindsay et al 1968:42) (Fig. 1-1). These isotope ratio measurements allow C4 plant intake to be estimated and compared

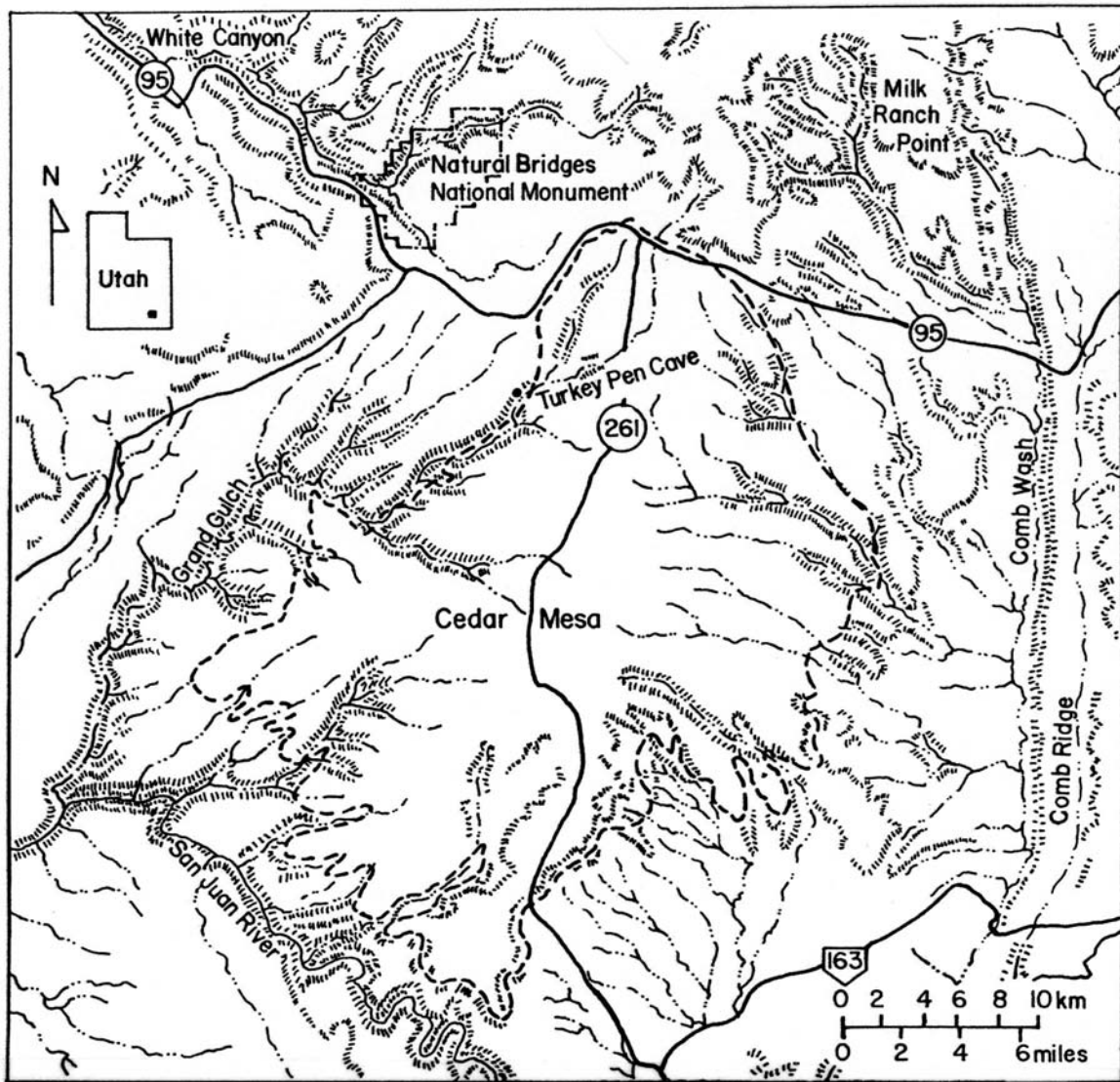


Fig. 4-1 Location of Cedar Mesa, Grand Gulch, and Turkey Pen

for the three time periods. In this area the major C4 plant food to consider as a human food would be maize, but some carbon that originated in C4 plants could make its way into humans via herbivore meat.

The Isotope Technique

The stable isotope approach to diet reconstruction has now been used archaeologically to determine the presence of maize in prehistoric human diets in a number of cases (Bender et al 1981; Bumsted 1984; Lynott et al 1985; Schwarcz et al 1985; van der Merwe and Vogel 1978; van der Merwe et al 1981). The technique has been described by a number of authors, and has been reviewed by van der Merwe (1982) so only a few important details are mentioned here.

We know that Carbon, from CO₂ of measurable isotopic ratio¹, is incorporated into plant tissues via photosynthesis at which time isotopic fractionation takes place, altering the isotope ratio. Also, when animals eat, their metabolisms recombine food-derived chemicals, containing Carbon and Nitrogen, and respire CO₂ and excrete urea, resulting in further fractionation of the carbon and nitrogen isotopes. It has been found that the difference between the isotope ratio for the average diet and that for the bone collagen extract (gelatin) of the consumers is about 4.5 (+0.4) per mil for lipid free samples (Chisholm 1986; Chisholm and Nelson, unpublished data; Koike and Chisholm 1988)², and about 5 per mil for samples with lipids left in (see van der Merwe 1982). As we now know this means that consumers bone gelatin, which may be recovered from a

prehistoric context, may be used to determine the isotope ratio for their average diet. Such gelatin-derived results may, in some cases, then be interpolated between the values for the diet alternatives that were available to the consumers, eg., C3 or C4 plants in order to estimate the relative proportion in which each alternative provided protein in their diets. In the case of nitrogen, the increment between diet and consumer gelatin is not quite as well understood, but what is particularly useful about nitrogen values is that the inter-trophic level difference between similar tissues is about 3 per mil (Chisholm, Nelson and Schwarcz, unpublished data, Minagawa and Wada 1984, Schoeninger and DeNiro 1984, Schwarcz 1991), which provides for better discrimination of trophic levels than does carbon, with its inter-trophic level increment of about 1 or less per mil (Bender et al 1981, DeNiro and Epstein 1978, Schoeninger 1985, Tieszen et al 1983).

It is always possible that the values for both C3 and C4 plants may have been affected to some extent by geographical, climatic or temporal differences in reservoir values, or by differences between tissues. In fact, maize kernels appear to be enriched in ^{13}C compared to leaves and cobs (Bender 1968, Creel and Long 1986, Lowdon and Dyck 1974 and Schwarcz et al 1985), with observed values for maize kernels of around -11 to -9 per mil. Samples from the Southwest (Bender 1968, Creel and Long 1986), suggest that the correct value for at least the maize component of a C4 diet in our study area may be about 1.5 to 2 per mil more enriched in ^{13}C than the usual C4 value of about

-12.5 per mil indicates. Herbivores and carnivores would of course react such differences. Clearly more data must be obtained on isotope ratios for the particular plant tissues that were eaten by herbivores and humans.

Samples, Analysis, and Results

While most plant foods thought to have been important in this area have known carbon isotope ratios, the major herbivores such as mountain sheep do not. Therefore, bones from six different individuals identified as mountain sheep (*Ovis canadensis*) from Cedar Mesa collections were analyzed, as were samples of archaeological maize (*Zea mays*) and modern Indian rice grass (*Oryzopsis hymenoides*). Unfortunately, other herbivore species from this area were not readily available for analysis.

However, a population of 55 deer (*Odocoileus hemionus hemionus*) from the Cache le Poudre drainage in north central Colorado has been analyzed by Hobson and Schwarcz (1986), following the same methods used here. Those deer were browsers from an environment with major plant species similar to the Cedar Mesa area (eg., *Artemisia tridentata*, *Purshia tridentata*, *Cercocarpus montanus*, *Bouteloua gracilis*, and *Muhlenbergia montana*) and thus should give similar values to Cedar Mesa browsers.

We were able to obtain human bone samples for isotopic analysis from only eight individuals (four Basketmaker II burials, three Pueblo burials and one Archaic burial). Although we tried to obtain further samples, no more were available for

analysis

The bone samples were processed by a variant of Longins (1971) method (Chisholm et al. 1983), including multiple treatments with dilute (0.1 N) HCl, overnight treatment with dilute NaOH, and dissolution of collagen in hot water (pH 3). Plant samples were hand cleaned, had their lipids removed with acetone, and were then air dried. Both gelatin and plant tissue samples were combusted at 90C in Vycor tubes and the resultant CO₂ measured with an isotope-ratio mass spectrometer. The usual measurement error for this instrument is 0.1 per mil. When combined with standard deviations for the C3 and C4 averages, and for the diet to consumer bone gelatin increment, this suggests an estimated error on our proportion determinations of about 10 percent. The nitrogen measurements were done on a Micromass Prism mass spectrometer, with sample combustion carried out in a Carl Erba combustion unit on the instrument. Results had an internal precision ranging from 0.011 to 0.032 per mil, and a reproducibility of $\pm 0.20 - 0.30$ per mil. The gelatin C:N values all fell between 2.8 and 3.2. The results are presented in Tables 4-1 and 4-2.

Table 4-1. Results of analysis of prehistoric Cedar Mesa mountain sheep.

Sample	Measured		Calculated diet $\delta^{13}\text{C}\%$	Estimated $\%C_{4\pm 5}$ *
	$\delta^{15}\text{N}\%$	$\delta^{13}\text{C}\%$		
NR C24.1 #8	5.0	-16.3	-20.8	23
GG 69-33 #51-1		-18.7	-23.2	6
UGG 4x site 3 #2	3.8	-16.5	-21.0	21
B 10-7 unit 10		-16.2	-20.7	24
UGG 9-6 #14		-19.2	-23.7	2
B 3X-10a #42		-15.0	-19.5	32
B FS2 BC16	4.8	-17.1	-21.6	15
Average	4.5 ± 0.64	-17.0 ± 1.48	-21.5	18.0

* Based on values for C3 plants of -24.0 per mil and for C4 plants of -10.0 per mil.

Table 4-2: Results of analysis of prehistoric Cedar Mesa human samples.

Period*	Sample	Measured		Calculated diet $\delta^{13}\text{C}(\%)$ ***
		$\delta^{15}\text{N}(\%)$	$\delta^{13}\text{C}(\%)$ **	
P III	Bu 3X-10a	10.5	-7.3	-11.8
P II/III	GG C12		-7.4	-11.9
P II/III	HS C3.1 #26	10.8	-7.1	-11.6
	Average	10.7	-7.3 ± 0.15	-11.8
BM II	Bu 9-6		-7.9	-12.4
BM II	B C35.2		-7.5	-12.0
BM II	NR C19.1 #18	9.5	-7.5	-12.0
BM II	NR C19.1 #17	10.4	-7.7	-12.2
	Average	10.0	-7.7 ± 0.19	-12.2
Archaic	NA 7523 (Navajo Mtn)	8.4	-13.9	-18.4

* P = Pueblo, BM = Basketmaker.

** C:N values are all between 2.8 and 3.1.

*** Based on the extracted bone collagen of a consumer being 4.5 per mil more positive than the value for its average diet (see text).

Plant Values

The carbon isotope ratio for a modern lipid-free sample of rice grass was -23.8 per mil (indicating that it is indeed a C3 species) and the nitrogen ratio was 1.4 per mil. This carbon value is somewhat more positive than other values reported for the Southwest, which average -26.0 ± 2.2 per mil in the Pecos River Valley, New Mexico (Des Marais et al 1983) and -26.1 ± 1.5 per mil near Oatman, Arizona (Ehleringer and Cooper 1988). The difference in values may reflect the removal of isotopically more negative lipids from our sample, and not from the others, or it may reflect a drier environment on Cedar Mesa than in the other sampled areas (c.f. Ehleringer and Cooper 1988). In the absence of further data we will use a rounded off value of -24 per mil to represent C3 species in the Cedar Mesa area. Our archaeological maize results were $\delta^{13}\text{C} = -9.9$ per mil and $\delta^{15}\text{N} = 13.5$ per mil for the kernel, or edible, portion. The carbon value agrees with those of Creel and Long (1986) for the southwest, so we will use a value of -10.0 per mil for a C4 diet in the Cedar Mesa area. Future measurements may lead to a modification of these values, which could change the natural proportion determinations for consumers, of up to perhaps 10 to 15%, but which should not significantly alter our temporal comparisons.

The maize N value, at 13.5 per mil is higher than those previously reported for the southwest, at 7.0 per mil. This brings about two different situations that will affect the natural

interpretations: 1) our value is incorrect, due perhaps to post depositional effects, or, 2) our value is correct, but represents an anomalous situation (such as the growing of maize in bean elds).

Herbivore Values

An average bone gelatin carbon isotope ratio of -20.6 ± 0.5 has been reported for modern Colorado deer (Hobson and Schwarcz 1986), indicating a dietary average of -25.1 . No nitrogen results were reported. While their gelatin is 4.5 enriched relative to their diet, muscle tissue should be enriched by only about 1 per mil as it is for other consumers (Bender et al. 1981, DeNiro and Epstein 1978, Schoeninger 1985, Tieszen et al. 1983). Therefore, meat from these deer should have an average carbon value of about -24.1 per mil, similar to the Indian Rice Grass value from Cedar Mesa. Deer from Cedar Mesa should exhibit similar values since their forage species were similar, and could be combined with the rice grass to form a C3 diet alternative group.

The prehistoric mountain sheep examined in this study (Table 4-1) gave an average carbon value of -17.0 ± 1.6 per mil and a nitrogen value of 4.5 ± 0.6 per mil. This indicates a diet that was higher in C4 plant material than that of the deer, averaging about 18% C4. As the mountain sheep are grazers and the deer are browsers, and as C4 species are grasses, these results are not surprising. The meat value for the mountain sheep would have been about -20.5 per mil.

Human diet alternatives and predicted human values

In this case there are three principal food categories available for human consumption, each with different $\delta^{13}\text{C}$ average values: C3 plants, C4 plants (primarily maize), and herbivore flesh. Since the deer, mountain sheep and the C3 plant values are close, we may consider them as one diet alternative group with an average value between -24.0 and -20.5 per mil. The C4 plant - maize group value used here is -10.0 per mil and may also include meat from C4 eating species such as turkeys, that may have been fed large quantities of maize. The presence of herbivore meat in the diets may be evident from high nitrogen ratios, which would indicate that the humans were eating from higher trophic levels.

In addition to plant remains Aasen (1984:40) found small unidentifiable fragments of bone in the Turkey Pen coprolites. If the animals were mountain sheep we would expect them to have a meat value of -20.5 per mil, as discussed above. Other grazing herbivores, such as rabbits and smaller rodents, should have similar values. Wild turkeys could complicate things somewhat as they are known to have been fed maize in some quantity. Consumption of small amounts of such herbivore meat might shift the results away from either of the C3 or C4 extremes, depending upon whether it was C3 or C4 species that the animals ate, or that their meat replaced in the human diet, particularly since meat is about 10 times as high in protein content than an equivalent amount of plant material.

In the case of nitrogen, we would expect low values, in the

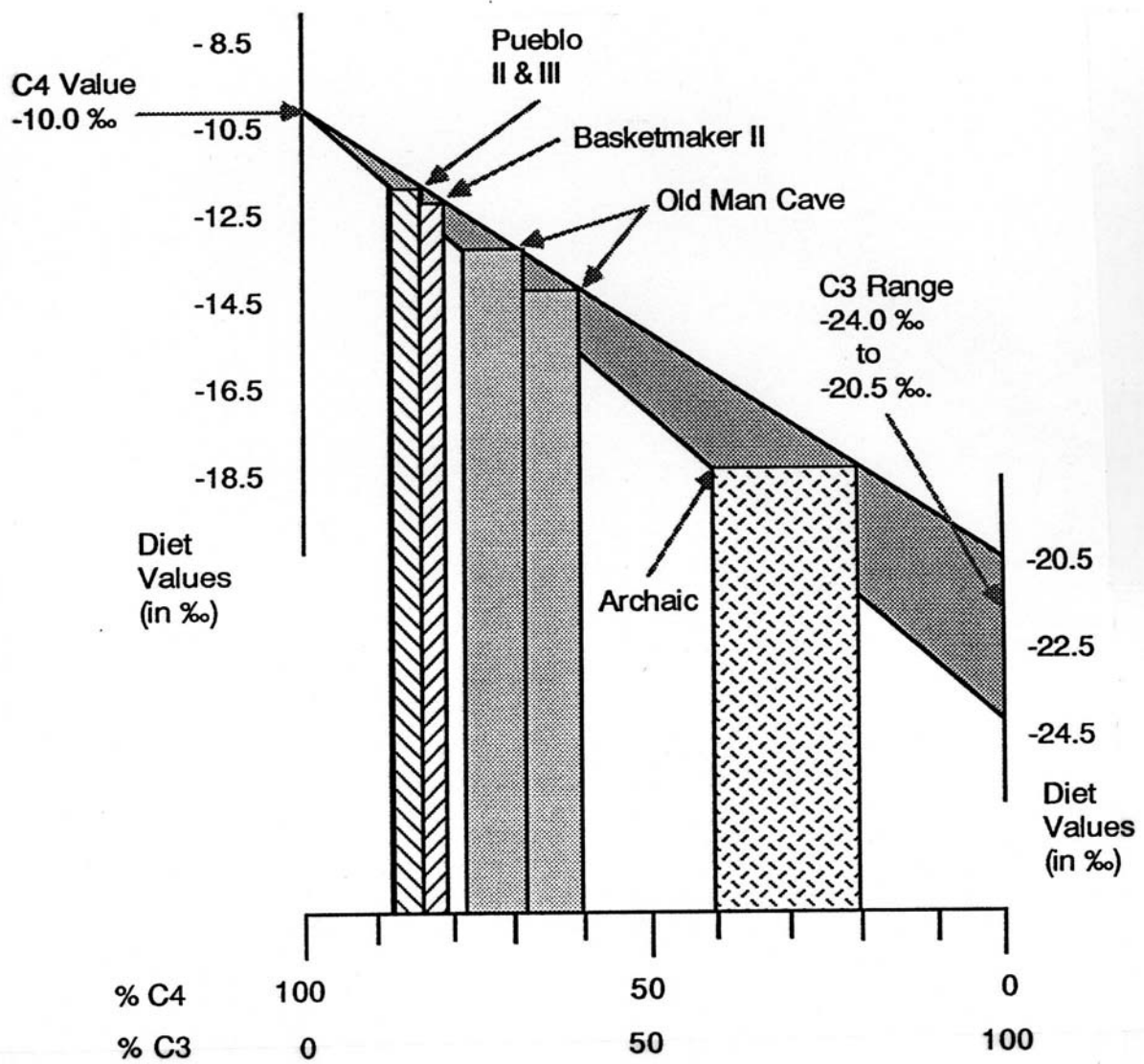


Fig. 4.2 Protein intake proportions for Prehistoric Cedar Mesa humans and indicated $\delta^{13}\text{C}$ values

range of the mountain sheep, from humans that were primarily non-C4 eating vegetarians. People who obtained much, or most, of their protein by eating herbivore meat, such as mountain sheep that ate mostly C3 plants, should yield nitrogen values around 7 - 8 per mil, i.e., about 3 per mil higher than their food source(s). Further, people who obtained most of their protein from maize, would be expected to have an even higher nitrogen value, perhaps of around 16.5 per mil.

Human Results

Comparing the human average diet results (Table 4-2) to the ranges of carbon values for the diet alternative combinations suggests a C4 intake of about 83 to 87% for the Pueblo II / III individuals, and of about 79 to 84% for the Basketmaker II individuals (see Fig. 4-2). Their nitrogen average values, of 10.7 and 10.0 per mil, respectively, are both lower than our nitrogen value for the maize, but higher than those for other maize samples in the southwest, and than that for the mountain sheep, and presumably for deer. If a maize value of 7.0 per mil, as found by other researchers, is correct, then the human nitrogen results support the carbon results in suggesting a high maize intake by the Basketmaker II / Pueblo people. However, if the nitrogen value of 13.5 per mil is the correct one then the human values of 10 - 10.7 per mil suggest that a reasonable proportion of the C4 carbon making its way into the humans collagen was not derived directly from maize, but may have come from herbivores that ate maize, or other C4 plants with lower $\delta^{15}\text{N}$ values. One possible pathway for maize, is through wild

turkeys, and clearly we will have to attempt measurements of their bone if we can obtain appropriate samples.

Although the available sample is too small in numbers for complete confidence it is evident, for this sample, that there is only a small difference between the two time periods, and that these Basketmaker II people made only slightly less use of C4 species than the Puebloans. The Puebloan results are consistent with those of Decker and Tieszen (1989) obtained in Mesa Verde. As expected, the Archaic individual's average diet, at -18.4 per mil, was much lower in C4 species. However, this individual's carbon isotopic ratio was more enriched than if he had eaten only C3 species, or mountain sheep with their meat value of -20.5 per mil. Therefore, it is clear that C4, and possibly a few CAM, species were an important dietary component. Van Ness (1986) analysis of the Desha coprolites from Dust Devil Cave shows *Opuntia*, *Sporobolus* and chenopods as the three most common plants. *Opuntia* species use the CAM pathway, which tends to give values similar to C4 species in a dry environment, and more similar to C3 species in mesic environments, and *Sporobolus* and many chenopods are known to use the C4 pathway. Thus it should be no surprise to find a slightly more positive value for this Archaic individual. If the diet alternatives of this individual were only C3 and C4 plants, with no maize, then his diet $\delta^{13}\text{C}$ value of -18.4 per mil represents a diet that was about 40% C4 in content. If the alternatives were mountain sheep and C4 species then the result would indicate a diet that was about 19% C4. These two situations represent the range of

C4 intake possible in this case. The Archaic individuals nitrogen value, of 8.4 per mil, is closer to the value expected for a consumer of mountain sheep than it is to a maize consumer, suggesting that perhaps the latter interpretation, of ca. 19% C4, is more appropriate. In all likelihood the diet would contain elements of all three alternatives, although the presence of edible C3 plants in the area appears low enough (Aasen 1984) that the result is probably closer to a C4 plant - herbivore mixture. A result of around 25 - 40 percent C4 would not be unexpected, but that is only a guess. Further evidence on Archaic diet alternatives in the study area will be necessary for more accurate interpretation.

Conclusions

This paper further illustrates some of the difficulties in determining diet proportions when there are more than two diet alternatives available. In such a situation it is only possible to obtain a range of proportion possibilities. Use of nitrogen isotope ratios helps to differentiate between meat and plant foods in the diets and thus may allow more exact determinations.

In spite of the problems with isotope ratio differences in plant tissues, and of multiple diet alternatives it is clear that the Basketmaker II and Puebloan individuals from Cedar Mesa analyzed here were obtaining nearly all of their protein forming carbon from C4 species. This is an increase of about 40 - 60 percent from the Archaic and no doubt results from the introduction of maize into local diets. There also appears to

be a slight increase (about 5 percent) in C4 use from Basketmaker II to Pueblo II/III times. This is probably due to an increase in maize consumption.

While it is clear that there are a number of unresolved issues, it is equally clear that, at Cedar Mesa, the Basketmaker II carbon isotope ratio is in close agreement with that of the Pueblo and both are in accord with an extensive presence of maize, as suggested by the analyses of Hough and Aasen. In contrast, the single Archaic value is quite different, and does not indicate as extensive C4 use. More detailed isotope ratios for the particular plant and animal tissues are needed to obtain more precise estimates of diets, but Basketmaker II reliance on maize is strongly supported.

Acknowledgements

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Notes:

1.) Sample measurement involves cleaning and purifying the sample, combusting it to obtain CO₂, and measurement of the CO₂ in an isotope-ratio mass spectrometer.

Results are expressed, in parts per mil (‰) as follows:

$$\delta(\text{‰}) = \{ [R \text{ sample} / R \text{ standard}] - 1 \} \times 1000.$$

Where R = (13C/12C) or (15N/14N). The carbon standard referred to is the internationally used PDB standard, while the nitrogen standard is AIR.

2.) The value of 5 used by van der Merwe (1982) and others is based on samples from which lipids have not been removed. The value of 4.5 is based on samples from which the lipids have been removed (Chisholm 1986, Chisholm and Koike 1988, Chisholm, Nelson and Howard n.d., Koike and Chisholm 1988). This latter value has been observed for a number of species now, including rodents (Chisholm 1986), cats (Chisholm 1986), ungulates (van der Merwe and Vogel 1978, and others), and monkeys (Koike and Chisholm 1988).

Chapter 5

THE CORE OF THE MATTER: BASKETMAKER II LITHIC TECHNOLOGY AND MOBILITY PATTERNS ON CEDAR MESA, SOUTHEAST UTAH.

Reid J. Nelson
Department of Anthropology
Washington State University

Introduction

One issue central to the question of Anasazi origins is whether Basketmaker II adaptation and organization differed from that of later Anasazi periods. I have chosen to isolate one aspect of Basketmaker II organization - namely group mobility - in order to see whether differences in mobility between Basketmaker II and later Anasazi periods were reflected in lithic assemblages. Such comparisons are important in our attempt to understand the continuum of Anasazi adaptation and organization, as well as to understand how well and where Basketmaker II fits within this continuum.

Two models of Basketmaker II to Pueblo II-III mobility change will be evaluated. The first model, which equates well with most traditional views that see Basketmaker II as being closely associated with late Archaic or as transitional between the Archaic and the Formative Anasazi (see Irwin-Williams 1973; Kidder 1962), is that there were substantial decreases in mobility and/or subsistence catchment size from Basketmaker II to Pueblo II-III. I will refer to this model as the Traditional

model. The second model, which fits well with some recent views that see the Basketmaker II as more adaptationally similar to later Formative Anasazi, is that there was little change in the degree of mobility and/or the size of catchment areas from Basketmaker II to Pueblo II-III because mobility and catchment size had already been substantially reduced prior to Basketmaker II. Because this model fits well with the recent works of Matson (1991; Matson and Chisholm 1991) and Dohm (1988), I will refer to it as the Matson-Dohm model.

Research Problem

This study utilized flaked stone data in order to identify whether changes in degree of mobility are reflected in the technological organization of chipped stone assemblages. It is not the intent of this study to define the nature of Basketmaker II mobility. Mobility is a loose and somewhat ambiguous term encompassing a variety of often poorly defined phenomena. In the case of the Cedar Mesa Anasazi, perhaps it is most useful to consider the degree of mobility as a measurement of increasing or decreasing catchment areas rather than a specific type of movement, since the notion of catchment areas does not attempt to define the specific type of mobility pattern in use but, instead, defines the area in which these patterns occur. For the purposes of this study a correlation can be made between high mobility and large catchment areas and between low mobility and small catchment areas.

It is also necessary to define technological organization. A useful definition of technology has been given by Wiant and

Hassen (1985:101) as "the body of knowledge a society uses to extract ..., collect ..., and fabricate implements." Thus, as Wiant and Hassen define it, the term technological organization refers to the "methods and techniques involved in the procurement, design, manufacture, and maintenance of implements," (1985:101).

In the last ten years, lithic analysts have spent a great deal of time trying to isolate which factors influence the organization of lithic technology (Andrefsky n. d., 1991; Bamforth 1986, 1991; Binford 1979, 1986; Goodyear 1979; Henry 1989; Parry and Kelly 1988; Rolland and Dibble 1990; Wiant and Hassen 1985). In 1988, a controversial article by Parry and Kelly suggested that a shift to a more sedentary settlement strategy is likely to be accompanied by a shift in the organization of lithic technology. This shift includes a decline in standardized core reduction and formal tool production and an increase in unstandardized core reduction and expedient flake tool production. In simpler terms, this is often referred to as decrease in formality and an increase in expediency.

Formality has been defined in various ways. Tools which have undergone extra effort in production and maintenance are usually considered formal, while tools which have had little effort expended in their production or maintenance are considered expedient. Formal tools are often characterized as being flexible, multi-purpose tools which are often extensively curated (Andrefsky 1986; Bamforth 1986; Goodyear 1979).

Bifaces, which usually exhibit a high degree of formality, have been shown to have the potential for repeated re-use and to function for use in a variety of tasks (Ahler 1971). Parry and Kelly (1988), among others, suggest that formal tools are associated with mobile groups which need multi-purpose tools available for the wide variety of situations that they may encounter (Andrefsky 1991). Binford (1979) would classify formal tools as anticipatory gear which are produced in anticipation of future needs.

Standardized cores are those which exhibit a patterned removal of flakes and prepared platforms. Parry and Kelly (1988) suggest that formal tools are usually struck from standardized cores thus the presence of these cores in an assemblage would indicate formal tool production. Bifacial cores are good examples of standardized cores, whereas bipolar cores are usually considered expedient.

Expedient tools are made, used, and discarded after little or no modification and their production is thought to be based on the need of the moment (Andrefsky n. d.). They are often unstandardized and wasteful of lithic raw material. Binford (1979) would classify expedient tools as situational gear which are produced in response to a condition and not an anticipated need. Parry and Kelly (1988) would argue that expedient tools are associated with more sedentary groups which no longer consider portability an important need.

Unstandardized cores generally show no patterned flake removal, nor do they show signs of platform preparation. Parry

and Kelly (1988) have argued that unprepared cores and specifically bipolar cores represent expedient technologies and that expedient tools are usually struck from unstandardized cores, thus the presence of these cores in an assemblage would indicate expedient tool production.

If Parry and Kelly are correct in linking expedient tools and unstandardized cores with sedentary groups and formal tools and standardized cores with mobile groups, several expectations can be developed for the two models I have proposed. In the Traditional model, we would expect that those periods which showed a higher percentage of expedient tools and unstandardized cores would be more sedentary than those with lower percentages of expedient tools and unstandardized cores. Thus, according to the Traditional model, Basketmaker II would exhibit a lower percentage of expedient tools than later periods because the Basketmaker II were more mobile than later groups. Also there would be a steady increase in the percentage of expedient tools as later groups became even more sedentary than the Basketmaker II. Likewise, core technology would become less standardized and a ratio of standardized to unstandardized cores would decrease between the Basketmaker II and later periods.

According to the Matson-Dohm model, however, there would be little change in the percentage of expedient tools between periods because the degree of mobility would have already been reduced prior to Basketmaker II. Also, there would be relatively little change in the percentage of expedient tools afterward since the Basketmaker II had a degree of mobility

similar to that of later periods.

Most would agree that the organization of lithic technology is not simply the result of one factor. Indeed, the picture is much more complicated than that. Bamforth (1991:217) has correctly pointed out that broad brush theories which attempt to assign one factor as the overriding influence on the organization of technology fail to recognize the complex set of factors which influence this organization. Such may be the case with the hypothesis proposed by Parry and Kelly (1988). The complex set of factors which do effect the organization of technology are certainly numerous and are almost always unique to a specific environmental and cultural setting.

Two factors which are often cited as important influences on the organization of technology are raw material availability and quality. Many scholars have recently argued that the availability and quality of raw material is as important if not more important than the degree of mobility in determining technological organization (Andrefsky n. d.; Henry 1989; Rolland and Dibble 1990; Wiant and Hassen 1985). Limited supplies of raw material might encourage the production of more general purpose, formalized tools since the toolmaker would need to conserve supplies by producing fewer tools which ultimately would need to serve more purposes. Likewise, an abundant supply might encourage the use of low investment disposable tools since expedient tools often more accurately fit the task at hand when compared to a generalized biface and take less time to manufacture than a formal tool. Moreover, groups living with an

abundant supply of raw material might not need as much formal anticipatory gear since any unexpected need can be filled with an expedient tool from readily available raw material.

Small, low quality, materials may be used differently and produce different end products than large, high quality, materials (Rolland and Dibble 1990). High quality material may be more important to any group desiring to invest more in a given tool. Reduction strategies might vary according to material size as well. For instance, bipolar reduction strategies are often used on small cores.

Methods

The Cedar Mesa assemblages used in this analysis have the advantage of all being from the same geologically homogeneous area. Thus, differential access to raw materials through time has been controlled for to a high degree. Because relatively abundant raw material is still available there today, it seems safe to assume that there were no major shortages through time due to the exhaustion of local supplies. It is possible, however, that larger raw material pieces may have become less abundant through time due to exhaustion.

Technological characteristics of late Basketmaker II assemblages were compared with those of Basketmaker III and Pueblo II-III assemblages. Data were compiled from the analysis of lithic materials done by Matson on surface collections made from across the mesa top during the Cedar Mesa Project (Matson and Lipe 1978; Matson et al. 1988, n.d.). The Cedar Mesa

collections represent three distinct cultural periods, each separated by an occupational hiatus (Matson and Lipe 1978; Matson et al. 1988). These periods are late Basketmaker II, which spanned approximately A.D. 200 - 400, Basketmaker III, which spanned approximately A.D. 650 - 720, and Pueblo II-III, which spanned approximately A.D. 1065 - 1270. This project recorded 123 separable Basketmaker II components, 48 Basketmaker III components, and 132 Pueblo II-III components on the mesa top.

Using Cedar Mesa data, the total number of tools within 25 pre-established flaked stone categories were compiled for each time period. Totals were also compiled for each functional site type (as previously defined by Matson et al. [1988]) within each time period. Sites which were clearly multi-component were not used in this analysis. These tool types are fairly straightforward morpho-use categories previously defined by Matson et al. (n.d.). Table 5-1 provides a listing of these categories. Note that all the tools listed as expedient are either utilized and not retouched at all, or are minimally retouched unifacially and, very rarely, bifacially. An inspection of a large sample of these tools confirmed that all of them show minimal input. In contrast, the formal tools are all bifacially worked and show a high degree of input. These tools generally consist of projectile points, knives, and drills. The total numbers of cores were recorded for each period and site class as well.

Table 5-1. Artifact Tool Types Included in Analysis.

<u>Artifact Type</u>	<u>Artifact Description</u>
Expedient	Flake Scraper Retouched Flake Steep Angle Utilized Flake Narrow Angle Utilized Flake Bifacially Retouched Flake Gravers Snapped Denticulates Flaked Denticulates Core Scrapers
Formal	Biface Fragments Large Point Fragments Small Point Fragments Jumbo Corner-notched Large Corner-notched, Straight Base Large Corner-notched, Round Base Large Side-notched Point Small Corner-notched Barbed Small Corner-notched Broad Based Small Triangular Points Desert Side-notched Point Small Shallow Side-notched or Stemmed Large Knives and Fragments Small Knives and Fragments T or Flanged Drills Other or Plain Shaft Drills

Table 5-2. Percent of Tool Types for All Site Classes by Period.

<u>Period</u>	<u>% Expedient</u>	<u>% Formal</u>	<u>Total # Tools</u>
Basketmaker II	89.2 (n=5,104)	10.8 (n=620)	5,724
Basketmaker III	87.5 (n=1,298)	12.5 (n=185)	1,483
Pueblo II-III	90.6 (n=2,759)	9.4 (n=287)	3,046

It was necessary to develop criteria for recognizing the morphological characteristics of formal and expedient tools. While a number of measurements could be made to quantify the formality of a given tool, the ones chosen here are thought to be general attributes which are sensitive to changes in technological organization. This analysis is not attempting to measure every technological attribute from each assemblage in each period. Its primary intent was to compare general changes in a certain few attributes over time which I will argue represent broader changes in the relative expediency and/or formality of the given assemblages.

Bifacial manufacture strategies which remove the majority of original flake surface and/or cortex during thinning and shaping were considered more labor intensive and higher in investment than unifacial manufacture strategies which usually seek only to modify an edge. Likewise, tools which substantially alter the original shape and form of the flake blank (or other blank) were thought to show a higher degree of input and thus a higher degree of formality than those tools which retain the original form of the flake during use. Projectile points are good examples of tools which, in their manufacture, alter the shape of the flake blank and have most of the original flake surface removed. Utilized flakes are good examples of tools which, in their manufacture, do not alter this basic shape, neither in plan view nor cross section. Bifacially thinned tools obviously show a higher level of thinning and

shaping in plan view and cross section than utilized flakes. Generally, the higher the input, the greater the degree of formality. Curation and resharpening, which are practices associated with formal tools (Ahler 1971; Andrefsky 1986; Bamforth 1986), were relatively common in the samples of bifacial tools inspected, but few expedient flake tools appeared to have been resharpened or curated.

If we are to gauge whether a causal relationship exists between the degree of mobility and the organization of flaked stone technology, we must first strive for an independent measurement of one or the other. Several recent studies suggest that the Basketmaker II may have been more similar to later Puebloan groups than previously thought. The lack of diversity (limited number of tool types relative to total number of tools) and the predominance of vegetal processing tools within Basketmaker II tool kits has been argued by Dohm (1988) to represent an adaptation representing agricultural intensification. Likewise, her work on Basketmaker villages suggests that the origins of later Anasazi villages may have been established by Basketmaker II. Formal village patterning, though loosely arranged, appears to be evident by Basketmaker II.

The probability that the Basketmaker II were farming maize more intensively than previously thought is also supported by the recent work of Matson and Chisholm (1991). Their analysis of stable isotopes from human bone gelatin has shown that the Basketmaker II diet may have included nearly the same amount of

maize as the later Pueblo II-III diet. If we consider these three pieces of evidence together - that the Basketmaker II were more than likely farming maize from loosely organized villages, we get a picture more reminiscent of Puebloan life than previously thought.

Results Tools:

The percentages of expedient versus formal tools show that in general no trend toward a greater reliance on expedient tools from Basketmaker II to Pueblo II-III can be noted on Cedar Mesa. The percentage of tools classified as formal and the percentage classified as expedient are shown in Table 5-2 and are represented in Fig. 5-1. Note that from Basketmaker II to Pueblo II-III an increase of only 1.4% was noted in expedient tools. Interestingly, the percentage of expedient tools actually decreased 1.7% from Basketmaker II to Basketmaker III.

These same observations were also made within the various site types defined on Cedar Mesa. The percentages of expedient and formal tools are listed in Table 5-3. Among habitational sites, the changes in percentages of expedient and formal tools between periods are even less variable than those in the over all totals. An increase of only 1% was noted in the percentage of expedient tools among habitational sites from Basketmaker II to Pueblo II-III. This suggests that the range of activities occurring at a habitation may have remained remarkably the same through time. Limited activity sites also show a consistent

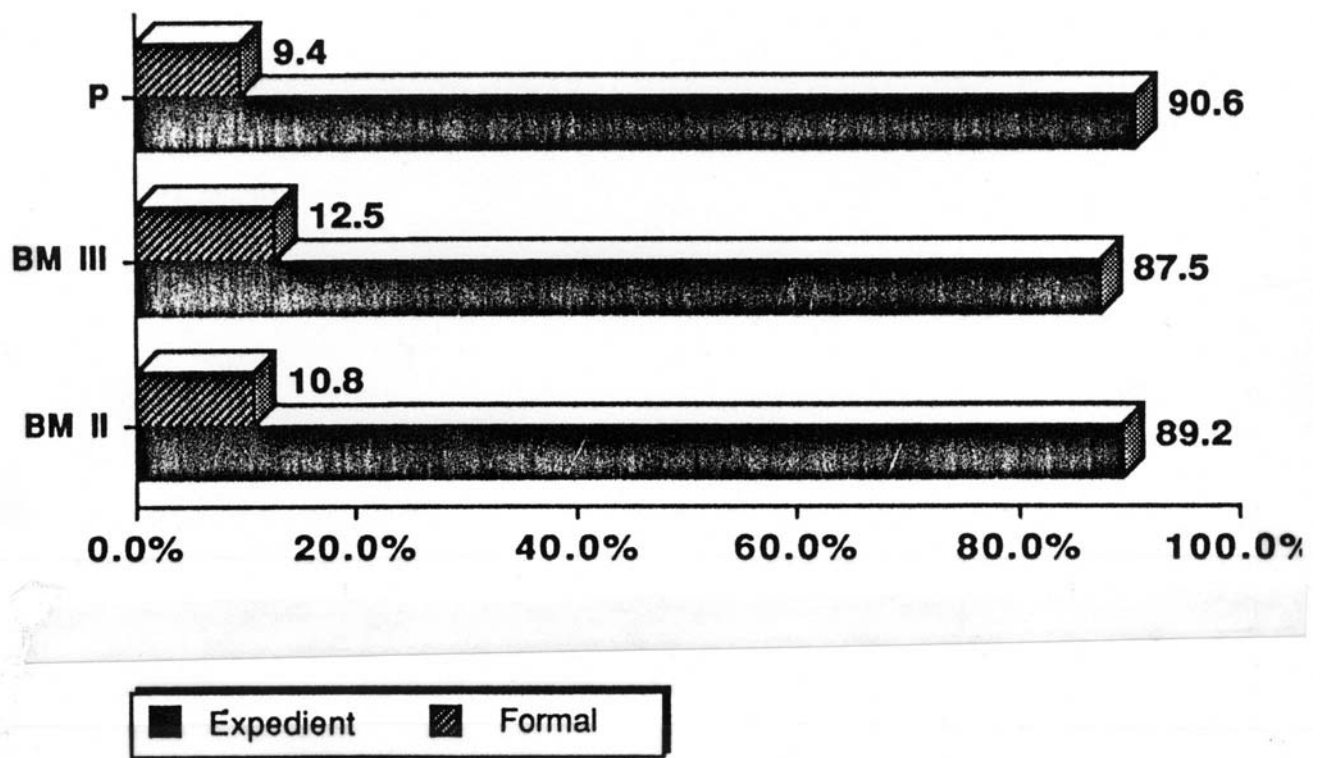


Fig. 5-1 Percentages of formal and expedient tools for all site classes by period

proportion of expedient to formal tools through time with, once again, the interesting exception of Basketmaker III, which shows a slightly lower percentage of expedient tools. This statistic may be the result of a somewhat low sample size for the Basketmaker III in this given site category. Three other site categories, namely problematic habitations, campsites, and lithic reduction sites, show results that are individually interesting but, because each one of these site classes has no represented population for one or sometimes even two of the time periods considered here, they will not be discussed. It is interesting to note, however, that there is no significant difference in the percentage of expedient tools between Basketmaker II campsites and habitations.

Table 5-3. Percentage of Tool Types for Individual Site Classes by Period.

<u>Site Class</u>	<u>Period</u>	<u>% Expedient</u>	<u>% Formal</u>	<u>Total # Tools</u>
Habituation	BM II	89.2 (n=2,363)	10.8 (n=286)	2,649
	BM III	86.9 (n=1,108)	13.1 (n=167)	1,275
	P II-III	90.2 (n=2,237)	9.8 (n=242)	2,479
Problematic Habituation	BM II	----	-----	
	BM III	93.7 (n=119)	6.3 (n=8)	127
	P II-III	93.1 (n=255)	6.9 (n=19)	274
Limited Activity	BM II	91.3 (n=796)	8.7 (n=76)	872
	BM III	87.7 (n=71)	12.3 (n=10)	81
	P II-III	91.1 (n=293)	8.9 (n=26)	293
Campsites	BM II	88.4 (n=1,795)	11.6 (n=236)	2,031
	BM III	----	-----	-----
	P II-III	----	-----	-----
Lithic Reduction	BM II	87.2 (n=150)	12.8 (n=22)	172
	BM III	----	-----	-----
	P II-III	----	-----	-----

Table 5-4. Ratio of Bifaces to Cores for All Sites in Each Period.

<u>Period</u>	<u>Bifaces:Cores</u>
Basketmaker II	1.70
Basketmaker III	1.37
Pueblo II-III	0.83

Cores:

Another shift recognized by Parry and Kelly (1988) in the technological organization of populations that are becoming increasingly sedentary is an increase in the number of unstandardized, expedient cores relative to the number of bifaces. An increase of the occurrence of unstandardized cores, which include bipolar cores, would indicate a shift to a more expedient core technology. A simple ratio of the total number of bifaces (high input tools) to flake cores, from which expedient flake tools usually come (Parry and Kelly 1988), should be indicative of the degree to which a population is oriented toward formal tool production versus expedient flake tool production. On Cedar Mesa, the ratio of bifaces to flake cores dramatically decreases from 1.70 during Basketmaker II and 1.37 in Basketmaker III to 0.83 during the Pueblo II-III occupation. Table 5-4 provides these statistics. An analysis of a sample of cores from each period also showed that bipolar cores were present in Pueblo II-III assemblages but none were

observed in earlier assemblages. Interestingly, the average weight of each core reduced about 8 % from Basketmaker II to Pueblo II-III and the incidence of unstandardized cores increased by 11%. Since our tool statistics (Tables 5-2 and 5-3) suggest that the number of bifaces was not decreasing over time, we can safely say that the number of expedient cores was increasing.

Discussion

As noted, no significant increase in the use of expedient tools with an accompanying decrease in the use of formal tools can be observed from Basketmaker II to Pueblo II-III.

Observations made on cores, however, suggest that a reliance on expedient core technology may have increased from Basketmaker II and III to Pueblo II-III, as is evidenced by the increased number of expedient cores. Also, it appears that cores were becoming smaller through time. Seemingly an increased reliance on unstandardized core reduction technology would be associated with an increase in the abundance of expedient flake tools, since it is these types of tools we assume are being made with such a strategy. Yet, as the tool data show, there was no significant increase in the percentage of expedient tools.

There are a two possible explanations for this. First, between Basketmaker II and Basketmaker III, as happened throughout the southwest, a switch was made from large dart points for projectiles to small arrow points. The production of small arrow points would obviously require a much smaller and

potentially less homogeneous core than that required for a large dart point. This would suggest that Basketmaker III and Pueblo II-III, which predominantly used small arrow points, would require much smaller raw material pieces in order to produce the small blanks necessary for arrow heads. They might then reduce these cores to smaller proportions since smaller flake blanks would suffice to produce an arrow head. This possibility is supported not only by the fact that cores from Pueblo II-III were found to be smaller than those from Basketmaker II, but also that bipolar technology, which is often used on smaller materials, was present in later assemblages (Pueblo II-III). Thus a possible explanation for the shift in core technology may have been more the result of a change in projectile forms rather than a change in mobility.

Second, raw material must be considered. Raw material types were not recorded for each item in the original analysis of these materials. However, Keller (1979) did analyze a sample of materials from these three periods and came up with a good approximation of what materials were being utilized and where they were being obtained. He found that most of the material types used were local and that the vast majority of them were moderate to high quality. Interestingly, Keller (1979) has also shown that Basketmaker II utilized materials almost entirely from Cedar Mesa, whereas in Basketmaker III and Pueblo II-III materials from well to the east were being utilized, with up to 21% being non-local during Basketmaker III and 17% being non-local during the Pueblo II-III period. At this point, it is

not known what effect the introduction of non-local materials may have had on the technological organization of the Cedar Mesa Anasazi. Because the quality of these materials tends to be similar to and usually no better than the quality of local materials, it is likely that little change was introduced to chipped stone assemblages due to a variance in raw material quality.

It is important to note that raw material availability and quality are two different factors. As more material was exhausted on the mesa, available raw material pieces may have become smaller, assuming that initially large pieces are preferred. The occurrence of this phenomenon has not been tested, however. A more sedentary population may have been limited to smaller raw materials because of the exhaustion of larger pieces in earlier periods and because of the diminished need for large pieces which may have resulted from the switch to arrow head technology between Basketmaker II and Basketmaker III. Thus, the increased reliance on expedient reduction strategies and the decrease in core size may reflect a minor difference between periods in the immediate availability of large raw materials due to relatively minor differences in raw material availability.

The general availability of relatively good quality raw materials on Cedar Mesa might suggest that an expedient assemblage would have been evident for each period regardless of mobility patterns. However, the consistency of these results with the independent evidence from Matson and Chisholm (1991)

and Dohm (1988) suggests that these results are more likely due to similarities between Basketmaker II adaptation and Basketmaker III and Pueblo II-III adaptation. Thus, the consistency in the proportion of expedient to formal tools is more likely the product of similar adaptations rather than raw material availability.

We are left with the possibility that the increased use of unstandardized cores may be more the result of immediate raw material availability and/or a change in projectile point technology rather than of a significant change in the degree of mobility. We cannot rule out the possibility that changes in mobility may result in minor changes in technological organization. It is with this somehow unfulfilling explanation that we see the inability of the increased sedentism model to provide meaningful answers to the immediate conditioners of flaked stone technology. If a heavy reliance the use of expedient tools can be linked with sedentary populations, then these three groups are similarly sedentary.

Conclusion

The extent to which we can correlate the degree of mobility and technological organization is questionable. Moreover, the ability of this potential relationship to provide a meaningful understanding of all the conditioners of technological organization is limited. Despite these limitations, the data still suggests that certain aspects of the technological organization of these three groups stayed remarkably similar

through time.

To reiterate, the results of this analysis show that the proportion of expedient tools versus formal tools stays remarkably similar through all time periods observed. This consistency would not be expected if we were to assume that a shift on Cedar Mesa to a more sedentary settlement strategy did occur from Basketmaker II to Pueblo II-III and that it was accompanied by an increased usage of expedient tools (change in the organization of lithic technology). Thus we are left with either the conclusion that a shift in settlement strategy is not strongly correlated with an increased reliance on expedient flake tools or that the Matson-Dohm model is correct and the similarity in technological organizations through time show that a shift to a more sedentary settlement strategy had already occurred prior to the Basketmaker II. Other lines of evidence, including stable isotope analysis and survey data provided by Karen Dohm, add further evidence to the suggestion that Basketmaker II was adaptationally and organizationally similar to later Puebloans. While these similarities cannot necessarily act as gauges for the degree of sedentism, they do support the notion that Basketmaker II adaptation was more similar to later sedentary Puebloan adaptations than previously recognized.

Chapter 6

CEDAR MESA FAUNA REMAINS

Michael Brand

Introduction

This report presents the results of the identification of faunal remains from twenty - two sites on Cedar Mesa, southeastern Utah. Faunal assemblages were collected between 1969 and 1991 by the Cedar Mesa Project and the Cedar Mesa Project II. The sites discussed in this report are found in and around five drainages on Cedar Mesa: Bullet (B, BU), (Upper) Grand Gulch (GG, UGG), Hardscrabble (HS), North Road (NR), and West John's (WJ). The project site numbers used in the text, consist of the drainage abbreviation, the quadrat designation and the number of that specific site within the quadrat. Therefore site B - 10 - 7, is the seventh site found in quadrat 10, in the Bullet drainage area. Both mesa top and canyon sites are present. A 'C' before the quadrat designation indicates a canyon quadrat. The 'x' included in some project site numbers designates excavation. Faunal assemblages from these sites range in size from a single specimen to over seven hundred specimens. The majority of assemblages are quite small.

Modern Cedar Mesa Fauna

The environment of Cedar Mesa today, with few exceptions, has changed little over the last few thousand years (Matson et al. 1990: I-22). Small mammals observed in the area today include: cottontail (*Sylvilagus* sp.), jackrabbit (*Lepus* sp.), woodrat (*Neotoma* sp.), kangaroo rat (*Dipodomys ordi*), mice, and badger (*Taxidea taxus*) (Matson et al. 1990: I-21). Carnivores known to inhabit the area include the coyote (*Canis latrans*) and bobcat (*Lynx rufus*). Sightings of mountain lions (*Felis concolor*) have also been reported. Mule deer are the only large mammal known to inhabit the mesa today, keeping primarily to the canyon heads, they are seen only occasionally on the open mesa top (Matson et al. 1990: I-21). Bighorn sheep (*Ovis canadensis*), present near the San Juan River to the south of Cedar Mesa, do not inhabit the mesa today, likely as a result of the use of the mesa for grazing domestic livestock (Lipe and Matson 1974).

Birds are relatively abundant on Cedar Mesa today (Matson et al. 1990: I-21). The golden eagle (*Aquila chrysaetos*), and a variety of hawks and owls have been observed. Snakes, lizards and amphibians are also commonly seen on the mesa.

Sites and Recovery Methods

The following subsections provide limited information on the sites discussed in this report and the methods used to recover the faunal assemblages. No information was presently available for the following sites: GG69, GG69 - 30, GG70, UGGx4, UGG - 6 - 1, and UGG - C11 - 1.

BU 3-7 (42Sa4089)

Work on BU - 3 - 7 was conducted primarily in July of 1972. At least two dwelling structures have been identified on the site, these features date to the either the Woodenshoe or Redhouse phase of the Pueblo III period. Faunal remains from this site were recovered from test pits. It is not clear whether back-dirt from the test pits was screen or not, likely no screening was done (R.G. Matson, personal communication).

BU 3-10A (42Sa4092)

Work on BU 3-10A was conducted primarily in July of 1972. Two occupations, a Basketmaker II and a late Pueblo II - early Pueblo III, are evident at this site. Dwelling structures from both occupations are present, however, the Pueblo period structure has sustained some damage from the disservice of pothunters. Faunal remains from BU - 3 - 10A were recovered from test pits. As above, screening of back-dirt was likely not undertaken.

B 10-7 (42Sa4133)

Work on B 10-7 was conducted during June of 1972. The site was occupied during the Clay Hills phase. The faunal assemblage from this site was recovered from excavations which utilized screens, however, information on the mesh size is not presently available.

HS 4-1

HS 4-1 was excavated in 1991 as part of the Cedar Mesa Project II. Basketmaker II, Basketmaker III and Pueblo occupations are all in evidence at this site. Excavation of three 1m x 1m units centered on the Basketmaker II, or Grand Gulch phase, occupation. Back-dirt was screened through 1/8 inch mesh.

HS 5-2

HS 5-2 was excavated in 1991 as part of the Cedar Mesa Project II. It is the lowest elevation Basketmaker II site on Cedar Mesa (Matson, this volume). Four 1m x 1m excavation units were put into a pithouse on the site revealing a structure approximately 4.5m in diameter, which appears to have burned following its abandonment. Back-dirt from the excavation units was screened through 1/8 inch mesh.

HS 5-3

HS 5-3 was excavated in 1991 as part of the Cedar Mesa Project II. Two 1m x 1m units were excavated into a Basketmaker II pithouse, however, no intact cultural matrix was found (Matson, this volume). Back-dirt was screened through 1/8 inch mesh.

HS C12-3

HS C12-3 was recorded in August of 1973 during the Canyon Inventory Survey made by the Cedar Mesa Project. Ceramics found

on the site place its occupation during the Pueblo II, Clay Hills phase. The site consists of a relatively large masonry room under an overhang of the canyon and was interpreted as possibly a habitation site. The single faunal specimen from this site appears to have been surface collected.

NR 11-4 (42Sa4034)

Work on NR 11-4 was conducted in June of 1973. The site was inhabited during the Mossbacks phase (Basketmaker III), and shows evidence of having been a habitation site with a large, rectangular slab structure, a possible pithouse, a jacal storage structure, hearths and relatively extensive midden. Ex cavations were conducted in the pithouse and antechamber, as well as in a trash area, slab lined hearth and a surface room (Dohm 1988). Numerous bits of burned bone were observed around one of the hearth features. Faunal remains from this site were excavated from test pits. It is unknown if screening was done or not.

NR C9-5, The Rock Island Site

NR C9-5 is a Basketmaker II site originally located by the Cedar Mesa Project. At that time over eight thousand lithic specimens were collected from about 40% of the surface of the site (see Brand, this volume). NR C9-5 was revisited in 1991 by members of the Cedar Mesa Project II. The site is located on a promontory between branches of North Road Canyon, with access from only the northwest. Sheer canyon walls reach straight down

over one hundred feet to the canyon floor on the north, east and south sides of the promontory. Two 50cm x 50cm test pits were excavated in 1991, one of which revealed the floor of a pithouse; further reinspection of the site suggests that there are at least five pithouses present on the site (Matson, this volume). Back-dirt from these test pits was screened through 1/8 inch mesh.

NR C22-4

NR C22-4 was recorded in July of 1974. The site was inhabited during either the Pueblo II or Pueblo III period, it consists of a rectangular structure with rounded corners built just below the canyon rim in a deep overhang. Faunal remains from this site were collected from the surface.

GG69 - 18

GG69-18, also known as the Pittman site (Dohm 1988) was excavated by Lipe (1978). Excavations included a Basketmaker II pithouse and two trenches, one of which was in trash deposits (Dohm 1988:174). It is unknown whether screens were used during the excavation, at any rate, only a single faunal specimen was recovered.

GG69 - 20

GG69 - 20, also known as the Leicht Site (Dohm 1988:179) is a Basketmaker II site excavated by Lipe (1978). Features present at the site included a pithouse (excavated) and hearth.

Excavations consisted of a long trench with some expansion off the trench in the area of a pithouse. A picture of the excavations (Lipe 1978:393) suggests that screens may have been used.

GG69 - 32

GG69 - 32 is located in a cave on the north side of Grand Gulch near its confluence with Kane canyon. The site was occupied during the Pueblo III period and has been interpreted as a habitation. It is presently unknown whether the faunal material present was excavated or collected from the surface.

UGG 4x-3

UGG 4x-3 is a dual component site excavated by the Cedar Mesa Project, with both a Mossbacks and a Clay Hills occupation. Faunal remains present for this site were recovered from excavation, however, it is not presently known if the back-dirt was screened.

WJ 12-6

Work on WJ 12-6 was conducted during July of 1973. The site was occupied during the Mossbacks phase. Features present on the site include a possible pithouse and a midden. Faunal remains from this site were recovered by excavation, with the back-dirt screened through 1/4 inch mesh. Excavations included the pithouse and antechamber, a slab lined cist a storage pit and a processing pit (Dohm 1988:233).

WJ C15-3

WJ C15-3 was recorded by the Cedar Mesa project in July of 1974. The site has been interpreted as a Clay Hills phase storage location. A single bone awl was collected from the surface of this site.

Identification Methods

Specimens from the twenty-two sites were identified and recorded following the procedures described in Cedar Mesa Manual for the Identification and Recording of Faunal Remains (Brand 1992). The recording system used for the Cedar Mesa faunal assemblages is largely based on Driver (1990), and as such the results should be largely comparable. Briefly, each specimen is treated individually and independently of all others. Taxonomic identifications proceeded only when a specimen could be identified to element (after Driver 1992). For each specimen a minimum set of information is recorded, following the system devised by Driver (1992). All specimens are given a three letter code for *Taxon*, this may range from unidentifiable, through general categories such as Large Mammal to species. *Element* is recorded, with a two letter code, using standard osteological terms. *Part* identifies the portion of the element present, this is recorded with a numeric code which varies for each element. *Side* obviously records the side of the body for each element, these may be recorded as: Right (R), Left (L), Unknown (U), or Irrelevant (I). *Fusion* records the state of

epiphysial fusion for both the proximal and distal end of an element. *Breakage* is also recorded for both ends of an element. Any *Modification* evident on a specimen is recorded, including natural and modifications resulting from human activity. Any specimen which has been modified as an artifact is sketched on the back of the record form. The final two categories are *Length* and *Thickness*. These data are on file at the Laboratory of Archaeology, Department of Anthropology and Sociology, at the University of British Columbia.

Identifications were done one provenience bag at a time, thus, all specimens were returned to their original bag eliminating any chance of accidental mixing. With appropriate caution each specimen was identified to the highest taxonomic category possible. In some cases it is possible to obtain a species identification. In other cases, due to a variety of factors, elements can only be identified to less formal taxonomic categories, such as Large Mammal. Identifications were made using the comparative collections at the Museum of Anthropology at The University of British Columbia, and the Department of Archaeology at Simon Fraser University. Published guides to skeletal morphology, such as Lawrence (1951), were also used when required.

Results of the Identifications

Identification results for each site are presented in Table 6-1. The NISP for each taxon appears in the appropriate cell within the table. The total NISP for each site appears at

SITE	BU-3-7	BU-3-10A	B-10-7	HS-4-1	HS-5-2	HS-5-3	HS-C12-3
AGE/PHASE	P3	Redhouse	Clayhills	G. Gulch	G. Gulch	G. Gulch	P2
TAXON							
Lagomorpha	1						
Cottontail	14(2)	6(1)	6(1)				
Jackrabbit	3(1)						
Rodentia							
Sciuridae	1						
Marmot							
Pocket Gopher	1						
Cricelidae							
Woodrat							
Voies							
Carnivora							
Canidae							
Canis spp.							
Artiodactyla	4(1)		1				1
Deer							
Mountain Sheep							
Turkey		3(1)					
Iguanidae							
Small Carnivore							
Small Rodent	1	2	5				
Large Rodent							
Small Mammal	22	2	12	2			
Medium Mammal	5		1				
Large Mammal	1				5		
Small Bird							
Medium Bird							
Large Bird		3	172				
NISP	53	16	197	2	5		1
UNIDENTIFIABLE	143	30	34	42	7	1	
TOTAL	196	46	231	44	12	1	1

Table 6-1 Faunal remains from sites on Cedar Mesa

SITE	NR-11-4	NR-C9-5	NR-C22-4	GG69	GG69-18	GG69-20	GG69-30	GG69-32
AGE/PHASE	Mossbacks	G. Gulch	Pueblo		G. Gulch	G. Gulch		P3
TAXON								
Lagomorpha								
Cottontail	1		4(1)				3(1)	2(1)
Jackrabbit	2(1)						1	1
Rodentia								
Sciuridae								
Marmot							1	
Pocket Gopher								
Cricetidae								
Woodrat							2	
Voles								
Carnivora								
Canidae								
Canis spp.	3						1	2
Artiodactyla	1						3(1)	
Deer	1							
Mountain Sheep							1	
Turkey							1	
Iguanidae								
Small Carnivore								
Small Rodent								
Large Rodent								
Small Mammal	3		1	1			2	1
Medium Mammal	1						1	
Large Mammal	1			4		1	2	1
Small Bird								
Medium Bird								
Large Bird							2	
NISP	13		5	5		1	20	7
UNIDENTIFIABLE	46	1	1	10	1	14	17	1
TOTAL	59	1	6	15	1	15	37	8

Table 6-1 Continued

SITE	G670	UG64X	UG64X-3	UG64X-3	UG64X-3	UG66-1	UG6-C11-1	WJ12-6	WJ-C15-3
AGE/PHASE		BM3/P	All	Mossbacks	Redhouse	BM3/P	P2/P3	Mossbacks	Clayhills
TAXON									
Lagomorpha		1	2(1)			2			
Cottontail	1	2	46(3)	4(1)	34(3)			1	
Jackrabbit			5(1)		3(2)				
Rodentia		1	2(1)		2				
Sciuridae		1	4(2)	2(1)	1			2	
Marmot									
Pocket Gopher									
Cricetidae			1	1					
Woodrat			1						
Voies			5(1)		4				
Carnivora			1		1				
Canidae									
Canis spp.			1	1					
Artiodactyla			4(1)		5(1)			1	
Deer									
Mountain Sheep			2		2(1)				
Turkey			1						
Iguanidae		1	1		1				
Small Carnivore		1							
Small Rodent			3		3				
Large Rodent		1							
Small Mammal		45	40	2	31			1	
Medium Mammal									
Large Mammal		7	4		3			2	1
Small Bird		1							
Medium Bird			1		1				
Large Bird		36	192		151				
NISP	1	103	318	10	244			7	1
UNIDENTIFIABLE	1	648	129	17	77	1	3	19	
TOTAL	2	751	447	27	321	1	3	26	1

Table 6-1 Continued

the bottom of each column. The Minimum Number of Individuals (MNI) was calculated for each of the formal taxonomic categories (i.e., not for large mammal etc.) and appears in parentheses behind the number of specimens. MNI was calculated using the following procedure: using paired elements from individual taxa, specimens are sorted as to side, when appropriate incomplete elements of the same side are paired, for example a fragment of a humerus with only a proximal end will be matched with a specimen consisting of only a distal end; rights and lefts are then paired, taking into account the relative age of each element based on epiphysial fusion. The MNIs presented in this report are calculated for the entire assemblage from each site, at this time no divisions have been made on the basis of provenience.

Unfortunately, very little faunal material was recovered from the majority of these sites. The median number of specimens recovered for the sites described in this report is fourteen. As noted above, only five of these sites produced more than fifty specimens. A total of twenty-seven taxa were identified in the faunal remains from these sites. Nine of these taxa were less formal categories such as small mammal, large bird etc. Mammalian taxa dominate the assemblages, although birds and reptiles are present in limited numbers. The mammalian taxa identified include Lagomorpha, cottontail (*Sylvilagus* sp.), jackrabbit (*Lepus* sp.), Rodentia, Sciuridae, Marmot (*Marmota* sp.), Pocket Gopher (*Geomyidae* sp.), Cricetidae, woodrat (*Neotoma* sp.), voles (*Microtus* sp.), carnivores, Canidae, *Canis*

sp., *Artiodactyla*, deer (*Odocoileus* sp., most likely *O. hemionus*) and mountain sheep (*Ovis canadensis*). The majority of these taxa are present in very limited numbers. Cottontail is the most abundant taxa, both in terms of NISP and MNI. Mammals are also represented in significant numbers at some sites in the general categories of small and large mammal.

Avian remains are relatively rare in the faunal material recovered from most of these sites. Of the specimens present only turkey (*Meleagris gallopavo*) could be identified. The rest of the avian material present was identified as medium or large bird. It is possible that some of the other elements which could only be identified as large bird are turkey as well. At a number of sites the high values of the large bird category is somewhat misleading as the majority of specimens in this taxa are fragments of eggshell. At site B 10- 7 eighty-seven percent (87%) of all identified specimens were eggshell fragments. Likewise, at UGG 4X-3 eggshell fragments comprised sixty percent (60%) of all identified specimens.

Only two reptile bones were present in these assemblages, both from separate sites.

Modification

Three types of modification are present in varying degrees among the specimens in these assemblages: (1) rodent gnawing, (2) burning, and (3) modification into artifacts. Direct evidence of the destruction of faunal material by the activity of rodents is slight in the present assemblages. Only four

specimens, from three different sites, had been gnawed by rodents. No incidence of carnivore chewing were observed in any of the assemblages.

Specimens which have been burned are much more prevalent from these sites. Burned specimens average forty-two percent (42%) in assemblages with a total number of specimens above the median. The majority of burned specimens from any given site are unidentifiable. Taxa which show burning include Lagomorpha, cottontail, jackrabbit, Sciuridae, Canis sp., Artiodactyla, small carnivore, small rodent, small mammal, large mammal and large bird. A number of eggshell fragments, from at least two sites, have also been burned. Whether this resulted from subsistence behavior or burning in a trash heap, for example, cannot be determined.

Ten of the twenty -two sites discussed in this report contained worked bone. The majority of these specimens simply show some evidence of abrasion and have not been fashioned into any specific form. Awls, or fragments of awls, were present at B 3- 7, GG69, GG69-30, NR 11- 4, UGG 4- 3 and WJ C15-3. Awls were manufactured from unidentifiable specimens and the elements of cottontail (tibia), Canis sp. (ulna), and Artiodactyla (metapodial). UGG 4-3 also had a bone tube (length = 4 cm) manufactured from the ulna of a large bird, and three small elongated discs made from bone. The dimensions of these discs average 18mm in length, 7mm in width and 2mm thick. They are flat on one side and slightly convex on the opposite. All three were recovered from Feature G which is dated, on the basis of

ceramics, to the Clay Hills Phase. These three artifacts closely resemble a series of eight Basketmaker artifacts from Cave 1 in Kinboko (House Canyon), described by Kidder and Guernsey: "The set of "dice" consists of eight lenticular pieces eleven-sixteenths inch long [18mm] and one-fourth inch wide [6mm] all have one flat and one rounded surface." (1919:189). The authors note that these artifacts may be inlays as opposed to dice. They later reported a similar artifact from Cave 6, a Basketmaker site on the South Comb near Marsh Pass (Guernsey and Kidder 1921:109).

Summary

This report has summarized the results of the identification of faunal remains from twenty-two prehistoric sites on Cedar Mesa, Utah. The majority of the assemblages are very small. Only five sites have an NISP greater than fifty (including both identified and unidentified). Identified remains from these sites were assigned to twenty-seven taxa, of which the majority are mammalian. Cottontail is the most abundant taxon in almost all of the assemblages. Unidentified specimens generally outnumber those which were identifiable. Worked bone artifacts are present for a number of the assemblages, and burning appears to be common.

Chapter 7

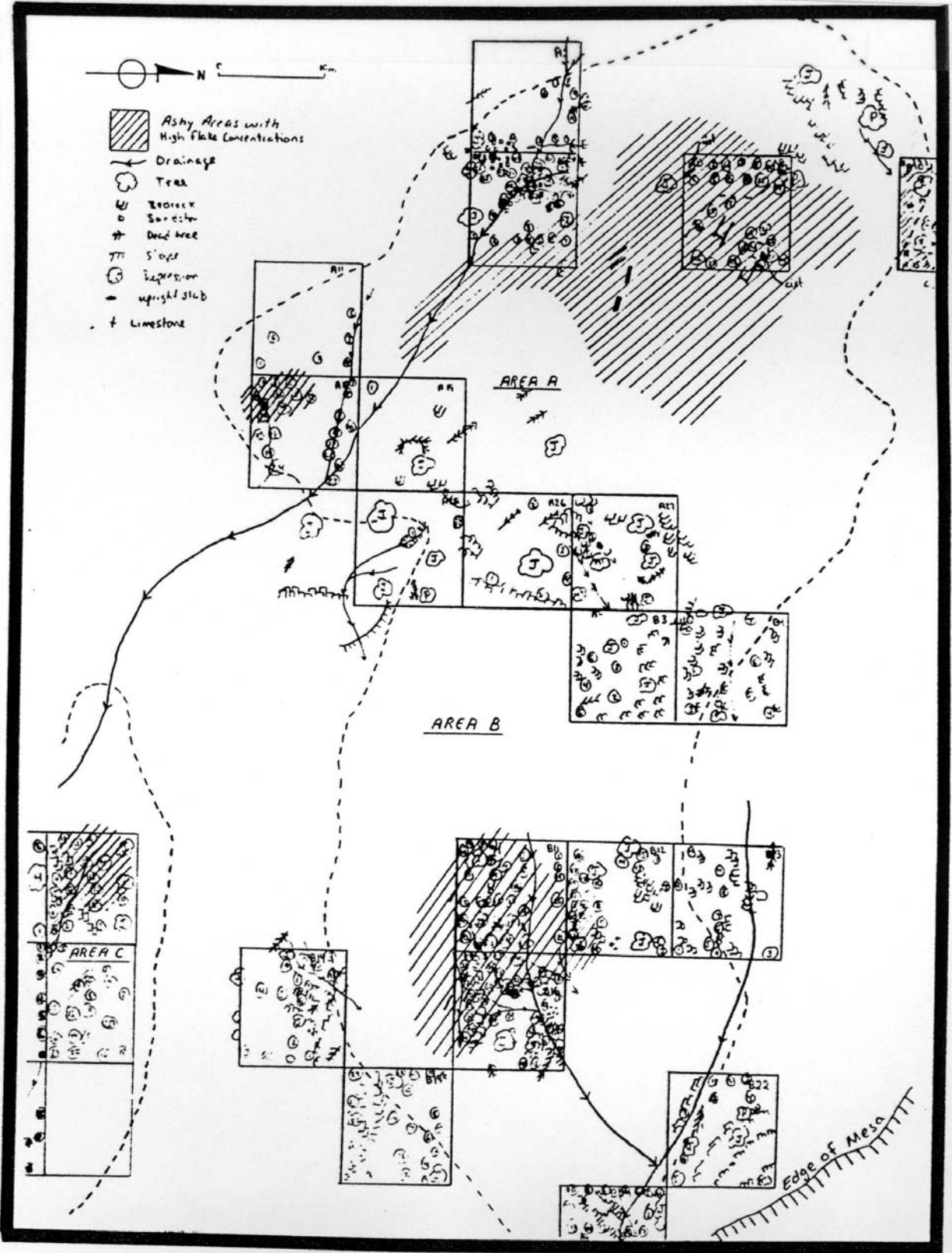
LITHIC ANALYSIS OF THE ROCK ISLAND SITE (North Road C9-5)

Michael Brand

Introduction

The Rock Island site (NR C9-5) is a large Basketmaker II site located on the eastern slope of Cedar Mesa, Utah. The initial survey and recording divided the site into three areas (Map 7-1). On the basis of observed surface characteristics these areas appear to differ in a number of aspects. The western most area, Area A, is defined by a very dense artifact scatter and the presence of a number of slab lined cists. Recent research at this site has demonstrated the presence of at least one pithouse in this area. Area B, located to the east of Area A, also has a high density artifact scatter, however, no surface features have been recorded in this section of the site. Area C, defined on the basis of a third concentration of artifacts on the surface, lies directly south of Area B. No surface features have been recorded for Area C.

This study will use lithic analysis to examine intra-site patterning at NR C9-5. Differences were observed in surface characteristics between the three areas identified on the site. The specific question to be answered by the lithic analysis is:



Map 7-1 Site NR C9-5 (Rock Island Site) on Cedar Mesa

are the three areas of the site the same, or do the chipped stone tools and lithic debitage from the site indicate differences between these areas? Two stages of analysis will be used in this paper to ascertain the nature of intra-site patterning. The first will be the analysis of all chipped stone tools collected from the site. If the three areas served different functions one would expect the frequency of specific tool classes to vary between the areas. The analysis of the chipped stone tools will be followed by analysis of a sample of debitage from each area. The debitage analysis is aimed at comparing the relative proportions of debitage which can be attributed to early and late portions of the lithic reductive sequence, in each area. The details for each stage of the analysis are discussed in separate sections below.

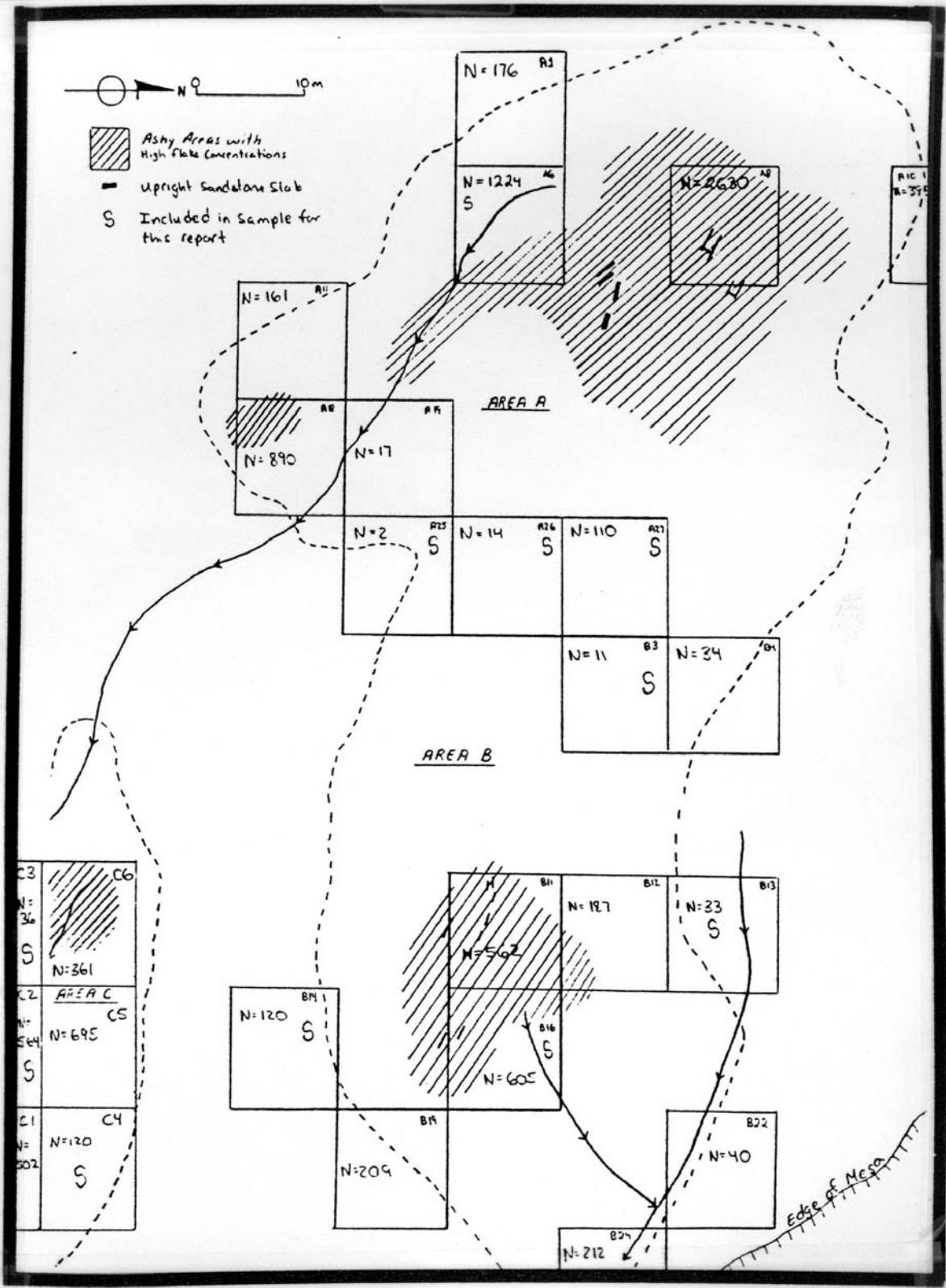
The Rock Island Site (NR C9-5)

The Rock Island Site (NR C9-5) is an Anasazi, Basketmaker II site located on Cedar Mesa, southeast Utah. The site was originally recorded by the Cedar Mesa project in 1974 as one of one hundred and thirty Basketmaker II sites located in the sampled drainages (Matson et al. 1988:248). NR C9-5 has a unique location. The site sits on the promontory between two branches of the North Road Canyon. The only access to this site is from the northwest. Sheer canyon walls reach straight down over one hundred feet to the canyon floor on the north, east and south sides of the promontory.

Initially three areas (A,B and C) were identified on the

site, based on concentrations of surface artifacts, primarily lithic debitage. A number of sandstone slab cists and numerous upright sandstone slabs, along with other pieces of sandstone were also observed on the site. A 10m x 10m grid was set up over the entire site and the units within each area were sampled (Map 7-2). Area A has a total of twenty-nine grid squares; complete surface collection was undertaken in ten of these squares. Ten squares were also surface collected from the twenty-four grid squares in Area B. Area C has only six grid squares, all of which were surface collected. The combined collections from each of the three areas equal over ten thousand catalog entries, representing forty-four percent of the site area.

Further testing was conducted at NR C9-5 in 1991 by the Cedar Mesa Project II. Pictographs and the remains of small structures constructed of sandstone slabs were noted on a small ledge below the top of promontory and slightly south of the access. Based on the data collected on this project, Matson (1994:231, this volume) believes that this site is a pithouse village with at least five pithouses. Two test pits were excavated in Area A. One test pit partially exposed the prepared floor of a pithouse. Upright sandstone slabs immediately to the west of this test pit (test pit 1) are likely associated with the entrance to this structure. Matson (1994:231, this volume) notes the defensive location of this site and the possible presence of the remains of a defensive wall at the only access to the site. There is currently a single



Map 7-2 Surface collection units at NR C9-5 and sampled units used in this report

radiocarbon date for NR C9-5 of 1670 ± 90 BP (WSU 4345) (A.D. 280) placing the site in the Grand Gulch Phase (Basketmaker II) on Cedar Mesa (Matson 1994:231).

Sampling Procedures

Due to the large amount of lithic material collected from this site and limited time for analysis, a stratified random sample was taken from the collected grid squares. The sample represents forty-two percent of the total collected grid squares (by area). The three areas on the site were stratified, based on their respective median values, into high and low density grid squares. Using a table of random numbers, one high density grid square was selected from each area. Also, using a table of random numbers, three low density grid squares from Areas A and B were selected for analysis. A smaller number of grid squares were originally collected from Area C, therefore only two low density grid squares were selected for the present analysis.

The sample of grid squares selected for Area A, starting with the high density grid square, in order of selection are as follows: A6, A25, A26 and A27. The grid squares selected for Area B, listed in order of selection are: B16, B14, B13 and B3. Grid squares C2, C4, and C3 were selected for Area C.

Methods

Ten variables were recorded for each specimen in the sample. The recording system is presented in Appendix I. The first two variables recorded, collection unit and catalog

number, identify the specimen and the area of the site from which it came. All specimens were assigned to one of twenty-five classes. The first six classes are debitage and the remaining nineteen are tools. Tool classes were chosen based on a general idea of what existed in the assemblage and previous lithic analysis for Cedar Mesa Basketmaker II sites (Matson 1981).

The manufacture of chipped stone tools is a linear, reductive process (Collins 1975:16), which is often divided into steps or stages. Attempting to identify the specific stage during which a particular flake was manufactured is a difficult and often ambiguous task. However, certain flake characteristics often result only during a limited portion of the reduction process. For example, the cortex on a nodule of raw material is generally completely removed prior to bifacial thinning. Mauldin and Amick (1989:67) state that in their experiments the majority of cortex was removed prior to the half way point in core reduction. Thus, flakes with cortex present were most likely removed during the early portion of the reduction sequence. Here emphasis is placed on relative portions of the reductive process rather than specific stages.

Four classes of debitage are present in the recording system used for the NR C9-5 lithic assemblage: cores, flakes, flake shatter and block shatter. A number of different variables are recorded for each debitage class. These variables are designed to provide some indication of the relative proportions of early and late tending portions of the reductive sequence present in each of the three areas of the site. Cores

are specimens which have no bulb of force and have a surface from which flakes have been removed (Chapman 1977:374). Although variables such as the presence or absence of cortex and weight are recorded for cores, their most important contribution is their very presence. The presence of a core is a good indication that earlier portions of the reductive sequence were performed in that area. Of course, the possibility remains that the cores were transported into an area where they were never actually used. However, the assumption made here is that cores were, in all probability, dropped in the general area of their use.

Flakes will be the primary class used in the debitage analysis. Both complete and broken flakes are included in this class, as long as they retain the striking platform. Four variables recorded for flakes, but not recorded for other classes of debitage are: striking platform, length, width and thickness. Four platform states are recognized: missing, for cases in which the platform has been sheared off; single facet platforms; cortex bearing platforms; and multiple platforms resulting from preparation of the striking platform prior to flake removal. Cortex bearing and single facet platforms are representative of the earlier portion of the reductive process. The presence of cortex on a platform indicates that the flake was removed during the early portion of reduction.

Single facet platforms are also characteristic of flakes removed in the earlier portion of the reductive sequence. Magne (1985:113) suggests that the number of scars, or facets, on the

striking platform increases during the later portions of the reduction sequence. Thus, flakes in the assemblage with multiple faceted platforms are characteristic of later reduction activities. Flakes which have had their striking platforms sheared off are also characteristic of the later portion of reduction, as the flakes being removed are on the whole generally thinner and, thus, more susceptible to platform destruction (based on limited personal observation).

Measurements of size are also important variables in the relative placement of flakes into a portion of the reductive sequence. In the reduction of a piece of lithic material the core becomes progressively smaller, this necessarily requires that the debitage also decreases in size as the reduction process proceeds. Mauldin and Amick (1989:77) note that flake length and maximum width are not good indicators of reduction stage. In this analysis length, width and thickness are multiplied together to provide a general measure of flake size (volume). Stahle and Dunn (1982) have suggested that weight is an adequate predictor of reduction stage. Their experiments indicated that seventy-six percent of the differences between reduction stages can be accounted for by weight.

Only two variables were recorded for flake shatter and block shatter, the presence or absence of cortex and weight. The use of both these variables in the placement of specimens into the relative portions of the reductive sequence has been discussed above. With the exception of cortex bearing specimens the use of flake shatter in this vein is somewhat ambiguous. In

the absence of a platform the only attribute which may contribute to the analysis is weight. However, there is no reliable means of estimating what portion of the original flake is represented by any given piece of shatter. Thus, the specimen may be weighed, but that weight is not comparable with that of complete flakes.

Block shatter is assumed to be representative of the earlier portion of the reduction sequence. It is unlikely that a piece of block shatter would result during biface reduction.

Results

A total of 2740 individual specimens were included in this analysis. Table 7-1 presents a breakdown of the number and frequency of each artifact class for the three areas of the site. The sample from Area A contained 1387 specimens, followed by a sample of 792 specimens from Area B and 561 specimens from Area C. The rank of the samples used in this analysis is the same as the rank of the total surface collections from the site. Area A has the most specimens and Area C the least.

NR C9-5 Tool Analysis

The chipped stone tool analyses was undertaken as the first step towards answering the question: are there differences between the three areas identified on the site? This requires comparison of the types and frequencies of different tool classes between Areas A, B and C. Originally nineteen classes of tools were included in the recording system. The initial

CLASS	AREA A		AREA B		AREA C	
	N	%	N	%	N	%
Core	1	0.1	3	0.4	1	0.2
Flake	297	21.4	228	28.8	145	26
Flake Shatter	818	59	388	49	319	57
Block Shatter	141	10.2	45	5.7	33	5.9
Smooth Pebble	8	0.6	3	0.4	0	0
Steep Angle Utilized Flake	14	1	15	1.9	1	0.2
Acute Angle Utilized Flake	15	1.1	37	4.7	11	2
Steep Angle Unifacially Retouched Flake	1	0.1	7	0.9	1	0.2
Acute Angle Unifacially Retouched Flake	3	0.2	2	0.3	0	0
Marginal Bifacially Retouched Flake	11	0.8	9	1.1	10	1.9
Complete Biface	1	0.1	3	0.4	7	1.2
Biface End Fragment	30	2.2	23	2.9	14	2.5
Biface Medial Fragment	20	1.4	5	0.6	13	2.3
Biface With End Missing	1	0.1	3	0.4	1	0.2
Complete Projectile Point	3	0.2	4	0.5	1	0.2
Projectile Point Fragment	7	0.5	9	1.1	1	0.2
Drill	4	0.3	2	0.3	0	0
Fragment of Drill	2	0.1	1	0.1	1	0.2
Denticulate	0	0	1	0.1	0	0
Graver	8	0.6	3	0.4	2	0.4
Ground Stone	2	0.1	1	0.1	0	0
TOTAL	1387	100	792	100	561	100

Table 7-1 Counts and frequencies for all debitage and tool classes for sample from NR C9-5

analysis showed that three of these classes were empty. No steep or acute angle formed unifaces or modified pebbles were present in the assemblage. With the exception of utilized flakes all chipped stone tools included in the assemblage were used in this analysis. The discussion of utilized flakes is limited to those tools included in the grid squares selected by the sample. Given the present organization of the assemblage the time necessary to separate the utilized flakes from all surface collection units was not available.

Figure 7-1 plots the frequencies of thirteen tool classes for each area of the site. Two striking differences are immediately observable in this figure, both relating to Area B. The frequency of biface medial fragments in Area B is less than ten percent of the total tools from this area, whereas biface medial fragments comprise twenty-two percent of all tools in area C and twenty-six percent of all tools in Area A. The second difference is the high frequency of steep angled, unifacially retouched flakes in Area B relative to the other two areas.

A number of smaller differences in the frequencies of the various tool classes also exist between Areas A, B and C. Comparing the frequencies for each tool class shows that Area A has a slightly higher frequency of graters. The frequencies of complete projectile points and projectile point fragments are higher in Area B. Area B also has the only denticulate. Area C shows higher frequencies of both complete bifaces and flakes with marginal bifacial retouch.

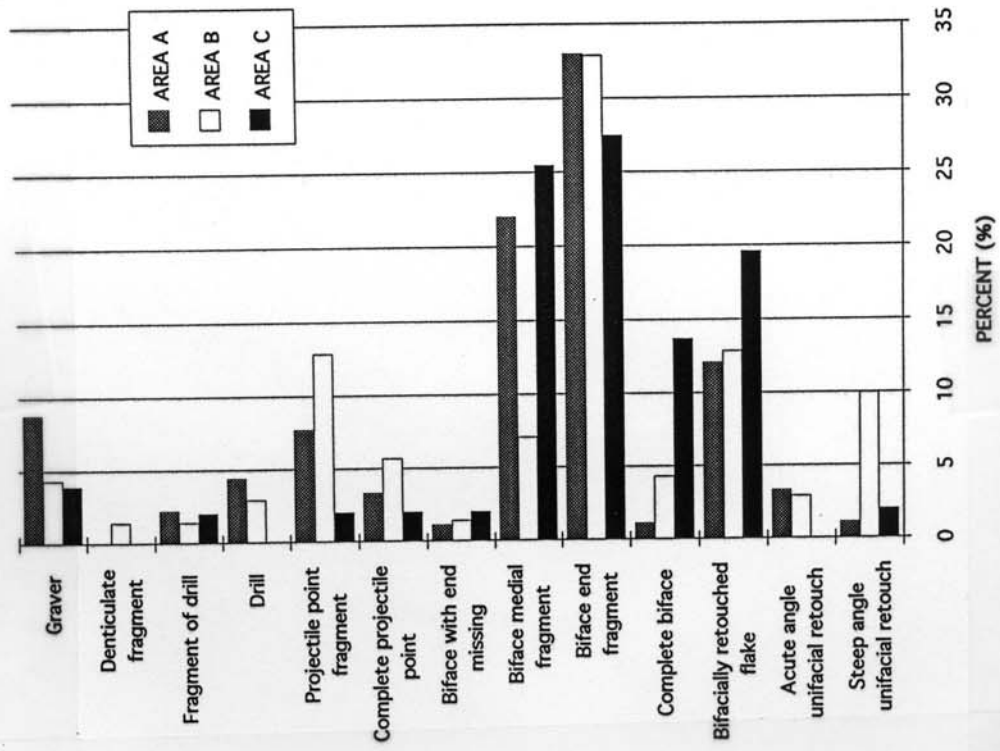


Fig. 7-1 NR C9-5 Tool class frequencies

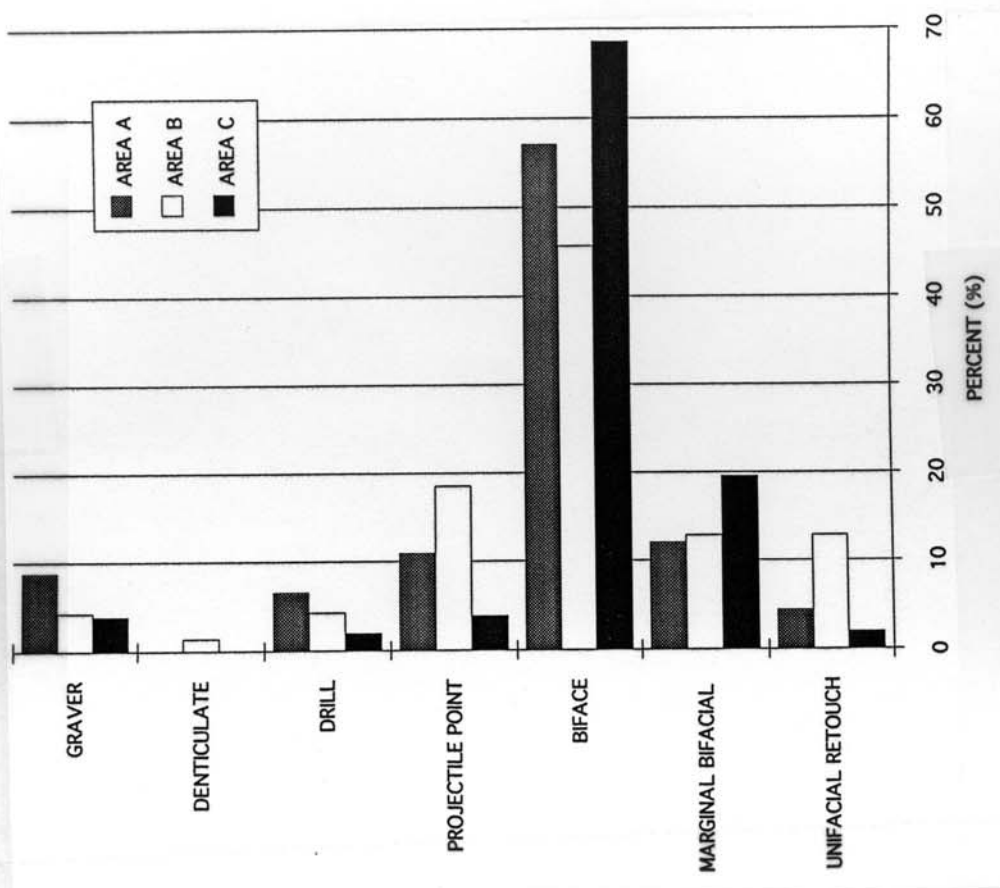


Fig. 7-2 Frequencies of grouped tool classes

Areas A and B show comparable frequencies of drills, biface end fragments and acute angled unifacially retouched flakes. As noted above Areas A and C have similar frequencies of biface medial fragments and Area B a much lower frequency. All three areas share similar frequencies of drill fragments and bifaces with an end missing.

With two exceptions the differences between the tool class frequencies in these three areas are small. There is no easily observable pattern in Figure 7-1 which would indicate marked differences between the areas of the site. However, the tool classes plotted in this figure are all very specific. A more productive approach to this data is to combine a number of related tool classes. This effectively reduces the number of classes from thirteen down to seven (Fig. 7-2). Complete biface, biface end fragment, biface medial fragment and biface with end missing are all combined into the grouped tool class Biface. Complete drills and drill fragments are combined into a single class, as are complete projectile points and projectile point fragments. Finally steep and acute angled unifacially retouched flakes are also combined. Gravers, denticulates and flakes with marginal bifacial retouch remain as individual classes.

Once again there is a mixture of large and small differences between the frequencies of the tool classes in Areas A, B and C. There are, however, more obvious differences observable in this figure. The frequency of unifacially retouched flakes remains substantially higher in Area B. The most striking feature of the figure is the differences in the

frequencies of bifaces between the three areas. Sixty-nine percent of the chipped stone tools in Area C are bifaces (or biface fragments). In Area A fifty-seven percent of the tools are bifaces and in Area B only forty-five percent of all tools are included in the biface class. The differences between these classes is consistently greater than ten percent.

Of particular interest in this figure is the way tool classes occur together with higher frequencies in specific areas. Area A has higher frequencies of graters and drills. Both these tool classes have utilized projections. It is interesting that they occur in greater frequencies in Area A, where one pithouse has been positively identified and evidence indicates that there may be at least two more in close proximity (Matson 1994, this volume). The functions of the tools in these two classes may be related to the activities undertaken near these dwellings. These tool classes occur with less frequency in Area B and are less common again in Area C. Surface evidence indicates that a pithouse may exist in Area B (R.G. Matson, personal communication 1993). At the present time there is no indication of a pithouse in Area C.

The frequency of projectile points and denticulates is higher in Area B than in either Area A or C. The occurrence of higher frequencies of the two tool types which require the most elaboration together in one area is of some interest. Unfortunately the denticulate tool class is only represented by a single artifact in the entire assemblage. Although it was collected from Area B, the existence of only one denticulate

does reduce the significance of its association with higher frequencies of projectile points in this area. As noted above, Area B also has the highest frequency of unifacially retouched flakes.

Finally, Area C shows higher frequencies of bifaces and flakes with marginal bifacial retouch. As noted previously the differences in the frequencies of this tool class are the most significant differences which exist between the three areas.

A comparison utilized flakes collected in the grid units included in the present sample show an interesting pattern. The frequency of utilized flakes in Area B is twice as high as the frequencies of utilized flakes in Areas A and C. This is an interesting result in light of the high frequency of unifacially retouched flakes in the same area. It is also interesting that the highest frequencies of tools with the lowest and highest manufacturing costs would occur in the same area.

As a third comparison of Areas A, B and C the seven tool classes used in Figure 7-2 were further combined into two classes, tools with a high amount of manufacturing input (bifaces, drills, denticulates, and projectile points) and those with a low amount manufacturing input (marginal bifacial retouch and unifacial retouch) (Fig. 7-3). It is unfortunate that the utilized flakes discussed here are only from sampled grid squares and not the entire surface collected assemblage. As they are it is not possible to include them in this comparison. This figure indicates that there is very little variation between the three areas in terms of high and low input

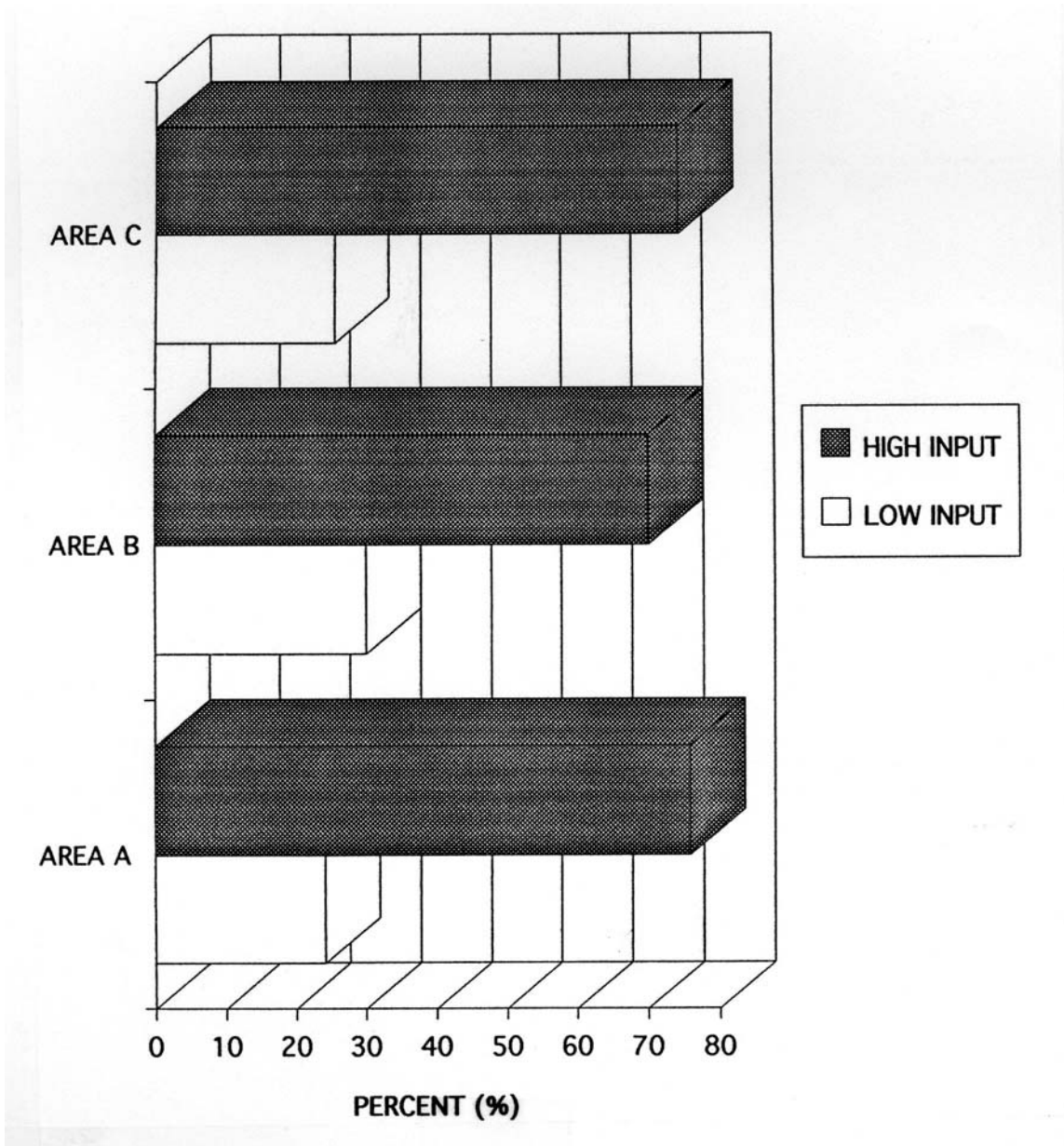


Fig. 7-3 Frequencies of tool classes grouped into high manufacturing input and low manufacturing input categories

tools.

A comparison of the material types used for different tool classes and in the different areas of the site produced quite homogeneous results. Jasper is the dominant material type for all areas of the site and all artifact classes. The one exception, excluding the single denticulate, is the higher frequency of chert used for projectile points in Area B.

NR C9-5 Debitage Analysis

Debitage analysis provides a second means of addressing the question of intra-site differences at NR C9-5. The archaeological recovery of chipped stone tools relates to the location that a tool was dropped in prehistory, through discard or loss (and any number of post-depositional processes), and is not necessarily the location of that tool's use. Debitage, however, generally remains at the location it was produced. Thus, through the analysis of lithic debitage it is possible to be quite certain that the debitage present represents activities undertaken in that area. The debitage used in this analysis represents a sample of the material collected from NR C9-5. Four classes of debitage were recorded for this site: cores, flakes, flake shatter and block shatter. The variables recorded for each of these classes, and their importance in the analyses have been presented earlier (see: Methods).

The approach used in this analysis is based on identifying relative proportions of debitage representing portions of the lithic reduction sequence in Areas A, B and C. The reductive

process is not considered in terms of discreet stages, or steps, but rather debitage is classified as having early or late tendencies. The relative proportions of early and late tending debitage will be compared between the three areas. This analysis will focus primarily on flakes, as they have the potential to provide the most information. Four variables will be used in the comparison: weight, size, cortex and platform types.

Flake weight can be used as an approximation of flake size, heavier flakes are considered representative of the earlier portion of the reductive sequence, lighter flakes represent the later portion. Figure 7-4 presents box plots for the weight of all flakes from Areas A,B and C. The mean value for Areas A and C are quite similar. The mean weight for Area B, however, appears to be larger, indicating that there may be a greater proportion of heavier flakes.

Figure 7-4 also shows that there are a number of outliers for each area which will affect the mean. Thus, a more appropriate measure may be the median. The median weight in Area A is 0.8g, with a lower hinge of 0.4g and an upper hinge of 1.5g (inter-quartile range=1.1). Area C also has a median of 0.8g, the lower hinge is 0.5g and the upper hinge is 1.7g (inter-quartile range=1.2). The similarity between these values indicates no difference between Area A and Area C. The median weight for Area B is 1.1g, with a lower hinge of 0.6g and an upper hinge of 2.3g (inter-quartile range=1.7). Area B has a higher median weight and greater inter-quartile range than the other two areas. This suggests that Area B may have slightly

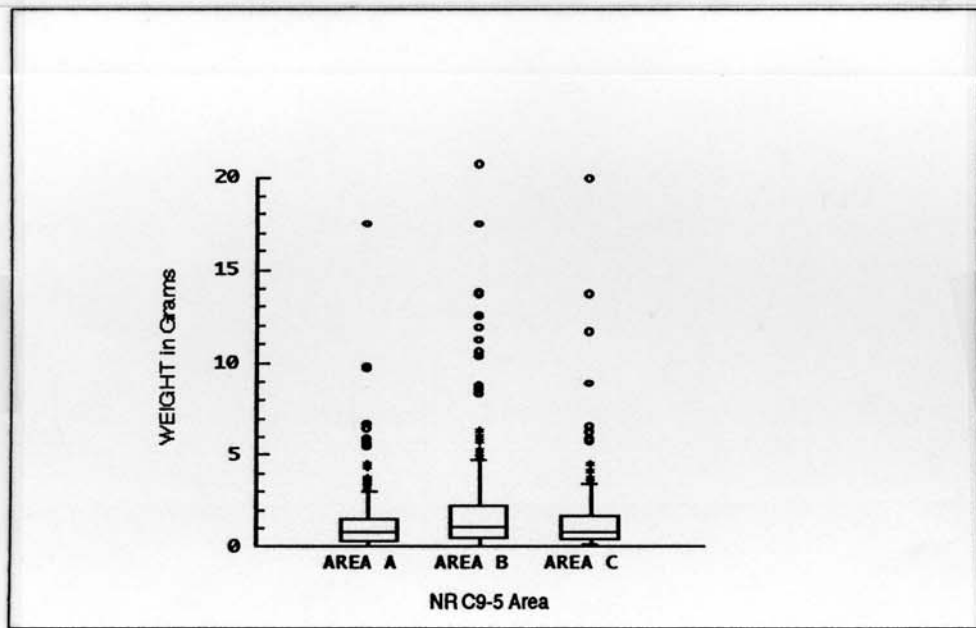


Fig. 7-4 Flake weight for Areas A, B, and C

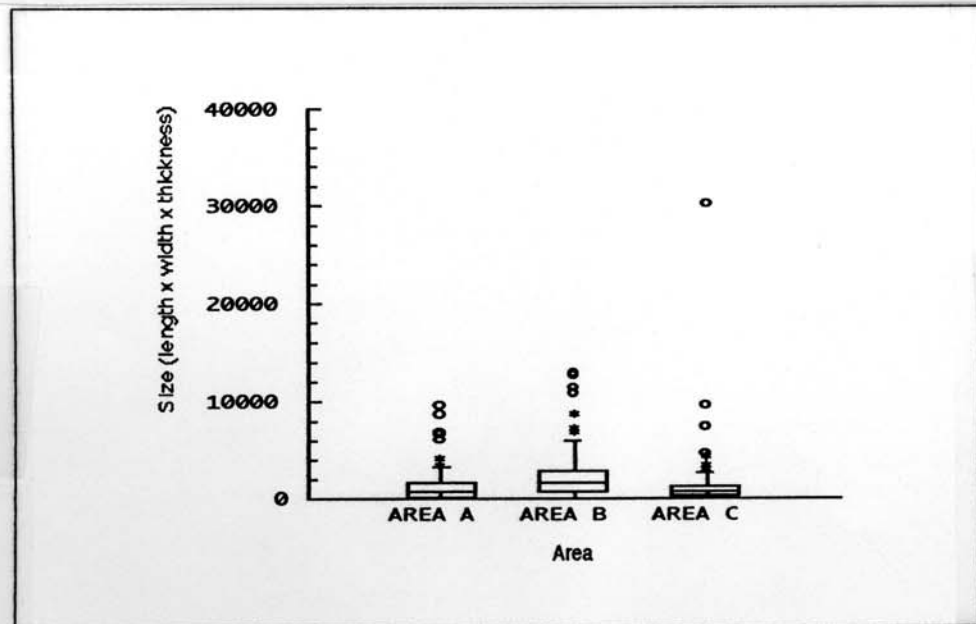


Fig. 7-5 Relative flake size for Areas A, B, and C

more early tending flakes than Areas A and C.

The second variable, size, was arrived at by multiplying the length, width and thickness of complete flakes to obtain a relative approximation of a flakes overall size. Figure 7-5 presents box plots for each of the three areas. The mean values for flake size from the three areas are quite different. Area B has the highest mean, 2459.1mm³; the mean value for Area A is 1299mm³, and the mean value for Area C is 2045mm³. This suggests that on the average there are a greater proportion of large flakes in Area B.

The median values for size also show large differences between the three area. Area B has a median value of 1560mm³, Area C has a median value of only 678mm³, and Area A falls in between with a median of 724mm³. The median value for Area B is greater than the upper hinge of Area C. The spread of the inter-quartile range around the medians for these areas are quite different. The inter-quartile range for Area B is 2185 (lower hinge=665, median=1560, upper hinge=2850). Area A has an inter-quartile range of 1422 (lower hinge=288, median=724, upper hinge=1650). The inter-quartile range for flake size in Area C is only 1024 (lower hinge=446, median=678, upper hinge=1470). Area B not only has a significantly higher median size but the spread around the median is also greater. Area C has the tightest spread around the median. These values strongly suggest that there are differences between the three areas of the site. Area B has the largest proportion of large, or early tending flakes, and Area C has the smallest proportion of early tending

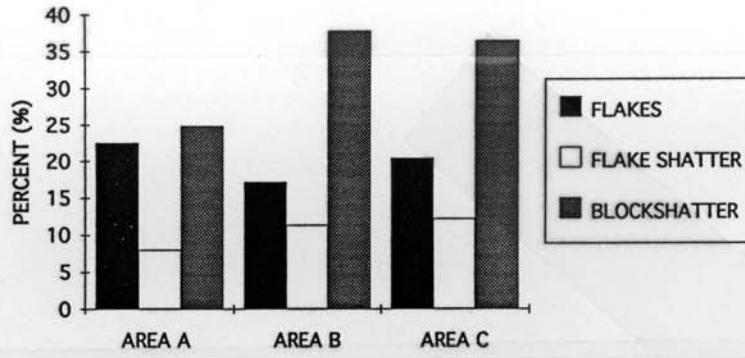


Fig. 7-6 Frequencies of specimens with cortex present in debitage categories

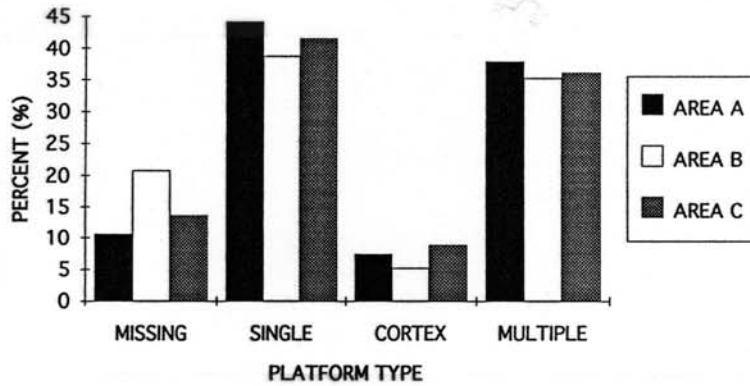


Fig. 7-7 Frequencies of platform types

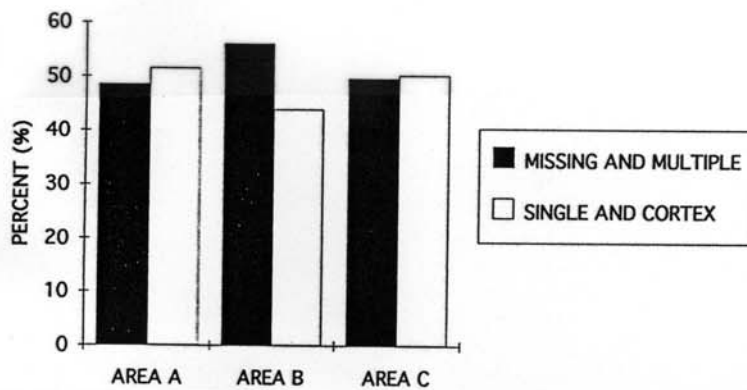


Fig. 7-8 Frequencies of grouped platform types

flakes. Although Area A has a greater median value and Inter-quartile range, the proportion of large, or early tending flakes in this area is closer to Area C than Area B.

The proportions of debitage with cortex present also provides a means of comparing Areas A, B and C. Figure 7-6 plots the percentages of flakes, flake shatter and block shatter with cortex for each area. The most obvious difference on the graph is the low frequency of cortex on block shatter from Area A. The proportion of flake shatter with cortex present is very similar for all three areas. All three areas have a similar proportion of flakes with cortex present. The largest difference is only six percent between Area A (23%) and Area B (17%). As noted above block shatter is considered to be associated with the earlier portion of the reductive sequence. Thus, the lower frequency of cortex bearing block shatter in Area A does not indicate any greater tendency toward the later portions of the reductive process for that area. Based on the similar proportions of flakes and flake shatter with cortex present this comparison suggests that there is no difference between the three areas.

Platform type was recorded for all flakes as one of four categories: missing, single, cortex and multiple. As discussed above missing and multiple facet platforms are considered characteristic of late tending debitage. Single facet platforms and platforms with cortex are considered characteristic of early tending debitage. Figure 7-7 plots the frequency of all four platform types for each area. With the exception of missing

platforms, there does not appear to be much difference in the frequency of different platform types between the three areas. Surprisingly Area B appears to have the highest frequency of missing platforms. Missing and multiple platforms were combined and single and cortex platforms were combined to form early tending and late tending groups. Figure 7-8 plots the frequencies of these two groups for all three areas. Once again we see only slightly higher proportions of late tending platform types in Area B.

Discussion

The analysis of the chipped stone tools and lithic debitage presented above suggests some interesting intra-site patterning at NR C9-5. Results from the comparison of stone tool class frequencies between Areas A,B and C indicate little difference between the three areas for most classes. The tool class frequencies are by no means identical across all three areas, however, the differences which do exist are not large. The one exception to this is the grouped biface tool class (Fig. 7-2). All three areas are separated by at least ten percent. The frequency of bifaces in Area C is sixty-nine percent, whereas in Area B, bifaces represent only forty-five percent of all chipped stone tools.

Separating the tool classes presented in Figure 7-2, into three groups based on the area with the highest frequency for each class also produces interesting results. This procedure puts drills and graters, which both have worked projections,

into the same group, Area A. Area C contains the greatest frequency of bifaces, and flakes with marginal bifacial retouch.

Area B has the highest frequencies of projectile points and denticulates (although there is only one), both tool types which require a high degree of elaboration. It is interesting that Area B also has the highest frequency of unifacially retouched flakes, which have the lowest manufacturing costs of all classes included in the tool class comparison. Although a comparison made between high manufacture input tools and low manufacture input tools suggested little difference between the three areas, separate analysis of utilized flakes also showed the highest frequency of this class in Area B. It is unfortunate that the utilized flakes included in this analysis only came from the sampled collections grid squares, and are not comparable with the other tool classes. However, even though their frequencies can only be taken from the entire sample from each area (Table 7-1) the frequency of utilized flakes in Area B is three times that of Areas A and C. This supports the suggestion that the frequency of expedient tools is greater in Area B. The possibility of related activities performed in Area B which resulted in the greater frequencies of highly elaborated tools and expedient tools is an interesting prospect.

The debitage analysis was aimed at identifying relative proportions of flakes (and to a lesser degree flake shatter and block shatter) belonging to early and late tending portions of the reductive sequence, in each of the three areas. Two parts of this analysis used variables, weight and size, which approximate

relative flake size. Comparison of the weight ranges for each area indicates that Areas A and C share similar proportions of late and early tending flakes. Area B, however, appears to have a somewhat greater proportion of larger flakes. Flake sizes, in general, become increasingly smaller as the reduction process proceeds, thus, a higher proportion of larger flakes in Area B suggests that there are more early tending flakes in this area.

This suggestion is supported by the results from a comparison of overall flake size (length x width x thickness). Once again Area B appears to have a greater proportion of larger, or early tending flakes. Although Area A has a greater proportion of larger flakes than Area C, the difference between these two groups is smaller than the difference between Areas A and B. Area B also has the greatest proportion of cores, however, the number of cores in the assemblage is small (Area A=1, Area B=3, Area C=1).

There is, however, some experimental data which complicates the use of this data. Maudlin and Amick (1989:77) note that numerous small flakes are produced during the early stages of core reduction from platform preparation. The further modification of larger flakes is a second factor which has an effect on the patterns of large and small debitage in a site. The fact remains, however, that there are differences in the proportions of large and small flakes between Areas A, B and C. To what extent these proportions are affected by the two factors just mentioned is unknown. Another consideration which relates to the frequencies of flake size in the NR C9-5 assemblage is

the effects of surface collection techniques. Large flakes have a better probability of being collected, this will bias the relationship between large and small flakes in the assemblage. As far as a comparison of flake size for the three areas of the site is concerned, it is not insensible to assume that small flakes had the same probability of being collected in all three areas (i.e., no greater attention was given to small flakes in one area than in the others).

Comparison of the relative proportions of debitage with cortex present suggests that there is little difference between the three areas of the site. The percentage of flakes and flake shatter with cortex are similar in each area. The only real difference observed in this comparison was the proportions of cortex on block shatter. However, block shatter is considered characteristic of the early portion of the reduction sequence, which reduces the importance of the different frequencies of cortex in this class. The proportions of flake shatter and block shatter are roughly equal in Areas B and C. The two areas also share similar proportions of both. The proportion of flake shatter in Area A is twice that of block shatter. The original size of individual pieces of flake shatter is unknown and as a result it is not possible to assign the specimens to early or late portions of the reductive sequence. It is impossible, based on the variables recorded for this class, to specify whether a piece of flake shatter represents ninety percent of a small flake, or only five percent of a large flake. This makes the difference in the frequencies of flake shatter and block shatter

in Area A difficult to interpret.

Comparison of the frequencies of four different platform types between the three areas provided results which tend to contradict the size comparison results, which indicate that higher proportions of early tending flakes occur in Area B. In the Methods section of this paper single facet and cortex bearing platforms were identified as characteristic of early tending flakes, whereas missing and multiple facet platforms are characteristic of late tending flakes. The frequency of single, cortex and multiple platforms are similar in all three areas. Only the frequencies of flakes with missing platforms are different, and the area with the greatest proportion of flakes with missing platforms is Area B. The differences in the frequencies of missing platforms between the three areas is not vast, but it is greater than the variation in the proportions of other platform types. If the assumption that flakes with missing platforms are produced during the later portion of the reductive sequence is wrong, the results of this comparison would support the results of the size comparisons. However, no data has been found to indicate that this is the case.

Conclusion

In conclusion, the analysis of chipped stone tools from NR C9-5 indicates that there are differences in the frequencies of bifaces in the three areas of the site. The analysis suggests some interesting patterning in the types of tools which are found with the highest frequencies in the same area. Such as the

gravers and drills in Area A; projectile points and expedient tools in Area B and bifaces and flakes with marginal bifacial retouch in Area C. The high frequencies of both unifacially retouched flakes and utilized flakes in Area B is particularly interesting. However, it should be noted that the frequencies of all these tool classes (with the exception of bifaces) are not extremely divergent.

The results of the debitage analysis are not as easy to interpret. Both measures of size, weight and overall flake size, support each other, and indicate that Area B has greater proportions of larger flakes. Larger flakes are characteristic of early portions of the reductive sequence and, thus, Area B may have higher proportions of early tending debitage. Unfortunately, this conclusion is not supported by analysis of the proportions of cortex bearing flakes, which suggests no difference between the areas, and the proportions of the different platform types, which shows slightly greater proportions of late tending platform types in Area B.

Appendix One

Recording Codes for NR C9 -5 LITHICS with Code Descriptions.

RECORDING CODES FOR NR C9 - 5 LITHICS

13 / 04 / 93

Note: Descriptions of codes are presented below.

1.0 COLLECTION UNIT

Letter for Area, and number of collection unit, e.g.. A26.

2.0 CATALOG NUMBER

NR C9-5- _____

3.0 CLASS

Debitage:

- unmodified raw material...1
- core2
- flake.....3
- flake shatter.....4
- block shatter.....5
- smooth pebble.....6

Tools:

- steep angle utilized flake7
- acute angle utilized flake8
- steep angle unifacially retouched flake..9
- acute angle unifacially retouched flake..10
- steep angled formed uniface....11
- acute angled formed uniface....12
- bifacially retouched flake.....13
- complete biface.....14
- biface end fragment.....15
- biface medial fragment.....16
- biface with end missing.....17
- complete projectile point.....18
- projectile point fragment.....19
- drill.....20
- fragment of drill..... 21
- modified pebble.....22
- denticulate frag.(Don's saws)..23
- graver.....24
- ground stone.....25

4.0 RAW MATERIAL

- chert.....1
- Jasper.....2
- Chalcedony.3
- Quartzite..4
- Other.....5

5.0 STRIKING PLATFORM

- missing....0
- single.....1
- cortex.....2
- multiple...3

6.0 CORTEX

- absent...0
- present..1

7.0 LENGTH

To the nearest millimeter.

8.0 WIDTH

To the nearest millimeter.

9.0 THICKNESS

To the nearest millimeter.

10.0 WEIGHT

To the nearest tenth of a gram.

11.0 COMMENTS

CODE DESCRIPTIONS

1.0 Collection Unit:

NR C9-5 is divided into three separate areas: A, B, and C. When the site was recorded and collected in 1974 a 10m x 10m grid was laid over the site. The collection grids were numbered independently for each area. A portion of these grids were then sampled through surface collection. Therefore an entry recording both the area and the number of the collection grid is entered for each specimen.

2.0 Catalog Number:

Each specimen in the NR C9-5 lithic assemblage has an individual catalog number. The only exception to this are a number of plastic bags containing two or more small flakes all subsumed under a single catalog number. In these cases the shared number is recorded for each specimen and a note is made in the comments column indicating that this is the case.

3.0 Class:

One of the following class designations is recorded for each and every specimen.

3.1 Unmodified raw material : specimens which, although of the proper material type, show no sign of purposeful modification.

3.2 Core: specimens which have been used to obtain pieces of material for further reduction. According to Chapman (1977:374), cores are specimens which have no bulb of force and have a surface from which flakes have been removed.

3.3 Flake: the primary feature on the specimens in this class is a recognizable striking platform. Platform states are described in section 5.0 Platform, and are discussed below. The exceptions to this rule are specimens which have a complete bulb of force indicating the location of the platform, however, the platform has been sheared away and is missing. This occurrence is indicated by the code '0' in the Platform column. Both complete and broken flakes may be included in this class as long as they fit into one of the two situations noted above. Complete flakes are indicated in the data when length, width and thickness have all been recorded. In the event of broken flakes only one or two of these measurements will be present. These measurements are discussed in detail below.

3.4 Flake shatter : specimens classed as flake shatter have identifiable interior and exterior surfaces, but do not have an identifiable striking platform. Interior surfaces are indicated by ripple marks and force lines (as well as the bulb of force, although it is not generally a concern in this class) (Sullivan and Rozen 1985:758). Other indicators of an interior surface are the absence of flake scars and in some cases a slightly concave curve, though the latter need not

always be the case. Exterior surfaces generally exhibit one or more negative flake scars and/or cortex.

3.5 Block shatter : block shatter, as opposed to flake shatter, does not have any distinguishable interior surface. Specimens in this class are generally irregularly shaped and may have negative flake scars on one or more surfaces.

3.6 Smooth pebble : a number of small smooth pebbles were included in the sampled collection grids. These range in size, though the majority are quite small. Often consisting of the material used in tool production, a number of these stones appear to have been flake shatter which through some process have become rounded and smooth on all surfaces. Provenance cards in some of the collection bags have identified them as turkey gastroliths.

3.7 Steep angle utilized flake : this class consists of flakes, or flake shatter, with edges at an angle greater than 45° which have been utilized. Utilization is indicated by small scarring and chipping along the edge of the flake. This material has been sitting together in bags or trays for twenty years now, and judging by the collections current state of organization it has been used by a number of students in the past. All this amounts to ample opportunity for interaction between flakes resulting in edge damage. Thus, care must be taken in classifying utilized flakes. As a rule I recorded utilization only when a number of fairly well defined and continuous, although minute, scars were observable along the edge of the specimen. Utilization is distinguished from unifacial retouch by the size and regularity of the scarring. Unifacial retouch generally has larger scars which appear in a regular arrangement.

3.8 Acute angle utilized flake : utilized flakes with edge angles less than 45° .

3.9 Steep angle unifacially retouched flake : the specimens in this class have unifacial retouch on one or more sides, on edges with angles greater than 45° .

3.10 Acute angle unifacially retouched flake : specimens with one or more retouched edges with angles less than 45° .

3.11 Steep angle formed uniface : specimens which have had their shape modified by unifacial retouch. Edge angles must be greater than 45° .

3.12 Acute angle formed uniface : same as above (in 3.11) except edge angles are less than 45° .

3.13 Bifacially retouched flake : specimens included in this class show marginal bifacial retouch, that is, the retouch is only along the edge of the specimen and does not continue into the interior surface.

3.14 Complete biface : complete bifaces are symmetrical artifacts (Pokotylo 1978:216), which have bifacial flake scars across all surfaces and along all edges. Within the present collection the shape and thickness of these specimens vary. Generally, however, they are triangular in shape and quite thin. Specimens which meet these requirements, but have been broken must be recorded as one of the three classes which follow (3.15 - 3.17).

3.15 Biface end fragment : specimens which are bifacial across both surfaces and show a combination of finished edges with a snapped edge. Within the present collection these include: triangular sections with two finished edges meeting at a point, with a snapped edge opposite the point; specimens which have two parallel, or spreading finished edges which are joined by a third finished edge at right angles to the first two, with a snapped edge opposite this; and combinations of specimens which show finished edges forming corners (although these are less common in the collection).

3.16 Biface medial fragment : these specimens are bifacial across both surfaces but have at least two snapped ends. Within the collection these generally have two finished edges running parallel to one another, or contracting, with the adjacent ends snapped off.

3.17 Biface with end missing : This class is an intermediary between Complete bifaces and Biface end fragments. An example would be a triangular biface which has a small portion of the tip broken off.

3.18 Complete projectile point : projectile points are "bifacially flaked symmetrical artifacts, with a sharply pointed end, acute angled blade margins, and a basal modification facilitate hafting" (Pokotylo 1978:216).

3.19 Projectile point fragment : this class consists of fragments of projectile points which retain a haft element.

3.20 Drill : drills have bifacially shaped projection. These are often shaped like keys. The base of the drill need not be bifacially retouched, however, to be included within this class the projection must be bifacially formed.

3.21 Drill fragment : any specimens with a broken bifacially formed projection.

3.22 Modified pebble : pebbles which have some indication of being modified by flaking, yet retain a portion of their

natural shape. Pebbles which have been modified by abrasion (i.e., ground stone) are recorded as class 3.25.

3.23 Denticulate fragment (Don's saws) : specimens in this class have denticulate edges. This type of tool on Cedar Mesa have been referred to as Don's saws (Matson 1981:2).

3.24 Graver : graters have unifacially retouched projections (as opposed to drills which have bifacially retouched protrusions).

3.25 Ground stone : the amount of ground stone from this site is quite small. For the purposes of this report it is all subsumed within this class.

4.0 Raw Material:

During the 1972 and 1973 field seasons of the Cedar Mesa Project, Don Keller (1979, 1982) conducted a survey of lithic materials from Cedar Mesa sites and raw material sources in the area. This survey identified eighteen different material types and various sources for each. For the present analysis these eighteen types have been grouped into five classes.

4.1 Chert : the chert on Cedar Mesa sites occurs in a number of colors, Keller (1979:appendix I) identified: gray, red-purple, purple and various pastel colors.

4.2 Jasper : the jaspers on Cedar Mesa are red and reddish brown in color, some specimens are streaked with yellow.

4.3 Chalcedony : types of this material include dark and light streaked, translucent white and rose.

4.4 Quartzite : a number of different colors of quartzite are present in Cedar Mesa sites, these include: brown, purple, white and green.

4.5 Other : this category includes various material types which do not fit into one of the above four and occur in low quantities in the NR C9-5 assemblage. Materials identified by Keller (1979) which may be included in this category include obsidian, petrified wood and black siliceous stone.

5.0 Striking Platform:

When a platform can be identified on a specimen it must be recorded in this column as one of four states.

5.0 Missing : a zero recorded in this column indicated that the bulb of force is present, however, the striking platform has been sheared off and is missing.

5.1 Single : flakes with only single facets on the striking platform.

5.2 Cortex : flakes with cortex platforms.

5.3 Multiple : flakes with multiple facets observable on the striking platform.

6.0 Cortex:

Every specimen must be given a code indicating whether or not cortex is present or absent.

6.0 Absent : no cortex at all on the specimen.

6.1 Present : given to any specimen on which cortex is present, regardless of the amount of area it covers.

7.0 Length:

Length is only recorded for complete flakes, that is, both the striking platform and the end margin (measured on an axis aligned with the striking platform and bulb of force) must be present. End margins may be feather terminations or hinge fractures. Length is measure to the nearest millimeter.

8.0 Width:

Width is measured only on complete flakes, with both the striking platform and side margins present. The measurement is taken at the widest part of the flake. If the flake has been broken and the distal margin is no longer present, width may only be measured on flakes with contracting side margins, that is, the widest part of the flake is present and the margins are obviously tapering off to the end of the flake. Flakes with the distal end snapped off at a point where the side margins are still spreading are not measured for width. Width is measured to the nearest millimeter.

9.0 Thickness:

Thickness measurements are only recorded for platform bearing flakes. Measurements are taken away from the bulb of force. Thus, it is possible to measure thickness on flakes which do not have intact margins, if enough of the flake is present to allow a measurement away from the bulb of force. Thickness is measured to the nearest millimeter.

10.0 Weight:

Weight is recorded for all specimens including tools, flake and block shatter. Weight is recorded to the nearest tenth of a gram. Some specimens, however, may weigh less than .05g. These have been recorded at their actual weight (e.g., 0.03g) as they could not be rounded up to .1g and zero was deemed an

unsatisfactory entry. These may later be added to an appropriate category for further study, such as the smallest size class.

11.0 Comments:

A comments column has been added to record any remarks regarding specific specimens which were not part of the formal recording procedure. As noted above small specimens which share a single catalog number are indicated here.

Chapter 8

SUMMARY AND CONCLUSION: Results of Exploring Anasazi Origins: The Cedar Mesa Basketmaker II

R.G. Matson

The previous chapters have reported on different aspects of the S.S.H.R.C. funded research. I will now compare the results of the field work with that which was proposed. Next, I will describe other research, including some that is still to be concluded. Finally I will review some other research which is relevant.

Dos Tanques-Dos Fuentes Locality

The most important research proposed in the S.S.H.R.C. grant was the determination of the nature of the material identified as Basketmaker II during the 1972/73 survey in Hardscrabble quadrats 4 and 5. This area was anomalous for Cedar Mesa Basketmakers in that it was much lower in elevation than other places with habitations sites and was the surveyed area most similar to locations with late Archaic material in others areas of the Southwest, such as Arroyo Cuervo (Irwin-Williams 1973). Of all the material identified as Basketmaker II on Cedar Mesa this was the most likely to be mistaken identified Archaic material.

When investigated in 1991, the discovery of two springs and two tanks (providing the locality name, Dos Tanques-Dos Fuentes) made the use of this area more understandable, but the presence of a significant potential floodwater farming area, with run-off from an extensive slick rock area made its use by farmers (BM III and Pueblo components were also present) feasible. As reported in Chapter 2, the material present here, previously identified as Basketmaker II, clearly dated to Basketmaker II times, and included two, and likely, three pithouses. Thus, even this material, was definitely Basketmaker II, although it is not clear that all of it was coeval with the mesa-top Grand Gulch Phase. Some of it may date to the previous canyon-rockshelter White Dog Cave Basketmaker II.

The relatively nearby quadrat Hardscrabble 11 was also briefly revisited, and the undated, but assigned to Basketmaker II, "Campsites" found there were dated to the Basketmaker II period. As well, Basketmaker II cists were found to be immediately adjacent, something not noted during the original 1970s survey and collection. Previously, only Basketmaker II pithouses had been dated, so this, and the dates from Hardscrabble 4 and 5 was an important confirmation that the non-pithouse material identified as Basketmaker II on the basis of surface mapping and collection did indeed date to that time.

The combination of the Dos Tanques-Dos Fuentes and Hardscrabble 11 investigations was an important confirmation of the inferences made on the basis of the 1970s survey and an extension of the understanding of the Cedar Mesa Basketmaker II

adaptation. Although the negative information about the lack of Late Archaic is not conclusive - there could always be Late Archaic somewhere else on Cedar Mesa - it does add support to the idea that the Cedar Mesa Basketmaker II was not an in situ development, but instead arrived with the complete Basketmaker II adaptation.

The Block Survey

The second priority laid out in the 1990 S.S.H.R.C. proposal was to investigate the nature of spatial distribution of Basketmaker II pithouses. Because of the nature of quadrat survey, a wide-area pattern can not be demonstrated. We therefore proposed to carry out two non-collection block surveys, one in North Road and one in West Johns drainage. We actually only completed the North Road block, which is reported in Chapter 3, by Karen Dohm. She reports 14 to 20 pithouses in this neighborhood and that the evidence is in accord with the Basketmaker II pithouse being distributed in dispersed hamlets. This supports previous inferences based on weaker evidence about the nature of the Cedar Mesa Basketmaker II adaptation. Villages are known from several other Basketmaker II occupations, mainly at Black Mesa, Durango, and Los Pinos, as Dohm reports.

Absolute convincing evidence, though, of the existence of villages would require information of contemporaneity. This is only possible through excavation and the recovery of tree-ring dateable wood. Otherwise, one can argue that these groups of

pithouses are temporal series, however unlikely, that appears.

The Rock Island Site (NR C9-5)

The third field-work priority was further testing of the Rock Island Site, NR C9-5. As reported in Chapter 2, this site turns out to be a concentrated "village" of five to nine pithouses, in a defensible location. A small test not only produced a radiocarbon sample that dates to the Grand Gulch Phase, but also evidence of a pithouse floor. This is the most concentrated Basketmaker II site yet known on Cedar Mesa, and is some distance from arable soil, indicating that defense was very important. Michael Brand reports on the lithic technology of the material collected in 1974 in Chapter 7.

Other Dating

The S.S.H.R.C. proposal also discussed the importance of AMS dating diagnostic perishables. If the two-rod-and-bundle basketry was older in Southern Arizona than in Utah, this would support the migration model for the origin of the Western Basketmakers. The most important sample for this would be the specimen reported by Haury (1975:Table 33) from Ventana Cave from Level 4. Unfortunately I found out while in Tucson, Arizona in 1992, that provenience had been lost on the basketry specimens and there was now no way of discovering which specimen was from Level 4. Without being able to date this artifact, the relative dates of the other ones suggested in the original proposal have less value, although I still think they are worth

doing. The other specimens mentioned were Durango one-rod-and-and bundle and the oldest two-rod-and-bundle specimen from Cowboy Cave. These remain undated today.

Documentation of Earlier Cedar Mesa Pithouse Excavation

The final significant portion of the S.S.H.R.C. proposal was the documentation of the 1969/70 (by Lipe) and 1984 (by Dohm) excavations. The basic analyses have been carried out by Reid Nelson, but the basic descriptions are not yet complete enough to be distributed. These are planned to be part of Reid Nelson's Master's Thesis (Washington State University) which remains in process. Some results coming from his analysis are reported in Chapter 5 of this report and in his article (Kiva 60(2) 1994). This project will not be completed until this part is finished, and in the event that Nelson is unable to complete his thesis, I will undertake to finish this portion. Chapter 7, the description of the lithic analysis of the Rock Island by Michael Brand is another portion of this project to describe incomplete portions of the earlier work.

Subsistence of Basketmaker II

A few words in the S.S.H.R.C. proposal referred to additional dating and data from the Stable Carbon Isotope analysis as being in process. Since then two of the manuscripts have been published, Matson and Chisholm (1991) and Matson (1991). Additional analyses supported by the current project is reported in Chapter 4 by Chisholm and Matson and in Chisholm and

Matson (1994) in Kiva 60(2). This Kiva paper includes information derived from the Old Man Cave Basketmaker II material, adjacent to Cedar Mesa (see Geib and Davidson 1994; Kiva 60(2)). The results reported in the first two papers are now on much firmer ground and have been cited as having far reaching implication for the prehistory of the Colorado Plateau (Fritz 1994:24) and as a case example of the "strength" of this sort of approach. It appears that our results have gone from being controversial to something dangerously close to conventional wisdom in the space of three or four years.

The S.S.H.R.C. proposal also indicates that excavated archaeological samples would be analyzed. At this time, I have only preliminary reports, as the first analyst (Dana Lepofsky) after some initial work, begged off, and the second (Lisa Huckell) has not completed the analysis. This investigation is not critical to main goals of this project, but would be useful information. Michael Brand also reports in Chapter 6 in this volume on the faunal remains recovered in various Cedar Mesa excavations. In any event, Basketmaker II diet is better known now than we anticipated it would be by the end of this project.

Other Relevant Results

The classification and dating of the Dos Tanques - Dos Fuentes and Hardscrabble 11 localities material to Basketmaker II is both a testimony to the inferences made on surface collections twenty years ago and a confirmation of the basic model of continuity of Anasazi adaptations (Matson, Lipe, and

Haase 1988) that all Anasazi from Basketmaker II to Pueblo III share. A recent review of Anasazi diet by Brand (1994) supports the idea of a basic continuity in diet throughout the Colorado Plateau from Basketmaker II to Pueblo III. More surprising than continuity in adaptation is the identification of the Rock Island site as a defensive site. That the Basketmaker II, like the Pueblo III, were concerned about defence and involved in extensive conflict is now very evident. Cole (Kiva 60(2); 1994) reports on images related to this in rock art, and Matson and Cole (1995) report on a number of lines of evidence supporting this proposition, from rock art, to scalps, to burial remains, and defensive site locations.

There is a recent upsurge in interest about many of these questions, which this S.S.H.R.C. supported project participated in, and helped to develop. A symposium of these issues was organized (mainly by Karen Dohm) at the Society for American Archaeology meetings in Pittsburg, in April of 1992, that brought many investigators together to exchange information and ideas. This symposium then led to a special issue of the Kiva, the leading journal on Southwestern Archaeology. This issue (Volume 60, Number 2, 1994) entitled Anasazi Origins: Recent Research on the Basketmaker II, was organized and edited by the S.S.H.R.C. principal investigators, Matson and Dohm. About half of this issue is material that came out of the S.S.H.R.C. funded programme and the other half contributed by independent projects.

The current information, both produced by the Exploring

Anasazi Origins and other projects supports a migration model for the Western Basketmaker II. Perhaps the most interesting results have been reported by Christy Turner (1993) who has found that the Western Basketmaker II teeth are more similar to those from central Mexico than other Southwestern remains, indicating a biological tie with Mesoamerica. Interestingly enough, this early "Mesoamerican" connection is later swamped by other forms. This information fits the pattern found by Matson (1991) in which the "Eastern" or "Los Pinos" Basketmaker II shows more material similarities with pre-existing Archaic material, in contrast with the Western Basketmakers, and in which the dating indicates a later development of Western Basketmakers than the Eastern variants. As suggested earlier (Matson 1991:313-16) this pattern would result if the Western Basketmakers were both migrants into the area and the first fully maize agriculturalists. Surrounding, less densely distributed, Archaic peoples would acculturate later to agriculture resulting in the different ethnicity seen in the Eastern Basketmaker II. The intrusion of a new group into the northern Southwest may well account for the now well attested Basketmaker evidence of conflict and at least one defensive site.

Conclusions

Many questions yet remains, but we are on a much firmer ground than we were ten years ago about the origin and

adaptation of the first Anasazi, the Basketmaker II. It is now well supported that the Basketmaker were dependent on agriculture with maize being by far the most important, and a secondary emphasis on squash (Matson 1991:4-12; Matson and Chisholm 1991). The Western Basketmakers, at least, share many similarities with the San Pedro Cochise and were likely migrants of San Pedro Cochise-like people up onto the Colorado Plateau. The "Milagro" San Pedro Cochise adaptation of maize-based pithouse villages in flood-water farming areas in southern Arizona was established by 800 B.C. (Huckell and Huckell 1984; Huckell 1990). This was likely the source of the Western Basketmaker II, first of flood-water farmers in the canyons of the Plateau, and then later of dry-farmers, such as seen on the mesa-top of Cedar Mesa. Substantial numbers of Basketmaker II people lived on places such as Cedar Mesa (estimates of 500-1000, Matson et al. 1988), and the evidence presented in this report indicates they lived in dispersed communities on Cedar Mesa.

This "Mesoamerican" derived content of the Basketmaker II changes dramatically in the Basketmaker III, where most innovative traits are seen to originate from the Eastern Basketmaker II, or from the area. Turner's (1993) evidence suggests that the Mesoamerican dental traits are lost during this period, indicating that the later Anasazi were biologically closer to the indigenous Archaic than the Western Basketmakers. Although there was undoubtedly later contact, and the site of Casas Grandes in many ways appears to be Mesoamerican, the

Southwest fundamentally was now a distinct culture area.

It will be interesting to see how evidence from the next few years fills out this sketch. I expect that we will find more "early" agriculture on the Colorado Plateau, dating from 1500 to 500 B.C., but that this will be discovered to be experimental, and that large scale agricultural use will postdate 500 B.C. I also predict more information along the lines of Christy Turner's recent report will be discovered, confirming the non-Mesoamerican nature of most of the Anasazi. I also predict that the origin of maize agriculture in the Southwest will be seen by most archaeologists as part of the rapid growth initiated about 1500 B.C. of maize agriculture in central Mesoamerica, which happens very soon upon the development of the first really productive forms of maize.

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