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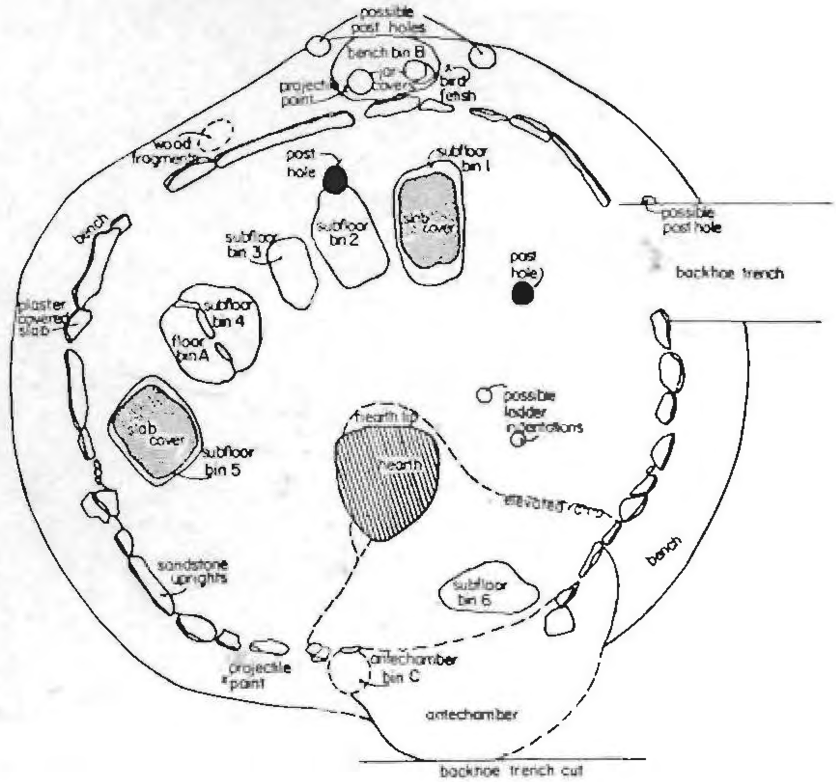

EXCAVATION OF TWO ANASAZI SITES IN SOUTHERN UTAH

1979 - 1980

CULTURAL RESOURCES SERIES

No. 9

"Excavation of Two Anasazi Sites in Southern Utah", Volume 9 in the series of Cultural Resource Monographs published by the Bureau of Land Management, includes separate reports of Utah excavations in San Juan and Kane Counties. The investigations detailed in the Monograph were conducted by the Antiquities Section, Utah Division of State History, at Big Westwater Ruin in San Juan County (1979), and by Nickens and Associates at the Kanab Site in Kane County (1980).

I am pleased to present this volume in our continued series of Cultural Resource Monographs.

DEAN STEPANEK

Associate State Director
Utah State Office
Bureau of Land Management

EXCAVATION OF TWO ANASAZI SITES IN SOUTHERN UTAH

BIG WESTWATER
RUIN
by
La Mar W. Lindsay

ARCHAEOLOGICAL INVESTIGATIONS
AT THE KANAB SITE
by
Paul R. Nickens
and
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Assembled
by
Richard E. Fike
and
David B. Madsen

1981
Utah State Office
Bureau of Land Management

In cooperation with the Utah Division of State History

INTRODUCTION

Despite the fact that some of the most dramatic and important archeological research in the Southwest took place along the northern fringe of the Anasazi area, research in the region has been relatively limited and largely ignored. People like A.V. Kidder and Neil Judd worked extensively in the southern Utah border region, as well as other areas of the Southwest, and were able to integrate their work with the rest of the Southwest. Unfortunately, with a few exceptions such as J.O. Brew's work on Alkali Ridge, these early researchers did not set a pattern. Research in the Southwest has become, for the most part, one of sub-regional specialization and with that specialization has come an ignorance of other subregions and especially of what could be called the fringe areas of the Southwest.

That is not to say that work has not continued apace in that region of the Anasazi area along the Colorado River. It has, but it has been conducted virtually in a vacumn. Numerous excavations, both as salvage work and as research projects have been conducted, analyzed, reported, and forgotten. For example, one of the largest salvage projects ever undertaken, the Glen Canyon Project, has had very little impact on the orientation of research in the Southwest and, considering the size of the project, work deriving from it has been cited very infrequently. Further, work in the western Anasazi or Virgin Branch area has been largely ignored by all but those directly working in the area and work to the east in the Kayenta and western Mesa Verde areas has faired little better. Occasionally, some research in the area, such as W.B. Lipe's work on Cedar Mesa, does create an impact on other workers in the Southwest, but this is the exception, not the rule. For the most part, synthesis of research between the Colorado River and the southern Utah border has been studiously avoided.

Why this should be the case is unclear, but one gets the distinct impression that academic chauvinism plays a significant role. However, the limited distribution of published reports has also been an important contributing factor. This has been especially true during the last decade with the advent of Cultural Resource Management reports whose distribution is often limited to one or two file copies. There is little one can do about chauvinism, but there is a solution to the limited availability of CRM reports. This volume and others like it make important cultural resource management studies, conducted under the auspices of the Bureau of Land Management, available on a much wider basis. These reports, in themselves, should help reduce the regionalism which prevails, simply by making information available on these more poorly known fringe areas. More importantly, however, these reports provide the basis for the interpretation of Cultural processes which cross-cut the Southwest. That is, they provide explanations of what happens on the fringes as well as the core areas. Data generated in these reports must necessarily contribute to broader and more comprehensive models of Southewestern prehistory.

The two reports published here contain elements which contribute substantially to this broader spectrum of Southwestern cultural change. While primarily descriptive in nature, these two site reports, one from the western Kayenta area and one from the margin of the Mesa Verde area and the eastern Kayenta, suggest that the changes which occurred in the more centralized portions of these regions were directly related to what happened on the margins. That, while the site densities and population aggregates may not have been as high, the same factors affected these marginal areas. That conclusion could be expected, but what may not be expected is the differential response which appears to have occurred. After reading these two reports, it appears that it may be possible to discern elements of change in these fringe areas that, once defined, will provide new insight into what happened and why and in what are presently the better known areas of the Southwest. These two papers are important, in sum, not only because they are reports of work in poorly known areas, but because they do provide analyses of fringe areas, they help us to understand the Southwest generally.

BIG WESTWATER RUIN

by

La Mar W. Lindsay

with

Artifact Sections
by

James Adovasio, Peggy Barnett, Michael Benson, Steven Emslie,
La Mar Lindsay, Mignonette Ray, Kay Sargent,
Carol Weins, and Joseph Winter

Prepared Under the Direction
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for the

Bureau of Land Management
Moab District
Moab, Utah

Salt Lake City

1981

PREFACE

Limited excavations were conducted at Big Westwater Ruin (42Sa6752), San Juan County, Southeastern Utah, by the Antiquities Section, Division of State History. The work was performed in connection with San Juan Stabilization, Incorporated, Mancos, Colorado and under an agreement with the Bureau of Land Management, Moab District. The excavations were conducted over the course of two months, during the 1979 field season, under the direction of David B. Madsen and the field supervision of La Mar W. Lindsay. Antiquities Section personnel who participated at various times during the project included Bruce Hawkins, Kevin Pollard, Kay Sargent, Greg Seward, and Deborah Truell Seward. The crew also consisted of several San Juan Stabilization people who provided much of the labor. These included Rebecca Austin, Grant Johnson, David Riley, and Ben Tedesco.

The excavations were conducted in support of a stabilization project which involved the reinforcement of the base of a number of masonry walls as well as patching holes and capping the tops of some walls to impede further deterioration. This portion of the report is submitted in conjunction with the description of the stabilization. The report consists of local environmental data, background research, a description of the site and the excavation, artifact descriptions, and an interpretive section.

Special thanks is given to the various contributors of several artifact sections. These include James Adovasio (basketry, textiles, and cordage), Peggy Barnett (plant remains), Michael Benson (lithics), Steven Emslie (bird remains), Kay Sargent (ceramics), Mignonette Ray (faunal material), Carol Weins (wood samples), and Joseph Winter (corn). A limited pollen study of cultural deposits by Lindsay is also included. Deborah Truell Seward performed the pollen extraction. David Harris, University of Texas El Paso, identified the faunal material. William Robinson of the Tree-ring Laboratory, University of Arizona, has provided a number of dates which establish a range for the principal construction period at the site. The data generated by the limited excavation and these specialists meshes nicely with our work at Westwater - Five Kiva - Ruin three miles to the north (Lindsay 1981). Many of these same scholars made contributions to that report. The excavations at both ruins contrasts and compares with the abundant data derived from the excavation of a number of open sites on the adjoining mesa (Lindsay et al 1978; Nielson 1979; Sargent 1979; Casjens et al 1980; Davis 1980).

Special thanks is offerred to Berkley Bryant of San Juan Stabilization whose cooperation and assistance was necessary to properly handle the excavation. He was more than willing to accept our recommendations, though they did not always necessarily conform to our original plans and scheduling. Bruce Louthan, Moab District, Bureau of Land Management, was particularly cooperative in adjusting to our field modifications of

original plans. Special appreciation is given to Richard E. Fike, Bureau of Land Management, Utah State Office, who readily saw the need for study and stabilization of the ruin and successfully procured the funding for the project. Mr. Fike is also credited with naming the ruin. Without the interest and concern of all, we would understand much less about the local prehistoric inhabitants of the Blanding Basin and just as important, the threat to the structural integrity of the ruin would have continued at an accelerated pace.

Kay Sargent of the Antiquities Section is credited with much of the photography. Also Ms. Sargent and Ms. Seward assisted with the mapping. Mignonette Ray and her laboratory crew are responsible for the preparation of the artifacts. These have been forwarded to the Utah Museum of Natural History now that analyses have been completed. Amy Pringle, Rachel Olschewski, and Renae Hendry assisted with the preparation of the manuscript.

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ABSTRACT

Test excavations and architectural analysis of Big Westwater Ruin (42Sa6752) in southeastern Utah provide evidence of culture change and instability in the western Mesa Verde Anasazi area. The rockshelter was occupied by early-Pueblo II times and finally abandoned by mid- to late-Pueblo III. Three periods of masonry construction in two separate room blocks and two episodes of destruction are identified. The first, a conflagration of construction associated with early masonry, likely occurred shortly after the ca. A.D. 900 onset of the Pueblo II period. This was followed by a period of extensive rebuilding of the two room blocks. This intermediate stage is associated with the mid- to late-Pueblo II/early-Pueblo III occurrence of Kayenta Tusayan Polychrome and Sosi Black-on-white pottery at the site. Fourteen tree-ring dates (A.D. 1147-1207) are associated with a second phase of intermediate stage masonry construction. The site was once again partially destroyed following the appearance of McElmo Black-on-white pottery at the site. The destruction probably occurred postdating A.D. 1207. Subsequent mid-Pueblo III late stage rebuilding and repair is associated with the installation of a series of 18 "observation ports" which provide nearly full view coverage of the alcove site location, including access and interior features. This adoption of an apparent mid- to late-Pueblo III defensive posture is associated with a subsistence shift toward an increasing reliance on domestic turkey.

Early-Pueblo II destruction and a mid- to late-Pueblo III subsistence shift are also identified at Westwater - Five Kiva - Ruin (42Sa14) three miles to the north. The evidence at both ruins suggests considerable cultural instability shortly after the Pueblo II introduction of masonry and corrugated pottery in this locale and again during mid-Pueblo III times. The latter may be the result of stress sometime following ca. A.D. 1150-1200 nucleation.

INTRODUCTION

Limited archeological excavations were conducted at Big Westwater Ruin (42Sa6752), a dual component Pueblo II-III Mesa Verde Anasazi rockshelter in San Juan County, southeastern Utah (Figure 1). The work was performed by the Antiquities Section, Division of State History in support of a stabilization and partial restoration project, for the Bureau of Land Management, Moab District. Stabilization was conducted by San Juan Stabilization Incorporated, Mancos, Colorado. The excavation and stabilization were conjointly done over the course of three months during the 1979 field season.

Although excavations were limited, consisting of a single exploratory trench and the "cleaning out" of a number of masonry rooms, the site sequence is sufficiently complex, well enough dated and hence understood, to provide some assessment of the nature of Pueblo II-III populations, their adaptive strategies, and the conditions leading to the abandonment of this locale. Big Westwater compares favorably with the upper levels of Westwater - Five Kiva (42Sa14), three miles up canyon to the north. The latter is by far the more extensive and complete of the two ruins. Although the alcove/rockshelter location of Big Westwater is about twice the size of Westwater - Five Kiva, the shelter is not nearly as deep to the rear (much less protected space) and less area was used for construction. There is no evidence that the large, central midden area at Big Westwater contains masonry construction. A local "old timer," who claimed to have seen Big Westwater prior to considerable looting and vandalism, suggested that masonry construction was once much more extensive. Though the evidence of looting was observed virtually everywhere, only a single wall, in Room Block A on the east, was definitely vandalized. Room Block B on the west is surprisingly well preserved. The generally good condition of the masonry contrasts with that at Westwater - Five Kiva which is much closer to the town of Blanding and more immediately accessible. Also, Big Westwater is somewhat more concealed from local traffic. The modern day discovery of the site (Thompson 1977; Lindsay et al 1978) found the high front wall of Room Block B in danger of eroding out at the base and toppling into the wash below. The spectacularity and endangered condition of the wall "caught the eye" of a visiting Washington Department of Interior dignitary who in turn recognized the need for stabilization.

The sequence at Big Westwater is much more limited than that at Westwater - Five Kiva. Dated Basketmaker III through late-Pueblo III developments are represented at the latter, while only a dated early- to mid-Pueblo III component and problematic Pueblo II construction are identified at Big Westwater. Despite the fairly brief time span, considerable remodeling and late construction are detected at Big Westwater. Defensive characteristics are associated with the final period of construction.

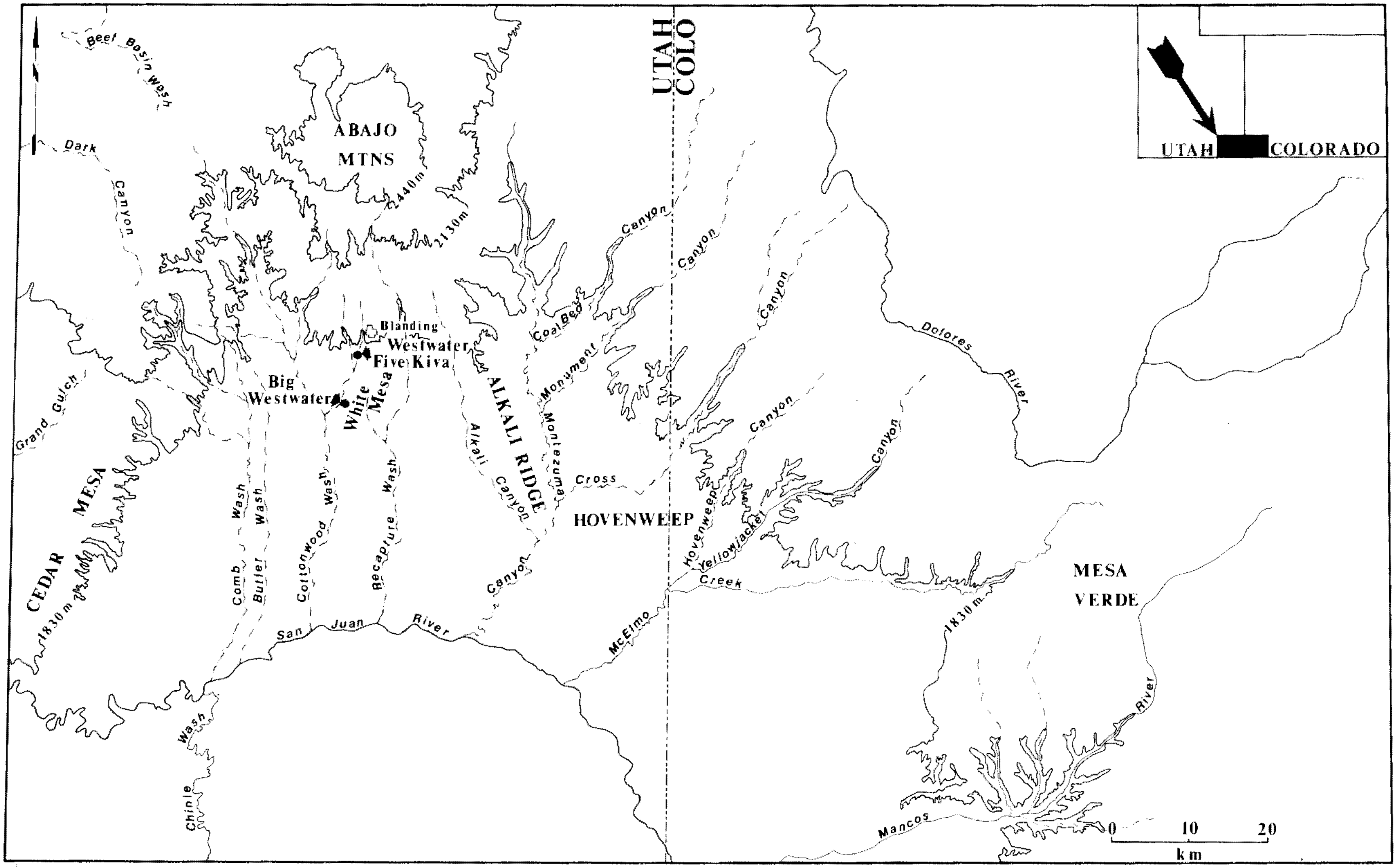


Figure 1. Regional Location Map of Southeastern Utah and Southwestern Colorado.

A sizable amount of artifacts recovered from Big Westwater are unprovenienced, although most are separated for the two room blocks. Although the fills of most masonry rooms were severely disturbed, it appeared that much of the looting consisted of prodding and turning over the deposits in each room so that mixing between rooms is probably negligible and hence, artifacts are provenienced separately for room fills. The broad range of artifacts recovered is comparable to those from the upper levels at Westwater - Five Kiva although, the preservation of perishables is not nearly as good. This is attributed to both the extensive ground water seepage at the rear of the shelter, resulting in the saturation of about a meter of deposits, adjacent to the wall, and to the fairly limited protected space in the shelter. Still, a fairly representative collection of basketry, textiles, cordage fragments, wood, and subsistence related macrofossils were recovered over the course of the excavations.

The principal concerns were to develop a site chronology from pottery and architectural typologies, supported by absolute dating, for comparison with Westwater - Five Kiva. However, considerable attention was given the mid- to late-Pueblo III defensive character of the ruin. It is this aspect which is most intriguing. No such posture was detected at Westwater - Five Kiva though this may be due to the vandalism that had occurred to the upper portions of the walls at the site. Defensive characteristics of various forms are apparent at several other ruins in the region, including a large alcove site in Butler Wash, a ruin on the San Juan River, another in a small tributary of Mule Canyon, and a large site at Ruin Point Springs near the Right-Hand Fork of Cottonwood Wash. At Big Westwater, we have plotted an extensive series of "observation ports" which provide combined fields of vision coverage for almost the entire alcove in which the ruin is located.

The limited excavations at Big Westwater provide evidence of a horticulturally dependent, Pueblo II-III Mesa Verde Anasazi population. Paleoecological reconstructions compare favorably to Westwater - Five Kiva - Ruin. The two rockshelters were apparently contemporaneously occupied from at least early-Pueblo II to mid- to late-Pueblo III times. Much of the reconstruction at Big Westwater is attributed to the early- to mid-Pueblo III period. It is not possible to say when the ruin was abandoned. If similar to Westwater - Five Kiva, we can postulate a post-A.D. 1250 abandonment.

ENVIRONMENTAL SETTING

Big Westwater Ruin is in a protected alcove derived from the contact of the Morrison and Burro Canyon formations. The canyon setting is typical of much of southeastern Utah where rockshelters abound. The region is characterized by extensive mesas and plateaus which are cut by networks of deep canyons and smaller washes leading to the San Juan and Colorado rivers. Most are dry from mid-summer to late-fall except where seeps and springs are active following the storage of adequate winter moisture. The high lacolithic Abajo Mountains to the north is the dominant landform. An extensive sage plain, containing deep, fertile soils stretches eastward to the Rocky Mountains of Colorado. The stable plain contrasts markedly with the highly dissected terrain to the west where frequent mid- to late-summer thunder storms contribute to advanced erosion, depositing silt in the major drainages of the region.

The environmental context of Big Westwater is very similar to Westwater - Five Kiva. It is in the same geologic formations, at a slightly lower elevation, and a little further removed from open-flowing perennial water. Modern vegetation and faunal resources are essentially similar.

Figure 2. Alcove Setting of Big Westwater Ruin

Location

Big Westwater is in a fairly extensive "U-shaped" alcove (Figure 2) at the head of a small tributary to and on the east side of Westwater Canyon. It is about two miles northeast of the confluence of Cottonwood and Westwater creeks (Figure 3). The site is about five miles south-southwest of the town of Blanding, in the SE 1/4, NW 1/4, NW 1/4 of Section 28, Township 37 South, Range 22 East, at latitude 37° 32' 70", longitude 109° 30' 65" (U.S.G.S. Brushy Basin 15 Minute Quadrangle). The rim above the alcove is at 1707 m elevation.

The tributary trends about a half mile westward to Westwater Creek which in turn flows southward to its confluence with Cottonwood Canyon. The bottoms of these canyons at the junctures are relatively broad and flat and they contain deep sands and silts. Cottonwood Canyon, like Westwater, is one of a number of drainages which originate on the southern flank of the high (3460 m) Abajo Mountains and flow southward to the San Juan River. All of the creeks including Westwater and Comb washes on the west maintain intermittent flow during normal water years. Recapture and Montezuma creeks are similar. Only Cottonwood, on the west, maintains a perennial flow and this is limited to wet years (Dames and Moore 1978). The descent of these canyons in the vicinity of the rockshelter exceeds 30 m per mile. For instance, the elevation of Westwater Creek varies from about 2040 m at its source to 1555 m at the confluence with Cottonwood Creek. The tributary containing Big Westwater is cut from White Mesa whose name was decided from the extensive *Oenethera* sp. (Evening Primrose) cover. This mesa is a fairly broad and lush tableland which stretches from north to south below the flanks of the Abajos.

Geology

Westwater Creek is in the Blanding Basin subdivision, immediately south of the Abajo Mountains. The basin is flanked by the Monument Upwarp at Comb Ridge to the west, and the Great Sage Plain on the northeast (Stokes 1977). These subdivisions are part of the Canyonlands Section of the Colorado Plateau Physiographic Province (Fenneman 1931). Westwater Creek and White Mesa lie in the approximate center of the basin.

The rockshelter (Figure 4) is cut from the contact between the Upper Brushy Basin Member of the Jurassic Morrison Formation and the underlying Cretaceous Burro Canyon Formation. The Upper Brushy Basin Member varies from 150 to 170 feet thick and consists of:

> variegated gray, pale-green, red-brown or purple bentonitic mudstone; a few lenses of distinctive green and red chert-pebble conglomeratic sandstone, some of which contain uranium-vanidum deposits (Haynes, Vogel, and Wyant 1972).

Figure 3. Aerial Photograph of Big Westwater Ruin Location

Figure 4. Big Westwater Ruin

The underlying Westwater Canyon member is exposed near the confluence of Westwater and Cottonwood canyons to the south of the shelter (Harshbarger, Repenning, and Irwin 1957).

Cretaceous Dakota Sandstone and Burro Canyon formations directly overlie the Morrison Formation. These are exposed on the southern and western margins of White Mesa (Haynes, Vogel, and Wyant 1972; Hintze and Stokes 1964). Remnants of the overlying formations are visible from Big Westwater Ruin. The Cretaceous formations on White Mesa are capped by a fairly uniform and stable one to three meters deep, Pleistocene and Holocene, reddish-brown, alluvial and eolian sandy loess (Arrhenius and Bonatti 1965). This Quaternary sand is more limited to the west where erosion has removed much of the cover with subsequent deposition in the major canyons. According to Dames and Moore (1978), the loess on White Mesa consists of two soil types. Blanding soils predominate with a very limited occurrence of Mellenthin on the east side of the mesa. The latter is much the same as the Blanding soil except that Mellenthin soils are much shallower in relation to bedrock. Blanding soils, as described (Dames and Moore 1978:2-312) are:

> deep soils found in wind blown fine sands and silts. Soil textures in the profile are predominantly silt loam; however, silty clay loam textures are found at some point in most profiles...Typically, this soil has a 4 to 5 inch reddish-brown silt loam "A" horizon overlying a reddish-brown silt loam to silty clay loam "B" horizon that extends downward to 12 or 16 inches. The "C" horizon and the underlying parent material is a light reddish-brown calcareous silt loam or silty clay loam. The "A" and "B" horizons are non-calcareous...

The horizons vary from light reddish-brown (5YR 6/4) to reddish-brown (5YR 5/4) (Dames and Moore 1978). These soils have contributed to the deposits of Big Westwater, both within and below the shelter. The deposits were variously used for mortar in the construction of masonry at the site.

Climate

Both the mid-latitude dry and humid microthermal climatic types (Burnham 1950) occur in the Blanding Basin. Precipitation varies from about a 12 inch per year average in the humid microthermal pocket immediately south of the Abajo Mountains, to about 10 inches elsewhere in the basin. Rainfall amounts are further reduced southward on the lower elevations of the San Juan River. The Blanding weather station has recorded an average annual precipitation of about 12 inches per year (Figure 5), however, variation from year to year is con-

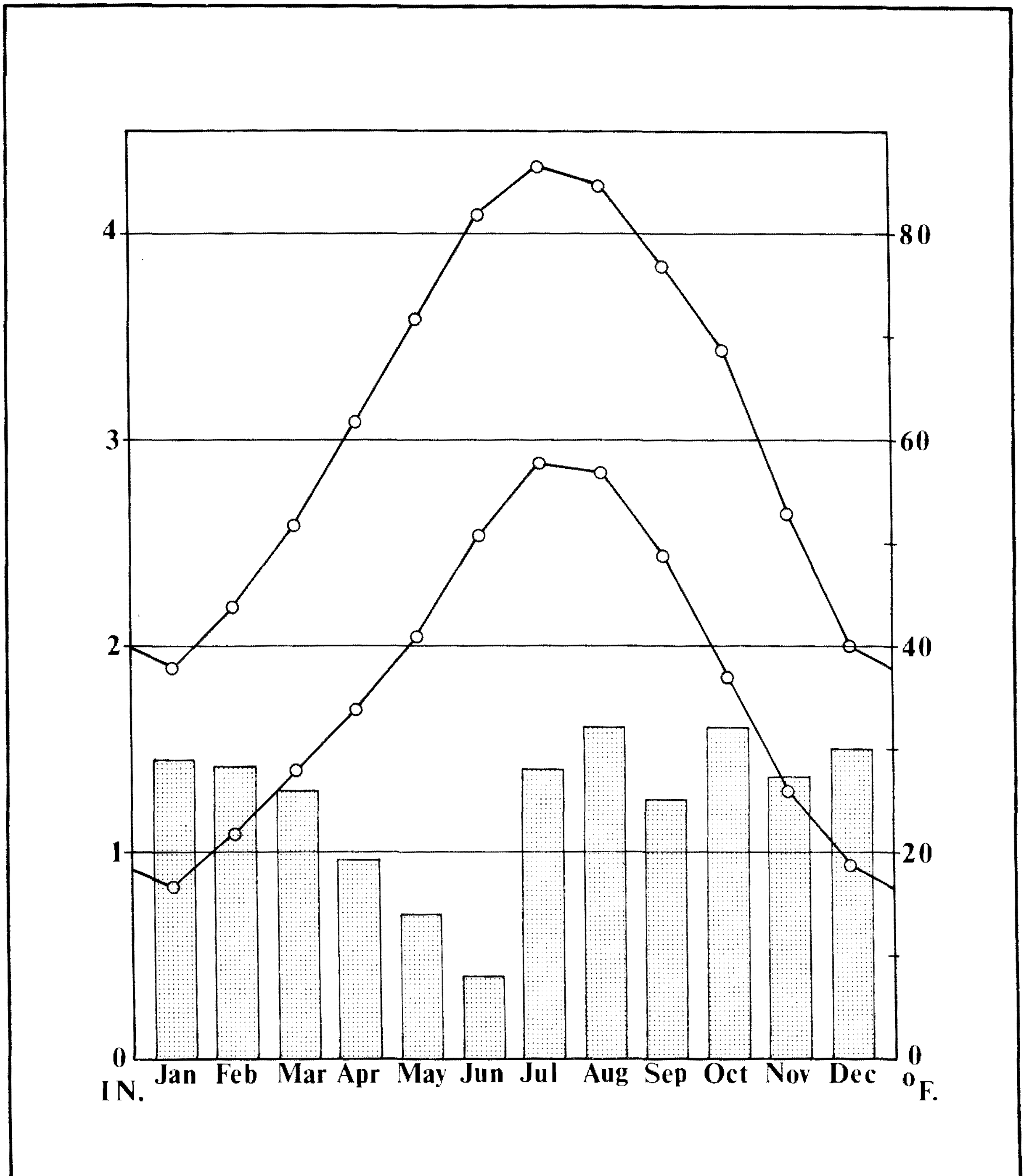


Figure 5. Blanding Precipitation and Temperature

siderable. Moisture is more or less evenly distributed throughout the year, with the exception of sparse amounts during the months of May and June. During the excavation of Westwater - Five Kiva - Ruin, Westwater Creek flow varied both seasonally and from year to year. Flow maxima occurred during the early spring and late summer of the 1977 field season, but the creek was entirely dry until the fall of 1978. The peak periods of early spring and late summer are the products of snow melt and torrential rains, respectively. Moisture in Blanding during 1977 was normal to wetter than usual while the summer of 1978 was exceptionally dry. The absence of water during the latter summer may also have been due to irrigation demands. During most summers, the region receives localized thunderstorms of high intensity from the Gulf, resulting in occasional flooding. These storms cause damage to roads and bridges and they contribute to the advanced erosion which has occurred in some areas.

The summer moisture is necessary for water flow in some creeks once snows have melted and for agriculture where irrigation is not practiced. During the normal water year of the 1979 summer field season at Big Westwater Ruin a number of seeps from the rear overhead of the shelter were monitored (Table I). Most of these contributed 50 to 75 ml of very potable water per hour. The Brushy Basin Member of the Morrison Formation is a highly variable aquifer (Dames and Moore 1978), however, at this location it is apparently fairly good. No such seepage was detected at Westwater - Five Kiva to the north.

Table I. Water Seepage Rates from the Contact between the Morrison and Overlying Burro Canyon Formations at the Rear of the Shelter

Shelter Rear Loci *	Collection (hrs.)	Total Amount	Amount per hr.
NE of Room 4	2	107 ml	53.5 ml
NE of Room 4	2	90 ml	45.0 ml
NE of Room 5	2	45 ml	22.5 ml
NE of Room 5	22	100 ml	4.5 ml
NW of central midden	1.5	100 ml	66.6 ml
N of Room 8	1.3	95 ml	73.0 ml
	30.83 hrs.	537 ml	265.05 ml
			Average 44.2 ml/hr.

* Not plotted

Temperatures recorded at the Blanding weather station indicate extremes which have varied from lows approaching minus 20° F during the winter to summer highs exceeding 100° F. The number of frost-free days is 145 at Blanding. This growing season increases southward with the lower elevations on the San Juan River. Temperature variations are considerable during the late evening and early morning hours with respect to topography. Generally, the rims above the canyons, at the edges of the mesas, stay quite warm while the canyon bottoms are cool. Temperatures in the central portions of the mesa are moderate. Though unrecorded, these variations were detected during several mid- to late-summer nightly trips through the canyons and across the mesas from the Colorado River to Blanding. The apparently prolonged growing season at the edges of the mesas must have implications for prehistoric settlement, aboriginal agriculture, and the location of prehistoric farm plots.

Paleoclimatic inferences from paleoenvironmental data are tenuous at best without local sequences developed from well dated, natural pollen and dendrochronological records. Pollen records generally provide indications of variations in floral productivity, the shifting of vegetation zones, and vegetational change, all of which may suggest climate as the causal agent. Pollen records developed from archeological deposits reflect man's intervention of his natural habitat. The over-representation of some plant species may be nothing more than the product of economic selectivity and inferences about a changing environment are particularly tenuous. Further removed, climatic change inferred from archeologically derived pollen data is even less acceptable. A dilemma exists in Southwestern paleoenvironmental and climatic reconstructions in the virtual absence of local natural sequences and the proliferation of a large number of studies from well dated archeological sites. Extant natural sequences are generally not dated in fine enough increments to provide positive correlation between natural and cultural events (e.g. Andrews et al 1975; Peterson and Mehringer 1976) and they are for the most part peripheral to the Southwest (e.g. Madsen and Currey 1980). Local nuances of paleoenvironmental change remain either undetected in gross natural pollen sequences or if apparent, they are generally insufficiently dated. There is also the question of the applicability of peripheral and or regional pollen studies to local developments (Bryan and Gruhn 1964). Do we have sufficient data to reconstruct a regional model of paleoenvironmental and climatic change? Euler et al (1979) have attempted a synthesis of paleobotanical, geomorphological, and hydrological data from the central Colorado Plateau for the period of Anasazi occupance of the region. They also suggest a corresponding relevance of southern California data (La March 1974). Dendroclimatology provides the most direct and relevant reconstruction of changing Anasazi climate. Pollen and macrofossil data from archeological sites shed some light on local vegetation and economic use.

Regional drought has long been considered causal to the late twelfth century Anasazi abandonment of the region and this more or less coincides with the onset of the 650 B.P. late Neoglacial stadial when general, wide spread cooling occurred over much of North America and Europe (Denton and Porter 1970). The preceding 1900 to 650 B.P. mid- late-Neoglacial interstadial, identified in several Plateau records (Currey 1976; Lindsay 1980a), provides evidence of a general warming context for much of the period of Anasazi occupance in Utah and southwestern Colorado.

Tree-ring records, principally from California (La Marche 1974) and Mesa Verde (Schulman 1947, 1952, 1954; Lancaster and Van Cleave 1954; Fritts, Smith, and Stokes 1965) provide evidence of a number of droughts during the mid- late-Neoglacial interstadial or during Basketmaker III through Pueblo III times. Schoenwetter's (1970) summary of Colorado Plateau pollen data tends to support the dendroclimatological reconstructions.

During the ca A.D. 450 to 750 Basketmaker III period, the climate was essentially cooler and wetter than the present (La March 1974). However, a sizable drought is recorded for A.D. 600 and at least five lesser droughts are interpreted for the period (Euler et al 1979). Pueblo I (A.D. 750 to 900) is characterized as cool and dry with drought recorded from A.D. 850 to 900 (La Marche 1974). Two lesser droughts are interpreted for preceding years (Euler et al 1979).

Pueblo II (A.D. 900 to 1100) is the "best known period of increased effective moisture on the Plateau" (Euler et al 1979). It is during this period when Anasazi sites proliferate and expand far northward of previous habitats. La Marche (1974) characterizes the period from late-Pueblo II (A.D. 1050) to early-Pueblo III (A.D. 1150) as generally humid. Three limited droughts are interpreted for the period from A.D. 920 to 1090 (Euler et al 1979). Shortly following the A.D. 1100 onset of Pueblo III times, a sizable drought is identified at A.D. 1150 (Euler et al 1979). La Marche characterizes the remainder of the Pueblo III period as warm and dry. Lancaster and Van Cleave (1954) suggest that climatic deterioration at Mesa Verde began ca A.D. 1190, culminating in the "Great Drought" beginning A.D. 1272 (Schulman 1947, 1954). Fritts, Smith and Stokes (1965) suggest the period from A.D. 1273 to 1285 was one of prolonged drought, but this was surpassed by ten other droughts of greater intensity in the Southwest between A.D. 512 to 1673. Two limited droughts are interpreted as culminating in A.D. 1190 and 1240 (Euler et al 1979).

The severity of the A.D. 1273 to 1285 drought is interpreted by Euler et al (1979) as less than those which occurred during mid-Basketmaker III (A.D. 600), late-Pueblo I (A.D. 850 to 900), and early-Pueblo III (A.D. 1150) times. However, these data seem to principally reflect changes in annual moisture and are less sensitive to the differences in seasonality. Fritts (1974) suggests that Southwestern tree growth is highly correlated principally with annual precipitation. Though summer moisture of the previous year is reflected in the development of the annual Douglas Fir ring, its contribution is considerably less than fall and winter moisture (Fritts 1976). Aschmann (1958) has discussed the importance of the seasonality of precipitation to human occupance in the Great Basin. The importance of mid-summer moisture to the growth and maturation of *Zea mays* in the Southwest is well understood. It may be that the A.D. 1273 to 1285 drought, or for that matter the series of Pueblo III droughts, reflect not only the loss of some winter moisture, but also that of much summer moisture as well. Perhaps, the earlier droughts of greater intensity were less severe to horticulture. Summer rainfall during the "Altithermal" may have been greater than at present in the Southwest (Van Devender and Spaulding 1979). This may also be true for the Neoglacial interstadials, including the mid- late ca 1900 to 650 B.P. interstadial (Denton and Porter 1970). However, according to Fritts, Smith, and Stokes (1965), there is no evidence for Martin's (1963) "great drought hypothesis" as a period of low winter - high summer precipitation. There is some evidence suggesting increasing Gulf derived moisture toward the end of the Altithermal and the Neoglacial interstadials (Currey 1980; Lindsay 1980b). If this is accurate, then to consider the Altithermal and subsequent interstadials as entirely dry for the full duration of each would be entirely misleading. It may be that the ca A.D. 900 to 1100 "optimal conditions" interpreted for Pueblo II represents just such a warm/wet period toward the end of an interstadial. The subsequent occurrence of the ca 650 B.P. onset of the late-Neoglacial stadial would tend toward a cool/dry climate, unfavorable for the production of corn. Cooling temperatures would have dominated the Neoglacial stadials including that which roughly coincides with the end of Pueblo III times. A shortened growing season and the loss of summer moisture may have been the principal contributing factor to late-Pueblo III Anasazi abandonment of the region.

Flora

An extensive pinyon/juniper forest belt dominates the region from the flanks of the Abajo Mountains to the southern edges of the mesas north of the San Juan River. The plant communities within this belt are relatively uniform and they have remained essentially unchanged for the past 800 years (Erdman, Douglas, and Marr 1969). Most plant species present today were likely present during Anasazi times. Palynological evidence, both local (Lindsay 1974, 1981) and regional (Martin 1963; Martin and Byers 1965), suggests that the conifer forest during Anasazi times was much reduced below that of the present day, and most studies indicate that forest development increased postdating the thirteenth century. There is limited evidence that this development had actually begun during A.D. 1100 to 1275 Pueblo III, Anasazi times (Martin and Byers 1965; Rohn 1971; Lindsay 1981, see also Pollen Analysis) but, this may be a local phenomenon. Reforestation is likely the product of both the inception of the 650 B.P. late-Neoglacial stadial (Denton and Porter 1970; Currey 1976) but, also rebound following extensive deforestation by the Anasazi (Matheny 1971). If the increases during Pueblo III times are a regional phenomenon, it may suggest that Anasazi requirements of timber for construction and/or deforestation for horticulture were much reduced below that of earlier periods. This may have been the result of a number of factors including the nucleation of Pueblo III populations into rockshelters, gradual population decline, hence the reduction in the number of farm plots, and an increasing dependence on turkey production over cultigens.

Mesic forest conditions are present in the Abajo Mountains where Engelmann spruce (*Picea Engelmanni*) Douglas fir (*Pseudotsuga taxifolia*) are dominant conifers. Ponderosa pine occupies the lower elevations on the drier, south-facing slopes. The species is also found in limited refugia on Elk Ridge and Cedar Mesa to the west and in Devils Canyon immediately to the north. A more extensive distribution of the sub-alpine conifers and ponderosa was likely during periods of cooler temperatures and/or greater effective moisture, the early post-pluvial (ca 12,000 to 10,000 B.P.) (Madsen and Currey 1980; Mehringer, Martin, and Hayes 1967; Petersen and Spaulding 1977) and during the 5,500 to 4,500, 3,000 to 1,900 and 650 to 100 B.P. Neoglacial stadials (Denton and Porter 1970; Currey 1976; Madsen and Currey 1980; Lindsay 1980a). The fertile and deep soils of White Mesa contribute to an extensive, modern sagebrush and grass community. This association was apparently particularly lush, during A.D. 900 to 1100 Pueblo II times (Lindsay 1981, see also Pollen Analysis), when climatic conditions were more favorable than the present (La Marche 1974; Euler et al 1979).

Vegetation studies are available for both White Mesa (Dames and Moore 1978) and Butler Wash to the west (Northcutt 1977). Ordinarily, the White Mesa study would be more applicable to understanding prehistoric adaptation at Big Westwater. However, plant associations on the mesa have been severely modified over the past 80 years by cultivation and livestock grazing, while Butler Wash remains relatively pristine.

Four tree/shrub "stand-types" are identified by Northcutt (1977) in Butler Wash. These include juniper, juniper/pinyon, sage, and saltbush. These species predominate at and in the vicinity of Big Westwater Ruin. The juniper standtype is the most extensive at the ruin. Juniper/pinyon is observed along Westwater Creek and on the rims of the canyon. Sage occupies the soils of the mesa where cultivation is not present. Saltbush is most extensive in the dry tributary leading to Westwater Canyon.

The juniper standtype includes both Utah juniper (*Juniperus osteosperma*) and limited, stunted pinyon (*Pinus edulis*). The latter is subdominant. Woody plants such as cliffrose (*Cowinia mexicana*), big sage (*Artemisia tridentata*), and snakeweed (*Guiterezia microcephala*) are sparsely represented. Pinyon/juniper stands are characterized by the growth of both to equivalent size, but with juniper still in greater proportions. A relative abundance of shrubs include cliffrose, mountain mahogany (*Cercocarpus montanus, C. intricatus*), serviceberry (*Amelanchier utahensis*), ash (*Fraxinus anomala*), Buffaloberry (*Shepherdia rotundifolia*), and Mormon tea (*Ephedra viridis*). Mountain mahogany is present only at higher elevations of the drainage. Perennials identified by Northcutt in the pinyon/juniper stand include prickly pear cactus (*Opuntia* sp.), *Yucca* sp., snakeweed, *Cryptantha flava* , twinpod (*Physaria* sp.), daisy (*Townsendia incana*), and bitterweed (*Hymenoxys acaulis*).

Sage and saltbush stands occupy flat terrain with sage on the stable mesa tops and saltbush on alluvial flats and floodplains cut by recent erosion. Sage (*Artemisia tridentata*) is associated with a variety of grasses including crested wheat grass (*Agropyron cristatum*), Indian rice grass (*Orizopsis hymenoides*), and brome grass (*Bromus* sp.). Many of the perennials associated with the pinyon/juniper are also found in the sage stand. Saltbush stands consist principally of 4-winged saltbush (*Atriplex canescens*), with increasing shadscale (*A. confertifolia*) where heavy grazing has occurred. Additional associated species include Russian thistle (*Salsola iberica*) and marginal rabbitbrush (*Chrysothamnus linifolius*). Dominant riparian vegetation observed by Northcutt in Butler Wash include cottonwood (*Populus fremontii*), willow (*Salix exigua*), and the introduced *Tamarix pentandra* . Riparian species occur to the west and north along Westwater Creek but, they are not present in the tributary below Big Westwater Ruin.

Fauna

The principal game animal is deer which are present in substantial numbers in the Abajo Mountains during the warm summer months. They retreat to the canyons at lower elevations once the winter snows occur. The deer population has, for whatever reason, dwindled significantly since the early seventies when they were visible in large numbers along the roadside from Monticello to Blanding. Few are seen during the present day. During prehistoric times deer populations were substantially less than the numbers indicated for modern times (Barnes 1922; Durrant 1952). They were, no doubt, immediately available to prehistoric populations, probably during the winter months. Elk are present in the Abajos and antelope and mountain sheep were available to the inhabitants of Cedar Mesa during prehistoric times (Smith 1974).

Large carnivores present today include mountain lion and bear in limited numbers. Other species listed for the region (Durrant 1952) include foxes, bobcat, coyote, beaver, badger, weasel, porcupine, jack and cottontail rabbit, and a large variety of rodents.

Meadowlark and several species of waterfowl were recovered from the ruin. It is unclear where the latter species were obtained, however, there may have been some ponding of water in Cottonwood Wash during periods of maximum effective moisture and before the late nineteenth century arroyo cutting had begun.

CULTURAL AND MODERN RESEARCH CONTEXTS

Research conducted in the Westwater/White Mesa locale has been limited primarily to the "Explanatory Period," defined by Willey and Sabloff (1974) as beginning in 1960, but much of the research actually typifies work of earlier eras. Evidence of the early antiquarian quest is abundant. Few studies have attempted to focus on the modern concerns of cultural evolution and process. However, most, including recent efforts, have been devoted to discussions of cultural and artifact typologies and their placement in the general sequence and only in a limited sense has there been an attempt to understand the articulation of local cultures and environments. There has been an over reliance on the Pecos Classificatin (Kidder 1927) and too rigid an interpretation of temporal placement. This has prohibited the successful comparison of settlement patterns between locales and makes regional syntheses impossible. The pitfalls inherent in rigid taxonomic application, ignoring local diversity, have plagued most local research efforts (cf. Cordell and Plog 1979).

The preoccupation with cultural typology is in part the direct result of a lack of well dated excavations but also is related to the limited size and diverse nature of the Anasazi sites in the region. A sizeable portion of the sites north of the San Juan River in southeastern Utah represent A.D. 900 to 1100 Pueblo II developments. While many of these continued to be occupied into Pueblo III times, there was an apparent preference for the occupation of rockshelters, in lieu of open sites, particularly toward the middle of the period. Most of the rockshelters are essentially "scaled-down" models of those at Mesa Verde. The spectacular Pueblo III multistory apartment dwellings the size of those at Mesa Verde are not found. Quite naturally, the focus of Southwestern archeology, has been on the larger sites elsewhere, with an eye on larger samples and more abundant data. The development of the larger sites directed toward tourist promotion have dictated the activities of the National Park Service and subsequently principal research efforts. Perhaps more importantly, sites north of the San Juan do not seem to follow exactly the temporal mold of Mesa Verde. The sites are predominantly Mesa Verdean, as defined by the pottery and architecture, but there is some question about the accuracy and/or sensitivity of some time markers, particularly San Juan Red Ware (Dalley 1973) and Mancos Corrugated pottery (Lindsay 1981). Architecture typology poses some difficulty as the limited standardization observed by Rohn (1977) in Chapin Mesa rockshelters seems to apply equally to rockshelters in the Westwater/White Mesa locale (Lindsay 1981). This lack of architectural uniformity is no doubt in part due to the limitations of space, but also it may be a product of preservation and the absence of the on-going need of repair or replacement. Why accept an innovation or new style when present accommodations are adequate? In this sense, rockshelter architecture is probably a typologically less sensitive time marker than pottery.

However, in this locale, somewhat removed from Mesa Verde, there may be less standardization in open-structural sites as well (Casjens 1980 et al). We are also plagued with the problems of apparent Kayenta Anasazi influence, at least during early-Basketmaker III and early-Pueblo III times (Wilson 1974; Lindsay 1981). The lack of a firm tree-ring dated sequence in the region, particularly from Basketmaker III to Pueblo II prohibits the comparison of sites during these periods.

In sum, we are faced with an inadequately dated, poorly understood Pueblo I component, limited architectural standarization (particularly during Pueblo III times), a questionable co-occurrence of the introduction of the kiva and corrugated pottery (in at least this locale) and the unknown significance of Kayenta pottery in the region. The reconstruction of changing Anasazi subsistence patterns in the context of paleoenvironmental change is impossible except for what may be gained from a single site or particular study. What reconstructions do exist are only tentative, at best, without local, well dated paleoenvironmental data.

Because of these problems and until a sufficient sample of various site types and developments have been adequately excavated and dated, local researchers are faced with adopting the most widely used, conventional framework. The Pecos Classification, modified from Jennings (1968) is the necessary organizing scheme for the interpretation of Big Westwater. The cautions of Brew (1946) and Jennings (1966; 1968) are acknowledged; that the classification should not be interpreted as providing a "fixed" temporal or typological framework.

Latest:	Pueblo V	A.D. 1700 to Present	
	Pueblo IV	A.D. 1300 to 1700	
	Pueblo III	A.D. 1100 to 1300	
	Pueblo II	A.D. 800/850 to 1100	Identified
	Pueblo I	A.D. 750 to 900	local
	Basketmaker III	A.D. 450 to 750	developments
	Basketmaker II	A.D. 1 to 500	
Earliest:	Basketmaker I (Archaic)	Pre-A.D. 1	

The developments identified in the Pecos Classification are distinguished by appearances and changes in domestication, pottery, architecture, and when possible, settlement pattern. However, we are forced to rely most heavily on pottery identification because of the greater attention given in Southwestern archeology to ceramic typology and because the large bulk of the data is derived from surface survey. Relatively few sites have been excavated and even less are adequately dated. Given these limitations, a broad outline of cultural change in the region can be deliniated.

Basketmaker I through Pueblo III (Pre-A.D. 1 through A.D. 1300) are the only periods applicable to Utah. Basketmaker I is the Archaic substratum which underlies Anasazi developments. Basketmaker II marks the appearance of domestication and precedes the introduction of pottery of the Basketmaker III period. Pueblo I is indicative of considerable experimentation and variability in pottery and is the least well known of the developments (Jennings 1968; Rohn 1977). Pueblo II marks the maximum extent of expansion and was a time when "the distinctive flavor of the Anasazi" reached maturity (Jennings 1968). Anasazi occupation in Utah culminates with Pueblo III retraction, nucleation, and subsequent (ca 650 B.P.) abandonment. Detailed descriptions of the development stages are available elsewhere (Jennings 1968; Berry 1975; Matheny 1975; Rohn 1977). Only Basketmaker III through Pueblo III are directly applicable to this immediate locale.

Basketmaker III is the initial pottery-bearing component. The earliest pottery consists of both plain gray and black-on-white wares. Red ware makes an appearance toward the ca A.D. 750 end of the period (Breternitz, Rohn, and Morris 1974). Beans were added to the corn and squash cultivated during Basketmaker II times. Both cave/rockshelters and open sites were occupied (Brew 1946; Dalley 1973; Wilson 1974; Casjens et al 1980).

Pueblo I is marked by considerable ceramic variability, with black-on-red, red-on-orange, and neck-banded gray ware added to plain gray and black-on-white pottery. The bow and arrow, tipped with small corner-notched points, replaced the atlatl. Pit structures continued to serve as dwellings with a strong trend toward the use of surface jacals (Brew 1946). Sites are typically located on low hillocks in river valleys and on the plateaus. The Pueblo I component remains the least well defined of the pottery bearing developments. It is transitional and particularly "short-lived," temporally variable, or absent in most areas.

Pueblo II was a time of expansion and florescence. Dispersed settlement and the development of the kiva and associated surface masonry rooms occur during the period. Corrugated pottery became common and corner-notched points were replaced with side-notched. Pueblo II sites are found virtually everywhere from river valleys to mountain settings. The expansion occurred northward to the town of Boulder in central Utah (Lister, Amber, and Lister 1960) and to Arches National Park in eastern Utah (Hunt 1953; Berry 1975). Limited numbers of Anasazi trade wares occur in Fremont contexts (e.g. Wormington 1955; Marwitt 1970).

Pueblo III was a period of retraction from expanded Pueblo II settlement and subsequent nucleation into larger and fewer villages. The retraction probably began sometime around A.D. 1150. Rockshelters and large open sites were occupied. These often consisted of several kivas and a number of masonry rooms. Multistory apartment dwellings and storage rooms occur in the larger rockshelters. The use of corrugated pottery continued with changes in rim style and the addition of distinctive black-on-white wares. The abandonment of some Utah sites occurred sometime between A.D. 1250 and probably A.D. 1275. Other Pueblo III sites were abandoned before this final period.

Following the work of J. O. Brew (1946) on Alkali Ridge, the history of modern formal research in the Westwater/White Mesa locale was inaugurated in 1960 by Dee Green at the "Edge of the Cedars Pueblo" in west Blanding (T. Walker, State Parks 1980, personal communication) and by Ray Matheny (1962) in Montezuma Canyon. Research since has been almost continuous.

The University of Utah surveyed and excavated a number of sites on Cedar Mesa in connection with Highway U-95 salvage (Dalley 1973; Wilson 1974). Fike and Lindsay (1976) conducted a reconnaissance for the Bureau of Land Management, of sites on the southern part of White Mesa and on the Bluff Bench adjacent to the San Juan River. This was shortly followed by an intensive survey of the Pinto-Abajo powerline transect, by Brigham Young University, roughly north-south down the mesa (Berge 1975). Limited excavations were conducted at several of these sites (Berge et al 1981). Hurst (1976) performed the first legitimate work (a reconnaissance of sites) in Westwater Canyon and this was followed by the Antiquities Section's extensive 1977-78 excavations of Westwater - Five Kiva - Ruin (Lindsay 1981). Thompson (1977) conducted an intensive inventory of sites on the mesa for Energy Fuels Nuclear, north of the area covered by Fike and Lindsay (1976). Subsequently, a number of these (Lindsay et al 1978) and some additional sites (Nielson 1979) were tested. A few additional sites were identified during the periods of testing. One of the sites inventoried by Thompson (1977) was fully salvaged (Sargent 1979). An additional intensive inventory of sites was conducted (Casjens and Seward 1980) on the mesa south of Thompson's (1977) survey and north of but partially overlaping the survey by Fike and Lindsay (1976). This resulted in the identification of a sizeable number of additional sites. A substantial portion of the sites in the area of the Thompson survey were fully excavated (Casjens et al 1980). The limited excavations at Big Westwater Ruin immediately west of these sites were conducted during the same year. Recent additional research efforts by the Antiquities Section include a survey of a limited portion of Recapture Wash northeast of Blanding (Nielson 1980) and the salvage excavation of a number of Basketmaker III sites on the San Juan River west of Bluff (Neily n.d.).

The inventories conducted on White Mesa and in adjacent canyons consistently demonstrate heavy Pueblo II and III occupations. Basketmaker III sites are also well represented. Pueblo I, except as suggested by the Fike and Lindsay (1976) survey, is quite limited. It is likely that many of the designated Pueblo I sites of the survey are actually transitional late-Basketmaker III/early-Pueblo I. These were recorded relying heavily on the presence of red ware pottery which alone, at least in this locale, does not necessarily indicate a "full-blown" Pueblo I component (Breternitz, Rohn, and Morris 1974). The ware occurs with typologically Basketmaker III architecture (Brew 1946; Lindsay et al 1978; Nielson 1979; Casjens et al 1980) and it has also been found in a dated Pueblo II context on Cedar Mesa (Dalley 1973).

Basketmaker III sites occur in canyon, mesa, and riverine settings. They generally consist of one or two pit houses, some as large as seven meters in diameter (Wilson 1974; Lindsay 1981; Neily n.d.). Configurations are both circular and quadrilateral. Most have antechambers and are partitioned with wing walls in the southern-half of the structures. The roofs are supported by four large interior support posts, and the walls consist of a sizeable number of perimeter posts set in and packed with jacal.

Three phases of Basketmaker III occupation may occur in this locale. Sites which may be a fairly early expression of the component, containing high proportions of Kayenta Lino Gray Ware with limited amounts of Chapin Gray, occur west of the Comb anticline in the western Mesa Verde area (e.g. Hurst 1974; Lipe 1970; Wilson 1974). However, several sites with high proportions of Chapin Gray and radiocarbon dated to 1835$\pm$125 B.P. (Sargent 1979) and 1730$\pm$70 B.P. (Neily n.d.) suggest probable contemporaniety with the early Basketmaker III sites to the west. The very early radiocarbon dates, as such, are unacceptable because they suggest an occupation of several hundred years before the generally accepted time of the introduction of pottery. The dated samples were derived from charcoal on a pithouse floor and a fire hearth, respectively, and may be from wood dead long before it was burned. Later Basketmaker III sites to the west, with high percentages of Chapin Gray (Dalley 1973; Wilson 1974) probably represent a second phase of the occupation. This may have been in connection with the abandonment of earlier sites at lower elevations to the south and east, in response to an extensive ca A.D. 600 drought (Euler et al 1979). A third phase (late-Basketmaker III early-Pueblo I) is characterized by sites containing high proportions of Chapin Gray and the appearance of the red wares. These occur with greatest regularlity in the vicinity of Alkali Ridge (see Brew's [1946:93] Abajo Focus), but are also found on White Mesa. The sites to the west contain very limited amounts of red ware, but this does not necessarily mean that late-Basketmaker III sites are absent. It may only indicate that the ware, apparently developed east of the Comb anticline (Lucius 1980), was particularly localized during this transitional period.

Pueblo I sites, as such, are scarce. Few apparently exist independent of either earlier or later developments and direct dating of the component is rare. Consequently, the nature of Pueblo I settlement in the Westwater/White Mesa locale is poorly understood. A continuation of the late-Basketmaker III tradition is prevalent in the architecture of Alkali Ridge (Brew 1946), Westwater - Five Kiva (Lindsay 1981), and on White Mesa (Casjens et al 1980). Red Ware is common and Piedra

Black-on-white occurs in limited percentages during this early-Pueblo I period. This pattern continues to at least A.D. 770 as dated at Site 13 on Alkali Ridge (Brew 1946). A later Pueblo I component is suggested by the ca A.D. 800 to 850 introduction of neck-banded, Moccasin Gray Ware pottery. This phase is tree-ring dated at A.D. 845 on Elk Ridge (Matheny 1974). Pueblo I on White Mesa is radiocarbon dated at 1100±85 B.P. (Casjens et al 1980). This may provide a terminal date on Pueblo I occupation of the mesa as only Pueblo II pottery was recovered from the dated pit house floor. It may be that the pit house was abandoned (ca A.D. 850) then reoccupied during Pueblo II times. By the end of Pueblo I, pit houses become smaller and the more centrally located interior support posts of Basketmaker III times are placed nearer the walls of the structures. Ventilators replace pit house antechambers. Several of the excavated, but undated White Mesa sites (Casjens et al 1980) demonstrate these in innovations. Bullard (1973) has identified the shift from pit house to surface domiciles as a principal criterion for assessing Pueblo I maturity. Unfortunately on White Mesa, the disturbed nature of the aboriginal surface and the probable destruction of associated rooms precludes an assessment.

Many of the earlier, late-Basketmaker III/early-Pueblo I sites in the Westwater/White Mesa locale were apparently destroyed by fire (Lindsay 1981; Lindsay et al 1978; Nielson 1979) at the time of or after abandonment. The absence of the Pueblo I component on Cedar Mesa (Dalley 1973; Wilson 1974; Lipe and Matson 1971) and its high incidence in the higher elevations of Elk Ridge (Matheny 1974; DeBloois 1975) may have been, at least in part, the result of abandonment of the lower sites in response to a ca A.D. 850 to 900 drought (Euler et al 1979). The paucity of sites containing Pueblo I pottery associated with late Pueblo I architecture in the Westwater/White Mesa locale may also be due to at least a partial abandonment toward the end of the period.

Pueblo II sites occur virtually everywhere with great frequency and essential uniformity. Optimal climatic conditions (Euler et al 1979) possibly characterized by a more favorable rainfall pattern for the production of maize (Schoenwetter and Eddy 1964; Schoenwetter 1966, 1970) are suggested for the period. The component is identified in rockshelters and large, stratified open sites, but generally it occurs as small Pruden or L-shaped units consisting of a number of contiguous masonry rooms and containing a single kiva. The ca A.D. 900 transition is fairly evident (cf. Brew 1946), although several dated anomalous components exist. At Westwater - Five Kiva (Lindsay 1981), Mancos Corrugated pottery is associated with a large, typologically distinctive late-Basketmaker III/early-Pueblo I jacal dwelling. This is interpreted as the survival, in a well protected context, of early architecture to Pueblo II times. Transitional late-Pueblo I/early-Pueblo II architecture on Cedar Mesa (Winter 1973), is tree-ring dated at A.D. 1001 and 1017 vv, well into the middle of the Pueblo II period. A single corrugated pottery sherd was recovered from the floor of the structure. The appearance of the kiva, surface masonry domiciles, and Mancos Corrugated and Black-on-white pottery marks the certain occurrence of the component. However, this does not mean that the development of the kiva and the introduction of corrugated pottery occurred simultaneously. For example, kiva construction may have occurred following the introduction of corrugated pottery at Westwater - Five Kiva (Lindsay 1981). Cortez Black-on-white, diagnostic of the early-Pueblo II Ackmen Phase at Mesa Verde (see Hayes and Lancaster 1975), is rare in the Westwater/White Mesa locale and to the west on Cedar Mesa.

Pueblo III sites are abundant in both canyon and mesa settings. Two phases which seem to coincide with McElmo and Mesa Verde Phases (see Hayes and Lancaster 1975) of the component seem to occur in the Westwater/White Mesa locale. Early-Pueblo III is a continuation of the scattered, small hamlet tradition established during Pueblo II times. McElmo and Mesa Verde Black-on-white and Mesa Verde Corrugated pottery mark the onset of the period. By ca A.D. 1150, intense construction activity occurs at Big Westwater and continues to about A.D. 1210. Principal construction occurs at Westwater - Five Kiva during an A.D. 1212 to 1214 interval. The 50 year construction span at Big Westwater encompasses what has been suggested as a period of extreme drought (Euler et al 1979). The construction at Westwater - Five Kiva immediately postdates the drought interval. The occurrence of Kayenta intrusives, Tusayan Polychrome and Sosi Black-on-white pottery and the appearance of poorly constructed masonry possibly during early- to mid-Pueblo III at Big Westwater and Westwater - Five Kiva Ruins may indicate a northern and/or northeastern migration of people with some Kayenta influence. This may have been the result of movement from the lower elevations to the south toward the higher elevations of the Abajo Mountains durng the prolonged desiccation.

Several of the excavated sites on Cedar Mesa (Dalley 1973; Wilson 1974) have been interpreted as limited to early-Pueblo III. It would seem that the process of nucleation -- into larger and fewer sites -- seems to coincide with the ca A.D. 1150 climatic deterioration. The number of late phase Pueblo III sites are relatively limited and given the apparent preference for rockshelters, a gradual abandonment of the Cedar Mesa and Westwater/White Mesa areas may have begun during the period. The latest construction at Westwater - Five Kiva occurred at A.D. 1247 to 1250. This probably marks the final period of construction in the Westwater/White Mesa locale. The periods of construction are essentially duplicated at Hovenweep (Winter 1976, 1977) with some construction during the drought period, and again immediately postdating the interval. A final period of construction, which included towers about canyon head springs ranges, from about A.D. 1230 to 1277. The absence of dates after this period probably identifies, very nearly, the time of abandonment of the region.

In sum, the evidence for direct cultural response -- local abandonment and subsequent reoccupation and changes in settlement -- to climatic change is most compelling. Berry (1980) has proposed just such responses but as a Southwestern regional phenomenon with a series of abandonments of many locales. These are essentially seen as transitional intervals which herald and provide for the typological changes of the Pecos Classification. While this may account for how and when some of the changes of Southwestern taxa occurred, several innovations seem more a local phenomenon, developing within the periods of the classification. The appearance of San Juan Red Ware seems to occur as a part of the Basketmaker III tradition and following the extensive use of fugitive red on Chapin Gray pottery (Neily n.d.). The appearance of neck-banded, Moccasin Gray Ware and changes in pit house architecture seem to occur more toward mid-Pueblo I times.

I have assumed that abandonment of the Westwater/White Mesa locale resulted in periodic movement to the higher elevations in the vicinity of the Abajo Mountains. This is not without the supporting evidence on Elk Ridge during Pueblo I times. If "prehistory repeats itself" then:

1) An A.D. 600 abandonment of Basketmaker III sites occurred at lower elevations. The appearance of red ware marks a return to the Westwater/White Mesa - Alkali ridge locale.

2) An A.D. 850 abandonment of Pueblo I sites occurred at lower elevations. The occurrence of neck-banded, Mocassin Gray Ware on Elk Ridge provides evidence of relocation at higher elevations. Pueblo I pit house architecture with Mancos Corrugated pottery on Cedar Mesa and White Mesa mark the return to former habitats.

3) A.D. 1150 nucleation is apparent in a number of tree-ring dated rockshelter sites and subsequent extensive construction activity.

4) Regional abandonment is complete shortly after A.D. 1277 as demonstrated at Hovenweep.

Obviously, cultural response to climatic change doesn't occur independent of historic, demographic, socio-political, and ideological factors. However, the constraints imposed on archeological data recovery and hence the very substance of archeology is necessarily limited to the technological aspects of culture, and then only in the forms of tools and the waste of their manufacture, architecture, and the refuse of subsistence. The way tools were used and the manner in which labor was organized for subsistence and construction is often difficult to specify.

We might surmise that given a continuing focus on horticulture in the context of changing environmental conditions:

1) the Anasazi became increasingly reliant on cultigens over wild plant and animal foods
2) Anasazi populations tended to increase over time
3) Anasazi food getters became increasingly locked into a schedule maximizing horticultural production.

In other words, Anasazi adaptation would have become more and more specialized.

How then, do we explain that the climatic deteriorations of A.D. 600 and 850 resulted in the movements of people and the abandonment of some locales while the A.D. 1150 drought provided the impetus for nucleation of populations into larger and fewer settlements. Obviously, factors in addition to drought (assuming that the three periods were of similar significance and extent) are operative to produce differing responses to similar climatic phenomena.

Assuming that nucleation was not maladaptive, it seems important to explore the possible advantages that would obtain from the clustering of people into larger and fewer sites. We might suggest that greater numbers of people engaged in cooperative efforts would:

1) result in more efficient horticultural production
2) result in greater efficiency in construction of settlements
3) provide for greater defense of the many by a limited few.

Perhaps, just as important, nucleation may be indicative of an attempt to achieve cooperation between locales. The deleterious effects of "spotty" and localized critical summer rainfall on horticultural production could have been partly compensated by the establishment of socio-political networks based on reciprocity. A population who may have experienced crop failure at a particular location one year may have been supported by others during the critical period while in a subsequent successful year they were obligated to repayment in kind. This could have best been accomplished through the local clustering of people under a central authority. Communication between local authorities would have then been quite simple.

Lest such an explanation seems overly flamboyant and untestable, we should consider the comparability of events detected in various rockshelters in the Westwater/White Mesa locale as well as elsewhere. Many rockshelter sites contain masonry much less carefully constructed overlying earlier, better made construction. This may suggest that nucleation was fairly rapid. Many sites contain deposits which are heavily laden with turkey fecal matter in the most recent levels immediately antedating abandonment. Also, a number of sites consist of masonry walls with "observation ports" suggesting a defensive posture during Pueblo III times. A suggested comtemporaniety of these developments (subsistence shift and concomitant defensive posture) indicates the presence of stress and something about the nature of local competition. Some degree of cooperation is indicated in the extensive system of "towers" both to the west and to the east of the Westwater/White Mesa locale. This system suggests some form of interlocale communication. Sites such as Westwater - Five Kiva, with a high proportion of kivas to the number of domicile and storage rooms may indicate the development of "special use" - habitation sites which exerted some influence over surrounding habitation sites.

The process of nucleation is well documented and the indications of communication between groups over a fairly broad area are apparent. Testing the "reciprocity hypothesis" as an integral part of the process of nucleation would require site patterning studies over a fairly broad area to determine:

1) the relationship of sites constituting a community or locale
2) the variability of habitation sites within a community or locale
3) the relationship of sites constituting differing communities or locales.

Explicit tree-ring dating would be required to establish the contemporaniety of sites. Given the definition of several communities and the identification of "distinctive" habitation sites within each, the relationship between communities could then be investigated.

SITE DESCRIPTION

Local Setting

Big Westwater Ruin is in a fairly symmetrical "U-shaped" alcove (Figure 6). The protected area of the shelter is about 40 m wide. The alcove gradually widens to approximately 400 m, about a quarter of a mile to the south and west at the confluence with Westwater Canyon. The rim of the alcove is 1706.8 m asl and it is about 15 m above the center of the shelter. The site is accessable from the rim on both the east and west sides where abundant talus provides a roughly 45^{0} descent into the canyon. There is also access from the canyon bottom into the alcove from Westwater Canyon. The dry wash of the alcove is immediately below the masonry at the dripline of the shelter. The dripline varies from inside the base of the masonry to directly below the canyon rim. The wash descends southward immediately outside the shelter at a rate of almost 1:1. This rate then decreases to about .5 m/8 m through the remainder of the tributary en route to Westwater. The wash carries water from intermittent summer storms which occasionally cascade over the rim above the shelter into the wash below.

The bottom of the alcove consists of deep silty sands derived essentially from the Mesa Verde loess of the mesa. These deposits support a variety of flora in the context of the dominant pinyon/juniper association. Vegetation identified in the immediate vicinity of the site includes big sagebrush (*Artemisia tridentata*) big rabbitbrush (*Chrysothamnus nauseosus*), snakeweed (*Gutierrezia microcephala*), wolfberry (*Lycium* sp.), narrowleaf yucca (*Yucca angustissima*), prickly pear cactus (*Opuntia* sp.), Mormon tea (*Ephedra nevadensis*), a few grasses, and annuals. The vegetation of the alcove is characteristically xeric with saltbush (*Atriplex* sp.) southward in the tributary. No cottonwoods were observed en route to Westwater Creek.

The shelter is roughly 40 m wide east-west and varies to the rear from about 6 m on the sides to 14 m in the center of the site. Variable exposures or lenses within the contact between the Brushy Basin Member of the Morrison Formation and the overlying Burro Canyon are exposed causing an irregular overhead in the shelter. Headroom varies from little more than a meter in places at the rear to as much as eight meters toward the front. This differential layering has resulted in a small enclave or shelf above the site on the east which contains several small, contiguous, masonry and daub storage rooms. A large rock spall weighing more than 50 tons has vertically fractured and appears precariously suspended above the kiva on the west.

Construction in the shelter consists of two masonry room blocks separated by a roughly 20 m (east-west) midden deposit

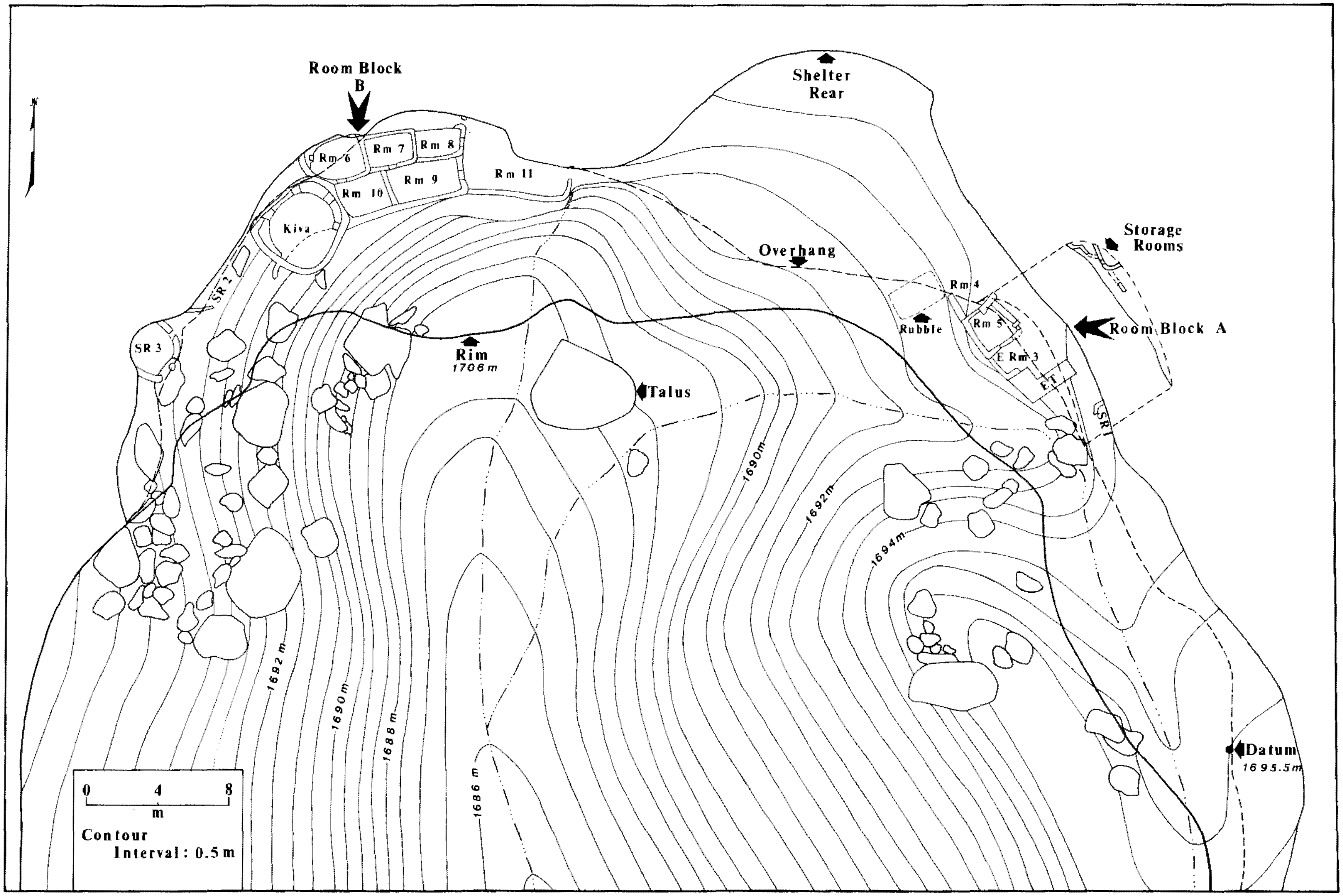


Figure 6. Site Plan and Contour Map

in the center of the site. Room Block A (Figure 7) on the east consists principally of two well constructed rooms of roughly equivalent size. The northwesternmost half of the front wall of one of the rooms (Room 4) has been reduced to rubble, apparently by vandalism. At least one earlier masonry room (Early Room 3) was identified in the course of excavation and several additional are hypothesized from wall detail. The storage rooms are on a ledge about eight meters above the room block. Room Block B (Figure 8) is in the northwest part of the shelter. It consists of a single kiva and an adjoining set of six contiguous rooms. The front and east walls of the room block indicate the roofed rooms provided an upper deck. Subdivision of the upper story is not evident. A series of "observation ports" are associated with this upper level as well as with the low front wall of the easternmost Room 11. The only access to the room block is from the center of the site through a doorway on the east. Several periods of construction and remodeling are evident, culminating in the final upper story construction.

Figure 7 Room Block A Before Excavation

Figure 8 Room Block B Before Excavation

Three storage rooms are in the shelter, in addition to those on the ledge above Room Block A. Storge Room 1 is about three meters southeast of Room Block A, along the rear wall of the shelter. Storage Rooms 2 and 3 are immediately adjacent to and southwest of the kiva. The rooms were only partially investigated. Petroglyphs, including an apparent depiction of a desert bighorn, are on a heavily weathered panel in the southeast part of the site. Numerous pictographed hand prints are just south of Storage Room 3 on the west. Other structures may exist in the shelter since several upright slabs occur immediately outside of and to the southeast of Room Block A and a large "L-shaped" stone to the east of Room Block B at the front of the shelter. However, none of the possible additional features were investigated. There is no evidence of structures in the large midden area in the center of the site.

Both looting and vandalism were evident at the first visit to the site. Large looters' pits were observed immediately east of Room Block A and in the eastern half of the central midden component. Smaller, shallow pits were virtually everywhere throughout the midden. Limited stratigraphy, consisting of eolian sand deposits with charcoal, ash, juniper bark, grass, and other vegetal material, was observed in the larger pits. The pit immediately east of Room Block A contained bands of sand, some darkly stained with charcoal and ash, and turkey feces. A large unidentified corrugated pottery sherd was observed in association with the lower darkly stained deposit. The fills of most rooms appeared to have been churned with daub chunks, vegetal material, and timber, variously exposed throughout the room blocks. An absence of pottery and chipped stone on the surface was particularly noticeable. a number of sherds, obviously a recent collection, were recovered from a natural wall niche at the rear of the shelter in Room Block B. A makeshift ladder of a large juniper trunk and small boards affixed with nails had been hoisted for access to the ledge containing the storage rooms above Room Block A. Modern grafitti occurs on the shelter walls. "G. A. H. Jr." is pecked in stone in the southeastern part of the site and it presumably represents the initials of George A. Hurst Jr., a recently deceased member of one of the early families in southeastern Utah (cf. Lindsay 1981). "Boy Scouts May 5, 1922" is on the wall at the rear of Masonry Room 11 in Room Block B.

Despite the apparent looting and vandalism that had occurred at the site, Room Block B was observed to have remained surprisingly intact. Variable masonry construction was immediately apparent, consisting of large, smoke-blackened stone blocks, footing well made construction and preceding a fairly crude, not so carefully laid masonry of small, mostly unshaped rock. The promise of the site's importance was apparent in the association of the "observation ports" with the later crude construction. An early Pueblo III ca. A.D. 1183 tree-ring date obtained from a timber provenienced only for Room Block B, suggested a date associated with the final period of construction.

Excavation Procedures

The principal goals of the excavation were to identify the overall site sequence and to evaluate and process room fills along the walls where stabilization was required. Questions generated by extant research (see Cultural and Modern Research Contexts), including the presence and nature of a Pueblo I occupation, the questionable co-occurrence of the introduction of the kiva and corrugated pottery, the heavy reliance on domestic turkey by mid-Pueblo III times, and the nature of site abandonment were the principal over-riding research interests. Site documentation and sampling were, when possible, geared to seeking solutions to these problems.

Room fills, for the most part disturbed, were not screened and as the excavation progressed it became apparent that because of the extremely loose nature of the fills any amount short of full removal seemed impractical. The fills of Rooms 4, 5, 6, 7, 9, 10, and the kiva were totally removed, while Early Masonry Room 3 and Room 8 were sectioned. Limited test pits were emplaced in Room 11 and Storage Rooms 1 and 3. Storage Room 2 and those on the ledge above Room Block A were not investigated. Generally, the storage rooms contained very limited deposits. The northeast-southwest exploratory trench was initiated a meter southeast of Early Masonry Room 3. It was placed where a large one meter diameter looter's pit had exposed extensive strata. The trench was expanded, first northeastward to near the rear wall of the shelter, then a meter to the northwest to expose the base of the wall of Room 3. In all, more than 30 cu. m of fill was processed from the rooms and the exploratory trench.

The fills of Rooms 3, 7, 9, and 10 were almost wholly disturbed. Suspected double floors of Rooms 6, 7, 8, 9, and 10 were either very fragmentary or they were totally destroyed. The fills of Rooms 4, 6, 8, and the kiva were at least partially intact. A large rock spall covering the east half of Room 8 prevented the looting, as well as the excavation, of that part of the room. The extent of the disturbance to Room 11 was not determined. Only Room 4 fill contained a set of deposits which could be analyzed in some detail and from which an artifact sequence could be derived. Also, some temporal distinctions are apparent from the comparison of artifacts derived from the subfloor fills of Rooms 9, 10, and the kiva with those derived from the general fills of the rooms. The southern portions of the latter structures are built near the dripline of the shelter, consequently, the floors were built upon loose fill derived from an earlier occupation. Pollen and flotation samples were obtained from both the trench deposits and the fill of Room 4. Early Masonry Rooms 1 and 2 are hypothetical and as such, they were not excavated. They are postulated soley on the limited wall detail of Rooms 4 and 5.

Datum was established for both vertical and spatial control. The rim of the alcove and hence elevation, was identified as the 5,600 ft. interval on the U.S.G.S. Brushy Basin 15 Minute topographic map. This made simple the conversion of site contours to actual elevations. All rooms were mapped in both plan and cross-section. Wall detail was sketched and measured where it was necessary to solve problems relating to the sequence of construction. The large number of samples collected for tree-ring dating were derived from both atop and within the fills of the rooms in Room Block B. One specimen was obtained from the subfloor fill of Rooms 9 and 10. Artifacts are provenienced for the various rooms, despite the considerable disturbance, because in most cases the extremely high walls probably precluded mixing between rooms during looting. Where this is not apparent, artifacts are provenienced only for the room blocks or their provenience is necessarily unknown.

General Site Sequence

No direct stratigraphic relationship was established between the two room blocks or with the storage rooms. However, the basal strata of the exploratory trench were directly tied to the earlier construction in Room Block A and later deposits are correlated with the differential fills of Room 4 (Figure 9). A correlation is apparent between the early masonry of the two room blocks. The early rooms in Room Block B are undesignated because their configurations in plan are essentially the same as later construction. Tree-ring dated timbers derived from Room Block B and their suggested association with later masonry construction are correlated with suggested dated pottery types from the upper level deposits of both the fill of Room 4 and the exploratory trench. Some correspondence in masonry type is also suggested, particularly for late stage construction, in the two room blocks.

Direct tree-ring dated construction provides the best evidence of temporal placement in the sequence. Although the construction in Room Block B is not directly dated, the sizeable number of dates over a fairly brief time span (see Dating) derived from timbers in the fills of the rooms are nearly as acceptable. The reliance on typological cross-dating using pottery from the strata of the exploratory trench and the levels of Room 4 fill is less exact. However, the pottery derived from these two sets of deposits, in part, correlates with the tree-ring dating of Room Block B construction. The relative sequence established from the deposits tends to confirm what is known about the site from the pottery derived from all proveniences and from the assessment of the sequence of masonry construction. Using the comparison of various types of masonry, in attempting to correlate the building sequence of the two separate room blocks, is somewhat tenuous. However, given correspondences of a sizeable number of attributes (stone types, unshaped or manner of shaping, mortar and method of application, chinking, and whether or not burned), at least the earliest and latest constructions in the two room blocks seem to be reasonably apparent.

The reconstructed Big Westwater sequence is based on these levels of correspondence. A sequence, beginning at least by early-Pueblo II times and ending during mid- to late-Pueblo III can be defined and is based on the evidence of various pottery types, the occurrence of various forms of masonry, and the absence of jacal construction. The occurrence of San Juan Red Ware in the subfloor fills of several rooms suggests that the site was occupied during Pueblo I times, but no constructin was identified for the period. Site destruction is evident in the conflagration of both room blocks shortly following the advent of masonry and corrugated pottery and before the occurrence of the Pueblo III wares. This was followed by considerable rebuilding of the site. A major period of construction is tree-

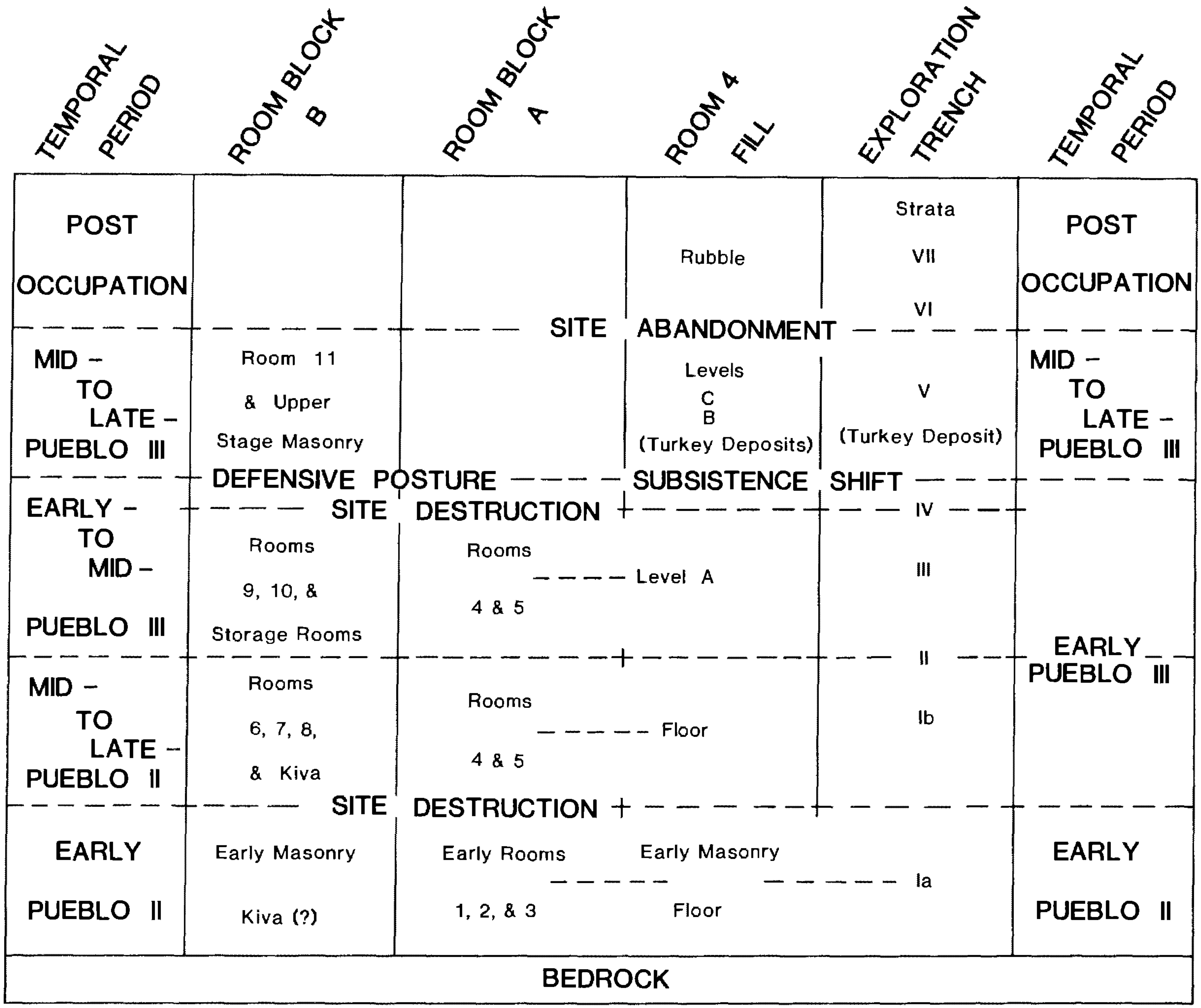


Figure 9. Diagram of the Site Sequence

ring dated from A.D. 1147 to 1207. This was followed by a second period of destruction. Subsequent remodeling and repair included the installation of the observation ports.

Site Stratigraphy

An exploratory trench was established in extensive, partially looted deposits, one to two meters southeast of the corner of Early Masonry Room 3 (Figures 10 and 14). The one by four meter trench was initiated, roughly southwest to northeast and parallel with the east wall of Room 5, to examine and sample the stratigraphic sequence in this part of the site.

Figure 10 Exploratory Trench Showing Cist in Cross-section

The stratigraphy seems to reflect the principal part of the overall sequence as suggested by pottery recovered throughout the site.

Seven strata, a slab-lined cist, and a clay dike with a large stone in situ were identified in the trench. The strata (I-VII) consist of two basal (Ia and b) components directly on bedrock, four additional (II-V), distinctive cultural deposits, and two uppermost (VI-VII) post-occupational components (Figures 11 and 12). Strata Ia and II are adjacent to and southwest of the clay dike. Strata Ib and III through VI are confined to the area from the dike to the rear of the shelter. Stratum VII is the only continuously distributed deposit in the trench.

Stratum Ia is a moderately consolidated, salmon-pink to -gray, clayey-sand containing charcoal and greenish-gray

Figure 11 Exploratory Trench Profile Showing Stratigraphy

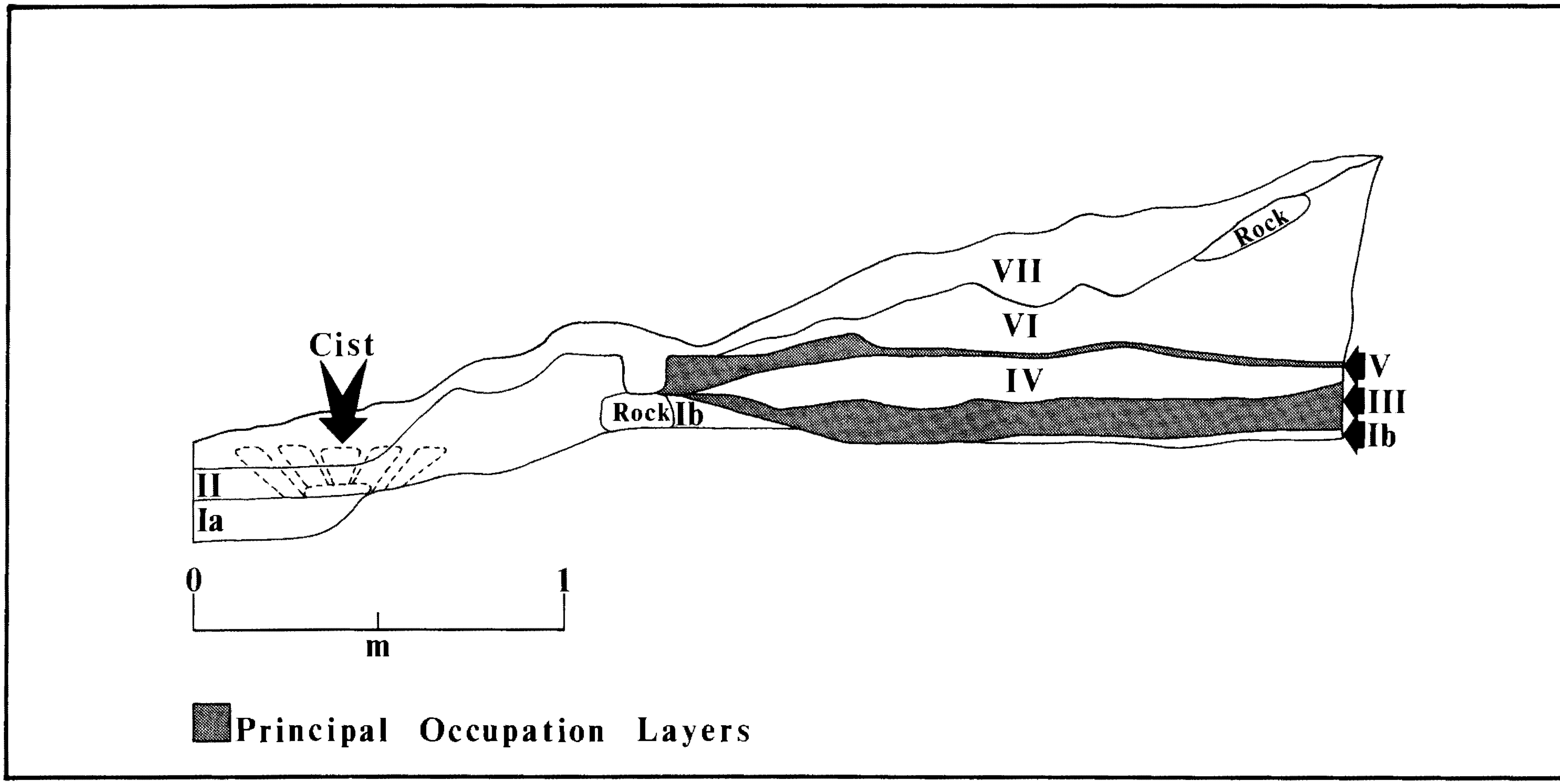


Figure 12. Profile Map of Exploratory Trench Stratigraphy

mudstone fragments derived from the contact between the weathered Brushy Basin Member of the Morrison and the overlying Burro Canyon formations. The deposit varies from 10 to 20 cm thick and it is distributed in only the approximate southwestern third of the trench. It is either contemporaneous with or immediately postdates the construction of Early Room 3. The cist, which originates from either the top of or within Stratum II, intrudes the deposit. Bluff Black-on-red and Deadman's Black-on-red pottery, and a single Tusayan Polychrome sherd were recovered from the stratum. The latter is likely intrusive from the overlying deposit.

Stratum Ib is a moderately consolidated, basal deposit of tan sand containing sparse charcoal flecks. It lies directly on bedrock. The stratum is restricted to the approximate northeastern third of the trench except for its very limited occurrence adjacent to the clay dike. The stratum varies from a maximum of 10 cm thick on the southwest to less than 5 cm at the rear of the shelter. The deposits gradually pinch out toward the center where Stratum III lies directly on bedrock. The stratum directly underlies Stratum III, and it is either contemporaneous with or postdates Stratum Ia. If it postdates Stratum Ia, then Stratum Ib must be temporally associated with Stratum II deposition. Stratum Ib appears to be confined by the clay dike and large stone which are suggestive of a footing for masonry construction antedating Stratum II. It is evidenced by a dike of salmon-red sandy clay, forming a slight arc one meter in length across the trench. The dike varies from 10 to 20 cm and it is 2 to 5 cm high. It contains several stone impressions on the top. A large stone is in situ on the northwest. An intrusion was identified in the trench profile above the large stone suggesting a masonry wall height of about 25 cm. This construction apparently remained intact to the abandonment of the site. Tusayan Polychrome pottery sherds were recovered from Stratum Ib. It probably correlates with the salmon-red sandy clay floor below Level A, and is associated with the intermediate stage masonry of Room 4.

Stratum II is a loosely consolidated, browish-gray sand with minor amounts of gravel, weathered rock fragments, and charcoal flecks. The deposit is limited to southwest of and adjacent to the clay dike in the approximate southwestern third of the trench. It variously, directly overlies both bedrock and Stratum Ia. The stratum, which varies from 5 to 15 cm thick, slopes downward to the southwest. The slab-lined and -paved cist (Figure 13) originates from either the top of or within the stratum. The slabs, partially shaped by both chipping and pecking, are bonded with a salmon-red sandy clay. The fill of the cist consisted of both Strata II and VII deposition. The cist is circular and measures 65 cm outside diameter at the top and 30 cm inside diameter at the bottom. It is 30 cm deep. The fill of the cist contained Cortez Black-on-white, McElmo Black-on-white, and Mancos Corrugated pottery. A single Mesa Verde Corrugated sherd may have been

Figure 13 Closeup of Cist in Cross-section and a Portion of the Southeast Wall of Early Masonry Room 3

derived from Stratum VII fill. Stratum II contained only unidentified corrugated body sherds.

Stratum III is a hard-packed blackish-brown clayey-sand and -ash lying immediately above Stratum Ib and bedrock. It is a use-packed accretion. The stratum slopes slightly downward toward the middle of the deposit. Its maximum thickness is 12 cm and the deposit pinches out at the clay dike on the southwest. The deposit directly underlies Stratum IV. The stratum is likely contemporaneous with Stratum II deposition and the construction of the cist. Mancos and possibly McElmo Black-on-white pottery sherds were recovered from the deposit.

Stratum IV is a loosely consolidated, brown sand containing daub chunks, charcoal flecks, and limited humus material. The deposit directly overlies Stratum III wherever the latter was identified in the trench. Stratum IV is restricted to the area northeast of the clay dike. It directly underlies Stratum V, the apparent turkey fecal deposit. Stratum IV is a maximum 15 cm thick throughout much of the deposit. It pinches out where it slopes rather abruptly downward at the dike. The deposit appears to have been deliberately laid, leveling the area to accommodate the turkeys associated with Stratum V. Only a single unidentified White Ware sherd was recovered from Stratum IV.

Stratum V is a moderately consolidated, dark brown deposit of sand and turkey feces. It is a fairly homogeneous deposit on the southwest where it reaches 11 cm thick. The deposit thins out toward the northeast to about two cm In the northeastern corner of the trench, the deposit is considerably more complex, consisting of two components (not shown in Figure 12). A fine powdery salmon-red sand, 10 cm thick, underlies a 5 cm thick set of laminae. These consist of a basal tannish-brown sand with humus and fecal material. This underlies dark brown sand and humus, a band of salmon-red sand, and uppermost, dark brown sand and humus. These deposits also directly overlie Stratum IV and they underlie Stratum VI, the basal post-occupational component. The reason(s) for the two sets of Stratum V deposits are not understood though they are contemporaneous. The stratum, including the laminae, probably correlates with turkey fecal Levels B and C of Room 4 fill, from which Mesa Verde Black-on-white pottery sherds were recovered. No pottery was recovered from Stratum V of the exploratory trench.

Stratum VI is the basal post-occupational component. The stratum is a loosely consolidated salmon-pink to -red clayey-sand containing charcoal, mortar fragments, gravel, and weathered rock fragments. Rock spall derived from the rear wall and the overhead of the shelter, increases in size and density toward the top of the component. The deposit reaches a maximum thickness of 62 cm at the rear of the shelter. It slopes downward toward the southwest, pinching out at the clay dike. The stratum directly overlies Stratum V. No pottery was recovered from Stratum VI.

Stratum VII is the uppermost deposit which caps this part of the site. It is a fine powdery, greenish-gray sand which becomes more compact with depth. The deposit contains some spall. The stratum varies from 5 to 20 cm thick and slopes downward to the southwest. It is the only continuously distributed deposit in the trench. Stratum VII directly overlies Strata II and VI on the southwest and northeast respectively. It also contributes to the fill of the cist which originates from the top of or within Stratum II. No pottery was recovered from Stratum VII.

In sum, the five occupational strata identified in the exploratory trench indicate a fairly complex and lengthy occupation in this part of the site. Stratum Ia, the basal cultural component is associted with the advent of masonry at the site. Bluff Black-on-red and Deadman's Black-on-red pottery recovered, provide evidence of a Pueblo I/early- to mid-Pueblo II deposition (Breternitz, Rohn, and Morris 1974). Tusayan

Polychrome from the Stratum Ib deposit suggests a late-Pueblo II/early-Pueblo III occupation (Breternitz 1966). It is associated with the intermediate stage masonry. Stratum II is likewise a late-Pueblo II/early-Pueblo III deposit containing unidentified corrugated pottery sherds. Additional Pueblo II pottery, including Cortez Black-on-white and Mancos Corrugated, was derived from the fill of the cist associated with Stratum II. The McElmo Black-on-white sherd from the fill indicates the cist probably remained in use to Pueblo III times. The cist was probably constructed in connection with the intermediate masonry stage. This represents the rebuilding of the site following the destruction of the early masonry. Stratum III is the single most abundant, principal occupational layer identified in the trench. The stratum likewise contained Pueblo II and possibly Pueblo III pottery. Thus, Strata I - III are the product of a Pueblo II occupation and lasting to at least the onset of Pueblo III times.

Little is indicated regarding the pottery from the remaining cultural Strata (IV and V). The Mesa Verde Corrugated sherd from the cist fill (probably from Stratum VII) indicates the site was utilized during Pueblo III times. Pottery from elsewhere on the site and the tree-ring dates derived from specimens collected from Room Block B corroborate a general Pueblo III occupation. Stratum IV is, in part, the likely product of mid-Pueblo III destruction, and it appears to have been a deliberate construction to provide a level base for the raising of turkeys in this part of the site. Given that Room Block A (see Room 4 fill, Levels B and C) and the area of the exploratory trench provided a locus for the confinement of turkeys, an abundance of Pueblo III pottery might not be expected. The turkey deposits which constitute Stratum V apparently span mid- to late-Pueblo III times and are associated with the final Anasazi occupation of the site. Strata VI and VII are post-occupational deposits.

Cultural Features

Big Westwater Ruin consists of two masonry room blocks separated by a large central plaza/midden area, various storage rooms, and two petroglyph/pictograph panels. Room Block A, on the east, consists of at least early masonry Rooms 1, 2, and 3 and middle or intermediate stage Rooms 4 and 5. Some remodeling and repair of the room block is evident during the final stage. The exploratory trench, initiated immediately to the southeast of Room Block A, contains some evidence of early masonry construction, but much of this was destroyed. Early masonry construction in Room Block B is limited to the rear of the room block. Intermediate construction in Room Block B consists of three, masonry Rooms (6, 7, and 8) and a single kiva. Rooms 9 and 10 were eventually added. Subsequent remodeling and repair occurred, consisting of the addition of Room 11 and an upper story to the room block. Storage rooms are present southeast of Room Block A and southwest of Room Block B. Petroglyphs are on the shelter wall in the southeastern part of the site. Pictographs are on a panel southwesternmost on the site.

The early and intermediate stages of masonry construction and subsequent late repair and remodeling vary considerably. Both shaped and unshaped large stone slabs, small but uniformly fractured stone, and unshaped rock are present. Types of stone and grades of mortar vary as do their relative proportions in the constructions. Generally, the amount of mortar tends to increase over time, while the size of stone decreases. Mortar color tends to vary with time from pale brown to reddish-brown and yellowish-red (Table II). Shaping of stone also tends to decrease toward the end of the occupation of the shelter. The early masonry identified in both room blocks consists of large, only partially shaped slabs. These are bonded with limited mortar and chinking is absent. The early stage is followed by a variety of construction including the use of large, finely-shaped slabs using very little mortar in Room Block A, small uniformly fractured stone with moderate amounts of mortar and limited chinking in portions of the kiva, and partially-shaped stone with abundant mortar and moderate chinking elsewhere in Room Block B. Later repair and remodeling in both room blocks consist of the use of unshaped rock, copious amounts of mortar and abundant chinking. Mortar was also applied in patches throughout the later construction.

Relationships between the two room blocks or with the storage rooms are not directly established. However, certain typological similarities and tree-ring dating in the context of the overall sequence established for the site provide some estimates of parallel construction. For example, much of the early masonry is smoke-blackened and it directly underlies subsequent unburned construction. Also, the upper or most recent masonry in both room blocks compares favorably in the use of small unshaped rock, similar color and high proportions of mortar, and abundant chinking. Thus, there is a fairly high

Table II Sample of Mortar Colors for Early, Intermediate, and Late Stage Masonry Construction

	Color	Description	Location
Late Stage	* 5YR 4.5/6	yellowish-red	Rooms 8 and 9, east wall
	* 5YR 5/6	yellowish-red	Kiva, rear wall
	* 10YR 7/2	light gray	Rooms 8 and 9, east wall
	* 5Y 6.5/3	pale olive	Room Block B, front wall
	5YR 4/4	reddish-brown	Room Block B, front wall
Intermediate Stage	* 7.5YR 6.5/2	pinkish-gray	Room Block A, front wall
	* 7.5YR 6.5/4	pink to light brown	Room 7, front wall
	* 7.5YR 6.5/4	pink to light brown	Rooms 8 and 9, east wall
	* 5YR 6.5/3.5	pink to light reddish brown	Kiva, rear wall
	5YR 6/4	light reddish-brown	Kiva, rear wall
	5YR 5/4	reddish-brown	Room 7, front wall
	2.5YR 5/4	reddish-brown	Room 8, front wall
	5Y 8/2	white	Room 7, front wall
Early Masonry	* 10YR 6.5/3	grayish-tannish brown	Room Block B
	* 7.5YR 6.5/4	pink to light brown	Room Block A

* Principal colors; others are poorly represented

degree of assurance that at least early and late masonry correlations between the two room blocks are valid. This is particularly important in accurately establishing major episodes at the site, such as early- to mid-Pueblo II destruction, early- to mid-Pueblo III destruction, and the adopted Pueblo III defensive posture and concommitant subsistence shift.

The general condition of the cultural features identified at the site ranges from very poor to excellent. Room Block A has undergone considerable vandalism resulting in the destruction of walls on the west and northwest. Rooms 4 and 5 had been looted resulting in the complete disturbance to the interior deposits of the latter. However, the excavation of Room 4 resulted in the identification of a sizeable amount of intact fill. Deposits surrounding the room block contained several looters' pits. Room Block B is fairly well intact though the roof common to Rooms 6 - 10 and that of the kiva had perished. A number of partial beams in the walls of the room block allows reconstruction. Room 11 was apparently not roofed. Stone was missing from portion of the walls including at the front of the room block and several interior walls. The front of the kiva wall had been destroyed including two pilasters. All rooms had been partially looted. The fill of Rooms 9 and 10 were entirely disturbed. About half of the kiva had been looted. Storage rooms, excepting those above Room Block A, were the least well preserved. Only Storage Room 3 remained more than 50 percent intact and all of the rooms were at least partially looted.

Early Masonry

The earliest masonry on the site consists of large coarse stones and flat slabs, bonded with pink to light brown (7.5YR 6.5/4) to grayish-tannish-brown (10YR 6.5/3), coarse sandy mortar. Pink to light brown mortar was also used during the intermediate rebuilding stage. Chinking with small stones is virtually absent. Most of the early masonry identified directly overlies bedrock and serves as the base for subsequent construction. Much of the limited walls that remain shows smoke blackening apparently from the conflagration of these earlier rooms. The evidence of the early construction is confined to several large slabs in Room Block A and the masonry underlying the more recent construction of Rooms 6, 7, and 8 in Room Block B. Early masonry Rooms 1 and 2 are hypothetical. Room 3 was apparently destroyed without further use. The early masonry is undated. The occurrence of San Juan Red Ware in the basal deposit of the exploratory trench suggests early-Pueblo II construction.

Room Block A (Figure 14). The early masonry in Room Block A consists of at least three rooms, only one which is partially intact. Rooms 1 and 2 are extremely fragmentary, hence spatial dimensions are only rough estimates.

Early Masonry Rooms 1 and 2 are partially reconstructed from segments present in the later Room 5 wall construction. A large 45 cm long stone slab at the base of the southwesternmost

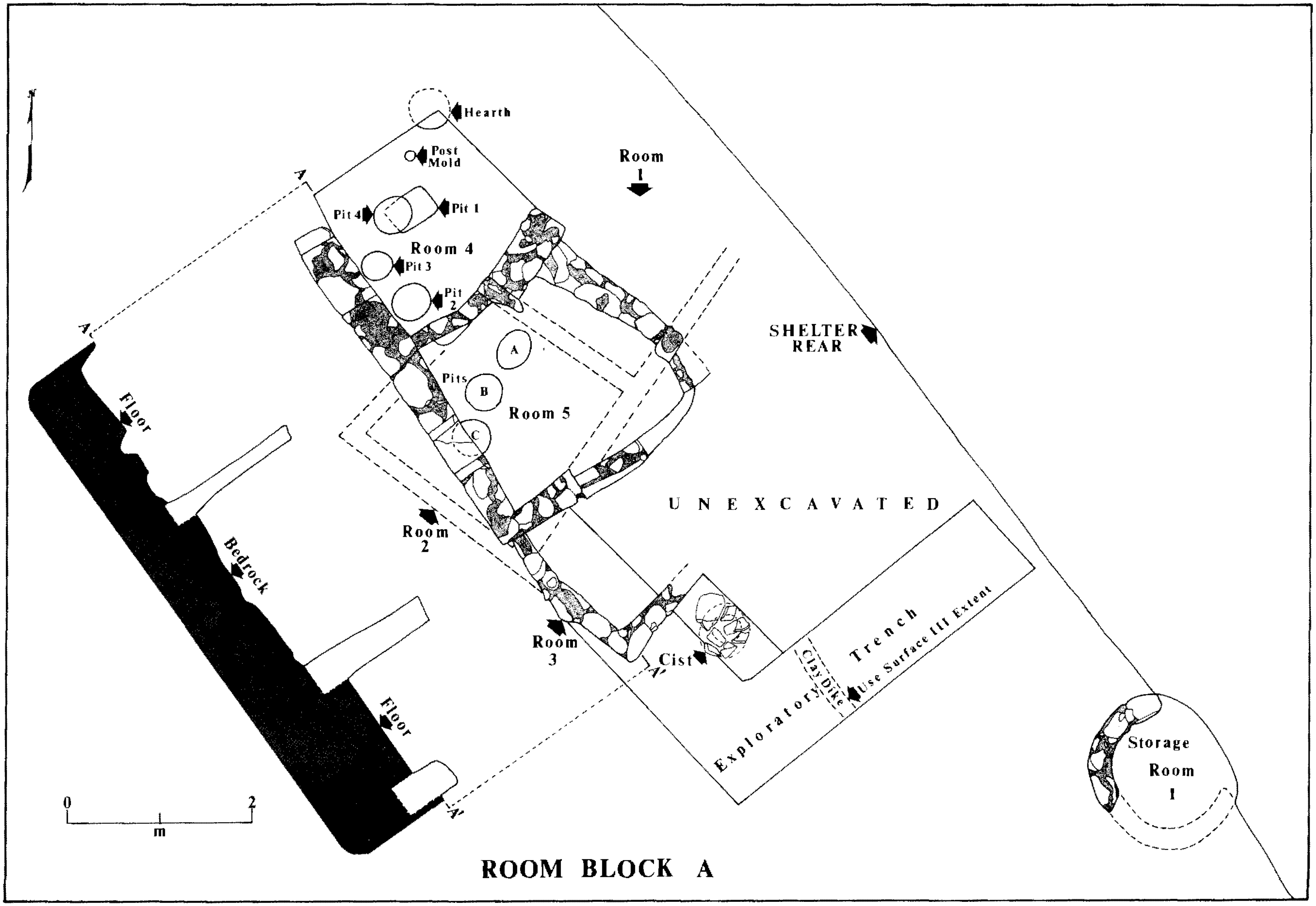


Figure 14. Room Block A Plan and Room Cross-section Map Showing the Locations of the Exploratory Trench and Cist

segment of the northwest wall of Room 5 (Figure 15) provides the remnant course of the northwest wall of Room 2. The slab is heavily smoke-blackened while the subsequent Room 5 wall construction is not. The slab lies directly on bedrock and is about 30 cm thick. This is comparable to the wall height of early masonry Room 3. The 20 cm width of the slab provides an estimate of the width of the walls of the rooms. The remaining possible wall segments of the two early masonry rooms approximate the full 1.5 m average wall height of Room 5. The segment on the southwest (Figure 15) essentially forms the southwest corner of Room 1 and it is the second northeasternmost segment of the later Room 5 wall. It runs to the southeast at roughly a right angle to the later construction. The wall

Figure 15 Northwest Wall of Room 5 Showing Large Stone Slab (basal-center) and Wall Remnant (second segment from right) of early Masonry Rooms 1 and 2

Figure 16 Northwest Wall of Room 5 Showing Wall Remnant (on right) of Early Masonry Room 2

segment is 60 cm long to the southeast and it is 20 cm high. The segment on the southeast (Figure 16) lies directly on bedrock outside of where it has been excavated about 30 cm deep, providing the level floor for Room 5. The segment is 30 cm long to the southwest and it is 20 cm wide. Given the limited wall remnants, the interior dimensions of Rooms 1 and 2 are 1.75 m wide (northwest to southeast). The depth (to the rear) of Room 1 is indeterminate. Room 2 is about two meters deep from the front wall of the room.

Three pits (A-C) are apparently associated with early masonry Room 2. They occur in a slightly arcing, northeast to southwest, alignment. Pit A, on the northeast, is 40 cm northeast-southwest and 38 cm wide. It is six centimeters deep. Pit B, in the center of the alignment, is oval-shaped, measuring 40 cm northeast-southwest and 38 cm wide. It is six centimeters deep. Pit C, on the southwest, is roughly circular, measuring 40 cm in diameter. It is 13 cm deep below the bedrock surface. The southwestern half of the pit underdies the southwest wall of Room 5. The three pits are lined with a two centimeter thick whitish-gray clay. The fill of the pits consisted of a loosely consolidated red sand containing charcoal flecks. No pottery was recovered from the pits. It is likely the pits originated from a 5 to 10 cm thick, hard-packed, tan, clay floor similar to that identified in early masonry Room 3. A floor associated with early masonry in the Room 5 area, was fully disturbed from the looting of the later structure. The depths of the pits may have been as much as 16 to 25 cm from the presumed floor of the early masonry room. The function of the pits is unknown.

Early masonry Rooms 1 and 2 are suggested, based on very limited evidence. This consists of the large slab, basal to the common wall of Rooms 4 and 5 and two fragmentary wall segments within the walls of the later room. Also, Pit C in Room 5 obviously antedates the southwest wall of the later room. The alignment of the pits is more nearly parallel with the wall orientation of the reconstructed Room 2 and with the southeast wall of early masonry Room 3. Still, the exact nature of the two rooms is obscure. Deposits immediately outside of Room 5, which may contain evidence of the west corner of Room 2, were not investigated. Also, there is some variation in the color of mortar adherring to the large stone slab at the base of the common wall of Rooms 4 and 5 and the fragmentary segment of the wall. The mortar on the slab is a pale grayish-tannish-brown (10YR 6.5/3) while that of the segment is a pink to light brown (7.5YR 6.5/4). The grayish-tannish-brown mortar conforms to the color of the mortar associated with the early masonry identified in Room Block B. The slabs used in the construction of the segment are much smaller than the large slab, but a progression toward the use of smaller stone from bottom to top might be expected.

Early Masonry Room 3 (Figures 13 and 14) is adjacent to and immediately southeast of Room 5. It was only partially excavated. The room consists of a single course of masonry. The room is about 1.8 m wide and more than 1.25 m deep to the rear. The walls vary from 23 to 35 cm wide. Both the front and southeast walls are about 60 cm high from the estimated depth of bedrock and they rise about 35 cm above the floor of the room. Fairly large stone slabs, bonded with a coarse, granular, grayish-tannish-brown (10YR 6.5/3) mortar were used in construction. Many of the slabs have been smoke-blackened. The ratio of stone to mortar is about 7.5:1. The northwest half of the front wall, where it curves into the alignment of the front walls of the later Rooms 4 and 5, appears to have been modified, post-dating the construction of the later rooms. Mortar color is a light reddish-tan to yellow (7.5YR 6.5/4) where this modification occurs. The stone is not nearly as well shaped and carefully laid and the ratio of stone to mortar is about 5:1. Chinking is absent. The floor of the room is a 5 to 10 cm thick, hard-packed tan clay. The clay contains finger impressions where it is packed against the walls. No pottery was recovered in contact with the floor. About a half cubic meter of fill was excavated from the room above the floor. The fill consisted of a basal 14 cm thick, salmon-reddish-tan sand. Above the sand a four centimeter thick layer of juniper bark occurred. Uppermost room fill consisted of a 33 cm thick, loosely consolidated sand with stone and daub rubble. Both Pueblo II (Cortez/Mancos Black-on-white) and Pueblo III (Mesa Verde Corrugated) pottery were recovered from undifferentiated fill of the room.

Evidence of an additional early masonry room (undesignated) in the Room Block A area was identified in the exploratory trench (Figures 12 and 14). This consists of a one meter long by 20 centimeters wide, salmon reddish-tan sandy clay dike, with stone slab impressions, lying directly on bedrock. The dike varies from two to five centimeters thick. A large stone was identified lying directly atop the dike in the northwest profile of the trench. An intrusion from the top of Stratum V on the northeast and Stratum II on the southwest may be the result of the removal of a large stone post-dating the abandonment of the site. The overall height is 25 cm from bedrock to the top of the intrusion. The dike is roughly northwest to southeast, arcing slightly northward on the northwest. If this phenomenon is an early masonry wall remnant, its construction antedates the deposition of Stratum II suggesting a comtemporaniety with the beginning of Stratum Ib deposition or during Pueblo II times. The construction appears to have remained in place for the duration of Stratum V deposition. It may be associated with early masonry Room 3 construction and later served in connection with the confinement of turkeys in the Room Block A area.

Room Block B (Figure 17). The configuration of early masonry construction in Room Block B is less obscure than in the Room Block A area, partly because the earlier construction served as the base for later masonry. The walls of later Rooms 6, 7, and 8 (excluding the rear-north wall of Room 7, the bench on the west side of Room 6, and the east wall of Room 8) were constructed atop the early masonry. This basal construction consists of large stone slabs and blocks bonded with a grayish-tannish-brown (10YR 6.5/3), coarse, granular sandy mortar. Most of the stone and mortar has been burned. Much of the stone used in this early construction has been shaped by flaking and wall chinking is absent. The ratio of stone to mortar is about 7.5:1. The height of the masonry varies from 10 to 55 cm.

Large stone blocks underlie later construction in the west wall of Room 10 (Figure 18). This 2.5 m long early masonry wall segment may be a remnant of a (possibly five or six) multi-sided structure which now contains the kiva. The asymmetry of the kiva suggests that it was constructed within the larger room. The walls of the earlier room support the bench containing the pilasters. However, only the masonry basal to the later construction of the west wall of Rooms 6 and 10 typologically warrants an early masonry designation. Much of the outer kiva wall appears to be construction intermediate between the early masonry and the final kiva construction.

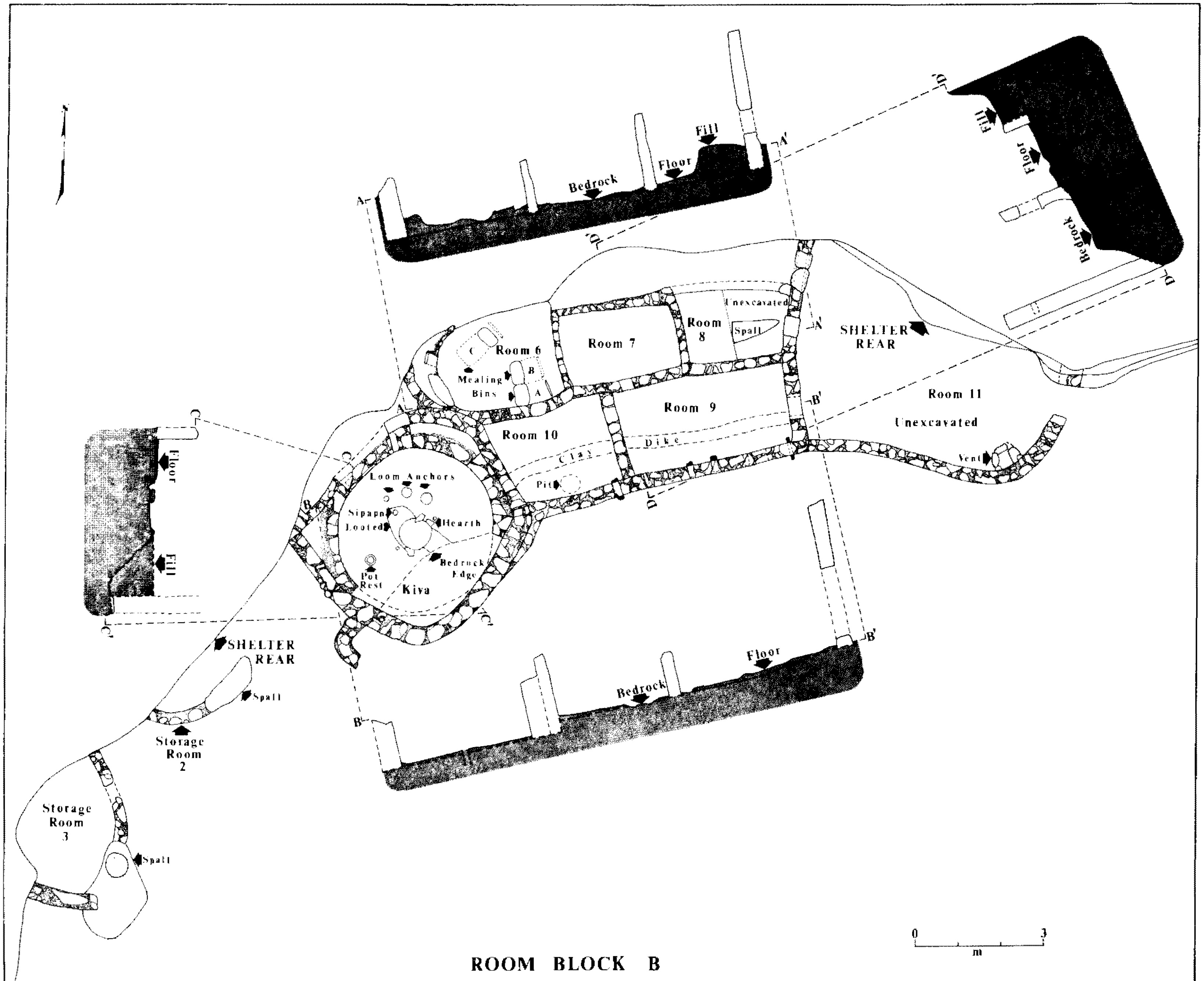


Figure 17. Room Block B Plan and Room Cross-section Map

Figure 18 West Wall of Room 10 Showing Basal, Large Early Masonry Stone Blocks

The only evidence of a floor associated with the early masonry in Room Block B is a less than one centimeter thick, reddish-tan clay on bedrock in the Room 7 area. A 5 to 10 cm thick, reddish-tan clay dike was identified on bedrock in Rooms 9 and 10. The dike is about 30 cm wide and 6.6 m in length. It occurs at the edge of the bedrock where it slopes immediately downward toward the wash below. This coincides with the dripline of the shelter in the Room Block B area. Later, post-A.D. 1147 (see Dating) construction was extended beyond the edge, filling the voids preparatory to laying the floors of Rooms 9 and 10 and the kiva. The dike may have footed early masonry construction. A three meter area at the rear-northwest corner of later Room 11 has been chipped from the shelter wall. Room 11 was not excavated except for a small sondage placed in the southeast part of the room.

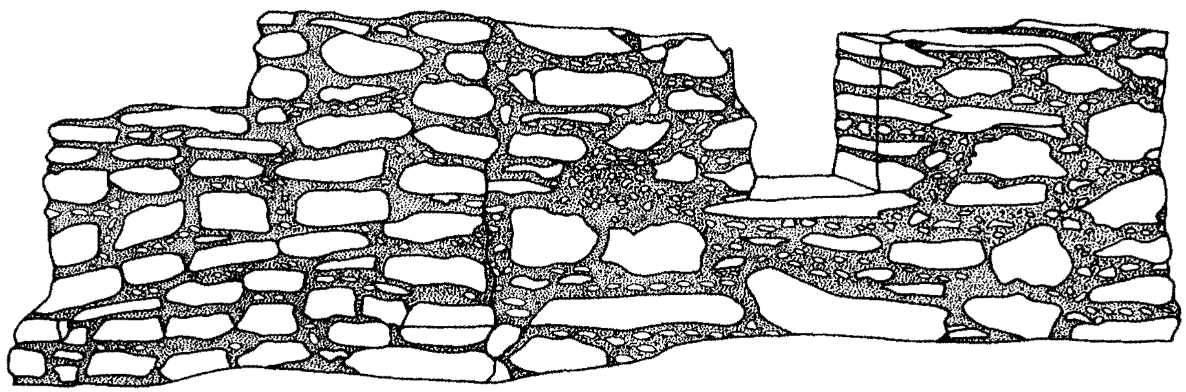
The early masonry component at Big Westwater Ruin is not directly dated. It is most certainly the product of Pueblo II times and it was probably constructed shortly after the ca A.D. 900 introduction of masonry in the region. San Juan Red Ware, a Pueblo I diagnostic (Breternitz, Rohn, and Morris 1974), occurs in both the basal deposits of the exploratory trench and the subfloor fill of the kiva. These deposits are either contemporaneous with or immediately antedate early masonry construction. Red ware has also been recovered from a dated Pueblo II context on Cedar Mesa (Dalley 1973) to the west. Its occurrence at Big Westwater provides the best estimate for an early-Pueblo II placement of the early masonry in the sequence at the site. The early masonry component seems to have been fairly short-lived. It was apparently destroyed by mid-Pueblo II times. The earliest floor associated with later Room 4 construction contains Pueblo II black-on-white ware, late-Pueblo II/early-Pueblo III Tusayan Polychrome and an early-Pueblo III (possibly McElmo Black-on-white) pottery sherd. However, the latter may be intrusive from the overlying Level A. Major destruction by fire of Westwater - Five Kiva - Ruin, three miles to the north, was identified as occurring shortly after the ca A.D. 900 appearance of corrugated pottery and, most certainly, by mid-Pueblo II times. The parallel, if not directly related, destructive events at the two ruins is particularly intriguing.

Intermediate or Middle Stage Masonry

A variety of masonry construction occurs with the mid-Pueblo II rebuilding of the site. At least two phases of construction are identified over a span of about 200 years, essentially encompassing mid-Pueblo II to early- to mid-Pueblo III times. Though the mid-Pueblo II rebuilding is not directly dated, a sizeable number of tree-ring dates ranging from A.D. 1147 to 1207 date a second phase of intermediate construction.

The rebuilding of the site, following early- to mid-Pueblo II destruction, consisted of the construction of particularly nicely shaped, well laid masonry in Room Block A (Rooms 4 and 5) and the somewhat different but carefully laid construction of Rooms 6, 7, and 8 in Room Block B. A second phase of construction occurs with the less careful addition of Rooms 9, 10, and the kiva. Room 11 was apparently constructed still later, in connection with late stage remodeling and repair. The construction of the various storage rooms on the site is problematic. The rooms are undated and the masonry is typologically quite different from the principal masonry construction. The storage rooms could have been constructed anytime during the Pueblo II or III occupations at the site.

Room Block A. Intermediate stage masonry in Room Block A is quite variable. The principal construction (Figures 19 and 20) consists of large stone blocks and flat slabs, shaped by both pecking and flaking. These are laid with a pinkish-gray (7.5YR 6.5/2) sandy clay mortar. Chinking is limited. Intermediate stage construction in Room Block A consists of contiguous masonry Rooms 4 and 5. The principal wall segments of these rooms consist of the continuous front-southwest wall of



Intermediate Stage - pinkish-gray (7.5YR 6.5/2)

Figure 19. Sketch of Intermediate Stage Construction Showing the Masonry Wall Fronting Rooms 4 and 5 in Room Block A

Figure 20 Closeup of the Masonry Construction of the Front Wall of Room 4

the two rooms, a common wall on the southeast of Room 4 (northwest in Room 5), and the rear-northeast wall of Room 5. A limited segment on the southeast which abuts the front wall of Room 5 may also be a product of the initial rebuilding. The two rooms were apparently simultaneously constructed with the addition of walls to remnant early masonry. Much of the earlier construction (Rooms 1 and 2) had been destroyed. The rebuilding of Room Block A probably correlates with Stratum Ib of the exploratory trench. The floor below Level A in Room 4 is the initial interior room deposit associated with the intermediate rebuilding stage. No such floor deposit was identified in Room 5 because of the extensive looting of the room.

Masonry Rooms 4 and 5 (Figure 14) are roughly square to rectangular. Room 4 is immediately adjacent to Room 5 on the northwest of Room Block A. The rooms share a common wall consisting of four masonry segments. These include early masonry and intermediate stage modifications and additions. The front southwest wall of the two rooms is continuous, although a portion of it has been destroyed on the northwest. The large rubble pile provides the approximate northwest to southeast dimensions of Room 4. Evidence of roofing is entirely absent. Only about half of Room 4 was excavated. A rear wall of the room was not identified. Room 5 was fully excavated.

The particularly well constructed standing front wall of the rooms (Figures 7 and 19) is straight, measuring four meters in length. The rubble pile on the northwest is about 1.7 m wide, thus the overall dimensions of Room 4 are about 3 m wide and more than 1.7 m deep to the rear. A rear wall was not identified. The dimensions of Room 5 are about 2 m deep to the rear and the width varies from 1.6 m on the northwest to 2.5 m on the southeast. The front wall of the two rooms varies from 30 to 45 cm wide. It is constructed directly on bedrock and varies from 1.3 to 1.5 m high. The wall in the south corner of Room 4 contains a large slab, 50 cm in length, which forms the base or sill for a window at the front of the room. The right side (entering Room 4) of a keyhole entryway is all that remains on the northwest. The size of the entryway cannot be estimated. The keyhole widens about 60 cm, 45 cm above the base of the wall. A window measuring 35 cm wide is also in the approximate center of the wall at the front of Room 5. It is 58 cm deep below the top of the wall. A large stone slab at the base serves as the sill. The windows of Room Block A are entirely unlike those of Room Block B, which are generally of much smaller stone and they are more rounded.

The front wall of the two rooms is constructed using large, rectangular stone blocks and slabs, some in excess of 50 cm in length, 30 to 40 cm wide, and 10 cm thick (Figures 19 and 20). The slabs have been shaped by both pecking and flaking. Generally, the stone becomes slightly smaller towards the top and chinking is limited. The stone has been very carefully set in a mortar which varies from a pinkish-gray (7.5YR 6.5/2) to salmon or yellowish-red (5YR 5.5/4) sandy clay. The mortar is slightly darker and more reddish towards the top of the wall. The ratio of stone to mortar varies from about 7.5:1 in the lower half of the wall to about 5:1 towards the top. The Room 4 portion of the wall contains the better shaped stone with less chinking. Plastering of the wall in either room is not evident. The front wall of the two rooms tilts slightly forward toward the front of the shelter, particularly on the southeast. The front wall construction is very similar to that of the rear segment of the common wall of the two rooms, the front segment of the southeast wall, and the rear wall of Room 5. This construction is unlike that anywhere on the site.

The segmented wall (Figures 15 and 21) common to the two rooms is incurvate (from Room 5) and consists of four differing constructions. The rear one meter segment is similar to the front wall of the room block. It is abutted on the southwest by the limited 20 cm wide segment interpreted as possible early masonry. The early masonry segment stands 1.3 m high above bedrock and it has been fractured on the southeast. The third segment from the northeast is 30 cm in length and 20 cm wide. The front, southwesternmost segment which abuts the front wall, is 65 cm in length and about 20 cm wide. The construction of

Figure 21 The Interior of Room 4 Showing the Wall Common to Room 5 (Front Wall Section is on Right)

the two forward segments is somewhat different than elsewhere in the room block. The stone is unshaped, much smaller, and less carefully laid. The mortar is a salmon-pink sandy clay. The ratio of stone to mortar is aout 2.5:1. A moderate amount of chinking occurs. Plastering of the wall segments is not evident. The basal, approximately 30 cm of the southernmost segment was loosened and fragmented with some masonry absent.

The identification of an entryway to Room 4 and only a window to Room 5 may indicate that originally entry was possible to the latter from Room 4. This may have been through an opening eventually plugged by the central wall segment. This may have been done to confine turkeys during Pueblo III times.

The southeast wall of Room 5, which adjoins the front wall in the south corner of the room, consists of two segments. The front one meter long segment is a continuation of the uniquely shaped, carefully laid masonry construction except near the top where some amorphous shaped rock and moderate chinking occurs.

It abuts the rear, truncated two meter segment. A one meter section of the wall is missing on the northeast. Bedrock beneath and outside of the southeast wall slopes upward about 25 degrees towards the northeast and rear of the shelter. Much of the bedrock has been removed in leveling to accommodate the floor of Room 5. Considerable loose rubble is present immediately beyond the east corner of the room.

The relatively straight, but angular, rear wall of Room 5 consists of two segments. The northwestern 1.5 meter segment is similar to that at the front of the room block. However, some unshaped stone and limited chinking occurs toward the top of the wall. The segment was apparently constructed following the rear segment of the common wall. It is truncated on the southeast where is abuts an approximately 20 cm wide segment interpreted as early masonry. This very limited segment is only about 35 cm in length and it is at a right angle to the other two segments of the rear wall of the room. The segment is only about 40 cm high above bedrock which begins to slope upward to the east. The southeasternmost segment of the rear wall of the room consists of only a few stones laid in mortar directly on bedrock.

The fills of Rooms 4 and 5 are entirely different. This is apparently because the latter had been almost entirely looted. Room 5 contained a fragmentary, two to three centimeter thick, hard-packed gray clay directly on bedrock. This is interpreted as the floor associated with the early masonry component. A mixed, loosely consolidated, nine centimeter thick deposit of small stones, daub, and tan, eolian sand, directly on the floor, is differentiated from a 60 cm thick covering fill deposit containing large slabs and rock. The latter most certainly relates to the most recent ca A.D. 1960 period of looting because of modern debris recovered from the fill. The large slabs were no doubt derived from the vandalism which occurred in conjunction with the looting. The intermediate nine centimeter thick deposit is at the level of an expected floor associated with the intermediate stage masonry. However, no such floor was identified. Pottery from undifferentiated Room 5 fill covers the full spectrum of site development. This includes Deadman's Black-on-red, possible Cortez Black-onwhite, and Mancos, McElmo, and Mesa Verde Black-on-white wares.

A basal 13 to 19 cm thick salmon-red sandy clay floor is associated with the intermediate or middle stage masonry construction of Room 4. The thickness of the deposit increases to the southwest. It contains limited amounts of charcoal and burned sticks. The deposit was virtually undisturbed, except for a small portion in the south corner of the room. Cortez/Mancos Black-on-white pottery was recovered from the floor deposit. The identification of Tusayan Polychrome correlates with Stratum Ib of the exploratory trench. The single McElmo Black-on-white sherd is likely intrusive from overlying Level A. A hearth and four pits originate from either atop or within the floor deposit (Figure 22).

Figure 22 Pits 2, 3, and 4 which Originate from the Top of the Floor Associated with the Intermediate Stage Masonry Room 4. The Clay Lining of Pit 1, which Originates from within the Floor Deposit is in the Bottom of Pit 4. the Hearth is not Shown.

The hearth originates from the approximate middle of the deposit, about seven centimeters below the top of the floor. No distinct surface assocated with the hearth was identified within the deposit. This may indicate that the occupation associated with the hearth was fairly brief. The center of the hearth is in the northernmost corner of the Room 4 excavation, about two meters northeast of the front wall of Room 4. It is circular, about 70 cm in diameter. The hearth is basin-shaped in cross section and it is seven centimeters deep at the center. The fill of the hearth consists of a basal, five centimeter thick black ash which underlies a two centimeter thick extremely white ash. The fill is capped by a sterile salmonred sand which constitutes the upper half of the floor deposit. The basin of the hearth is fire-reddened and -hardened. No pottery was recovered from the fill of the hearth.

A small, circular ash pit (undesignated and not shown in Figure 14) is apparently contemporaneous with the hearth. The center of the pit is 75 cm from the wall common to Rooms 4 and 5 and about 1.3 m from the front wall of the room. It is immediately adjacent to and northwest of rectangular Pit 1. The ash pit is 50 cm in diameter and 5 cm deep. The fill consists of a five centimeter thick, powdery, whittish-gray ash. The pit basin has been fire-reddened and -hardened. About 10 cm of the southern part of the pit has been truncated by overlying Pit 4. The latter originates from the top of the floor deposit. No pottery was recovered from the fill of the pit.

Pit 1 is a rectangular pit originating from within the floor deposit (Figure 23). It is oriented northeast to southwest, with the center 1.3 m from the common wall on the southeast and 70 cm from the front wall of the room. The pit, at the top, is 57 cm in length and 39 cm wide. It is 39 and 21 cm at the bottom. The rectangular pit has rounded corners and it

Figure 23 Closeup of Pit 1 which Originates from within the Floor Deposit Associated with the Intermediate Stage Masonry of Room 4. The Pit is Truncated on the Right by the Overlying Pit 4.

is lined with a 50 mm thick, extremely durable, hard-packed white clay plaster. The approximate southwestern-third of the pit is truncated by Pit 4 which originates from the top of the floor deposit. Pit fill consisted of salmon-red clay daub partly capped by a greenish-gray, granular deposit apparently derived elsewhere from bedrock, and partly by the salmon-red floor deposit. No pottery was recovered from the fill.

Pits 2, 3, and 4 originate from the top of the floor deposit. Pit 2 is circular, measuring 40 cm in diameter and 19 cm deep. The center of the pit is 35 cm north of the south corner of the room. Pit 3 is circular, measuring 35 cm in diameter and 25 cm deep. The center of the pit is 55 cm northwest of the center of Pit 2. Pit 4 is circular, measuring 41 cm in diameter and 21 cm deep. The center of the pit is 1.25 m from the common wall of the two rooms and 65 cm from the front wall of Room 4. It truncates the southwestern third of the underlying Pit 1. The three pits have relatively straight sides. Digging stick marks or grooves remain from their original construction. A stone slab is set in the bottom of Pit 3. The fills of the three pits vary. Pits 2 and 3 contained the dark grayish-sand of overlying Level A, but with some turkey feces. It is likely the two pits were looted as the only evident disturbance to Room 4 deposits occurs in the south corner of the room. Unidentified corrugated pottery was recovered from the fill of Pit 3. The fill of Pit 4 consisted of loose salmon-red sterile sand. This was capped by the hard-packed dark gray sand of Level A. A post hole was identified 70 cm north-northeast of Pit 4. It originates from the top of the floor deposit. The post hole is 12 centimeters in diameter and three centimeters deep.

The hearth, ash pit, and Pit 1 are temporally distinct from the three Pits 2, 3, and 4. The functions of the pits, except the hearth and ash pit, are not understood. The construction of the mid- to late-Pueblo II intermediate stage masonry of Room Block A is associated with the salmon-red sandy clay floor deposit of Room 4. It is possible that while the hearth, ash pit, and Pit 1 are associated with the initial construction, Pits 2, 3, and 4 may be the product of an early-Pueblo III, second phase of intermediate stage construction more apparent in Room Block B. This entailed the additions of Rooms 9 and 10. It seems that the function of Room 4 changed by or shortly after the onset of Pueblo III times as no hearth was identified in the room during the second phase.

Room 4, and presumably Room 5, continued in use through several depositional Levels (A-C) to at least mid-Pueblo III times. Level A directly overlies the salmon-red sandy clay floor associated with the intermediate stage masonry. It is a compact, dark gray sand with charcoal ash, and small sticks. The limited occurrence of turkey feces is probably intrusive from overlying Level B. The Level A deposit varies in thickness from two to eight centimeters. It was not identified in the south corner of the room where deposits were disturbed. Possible McElmo Black-on-white pottery was recovered dating the deposit to early- to mid-Pueblo III. The deposit is apparently the product of the Room 4 occupation, as well as the debris of the early- to mid-Pueblo III site destruction (Figure 9). This correlates with Strata III and IV, respectively, of the exploratory trench.

Level B directly overlies Level A. It is a one to five centimeter thick deposit of matted, light brown eolian sand, turkey feces, and small sticks. Mesa Verde Black-on-white pottery was recovered from the deposit. It has been disturbed in the south corner of the room. The deposit, with Stratum V of the exploratory trench, represents a major shift in the function of at least Room 4 and the area immediately southeast of Room Block A. The two turkey fecal bearing deposits (Level B and Stratum V) immediately post-date evident site destruction associated with Level A in Room 4 and Stratum IV in the exploratory trench.

Level C directly overlies Level B. It is a two centimeter thick, dark brown, matted turkey feces and vegetal material which includes juniper bark. The separation from the underlying Level B is quite distinctive. It is continuous everywhere throughout the excavation except where it has been disturbed in the south corner of the room. No pottery was recovered from the deposit. It directly underlies post-occupational debris, hence Level C is the final occupational component of Room 4. The deposit correlates with Stratum V of the exploratory trench. The significance, if any, of the variation of light to dark turkey fecal matter of Levels B and C, respectively, is unknown. It could represent changes in the diet of the turkeys and the manner in which they were kept, or it merely may be a function of preservation. The pollen analysis of the two turkey fecal deposits shows little deference except for the appearance of *Populus* pollen in Level C. (See Pollen Analysis of Big Westwater Site Deposits.)

Grayish-tan eolian sand, containing rodent feces overlies Level C. The deposit averages about 15 cm thick. It represents the initial post-occupational component. The deposit is equated with Stratum VI of the exploratory trench. Similarly, as seen in Stratum VII of the trench, a deposit of coarse rock, stone slabs, and daub, about 30 cm thick, caps Room 4 fill. Both are associated with modern looting and vandalism. Pottery recovered from the post-occupational fill of the room includes Mancos, McElmo, and Mesa Verde Black-on-white and Mesa Verde Corrugated.

Room Block B. Intermediate or middle stage masonry in Room Block B consists of masonry Rooms 6, 7, and 8, along the rear wall of the shelter, followed by the additions of Rooms 9 and 10 at the front of the room block. The six-sided outside wall of the kiva antedates these rooms. However, whether the kiva, as such, was added or remodeled with the construction of the latter rooms cannot be determined. The construction of what is essentially two sets of rooms is quite different. Rooms 6, 7, and 8 use, as a footing, the large stone blocks and slabs of the early masonry component. The intermediate masonry construction, atop the earlier large stone blocks, is somewhat variable, but in general, it is carefully laid using shaped stone and a consistent, fairly coarse and gritty, pink to light brown (7.5YR 6.5/4) to reddish-brown (5YR 5/4) sandy clay mortar (Figure 24). Much of the stone has been shaped by flaking and the construction contains some chinking. Subsequent late stage modifications and repair of Rooms 6, 7, and 8 involved the use of variable stone (shaped and unshaped) and light gray (10YR 7/2) and yellowish-red (5YR 4.5/6) to reddish-brown (5YR 5/4) sandy clay mortar (Figures 25 and 26). Light to heavy amounts of chinking occur.

The outside wall of the kiva provides evidence of three stages of construction. However, an additional episode of destruction not seen elsewhere on the site may have occurred. Early masonry was identified at the base of the northeast and east-northeast wall segments. Following the early- to mid-Pueblo II conflagration, the intermediate stage of rebuilding and construction is evident in the six-sided outside wall of the kiva. The masonry is much like that of the lower portions of the walls of Rooms 9 and 10. Both shaped and unshaped stone was used with moderate chinking. The mortar is a brown (7.5YR 5/2) sandy clay. The masonry has been burned. The burning of the outside wall of the kiva likely occurred by early-Pueblo III times. The third phase consisted of the addition of the kiva using masonry much like that of the preceding phase. In general, both shaped and unshaped stone was used with moderate chinking. The mortar is a pink to light reddish-brown (5YR 6.5/3.5) sandy clay (Figure 27). Still later repair at the rear of the kiva below the bench consists, in places, of the selected use of small, naturally shaped stone, carefully laid, using a light reddish-brown (5YR 6/4) sandy clay mortar. Chinking is very limited. The careful repair is unlike the later shoddy remodeling and repair elsewhere. The kiva was once again destroyed by fire during early- to mid-Pueblo III times. This correlates with the evidence in both room blocks, however, evidently only the kiva was burned. The last phase of construction, in which the kiva walls were plastered with a yellowish-red (5YR 5/6) clay, probably coincides with the mid- to late-Pueblo III rebuilding of the site.

The addition of Rooms 9 and 10 at the front of the room block consists of the use of large to medium size stone, both shaped and unshaped, with a pink to light brown (7.5YR 6.5/4) mortar and limited chinking. Subsequent later remodeling and repair of these rooms (Figure 25) involved less careful construction using unshaped stone and rock set in a light gray (10YR 7/2) mortar. Chinking is very heavy. Uppermost, the stone was set in a reddish-brown (5YR 4/4) and yellowish-red (5YR 4.5/6) mortar. Chinking is spotty.

Rooms 6, 7, and 8 constitute the initial intermediate stage construction in Room Block B, following the six-sided, outside kiva wall. The principal wall segments of these rooms (Figure 17) include the construction from the rear of the shelter, of the curving west and south (front) wall of Room 6. The wall is

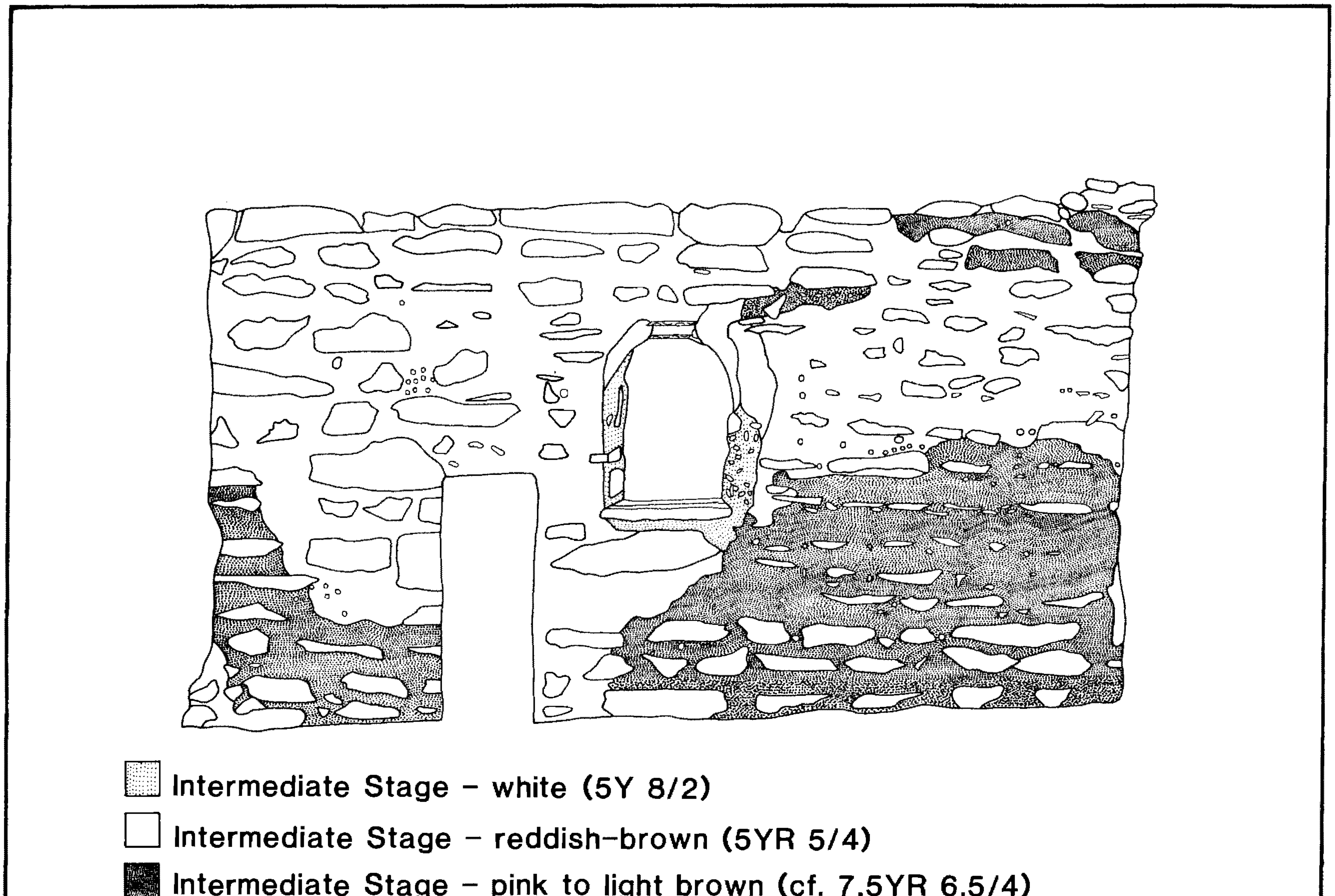


Figure 24. Sketch of Intermediate Stage Construction Showing the Front Wall of Room 7 in Room Block B

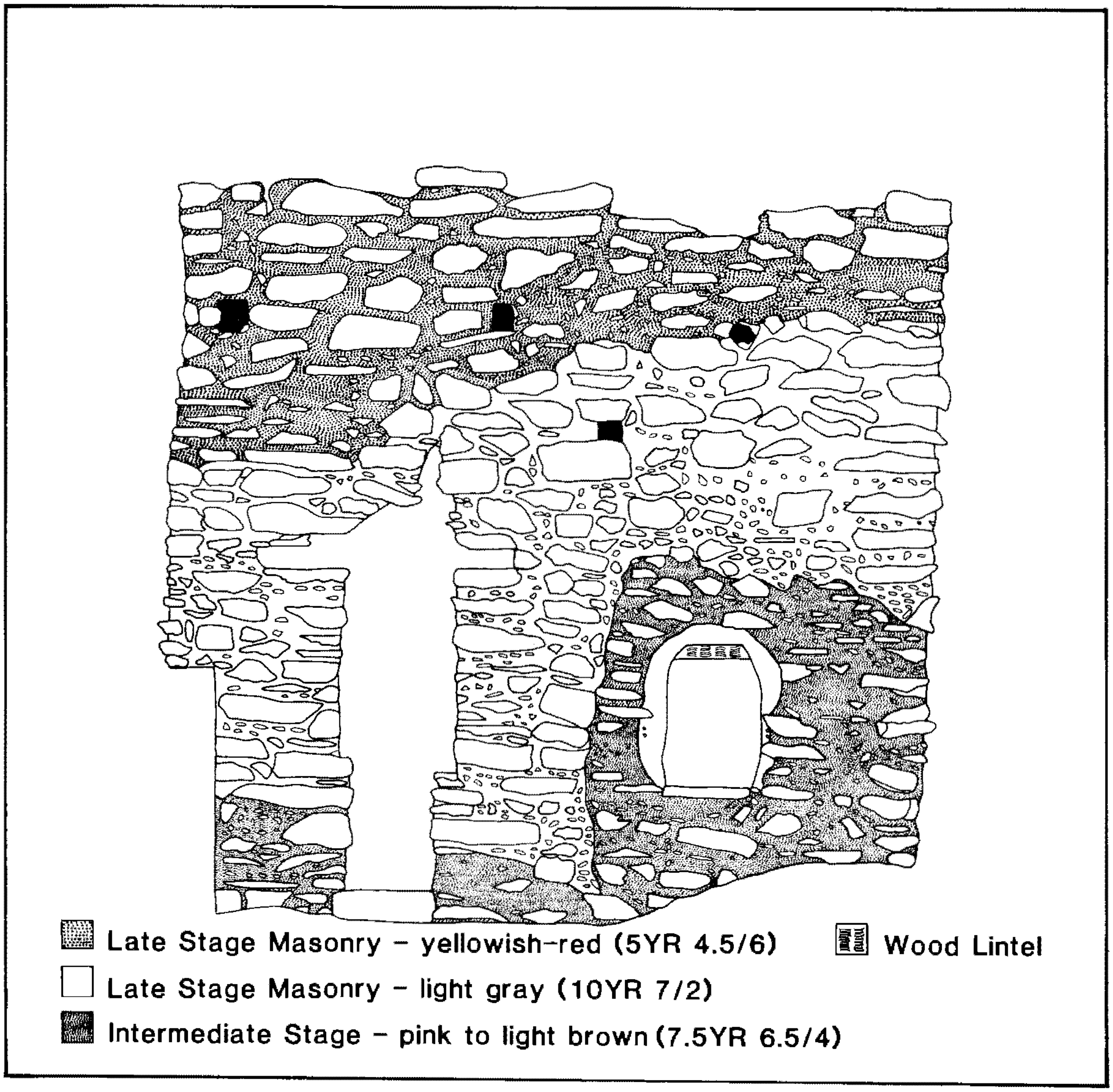


Figure 25 Sketch of Intermediate and Late Stage Construction Showing the East Wall of Rooms 8 and 9 in Room Block B. The Darkened Areas in The Upper Part of the Wall are Observation Ports and Not Associated with Roof Construction

Figure 26 East Wall of Rooms 8 and 9 in Room Block B Showing Intermediate and Late Stage Construction (see Figure 25)

flush against the outside kiva wall on the southwest. The east wall of Room 6 was then added followed by the walls of Room 7. The walls of Room 8 were added to Room 7. Although the front wall constructions of the rooms are similar and contrast with both the dividing and rear walls of the rooms, the three were constructed as a unit. The front walls (Figure 28) and the east wall of Room 8 are much thicker (25-35 cm wide) with larger stone slabs than elsewhere. These walls probably served as the front of the room block until Rooms 9 and 10 were eventually added. The remaining walls vary from 15 to 20 cm wide, excepting the rear wall in the northeast corner of Room 7 where it widens to nearly 40 cm. The added strength at this location may have been necessary because of the water seepage from the rear of the shelter (see Table I).

The height of the front wall of the rooms is about 1.75 m above bedrock. This roughly corresponds to the height of the

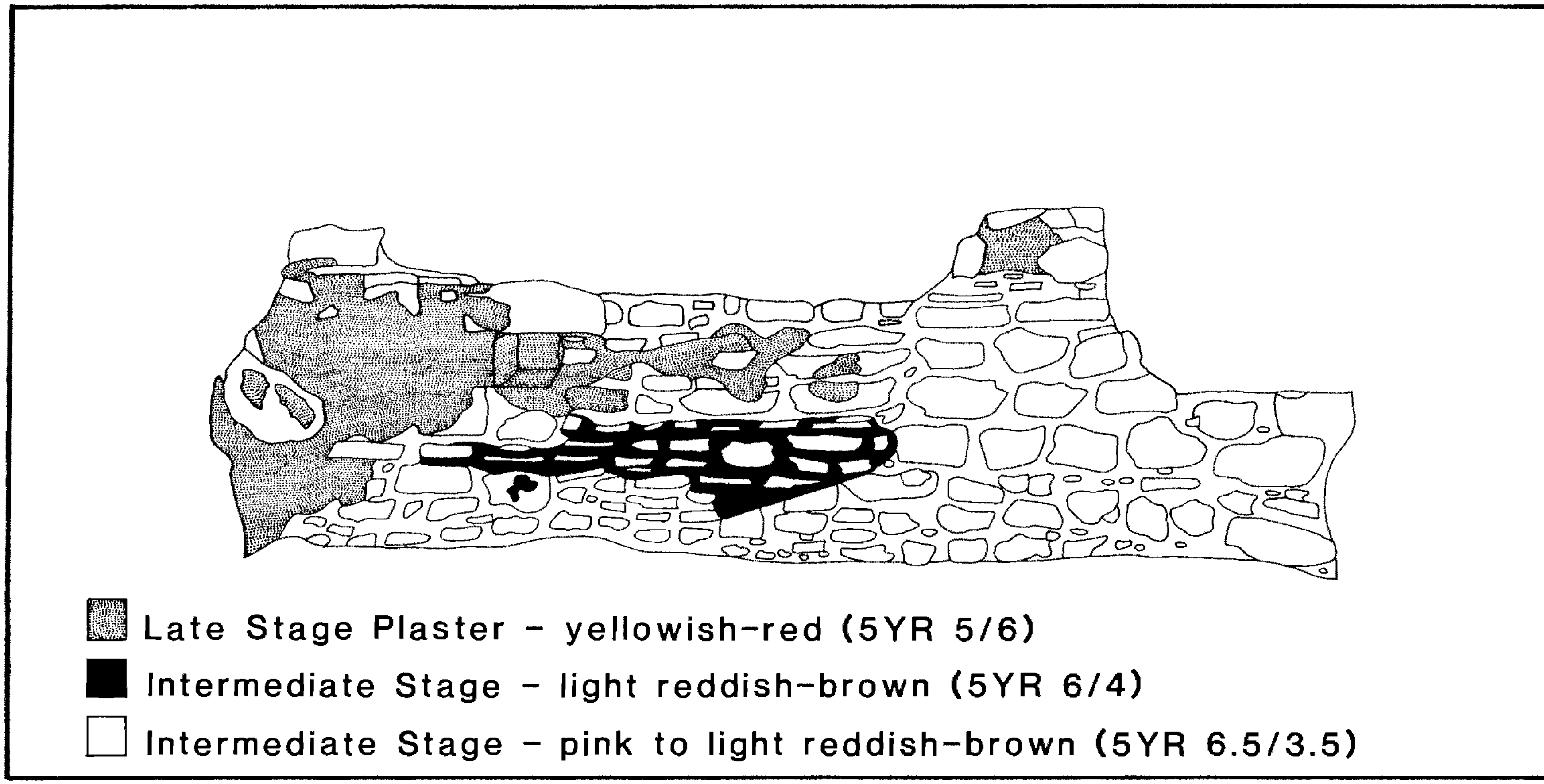


Figure 27. Sketch of Intermediate and Late Stage Construction Showing the Wall at the Rear of the Kiva

Figure 28 Wall Detail of the South Wall of Room 6 (note punctate markings)

roof beam butts in the wall fronting Rooms 9 and 10 (see Figures 17 and 49). The height of the interior, dividing walls are similar except for the wall common to Rooms 6 and 7 which is only 1.25 m. This is apparently due to vandalism. The rear walls of the rooms (7 and 8) are only approximately 60 cm high and there is no evidence of vandalism. It is probable that entry to Rooms 7 and 8 was through a doorway in the east wall to the rear of Room 8. This doorway is 90 cm wide from the outside, northeast corner of Room 8 to the rear wall of the shelter. Masonry is on the shelter wall toward the top where it slopes to the rear. Lintel impressions are in the masonry of both the outside corner of Room 8 and the masonry on the shelter wall. The lintels consisted of two sticks, 1.4 m long, set about 25 cm apart. The lintels are about two meters above the two large stone slabs set in the base of the doorway. The height of the doorway is much greater than the doorway to Room 9.

Access to Room 6 was through an entry or window in the front wall of the room. This entry is 50 cm wide at the top and 1.05 m from the top of the wall to the base. It may have been keyhole-shaped similar to the entries to Rooms 4 and 5 in Room Block A. The lower-third was 30 cm wide. This part of the entry was then plugged with a large, flat slab at the top of the keyhole construction, leaving an 80 cm high window at the top. This window was eventually plugged with small stones and daub. Much of the lower plug of the original entryway had sloughed leaving a large hole in the masonry in this part of the wall.

Windows are also in the front and east walls of Rooms 7 and 8 respectively. The window in the Room 7 wall (Figure 29) is 40 cm wide and 55 cm high. Similar to the lintels above the doorway at the rear of the room block, two sticks are set in mortar at the front and rear at the top of the window. A large

Figure 29 Window Detail in South Wall of Room 7 (from Room 9) (see Figure 24)

Figure 30 Room 7 Excavated Showing Sectioned Floor from Ledge Above

slab forms the sill at the base. Mortar has been placed in the interior along one of the sides of the window to accommodate a large, upright slab as a window cover. The remnants of two *Yucca* sp. loops are on the face of the wall at each side of the window. This would allow the insertion of a large stick through the loops to hold the slab in place. The window in the east wall of Room 8 is similarly constructed but, with one large stick for the lintel. A large, flat slab forms the sill, mortar is packed around the interior of the sides of the window, and *Yucca* sp. loop remnants are also present. The window is 57 cm high and 43 cm wide. Both windows are much differently constructed than those in Room Block A. the latter are of coarse stone blocks set using little mortar. The Room Block B windows are somewhat rounded using relatively small stone set in abundant mortar.

Room 6 is an inverted, D-shaped room, while Rooms 7 (Figure 30) and 8 (Figure 31) are roughly rectangular. Room 6 is 3.3 m

Figure 31 Room 8 from the Rear of the Shelter, Showing Rock Spall in situ

(maximum) wide and 2.25 m deep to the rear of the shelter. Room 7 is 2.7 m wide and 1.6 m to the rear. Room 8 is 2.5 m (average) wide and 1.7 m to the rear. Rooms 6 and 7 were fully excavated. Only the west-half of Room 8 was excavated because of a large rock spall within and atop the fill of the room.

The floors and fills of the three rooms are variable. This is in part due to looting, but also to differences in function. Room 6 contains several fragmentary mealing bins which are set in a sterile, 15 cm thick, gray sand containing pebbles. The top of the bins are intrusive from a red sandy clay floor which was laid atop the early masonry. Hence, the floor was in place before the intermediate stage masonry walls of Room 6 were constructed. The floor, like the mealing bins, is extremely fragmented. No pottery was recovered in contact with the floor fragments. Two floors, which were heavily fragmented due to looting, were itentified in Room 7. The lower floor consisted of a very thin red clay directly on bedrock. A gray compacted sand, with small pebbles and vegetal material about five centimeter thick, was atop the lower floor. Uppermost, another fill unit, five centimeter thick, consisted of a matting of juniper bark, wood, twigs, corncobs and unidentified pottery. The upper floor was laid directly on the upper fill unit. This consisted of a four centimeter thick compacted gray sand with pebbles and vegetal material. McElmo/Mesa Verde Black-on-white and Mesa Verde Corrugated pottery was recovered from the floor. No floor was identified in Room 8. The fill in the excavated west half of the room was entirely disturbed and historic debris was encountered throughout and on bedrock.

The fills of the three rooms consisted principally of red sand containing vegetal material, unburned daub, rodent feces, and pottery. The fill of Room 7 contained both Pueblo II and III pottery types, otherwise only Pueblo III pottery was recovered from the remaining two rooms. Some looting was evident in the fills of all rooms.

Only Room 6 contained interior features. These include a bench with a wall niche and three fragmentary mealing bins. The bench is an arch cut into bedrock and the rear wall of the shelter on the west side of the room. It is about 50 cm wide (maximum) and roughly 20 cm high above bedrock. The construction consists of masonry at the rear, bedrock in the center, and a large in situ spall which has been shaped toward the front. The wall niche is constructed of masonry and partially hewn from bedrock. It is 25 cm wide, 25 cm deep to the rear, and 25 cm high. It is open at the top. It is impossible to determine the function of the bench or if it was originally a part of an earlier structure. If it was a feature of an earlier kiva, the orientation would have been approximately west-northwest to east-southeast. This presumes both symmetry and an axis from the niche through the center of the structure. Other diagnostics, characteristic of kivas, are absent but floor features, such as a fire hearth and sipapu, may have been obliterated with the construction of the mealing bins.

The three mealing bins (Figure 32) originate from the top of the clay floor about 15 cm above bedrock. The base of the bins have been excavated about five centimeters into bedrock. Bins A and B on the south are contiguous. They are oriented east to west with the basins on the west. Bin C is in the northwest part of the room. The bin is oriented southwest to northeast with the basin on the northeast. The bins vary from 80 cm to 1.1 m in length and average about 55 cm wide. They are constructed with upright slabs at the ends opposite the grinding surfaces. Flat slabs were placed in clay in the basins. All are fragmentary and the metates were removed. The grinding surfaces were constructed on about a 45^{o} incline. The basins are 15 to 20 cm deep below the floor of the room.

Rooms 9 and 10 were constructed following those (6, 7, and 8) at the rear of the shelter and the outside wall of the kiva. Rooms 9 and 10 are at the front of Room Block B. The addition of these rooms is interpreted as a second phase of intermediate stage masonry construction. The kiva, as such, was probably constructed coincident with Rooms 9 and 10. The

Figure 32 Remnants of Mealing Bins in Room 6

principal wall segments of the two rooms (Figure 17) consist of the continuous front and east walls which abut the outside kiva wall on the west and the outside, southeast corner of Room 8 on the northeast respectively. The dividing, interior wall, common to the two rooms abuts the south wall of Room 7 near and west of the window. The northeast, outside wall of the kiva serves as the west wall of Room 10. The basal construction of the continuous front and east wall of the rooms is similar to the east wall of Room 8. The roughly upper three-fourths of the wall was destroyed and rebuilt during the mid- to late-Pueblo III late stage reconstruction.

The front and east wall of the rooms varies from 30 to 40 cm wide. The dividing, interior wall is about 25 cm wide. the latter averages about one meter high, but it was probably closer to two meters before it was vandalized. Also a lower portion of the wall beyond the edge of the bedrock had sloughed, probably when subfloor deposits were partially looted. The upper portion of the front wall of Room 10 had been destroyed and three large holes occur in the wall in Room 9. One is at the base of the wall and two are at the level of the roof. These are probably the result of vandalism. However, the outside base of the wall had also begun to erode, endangering the entire room block. The front wall of the rooms varies from 3.5 m on the east to about 2 m on the west (Room 10) where the latter has been vandalized. However, the front and east wall was probably only about 1.75 m to 2 m high above bedrock during the intermediate stage. This is consistent with interior wall heights in the room block and the placement of the roof beams (see Figure 49 and Dating). Six roof beam butts occur in the front wall and two additional beam "molds" were identified. The beams were placed exclusively north to south. Evidence of beams in the east wall of the room block is entirely absent. Seven beams supported the roof over Room 9 (and presumably Room 8 and the eastern two-thirds of

Figure 33 Room 9 Looking Southeast toward Entry

Room 7) and six or seven beams would have been placed over Room 10 (and Room 6 and the western third of Room 7). The beams average about 15 cm in diameter and they are spaced from 55 to 65 cm. The height of the roof above the floors of the rooms was about 1.75 m. Tree-ring dating of various beam samples from the room block indicate a probable early-Pueblo III construction of the roof. The front and interior wall constructions post-date A.D. 1147 (see Figure 38 and Dating).

A keyhole-shaped doorway in the east wall (Figure 33) provided entry to Room 9. The doorway is 45 cm wide at the bottom and 60 cm wide at the top. The construction occurs about 75 cm above a large stone which served as a footing at the base. The lintel is missing and the masonry in a portion of the wall above the doorway has been destroyed. The lintel appears to have consisted of two, 2.5 cm in diameter sticks. The overall height of the doorway is estimated as 1.6 m. The doorway was

Figure 34 Plugged Entry in West Wall of Room 10

apparently constructed during the intermediate stage and was then partially destroyed. It was rebuilt during the late stage remodeling and repair.

An additional doorway associated with intermediate stage masonry is in the west wall of Room 10 (Figure 34). It was eventually plugged. The masonry plug is backed on the kiva side of the wall by the northeast pilaster. The doorway provides the evidence of a structure, predating the kiva, which was initially constructed during the early masonry stage construction and then modified. The kiva, as such, was probably then constructed during the second phase of intermediate stage construction. The doorway is 47 cm wide and 96 cm high. The base consists of a large stone slab about 50 cm above bedrock.

Rooms 9 (Figure 35) and 10 (Figure 36) are roughly rectangular. Room 9 is nearly 4 m east to west and 2.1 m deep to the rear. Room 10 averages 2.7 m east to west and 2.1 m deep.

Figure 35 Room 9 from Rear of Shelter.

Figure 36 Room 10 Looking West toward Kiva

Both rooms were fully excavated and were found to be extensively disturbed. Looters had overlooked an almost fully restorable Mesa Verde Corrugated vessel in the subfloor fill of Room 10. The rim was partially destroyed. Floor destruction in both rooms was nearly complete. Room 9 contained two fragmentary floors. The lower floor is a two to three centimeter thick, tan, sandy clay directly on bedrock. Associations are unclear, but it may be associated with the early masonry component. The upper floor is a two centimeter thick, tan, sandy clay. A seven centimeter fill unit, consisting of tan, clayey sand with vegetal material separates the two floors. The upper floor was apparently extended beyond the bedrock edge of the shelter to the front walls of the rooms. The floor was laid over deliberately placed fill about 50 cm deep and 15 to 30 cm wide along the nearly total length of the wall. It consisted principally of coarse plant materials including *Artemisia* sp. (probably *A. tridentata*) and juniper bark, in a matrix of loose reddish-tan sand. The higher *Artemisia* pollen counts were derived from early-Pueblo III deposits. This supports the attempted correlation between the masonry construction and site deposits. An extremely large (about 35 cm in diameter), partially burned timber was recovered from the base of the subfloor fill and lying directly beneath the interior, common wall of the two rooms (Figure 37). The Mesa Verde Corrugated vessel (Figures 38 and 67) was recovered from the subfloor fill of Room 10. The vessel was enshrouded with a *Yucca* sp. lace network, presumably for carrying. The vessel was in loose fill and was probably intended, during late use, to remain in place. Room 10 also contained two floors and similarly composed fill. No pottery was recovered in contact with the badly disturbed floors of the rooms. Pottery recovered from both the general and subfloor fills of Room 9 was limited to Pueblo III ceramics. The fills of Room 10 contained both Pueblo II and III ceramics. The occurrence of Pueblo II pottery in the subfloor fill of Room 10, but not Room 9, probably is the result

Figure 37 Dated (A.D. 1147) Timber in Subfloor Fill of Rooms 9 and 10 (see Dating)

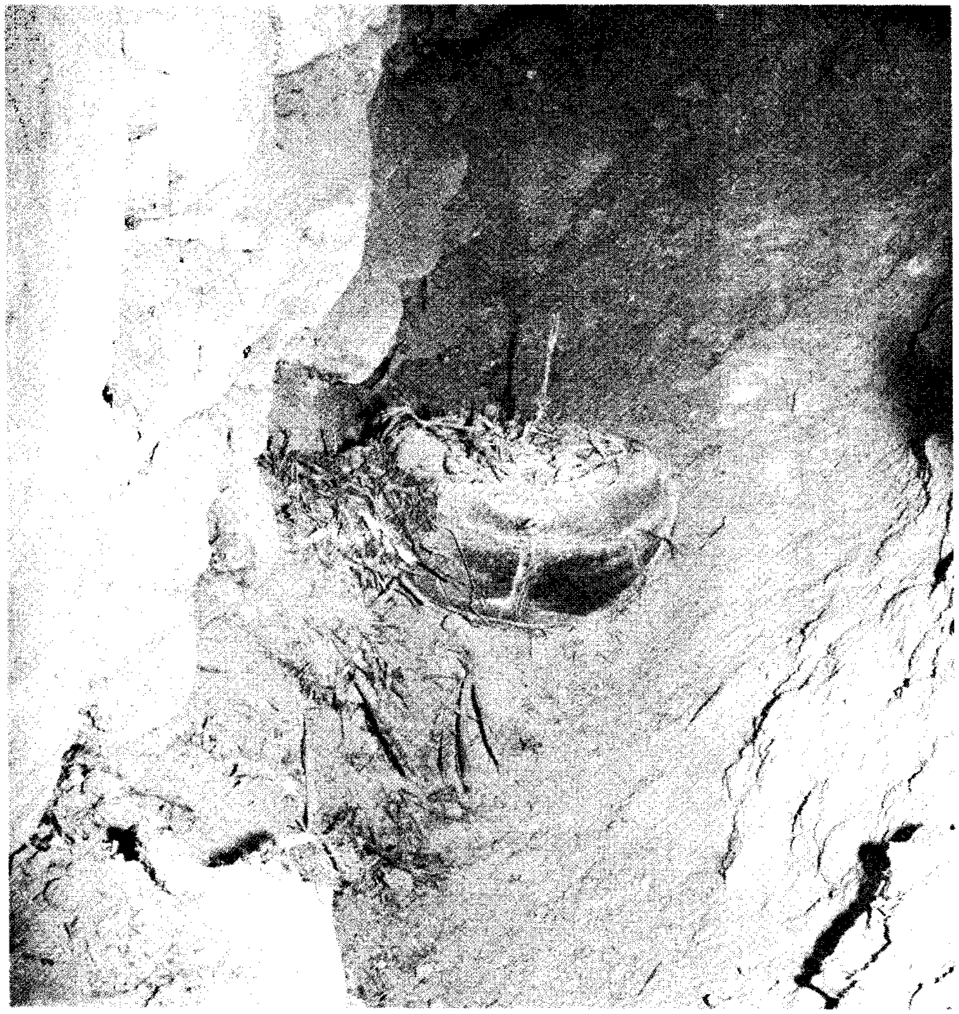


Figure 38 Mesa Verde Corrugated Vessel in situ in the Subfloor Fill of Room 10 (see reconstructed vessel, Figure 67)

of differential selection of deposition to fill the voids below the floors of the two rooms. A Tusayan Polychrome pottery sherd from the subfloor fill of Room 10 suggests that the upper floor was probably laid during early-Pueblo III times. This is consistent with the A.D. 1147 dated timber below the interior wall of the room.

Kiva. The outside six-sided wall of the kiva (Figure 17) was, at least in part, constructed atop early masonry. Large stone slabs and blocks form the base of the wall on the north and northeast (observed from Rooms 6 and 7 respectively). Elsewhere however, much of the masonry that is visible appears to be a product of the intermediate stage. The north and east portions of the wall, above the early masonry, were in place when Room 6 was constructed, thus indicating mid- to late-Pueblo II origins for the original structure. It is impossible to determine if an earlier kiva was contained within the structure prior to early-Pueblo III times. The plugged entry from Room 10, now backed by the northeast pilaster, may suggest that the kiva was a fairly recent (early-Pueblo III) addition. A side entry to the kiva would be rather unusual, however, rockshelters are notorious for the construction of typologically unusual features (cf. Rohn 1977).

The six-sided room (Figure 39) varies from 4 to 4.5 m in diameter. Corners are both rounded and approximately square. The rear wall of the room is built near, but not flush against the rear wall of the shelter. The wall on the north is rounded, while elsewhere they tend to be straight. Portions of the wall, on the northwest and south were destroyed. However, a basal course of stone allows reconstruction. Wall thickness varies from about 25 to 50 cm. The greater width was maintained beyond the dripline of the shelter. Wall heights vary considerably, but this is due to late stage remodeling and repair as well as subsequent vandalism. It is likely that a wall height of 1.75 to 2 m was maintained during intermediate stage construction. This is consistent with the walls else-

Figure 39 Kiva Location Looking Toward the Rear of the Shelter, Showing Section of Outside Wall Associated with Intermediate Stage Construction (east pilaster in center

where constructed during the period in Room Block B. Later (mid- to late-Pueblo III) remodeling, extended the walls of the structure an additional 1.5 to 1.75 m, to an overall height of 3.5 to 4 m above bedrock.

The kiva, as such, was constructed by early-Pueblo III, either coincident with or following the additions of Rooms 9 and 10 in the room block. It appears to have been burned prior to pilaster construction and again during the postulated mid-Pueblo III site destruction. Three tree-ring dates (A.D. 1150, 1171, and 1194) derived from timber specimens recovered from the fill of the kiva suggest this second conflagration was incomplete. This, of course, presumes that beams from elsewhere were not reused.

The kiva (Figure 40) is roughly circular (slightly oval, elongated north-south) and varies from 3.6 to 4.2 m in diameter. It contains five pilasters, one of which is nearly destroyed. A sixth, on the south, is absent due to the nearly

Figure 40 Kiva Fully Excavated

complete destruction of the outside wall, well below the floor. Interior features include a partially destroyed fire hearth, and a sipapu and wall niche which provide evidence of a northwest to southeast orientation. Three clay plugs containing remnant loom anchors, two small holes in the floor immediately adjacent to the fire hearth, and a shallow, clay-lined depression are additional floor features. The approximately northeastern two-thirds of the kiva had been looted and the southern third of the superstructure was vandalized. Evidence of a recess and ventilator were completely destroyed. The bench, upon which all but the east pilaster were constructed, is about two-thirds complete. The kiva was completely excavated including the subfloor fill beyond the dripline.

The bench is about 90 cm above the floor of the kiva and it varies from 35 to 60 cm wide. The pilasters are built atop the bench to a maximum height of 70 cm. The overall height of the pilasters is 1.6 m above the floor. The pilasters average about 50 cm wide. The east pilaster is built directly from the floor and there is no evidence of a bench on the south. The remaining pilasters are on the approximate northeast, north, northwest, and southwest. The latter has been almost totally destroyed. A south pilaster was likely present at one time. The walls and bench of the kiva were plastered with three to five layers of a reddish-tan, sandy clay. The walls were heavily burned from the floor to about midpoint around the walls. This is probably due to the location of burning beams which continued to smolder after the roof had collapsed, thus staining the walls. The fill contained both burned and unburned rodent feces suggesting the kiva remained intact for sometime after the site was abandoned and before it was burned. The wall at the rear (Figures 27 and 41) was repaired using small, naturally shaped, rectangular stone very carefully laid and using limited mortar (very similar to late Kiva 5 at Westwater - Five Kiva - Ruin [Lindsay 1981]). This repair may have been required due to water seepage at the rear of the shelter.

The floor of the kiva consisted of two roughly 1.5 cm thick clay components. A dark gray sandy clay was laid over an earlier light gray sandy clay floor. The clay was laid on juniper bark which was in direct contact with bedrock. This is curiously like the use of bark to back jacal at Westwater - Five Kiva (Lindsay 1981; see also, Lindsay, Pollen Analysis). McElmo/Mesa Verde Black-on-white pottery was recovered from the floor. A mano was recovered northwest of the sipapu. The floor was laid over fairly complex fill deposition beyond the dripline of the shelter (Figure 42). A 2.2 cm thick tan sand with gray ash and corn husks was directly on bedrock. This was overlain by a 12 cm thick yellowish-tan sand, rock, and juniper bark. Pottery from subfloor fill consisted of Deadman's Black-on-red, Mancos Black-on-white and Sosi Black-on-white. The latter is a late-Pueblo II/early-Pueblo III Kayenta intrusive suggesting the floor was laid probably not before

Figure 41 Closeup of the Rear Wall of the Kiva, Showing Masonry Detail and Wall Plaster (see Figure 26)

early-Pueblo III times. The fill above the floor was extremely disturbed except in the southwestern third of the kiva. A clay pipe and polished stone axe were recovered from the fill, near the floor, suggesting these were standard implements of the kiva. They were likely on the bench when the kiva was destroyed. Pottery from the fill includes a broad range of Pueblo II and III types indicating that the early pottery was derived from subfloor fill in the course of looting.

The fire hearth is in the approximate center of the kiva. It has a clay rim with small slabs and stones and is raised two to three centimeters above the floor. The rim is five to six centimeters wide. The hearth is about 70 cm in diameter from rim to rim and 17 cm deep. The basin intrudes bedrock about 15 cm. The fill of the hearth consisted of a two meter thick, powdery whitish-gray ash. The northern half of the hearth was extremely damaged as was the floor from the hearth to well beyond the sipapu, 28 cm to the northwest. The sipapu is 12 cm

Figure 42   Section of Kiva Subfloor Fill beyond Bedrock Floor

in diameter and 20 cm deep. It is inverted cone-shaped in cross section and intrudes bedrock. Two small, circular, clay-lined depressions intrude bedrock. They are 20 cm from the rim on each side of the hearth on an axis at right angles to the hearth-sipapu alignment. The depressions are five centimeters in diameter and seven centimeters deep. The function of these is unknown, but they may have accommodated a superstructure for use over the hearth.

Three clay plugs occur in the floor and apparently intrude bedrock. They form a slight arc north of both the hearth and sipapu, about halfway between the hearth and the wall on the north. The arc is roughly east to west. The clay plugs vary from 10 to 28 cm in diameter and each contains fragmented *Yucca* sp. stubbs which protrude from the surface of the plugs. They are interpreted as loom anchors. Spacing and configuration are very similar to those identified at Westwater - Five Kiva (Lindsay 1981; see also Adovasio, Perishable Industries). A small, 15 cm in diameter depression is 75 cm southwest of the hearth. It is clay-lined and has a slightly raised rim. The rim is about six centimeters wide. It may have served as a pot rest. The wall niche at the rear of the kiva is slightly offset (about 25 cm to the west of center) from the hearth-sippapu alignment. The base of the niche is near midpoint between the floor and the bench. It is nearly 25 cm wide, 25 cm deep to the rear, and 25 cm high. The niche has been plastered.

Storage Rooms. Three small masonry rooms, probably used for storage, were variously identified in the shelter (see Figures 6, 14, and 17). Additionally, a complex of three small contiguous rooms are on the ledge above Room Block A (see Figure 6). Storage Rooms 1, 2, and 3 are in extreme disrepair and it is not possible to identify when they were constructed. The construction of Storage Room 2 postdates the mid- to late-Pueblo II intermediate stage of the outside wall of the kiva and the others were also probably constructed after this time. The storage rooms above Room Block A are well preserved despite the "ladder" constructed by looters for access to the ledge. Storage Room 1 contained only a marginal amount of fill, principally loose rubble. Storage Room 2 contained a sizeable amount of coarse rubble but it was not tested. A modest test was conducted of limited Storage Room 3 deposits.

Storage Room 1 (Figure 14) is about five meters east-southeast of Room Block A. It is roughly circular and less than half of the masonry has survived. The room is about 2.3 m inside diameter. The masonry is constructed on a shallow ledge at the base of the shelter. The wall on the north abuts a large boulder which in turn is flush against the rear wall. A portion of the rear shelter wall has been removed, thus increasing the storage area. The masonry wall averages 40 cm wide and it is less than 10 cm high. The wall was likely about a meter high to the overhead in the rear of the shelter. The masonry consists of unshaped stone slabs set in a reddish or salmon pink mortar with moderate chinking. The ratio of stone to mortar is about 1:3.

Storage Room 2 (Figure 17) is immediately southwest of the kiva. It is a roughly, elongated, D-shaped room, constructed against the rear wall of the shelter. Only the approximate southern half of the room has survived. It is 5 m wide and about 75 cm deep to the rear. The masonry is very similar to that of Storage Room 1. The wall on the south abuts both the rear of the shelter and a large rock spall at the front, approximate middle of the wall. It has been destroyed from the spall to where it abutted the kiva by both spalling from the overhead and rolling talus. The height of the remnant wall is about 30 cm above the surface of existing, untested deposits. Another very brief wall (Figure 17) abuts the outside wall of the kiva on the southwest. It is similar to the masonry of Storage Room 2, but an association with the latter is unclear.

Storage Room 3 (Figure 17) is the better preserved of the three rooms. It is 1.5 m southwest of Storage Room 2. The room is roughly circular to D-shaped (Figure 43). It is 3 m (maximum) wide and about 2.25 m deep to the rear. The walls

Figure 43 Storage Room 3 Unexcavated

abut the rear of the shelter on the north-northeast and south. A portion of the rear of the shelter has been removed to provide greater storage space. A large spall at the front was used as a part of the wall construction and to foot the upper courses of masonry. A depression, 50 cm in diameter and about 5 cm deep has been ground in the top of the spall within the room. This was apparently used as a grinding feature. The wall averages about 30 cm wide and is approximately 1 m high where it reaches the overhead of the shelter. A small opening, now partially destroyed, on the northeast may have provided access. It is about 35 cm wide. The masonry consists of unshaped slabs and rock, set in a red sandy clay. The ratio of stone to mortar is about 1:2. The overhead and rear walls of the shelter within the room are fire-blackened. A small, 50 cm^2 sondage in the entry provided the identification of two floors in the structure. The basal floor is a very thin grayish-tan sandy clay. It lies directly on bedrock. An intermediate fill, about 20 cm thick, lies on the lower floor.

It consists of a tan sand with charcoal. The upper floor is a grayish-tan sandy clay, about five centimeters thick. Turkey feathers, including down, were recovered from the upper floor. No pottery was recovered from either floor of the storage room.

The storage rooms on the ledge, (Figures 6 and 44) above Room Block A, consist of three walls. The ledge is about 7 m above the base of Room Block A and 4 m below the 1706 m elevation rim of the alcove. The ledge is about 8 m in length and 2.5 m deep to the rear. The three walls (from north to south) are roughly 2, 2.5, and 1 m in length. The wall in the center is jacal, while the remainder consist of unshaped slabs and rock set in a tan sandy clay. The northwesternmost wall abuts the shelter wall on the northwest and the jacal wall on the southeast. The semicircular jacal wall is constructed against the rear wall of the ledge. The southwestern masonry wall abuts the jacal wall on the northwest. A portion of the latter

Figure 44 Storage Rooms on Ledge above Room Block A

has been destroyed. The room on the north has a small, 35 to 40 cm wide opening on the south. Access to the central jacal unit is through a 25 cm wide entry. The southernmost unit is open (about 25 cm wide) on the south. No artifacts were recovered from the storage rooms on the ledge.

Petroglyphs and Pictographs. Two rock art panels were identified in the rockshelter. Both are peripheral to the masonry construction. Petroglyphs are on a small panel 25 m southeast of Room Block A. A pictograph panel is five meters south of Storage Room B. The petroglyphs (Figure 45) are heavily eroded. The panel includes an apparent depiction of a Desert Bighorn and a character similar to the Greek upsilon. The remaining petroglyphs are indistinct. The pictographs (Figure 46) consist of four, apparent right-hand prints with palms open and thumb and fingers spread. They are negative casts on a wall that is heavily smoke-blackened. One hand

Figure 45 Big Horn Sheep and Unidentified Petroglyphs in Southeastern Part of the Site

Figure 46 Hand Print Pictographs in Southwestern Part of the Site

print may be missing.

The initial phase of intermediate stage construction is evident in both room blocks at Big Westwater. The phase is not directly dated, but it is interpreted as a mid- to late-Pueblo II occurrence. This is based indirectly on dated, similar events - early-Pueblo II masonry, early-Pueblo II site destruction, and mid-Pueblo II rebuilding - at Westwater - Five Kiva (Lindsay 1981). An A.D. 1147 to 1207 series of tree-ring dates indicate when additional rooms were added during early Pueblo III times, as a second phase of construction. The sequence in the kiva is much the same with a prekiva construction phase followed by destruction. The kiva, as such, was then added during the second phase of construction. Site destruction, interpreted as a mid-Pueblo III event, terminates the intermediate stage and provides for a final, late stage of remodeling and repair.

Late Stage Masonry

Late stage masonry construction consists of additions and repair. Site destruction is interpreted for mid-Pueblo III times which involved the sloughing of the front and east walls of Room Block B. Roof beams associated with the second phase of intermediate stage construction apparently remained intact. The kiva may have been only partially destroyed (see Intermediate Stage Masonry) and it provides the only conflagration in the room block. Subsequent construction involved the repair of the front and east walls of the room block and probably the kiva. The front and east walls were extended well above the level of previous intermediate stage roof construction and Room 11 was also added. There is no evidence that the late constructed upper story of the room block was subdivided. Late remodeling and repair in Room Block A is less well understood. The plugging of an access through the wall common to the two principal masonry rooms may have occurred (see Intermediate Stage Masonry). The entire Room Block A area appears to have been relegated to the housing of turkeys at a late date. Although superstructure southeast of the room block was not well defined (see Site Stratigraphy), a large turkey pen was probably in this area during the late stage as well. The late occurrence of turkeys in the Room Block A area and their introduction to Storage Room 3 on the west side of the shelter suggests a subsistence shift occurred. This involved an apparent change from an exclusively heavy dependence on cultigens toward an increasing reliance on domestic turkeys. This seems to have occurred in connection with the installation of "observation ports" in the late stage construction in Room Block B.

Room Block B. Late stage masonry in the room block consists of the addition of Room 11, the repair of the kiva and the front and east walls of the room block, and the extension of these walls constituting the addition of an upper story above Rooms 6, 7, 8, 9, and 10 and apparently the kiva. Late stage masonry throughout the room block is much less carefully laid than earlier construction. It consists of both shaped and unshaped stone. The size and placement is highly variable and seemingly arbitrary as compared to the earlier stages. Chinking is also variable.

Room 11 (see Figure 17) is a late stage addition to the room block and is fairly well preserved. The room was not excavated except to test a vent which was evident at the wall on the southeast. Room 11 is roughly D-shaped. It is 6.25 m (maximum) wide and averages 3.25 m deep to the rear. The addition consists of a single, somewhat serpentine, wall at the front and on the southeast. The east wall of Rooms 8 and 9 is on the west. The wall abuts the outside corner of Room 9 and is truncated on the east where an entryway to the room occurs (Figure 47). The entry is 75 cm wide from the end of the wall to the wall of the shelter where mortar is present. This indicates that the entry was entirely formed by masonry. The

Figure 47 Room 11 from Outside of Entry to Room Block B

wall averages 30 cm wide and rises to a maximum height of nearly 2.5 m. The estimated height above the floor is 1.75 to 2 m. This coincides with the interior walls of the room block. There is no evidence of roofing.

A small, roughly 35 cm^2, vent (Figure 48) is flush against the wall in the southeast part of the room. The slab-lined vent originates from the floor of the room and exits immediately beneath the front wall below the shelter. The function of the vent is unknown, however, it is curiously placed at the head of the arroyo in the alcove (compare Figures 6 and 17) where refuse would have been periodically washed from the site.

Destruction of the room block, preceding late stage remodeling and repair, consisted of the sloughing of the upper 1.4 m of the wall fronting Room 9 (see Figure 35) and about 1.8 m of the wall at the front of Room 10. This left only a 20 to 60 cm standing wall at the front of the shelter. The approximate south half of the east wall of the room block was des-

Figure 48 Vent Detail in Southeast Corner of Room 11

troyed leaving a 60 cm or less standing wall (see Figures 25 and 26). The outside wall of the kiva shows slight damage at the approximate top (two meters above the floor) of intermediate stage construction (see Figure 39). Although much of the front wall and the south half of the east wall was destroyed in the room block, the interior walls apparently remained intact. This suggests that the original roof beams used for Rooms 6, 7, and 8 and subsequently Rooms 9 and 10 remained in place, though suspended at the front of the shelter (see Dating).

Subsequent repair of the room block involved both the reconstruction and extension, to about four meters above bedrock, of both the front and east masonry walls and the extension of the eastern and front portions of the outside wall of the kiva. Room 11 was added coincident with the extension. The masonry used for both the repair and extension is particularly crude and has the appearance of being rather hastily constructed. Both shaped stone and unshaped rock were used throughout and chinking is highly variable, ranging from little or none at all to excessive. The intention, at the outset, to extend the walls beyond previous intermediate stage two meter heights is apparent.

The initial reconstruction involved the use of a light gray (10YR 7/2) mortar to 1.75 to 2 m above bedrock in the front wall of the room block and the reconstruction of the doorway in the east wall, as well as an additional 1.65 m above Room 8. Additionally, the east and south portions of the outside wall of the kiva were extended about 1.25 m. Patches of mortar on the inside of the east wall of the room block contained textile impressions suggesting hands were wrapped during the application. Construction of the remainder of the walls to the four meter height consisted of the use of a yellowish-red (5YR 4.5/6) mortar. The construction included the stabilization of existing beams in the front wall of the room block (Figure 49), the placement of an apparent doorway in the east part of the

Figure 49 Detail of Late Stage Wall Construction of South Wall of Room 9, Showing Roof Beam Butts

outside wall of the kiva, and the installation of a rather elaborate series of observation ports. The roof beams (see Intermediate Stage Masonry - Rooms 9 and 10) occur exclusively at the approximate two meter level, thus all are placed in the uppermost final stage masonry. The beams were originally used in the intermediate stage. The doorway in the wall above the kiva is extremely fragmentary and only portions of the south side and the footing or sill remains. The base of the doorway was constructed using light gray mortar and the upper part was finished with the yellowish-red mortar. The footing is about 30 cm above the approximate level of the kiva roof or more than 2.3 m above the floor of the kiva. It provides access to the upper story, above Rooms 6, 7, 8, 9, and 10, from the roof of the kiva.

The observation ports are numerous, well constructed, methodically placed holes in the various late stage masonry walls (Figure 50; Table III). The holes vary from 5 to 10 cm in diameter and all but one are in the uppermost, yellowish-red mortar of final stage construction. The ports occur in the front wall of Room 11 (Figure 47), the east wall above Rooms 8 and 9 (Figures 25 and 26), the front wall above Room 9 (Figure 35), and the east portion of the wall above the kiva (Figure 39). They likely were once present in the south portion of the wall above the kiva.

Six ports (a - f) are variously placed in the front wall of Room 11. They vary in estimated height from 80 cm to 1.5 m above the floor of the room. Directions vary from east to south-southwest. Most are east-southeast and south-southeast. The ports vary from 0 to 33° depression. They provide views of the plaza/midden and east areas of the site, down the arroyo to the south, and the access from the rim of the alcove on the southwest.

Four ports (g - j) are in the east wall above Rooms 8 and 9. They vary in estimated height above the floor of the upper story from 25 to 85 cm. Port "g" is constructed at the top of the initial late stage masonry using light gray mortar (see Figure 25). Directions are exclusively east-southeast. The ports vary from 26° depression to 10° elevation. All but one are depressed. They provide views of the entryway to Room 11 and Room Block A, the plaza/midden area, and the storage rooms on the ledge and the above rim of the alcove.

Two ports (k and l) are in the front wall of Room 9. Their estimated height above the floor of the upper story is 62 and 85 cm. Directions are south-southeast and south-southwest. The ports provide views of the southeast access to the site from the rim of the alcove and the access from the southwest.

Six ports (m - r) are variously placed in the eastern portion of the wall above the kiva. They vary in estimated height above the floor of the upper story from 47 cm to 1.45 m. Directions vary from east-northeast to south-southwest. The majority are directed to the east-northeast. The ports vary from 11° depression to 5° elevation. Most are depressed. They

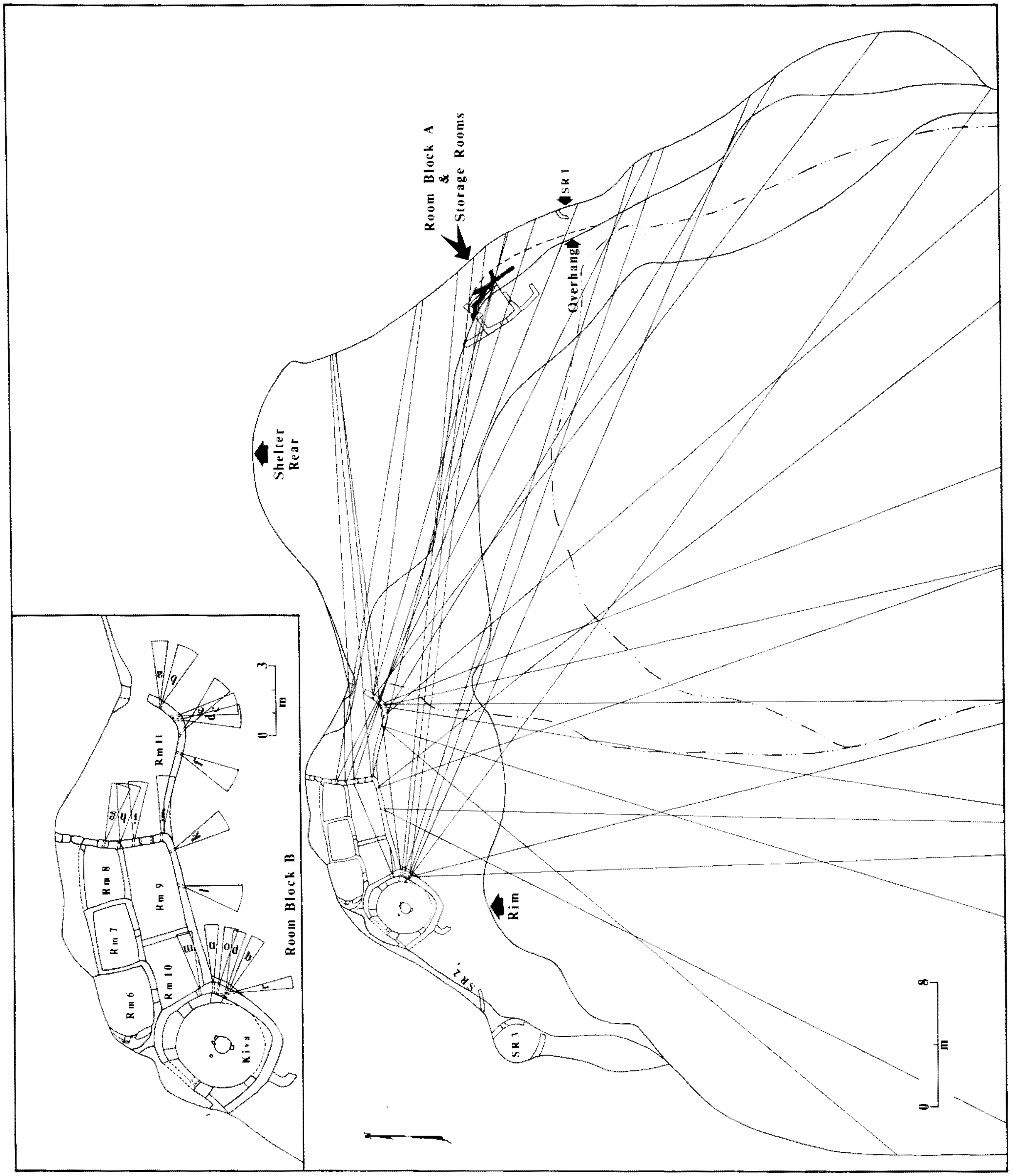


Figure 50 Plan Map of Observation Ports in Room Block B

Table III Room Block B Observation Port Locations, Bearings, Elevations or Depressions, and Foci

Designation*	Location	Bearing ($N=0^o$)	Elevation or Depression	Focus
a	Rm 11	90^o (E)	down 22^o	site-center
b	Rm 11	118^o (ESE)	down 10^o	site-east
c	Rm 11	169^o (SSE)	down 33^o	arroyo-south
d	Rm 11	178^o (SSE)	level 0^o	arroyo-south
e	Rm 11	132^o (ESE)	down 24^o	access-southeast
f	Rm 11	206^o (SSW)	down 20^o	access-southwest
g	Above Rm 8	107^o (ESE)	down 17^o	Rm 11 entry and Room Block A
h	Above Rm 8	100^o (ESE)	down 26^o	Rm 11 entry and Room Block A
i	Above Rm 9	95^o (ESE)	up 10^o	Storage Rms and rim above
j	Above Rm 9	94^o (ESE)	down 20^o	site-center
k	Above Rm 9	150^o (SSE)	up 18^o	rim-southeast access and mesa to south
l	Above Rm 9	192^o (SSW)	down 8^o	access-southwest
m	Above Kiva	75^o (ENE)	down 4^o	southeast corner of upper story
n	Above Kiva	89^o (ENE)	up 5^o	rim-above Storage Rms
o	Above Kiva	103^o (ENE)	down 8^o	Storage Rm 1 and Room Block A
p	Above Kiva	104^o (ENE)	up 4^o	Storage Rm 1 and Room Block A
q	Above Kiva	120^o (ENE)	down 10^o	rim-southeast access
r	Above Kiva	171^o (SSE)	down 11^o	arroyo-south

* (see Figures 50-52 and 54)

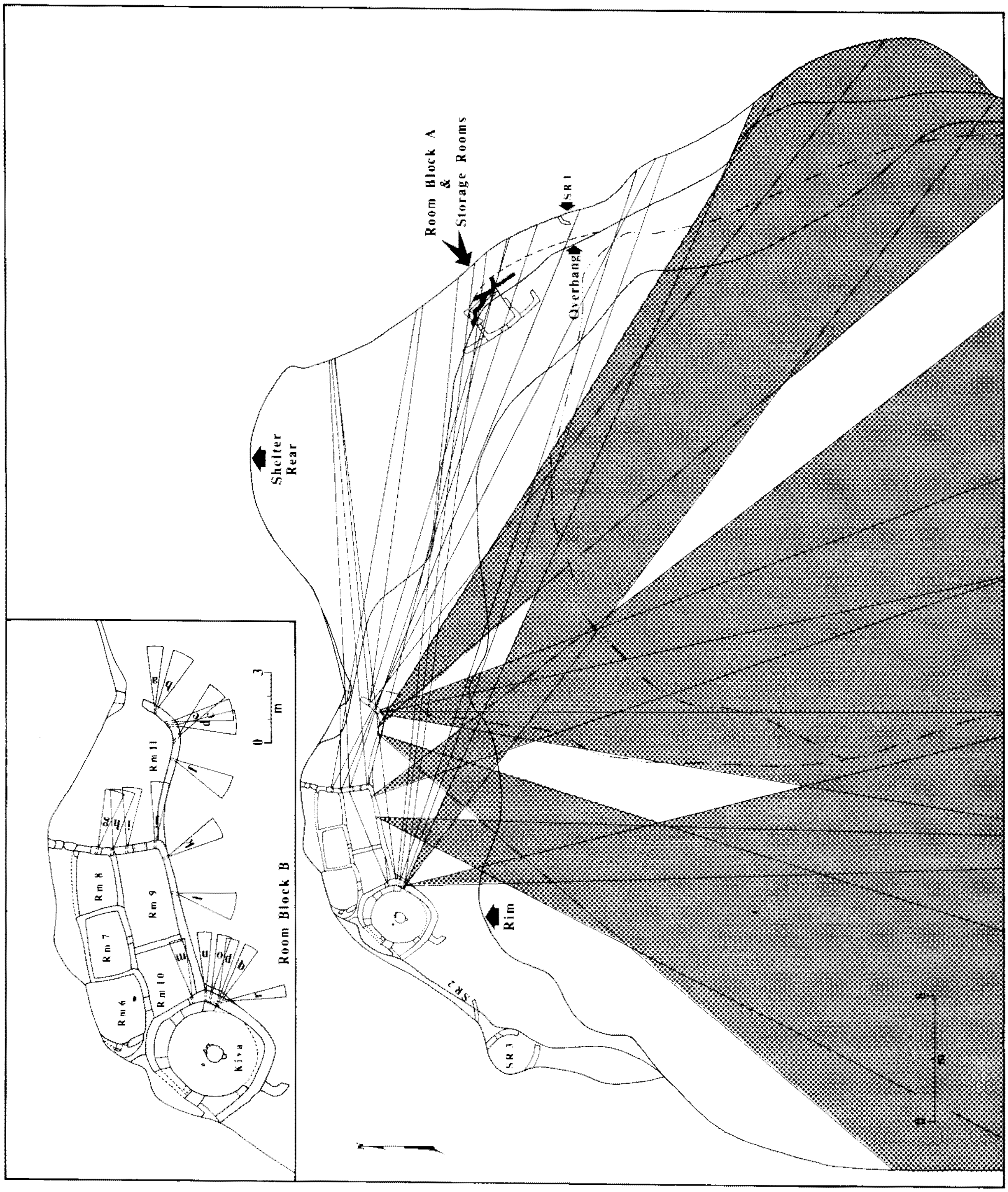


Figure 51 Plan Map of Access Coverage to the Alcove from Various Observation Ports in Room Block B

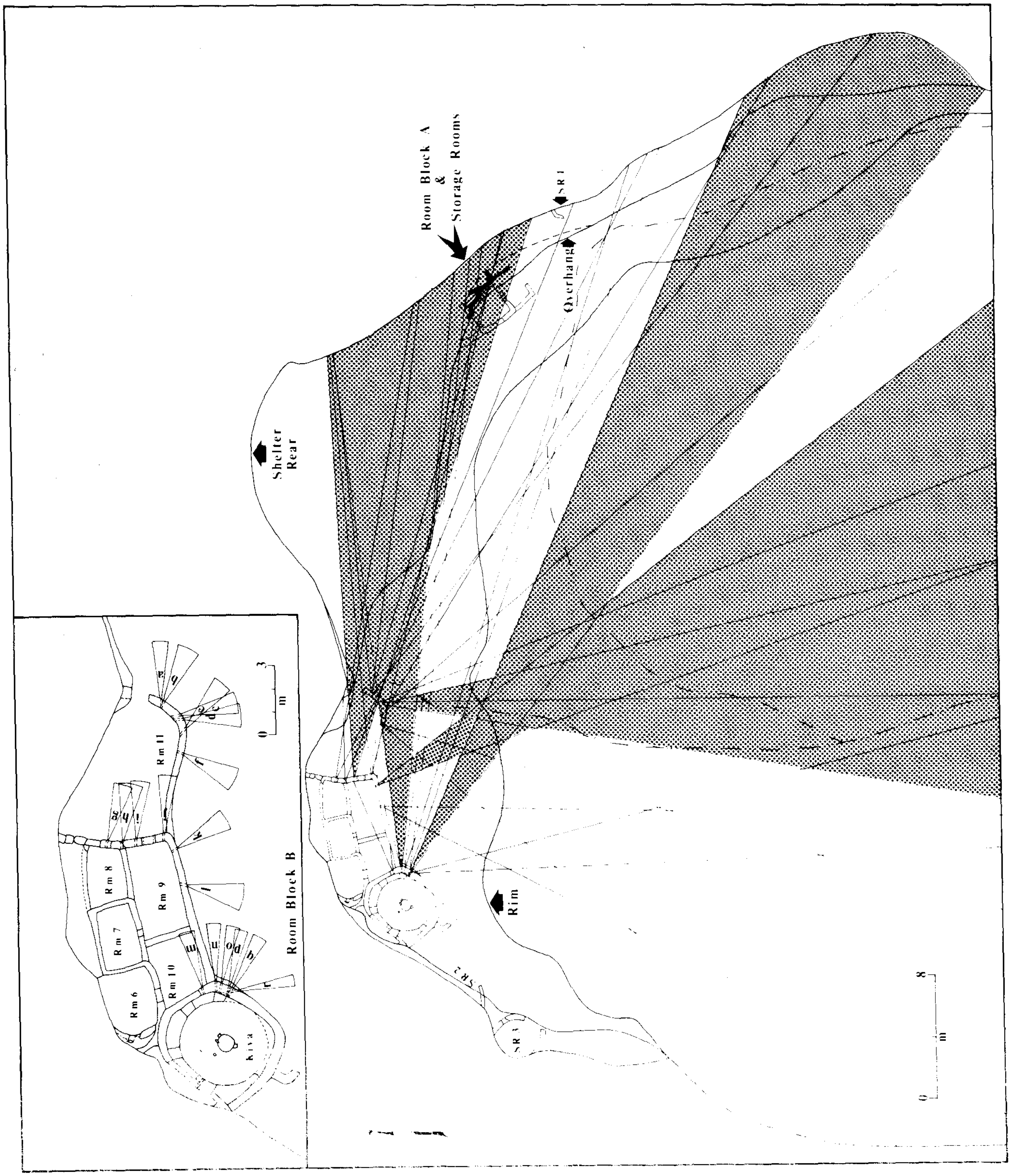


Figure 52 Plan Map of Elevated Observation Ports in Room Block B which Provide Views of the East Rim of the Alcove and the Mesa to the South

provide views of the southeast corner of the upper story, Storage Room 1 and Room Block A, the rim of the alcove above the storage rooms on the ledge, the rim at the southeast access to the site, and down the arroyo to the south.

In sum, each set of observation ports provides views both on the site and of the various accesses. Various ports, taken together, provide nearly full view coverage of all accesses (Figure 51) including from both the east and west rims of the alcove where descent to the site is possible and south up the arroyo. The various elevated ports (Figure 52) provide additional coverage of the southeast access (e.g., Figure 53), but

Figure 53 View of the Rim at the Southeast Access to the Alcove through Observation Port "k" above Room 9

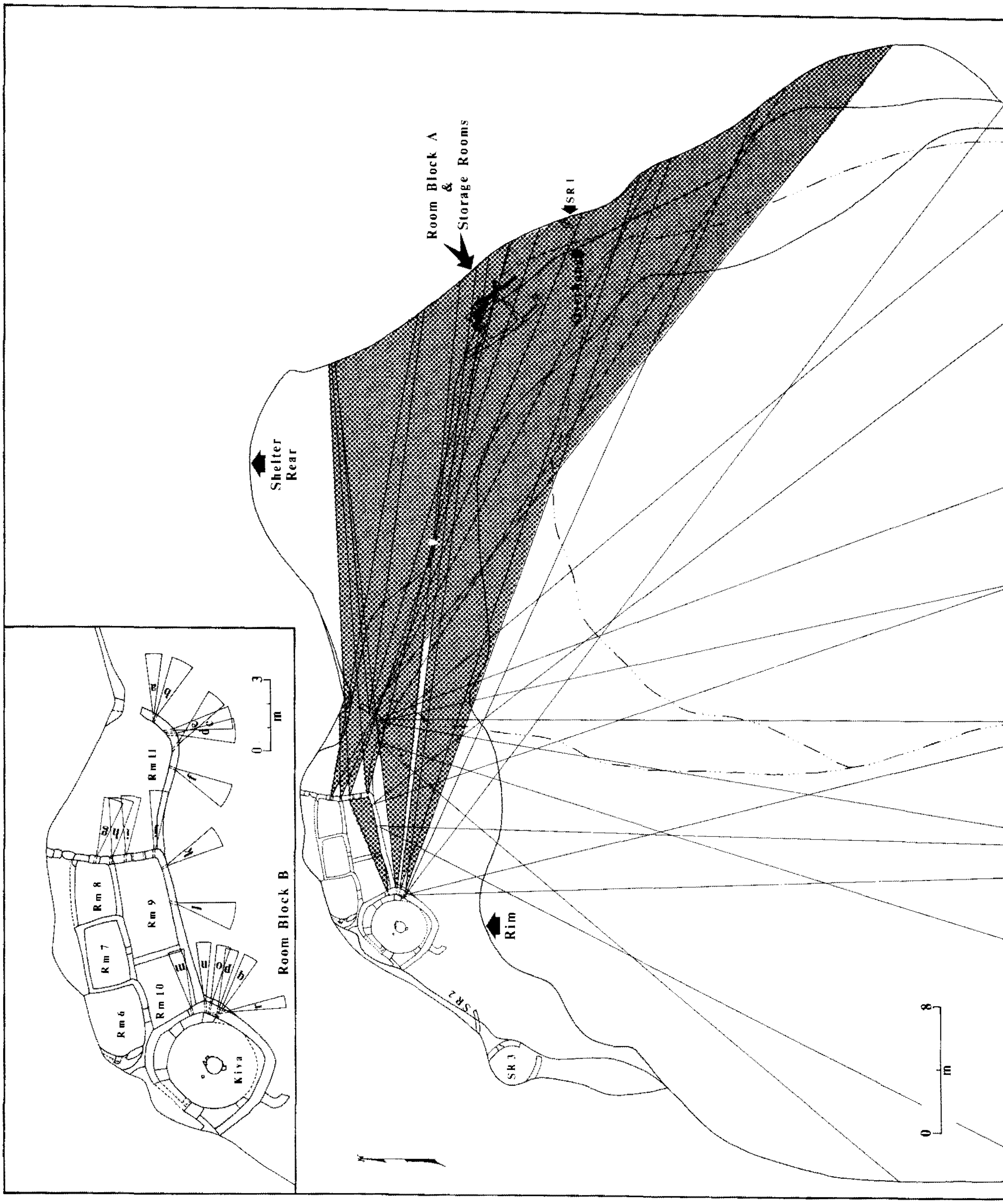


Figure 54 Plan Map of Inner Site Observations from Room Block B. This includes Room Block A and the Storage Rooms above, the Entry to Room Block B, and the Entry to Room 9 (from above the kiva).

also the storage rooms on the ledge and the rim above Roo… Block A. The south wall above the kiva likely contained elevated ports providing more extensive scrutiny of the southwest rim of the alcove. More curious are the various ports which provide nearly complete coverage of the eastern part of the site (Figure 54). This includes views of Room Block A and the storage rooms above (e.g., Figure 55), the entry to Room 11 (Figure 56), and the southeast corner of the upper story above Room 9 (Figure 57), from the wall above the kiva.

In sum, the apparent carefully constructed, methodically placed holes in the walls of late stage construction convincingly argues for the interpretation that they were used for observation. Why the observation ports were necessary toward the close of the occupation of the shelter is unclear. Observation of the various accesses to the site seems reasonable but why a number of ports provide coverage of on site features is

Figure 55 View of Room Block A and Storage Rooms Above through Observation Port "p" above Kiva

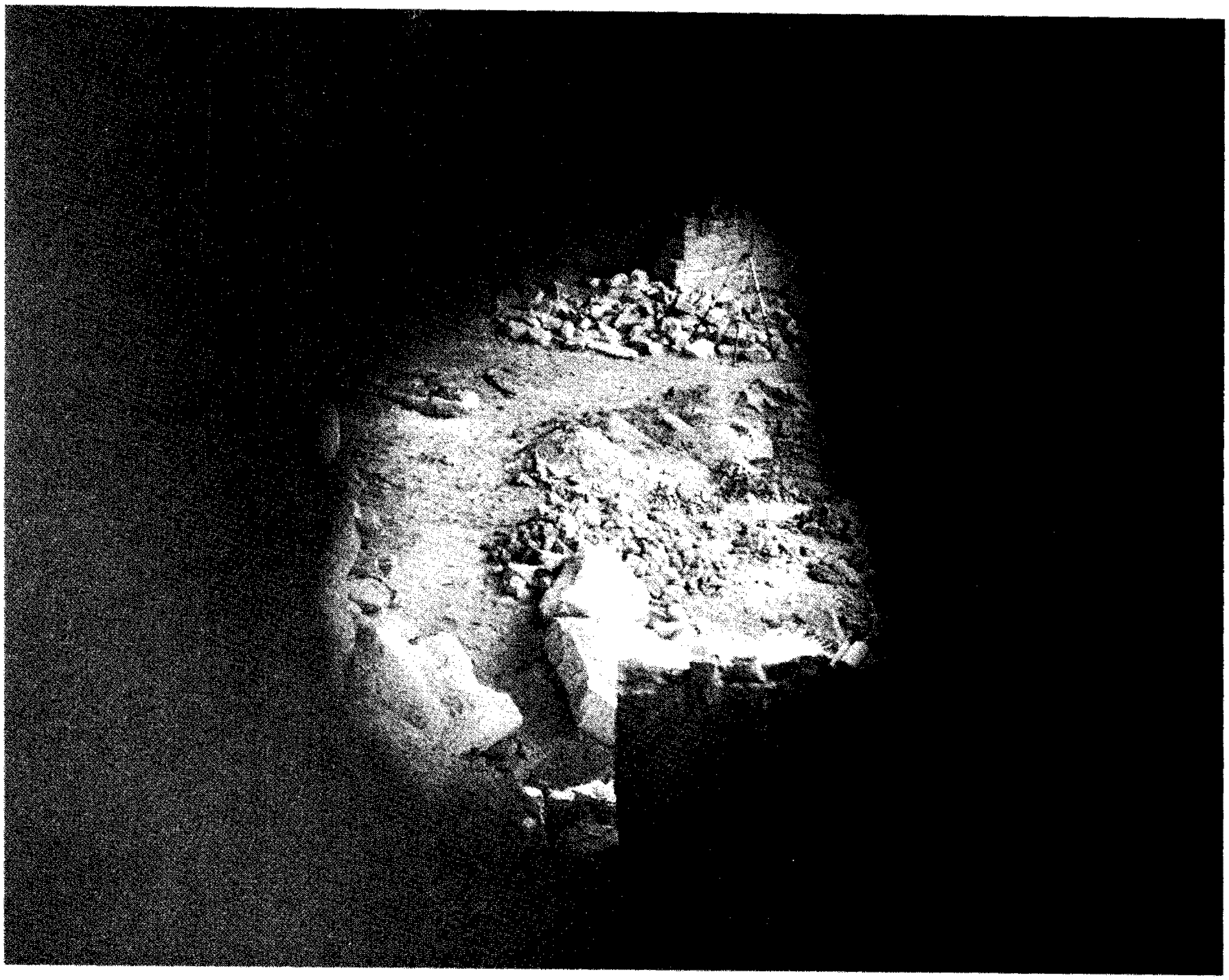


Figure 56 View of Entry to Room Block B (Room 11) through Observation Port "g" from above Room 8

particularly intriguing. The focus on storage rooms and the abandoned Room Block A in the eastern part of the site, when rooms were given to turkeys, may provide a clue to why such observations were necessary (see SITE SUMMARY). Precise dating of late stage construction and hence, the ports, is uncertain. They were likely in place very near the A.D. 1207 tree-ring date obtained from a timber in Room Block B (see Dating).

Little additional information is obtained from the locations and arrangements of the ports. Most are directed east, southeast, and south, however, a number may have been in the south portion of the wall above the kiva, placed for views to the southwest. Population estimates based on the number of ports would be misleading because many are placed close

Figure 57 View of the Southeast Corner of the Upper Story (above Room 9) through Observation Port "m" from above the Kiva.

together and several could have been "manned" by a single individual. The 25 cm height above the floor of port "h" in the east wall of the room block suggests it may have best accommodated a child, however, as it depressed 26° and peers directly down at the entry to Room 11 it could have been used by an adult in a sitting position. Others, such as port "d" in the front wall of Room 11 and "o" in the east wall above the kiva, approach 1.5 m above their respective floors and would have required use by an adult.

Dating

Fourteen timber specimens, principally juniper, were collected from Room Block B at Big Westwater Ruin (Table IV). One specimen (UWM-114 [11833vv]) was collected during the 1978 field season when the site was first visited. The remainder were obtained during the 1979 excavations.

Table IV Tree-ring Dates

Provenience	Lab Designation	Species	Dating Inside	-	Outside
Room Block B	UWM - 150	Juniper	0986±p	-	1207r
Room Block B	UWM - 147	Juniper	0994±p	-	1201rB
Room Block B	UWM - 155	Juniper	1128p	-	1198rG
Room Block B	UWM - 148	Juniper	0923p	-	1197rB
Room Block B	UWM - 157	Juniper	1057±p	-	1194rB
Kiva Fill	UWM - 160	Juniper	1009p	-	1194vv
Room Block B	UWM - 114	Juniper	0978±p	-	1183vv
Room Block B	UWM - 154	Juniper	1060p	-	1180++rLB
Room Block B	UWM - 151	Juniper	1077p	-	1174r
Kiva Fill	UWM - 164	Juniper	1062±p	-	1171vv
Room Block B	UWM - 153	Juniper	1044p	-	1161++B
Kiva Fill	UWM - 162	Juniper	1003±p	-	1150+B
Room Block B	UWM - 149	Juniper	0916p	-	1149+rB
Room 9 and 10 Subfloor Fills	UWM - 159	Pinyon	0831p	-	1147+r

Symbols: p - pith ring present; ±p - pith ring present, but due to the difficult nature of the ring series near the center of the specimen, an exact date cannot be assigned to it -- the date is obtained by counting back from the earliest dated ring; B - bark present; G - beetle galleries are present on the surface of the specimen; L - characteristic surface patination and smoothness, which develops on beams stripped of bark, is present; r - less than a full section is present, but the outermost ring is continuous around available circumference; vv - there is no way of estimating how far the last ring is from the true outside; + - one or more rings may be missing near the end of the ring series whose presence or absence cannot be determined because the specimen does not extend far enough to provide an adequate check; ++ - a ring count is necessary due to the fact that beyond a certain point the specimen could not be dated.

All of the specimens, but UWM-159 (A.D. 1147+r) were recovered from either the surface or they were partially covered by disturbed fill. For this reason, proveniencing for specific rooms other than the kiva, is ignored. Specimen UWM-159, the only pine represented, was recovered from the subfloor fill directly below the wall common to Rooms 9 and 10, at the front of the shelter. Modern campfire debris in the center of the site contained charred timbers suspiciously like those collected from the room block. These may have been collected by recent visitors for firewood.

Collection of specimens from in situ beams in the front wall of the room block was not attempted because of the lack of proper equipment. However, the timber sample obtained seemed sufficiently large and all appeared to be from a single stage of masonry construction, hence, pursuit of the in situ beams did not seem necessary. Three of the specimens were obtained from disturbed fill of the kiva and their established provenience is likely. In sum, the sizeable number of specimens from the relatively small room block seems to be a fairly representative sample of the total number of beams used in construction. These provide a respectable number of dates which identify a principal period of construction at the site.

It is the range of dates and the almost gradual or periodic additions to the sequence without significant clustering, on one hand, and the absence of dates indicative of the extended sequence to include Pueblo II times that is particularly perplexing. An abundance of Pueblo II pottery, Mancos Black-on-white and Mancos Corrugated, supported by considerable variations over time in masonry construction provides an indication of a heavy and lengthy Pueblo II occupation. Surely the shelter did not remain unoccupied for the duration of Pueblo II following the conflagration of early masonry. Also, it does not seem reasonable that Rooms 6, 7, and 8 remained unroofed until Rooms 9 and 10 were added. An early-Pueblo III (ca A.D. 1150) fire may have occurred which destroyed timbers cut during Pueblo II. The ca A.D. 1147 dated specimen, which was burned, from the subfloor fill of Rooms 9 and 10 may be just such an indication. However, an early-Pueblo III fire was not detected in the forms of other evidence elsewhere.

The ca 60 year range of dates (ca A.D. 1147 to 1207) is surprising considering that they occur in a very few rooms and were likely associated with a single stage of masonry. There is little doubt that some reuse of beams has occurred and perhaps some were added as repair became necessary. However, the latter should have been minimal because of the protection of the rockshelter. Only the kiva extends to near the primary dripline of the shelter and would have been subject to the ravages of nature.

Summary and Discussion of the Sequence

A duality of the Big Westwater Ruin sequence exists in the form of site deposits and architecture. The depositional sequence is temporally established using typological cross-dating of pottery. The construction sequence is temporally fixed by tree-ring dating. While site deposits are dated throughout the entire history of the site, only a brief period of the full architectural sequence is associated with tree-ring dates. However, the latitude of temporal placement using pottery is considerable and can vary several hundred years. Tree-ring dating, by contrast, firmly establishes an event to the year or over several years. Pitfalls inherent in the two types of dating are numerous. Pottery types are assumed to have occurred everywhere at the same time and remained popular for similar durations throughout the region. The most difficult problem encountered by tree-ring dating is the reuse of beams from earlier construction and conversely, periodic repair, introducing recently cut timbers to older construction.

Pueblo II and III Mesa Verde Anasazi occupations at Big Westwater are based on the various pottery types recovered from the excavations and on the architecture. A portion of the masonry construction is tree-ring dated. However, when the shelter was first occupied and the dating of initial masonry construction remains in doubt.

Big Westwater consists of two masonry room blocks separated by a large, central plaza/midden component. The central area was not tested. An exploratory trench was placed immediately to the southeast of easternmost Room Block A. Five occupational strata (Ia and b through V) were identified and assessed as representing an occupation which essentially spans the ca A.D. 900 to 1250 Pueblo II and III time periods. Stratum Ia, which contained San Juan red Ware, is tied directly to an early masonry component (Rooms 1, 2, and 3) in the room block. The red ware is ordinarily associated with ca A.D. 750 to 900 Pueblo I (Breternitz, Rohn, and Morris 1974), however it has also been found in a tree-ring dated Pueblo II context on Cedar Mesa (Dalley 1973). The later occurrence of the red ware suggests that Stratum Ia and hence the early masonry component are dated early- to mid-Pueblo II. Early masonry was also identified in Room Block B on the west where it served as the base for later intermediate stage construction of Rooms 6, 7, and 8 and possibly the outside wall of the kiva. Much of the early masonry has been burned and this may have occurred by mid-Pueblo II times. Similar destruction occurred during early- to mid-Pueblo II at Westwater - Five Kiva (Lindsay 1981), three miles to the north.

Subsequent intermediate stage masonry consists of the construction of Rooms 4 and 5 in Room Block A and Rooms 6, 7, and 8, and a six-sided structure in Room Block B. It is not possible to determine if the kiva in the latter room was built during the initial phase of intermediate stage construction or if it is contemporaneous with the additions of Rooms 9 and 10. Although Rooms 6, 7, and 8, and likewise Rooms 4 and 5, are undated, they were likely constructed during mid- to late-Pueblo II times. Tusayan Polychrome pottery recovered from Stratum Ib of the exploratory trench and the floor of Room

4 suggests a late-Pueblo II or possibly early-Pueblo III deposition (Colton 1955). Only unidentified corrugated pottery was recovered from Stratum II, while the overlying Stratum III contained both Pueblo II and possibly Pueblo III (Mancos/McElmo Black-on-white) pottery.

A final phase of intermediate stage construction consisted of early-Pueblo III additions of Rooms 9 and 10. The kiva was also either added or remodeled, if it was present earlier within and following the early-Pueblo III burning of the six-sided structure. The addition of Rooms 9 and 10 postdates A.D. 1147. A series of tree-ring dates (A.D. 1149 to 1207), provenienced from both Room Block B and the kiva, are apparently associated with the final phase of intermediate stage construction. The beams were then reused for late stage remodeling and repair.

Site destruction occurred during mid-Pueblo III times in which the front and east walls of Rooms 9 and 10 were destroyed. The kiva apparently, at least partially, burned and the rubble of destruction was identified as Stratum IV of the exploratory trench. Only unidentified white ware was recovered from the deposit. Precise dating of the mid-Pueblo III destruction is not available, however, it may immediately antedate A.D. 1243. The date may indicate when much of the central part of Westwater - Five Kiva (Lindsay 1981) was occupied by turkeys. Similar turkey fecal deposits at Big Westwater directly overly Stratum IV rubble in the exploratory trench. Levels B and C, in Room 4 are also similar. Mesa Verde Black-on-white pottery was recovered from Level B.

Late stage masonry construction seems to occur with the establishment of turkeys in Room 4 (and likely Room 5), the area of the exploratory trench, and Storage Room 3 in the southwest part of the site. Late stage masonry construction consisted of the repair of Rooms 9 and 10 and the kiva, the addition of Room 11, and the two meter extension of the front and east walls of the room block and the outside wall of the kiva. Much of this masonry is particularly crude and apparently hastily constructed. The repair and additions resulted in the construction of two upper story rooms, one above the kiva and the other over the room block. Eighteen "observation ports" are associated with this final stage of construction. These ports, together, provide an essentially full view of the various accesses to the rockshelter. Additionally, various ports provide on site views of Room Block A and the various storage rooms in the eastern part of the site. The focus on Room Block A seems to roughly coincide with the use of the eastern part of the site as a locus for subsistence activities (as opposed to domicile or ceremonial functions).

Site abandonment is undated, but if similar to Westwater - Five Kiva, it was occupied to at least A.D. 1250. Evidence of destruction associated with the abandonment of Big Westwater is absent, although the kiva was burned apparently some time after. Strata VI and VII in the exploratory trench are post-occupational deposits which provide some information regarding climatic/environmental change after the Anasazi abandoned the region.

ARTIFACTS

Introduction

The variety of artifacts recovered from Big Westwater Ruin are grouped according to the kinds of information they should provide. Pottery, stone, and basketry, twine and cordage are the diagnostics which provide some estimates of who occupied the site and the temporal placement of the occupation. Pottery is the principal diagnostic. Although, the stone inventory is very limited, it may be significant in determining principal site functions. Perishable industries have not yet been fully analysed and only a brief synopsis of the industries at both Big Westwater and Westwater - Five Kiva - Ruins is provided. A more detailed report will be published elsewhere. Tools, which also include worked bone and wood, provide some information on what activities were conducted at the site. Faunal material, bird remains, maize, plant macrofossils and pollen provide some estimates of what food stuffs were utilized and also something about the nature of the environment. The pollen study, supplemented by the macrofossil inventory, allows some measure of paleoenvironmental change and the availability of plants for cultural use.

The artifact sample is quite limited considering the amount of cultural fill processed. However, much of the room deposits were disturbed and in the course of looting a sizeable quantity of artifacts were probably removed from the site. This may explain why only a single, wholly restorable, ceramic vessel was recovered during the excavations. Although the disturbance to the site contributed to a very high percentage of unprovenienced artifacts, the limited pottery sample provides ample indication of extensive Pueblo II and III occupations. The very limited chipped stone sample may be explained as the result of the lack of stone tool manufacture at the site. While looters may have carted off finished tools, it is unlikely that debitage would have commanded much attention. Perishable artifacts constitute a fairly sizeable percentage of the total artifacts recovered from the shelter because of the dry deposits. Only at the shelter rear, where water seepage occurs, were perishable artifacts not recovered in good condition. This involved only the northeasternmost meter of the exploratory trench and the rear of masonry Rooms 4 through 8.

Pollen sampling, because of the disturbed nature of the site, was limited to the strata of the exploratory trench and the fill of masonry Room 4. Artifacts are provenienced for the fills and floors of the rooms except when disturbance precluded such determinations. Contextual uncertainties required that a large percentage of artifacts are designated only as from Room Blocks A and B or from the site surface and provenience unknown.

Ceramics

from

Big Westwater Ruin

by
Kay Sargent

Eight hundred and fifty-five ceramic sherds and one partially restorable vessel were recovered from Big Westwater Ruin. Corrugated gray wares comprise the largest category (55 percent), followed by white wares (38 percent). Plain gray and red wares make up less than 8 percent of the sample (Table V). Close to half (153) of the white ware sherds were classified as unidentifiable due to the lack of, or limited, design sufficient for identification. The majority of typed specimens are principally from the Pueblo II and III periods.

Many of the type differentiations in the painted wares are based on stylistic elements and composition. Best identifications are made on whole vessels, and even then there are uncertainties. For example, Rohn (1971:178-179) notes in discussing a McElmo-Mesa Verde Black-on-white seed jar:

> This motif is common on Mancos Black-on-white, and a case could be made for classifying this jar as Mancos Black-on-white with organic paint. Material of this nature has also been referred to as Wetherill Black-on-white (Hayes 1964). An equally good case could be made for classifying the jar as McElmo Black-on-white.

Many of the sherds in the sample were too fragmentary to provide adequate design for identification. Due to the limited nature of the sample size, and the predominance of smaller sherds, identifications in many cases were tentative as to specific type. As a result, many of the categories in the black-on-white ceramics are narrowed to either of two types. For example, Mancos/McElmo Black-on-white is a category for pottery sherds which are either Mancos Black-on-white or McElmo Black-on-white.

Ninety-three percent of the identified black-on-white sherds (166 total) are Cortez/Mancos, or later, types which indicate the principal use of the site was during Pueblo II and Pueblo III times. The corrugated gray wares, made in the Pueblo II and III periods, represent more than half the sample. Half of the identified sherds in the small red ware sample are Tusayan Polychrome, a late Pueblo II/early Pueblo III Kayenta type. The sample size of each type is too small to provide comparisons of distribution by area. The largest number of provenienced sherds and the restorable vessel are from Room Block B. The widest range of provenienced types are also

Table V

Ceramic Provenience

	GRAY WARE	Chapin	Unidentified grayware		RED WARE	Bluff Black-on-red	Deadman's Black-on-red	Unidentified red ware	Tusayan Polychrome		WHITE WARE	Piedra Black-on-white	Cortez Black-on-white	Cortez/Mancos Black-on-white	Mancos Black-on-white	Mancos Black-on-white corr. variety	Mancos/McElmo Black-on-white	McElmo Black-on-white	McElmo/Mesa Verde Black-on-white	Mesa Verde Black-on-white	Unidentified Black-on-white corrug.	Unidentified White ware	Sosi Black-on-white	CORRUGATED WARE	Mancos corrugated	Mesa Verde corrugated	Unidentified corrug. sherds	Unfired sherds		TOTALS
General Surface Prov. Unknown	1	3			1	2	2				5			11	3	3	5	8	8		39				10	100		3		204
Exploratory Trench Prov. Unknown														3				1			1			1		11				17
Stratum VII																														0
Stratum VI																														0
Stratum V																														0
Stratum IV																					1									1
Stratum III														1		1										4				6
Stratum II																										7				7

	GRAY WARE Chapin	Unidentified grayware		RED WARE	Bluff Black-on-red	Deadman's Black-on-red	Unidentified red ware	Tusayan Polychrome			WHITE WARE	Piedra Black-on-white	Cortez Black-on-white	Cortez/Mancos Black-on-white	Mancos Black-on-white	Mancos Black-on-white corrug. var.	Mancos/McElmo Black-on-white	McElmo Black-on-white	McElmo/Mesa Verde Black-on-white	Mesa Verde Black-on-white	Unidentified Black-on-white corrug.	Unidentified White ware	Sosi Black-on-white	CORRUGATED WARE	Mancos corrugated	Mesa Verde corrugated	Unidentified corrug. sherds		Unfired sherds	TOTALS
Stratum Ib								3																						3
Stratum Ia					1	1		1																						3
Cist		1										1					1				2			3	1	35				44
Room Block A E Room 1																														0
E Room 2																														0
E Room 3 Fill														2							1				1	3				7
Room 4 General fill							1							1		1	2	1	1		12				2	57				78
Level C																														0
Level B																			3		1									4
Level A																		1								1				2
Floor		2						3					1	1				1			4					3				15

	GRAY WARE	Chapin	Unidentified grayware		RED WARE	Bluff Black-on-red	Deadman's Black-on-red	Unidentified red ware	Tusayan Polychrome		WHITE WARE	Piedra Black-on-white	Cortez Black-on-white	Cortez/Mancos Black-on-white	Mancos Black-on-white	Mancos Black-on-white corrug. var.	Mancos/McElmo Black-on-white	McElmo Black-on-white	McElmo/Mesa Verde Black-on-white	Mesa Verde Black-on-white	Unidentified Black-on-white corrug.	Unidentified white ware	Sosi Black-on-white	CORRUGATED WARE	Mancos corrugated	Mesa Verde corrugated	Unidentified corrug. sherds		Unfired sherds		TOTALS
	Pit 3																										1				1
	Wall (east)																		1								2				3
Room 5	Fill		2				1							2	4	1		1	4	2		6					12				35
	Subfloor fill																			1											1
Room Block B Prov. Unknown		2	1					2	1						9		7	5	6	4	1	18			1		44				101
Room 6	Fill																1	1	4	1		6					2				15
Room 7	Fill	2	2				2	1	1			2	1		4	1	1	5	9	6		25	1			4	58		1		126
	Upper fill																		1	1						1	6				9
Room 8	Fill																										1				1
Room 9	Fill	1	1															3	3	1		4				2	17				32
	Subfloor fill																		1			2					1				4

		GRAY WARE	Chapin	Unidentified grayware		RED WARE	Bluff Black-on-red	Deadman's Black-on-red	Unidentified red ware	Tusayan Polychrome		WHITE WARE	Piedra Black-on-white	Cortez Black-on-white	Cortez/Mancos Black-on-white	Mancos Black-on-white	Mancos Black-on-white corrug. var.	Mancos/McElmo Black-on-white	McElmo Black-on-white	McElmo/Mesa Verde Black-on-white	Mesa Verde Black-on-white	Unidentified Black-on-white corrug.	Unidentified white ware	Sosi Black-on-white	CORRUGATED WARE	Mancos corrugated	Mesa Verde corrugated	Unidentified corrug. sherds		Unfired sherds	TOTALS
Room 10	Fill	1												1	1					1		6				2	9				21
	Subfloor fill		1					2	1						2							8				*2	21				*37
Kiva	Fill	3	8					2				1		1	2					1		13				1	42		1		75
	Floor contact																		2								1				3
	Subfloor fill		2				1								1								1				8				13
Storage Room 1	Fill																					4					3				7
Storage Room 2																															0
Storage Room 3																															0

*Partially restorable vessel

	GRAY WARE	Chapin	Unidentified grayware		RED WARE	Bluff Black-on-red	Deadman's Black-on-red	Unidentified red ware	Tusayan Polychrome		WHITE WARE	Piedra Black-on-white	Cortez Black-on-white	Cortez/Mancos Black-on-white	Mancos Black-on-white	Mancos Black-on-white corrug. var.	Mancos/McElmo Black-on-white	McElmo Black-on-white	McElmo/Mesa Verde Black-on-white	Mesa Verde Black-on-white	Unidentified Black-on-white corrug.	Unidentified White ware	Sosi Black-on-white	CORRUGATED WARE	Mancos corrugated	Mesa Verde corrugated	Unidentified corrug. sherds		Unfired sherds		TOTALS
TOTALS																															
General Surface Prov. Unknown		1	3			1	2	2				5			11	3	3	5	8	8		39				10	100		3		204
Exploratory Trench			1			1	1		4				1		4		1	1	1			4			4	1	57				81
Room Block A			4				1	1	3					3	8	1	1	3	8	7		24				3	79				146
Room Block B		9	15				3	7	3			3	1	2	19	1	9	14	26	15	1	82	2		1	12	210		2		437
TOTALS		10	23			2	7	10	10			8	2	5	42	5	14	23	43	30	1	149	2		5	26	446		5		868

from this area. Breternitz, Rohn and Morris (1975) provide the reference for establishing the major categories. Thanks are due to Alan Spencer and Robert Neily who provided assistance in the identifications of the ceramics.

DISCUSSION OF TYPES

Gray Ware

Chapin Gray is characterized by the predominance of crushed rock temper which distinguishes it from Lino Gray. Igneous rock such as diorite or andesite is common and often sandstone is included. Sand and mica are rare. The tempering particles are large, often protruding the surface. The vessels were generally scraped and smoothed, often creating draglines. Polished specimens were previously considered as a separate variety--Twin Trees. The thickness is variable (2.5-9.0 mm) averaging 4.5 to 5.5 mm. Chapin Gray Ware was manufactured during the Basketmaker III and Pueblo I periods. In Basketmaker III times, it is associated with Chapin Black-on-white and Abajo Red-on-orange. During Pueblo I, it is associated with Bluff Black-on-red, Deadman's Black-on-red and Moccasin Gray Wares (Breternitz, Rohn, and Morris 1974). According to Breternitz, Rohn and Morris (1974:14), "Body sherds of these four types (Chapin Gray, Moccasin Gray, Mancos Gray and Mummy Lake Gray) cannot be separated reliably." Rohn (1977) suggests that the Basketmaker III-Pueblo I Chapin Gray type is a variety of the Chapin Gray series which spans the period from Basketmaker III to early Pueblo III. He concurs with Breternitz, Rohn and Morris that the other varieties can only be distinguished in whole vessels or rim and neck sherds. Moccasin Gray, a Pueblo I ware, differs from Chapin in the presence of unobliterated neck bands. Mancos Gray, an early Pueblo II ware, also differs from Chapin in the presence of neck bands. Mummy Lake Gray, a Pueblo II and Early Pueblo III ware, differs from the other types in having vessel forms similar to those of corrugated vessels and a flaired or everted fillet rim (Breternitz, Rohn, and Morris 1974). It would appear that the sherds typed as Chapin plain gray can only be designated as a plain gray ware except for rim sherds.

Based on the absence of other Basketmaker III pottery types and the presence of Pueblo I wares (various red wares including Bluff and Deadman's Black-on-red and Piedra Black-on-white), the few Chapin Gray sherds recovered would represent the Pueblo I period at the site rather than Basketmaker III. However, all of the Chapin Gray sherds in this sample are body sherds so that temporal determinations cannot be made from this type at Big Westwater Ruin.

Unidentified plain gray ware is an ill-defined category, comprising sherds with diverse temper. Most of these specimens are, in part, sherd tempered. They may be from uncorrugated portions of corrugated vessels. Since these were utilitarian forms, less care may have been taken in the selection of temper and most have some portion where the coils were obliterated. Some of these may also be unslipped sherds from vessels intended to be white ware or painted black-on-white vessels since in some cases the presence of a slip is the only differentiation for white ware sherds. This category is chronologically non-diagnostic. In most cases the temper of these sherds is mixed, and not confined to just sherd temper. Both Mancos and Mesa Verde Corrugated pottery predominately are crushed igneous rock tempered, "rarely (with) sand or sherds" (Breternitz, Rohn and Morris 1974: 17,21). The earlier black-on-white types, Chapin, Piedra and in large part, Cortez, were tempered with crushed igneous rock. The use of crushed sherds for temper first occurs in Cortez Black-on-white. It was extensively used in Mancos and Mesa Verde Black-on-white pottery, though not to exclusion of rock temper. Generally sherd temper was associated with some crushed rock temper, possibly derived from the crushed sherds (Breternitz, Rohn and Morris 1974).

Red Ware

Red wares in the San Juan region were generally in use during the Pueblo I period though Abajo Red-on-orange first appears in late Basketmaker III times (Breternitz, Rohn, and Morris 1974). Local red ware types recovered from Big Westwater are Bluff Black-on-red, Deadman's Black-on-red, and unidentified red ware. Tusayan Polychrome, a late-Pueblo II early-Pueblo III Kayenta tradeware, was also recovered from the site.

<u>Bluff Black-on-red</u> (Figure 58d) is the earliest (A.D. 750 to <u>900, Breternitz, Rohn</u> and Morris 1974) of the red wares recovered from Big Westwater Ruin. This type is tempered with light colored crushed rock, a little sand, and occasionally crushed sherds. It is brick red to pink in color without a slip or glaze. The design layout is bilateral and quadrilateral, often leaving large portions of the field plain. The rim is usually flattened. It is probably a technological variation of Abajo Red-on-orange (Breternitz, Rohn, and Morris 1974) though Rohn (1977) classes it as an unslipped form of Deadman's Black-on-red. Breternitz, Rohn, and Morris (1974) are followed in referring to it as a separate type. One Bluff Black-on-red sherd was recovered from the general surface collection, and another from Stratum 1a of the exploratory trench.

<u>Deadman's Black-on-red</u> (Figure 58e-f) is essentially contemporaneous with <u>Bluff Black</u>-on-red but lasts later in time. It is generally dated from A.D. 800 to 1000 and it is thought to have been derived from Bluff Black-on-red. Its surface is smoothed and polished and slipped with bright red clay. Design elements are generally angular rather than curved. Parallel lines, sometimes zig-zagged, are common (Breternitz, Rohn and Morris 1974). Seven sherds of Deadman's Black-on-red were recovered

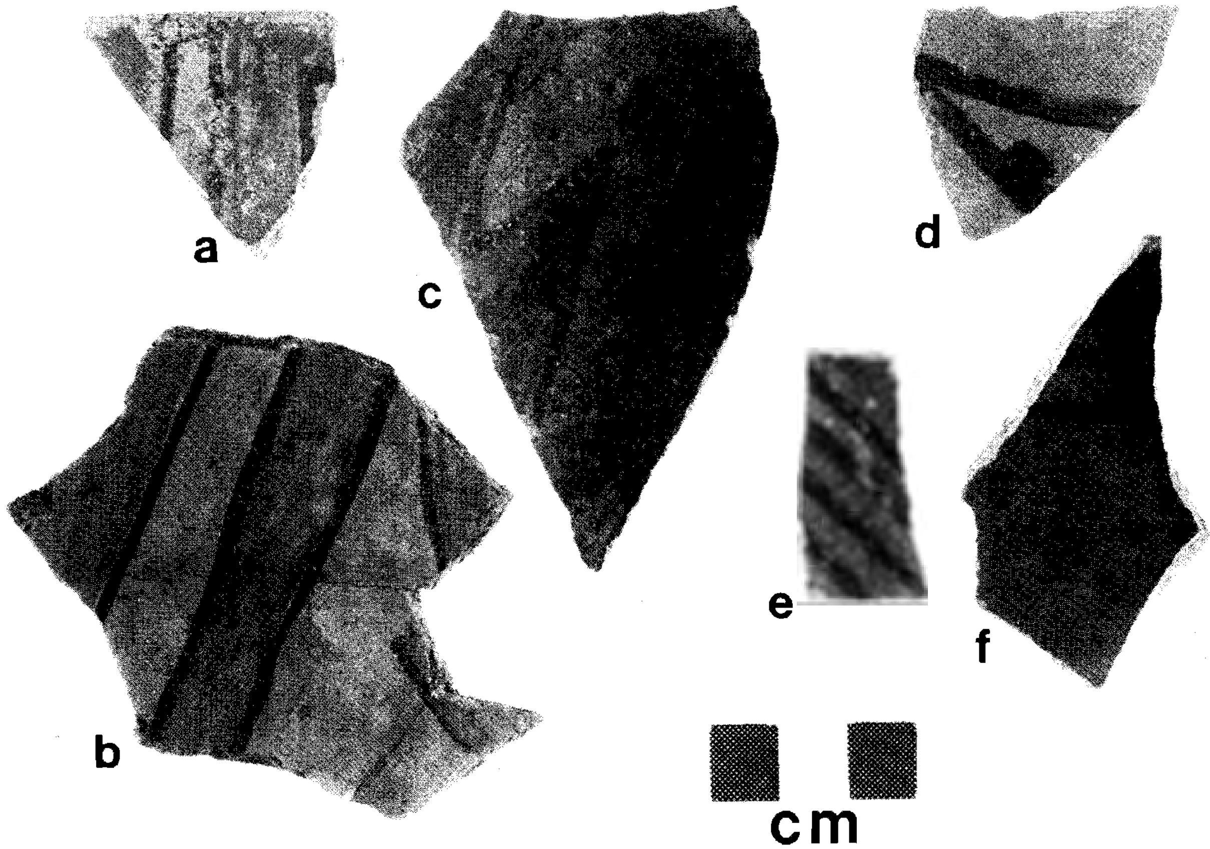


Figure 58 Red Ware Ceramic Sherds: Tusayan Polychrome a-c; Bluff Black-on-red d; Deadman's Black-on-red e,f.

from the site. One was found in Stratum 1a of the exploratory trench, along with the Bluff Black-on-red sherd. Others were recovered from the fills of Rooms 5 and 7 and one was from the subfloor fill of the kiva. One sherd (Figure 59) has been ground at an angle on one edge.

Tusayan Polychrome (Figure 58a-c) is an intrusive Kayenta ware dating from late Pueblo II to early Pueblo III. Design elements of this style are angular, often consisting of vertical, horizontal and diagonal stripes and hachures. Black lines outline red painted areas. Colton (1956) designates this type as Pueblo III, from about A.D. 1150 to 1300 and notes that this is a fairly common trade ware from northern Arizona. This type was found associated with an A.D. 1212 to 1214 tree-ring dated construction at Westwater - Five Kiva - Ruin to the north (Lindsay 1981). This trade ware seems common to the area as it is also reported from site 42Sa863 in Montezuma Canyon to the

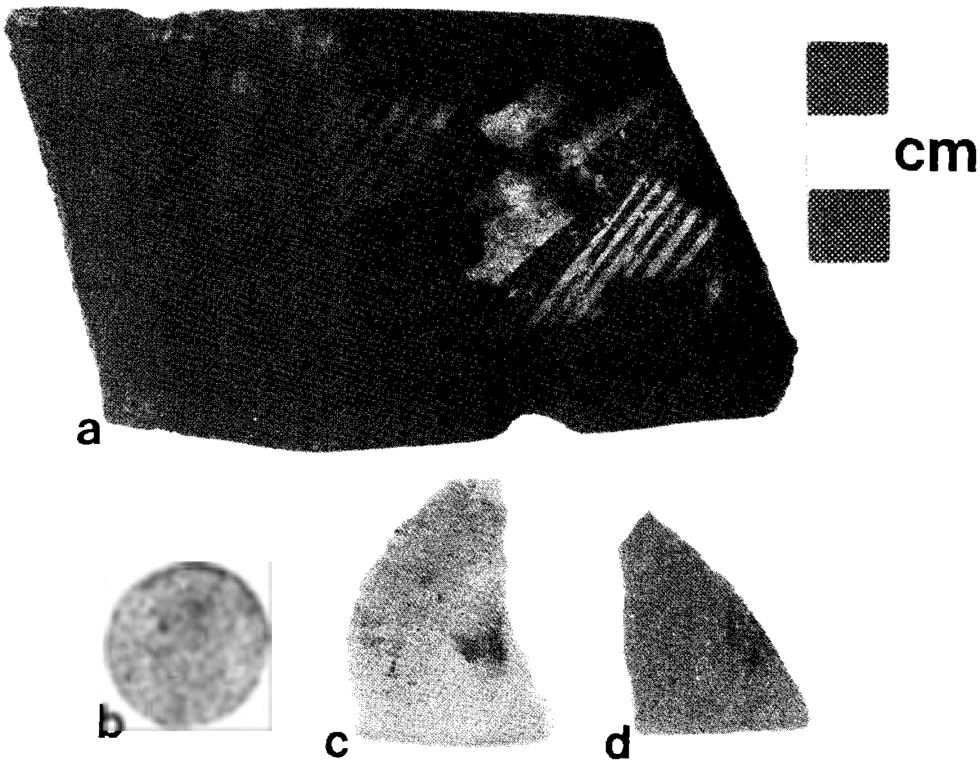


Figure 59 Worked Ceramic Sherds: Mancos Black-on-white a; Unidentified Sherd b; Mesa Verde Black-on-white c; Deadman's Black-on-red d.

east (Forsyth 1977:159). Ten sherds of this type were recovered from Big Westwater Ruin. Provenienced sherds are from Strata 1a and 1b in the exploratory trench, from the floor of Room 4, the fill of Room 7 and the subfloor fill of Room 10. Its presence in Stratum 1a of the exploratory trench along with Bluff Black-on-red and Deadman's Black-on-red is questionable since the latter are Pueblo I wares. It is likely either intrusive or the San Juan Red Wares persist well into Pueblo II times, similar to the occurrence on Cedar Mesa (Dalley 1973).

Unidentified Red Ware consists of fragmentary sherds or those lacking in enough design for identification. Provenienced sherds of this category were recovered from Room 4 in Room Block A and Room 7, subfloor fill of Room 10, and the kiva of Room Block B.

White Ware

Piedra Black-on-white (Figure 60) is the earliest white ware found in the sample. The type was made during the Pueblo I period (A.D. 750 to 900) and is probably derived from Chapin Black-on-gray (Breternitz, Rohn and Morris 1974). The only provenienced sherds are from the fills of Room 7 and the kiva in Room Block B.

Cortez Black-on-white is an early (ca A.D. 900 to 1000) Pueblo II ware (Breternitz, Rohn, and Morris 1974). It probably was derived from Piedra Black-on-white. Provenienced sherds were recovered from the cist in the exploratory trench and the fill of Room 7 in Room Block B.

Cortez/Mancos Black-on-white. Five sherds were identified to be one of these two types, made sometime during the Pueblo II period. Provenienced sherds of this category are from the

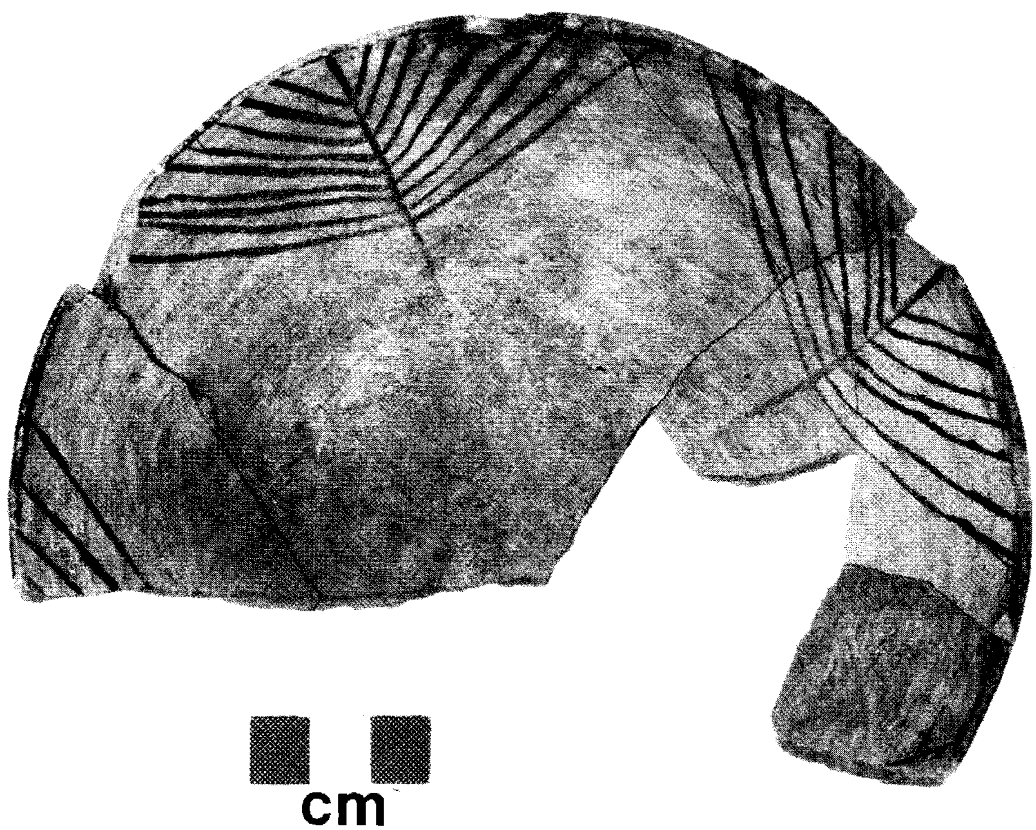


Figure 60 White Ware: Partially Restored Piedra Black-on-white Bowl

floor of Room 4 and the fill of Room 5 in Room Block A; and in Room Block B, from the fills of Room 10 and the kiva.

Mancos Black-on-white (Figure 61) is a Pueblo II ware dating from about A.D. 900 to 1150 (Breternitz, Rohn and Morris 1974). Provenienced sherds were recovered from Stratum III of the exploratory trench, early Room 3 fill, the floor of Room 4, and the fill of Room 5 in Room Block A; and the fill of Room 7, the fill and subfloor fill of Room 10, and the fill and subfloor fill of the kiva in Room Block B. A sherd from Room 5 has been abraded and ground slightly on one edge. Another Mancos Black-on-white sherd (Figure 59) has been more extensively worked and is fire blackened. This latter artifact is unprovenienced. Mancos Black-on-white Corrugated sherds were recovered from the general surface sample, the surface of Room Block A and from Room Block B.

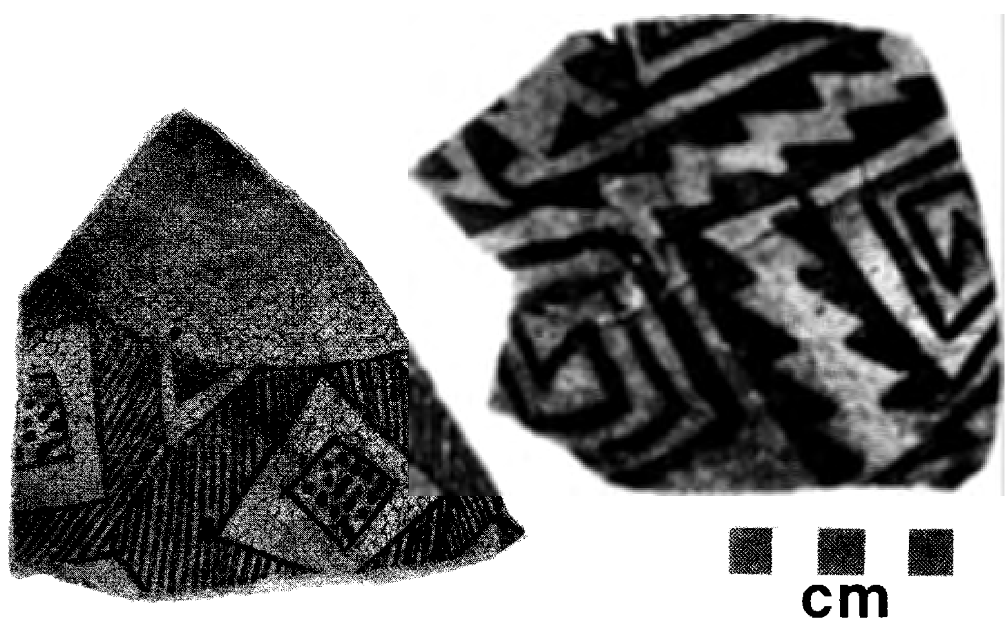


Figure 61 White Ware: Mancos Black-on-white Ceramic Sherds

Mancos/McElmo Black-on-white. (Figure 62) Fourteen sherds were classified as either Mancos or McElmo Black-on-white, and would be either Pueblo II or early Pueblo III manufacture. Provenienced specimens are from Stratum III of the exploratory trench, the general fill of Room 4 in Room Block A, and the fills of Rooms 6 and 7 in Room Block B.

McElmo Black-on-white (Figure 63) is an early Pueblo III ware dating from ca A.D. 1075 to 1275 (Breternitz, Rohn and Morris 1974). Rohn (1971) sees McElmo as a variety of Mesa Verde Black-on-white. The subjective nature of type identification is illustrated by Rohn's (1971:145) comment on the Mesa Verde Black-on-white pottery from Mug House "if found on earlier sites would be labeled McElmo Black-on-white by some archeologists." Breternitz, Rohn and Morris (1974) note in discussing McElmo Black-on-white that "many designs are transitional between Mancos Black-on-white and Mesa Verde Black-on-white;"

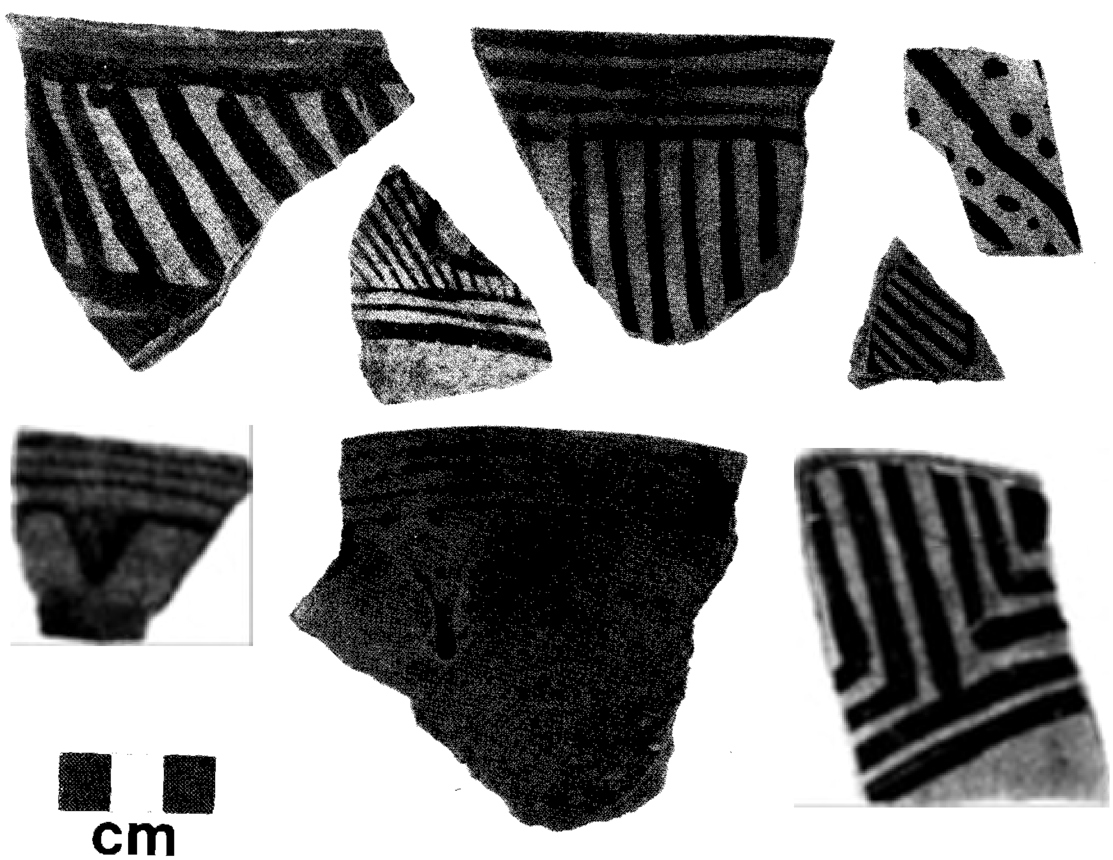


Figure 62 White Ware Ceramic Sherds: Mancos/McElmo Black-on-white

Figure 63 White Ware: McElmo Black-on-white Ceramic Sherd

and that "in general, a range of variation in McElmo may be seen as distributed along a continuum between Mancos Black-on-white and Mesa Verde Black-on-white." Aside from pointing to the difficulties that may arise in identifying individual sherds along such a continuum, these comments imply a direct development within the Mesa Verde White Ware sequence. In contrast, Abel (in Breternitz, Rohn and Morris 1974:42) believes McElmo Black-on-white"...came directly out of the Kayenta country and appears first in Chaco Canyon....at about 1050 or 1060" and "reached the Mesa Verde about a century later" (A.D. 1150-1160). He sees the importation of the idea of vegetal paint from the Kayenta, eventually reaching Mesa Verde in the form of McElmo Black-on-white. It is interesting to consider the idea of McElmo Black-on-white as diffused from Kayenta since Tusayan Polychrome is another, and more direct, import from the Kayenta region at roughly the same or slightly earlier period (late-Pueblo II to early-Pueblo III).

This compares favorably with the second period of Kayenta influence into the eastern area hypothesized by Lipe and Matson

(1971) and Lister (1964) and discussed by Plimpton and Fritts (1974) among others. The first period of strong Kayenta influence was in the Basketmaker III period, which is not represented at Big Westwater Ruin. Hayes and Lancaster (1975:136) note:

> McElmo Black-on-white is the dominant decorated pottery of a short early Pueblo III period (Swannack 1969). Though individual sherds out of context may be difficult or impossible to distinguish as 'Sloppy Mesa Verde' from a late site or 'incipient Mesa Verde' from an early one, Kidder's term of years ago--'Proto-Mesa Verde' seems to have been close to the mark. As difficult as it is to pin down, there is a McElmo Black-on-white during a time of experimentation.

Twenty-three sherds of McElmo Black-on-white were recovered. Provenienced specimens are from the cist in the exploratory trench, the fills of Rooms 4 and 5 in Room Block A, and Rooms 6, 7, and 9 of Room Block B.

<u>McElmo/Mesa Verde Black-on-white</u> (Figure 64). Forty-three sherds were identified to be one of these two types and would

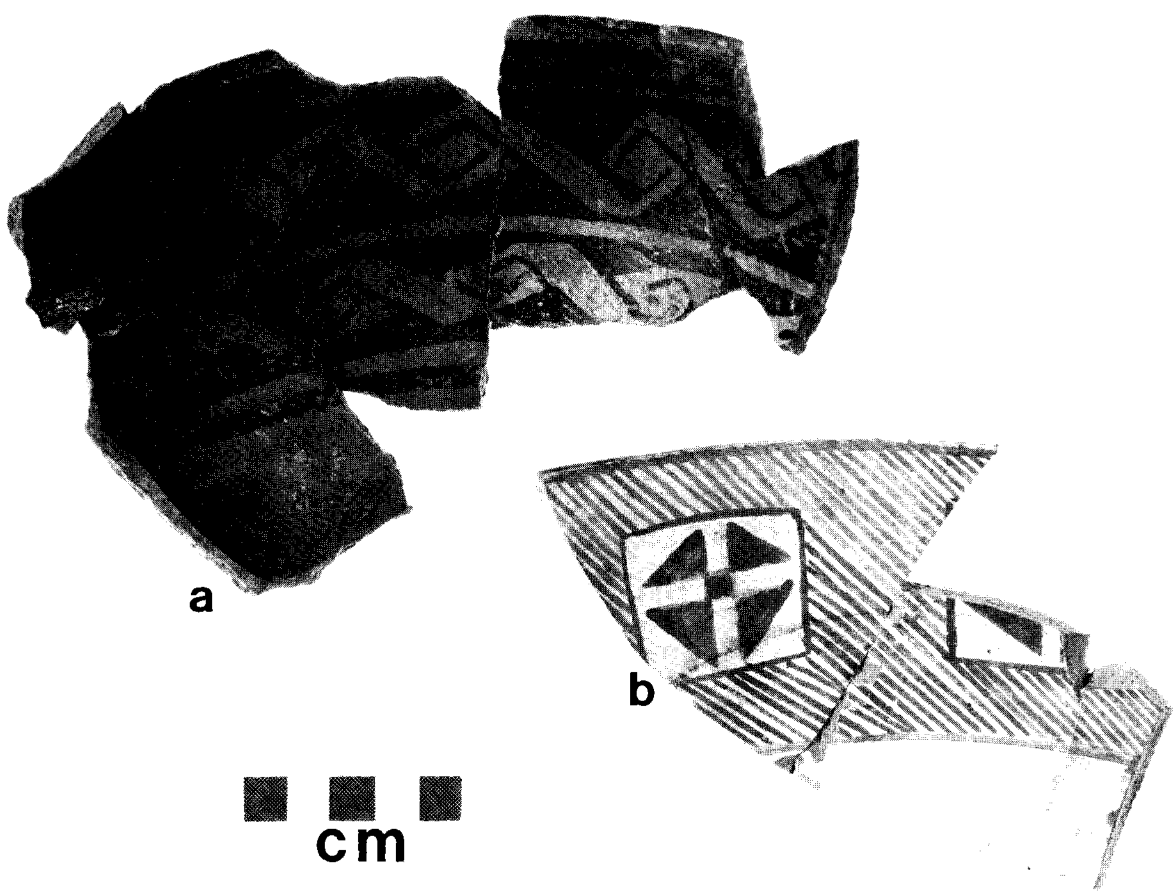


Figure 64 White Ware Ceramic Sherds: McElmo/Mesa Verde Black-on-white

fall within the Pueblo III period. Provenienced sherds were recovered from the general fill, Level A, the floor, and east wall B of Room 4 and the fill of Room 5 in Room Block A; and Room Block B, from the fill of Room 6, the fill and upper floor of Room 7, the fill and subfloor fill of Room 9, and from the floor of the kiva.

Two bowls contain design elements that are quite distinctive for the sample. One bowl fragment (Figure 64a) is from the fill of Room 5 in Room Block A. It consists of a center square with pendant triangles from its corners, giving an impression of a "cross." It is set within another, open, square within a band of diagonal hatching. Similar designs have been found at Mug House on McElmo/Mesa Verde Black-on-white pottery (Rohn 1971: Figure 191a, g, i; Figure 195; Figure 196; Figure 206). Rohn notes "Talons, swastikas, and squares with external corner triangles were placed in relatively open interior spaces not occupied by the design motif or inside the large space breakers within solid units" (Rohn 1979:171). At Mug House, this figure is found within triangles, scrolls and circles. This same design element, enclosed within two concentric circles in hatched lines is found on Mancos Black-on-white pottery from the Kiln Site (42Sa2160) excavated on Highway U-95 (Madsen 1975: Figure 44c). A square with pendant triangles from the corners is present in the middle of the open interior Mesa Verde Black-on-white bowl from Montezuma Canyon (Forsyth 1977: Figure 86b). This is also found on a Mesa Verde Black-on-white sherd from Badger House community (Hayes and Lancaster 1975: Figure 164c).

The second design (Figure 64b) is less unusual in being a variation on interlocking scrolls, a common motiff. It differs in the scroll being more angular than the curvilinear ones usually seen. Similar designs are found on Cortez Black-on-white pottery and a Mesa Verde Black-on-white mug handle (Breternitz, Rohn and Morris 1974: Figures 18c and 24f). It is also on a Mesa Verde Black-on-white bowl from Montezuma Canyon (Forsyth 1977: Figure 83b).

While initially, it was considered possible that these bowls were trade ware from the Kayenta region (for example, the angular scroll design is present in Walnut Black-on-white [Colton 1955]), they are more likely to have been made locally since similar motiffs are found from a number of sites in the area.

Sosi Black-on-white. Two sherds were identified as a Kayenta intrusive. The type occurs in the Kayenta region ca A.D. 1070 - 1150 as a late-Pueblo II/early-Pueblo III ware (Colton 1955). The temper is a fine quartz sand. Designs consist of bold, predominantly horizontal stripes and some with large solid triangles (Colton 1955). The type occasionally occurs in this locale. A whole vessel was recovered from an early-Pueblo III site on Cedar Mesa (Wilson 1974). The two sherds were recovered from Room Block B. One was recovered from the subfloor fill of the kiva thus placing its floor construction no later than late-Pueblo II/early-Pueblo III.

Mesa Verde Black-on-white. (Figures 65 and 66). This is a classic Pueblo III ware and is generally dated A.D. 1200 to 1300 (Breternitz, Rohn and Morris 1974). It is thick walled and highly slipped. The decoration field is very subdivided and filled in. Breternitz, Rohn and Morris (1974:46) note "Mesa Verde Black-on-white has been called a refined McElmo Black-on-white." It is generally associated with Mesa Verde Corrugated and McElmo Black-on-white pottery. Thirty Mesa Verde Black-on-white sherds were recovered. None of these were from the exploratory trench.

Provenienced sherds were recovered from the Level B of Room 4 and the fill and subfloor fill of Room 5, in Room Block A. In Room Block B, provenienced sherds are from the fill of Room 6, the fill and upper floor of Room 7, and the fills of Rooms 9, 10 and the kiva. One of the sherds from Room 7 has been worked (Figure 59). It has been abraded on one side as if used for scraping or smoothing pottery.

Figure 65 White Ware: Partially Restored Mesa Verde Black-on-white Bowl

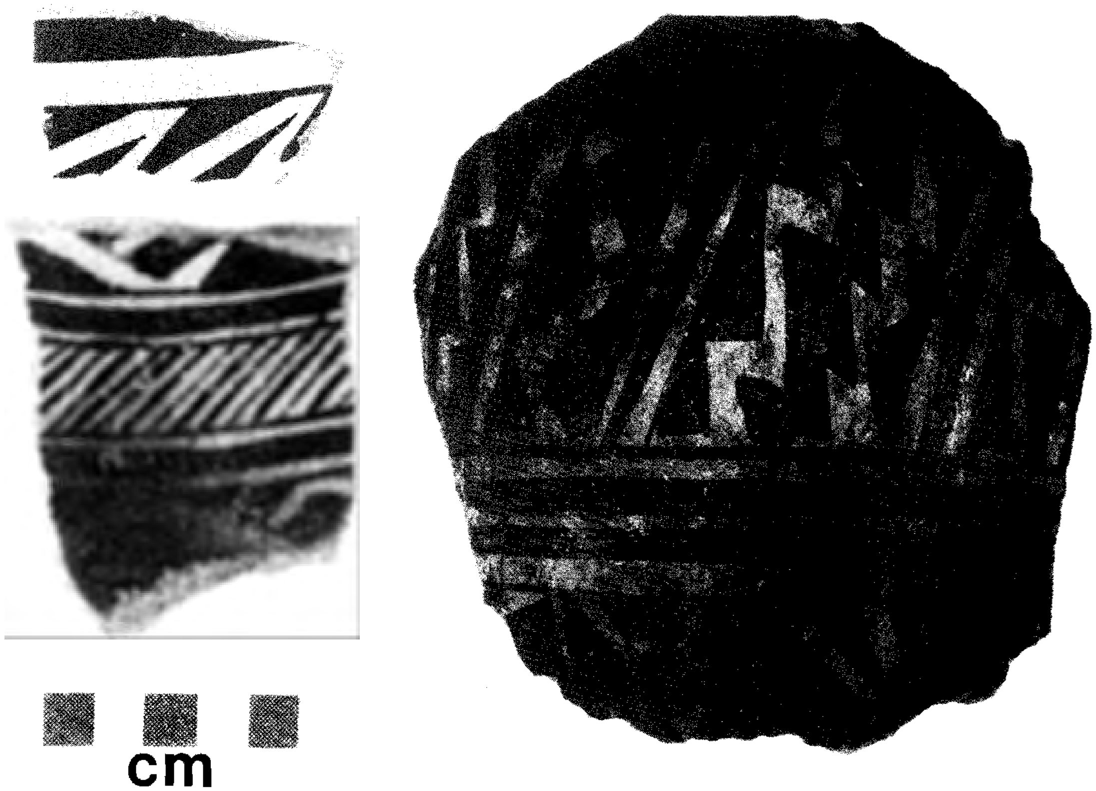


Figure 66 White Ware Ceramic Sherds: Mesa Verde Black-on-white

Corrugated Wares

Unidentified Corrugated Sherds. Corrugated vessels are thought to have been utilitarian wares. Breternitz, Rohn and Morris (1974) suggest use for storage and/or cooking. A total of 469 sherds and one whole vessel were recovered, comprising more than half of the total sample. Since the rim and neck of these vessels are generally the diagnostic element (Breternitz, Rohn and Morris 1974), the majority of these (449) are unidentified. Corrugated sherds are most commonly from Mancos or Mesa Verde Corrugated vessels, Pueblo II and Pueblo III wares respectively. Since the only corrugated rims found were of these two types, it is assumed that the corrugated body sherds from Big Westwater Ruin are from one of those two types and represent the Pueblo II and Pueblo III periods. One unprovenienced corrugated body sherd is much thicker and may correspond to what Forsyth (1977) calls Hovenweap Corrugated.

Mancos Corrugated. These are most often bell-mouthed jars with the mouth diameter almost as wide as the greatest diameter of the body. Jars and pitchers are short-necked. The rims are flairing. This ware is generally dated A.D. 900 to 1200. Mancos Corrugated is a Pueblo II ware, but Morris (in Breternitz, Rohn and Morris 1974) suggests it was in use during early Pueblo III as well. Only five Mancos Corrugated sherds were recovered. Three are from the cist in the exploratory trench and two are unprovenienced from the trench and Room Block B.

Mesa Verde Corrugated (Figure 67). This is a Pueblo III ware and is generally dated from A.D. 1100 to 1300 (Breternitz, Rohn and Morris 1974). Twenty-six rim sherds and one nearly whole vessel were recovered. Most of the provenienced sherds and the one vessel are from Room Block B. In the exploratory trench, only one sherd of Mesa Verde Corrugated was found in the cist fill. In Room block A, Mesa Verde Corrugated sherds were recovered from the fills of Rooms 3 and 4. In Room Block B, sherds were recovered from the fill and upper floor of Room 7, the fill of Room 9, and the fill and the subfloor fill of Room 10. The latter provenience also contained the one whole vessel. One sherd was recovered from the kiva fill.

The one whole vessel (Figure 67) is in a basketry holder and measures 38 cm high by 32 cm wide with an orifice diameter of 21 cm.

Miscellaneous

One unfired sherd was recovered from the fill of Room 7 and another from the kiva fill in Room Block B. Two clay samples were recovered from the kiva fill. In addition to the five worked sherds (discussed within types Mancos Black-on-white, Mesa Verde Black-on-white and Bluff Black-on-red), one unidentified sherd (Figure 59), worked into a circular disc, and one clay pipe (Figure 68) were found in the kiva fill. The tubular clay pipe is 6.5 cm long, 2.6 cm maximum outside diameter, 1.5 to 1.7 cm inside diameter at the larger opening and 0.9 to 1.0 cm inside diameter at the smaller opening. There is a slight constriction and darker area around the smaller end averaging approximately 1.5 cm out from the opening with a maximum of 2.5 cm at one side. The regularity of the stain and the slight constriction may suggest that it was fitted onto a holder.

DISTRIBUTION WITHIN THE SITE

Exploratory Trench

Eighty-one sherds were recovered from the exploratory trench east of Room Block A. Sherds were found in only five depositional units. Stratum 1a yielded three red ware

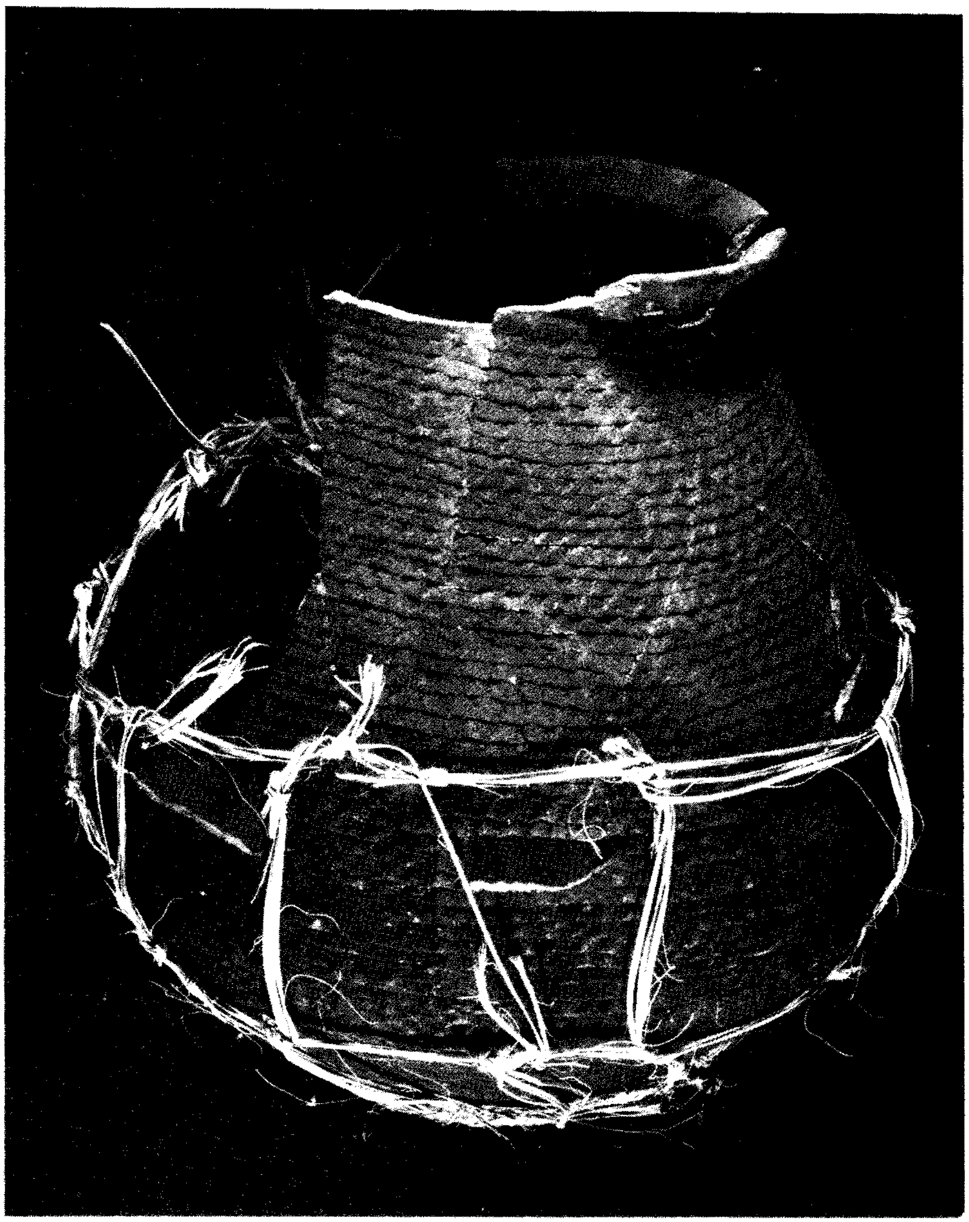


Figure 67 Partially Restored Mesa Verde Corrugated Vessel

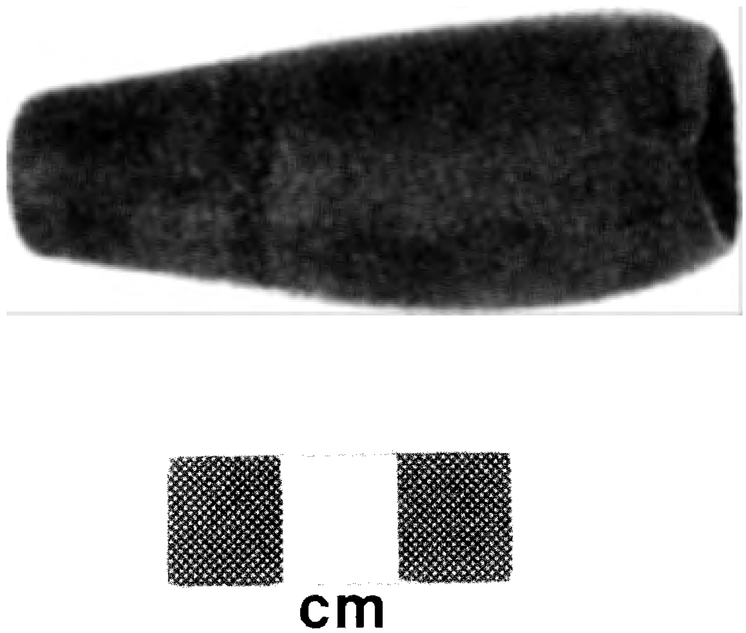


Figure 68 Tubular Ceramic Pipe

sherds--Bluff Black-on-red, Deadman's Black-on-red and Tusayan Polychrome. The first two are Pueblo I manufacture. The third is a late-Pueblo II/early-Pueblo III ware and it is likely intrusive from the overlying Statum Ib. Stratum lb contains three Tusayan Polychrome sherds. Stratum II had seven unidentified corrugated body sherds. Stratum III had one Mancos Black-on-white sherd, one Mancos/McElmo Black-on-white, and four corrugated body sherds. Stratum IV had one unidentifiable white ware sherd. No sherds were recovered from Strata V-VII. The cist contained Cortez and McElmo Black-on-white sherds as well as Mancos and Mesa Verde Corrugated sherds. Strata II and VII contribute to the fill of the cist.

The presence of Bluff and Deadman's Black-on-red sherds in the lowest stratum (la) would argue for deposition during Pueblo I times, but possibly as late as Pueblo II times. The presence of Tusayan Polychrome, not known earlier than late-Pueblo II in this area (A.D. 1212 to 1214 at Westwater - Five Kiva - Ruin [Lindsay 1981]) would lengthen the span of Stratum la to include the latter period. Since Stratum lb has three sherds of Tusayan Polychrome, intrusion from that stratum is a possibility. The remaining Strata II-V contain Pueblo II and Pueblo III sherds. The cist contains early Pueblo II (Cortez Black-on-white) through Pueblo III ceramics.

Room Block A

Most of the ceramic associations for Room Block A are Pueblo II and III. Early Room 3 fill contained Pueblo II and III pottery with two Mancos Black-on-white sherds, one unidentified white ware sherd, one Mesa Verde Corrugated sherd, and an unidentified corrugated body sherd. Room 4 is associated with Pueblo II and III pottery. Cortez/Mancos, Tusayan Polychrome, and McElmo/Mesa Verde Black-on-white and corrugated body sherds were found in floor contact. Level A contained possible early-Pueblo III ceramics including McElmo/Mesa Verde Black-on-white and a corrugated body sherd. Level B contained only Pueblo III ceramics including Mesa Verde Black-on-white and an unidentified white ware sherd. No ceramics were recovered from Level C. Pit 3 yielded one corrugated body sherd. Room 5 ceramic assemblages appear to be mixed, which is consistent with the assessment the room had been looted. Pueblo I through Pueblo III ceramics were found in the fill. The floor was almost totally destroyed. One Mesa Verde Black-on-white, a Pueblo III ware, was recovered from the subfloor fill.

Room Block B

Room 6 contained primarily Pueblo III ceramics. One sherd is possibly Pueblo II (Mancos/McElmo Black-on-white). The other diagnostic types are Pueblo III (McElmo/Mesa Verde Black-on-white and Mesa Verde Black-on-white). Room 7 fill contained ceramics from Pueblo I through the Pueblo III (Deadman's Black-on-red, Piedra Black-on-white, through the Mesa Verde Black-on-white sequence, Tusayan Polychrome, Sosi Black-on-white, and Mesa Verde Corrugated). The upper floor yielded Pueblo III ceramics only--McElmo/Mesa Verde Black-on-white, Mesa Verde Black-on-white, and Mesa Verde Corrugated. Room 8 yielded only one corrugated body sherd, indicating the Pueblo II-III periods. Room 9 contained mostly Pueblo III ceramics (McElmo Black-on-white, McElmo/Mesa Verde Black-on-white, Mesa Verde Black-on-white, and Mesa Verde Corrugated). The subfloor fill contained similar ceramics. Room 10 contained Pueblo II and III ceramics--Cortez/Mancos Black-on-white, Mesa Verde Black-on-white and Mesa Verde Corrugated. Most are Pueblo III. The subfloor fill similarly contained mostly Pueblo II ceramics including one Tusuyan Polychrome, Mancos Black-on-white, Mesa Verde Corrugated sherds and the one Mesa Verde Corrugated vessel were recovered from this provenience. The Pueblo III vessel and sherds were probably from an intrusive storage pit, its level of origin disturbed from looting. No ceramics were recovered from Room 11.

The kiva fill contained sherds from Pueblo I to Pueblo III periods including red ware, Piedra Black-on-white, Cortez /Mancos Black-on-white, Mesa Verde Black-on-white, and Mesa Verde Corrugated, along with two worked sherds and a clay pipe. The floor of the kiva yielded McElmo/Mesa Verde Black-on-white, Pueblo III ceramics, and one corrugated body sherd. The subfloor fill contained Pueblo I and II ceramics including Deadman's Black-on-red, Mancos Black-on-white, and corrugated body sherds. A single Sosi Black-on-white sherd from the subfloor fill of the kiva suggests a probable date of no earlier than Pueblo III for its construction. Storage Room 1 contained only unidentifiable white ware and corrugated body sherds.

Most of the ceramics from Room Block B are from the Pueblo II and III periods. Exceptions are the general fill of Room 7, and the kiva fill. These rooms contained mixed fill from at least some looting as the ceramics range from Pueblo I to Pueblo III. The subfloor fill of the kiva appears to have been derived from earlier times as only ceramics from Pueblo I and II periods were recovered from this provenience. No construction specific to Pueblo I was identified at the site.

Lithics

from
Big Westwater Ruin

by
Michael P. Benson

INTRODUCTION

The excavations recovered a lithic assemblage of 170 artifacts. Sixty-two of these are classified as tools while the remaining 108 are debitage. Tools were classified and analyzed according to basic production technologies, and include flaked or chipped stone and ground and pecked stone. However, these groupings are somewhat arbitrary and some overlapping occurs.

Analysis was conducted on both tools and debitage. The data was coded onto computer statement sheets for computer-aided statistical analysis. Variables which emphasize production technology were the primary focus of the analysis as well as attributes which allow for cross comparison with other lithic assemblages. A Bausch and Lomb 10-70X variable sterioscope was used to determine edge damage, abrasion, polish, and any other functional or technological attributes evident on the tools. Debitage was also analyzed by defining technological attributes evident on individual flakes, but the limited sample size and the fairly extended occupation of the site did not allow for any significant conclusions to be drawn from the data. Exact provenience for each tool is found in Table VI. Of the 62 total tools assemblage, 28 (44.3 percent) are listed as provenience unknown, 32 (52.5 percent) are from fill and sealed deposits, and only 2 (3.3 percent) are found in actual floor contact.

CHIPPED STONE

Five tool categories are identified under chipped stone. These are thin bifaces (knives), thick end worked unifaces (scrapers), notches, used flakes, and cores.

Thin Bifaces (Figure 69b). Only one broken specimen in this category was analyzed. It is made out of a banded local chert, identified as Cottonwood Chert. The main source for this type of chert is found in Cottonwood Wash to the west.

Thick End-Worked Uniface (Figure 69e). Only one specimen was analyzed. It is made out of a fine grained quartzite and has at least one edge used as a scraper plane. It measures 6.0 cm long, 6.6 cm wide, 1.6 cm thick, and weighs 63 gms.

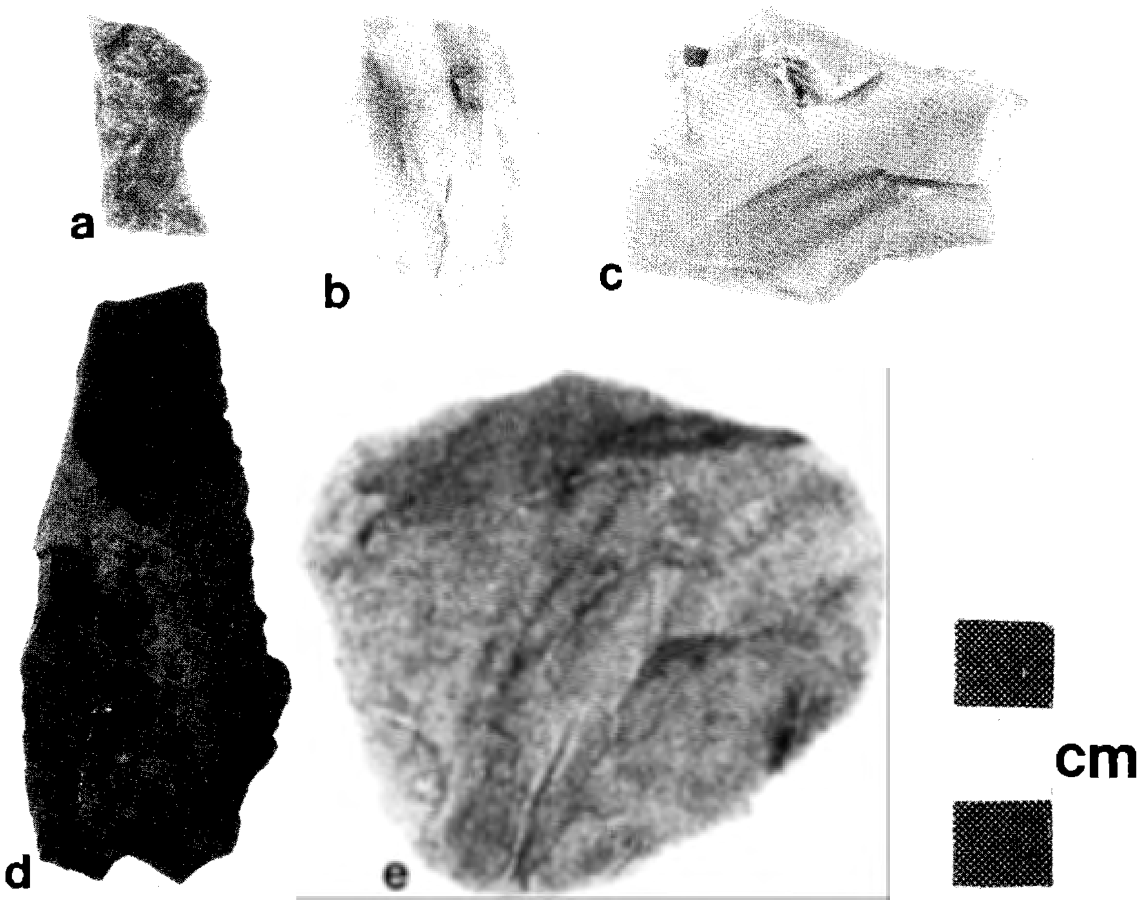


Figure 69 Chipped Stone Artifacts: Notch a; Thin Biface b; Used Flakes c, d; Thick End-worked Uniface e.

<u>Notches</u> (Figure 69a). Two notches were recovered. These were both found on one or more edges of small waste flakes and were probably used for a variety of functions. One notch measures 3.3 cm long, 4.5 cm wide, 2.5 cm thick, and weighs 13 gms. The other notch measures 2.4 cm long, 1.5 cm wide, 0.6 cm thick, and weighs 3 gms. As indicated by the measurements, this tool type is found on a variety of flake sizes and shapes.

<u>Used Flakes</u> (Figures 69c, d). A total of 13 used flakes were analyzed. They are found to be the predominant chipped stone tool type. Mean metric attributes and their standard deviations are listed below.

Length-	Mean 5.0 cm	Standard Deviation 2.7 cm
Width -	Mean 3.6 cm	Standard Deviation 1.7 cm
Thickness -	Mean 1.2 cm	Standard Deviation 4.6 cm
Weight -	Mean 21.8 gms	Standard Deviation 17.7 gms

Flakes from a wide variety of stone types were used as these nonspecific tools. These include sandstone, medium and fined grained quartzites, basalt, metamorphosed siltstone, and a variety of cherts. Because of their unmodified nature, this tool type could only be separated from debitage by the evidence of some type of edge damage, i.e. microflakes, striations, or polish.

Cores (Figure 70). Six cores; four chert, one quartzite, and one metamorphosed siltstone were analyzed. Of these only one was complete enough to determine its basic form. It is irregular with multiple prepared platforms. The remaining five are only fragments or discharged pieces of raw material.

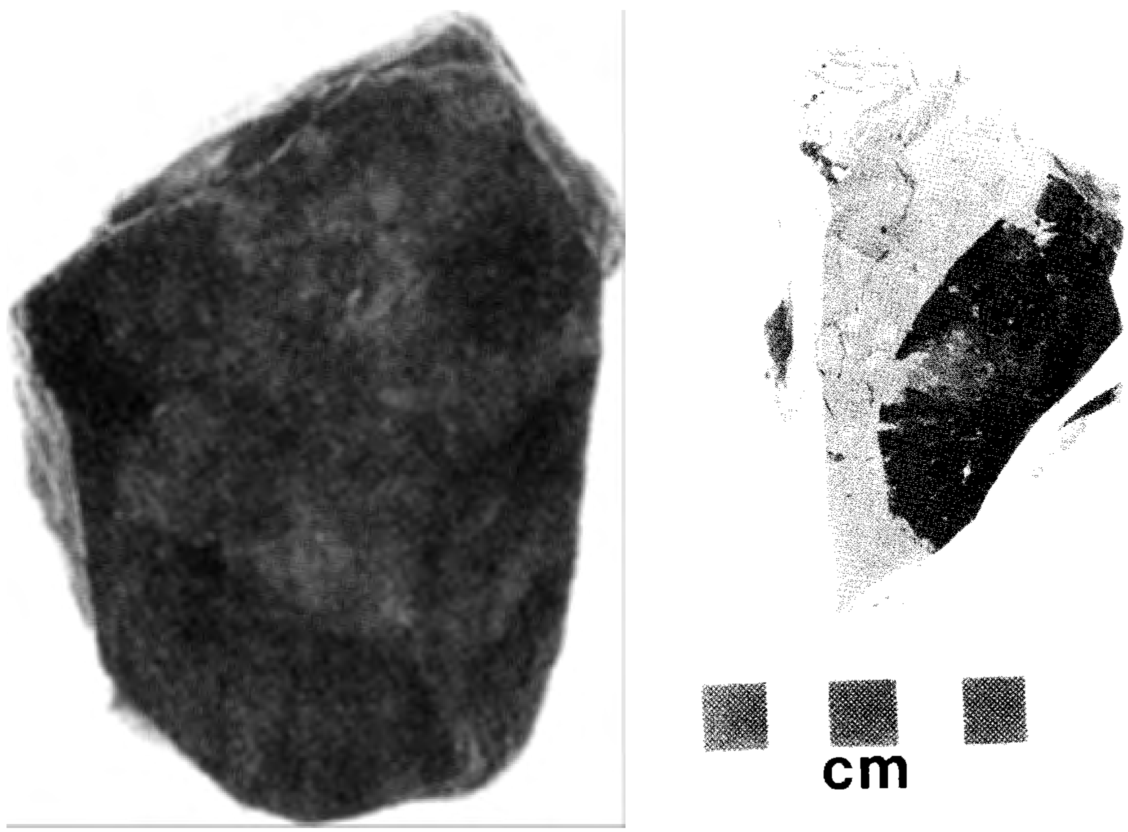


Figure 70 Chipped Stone Artifacts: Cores

GROUND STONE

Nine tool categories were defined for ground stone. They include hammerstones, abraders, pestles, pounding stones, grinding stones, manos, metates, axes, and polishing stones.

Hammerstones (Figure 71). A total of 22 hammerstones were classified into two technological types. Type A consists of hammerstones made from a raw material without modification. Type B hammerstones are made from exhausted tool forms such as cores and choppers.

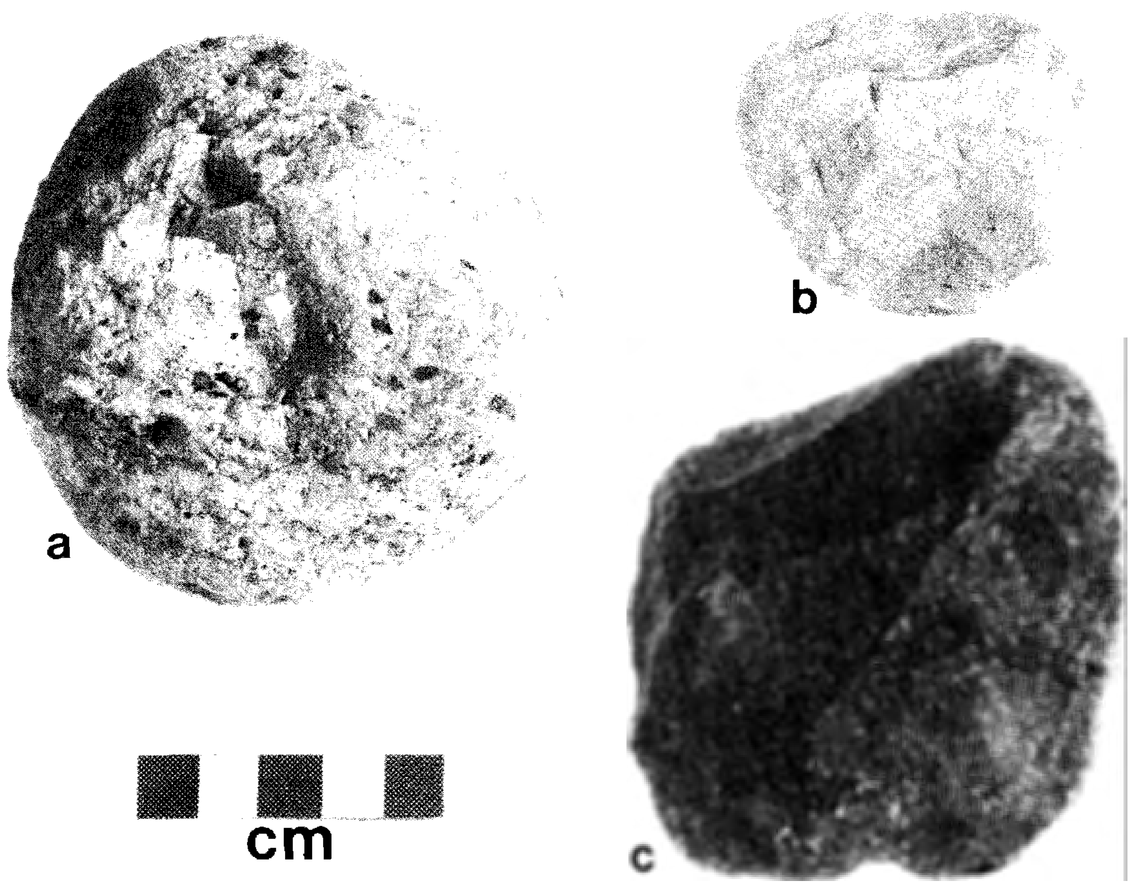


Figure 71 Ground Stone Artifacts: Hammerstones, Type A a; Type B b,c.

Sixteen Type A hammerstones were analyzed. Seven are quartzite, two are metamorphosed siltstone, one is argillite, five are chert and one is from conglomerate. Mean metric attributes and standard deviations are listed below.

Length-	Mean 7.0 cm	Standard Deviation 3.3 cm
Width-	Mean 6.0 cm	Standard Deviation 2.8 cm
Thickness-	Mean 4.2 cm	Standard Deviation 2.1 cm
Weight-	Mean 362 gms	Standard Deviation 291 gms

Six Type B hammerstones were also analyzed. Three are quartzite and three are chert. Mean metric attributes are listed below.

Length-	Mean 6.3 cm	Standard Deviation 3.3 cm
Width-	Mean 5.7 cm	Standard Deviation 2.8 cm
Thickness-	Mean 3.0 cm	Standard Deviation 1.7 cm
Weight-	Mean 173 gms	Standard Deviation 119 gms

Abrader (Figure 72c). This tool is ungrooved and made from a coarse sandstone.

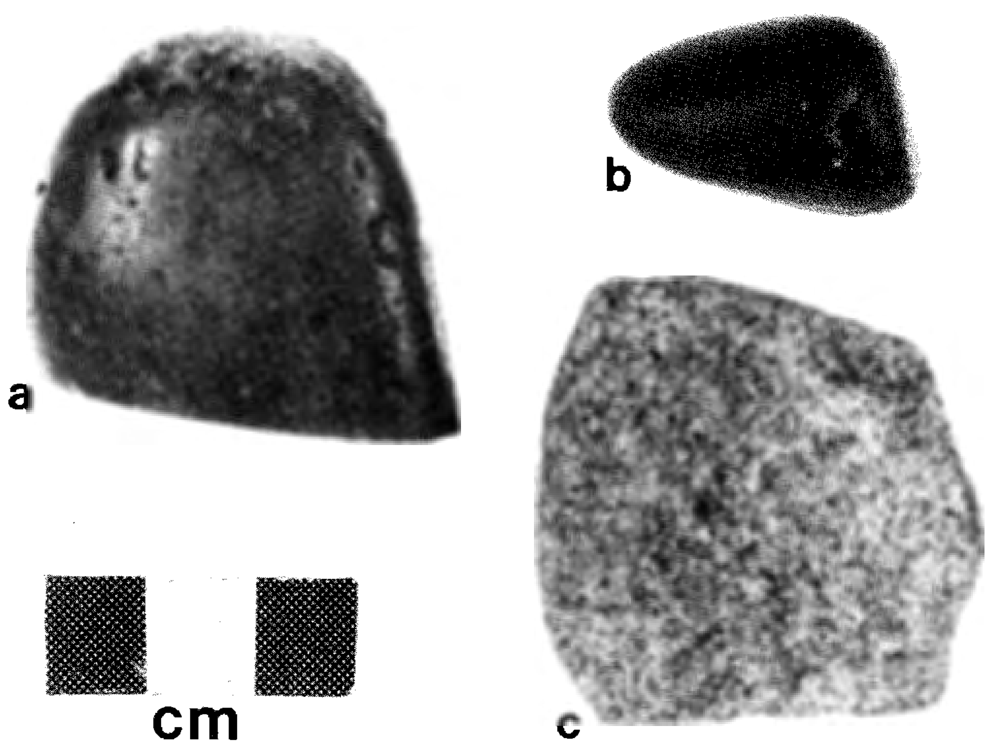


Figure 72 Ground Stone Artifacts: Unspecialized Pounding Stone a; Polishing Stone b; Abrader c

Pestle. This is an unspecialized and unshaped pestle made out of a fine grained quartzite. It measures 3.6 cm long, 4.2 cm wide, 2.9 cm thick, and weighs 70 gms. One end shows signs of extensive battering.

Unspecialized Pounding Stones (Figure 72a). Two tools were placed in this category. This tool type is differentiated from hammerstones largely on the basis of size and shape. The metric attributes are as follows:

Length-	Mean 17.0 cm	Standard Deviation 4.2 cm
Width-	Mean 11.0 cm	Standard Deviation 1.4 cm
Thickness-	Mean 7.5 cm	Standard Deviation 2.1 cm
Weight-	Mean 1757 gms	Standard Deviation 265 gms

Unspecialized Grinding Stones. Three tools were placed in this category due to their apparent use as grinding implements, yet they have no deliberate shaping and are highly variable in outline. All are made from coarse sandstone.

Manos (Figure 73a and b). A total of 6 manos were analyzed. Subtyping according to form and outline was not attempted although such data was recorded. Two are made from a granitic stone, two from quartzite, and two from sandstone. Mean metric attributes are as follows.

Length-	Mean 11.9 cm	Standard Deviation 13.8 cm
Width-	Mean 11.4 cm	Standard Deviation 16.0 cm
Thickness-	Mean 3.1 cm	Standard Deviation 1.5 cm
Weight-	Mean 1434 gms	Standard Deviation 1092 gms

Metate. One sandstone slab metate was analyzed. It measures 44.5 cm long, 31.0 cm wide, and 110 cm thick.

Axe (Figure 73c). One notched axe was analyzed. It measures 15.1 cm long, 6.2 cm wide, 3.0 cm thick, and weighs 442 gms. It is made from a metamorphosed siltstone and has been burned.

Polishing Stones (Figure 72b). Two polishing stones, one quartzite and one quartz, complete the ground stone inventory.

ENIGMATIC ARTIFACTS

Several artifacts, of dubious nature, were also collected during excavations but little can be said about them due to their form and unidentifiable function. Many of these may represent materials being brought into the rock shelter by its inhabitants but because they show no significant modification, they can only be classified as enigmatic. Most of these specimens are made from sandstone or brecciated cherts. Small concretions also make up a portion of this category.

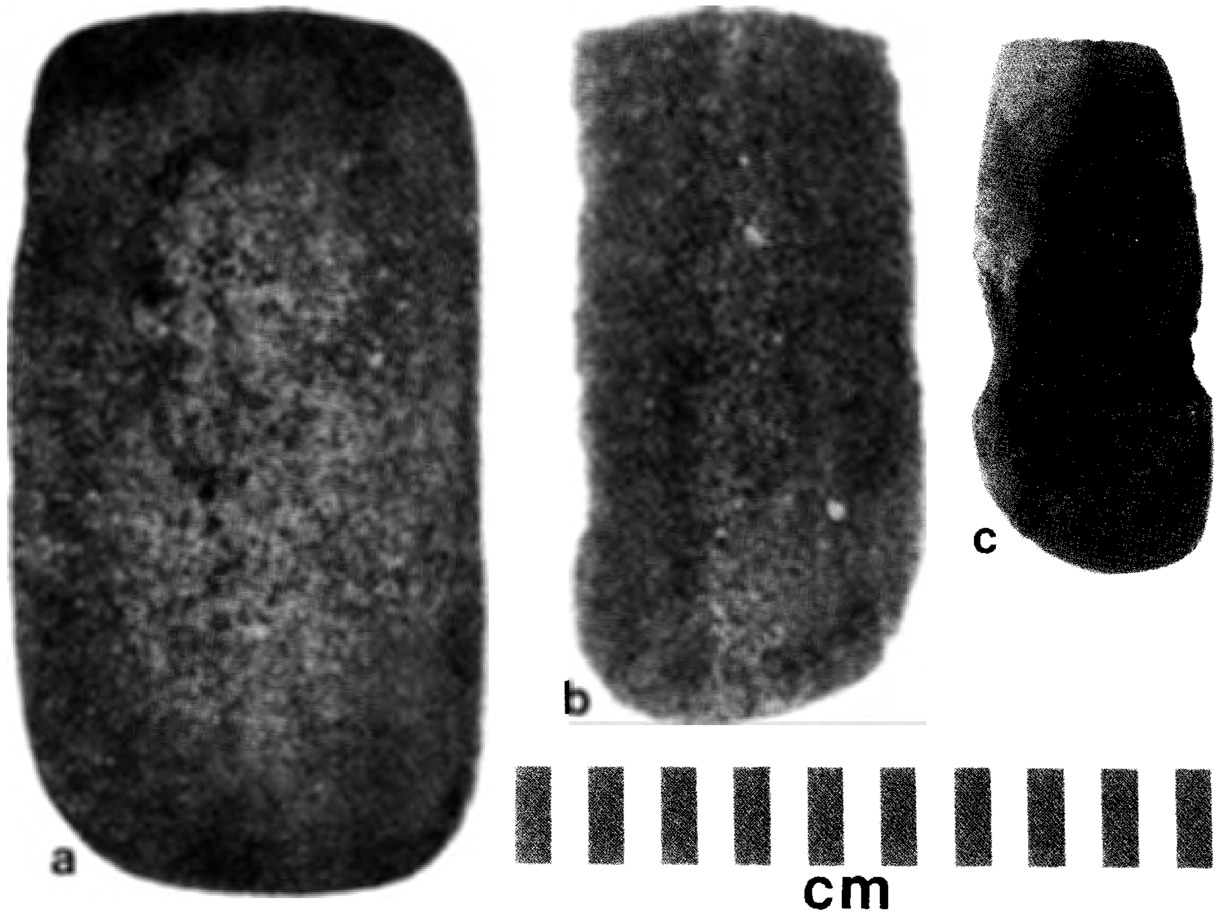


Figure 73 Ground Stone Artifacts: Manos a, b; Axe c

DISCUSSION

Few significant conclusions can be derived from the lithic assemblage from Big Westwater Ruin. This is largely due to the small lithic assemblage found at the site and its unspecialized nature. Only two of the 62 tools, a used flake and a mano, were found in actural floor contact. The used flake was found on the floor of Room 5 in Room Block A which temporally spans Pueblo II and III occupations. The mano on the other hand, was found on the floor of the kiva of Room Block B which has a tentative assignment of Pueblo III. Because neither of these artifacts can be considered culturally or temporally sensitive, little value can be given to their provenience. The remaining assemblage, including debitage, was found either in fill contexts or general surface or provenience unknown which indicates the overall disturbed nature of the cultural deposits at the site. Fifty-three percent of the lithic artifacts were recovered from fill and sealed stratigraphic deposits. Only a little over 3 percent were from floor contact.

Chipped stone only constitutes 38 percent of the total tool assemblage with ground stone comprising the remaining 62 percent. Of the chipped stone, over 56 percent are used flakes, with 26 percent cores and core fragments, and only 18 percent consisting of more functionally specific tools.

The largest ground stone category is hammerstones, 58 percent of the assemblage. If unspecialized pounding stones are included with hammerstones as being functionally the same, then this total would be nearly 63 percent. Manos constitute over 15 percent of the ground stone. The remaining tools constitute 21 percent.

There are indications that thermal alteration was used to enhance flaking properties of some materials used in the chipped stone assemblage. Twenty-one percent of the assemblage show signs of being burned as evidenced by noted color change, potlidding, and crazing. Over 15 percent show definite signs of deliberate annealing processes, while 64 percent show no signs of either burning or annealing. Burned specimens may have resulted from either deliberate annealing or else by extraneous causes such as accidental, man-made, or natural fires.

The fact that the lithic assemblage is so limited in scope and size poses several questions in and of itself. Is there a bias in sampling and excavation? Has the assemblage been significantly altered due to collecting activities at the site? Is there a tendency for sites of this type and time period to have characteristically small and unspecialized lithic assemblages? It should be noted that the midden area of the site was never tested or collected as well as the fact that the site has been extensively collected by local residents for a number of years. However, the total lithics recovered from nearby complete excavation of Westwater - Five Kiva - Ruin (Lindsay 1981) was also quite limited. This may suggest that lithics tool production occurred for the most part, removed from both rockshelters.

Table VI

Lithics Provenience

CHIPPED STONE GROUND STONE

	Used Flakes	Cores & Core Frag.	Notches	End Worked Unifaces	Thin Biface (knife)				Unworked Hammerstone	Exhausted Tool Hammerstones	Abraders (ungrooved)	Pestle Unworked	Pounding Stones (unspecialized)	Grinding Stones (unspecialized)	Manos (one handed)	Manos (two handed)	Notched Axes	Polishing Stones	Slab Metate											TOTALS
General Surface Prov. Unknown	3	4	1	1					6	5					1	2		2												25
Exploratory Trench																														0
Stratum VII																														0
Stratum VI																														0
Stratum V																														0
Stratum IV																														0
Stratum III	1													1																2
Stratum II																														0
Stratum Ib																														0

	CHIPPED STONE							GROUND STONE																						
	Used Flakes	Cores & Core Frag.	Notches	End Worked Unifaces	Thin Biface (knife)			Unworked Hammerstone	Exhausted Tool Hammerstones	Abraders (ungrooved)	Pestle Unworked	Pounding Stones (unspecialized)	Grinding Stones (unspecialized)	Manos (one handed)	Manos (two handed)	Notched Axes	Polishing Stones	Slab Metate												TOTALS
Stratum Ia																														0
Room Block A Room 4 General Fill	1				1																									2
Level C																														0
Level B																														0
Level A																														0
Floor																														0
Room 5 Fill								2			1	2		1	1															7
Floor Contact	1																													1
Room Block B Room 6 General Fill																		1												1
Fill								1			1																			2
Room 7 Fill	4		1					1		1																				7

	CHIPPED STONE								GROUND STONE											
	Used Flakes	Cores & Core Frag.	Notches	End Worked Unifaces	Thin Biface (knife)				Unworked Hammerstone	Exhausted Tool Hammerstones	Abraders (ungrooved)	Pestle Unworked	Pounding Stones (unspecialized)	Grinding Stones (unspecialized)	Manos (one handed)	Manos (two handed)	Notched Axes	Polishing Stones	Slab Metate	TOTALS
Room 9 Fill									3						1					4
Room 10 Fill									1											1
Kiva Fill	3	2			1				2	1			1				1			11
Floor Contact																1				1
TOTALS																				
General Surface Prov. Unknown	3	4	1	1					6	5					1	2		2		25
Exploratory Trench	1													1						2
Room Block A	2				1				2			1	2		1	1				10
Room Block B	7	2	1		1				8	1	1	1	1		1	1	1		1	27
TOTALS	13	6	2	1	2				16	6	1	2	3	1	3	4	1	2	1	64

Perishable Industries From Westwater - Five Kiva (42Sa14) - And Big Westwater (42Sa6752) Ruins

San Juan County, Utah:

A Synopsis

by
J. M. Adovasio

with the assistance of
J. S. Alexandrowicz
N. Luffman
M. Taft

ACKNOWLEDGMENTS

Analysis of the perishables from Westwater - Five Kiva - and Big Westwater ruins, described and discussed in this report, was conducted at the Basketry Analysis Facility of the Cultural Resource Management Program, Department of Anthropology, University of Pittsburgh under contract to the Antiquities Section, Utah Division of State History. Major assistance in the analysis and description of the sandals, cordage and miscellaneous constructions was provided by J. S. Alexandrowicz, N. Luffman and M. Taft. J. S. Alexandrowicz also assisted in the analysis of textiles and basketry from the study area. The authors wish to acknowledge S. D. Emslie who analyzed the feathers associated with the perishable assemblage and S. Weber and R. Hevly who provided identification of some of the raw materials used in the production of the perishables reported here. Additional assistance in raw material identification was provided by R. L. Andrews. D. Schlitter, Section of Mammals, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, identified the fur and hide specimens associated with several specimens of cordage. The authors are grateful to V. Krantz, Smithsonian Institution, Washington, D. C., who photographed the Westwater - Five Kiva and Big Westwater perishables. Photographic prints were prepared by D. Hupchick. Major assistance in the cleaning and stabilization of the most fragmentary of the Westwater textiles was generously provided by J. Gardner, Conservator, Section of Man, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. Assistance in the analysis of pigments was provided by R. Feller and W. Pingatore, Mellon Institute, Pittsburgh, Pennsylvania, and R. C. Carlisle of the Cultural Resource Management Program. This manuscript was typed by G. Placone and edited by R. C. Carlisle, Editor, Cultural Resource Management Program.

INTRODUCTION

Two hundred eighty-one vegetal specimens were recovered during the excavations at Westwater - Five Kiva - (42Sa14) and method and preparation of foundation and sewing elements, raw materials and (where available) type of splice.

Plaited basketry specimens were allocated to three structural types based on interval of element engagement. Additionally, plaited specimens were analyzed for selvage treatment, shifts, method of preparation of elements, form, wear patterns, function, type and mechanics of mending and decorative patterns and mechanics.

Textiles. Nine fragmentary specimens of textiles were recovered during excavations at Westwater - Five Kiva - and Big Westwater ruins. Textile specimens were allocated to two structural types based on the number and sequence of warps engaged at each weft crossing. Additionally, all textiles were analyzed where feasible for selvage, method of preparation of warps and wefts, form, wear patterns, functions, decorative patterns and mechanics, type and mechanics of mending and raw materials.

Sandals. Sixteen fragmentary sandals were recovered during the excavations at Westwater - Five Kiva - and Big Westwater ruins. Sandals were allocated to three structural types based on the method of sole manufacture. One sandal type is twined while two are plaited. All sandals were analyzed for method of sole construction including selvages, method of preparation of elements, type and technique of tie or binding, method of insertion of new elements, decorative patterns and mechanics, type and mechanics of mending and raw materials.

Cordage. Two hundred forty fragmentary specimens of cordage were recovered during the excavations at Westwater - Five Kiva - and Big Westwater ruins. These have been allocated to 27 structural types and nine residual categories. The 27 structural types were established on the basis of three interrelated construction attributes (see Andrews and Adovasio 1980; Andrews, Adovasio and Carlisle n.d.):

1. Number and composition of plys (one, two or more/simple or compound)
2. Direction of initial "spin" (S or Z)
3. Direction of final "twist" (S or Z).

These attributes are, perhaps, familiar to most readers, however, it is certain tht some of them require elucidation particularly as identical terms are employed by some authorities to designate quite different phenomena.

The term "ply" as used here denotes a strand or bunch of fibrous material that is almost always twisted. These strands can be used alone to form single ply cordage or in groups to form multiple ply cordage. Multiple ply cordage is produced by twisting two or more "single" plys together.

An individual ply can be homogeneous or simple in that it consists of a single strand or bunch of material with the same twist, or it can be *compound*. Compound plys are constructed with multiple strands or bunches of material that are individually twisted and then twisted with each other (usually) in the opposite direction. Compound plys are actually separate pieces of cordage which when twisted together with other such plys, form a technically distinct finished product or new type.

At this juncture, it should be stressed that technically very few (if any) of the cordage specimens and/or individual plys from Westwater - Five Kiva - and Big Westwater ruins were actually produced via spinning in the literal sense (see Emery 1966: 9). Virtually all of the cordage from these sites was produced from what Emery (1966: 9) calls "fibers of limited length." In the Westwater - Five Kiva and Big Westwater cordage, these fibers were twisted to form individual simple plys or components of compound plys, but they were *not* spun in the manner of cotton, wool, bast, etc. Thus, *spin* denotes here the initial twist of a given fiber strand or bunch of fibers while *final twist* denotes the terminal twisting of several plys together. Strictly speaking, in Emery's (1966) terminology *all* of the Westwater - Five Kiva and Big Westwater cordage is twisted but not spun.

The term "spun" is employed to designate arbitrarily the initial twist of a given ply *only* because this term is nearly universal in the archeological literature on cordage. Moreover, it renders descriptions considerably less complex.

The direction of initial "spin" or final twist can be only S or Z, and these terms have exactly the same meaning as those specified in Emery (1966: 11).

In addition to the aforespecified construction attributes, each cordage specimen was scrutinized for the presence and type of splices, the presence and type of knot(s), angle of final twist and ancillary manipulations such as rat-tailing, wrapping, etc.

Knot terminology follows Shaw (1979); angle of twist measurements were taken according to the procedures specified in Emery (1966:11).

Each of the 27 types of cordage recognized in the Westwater - Five Kiva and Big Westwater assemblage is distinguished by a symbol that graphically designates that type. For example, TYPE I: TWO PLY, S SPUN, Z TWIST is symbolized as Z_S. In this symbol, Z denotes the final twist while (^S_S) indicates that there are two plys with an initial spin of *s*. The use of these symbols provides [as eloquently indicated by Hurley (1979) and others] an economical means of encapsulating the essential data on any given piece of cordage. Complete details on the Westwater - Five Kiva and Big Westwater cordage go far beyond the limits of this synopsis. These data will be presented in the final report on the perishables from both of these sites.

Miscellaneous Fibers and Fiber Constructions. Two specimens, herein designated as miscellaneous fibers and fiber constructions, were recovered from Westwater - Five Kiva. These are not assignable to any of the major, recognized classes or structural types from the site, and they have been allocated to two arbitrary categories based upon their predominant technological, structural or formal attributes. Both specimens of miscellaneous fibers and fiber constructions were analyzed for kind and degree of preparation of raw materials, splices, mends, decorative patterns and mechanics, wear patterns and (where possible) function.

Overarching trends and patterns in the structural types and residual categories established by the aforespecified procedures are discussed below. This information will be presented in much greater detail in the final report on the perishables from Westwater - Five Kiva - and Big Westwater ruins. It should be noted that the term "type" is used here purely as a classificatory device. While it is certain that these types reflect highly standardized, culturally influenced or determined behavior sets, the authors hesitate to equate these types with any notions of aboriginal "mental templates." Whether or not these types do reflect the templates of generations of artisans is a question both immaterial to this study and best left to others more conversant with such matters.

The descriptive terms utilized in the analysis are those employed in Adovasio (1977), Andrews and Adovasio (1980), Andrews, Adovasio and Carlisle (n.d.) and Emery (1966).

OVERVIEW

As noted above, 14 specimens of basketry as well as nine specimens of textiles, 16 specimens of sandals, 240 specimens of cordage and two miscellaneous fiber constructions were recovered during the excavations at Westwater - Five Kiva - and Big Westwater ruins. Although the analysis of this assemblage is still underway, the following admittedly tentative "observations" can be offered.

Over 90% of the extant perishable assemblage discussed here derives from Westwater - Five Kiva - Ruin while the remaining 10% is from Big Westwater. Collectively, both assemblages span the time period from Basketmaker III through late-Pueblo III. The great majority of the provenienced specimens are ascribable to Pueblo III contexts. Unfortunately, varying and occasionally substantial proportions of the basketry, textile, sandal, cordage and miscellaneous fiber construction samples are from contexts of unknown provenience. This renders the establishment of a precise developmental chronology for the industries in question somewhat difficult although by no means impossible.

Space and the incomplete state of the analysis prohibit the presentation of analytical details of the perishable industries from these sites and forestall the offering of any substantive generalizations or definitive conclusions. It does appear, however, that the following "summary" statements are valid.

It is important to note that neither the Westwater - Five Kiva nor Big Westwater perishable assemblages contain anything that is atypical of Anasazi sites of the chronological periods encompassed at both sites. The basketry, textiles, sandals, cordage and miscellaneous fiber constructions are all more-or-less "standard" Anasazi types that are well-documented elsewhere in Utah, specifically, and in the Anasazi domains of the Greater Southwest, generally (see Adovasio, Gunn et al 1981; Kent 1957; Morris and Burgh 1941). Further, the raw materials employed in the perishable industries and their method of preparation are likewise paralleled at other "contempoary" Anasazi sites. In this vein, all of the textiles from both sites are made of *Gossypium* sp., and although this does not constitute the first report of cotton textiles from Utah, it is the first indication of the use of this plant in the immediate study area.

A second point worthy of emphasis is that it appears that the perishable assemblages from both Westwater - Five Kiva - and Big Westwater ruins are much more closely related" to one another than simple chance or broad "cultural affinities" alone might warrant. Specifically, it seems that on the basis of limited statistical studies of the cordage (see Adovasio, Andrews, Carlisle and Drennan n.d.; Andrews and Adovasio 1980), at least some of the weavers and those involved at both sites in perishable crafts were practitioners of or participants within the same general subregional craft milieu. The degree of "craft proximity" demonstrated in the products of the perishable industries from these sites remains to be established. It is certain, however, that both sites exhibit closer "connections" to each other than either does separately to any other Anasazi site or perishable collection.

A third major trend perceived during the analysis suggests that while the perishables from both sites are typically Anasazi, the basketry and perhaps cordage collections may include some items of non-local Anasazi origin. Several of the basket fragments and certain of the cordage types as well as some of the textile finishing techniques may be of Kayenta origin and hence intrusive into the study area. If this intrusion should be substantiated by the results of the analysis now in progress, it would appear that this putative influx of possible Kayenta perishables affected both sites at roughly the same time.

As a final comment, the perishable data from both Westwater - Five Kiva - and Big Westwater ruins seem to support the general conclusions drawn in Adovasio, Gunn et al (n.d.) and Adovasio, Carlisle and Andrews (1978) regarding the evolution and general characteristics of Anasazi basketry. The data from Westwater - Five Kiva - and Big Westwater ruins strongly support the premise that any notion of a great degree of developmental uniformity and typological standardization within Anasazi basketry (notably during Pueblo III times) is largely illusory and itself the artifact of inadequate sampling (see Adovasio, Gunn et al 1981; Adovasio, Carlisle and Andrews 1978; Adovasio 1977). Stated another way, while the basketry and other perishables recovered from Westwater - Five Kiva - and Big Westwater ruins are patently Anasazi (as opposed to

Fremont, Mogollon, etc.), they clearly illustrate that a very significant amount of regional specialization characterized Anasazi basketry and perishable production. Morever, these data suggest that this regional specialization is of considerable antiquity.

An extensive "fleshing out" of the brief synoptic "skeleton" presented above is anticipated as is the addition of significant data on idiosyncratic variation in perishable manufacture both within and between the sites under discussion. We do <u>not</u> forsee that the "summary statements" briefly articulated here will be altered substantially in the final Westwater - Five Kiva and Big Westwater perishable report.

Summary and Discussion of Diagnostic Artifacts

The pottery, stone, and perishable materials from Big Westwater Ruin provide the evidence of Pueblo II and III, Mesa Verde Anasazi occupations. Although a limited amount of Basketmaker III and Pueblo I pottery was recovered, other evidence of the earlier components was not detected. Stone artifacts are few and generally uninformative. The lack of chipped stone suggests that lithic tool manufacture in the rockshelter, or at least within the masonry rooms, was very limited and few stone tools were required for on site activities. The perishable industries (basketry, twine, and cordage) from Big Westwater are ascribed to both Pueblo II and III manufacture and generally support the temporal and typological pottery evidence.

The pottery recovered from Big Westwater provides the evidence of the site sequence. The absence of Abajo Red-on-orange, despite abundant Chapin Gray Ware, indicates that in contrast to Westwater - Five Kiva - Ruin (Lindsay 1981), the site was not occupied during Basketmaker III times. It may be that the shelter was somewhat wet (see Climates: Past and Present), hence no advantage was obtained from its occupation. Ordinarily, the presence of Deadman's and Bluff Black-on-red and Piedra Black-on-white indicates a Pueblo I occupation. However, the few red ware sherds and the limited amounts of the Pueblo I white ware can hardly be interpreted as indicative of a "full blown" Pueblo I component. Red ware has been tree-ring dated in a Pueblo II context on Cedar Mesa (Dalley 1973) and Piedra Black-on-white is found in at least one Pueblo II context on nearby White Mesa (Casjens et al 1980). Also, no Pueblo I architecture was identified at Big Westwater.

The bulk of the pottery indicates heavy Pueblo II and III occupation of the shelter and this is supported by both the architecture and tree-ring dating (compare Figures 74, 75, and 76). Excepting a sizeable amount of Mancos Black-on-white, a far greater proportion of Pueblo III pottery was recovered from the site. Mesa Verde Corrugated dominates Mancos Corrugated, Tusayan Polychrome outnumbers other red ware types, and McElmo and Mesa Verde Black-on-white, taken together, dominate other white wares including Mancos Black-on-white. The sizeable proportion of McElmo Black-on-white and the presence of Kayenta Tusayan Polychrome and Sosi Black-on-white favorably correlate with the A.D. 1147 to 1207 range of tree-ring dates obtained from Room Block B. This strong expression of early-Pueblo III and the abundant, dated masonry construction provide the evidence of nucleation in this locale. Mesa Verde Corrugated pottery apparently increased significantly over earlier Mancos Corrugated while the Pueblo II and III white wares remained about the same (actually fewer Mesa Verde Black-on-white sherds were recovered than Mancos Black-on-white). This could be a product of sampling (less Mancos Black-on-white was retained on site following its decline in popularity), nucleation and

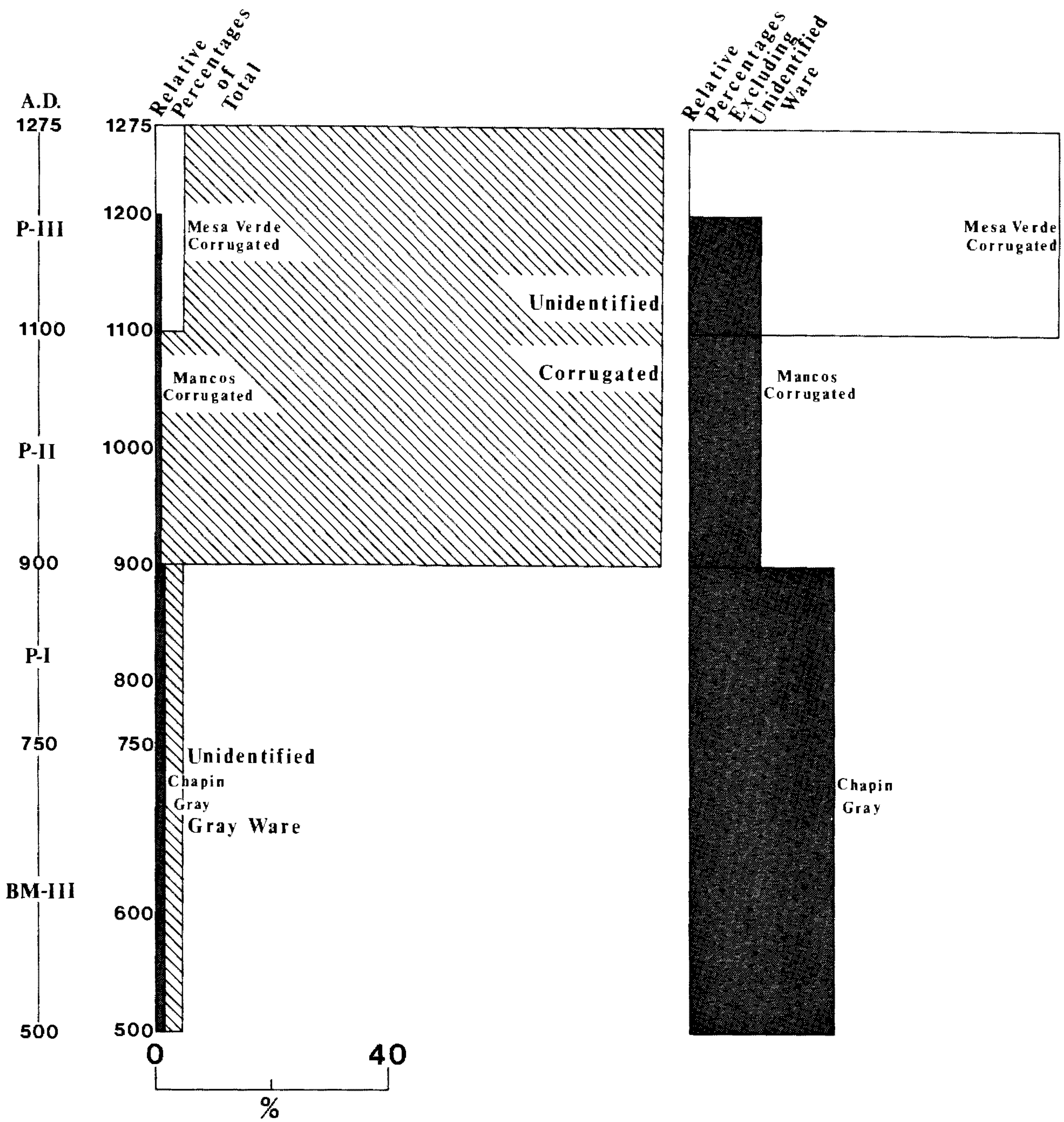


Figure 74 Relative Percentages of Gray Ware Pottery Types

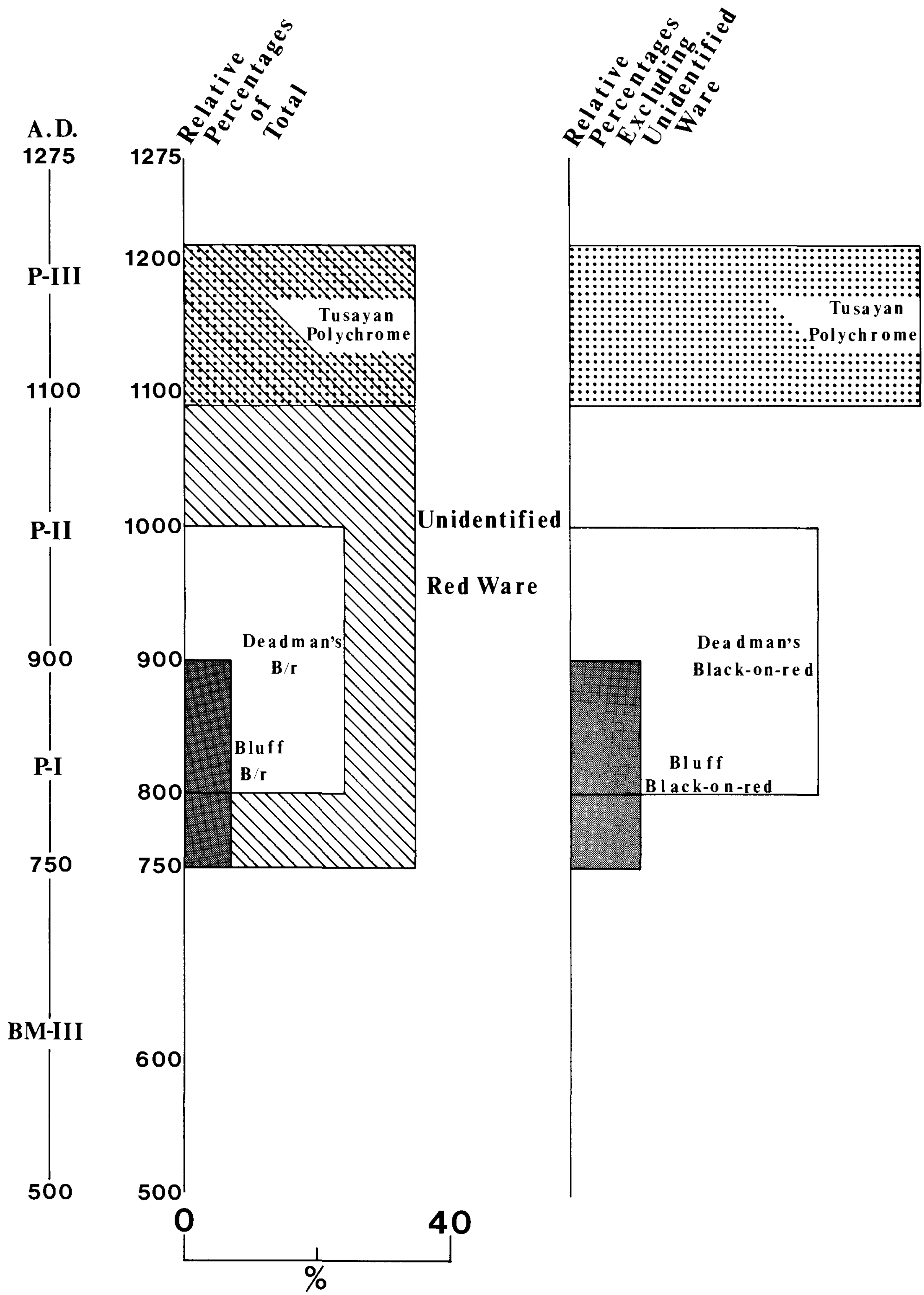


Figure 75. Relative Percentages of Red Ware Pottery Types

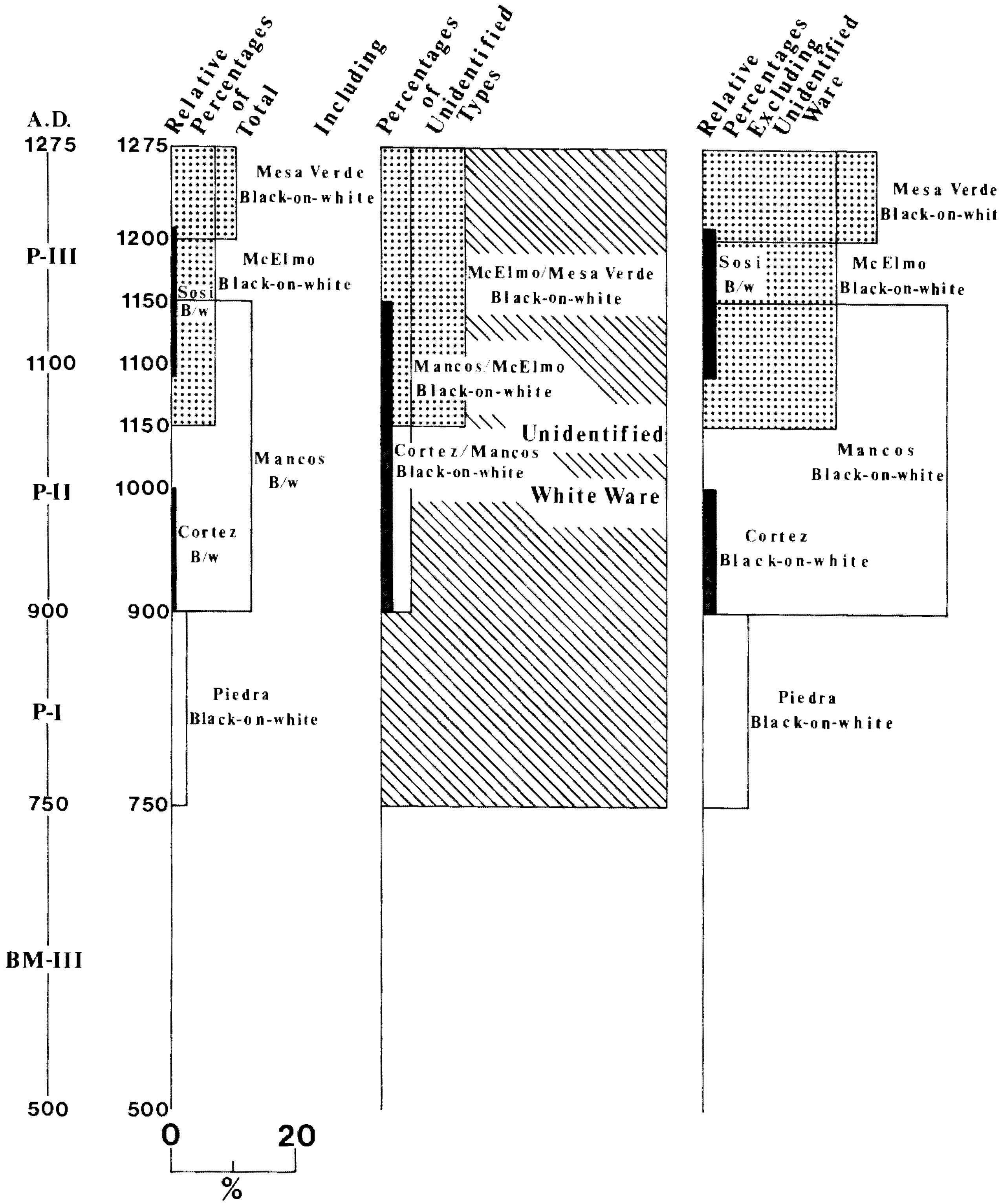


Figure 76 Relative Percentages of White Ware Pottery Types

changes in site function, or increasing specialization in the manufacture of pottery.

The process of nucleation involved the organization of early-Pueblo III populations into larger and fewer sites with an apparent preference for rockshelters. Nucleation may have been triggered by the A.D. 1150 drought and it is during this period that the tree-ring dated construction occurs at Big Westwater. The relatively high percentages of Mesa Verde Corrugated pottery over earlier culinary wares may suggest that the priorities of a population under stress, given the necessity of increasing demands for construction as a part of nucleation, little time was allowed for the manufacture of painted wares. Increasing specialization may or may not have been a product of nucleation. Regardless, specialization with fewer artisans may have been counter-productive to the manufacture of quantities of decorated wares. The demands, given increasing populations at fewer sites, it would seem were on the production of culinary wares to provide for adequate food storage and for food processing. Also, during Pueblo III times, Big Westwater, similar to that postulated for Westwater - Five Kiva, may have served as a locus for control and storage of food stuffs for surrounding sites. This would likely result in higher proportions of culinary ware over decorated types during the period.

Admittedly, sampling may have tended to bias the data in several ways. The upper levels of the exploratory trench were restricted to the sampling of turkey fecal deposits which were devoid of pottery. Also, we would expect that within the confines of rockshelters, much earlier deposition includng pottery would have been cast out in preparation for later construction. This was a common practice at Westwater - Five Kiva. It is questionable that Big Westwater contains an extensive midden. Refuse was more likely hurled into the wash below which was in turn transported and scattered down the tributary toward Westwater Canyon proper.

Despite the possible problems of sampling, the recovery of considerably greater amounts of Mesa Verde Corrugated pottery over earlier culinary wares, while the relative proportions of decorated wares remains about the same, is most intriquing. The occurrence of Kayenta Tusayan Polychrome and Sosi Black-on-white compares favorably with the limited recovery of these types at other sites in the Westwater/White Mesa locale. This suggests the presence of at least some Kayenta influence. Numerous late-Pueblo II/early-Pueblo III sites occur west of the Comb anticline, on Cedar Mesa, which contain considerably greater amounts of Kayenta pottery (see Lipe and Matson 1971; data on file). Tusayan Polychrome occurs in an A.D. 1212 - 1214 tree-ring dated structure at Westwater - Five Kiva (Lindsay 1981). The occurrence of the type in the depositional units of Stratum 1b of the exploratory trench and the floor of masonry Room 4 assures at least a late-Pueblo II temporal placement of the two contexts. The Kayenta pottery appears to occur somewhat earlier than the poorly constructed late stage masonry in both room blocks.

The lithic sample is particularly limited. A number of basic tool types are represented including bifaces, unifaces, used flakes, cores, hammerstones, abraiders, pestles, pounding, polishing and grinding stones, manos, metates, and axes. However, no diagnostic projectile points were recovered from the excavations. The generally sparse lithic sample, and more particularly, the ratio of finished and used tools to the limited debitage suggests that tools were generally manufactured off the site. This may indicate that seasonal scheduling for procurement of exotic resources was maintained by at least a portion of the male population at the site. However, the basic tool kit was maintained at the site judging from the relatively large number of cores and hammerstones recovered. The lithic sample favorably compares with that recovered from Pueblo II and III contexts at Westwater - Five Kiva - Ruin (Lindsay 1981). Both samples suggest, what is interpreted from other evidence, that Pueblo III populations at both sites were principally engaged in horticultural pursuits and they were heavily dependent on cultigens. The recovery of the axe and ceramic pipe from the fill of the kiva indicates that both were likely customary paraphernalia in the kiva. The Cottonwood chert biface recovered is expected considering the proximity of the site to the source area in Cottonwood Canyon.

The analysis of basketry, textiles, and cordage generally supports the ceramic evidence of Pueblo II and III, Anasazi occupations at the shelter. Textiles are exclusively cotton, suggesting extensive contact with areas in the Southwest which accommodated the plant. The perishable industries at both Big Westwater and Westwater - Five Kiva - ruins are very similar suggesting close affinities between the two sites. Consistent with the intrusive pottery, certain of the basketry and cordage specimens may include items of Kayenta manufacture.

In sum, the diagnostic artifacts firmly place Big Westwater occupance during Pueblo II and III times. Standard Mesa Verde pottery types were recovered from the site as well as several Kayenta intrusives. Stone tool manufacture was particularly limited which emphasizes the premise that Big Westwater inhabitants were heavily reliant on horticulture, but also it may possibly point to the engagement by at least a portion of the male population in a limited seasonal round involving some hunting and plant collecting. The basketry and textiles recovered suggest the site was a part of a subregional milieu with close ties to Westwater - Five Kiva and less so with Mesa Verde Anasazi sites further removed. Both the pottery and basketry provide evidence of some Kayenta influence.

Faunal Material

from
Big Westwater Ruin

by
Mignonette Ray

The limited collection of animal bone from Big Westwater Ruin provides few conclusions on the utilization of specific animals and the nature of procurement and subsistence. On the other hand, it does support a general hypothesis that the utilization of wild animals represented a relatively minor portion of the overall diet. A total of 573 bones, representing 19 species and a minimum of 48 different individuals, were identified by Brett Russell (see Table VII).

The collection is dominated by rabbits, primarily cottontail (minimum of 16 individuals), although jack rabbits are well represented (five individuals). A variety of other rodents including prairie dog, gophers, woodrats, and microtine rodents were recovered in very limited quantities. Large mammals were limited to deer (one individual) and cow and sheep. The latter two are no doubt a modern derivation. Two types of lizards were recovered. Bird bones were limited to two turkey bones. These were inadvertently retained in the mammalian faunal collection (see Bird Remains from Big Westwater Ruin).

Interpretation of such a limited collection is tenuous at best and is compounded by the fact that many of the bones may have been naturally deposited (e.g. McGuire 1980). With the exception of the single deer, all the species represented could have been readily procured within the canyon bottom or on the mesa edge immediately surrounding the site. Of these species only the rabbits can be confidently said to have served as a dietary resource. Other faunal records from nearby archeological sites (Lindsay et al 1979; Casjens et al 1980) indicate some change through time in the nature and intensity of animal procurement. At Big Westwater, however, little change is noted and the major conclusion that can be drawn is that reliance on wild animals was limited, and that what animals were used were obtained locally. Apparently group mobility, and even the mobility of individuals within the group, was extremely limited.

Table VII

Faunal Material Provenience

	Crotaphytus collaris	*Sceloporus graciosus*		*Lepus californicus*	*Sylvilagus auduboni*		*Cynomys* sp.	*Thomomys bottae*	*Dipodomys* sp.	*Peromyscus* sp.	*Onychomys* sp.	*Neotoma* sp.	*Neotoma mexicana*	*Neotoma cinerea*		*Canis latrans*	*Vulpes vulpes*	*Spilogale gracilis*		*Bos* sp.	*Odocileus* sp.	*Ovis capra*		Small mammal	Large mammal	Rodent	Unidentified			TOTALS
General Surface Prov. Unknown	1			1	26		4		2			3				1		1			9			1	1					50
Exploratory Trench Prov. Unknown																														0
Stratum VII																														0
Stratum VI																														0
Stratum V																														0
Stratum IV																														0
Stratum III																														0
Stratum II																														0
Stratum Ib																									1					1

	Crotaphytus collaris	*Sceloporus graciosus*		*Lepus californicus*	*Sylvilagus auduboni*		*Cynomys* sp.	*Thomomys bottae*	*Dipodomys* sp.	*Peromyscus* sp.	*Onychomys* sp.	*Neotoma* sp.	*Neotoma mexicana*	*Neotoma cinerea*		*Canis latrans*	*Vulpes vulpes*	*Spilogale gracilis*		*Bos* sp.	*Odocileus* sp.	*Ovis capra*		Small mammal	Large mammal	Rodent	Unidentified			TOTALS
Stratum Ia																														0
Room Block A Room 4 General fill					2		1																		1					4
Room 5																									1					1
Fill				1												1														2
Room Block B Prov. Unknown				10	71			4			1	5	2				2				5			4		1	2			107
Room 7 Fill				5	63		3	4				19		2							1			1			5			103
Room 9 Fill				10			1														1									12
Subfloor fill					2																									2
Room 10 Fill				7	42			3		1		8									2			11		1	4			79

		Crotaphytus collaris	*Sceloporus graciosus*		*Lepus californicus*	*Sylvilagus auduboni*		*Cynomys* sp.	*Thomomys bottae*	*Dipodomys* sp.	*Peromyscus* sp.	*Onychomys* sp.	*Neotoma* sp.	*Neotoma mexicana*	*Neotoma cinerea*		*Canis latrans*	*Vulpes vulpes*	*Spilogale gracilis*		*Bos* sp.	*Odocileus* sp.	*Ovis capra*		Small mammal	Large mammal	Rodent	Unidentified			TOTALS
	Subfloor fill		4		7	7							2				6					3									29
Kiva	Fill		10			10		1														5	1		1						28
	Floor contact					6							1																		7
Storage Room 1 fill			20			14			2	2			5					9			14				3			6			75
Storage Room 2																															0
Storage Room 3																															0

	Crotaphytus collaris	*Sceloporus graciosus*		*Lepus californicus*	*Sylvilagus auduboni*		*Cynomys* sp.	*Thomomys bottae*	*Dipodomys* sp.	*Peromyscus* sp.	*Onychomys* sp.	*Neotoma* sp.	*Neotoma mexicana*	*Neotoma cinerea*		*Canis latrans*	*Vulpes vulpes*	*Spilogale gracilis*		*Bos* sp.	*Odocileus* sp.	*Ovis capra*		Small mammal	Large mammal	Rodent	Unidentified			TOTALS
TOTALS																														
General Surface Prov. Unknown	1			1	26		4		2			3				1		1			9			1	1					50
Exploratory Trench																									1					1
Room Block A				1	2		1									1									2					7
Room Block B		14		39	201		5	11	0	1	1	35	2	2		6	2			0	17	1		17		2	11			367
TOTALS	1	14		41	229		10	11	2	1	1	38	2	2		8	2	1		0	26	1		18	4	2	11			425
Minimum Number of Indiv.	1	4		5	16		2	3	1	1	1	8	8	8		1	1			1	1	1								63

Bird Remains

from
Big Westwater Ruin

by
Steven D. Emslie

INTRODUCTION

Excavations at Big Westwater Ruin, 42Sa6752, have produced a small collection of bird bones and feathers which date to Pueblo II and III periods. This report presents the analysis of these remains.

Material was identified using comparative skeletal and skin collections at the Museum of Northern Arizona, Flagstaff, and the Lyndon L. Hargrave Ornithology Collection also at the museum. Feathers were identified by macroscopic comparison with modern specimens and occasionally by microscopic examination of feather structure, a technique described by Messinger (1965).

THE DATA

A total of 51 bones and 38 feathers representing seven taxa was recovered from the site. Table VIII presents the species identified, the numbers of bones and/or feathers in each taxon, and the minimum number of individuals (MNI) represented. MNI's were calculated by counting the greatest number of elements of the same side per species, and by considering young versus old individuals based on bone and feather growth. The most common species represented at the site is the Common Turkey (*Meleagris gallopavo*), followed by American Coot (*Fulica americana*), duck or teal (*Anas* sp.), Great Horned Owl (*Bubo virginianus*), Long-eared Owl (*Asio otus*), and meadowlark (*Sturnella* sp.). A description of the elements recovered and their provenience is provided in Tables IX and X.

DISCUSSION

With the exception of the Common Turkey, all taxa represented at Big Westwater currently occur in the region of the site (Behle and Perry 1975). The American Coot is restricted to lakes and marshes and its presence, in conjunction with the single duck or teal bone, at the site indicates ponds, marshes, or lakes were prehistorically located near the site. The Great Horned Owl and Long-eared Owl are resident throughout Utah in a variety of habitats. The meadowlark is also resident and indicates the presence of large open grassy areas. This species is also found near agricultural fields and it was probably near the prehistoric fields in the region. The Common Turkey was kept as a domestic bird by the Indians and has been discussed

Taxon	Number bones	Number feathers	MNI
Aves	2	6	-
Duck or teal (*Anas* sp.)	1		1
Common Turkey (*Meleagris gallopavo*)	42	30	5
American Coot (*Fulica americana*)	3		1
Great Horned Owl (*Bubo virginianus*)	1	2	2
Long-eared Owl (*Asio otus*)	1		1
Meadowlark (*Sturnella* sp.)	1		1
TOTAL	51	38	11

Table VIII. Bird taxons represented at Big Westwater Ruin with total numbers of bones and feathers, and calculated MNI's.

Table IX. Provenience and Element Descriptions of Bird Bones and Feathers.

Provenience	Taxon	Element
FS 2.1	*Meleagris gallopavo*	right humerus, length 134.5 mm
3.3	Aves	rib
	Anas sp.	proximal left ulna
	Fulica americana	right coracoid, proximal right humerus
	Sturnella sp.	right humerus (immature)
3.15	*M. gallopavo*	stripped remige
4.2	*M. gallopavo*	quill midsection
4.8	*M. gallopavo*	right tibiotarus with proximal end broken; right scapula
5.6	*M. gallopavo*	left pelvis with ends broken
6.4	*M. gallopavo*	right radius, length 134.4 mm
7.3b	Aves	remige and quill midsections, covert
7.4	*M. gallopavo*	right primary and remige midsections, covert
10.4	*M. gallopavo*	distal left tibiotarsus; distal right tarsometatarsus; medial left femur
11.3b	*M. gallopavo*	right humerus with ends broken; cervical vertebra
11.6	*M. gallopavo*	three coverts
	M. gallopavo (?)	remige
	Aves	quill midsection
13.4	*M. gallopavo*	right tarsometatarsus, distal

Provenience	Taxon	Element
FS 15.2	*M. gallopavo*	medial right pelvis; quill midsection
	Fulica americana	sternum
	Asio otus	right tarsometatarsus, length 39.6 mm
22.2	*M. gallopavo*	left ulna, length 112.5 mm
23.6	*M. gallopavo*	two coverts
23.8	*M. gallopavo*	medial right femur, cervical vertebra
25.2	*M. gallopavo*	three remige midsections, one covert
27.5	*M. gallopavo*	proximal left ulna; proximal left humerus, burned; proximal left femur; distal right tibiotarsus; skull fragment
59.1	*M. gallopavo*	medial right tarsometatarsus
62	*M. gallopavo*	proximal left humerus, burned
62.2	*M. gallopavo*	proximal right coracoid, burned; sternum fragment
63.3	*M. gallopavo*	distal right scapula
69.2	*M. gallopavo*	left radius, length 104.8 mm
69.7	*M. gallopavo*	covert
71.1	*M. gallopavo* (?)	left primary
76.2	*M. gallopavo*	two coverts, one quill midsection
76.4	Aves	eggshell
77.2	*M. gallopavo*	fibula

Provenience	Taxon	Element
FS 78.3	*M. gallopavo*	distal left humerus; skull; cuneiform; left tarsometatarsus with ends broken
78.4	*M. gallopavo*	distal left tarsometatarsus
81.1	*M. gallopavo*	medial left ulna
82.3	*M. gallopavo*	right carpometacarpus, length 62.5 mm
82.4	*M. gallopavo*	quill midsection
83.2	Aves	quill midsection
	Bubo virginianus	covert
84.2	Aves	remige midsection, quill midsection
	M. gallopavo	two left secondaries, three remiges, three coverts
	Bubo virginianus	breast covert
84.4	*M. gallopavo*	right scapula; phalanx
86.2	*M. gallopavo*	right ulna with ends broken
87.1	*M. gallopavo*	distal right tibiotarsus with cut marks
87.2	*M. gallopavo*	right humerus with proximal end broken
100.1	Aves	rib
100.6	Aves	eggshell
102.2	*M. gallopavo*	right and left coracoid; distal right scapula
126.1	*Bubo virginianus*	left femur, immature

Table X

Bird Remains Provenience

	AVES	*Meleagris gallopavo*	*Fulica americana*	*Bubo virginianus*	*Asio otus*	*Sturnella* sp.	*Anas* sp.	Unidentified																						TOTALS
General Surface Prov. Unknown		9																												9
Exploratory Trench Prov. Unknown		3																												3
Stratum VII																														0
Stratum VI																														0
Stratum V																														0
Stratum IV																														0
Stratum III																														0
Stratum II				1																										1
Stratum Ib																														0

	AVES	*Meleagris gallopavo*	*Fulica americana*	*Bubo virginianus*	*Asio otus*	*Sturnella* sp.	*Anas* sp.	Unidentified	TOTALS
Stratum Ia									0
Room Block A Room 4 General fill	1	7							8
Level C									0
Level B									0
Level A		1							1
Floor									0
Room 5 Fill		1							1
Room Block B Prov. Unknown	1	10	1	1	1				14
Room 6 Fill		4							4
Room 7 Fill	2	12		1					15
Upper floor		1							1

	AVES	*Meleagris gallopavo*	*Fulica americana*	*Bubo virginianus*	*Asio otus*	*Sturnella* sp.	*Anas* sp.	Unidentified	TOTALS
Room 9 Fill		1							1
Room 10 Fill	2	2	2			1	1		8
Subfloor fill	1	10						1	12
Kiva Fill		6							6
Hearth fill		1							1
Storage Room 1 fill	2								2
Storage Room 2									0
Storage Room 3									0

	AVES	*Meleagris gallopavo*	*Fulica americana*	*Bubo virginianus*	*Asio otus*	*Sturnella* sp.	*Anas* sp.	Unidentified	TOTALS
TOTALS									
General Surface Prov. Unknown		9							9
Exploratory Trench		3		1					4
Room Block A	1	9							10
Room Block B	6	47	3	2	1	1	1	1	62
TOTALS	7	68	3	3	1	1	1	1	85

in detail in an earlier paper (Emslie 1981). All of the turkey remains from the site represent the large Indian Domestic as defined by McKusic (1980, personal communication). All of the above species, with the exception of the American Coot and meadowlark, also occurred in the archeological remains from the Westwater - Five Kiva - Ruin located approximately three miles to the north (Emslie 1981).

Six worked bones of the Common Turkey are included in the above identifications. These bones are a right tibiotarsus (FS 4.8) (field specimen numbers are retained for this report to provide an accounting of each specimen identified), left tibiotarsus (FS 10.4), right tarsometatarsus (FS 13.4), left ulna (FS 27.5), and two left tarsometatarsi (FS 78.3 and 78.4). Several other turkey bones are also burned and one distal right tibiotarsus (FS 87.7) displays cut marks indicating the use of this species for bone tools, ornaments, and for food.

CONCLUSIONS

Only limited information on prehistoric ecology is obtained from this small collection of bird remains. Nearby ponds, lakes, and marshes are indicated by the presence of duck or teal and American Coot bones. Large open areas and/or agricultural fields are also suggested with the presence of meadowlark. This collection adds to our knowledge on the prehistoric use of birds in this region of the Southwest.

Wood

from Big Westwater Ruin

by
Carol Wiens

Wood artifacts were identified according to Saul (1955). The 20 worked wood artifacts recovered during the excavation (Table XI) included 20 percent *Atriplex* (Saltbush), 10 percent *Cercocarpus* (mountain mohagany), 15 percent *Juniperus*, 5 percent *Populus* (Cottonwood), 10 percent *Quercus* (oak), 5 percent *Rhus trilobata* (squawbush), 25 percent *Salix* (willow) and 10 percent unidentifiable. Ten unworked pieces of wood were recovered. Eight specimens were identified as *Atriplex*, *Cercocarpus*, *Juniperus* or *Populus*, while two were unidentifiable.

The worked wood artifacts were recovered primarily from the surface (30 percent) or within Room Block B (50 percent). These artifacts were placed in the following groups.

Digging sticks. (Figure 77) Two digging sticks both of *Cercocarpus* were found on the surface.

Loom shuttles (?). (Figure 78) Two pieces of wood possibly used as loom shuttles were recovered in Room Block B. Both were too rotten to identify.

Tools for smoothing. (Figure 79) Three artifacts may have been used as smoothing tools. Two of *Juniperus* were found on the surface and the other of *Quercus* was recovered in Room Block B.

Artifacts of undetermined function. The remaining 14 artifacts had various functions. They have rounded, sharpened, or charred ends. They were recovered throughout the site and are of a variety of plant species.

Discussion

This site had relatively few worked wood artifacts. Fifty percent of these were recovered from Room Block B and 30 percent were found on the surface. The small number of artifacts makes any generalizations difficult. Preservation was generally good. Only 4 of the 30 artifacts were unidentifiable.

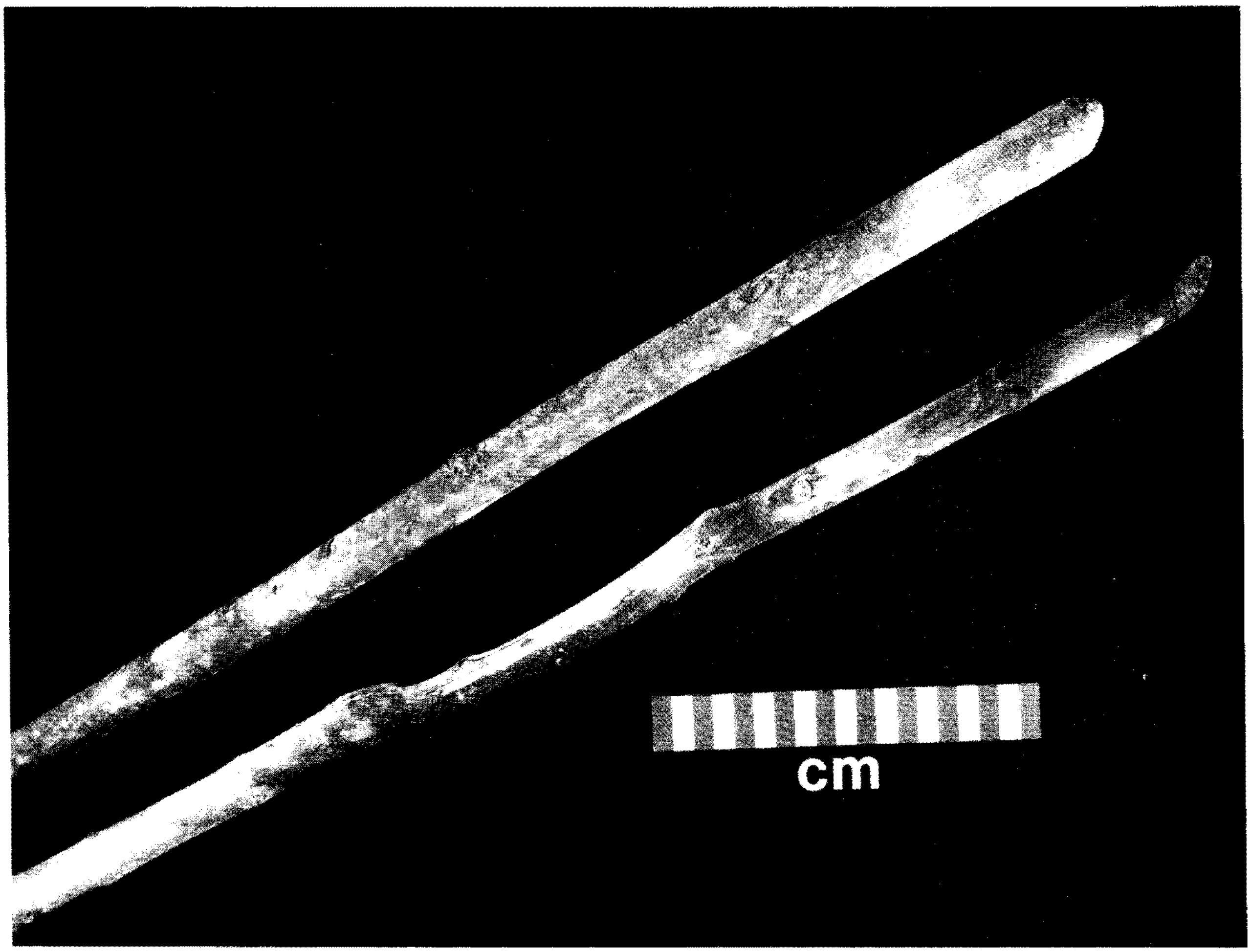


Figure 77   Digging Sticks

Figure 78 Loom Shuttles (?)

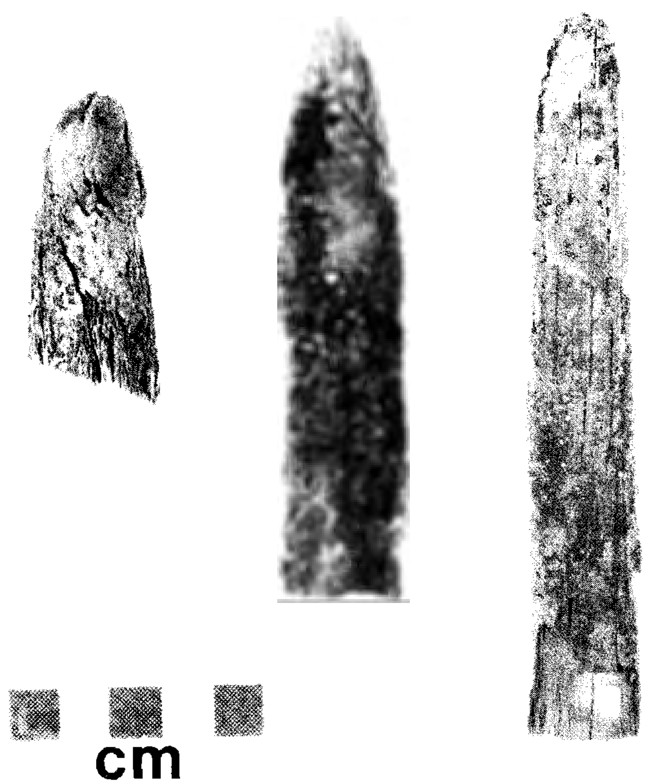


Figure 79 Smoothing Tools

Table XI

Wood Provenience

	WORKED WOOD								UNWORKED WOOD								
	Atriplex	*Cercocarpus*	*Juniperus*	*Populus*	*Quercus*	*Rhus*	*Salix*	Unidentified	*Atriplex*	*Cercocarpus*	*Juniperus*	*Populus*	*Quercus*	*Rhus*	*Salix*	Unidentified	TOTALS
General Surface Prov. Unknown		2	2			1	1					1					7
Exploratory Trench Prov. Unknown			1														1
Room Block A Room 4 General fill							2										2
Room 5 Fill					1												1
Room Block B Prov. Unknown	1									1							2
Room 7 Fill	2							1			1	1					5
Upper floor																1	1
Room 8 Fill				1	1												2
Room 9 Subfloor fill							1										1

	WORKED WOOD												UNWORKED WOOD																	
	Atriplex	*Cercocarpus*	*Juniperus*	*Populus*	*Quercus*	*Rhus*	*Salix*	Unidentified					*Atriplex*	*Cercocarpus*	*Juniperus*	*Populus*	*Quercus*	*Rhus*	*Salix*	Unidentified										TOTALS
Room 10 - Fill	1																													1
Subfloor fill															2															2
Kiva Fill							1	1					1																	3
Subfloor fill																1				1										2
TOTALS																														
General Surface Prov. Unknown		2	2			1	1									1														7
Exploratory Trench			1																											1
Room Block A					1		2																							3
Room Block B	4			1	1		2	2					1	1	3	2				2										19
TOTALS	4	2	3	1	2	1	5	2					1	1	3	3	0	0	0	2										30

Maize

from
Big Westwater Ruin

by
Joseph C. Winter

INTRODUCTION

The Big Westwater Ruin (42Sa6752) excavations yielded 342 dried corn cobs, 73 kernels, 5 peduncles (cob stems) and a number of tassels, leaves and stalks. Table XII presents the provenience and morphological data (also see the Artifact Provenience lists). All of the cobs and kernels were measured by a calipher, and the collection was analyzed for temporal/-morphological patterns within the site. The collection has also been compared with other Mesa Verde Anasazi collections for regional patterns.

INTRA-SITE PATTERNS

The cobs, kernels and other maize remains were from 17 proveniences within the site, with the bulk of the materials from Room Block B (249 cobs and 72 kernels). Room Block A yielded 69 cobs, while the Exploratory Trench and the General Surface (Provenience Unknown) category yielded 9 and 15 cobs/ 1 kernel, respectively. In general, the collection is quite homogeneous, and consistent with a mid- to late-Pueblo III period temporal position. Row numbers, percent of 8-rowed cobs, cob-rachis index, cupule width, and lower glume width and thickness are generally the same throughout the site, whether the location is subfloor fill, floor contact, room fill, etc. Some of the cobs would fit into the "Pima-Papago" series, others might be typed as "Mais de Ocho," and a few represent the earlier "Chapalote" series, but most are a uniform, intermediate blend that was typically grown in the northern Southwest in late Anasazi times. As I have pointed out elsewhere (Winter 1973:440-442):

> A series can be thought of as an evolutionary or developmental sequence of closely related forms of maize ....A basic assumption underlying maize analyses is that such related forms, defined from the quantitative measurement of archeological collections, may at times represent actual fossil varieties which were once grown and selected for by aboriginal farmers.

The Big Westwater kernels demonstrate that most of the corn was a yellow flour type, while the cobs show that it was generally healthy, productive and uniform. However, the presence of a number of immature, runty cobs suggests that

Table XII. Maize Attribute Data and Provenience from Big Westwater Ruin

Provenience	# of cobs	% of 8-row	Mean row #	Mean cob diam (mm)	Mean rachis diam (mm)	Mean Cob/ rachis index	Mean copule width(mm)	Mean lower glume width(mm)	Mean Lower Glume Thickness(mm)	Kernels #	Mean Width(mm)	Mean Thickness(mm)	Mean Height(mm)
General Surface provenience ?	15	13	11	11	6	1.8	7	5	4	1	9	4	8
Fill Trench, surface provenience ?	9	22	10	12	6	2.0	7	5	4				
Room Block A, Room 4 Fill	44	30	10	9	5	1.8	6	5	4				
Room Block A, Room 4, stratum A	2	0	10	9	6	1.5	7	5	4				
Room Block A, Room 4, Stratum B	2	0	11	11	7	1.7	6	5	4				
Room Block A, Room 4, Floor	1	0	12	10	6	1.7	7	5	4				
Room Block A, Room 5 Fill	19	26	10	11	6	1.9	7	5	4				
Room Block A, Room 5, floor contact	1	0	10	9	4	2.2	6	3	3				
Room Block B provenience ?	16	25	10	11	6	1.9	7	5	3	1	10	8	5
Room Block B, Room 7 Fill	72	25	10	15	7	2.1	7	5	4	1	8	4	8
Room Block B, Room 7 upper floor	13	7	10	12	6	2.0	7	5	4				
Room Block B, Room 9 Fill	8	25	11	10	6	1.7	7	5	4				
Room Block B, Room 9 subfloor fill	1	0	10	10	4	2.5	7	4	3				
Room Block B, Room 10 Fill	48	31	10	10	6	1.7	7	5	4	57	8	4	8
Room Block B, Room 10 subfloor fill	58	26	10	13	6	2.1	7	5	4	7	9	4	5
Room Block B, Kiva Fill	32	34	10	17	8	2.1	7	5	4	5	9	5	9
Room Block B, Kiva subfloor fill	1	0	11	9	4	2.2	5	4	3	1	9	4	9
TOTALS	342	26	10	12	7	1.7	7	5	4	73	8	4	8

famine or poor yield may sometimes have been factors in the agricultural system, and that all of the cobs, no matter how stunted, were brought back from the fields for food. Stalks, leaves and tassels were also sometimes brought back, perhaps for fuel and construction purposes. Beans and squash were apparently crops along with corn.

REGIONAL COMPARISONS

In a number of other papers I have questioned the usefulness of the "racial" approach to prehistoric Southwestern maize and have suggested instead that researchers should concentrate on analyzing clinal distributions of morphological characteristics (Winter 1972, 1973, 1974c; Litzinger and Winter 1974). When examined in this manner, the Big Westwater Ruin corn fits into the row number pattern observed in the Mesa Verde region for Pueblo II and III period collections (Table XIII). The materials to the east from Hovenweep and Mesa Verde, for example, average 31 percent and 34 percent 8-rowed cobs, while the Big Westwater Ruin sample averages 26 percent 8-rowed. The collections to the west from Comb Ridge, Cedar Mesa and Elk Ridge, in contrast, average 19 percent, 33 percent, and 24 percent. Overall average row numbers are very consistent across the region, but the other morphological data, when available, do not have clear clinal distributions. Thus it appears that the local farmers were growing corn derived from a common gene pool, and were sharing seed material among themselves. There is a definite gradient or cline of row number towards the east, from 19 percent at Comb Ridge, to 26 percent at Big Westwater Ruin, to 31 percent at Hovenweep, and to 30 percent to 46 percent at Mesa Verde, for percentages of 8-rowed cobs. The gradient is not as clear to the west, but the percentages of 8-row do seem to gradually drop off towards Glen Canyon.

These patterns suggest that while farmers in each locality were exchanging maize among themselves, farmers in border areas or in regions of overlap were similarly exchanging corn, thereby providing the gradient of morphological characteristics. This cline occurred only during the Pueblo II and III periods, since earlier collections from Mesa Verde averaged merely 7 percent 8-row during Pueblo I times (Cutler 1965).

It is expected that the analysis of the Westwater - Five Kiva - Ruin and White Mesa maize collections will bear out this intra- and inter-regional pattern and add further details. At Hovenweep, for example, there is evidence for a local, north-south gradient of 8-rowed material as represented in 11 sites across a 10 km area. This same type of trend should be reflected in the Big Westwater, Westwater - Five Kiva - Ruin, and White Mesa sites.

Table XIII. Comparative Morphological Data for PII and III Northern Anasazi Maize Collections (from Cutler 1965, 1966; Litzinger and Winter 1975; Reaves 1977; Winter 1974a, 1975b)

Location	# of cobs	% of 8-row	Mean row #	Cob/rachis index	Mean cupule width (mm)	Mean lower glume width (mm)	Mean lower glume thickness (mm)
Mesa Verde							
Mug House	3621	46					
Long House	2171	42					
Step House	5932	30					
Hovenweep	270	31	10	2.9	5	3	2
Big Westwater Ruin (42Sa6752)	342	26	10	1.7	7	5	4
Comb Ridge (42Sa2136)	75	19	11	1.4	7	4	
Elk Ridge	133	24	10	2.1	7	4	
Cedar Mesa	735	33					
42Ka178	208	22					
Glen Canyon (42Ka274)	507	23			8		

Many uncontrollable factors in taking soil samples preclude weighing and counting seeds and plant parts. Plant taxa identified from each sample were recorded simply as present in the samples. The number or amount of each taxa actually reflects nothing more than preservation in that sample. Thus, for any sample a taxon may be represented one or 20 times but was counted as only one occurrence. This insures that accidents of preservation are not mistaken for changes in cultural use. (For an indepth discussion on the problems of counting and weighing plant macrofossil remains, see Coulam and Barnett in Jennings, et al 1980.)

Twenty-six taxonomic varieties from 18 families were identified from the samples (Table XV). These include three cultigens and 23 varieties of wild plants. Seeds or parts from POACEAE (grass) appeared in 79% of the samples (including *Zea mays*). The second most frequently occurring family was CUPRESSACEAE, specifically *Juniperus* sp., which appeared as leaves, bark, and wood in 64% of the samples. Occurring in 57% of the samples were seeds of the family CHENOPODIACEAE including *Chenopodium* sp. and *Corispermum hyssipfolium* (Table XV). *Corispermum hyssipfolium* is recorded as an introduced species by botanists. However, this seed has been recorded in both coprolite and flotation samples from Cowboy Cave, an Archaic site near Canyonlands Park in Southeastern Utah (Hogan 1980; Barnett and Coulam 1980).

The contents of the ceramic vessel contained the largest variety of plant taxa, and most were charred. However, with a few minor discrepancies, the same varieties also occurred in a sample from the fill of the same feature. This leads to the conclusion that the taxa represented in the vessel were accidental inclusions. This is not to say that the plants were not collected and brought to the site for their economic use.

Some of the plant remains recovered from the turkey coprolite bearing deposit in Strata V, the exploratory trench, are evidence of turkey feed. Although these coprolites contained *Amaranthus retroflexus* , these seeds were also recovered from samples in other features, unassociated with turkey coprolites. As this plant is reported as economically useful to humans, it is assumed that it was used as food for both turkeys and humans.

The only seed appearing in samples from the exploratory trench (Strata I, II and V) and nowhere else is *Portulaca* sp. Although it, too, may have been used as turkey feed, it has also been reported as useful to humans.

BULK PLANT REMAINS

The large botanical remains collected from Big Westwater Ruin were excellently preserved in the arid depositional environment. The most prevalent macrofossil represented is *Yucca* sp., followed by *Cucurbita* sp., POACEAE (including *Zea mays*), and *Juniperus* sp. All of the plant taxa represented appear in Table XVI.

Table XV

Plant Remains Provenience

	Amaranthus retroflexus	*Artemisia tridentata*	*Helianthus petiolaris*	*Lepidium* sp.	CACTACEAE	*Opuntia* sp.	*Chenopodium* sp.	*Corispermum hyssipfolium*	*Cucurbita* sp.	*Juniperus* sp.	*Carex* sp.	*Ephedra viridis*	*Phaseolus* sp.	*Yucca* sp.	*Sphaeralcea* sp.	*Pinus edulis*	POACEAE	*Elymus* sp.	*Hordeum* sp.	*Oryzopsis hymenoides*	*Sporobolus cryptandrus*	*Zea mays*	*Portulaca* sp.	*Fallugia paradoxa*	*Ribes* sp.	*Celtis reticulata*				
General Surface Prov. Unknown																														
Exploratory Trench Prov. Unknown																														
Stratum VII	X																													
Stratum VI																X														
Stratum V							X			X						X							X		X					
Stratum IV																														
Stratum III				X			X			X						X	X				X					X				
Stratum II	X						X			X			X							X			X		X					
Stratum Ib							X																X							

X = Present

	Amaranthus retroflexus	*Artemisia tridentata*	*Helianthus petiolaris*	*Lepidium* sp.	CACTACEAE	*Opuntia* sp.	*Chenopodium* sp.	*Corispermum hyssipfolium*	*Cucurbita* sp.	*Juniperus* sp.	*Carex* sp.	*Ephedra viridis*	*Phaseolus* sp.	*Yucca* sp.	*Sphaeralcea* sp.	*Pinus edulis*	POACEAE	*Elymus* sp.	*Hordeum* sp.	*Oryzopsis hymenoides*	*Sporobolus cryptandrus*	*Zea mays*	*Portulaca* sp.	*Fallugia paradoxa*	*Ribes* sp.	*Celtis reticulata*				
Stratum 1a																	X													
Room Block A Room 4 General fill																														
Level C							X	X		X											X				X					
Level B	X									X										X										
Level A						X				X												X								
Floor							X		X	X									X											
Room 5																														
Room Block B Room 6																														
Room 7																														
Room 8																														
Room 9																														

	Amaranthus retroflexus	*Artemisia tridentata*	*Helianthus petiolaris*	*Lepidium* sp.	CACTACEAE	*Opuntia* sp.	*Chenopodium* sp.	*Corispermum hyssipfolium*	*Cucurbita* sp.	*Juniperus* sp.	*Carex* sp.	*Ephedra viridis*	*Phaseolus* sp.	*Yucca* sp.	*Sphaeralcea* sp.	*Pinus edulis*	POACEAE	*Elymus* sp.	*Hordeum* sp.	*Oryzopsis hymenoides*	*Sporobolus cryptandrus*	*Zea mays*	*Portulaca* sp.	*Fallugia paradoxa*	*Ribes* sp.	*Celtis reticulata*				
Room 10 Subfloor fill	X	X	X		X	X	X	X		X		X	X	X	X	X	X		X	X		X		X	X	X				
Vessel	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X		X	X		X		X	X	X				
Room 11																														
Kiva																														
Storage Room 1																														
Storage Room 2																														
Storage Room 3																														

	Amaranthus retroflexus	*Artemisia tridentata*	*Helianthus petiolaris*	*Lepidium* sp.	CACTACEAE	*Opuntia* sp.	*Chenopodium* sp.	*Corispermum hyssipfolium*	*Cucurbita* sp.	*Juniperus* sp.	*Carex* sp.	*Ephedra viridis*	*Phaseolus* sp.	*Yucca* sp.	*Sphaeralcea* sp.	*Pinus edulis*	POACEAE	*Elymus* sp.	*Hordeum* sp.	*Oryzopsis hymenoides*	*Sporobolus cryptandrus*	*Zea mays*	*Portulaca* sp.	*Fallugia paradoxa*	*Ribes* sp.	*Celtis reticulata*				TOTALS
TOTALS																														
General Surface Prov. Unknown																														
Exploratory Trench	2			1			4			3				1			4	1			1	1	3		2	1				23
Room Block A	1					1	2	1	1	3									1	1	1	1			1					14
Room Block B	2	2	2	1	2	2	2	2		2	1	2	1	2	2	2	2		2	2		2		2	2	2				41
TOTALS	5	2	2	2	2	3	8	3	1	8	1	2	1	3	2	2	6	1	3	3	2	4	3	2	5	3				78

Table XVI. Plant Families in Diminishing Order of Frequency of Occurrence

Flotation (14 samples)	
POACEAE	11
CUPRESSACEAE	9
CHENOPODIACEAE	8
AMARANTHACEAE	5
SAXIFRAGACEAE	5
CACTACEAE	3
LILIACEAE	3
PORTULACEAE	3
ULMACEAE	3
ASTERACEAE	2
BRASSICACEAE	2
EPHEDRACEAE	2
MALVACEAE	2
PINACEAE	2
ROSACEAE	2
CUCURBITACEAE	1
CYPERACEAE	1
FABACEAE	1

Bulk Samples (149)	
50	LILIACEAE
40	CUCURBITACEAE
19	POACEAE
18	CUPRESSACEAE
9	PINACEAE
6	CACTACEAE
4	FABACEAE
2	ULMACEAE
1	ASTERACEAE
1	SAXIFRAGACEAE

		Cucurbita sp.	Hull	Stem	*Juniperus* sp.	Bark	*Yucca* sp.	Cordage	Fiber	Knotted leaves	Quids	*Zea mays*	Stalk	Knotted husk	Wood, Unidentified	Knotted twist	Shaped stick	TOTALS
Room 6																		0
Room 7	Fill	1	1						4	12		10						28
Room 8																		0
Room 9	Fill									4								4
Room 10	Fill				1				2	5					1			9
	Subfloor fill								2	2		1						5
Room 11																		0
Kiva	Fill							4	2	5		5						16
	Floor contact								2							1		3
Storage Room 1																		0
Storage Room 2																		0

	Cucurbita sp.	Hull	Stem	*Juniperus* sp.	Bark	*Yucca* sp.	Cordage	Fiber	Knotted leaves	Quids	*Zea mays*	Stalk	Knotted husk	Wood, Unidentified	Knotted twist	Shaped stick	TOTALS
Storage Room 3																	0
TOTALS																	
General Surface Prov. Unknown							1	1	5								7
Exploratory Trench																	0
Room Block A										1			1				2
Room Block B		1	1		1			4	14	31		21			1	1	75
TOTALS		1	1		1		1	5	19	32		21	1		1	1	84

and is semi-circular in shape. The outside surface was smoothed and shaped with the top edge smoothed and flattened. A deep groove was cut into the outside surface parallel with and 10 cm below the top.

Zea mays Stalk. Four sections of *Zea* stalk were hollowed out, cut and smoothed on one or both ends. The first piece is 3.2 cm in length and .7 cm in diameter and burned on one end. The second piece is 4.2 cm long, .9 cm in diameter and also burned on one end. The third piece is 5.8 cm long, .7 cm in diameter and has one end broken. The entire piece was fire-blackened. The fourth piece of stalk is 13.6 cm long, .8 cm in diameter, smoothed, and fire blackened.

Two sections of the interior of *Zea* stalks appear to have been shaped and smoothed for some unknown purpose. One piece measures 2.7 cm in length and .2 cm in diameter. The second piece is 4.5 cm in length and .4 cm in diameter.

Zea mays Husk. Two lengths of *Zea* husk were tied together with a sheet bend knot. They measure 11.5 cm in length and 1.6 cm in width.

Wood, Unidentified. Two lengths of wood twisted together in an S-twist were tied together with a sheet bend knot. The length measures 28.5 cm and the width is .6 cm.

A single length of wood, smoothed, and shaped to a point on one end measures 14.2 cm long and .6 cm in diameter. The entire piece is fire-blackened.

Unworked Plant Remains

Domesticated. *Cucurbita* sp., *Zea mays*, and *Phaseolus* sp. were all recovered from the site. The most numerous remains are *Cucurbita* sp. in the form of seeds, peduncles, and hull fragments. *Zea mays* was the second most common domesticate found with stalks, husks, and influorescences. Only six *Phaseolus* sp. (beans) were found. One is white and the other five are reddish-brown.

Wild Remains. Wild plant remains include a whole *Opuntia* sp. pad; *Juniperus* sp. bark, wood and berries; leaves, nuts, fruits and sticks. The most prevalent wild plant remains are *Yucca* sp. in the forms of a whole pod, a root, fiber, and leaves. Unworked domesticates and wild remains are presented in Table XIX.

CONCLUSIONS

The analysis of the plant remains from Big Westwater Ruin indicates that the prehistoric inhabitants relied as heavily on wild plants as on the domesticates *Zea mays*, *Phaseolus* sp., and *Cucurbita* sp. However, these plants probably do not represent the entire range of plants that were used. It is not known how

Table XVIII

Unworked Plant Remains Provenience

	DOMESTICATES	*Cucurbita* sp.	Hull	Peduncle	Seed	*Phaseolus* sp.	Bean	*Zea mays*	Husk	Influorescens	Stalk	WILD PLANTS	ASTERACEAE	Flowers	*Celtis reticulata*	Fruit	Leaf	*Juniperus* sp.	Bark	Berry	Wood	*Opuntia* sp.	Pad	Spine	*Pinus* sp.	Cone	Needle	Nut	Wood	POACEAE	*Oryzopsis hymenoides* (contd.)
General Surface Prov. Unknown		X	X	X						X								X		X								X			
Exploratory Trench Prov. Unknown		X	X																												
Room Block A Room 4 General fill			X															X													
Level C																															
Level B				X																											
Level A																															
Floor																															
Room 5 Fill		X	X																												
Room Block B Prov. Unknown		X	X			X		X		X									X	X		X									

X = Present

	(contd.)	Seed	*Ribes* sp.	Branch/berry	*Yucca* sp.	Fiber	Leaf	Pod	Root	Wood, Unidentified	Seeds, Unidentified																			
General Surface Prov. Unknown					X	X			X																					
Exploratory Trench Prov. Unknown																														
Room Block A Room 4 General fill			X			X																								
Level C																														
Level B																														
Level A																														
Floor																														
Room 5 Fill																														
Room Block B Prov. Unknown						X	X	X																						

		DOMESTICATES	*Cucurbita* sp.	Hull	Peduncle	Seed	*Phaseolus* sp.	Bean	*Zea mays*	Husk	Influorescens	Stalk	WILD PLANTS	ASTERACEAE	Flowers	*Celtis reticulata*	Fruit	Leaf	*Juniperus* sp.	Bark	Berry	Wood	*Opuntia* sp.	Pad	Spine	*Pinus* sp.	Cone	Needle	Nut	Wood	POACEAE	*Oryzopsis hymenoides* (contd.)
Room 6	Upper floor																			X												
Room 7	Fill		X	X	X					X	X								X	X	X		X	X		X		X				
Room 8																																
Room 9	Fill		X		X				X	X																						
	Subfloor fill		X		X		X													X												
Room 10	Fill		X	X							X									X			X									
	Subfloor fill		X	X	X		X		X								X		X	X			X					X				
Room 11																																
Kiva	Fill		X	X	X		X									X			X	X	X		X				X					
	Floor contact																															
	Subfloor fill		X		X																											

(contd.)		Seed	*Ribes* sp.	Branch/berry	*Yucca* sp.	Fiber	Leaf	Pod	Root	Wood, Unidentified	Seeds, Unidentified	TOTALS
Storage Room 1	Fill									X		
Storage Room 2												
Storage Room 3												
TOTALS												
General Surface Prov. Unknown		3				1	1			1		13
Exploratory Trench												2
Room Block A				1			1					6
Room Block B		1				4	4	1	1	3	1	72
TOTALS		4		1		5	6	1	1	4	1	93

Table XIX. Seasonal Availability of Plants

	January	February	March	April	May	June	July	August	September	October	November	December
Amaranthus retroflexus				—	—	—	—	—	—			
Artemisia tridentata	—	—	—	—	—	—	—	—	—	—	—	—
Helianthus petiolaris						—	—	—	—			
Lepidium sp.					—	—	—	—				
CACTACEAE	—	—	—	—	—	—	—	—	—	—	—	—
Opuntia sp.	—	—	—	—	—	—	—	—	—	—	—	—
Chenopodium sp.				—	—	—	—	—	—	—		
Corispermum hyssipfolium							—	—	—			
Cucurbita sp.	—	—	—	—	—	—	—	—	—	—	—	—
Juniperus sp.	—	—	—	—	—	—	—	—	—	—	—	—
Carex sp.						—	—	—				
Ephedra viridis	—	—	—	—	—	—	—	—	—	—	—	—
Phaseolus sp.	—	—	—	—	—	—	—	—	—	—	—	—
Yucca sp.	—	—	—	—	—	—	—	—	—	—	—	—
Sphaeralcea sp.					—	—	—	—				
Pinus edulis	—	—	—	—	—	—	—	—	—	—	—	—
POACEAE *												
Elymus sp.							—	—	—	—		
Hordeum sp.						—	—	—				
Oryzopsis hymenoides					—	—	—	—				
Sporobolus cryptandrus						—	—	—	—	—		
Zea mays	—	—	—	—	—	—	—	—	—	—	—	—
Portulaca sp.	—	—	—	—	—	—	—	—	—	—	—	—
Fallugia paradoxa				—	—	—	—	—	—	—		
Ribes sp.						—	—	—				
Celtis reticulata	—	—	—	—	—	—	—	—	—	—	—	—

* Many genera reported as useful by ethographers

many or which species of wild plants were gathered and consumed away from the habitation area. The parts of the plants which were gathered as greens, for example, would not necessarily appear in the plant record.

The seasonality of the plant taxa recovered range from year-round, for those which can be utilized in some way at all times (including through storage), to specific months when only certain edible parts are used as berries, seeds, or greens (Table XIX).

The annual round of gathering and horticulture enabled the inhabitants to supplement their diet of domesticates with a variety of wild plants. In addition, they were able to collect wild plants for food when the crops were poor or the stored supply of crops were depleted in early spring.

Many plants were also used for construction material, fuel and medicine (Table XX). Although the ethnographic reports of the uses of the plant taxa recovered does not mean that prehistoric inhabitants utilized these plants in the same manner, the possible uses are restricted and are probably reported within the various ethnographies.

Although there is a difference in the list of plants reported from the flotation analysis and the bulk sample (Table XVI), it presents a better picture of the entire range of plants than would a single study.

Table XX. Ethnographic Uses of Plants

	FOOD	FUEL	MEDICINE	CONSTRUCTION	SOURCE
Amaranthus retroflexus	X				(8)
Artemisia tridentata	X		X	X	(4) (7) (8)
Helianthus petiolaris	X		X	X	(2) (8)
Lepidium sp.	X				(4) (8)
CACTACEAE	X		X		(4) (6) (8)
Opuntia sp.	X				(2) (8)
Chenopodium sp.	X		X		(2) (4) (5) (7)
Corispermum hyssipfolium	X				*
Cucurbita sp.	X			X	(3) (8)
Juniperus sp.	X	X	X	X	(2) (6) (8)
Carex sp.	X				(8)
Ephedra viridis	X		X		(2) (4) (8)
Phaseolus sp.	X				(6) (8)
Yucca sp.	X			X	(2) (3) (8)
Sphaeralcea sp.	X		X		(6) (8)
Pinus edulis	X	X	X	X	(2) (4) (6) (8)
POACEAE	X				(1) - (8)
Elymus sp.	X				(4) (8)
Hordeum sp.	X				(8)
Oryzopsis hymenoides	X				(2) (4) (8)
Sporobolus cryptandrus	X				(2) (4) (8)
Zea mays	X			X	(6) (8)
Portulaca sp.	X		X		(2) (3) (7) (8)
Fallugia paradoxa			X	X	(1)
Ribes sp.	X		X		(2) (4) (6) (8)
Celtis reticulata	X		X		(3) (7) (8)

* Found in coprolites and flotation samples at Cowboy Cave, Utah.
(1) Elmore 1976 (2) Harrington 1967 (3) Kirk 1975 (4) Stewart 1938
(5) Sweet 1962 (6) Whiting 1939 (7) Wyman and Harris 1951
(8) Yanovsky 1936

Pollen Analysis of Big Westwater

Site Deposits

by
La Mar W. Lindsay

INTRODUCTION

Pollen analysis of a limited depositional sample was conducted at Big Westwater. The focus of the sampling was to develop a pollen sequence through the Pueblo II and III occupations of the site. Disturbance to most rooms precluded the sampling and analysis of floors. Turkey fecal deposits in the exploratory trench and the upper levels of masonry Room 4 fill in Room Block A suggest possible similarities with the mid- to late-Pueblo III occupation of Westwater - Five Kiva - Ruin (Lindsay 1981) three miles to the north. The extensive sampling and analysis at the latter ruin indicates a gradual increase in arboreal pollen, principally juniper, during Pueblo III times. Similar preabandonment arboreal pollen increases were also detected from the upper levels at Mug House - Mesa Verde (Martin and Byers 1965: 126 - Profile 3b, 127 - Profile 2, and 128 - Profile 6). However, no hypotheses were advanced, in the absence of corroborative data, as to the significance of the phenomenon (cf. Rohn 1971:256). Most pollen profiles show increases in arboreal pollen occurring after site (or regional) abandonment (cf. Martin 1962; e.g. Martin and Byers 1965:129 - Profile 7). However, I suspect that many Pueblo III sites were abandoned before the pollen shift occurred or that the sampling of mid- to late-Pueblo III deposition has, in many cases, not been in fine enough increments to detect such preabandonment change.

The sampling of the upper stratigraphic levels at Westwater - Five Kiva involved the separation of micro-stratigraphic laminae of turkey dung which were deposited uppermost on the site (Lindsay 1981). While these laminae are undated, tree-ring dates from elsewhere in the rockshelter demonstrate that the site was occupied to at least A.D. 1250 (UWM-44). The date was originally considered aberrant because it was thought to have been associated with jacal construction in use from Basketmaker III to early-Pueblo II times. However, upon final analysis, it is apparent that the date is associated with the extensive maintenance of turkeys in the shelter during Pueblo III times. Several A.D. 1243 (LA-U-3, LA-U-4, and UWM-43) tree-ring samples may suggest the dating of the basal lamination and hence the onset of the arboreal increase.

Similar turkey fecal deposition was observed at Big Westwater Ruin in the profile of a large, approximately one meter in diameter looter's pit. The pit was located immediately southeast of Room Block A. The exploratory trench was initiated to identify the full stratigraphic sequence at the site and to obtain a range of artifacts representative of the sequence. The trench was placed to obliterate the pit and to process the spoil which had apparently been derived from the pit in the course of the looting. Pollen sampling from the stratigraphic profile of the exploratory trench involved only a single sample from each stratum and included one from a fairly thin turkey fecal deposit. When similar deposits were identified in the fill of masonry Room 4 of Room Block A, these were sampled correspondingly. The upper levels of the fill of the room included two discrete turkey fecal deposits.

A specific goal of the pollen sampling and analysis was to obtain sufficient information for comparison with the Westwater - Five Kiva profile. More specifically, could the preabandonment increases in arboreal pollen be demonstrated at both rock-shelters and if so, what does this mean in the context of the wanning Pueblo III occupation in the Westwater/White Mesa locale? Finally, a comparison with Mug House archeological and pollen sequences may provide some information regarding the abandonment of southeastern Utah and southwestern Colorado.

PROCEDURE

Sampling.

Twelve, approximately 50 gm samples, were selected from those obtained during the 1979 excavations. Eight samples were derived from the seven strata (Ia and Ib through VII) of the exploratory trench and four are from the floor and fill levels (A through C) of masonry Room 4 in Room Block A. The samples appear to represent the full Pueblo II and III occupational sequence at the site (see SITE DESCRIPTION, Figure 9).

<u>Exploratory Trench Samples</u>. Stratum Ia is a Pueblo II deposit associated with early masonry construction. Strata Ib and II are interpreted as mid- to late-Pueblo II and early-Pueblo III. Both are associated with subsequent intermediate stage masonry. Strata II and III are early-Pueblo III deposits associated with much of the final intermediate stage construction on the site. Stratum IV is interpreted as mid-Pueblo III occurring in connection with site destruction and the leveling of rubble to use as a base for subsequent construction. Stratum V is the mid- to late-Pueblo III turkey deposition identified in the exploratory trench. It was not separable into subcomponents. Strata VI and VII are post-occupational components.

<u>Stratum Ia</u> is a moderately consolidated, salmon-pink to -gray clayey-sand containing charcoal and greenish-gray mudstone fragments derived from the contract of the Morrison and overlying Burro Canyon formations. San Juan Red Ware was recovered from the deposit.

<u>Stratum Ib</u> is a moderately consolidated, deposit of tan sand containing sparse charcoal flecks. Tusayan Polychrome pottery was recovered from the deposit.

<u>Stratum II</u> is a loosely consolidated, brownish-gray sand with limited gravel, weathered rock fragments, and charcoal

flecks. Cortez Black-on-white, Mancos Corrugated, and McElmo Black-on-white pottery were recovered from the deposit.

Stratum III is a hard-packed, blackish-brown, clayey, sand and ash. Mancos and possibly McElmo Black-on-white pottery were recovered from the deposit.

Stratum IV is a loosely consolidated, brown sand containing daub chunks, charcoal flecks, and limited humus. No diagnostic pottery was recovered from the deposit.

Stratum V is a moderately consolidated, dark brown deposit of sand and turkey feces. It was a fairly homogeneous deposit where the pollen sample was obtained. No pottery was recovered from the deposit (see Room 4 fill, Levels B and C).

Stratum VI is a loosely consolidated salmon-pink to red clayey sand containing charcoal, mortar fragments, gravel, and weathered rock fragments. It is interpreted as the basal post-occupational component.

Stratum VII is a fine powdery, greenish-gray sand which becomes more compact with depth. It is the most recent post-occupational deposit which caps all other deposition in the central and eastern parts of the site.

There is some question regarding the stratigraphic relationships of Stratum Ia and b, and Stratum II. All are discontinuous, basal deposits occurring directly on bedrock. Stratum Ia and Stratum Ib are spatially separated by Stratum II. The latter also directly overlies Stratum Ib, but not Stratum Ia. It is possible that Strata Ib and II are contemporaneous as both late-Pueblo II and possible early-Pueblo III pottery were recovered from the deposits. However, the relative thickness of Stratum II and the recovery of McElmo Black-on-white pottery suggests that it was at least in part derived from an early-Pueblo III occupation. Stratum Ib can only be identified as a late-Pueblo II/early-Pueblo III deposit based on the recovery of Tusayan Polychrome pottery (see Ceramics).

Masonry Room 4 Fill Samples. The floor associated with the intermediate stage masonry construction of Room 4 and Stratum Ib provide the only direct means of association of the two sets of deposits. The Room 4 floor is the basal, mid- to late-Pueblo II sample. Level A is an early- to mid-Pueblo III deposit. Levels B and C represent the final occupation of the room and both are equated with Stratum V of the exploratory trench.

The floor is a moderately hard-packed, salmon-red, sandy-clay. Tusayan Polychrome and Cortez and Mancos Black-on-white pottery were recovered from the floor. A McElmo/Mesa Verde Black-on-white pottery sherd was probably derived from the overlying early-Pueblo III Level A. The identification of several Tusayan Polychrome pottery sherds supports the association with Stratum Ib of the exploratory trench.

Level A is a compact dark gray sand with charcoal, ash, and small sticks. Its composition is much like that of Stratum III of the exploratory trench. The level is interpreted as an early- to mid-Pueblo III deposition.

Level B is a deposit of matted light brown eolian sand and small sticks cemented with turkey feces. Mesa Verde Black-on-white pottery was recovered from the deposit. Level B and the overlying Level C are equated with the mid- to late-Pueblo III Stratum V deposition in the exploratory trench.

Level C is dark brown, matted turkey feces containing vegetal material including juniper bark. The level is the final occupational component of masonry Room 4. No pottery was recovered from the deposit.

Pollen Extraction and Identification

The approximately 50 gm samples were processed using extraction procedures in general use for alluvial and eolian deposits of the Great Basin and the Southwest (Mehringer 1967). Following extraction, pollen residue was stained with basic fushin, mounted on slides using glycerol, and counted under 600x magnification. Pollen abundance and generally good preservation provided 200 grain pollen counts for all samples. Amounts of silicates and humates varied considerably from slide to slide. Pollen was identified using the reference material of the University of Utah Herbarium.

DESCRIPTIVE RESULTS

Pollen types are grouped according to known natural and possible cultural relationships (Figure 80a and b). Both exotic and local arboreal species (AP) are represented. These wind-born pollen types travel some distance (McAndrews and Wright 1969) and are expected in varying amounts in the pollen rain throughout the Southwest (e.g. Martin 1963; Martin and Byers 1965). The absence of *Pseudotsuga* in the pollen samples is not surprising because the pollen type is transported only short distances and generally occurs infrequently in Southwestern samples (Martin and Byers 1965). Big Westwater Ruin is in the heart of the pinyon-juniper belt and these local species should be heavily represented. *Pinus edulis* and *P. ponderosa* are not distinguished. Limited refugia of the latter occur both about 15 miles to the north and well to the west on Cedar Mesa. Other arboreal species including *Quercus*, *Acer*, *Populus*, and *Salix* occupy the canyons, particularly to the north, and are expected as local pollen types.

Non-arboreal pollen types (NAP) are grouped as cultigens, cultivars, and other species which naturally occur. The extremely high percentages of *Zea mays* pollen, with the abundant macrofossils (see Barnett, Plant Remains), provides the evidence of a heavy reliance on domesticates. Percentages of *Zea* pollen are expected to be quite variable (Martin 1963; Martin and Sharrock 1964; Martin and Byers 1965) and it has also been observed in particular abundance (Martin and Sharrock 1964; Lindsay 1981). *Curcubita* pollen is only occasionally identified in Southwestern archeological deposits (Martin and Byers 1965; Lindsay 1974, 1981), though at Westwater - Five

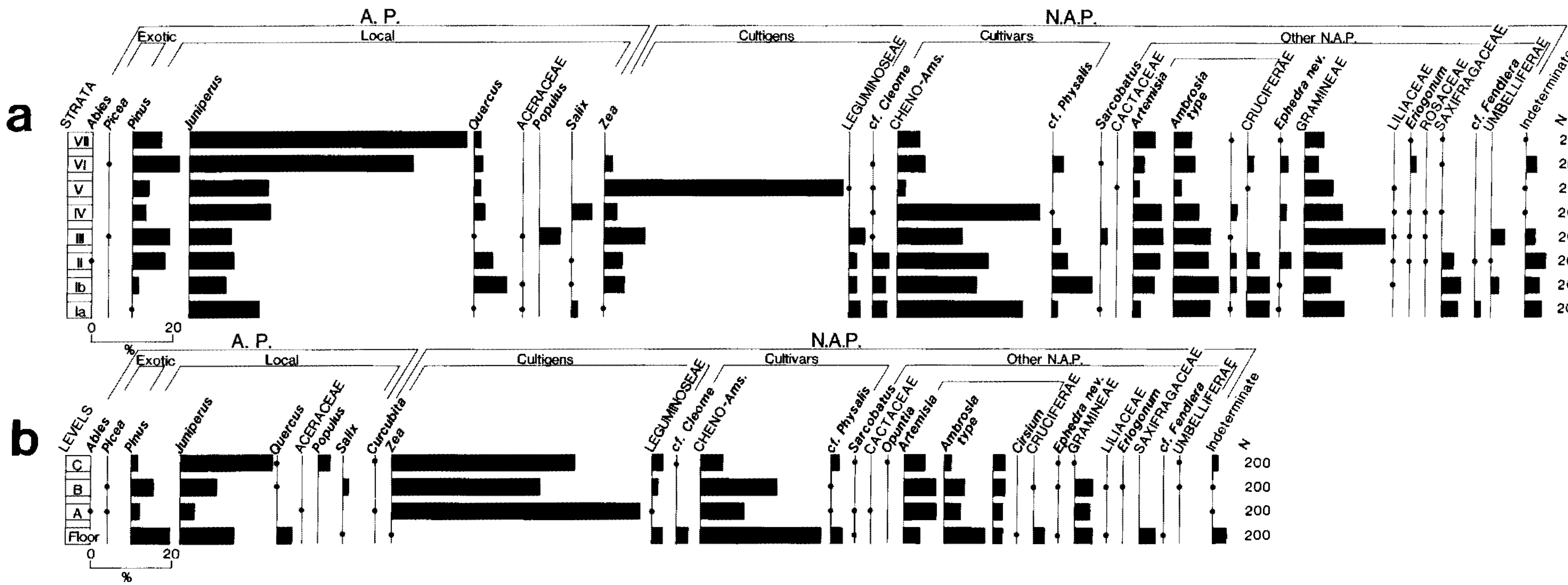


Figure 80. Pollen Diagram of Relative Percentages from Big Westwater Exploratory Trench (a) and Room 4 fill (b) Deposits

Kiva, deposits were virtually littered with squash rinds and peduncles. *Phaseolus* pollen is only rarely identified in Southwestern sites and there is probably little justification to include LEGUMINOSEAE pollen in the cultigen grouping (Figure 80a and b) as, most certainly, several species are represented in the profile. Modern legumes in the Westwater/White Mesa locale include several varieties of *Astragalus* and *Psoralea* . However, beans are well represented in the macrofossil inventory (Barnett, Plant Remains). LEGUMINOSEAE pollen occurs in only minor amounts and does not readily influence the general data one way or the other. The cultivar grouping includes plants which are known to have been encouraged by the Hopi (e.g. Whiting 1939; Hack 1942), Zuni (e.g. Stevenson 1915) and other Southwestern cultures during ethnohistoric times. Still, there is no firm evidence that all of these plants were directly encouraged as many of the species occur in disturbed soils where agriculture has been practiced. The Cheno-ams, *Physalis*, and *Cleome* are all present in varying abundance today in the Westwater/White Mesa locale. The remaining non-arboreal pollen types also occur as modern species. Some of these, particularly the composits, are associated with disturbed soils and readily invade agricultural land. Many of the non-arboreal species, according to the archeological and ethnographic records, were variously utilized. Grasses, the composits, *Ephedra* and *Yucca* (probably heavily represented in LILIACEAE) are well represented in the macrofossil inventory (Barnett, Plant Remains). The absence of *Spheralcea* (MALVACEAE) and *Oenethera* (ONAGRACEAE) in the pollen inventory is somewhat perplexing as they occur in both the archeological record on the mesa (see Janetski in Casjens et al 1980) and are present in abundance today. *Spheralcea* is also present in the Big Westwater macrofossil inventory (Barnett, Plant Remains). Both species are insect pollinated, and it may be that while they occupied the disturbed mesa soils during prehistoric times, economic utilization at the shelter was very limited.

In sum, the plant families and various genera represented in the pollen inventory for prehistoric times are present today in the Westwater/White Mesa locale. Exotic arboreal species are in the nearby Abajo Mountains to the north. The pollen of many non-arboreal plants cannot be identified to species and hence many of these are likely represented in the various family categories. The pollen data is in apparent agreement with Erdman, Douglas, and Marr (1969), that, in general, plant communities have remained unchanged for at least the past 800 years. However, the size of competing communities, depending on demands, may have varied considerably over the full temporal range of the Anasazi occupation of southeastern Utah.

In general, the pollen analysis compares quite favorably with that of the macrofossils (Barnett, Plant Remains). The few families identified in the macrofossil samples and not in the pollen study include BRASSICEAE (*Lepidium* sp.), MALVACEAE *Spheralcea* sp.), PORTULACACEAE *Portulaca* sp.), and ULMACEAE (*Celtis reticulata*). Several of these species were probably fossil sample), LILIACEAE (probably includes *Yucca* sp.), *Eriogonum*, ROSACEAE (which may include *Fallugia paradoxa*), SAXIFRAGACEAE (which may include *Ribes* sp. and a possible identification of *Fendlera*), and UMBELLIFERAE. The latter family does not occur in the macrofossil record (Barnett, Plant Remains). Macrofossils that are not represented in the pollen identifications include CYPERACEAE (*Carex* sp.), PORTULACACEAE (*Portulaca* sp.), and ULMACEAE (*Celtis reticulata*). Only *Artemisia* (*A. tridentata* in the macrofossil sample), the *Ambrosia* type COMPOSITAE, and GRAMINEAE (*Elymus* sp., sp., *Oryzopsis hymenoides* , and *Sporobolus cryptandrus* in the macrofossil sample) are sufficiently represented to allow interpretation. *Artemisia* , in both profiles shows a gradual increase to Strata III and IV and Level B samples (early-Pueblo II to early- to mid-Pueblo III) followed by diminished percentages roughly corresponding to mid-Pueblo III times. The *Ambrosia* type - low spine COMPOSITAE remain fairly well represented through the Stratum III and Level B samples, followed by minor decreases in the mid- to late-Pueblo III samples. GRAMINEAE peaks with the Stratum III sample of the exploratory trench, followed by a gradual decrease through site abandonment and the post-occupational samples. Grass is under represented in the Level C, Room 4 fill sample.

In sum, the arboreal pollen counts may be indicative of changing climatic conditions but not independent of the effects of Anasazi construction requirements for timber (particularly juniper) and land use. Also, the constraints imposed by a number of high cultigen counts (particularly *Zea*) on the arboreal pollen percentages further distorts the climatic record. The pollen of cultigens (predominantly *Zea*) provides abundant evidence of the Anasazi committment to, and the heavy reliance on, domestic foods. The high count on possible cultivars (particularly the Cheno-ams) suggests both the probable nearby location of farm plots and that these plants were likely heavily utilized. Grasses, the COMPOSITAE, and various weedy plants provide additional evidence of nearby farm plots and no doubt some of these, while not directly encouraged, were utilized.

INTERPRETATION

The natural pollen rain of the southwest is "surprisingly" consistent despite some irregularities between various studies (see Schoenwetter 1970 for discussion). This is no doubt the product of fairly uniform vegetation patterns particularly in northern Arizona and southern Utah, but also because of the considerable distances that wind-born pollen are transported. For instance, a sizeable change in pine pollen, would be detected throughout the region. Plant communities are fairly stable and they are well adapted to cope with prolonged periods of limited effecitve moisture.

Pollen records obtained from archeological site deposits are influenced by both climate and man. Hence, uniformities in the record over time could also be a product of regularities in the adaptive process between locales and for that matter across the entire region. Schoenwetter (1970) (see also Schoenwetter and Eddy 1964 and Schoenwetter 1966) has argued for the utility of climatic reconstruction interpreted from the pollen analysis of archeological site deposits. The pollen record from the Cowboy Cave cultural deposits, for example, (Lindsay 1980a) reflects the Neoglacial sequence (Denton and Porter 1970). Well dated changes over lengthy time intervals seemed to support the generalized sequence and suggested an essential agreement between supply (the vegetative environment and the availability of various plants) and demand (cultural use). In addition to a ca 8500 B.P. occupation, the Cowboy Cave was occupied throughout roughly the latter half of the Altithermal and during the Neoglacial interstadials when grasses were abundant. However, though the Neoglacial sequence was particularly useful for interpreting the Cowboy Cave record, it is much too general to be of use in understanding the relatively brief period of Anasazi occupance of the Southwest. The exception to this is the ca 650 B.P. period of transition from the mid- to late-Neoglacial interstadial to the present late-Neoglacial stadial (Denton and Porter 1970; see also Currey 1976, 1980).

Big Westwater Ruin was occupied during Pueblo II and III times (ca A.D. 900 to 1250), thus placing the occupation toward the end of the ca 1900 - 650 B.P. mid- to late-Neoglacial inter- stadial (Denton and Porter 1970). Site abandonment and presum- ably the region (southwestern Colorado and southeastern Utah), occurred with the approximate onset of the ca 650 B.P. late-Neoglacial stadial. This stadial is indicated in various pollen records throughout the Southwest (and Great Basin) with the seemingly ubiquitous and dramatic increases in arboreal pollen postdating the late 13th century Anasazi abandonment of the region. Increases of the same magnitude were identified at Cowboy Cave (Lindsay 1980) during the ca 5500 - 4500 B.P. and 3300 - 1900 B.P. early- and middle-Neoglacial stadials (Denton and Porter 1970). These periods of increased arboreal pollen are interpreted as a product of cooler temperatures and the dominance of winter storm patterns.

Schoenwetter (1966, 1970) and Schoenwetter and Eddy (1964) have suggested a period of optimal climatic conditions for the production of *Zea* coincident with ca A.D. 900 - 1100 Pueblo II times. This period is characterized by a summer dominant rainfall pattern and one when the Anasazi expanded far north of previous habitats. There is some evidence for increased effective moisture toward the end of the Altithermal (cf Martin 1963) and at the close of the earlier Neoglacial interstadials (cf Currey 1980; Lindsay 1980b). The optimal Pueblo II climatic conditions provide further support for this apparently repetitive phenomenon.

The Big Westwater pollen profiles (Figures 80a and b, and 81) demonstrate both the summer dominant wet interval of Pueblo II times and the post-abandonment, late-Neoglacial arboreal pollen increase. *Juniperus* counts in post-occupational samples

Strata VI and VII are nearly triple the occupational samples. While these strata are undated they obviously occur well into the late-Neoglacial period. Stratum VII is probably fairly recent. The general increase in arboreal pollen (Figure 81) is predominantly *Juniperus* as *Pinus* values, by comparison, remain fairly low. *Quercus* actually diminishes over the course of both profiles (Figure 80a and b). Occupational samples show extremely high Cheno-am counts and moderate COMPOSITAE (excepting high spines) and grasses to the final occupational samples (Stratum V and Level C) of both profiles. However, with the removal of the high *Zea* count from Stratum V, the decrease in non-arboreal pollen would be less dramatic. Still, the high Cheno-ams, COMPOSITAE, and GRAMINEAE provide firm evidence of a lengthy climatic regime which promoted the propagation and growth of summer rainfall dependent plants, including *Zea*.

Preabandonment *Juniperus* pollen increases during mid- to late-Pueblo III times (compare Figure 80a and b) is particularly intriguing. The increase is apparent in both profiles and occurs temporally, at least, with the deposition of Stratum IV in the exploratory trench and Level B of masonry Room 4 fill. The two deposits are dissimilar as Stratum IV is, in part, rubble which was deliberately laid in preparation for the housing of turkeys, while Level B is the initial turkey deposit in Room 4. Also, pollen counts in the two samples are quite different (compare *Zea* variations). The removal of the constraints of the high *Zea* pollen counts of all samples preserves the gradual nature of change and clarifies the limited distortion expressed in the relative percentages. This is particularly true for the one sample (Stratum V) which distorts an accurate reconstruction of gradual change. The removal of the nearly 60 percent *Zea* from the stratum would result in a doubling of the 20 percent *Juniperus*, thus placing the count about mid-point between the Strata IV and VI values. Gradual change is supported in both profiles and is preserved in the A.P./N.A.P. summary (Figure 81).

Preabandonment arboreal pollen increases have also been identified in various pollen profiles from Mug House (Martin and Byers 1965) and Westwater - Five Kiva - Ruin (Lindsay 1981). However, there are notable differences in these profiles and as they compare with Big Westwater. At Mug House, increasing *Pinus* counts precede *Juniperus* in samples from the trash slope, Profile 3b (Martin and Byers 1965:126), while pollen increases of the two arboreal species are roughly equivalent from the trash slope, Profile 2 and Profile 6 from the fill of Kiva D (Martin and Byers 1965:127-128). Expectedly, the pollen profile from Westwater - Five Kiva more closely resembles the Big Westwater profiles. *Juniperus* is the principal contributor to the gradual increase in arboreal pollen at Westwater - Five Kiva, but a predominance over *Pinus* is less "clear-cut." Similarities with the Big Westwater profiles are more apparent in the comparisons of the A.P./N.A.P. summaries from the two sites and importantly, the Westwater - Five Kiva summaries cover a much broader time span (Basketmaker III

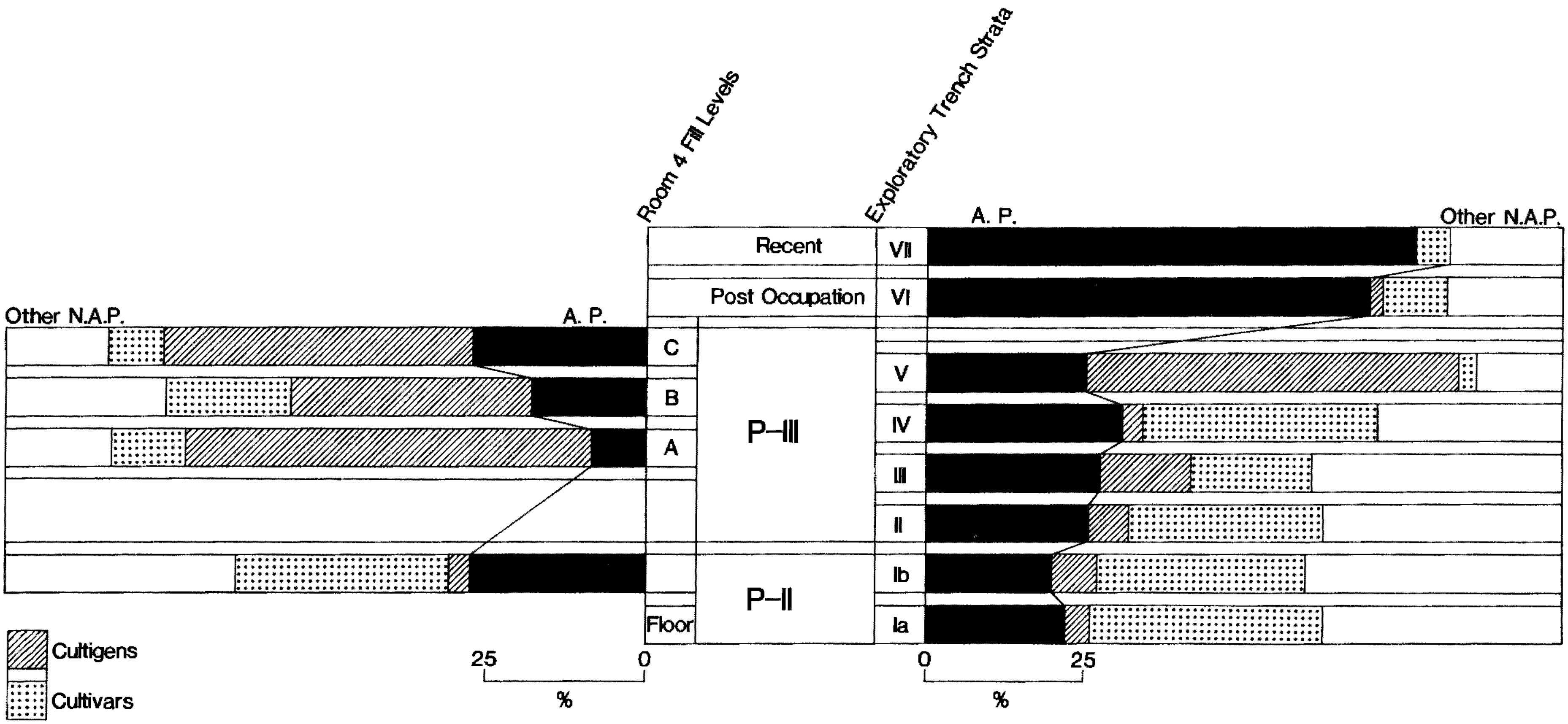


Figure 81. Arboreal/Nonarboreal Pollen Summary Showing the Relationship between the Exploratory Trench Strata and Room 4 Fill Levels and Their Approximate Temporal Placement in the Anasazi Sequence.

through Pueblo III), involving a large number of samples for each component.

In sum, the pollen data from Mug House, Westwater - Five Kiva, and Big Westwater demonstrate arboreal pollen increases antedating late-Pueblo III abandonment. *Pinus* is a principal contributor to the increases at Mug House while *Juniperus* is the dominant arboreal species at Westwater - Five Kiva and Big Westwater.

The variations between the two locales could be a matter of differing ecosystems or the product of adaptive variation and the differing Pueblo II and Pueblo III demands on local resources. The variation between locales is not a pure and simple matter of forest succession, although this must be taken into account. Woodbury (1947) suggests that *Juniperus* apparently predominates in the initial stages of reforestation throughout the pinyon/juniper belt. We would expect then, whatever the cause, increasing arboreal pollen values reflecting reforestation should, at least initially, be dominated by *Juniperus*. The two locales today differ in the ratios of pine to juniper and in the immediate availability of Douglas fir. The Mesa Verde area is somewhat more mesic than the lower Westwater elevations, hence the pigmy conifers seem to occur in roughly equivalent amounts and Douglas fir is present. At Westwater, juniper predominates and Douglas fir is somewhat removed. Contrary to Woodbury's (1947) estimate, reforestation at higher elevations may involve higher proportions of *Pinus* than in the more xeric locations.

Cultural demands on the various forest components may have varied, although this is particularly difficult to assess from available data. Rohn (1971:256), has considered (from the Martin and Byers 1965, Mug House pollen data) that

> the steady decrease in arboreal pollens throughout the period of occupation may reflect depletion of trees around the site as they were cut for construction purposes and firewood. The sharp rise of tree pollen at the end of the occupation, but before final abandonment may represent an initial recovery of the forest, yet it is hard to explain why this should have begun before the Indians had entirely moved out.

If Rohn is correct then, the depletion should be reflected in the preference for types of wood used in construction. I doubt if living trees would have been directly harvested for firewood. This differential depletion may well have been the case in the Westwater locale where the overwhelming preference was for juniper. Most of the wood samples collected for tree-ring dating were juniper, although pine was minimally represented at both shelters and a single Douglas fir sample was recovered from a Basketmaker III context at Westwater - Five Kiva. The Westwater - Five Kiva - pollen data tends to show an equivalent depletion of both arboreal species, though the preabandonment pollen increase is principally the product of the *Juniperus* counts. Tree-ring dated specimens (39) from Mug House consisted of about 50 percent Douglas fir, 25 percent pine, and 25 percent juniper (Rohn 1971:19). However, this is misleading because of the erratic nature of ring growth of juniper and the consequent problems of dating. It may be that a considerably greater number of *Juniperus* samples were originally submitted for dating than the results indicate. A listing from Mug House of all wood samples collected suggest this with juniper numbering 482 specimens, pine 84, and Douglas fir 58. Still a far greater proportion of samples other than juniper were collected from Mug House as compared to the Westwater rockshelters. The proportions of the three species used in construction at Long House - Mesa verde (Cattanach 1980) are comparable to those from Mug House.

The preference for juniper is particularly well documented for the entire lengthy occupation at Westwater - Five Kiva (Lindsay 1981). The species was used for upright posts of both the Basketmaker III component as well as later Pueblo III turkey pen construction. It was the principal timber used in roofing the kivas. Juniper bark was used to back jacal construction where mud was packed against stone and bark strips were periodically laid in the turkey pens and runs. The extensive use of the species is apparent.

Man influenced the environment and hence the pollen record in ways other than forest depletion. The introduction of *Zea mays* and the inordinately high *Zea* pollen percentages particularly in several of the Big Westwater samples impose constraints on the aboreal counts. Conversely, a reduction in *Zea* pollen, best seen in the Westwater - Five Kiva samples (Lindsay 1981) removes the constraints and allows for the greater representation of aboreal pollen. A case for agricultural failure cannot be made from the Big Westwater pollen record. However, the comparison of the two sets of archeological and palynological data (Big Westwater and Westwater - Five Kiva) may provide some indication of population stress and change (see SITE PALEOECOLOGY).

With the approaching late-Neoglacial stadial, we must assume that cooler temperatures would result in a shorter growing season. This may, in part, have been the impetus for Pueblo III movement from the interior of White Mesa to the canyon rims (Casjens et al 1980). The process of nucleation may have coincided with the onset of a gradual abandonment of the Westwater/White Mesa locale. The later would have resulted in not only a reduced rate of forest depletion, but also fewer farm plots and plants, such as Cheno-ams, which are normally associated with agriculturally disturbed soils. Gradual abandonment with the gradual reduction of constraints on arboreal pollen provides a solution to Rohn's (1971:256) query of why the "sharp rise in tree pollen before the Indians had entirely moved out."

In sum, there is good reason to suspect that the preabandonment increase in arboreal pollen is the product of several factors.

1) The approaching onset of the ca 650 B.P. late-Neoglacial stadial with cooler temperatures and greater

effective moisture likely resulted in forest expansion and greater pollen production. This would have occurred at the expense of plants dependent on summer rainfall.

2) Pueblo II expansion and the initial ca A.D. 1150 stage of Pueblo III nucleation resulted in considerable construction activity and considerable demands on the forest for wood. Forest depletion may be interpreted from a number of pollen profiles. Subsequent reforestation involves some variability of succession depending on elevation and the amount of depletion of the various forest components. At Mesa Verde where conditions are somewhat mesic, pine and juniper seem to be equivalent components of forest succession. In the more xeric Westwater/White Mesa locale, juniper tends to be the principal species in the initial stages of regrowth.

3) Possible post-A.D. 1150 erratic cultigen production and agricultural failures and the lessening of the constraints imposed by, principally *Zea*, would add to the increasing arboreal pollen counts. However, distortions in the record caused by such constraints appear to be negligible at Big Westwater.

SITE SUMMARY AND AREAL INFERENCE

Introduction

Big Westwater Ruin provides evidence of lengthy Pueblo II and III Mesa Verde Anasazi occupations. Earliest construction on the site was extensively burned, apparently by mid-Pueblo II times and as a prelude to considerable mid- to late-Pueblo II and early-Pueblo III construction. This intermediate stage construction is tree-ring dated from A.D. 1147 to 1207. Site destruction occurred again, apparently by mid-Pueblo III times. Subsequent construction involved both repair and the addition of an upper story to one of the room blocks (B). The addition included the installation of a number of "observation ports" in the masonry walls which provide full view coverage of major accesses to the alcove and rockshelter and of on site features. This late stage construction and repair was apparently coincident with the introduction of turkeys to the entire Room Block A area. The site was abandoned following this final stage.

The context of what seems to be fairly dramatic Pueblo II and III cultural change requires reconstruction in order to begin to specifically address why such change occurred. This should contribute to a better understanding of the relationship between culture and environment (at least for agrarian societies) and to the processes of culture change. It is much too simplistic to subscribe to the idea that climatic/environmental change is the sole prime mover of culture change, but it most certainly must be taken into account in instances where effective moisture and temperature are critical to highly specialized subsistence strategies. The evidence of the heavy dependence on horticulture by the Anasazi in the context of changing climatic conditions may be just such an instance.

The premise developed from the Big Westwater paleo-environmental and archeological data, supported by that of Westwater - Five Kiva (Lindsay 1981) suggests that climatic change served as a triggering mechanism modifying relationships between essentially <u>complacent</u>, local Pueblo II Anasazi groups which subsequently moved in a direction of <u>cooperation</u> (nucleation) during early-Pueblo III times. Failure to successfully establish cooperation or its breakdown resulted in intense <u>competition</u> and eventual abandonment.

Climatic fluctuation is seen as an essential ingredient to change in the Westwater/White Mesa locale. However, I hasten to add, that there is no clear agreement on regional climatic reconstruction. Scholars vary in the priorities of various kinds of evidence and in the interpretation of various studies. The two Westwater studies and others from the greater Colorado Plateau suggest that an acceptable broad outline of general climatic change has been advanced (Denton and Porter 1970) but, that the significance of the sequence must be treated with caution according to the vagaries of latitude and longitude, elevation, and topography (cf Bryan and Gruhn 1964).

Site Summary

Two lines of evidence, stratigraphic and architectural, provide the reconstruction of the sequence and dating of events in the rockshelter. The correlation of the two kinds of evidence is critical, not only to the absolute dating of events, but to the reconstruction of the contexts in which they occurred. Ultimately, causal inferences are wholly dependent upon the accuracy of the correlations. A single architectural event (intermediate stage construction) is tree-ring dated, with earlier and later stages interpreted in relation to the dated portion of the sequence. The stratigraphic sequence is dated according to the pottery recovered from the exploratory trench and the fill of Room 4. The various strata are not only correlated with the architectural sequence, but also provide the sampling context for paleoenvironmental reconstruction. In sum, the correlation of architecture, site stratigraphy, and paleoecological/environmental information provides the reconstruction of the sequence of principal events at the site and when and why they occurred.

Site destruction by fire of the early masonry component in both Room Blocks A and B occurred during Pueblo II times. A similar event at Westwater - Five Kiva suggests the destruction occurred during the early part of the period. Subsequent undated intermediate stage rebuilding, an initial phase, occurred prior to the dated second phase of intermediate stage construction. Finally, additional rooms were added and roofed over the early-Pueblo III (A.D. 1147-1207) period. Subsequent destruction involved the toppling of walls in Room Block B, however, rooms at the rear of the shelter remained intact. The rooms were rebuilt with the additions of Room 11 and an upper story to Room Block B. Roof beams of the second phase of intermediate stage construction were reused. This late stage remodeling and repair of Room Block B involved the installation of "view ports" at the front of the shelter (including the wall above the kiva) and the east wall of the room block. The ports provide full view coverage of accesses to the alcove and rockshelter, Room Block A and the storage rooms in the eastern part of the site, and the entry to Room Block B (unroofed Room 11). This apparent defensive posture was adopted in connection with the deposition of considerable turkey dung in Room Block A and its immediate surrounds. A subsistence shift toward an increasing reliance on turkey is suggested as occurring sometime prior to the abandonment of the site. If similar to Westwater - Five Kiva, the site was abandoned after A.D. 1250.

Changes in subsistence during Pueblo II and early- to mid-Pueblo III times are undetected. Domesticates are present throughout the occupation of the site and a number of both edible wild plants as well as cultivars were recovered from the deposits. Still, the evidence overwhelmingly suggests that the occupants of the shelter were very much dependent on cultigens and that other foods were supplemental. The paucity of lithics (tools and debitage) indicates that tools were manufactured elsewhere and further, that male members were engaged in hunting (and gathering?) forays during certain times of the year. However, the limited faunal material recovered from the shelter suggests that game harvested elsewhere was eaten elsewhere. Agricultural failure by mid-Pueblo III times is inferred as in part causal to the subsistence shift, but direct evidence is limited. The recovery of "runty" cobs is not restricted to the final period of site occupation. However, the evidence of changing mesa settlement, pollen percentages from site deposits and extant climatic reconstructions provides some speculation about changing climate, agricultural productivity, and social conditions.

Paleoenvironmental Context

The ca 1900 to 650 B.P. mid- to late-Neoglacial interstadial and subsequent late-Neoglacial stadial (Denton and Porter 1970) provide the general framework for interpreting a changing Pueblo II and III Anasazi climate. However, the effect of this general hemispheric phenomenon requires local interpretation.

Pollen profiles from Big Westwater and Westwater - Five Kiva show considerable increases in arboreal pollen postdating the abandonment of both sites. The arboreal pollen increases, which more than double Pueblo II pollen ratios, are principally juniper, although moderate increases of pine are also represented. Martin and Byers (1965) have discussed possible interpretations of similar pollen data from Mug House - Mesa Verde (cf Rohn 1971) and these include (not necessarily in an order of acceptability):

1. Climatic change in the direction of cooler temperatures, contributing to increased pollen production of the pigmy conifers.
2. Reforestation following regional abandonment.
3. The lessening of constraints imposed on arboreal percentages by the removal of *Zea* and the pollen of wild and semicultivated plants which normally accompany horticulture.

Obviously, any or all explanations may apply particularly in the comparison of pollen percentages obtained from Pueblo II contexts versus those derived from postabandonment. Such dramatic postabandonment increasee in arboreal pollen must be due, in part, to the ca 650 B.P. onset of the late-Neoglacial stadial because the phenomenon has been identified as a regional occurrence (see e.g. Martin 1963) and is supported by tree-ring data far removed from the Anasazi region (La Marche 1974). The climate of the (ca A.D. 900-1150) latter part of the mid- to late-Neoglacial interstadial (Pueblo II times) is characterized as an optimal climate of warm temperatures and dominated by summer storm patterns (Schoenwetter 1966, 1970). The climatic optimum provided for the successful production of *Zea* and resulted in Pueblo II Anasazi expansion. The Westwater pollen data supports this with fairly heavy representations of grasses and Cheno-ams during the period.

Big Westwater was occupied no later than the climatic optimum and probably as a part of general Pueblo II expansion throughout the region. The initial occupation resulted in the construction of a number of masonry rooms. However, site destruction occurred at sometime early in the history of the occupation. The site may have been destroyed during early-Pueblo II times, similar to the dated occurrence at Westwater - Five Kiva. Subsequently, at Big Westwater, considerable construction occurred suggesting a lengthy period of stability for the duration of Pueblo II times and lasting approximately 50 years beyond the onset of Pueblo III.

Considerable construction occurred at Big Westwater over the tree-ring dated ca A.D. 1147 to 1207 period which apparently coincides with a sizeable early-Pueblo III drought (see Climates). Anasazi settlement patterns seem to shift during this early-Pueblo III interval from that of complacent, Pueblo II groups, in relatively small, scattered hamlets, to that of larger and fewer settlements. Pueblo II groups were complacent in the sense that competition was limited in the Pueblo II context of scattered settlements, abundant resources, and successful horticulture. Cooperation between Pueblo II groups was neither easily attainable or necessary.

The process of nucleation consisted of the occupation of fewer and larger sites and quite possibly with a preference for rockshelters where protected, multistory dwellings were particularly feasible. However, this preference was not new because many, including Westwater - Five Kiva, were occupied throughout much of Anasazi prehistory. On White Mesa, Pueblo III sites tend to cluster along canyon rims marking a shift from Pueblo II occupation of the mesa interior (Casjens and Seward 1980; Casjens et al 1980). In sum, nucleation into the canyons and along the canyon rims is apparent in the Westwater/White Mesa locale and this occurrence seems to coincide with the A.D. 1150 drought.

Understanding why nucleation occurred and what advantages were obtained are crucial to the model of change developed from the Big Westwater and Westwater - Five Kiva data. The coincident occurrence of the dated construction and drought suggests that the latter was a triggering mechanism for nucleation. However, drought as such, is much too simplistic an explanataion as numerous droughts have occurred throughout the occupation of the region with quite variable consequences. The pollen data from Big Westwater and Westwater - Five Kiva clearly demonstrate arboreal pollen increases, predominantly juniper, before site abandonment. The increases at Big Westwater, though not directly dated, begin in that part of the depositional sequence equated with early-Pueblo III intermediate stage masonry construction. The alternatives for explanation of preabandonment arboreal pollen increases are limited because evidence for decreasing horticultural production (see Big Westwater *Zea* pollen counts) is entirely lacking and reforestation has not yet begun. This can only suggest that the onset of the late-Neoglacial stadial with cooler temperatures and overall greater effective moisture occurred 100 to 150 years earlier than previously detected. General cooling may also explain why Pueblo III mesa sites are concentrated on the canyon rims where nocturnal temperatures are highest. The location of farm plots in proximity to these sites would partly compensate for the shortened growing season prompted by general cooling. Schoenwetter and Eddy (1964) and Schoenwetter (1970), from the Navajo Reservoir pollen data, have discussed the effects of the climatic shift on horticulture, however, the pollen record is truncated at ca 1100 and the early-Pueblo III shift is not demonstrated. Martin and Byers (1965) pollen data from Mug House demonstrate Pueblo III, preabandonment arboreal pollen increases and tend to support the Westwater data if not the interpretation.

The advantages obtained from the settlement shift may be numerous and can likely be subsumed under the ruberic of co-operation. This may have involved the intensification of labor for construction and horticulture. Just as important, nucleation would have provided for more effective communication between greater numbers of people in larger settlements and cross-cutting canyon drainages. Given the "spotty" and localized nature of summer rainfall, prevalent today, but not necessarily so during Pueblo II times, horticultural successes may have become just as localized. Reciprocal networks involving trade agreements between settlements of different canyons, would have been less possible without nucleation.

Site destruction and subsequent rebuilding occurred either by or shortly postdating A.D. 1207 at Big Westwater and this seems to coincide with a subsistence shift in a direction of a heavier reliance on turkey. Site reconstruction involved both room repair and modification with the installation of observation ports in late stage masonry. The ports provide full view coverage of access to the site and of on site features of food storage and where turkeys were kept. The latter essentially involved the abandonment of the eastern part of the site for turkey husbandry.

The events of destruction, site rebuilding and concomitant adoption of an apparent defensive posture, and the subsistence shift, all provide the evidence of either the failure to gain adequate cooperation or at least to compensate for horticultural instability. This marks the onset of a period of intense competition. The period of competition may have been fairly brief. The dating of the abandonment of Big Westwater is not possible but it may be similar to Westwater - Five Kiva postdating A.D. 1250. Failure to achieve cooperation in the context of continuing unfavorable climate, with cooler temperatures and less than adequate summer rainfall, are hyphothesized as the principal causal factors for the Anasazi abandonment of the Westwater/White Mesa locale.

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ARCHAEOLOGICAL INVESTIGATIONS AT THE KANAB SITE
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Under Terms of

EPA Order No. X1326NASX

January 1981

PREFACE

Archaeological mitigation investigations at the Kanab Site, designated 42Ka1969 in the Utah Statewide Survey, were conducted under terms of Environmental Protection Agency Purchase Order No. X1326NASX, effected between EPA and Nickens & Associates on 16 May 1980. The work was undertaken to provide compliance with 36 CFR 800.7 prior to construction of a new wastewater treatment lagoon system at Kanab, Utah. The efforts were completed under the supervision of the EPA Project Officer, Mr. Michael J. Salazar of the Denver office.

Field studies and subsequent analyses were directed by Paul R. Nickens, Principal Investigator, and Kenneth L. Kvamme, who served as Field Director for the project. Jo Ann Christein-Kvamme, Terry L. Adams, and Margaret Adams served as crew members for the excavation phase. In our office, editorial and clerical assistance was provided by Janet Sprouse, and Susan O'Connell participated in analysis of the artifacts. Ms. O'Connell also drafted the maps utilized in the report.

Considerable gratitude is extended to BLM archaeologists Gardiner F. Dalley, Cedar City District Office, and Doug McFadden of the Kanab Resource Area Office, who, in addition to participating in the excavations, provided continuous logistic support to the project. These two men also shared their collective knowledge concerning the prehistoric occupations of the general area. Jim Dykman, Compliance Administrator for the Utah Division of State History, also visited the excavation and spent a brief time working with the crew.

Special thanks go to the City of Kanab which made available on three occasions a backhoe and operator. Without the aid of the backhoe our tasks would have been far more arduous, and it is likely that the major architectural feature at the site would have gone undetected. We further express appreciation to Dr. Richard Thompson of Southern Utah State College who visited the site during excavations and subsequently made available much literature concerning previous studies of the prehistoric Anasazi utilization of the "Western Anasazi Area."

Important ancillary studies were undertaken by several persons. Steven D. Emslie, Center for Western Studies, analyzed nonhuman faunal remains and has prepared an appendix to the report on his findings. Linda J. Scott of Palynological Analysts processed pollen samples from the archaeological contexts; her results are also included as an appendix. Radiocarbon specimens were dated by Charles S. Tucek, Radiocarbon, Ltd. Dr. David A. Breternitz and William A. Lucius of the Dolores Archaeological Project reviewed and commented on some of the recovered ceramic sherds.

The authors wish to express sincere appreciation to each of these men and women for their important contributions toward completion of the project.

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ABSTRACT

Archaeological mitigation efforts were conducted at Site 42Ka1969, designated the Kanab Site, during the summer of 1980 by personnel from Nickens and Associates. The site is located within the boundaries of a proposed wastewater treatment lagoon system, found about 5 km south of the town of Kanab, Kane County, Utah. In the field, a multistage data recovery phase revealed the presence of two cultural components. The locale was first occupied during Basketmaker II or early Basketmaker III times, as evinced by a completely buried aceramic charcoal-laden level with few artifacts and no features. An Elko corner-notched point and a radiocarbon date of A.D. 520 $\pm$ 120 came from this level. The primary occupation of the site occurred in the late 1000s as witnessed by a pithouse domiciliary unit, several surface storage cists and associated work patios, and midden. Numerous specimens of stone, shell, and ceramics were recovered and are discussed in the report. A sizable sample of nonhuman faunal bone and several pollen samples were analyzed by specialists. The overall results indicate a small village of Virgin Anasazi living in the eleventh century along the bank of Kanab Creek. The subsistence economy probably centered around the cultivation of corn, with a wide array of wild plants and animals utilized as dietary supplements. It is posited that a relatively severe deterioration of the climate at the end of the eleventh century, as shown in the general Southwestern dendrochronological record, may have contributed to the abandonment of the Kanab Site.

CHAPTER I

INTRODUCTION

Archaeological Site 42Ka1969 is one of two prehistoric sites recorded in 1978 by the Department of Anthropology, University of Utah, during an archaeological survey of a 160-acre tract found about 5 km south of Kanab, Utah (Sisson 1978). The other site, 42Ka1970, lies primarily on private land and, as a consequence, was not further investigated. Site 42Ka1969, however, is located on Bureau of Land Management acreage which is proposed for acquisition by the City of Kanab on which to build a new wastewater treatment lagoon. The construction will be under the sponsorship of the Environmental Protection Agency.

As part of the BLM's responsibilities in granting transfer of the land to the city, extant cultural resource protection legislation requires that affected cultural resource properties be evaluated and, if necessary, mitigated prior to loss of significant data as a result of construction activities. Since 42Ka1969 would be directly impacted by the proposed action, the BLM contacted Nickens and Associates in order to achieve data recovery at the site. Following a pre-fieldwork visit to the site, a proposal was submitted to the EPA to undertake intensive testing and excavation of the subsurface deposits for the purpose of defining archaeological features not apparent at the present ground surface.

Thus, between 19 May and 15 June 1980, a four-person crew conducted a multistage data recovery phase at 42Ka1969, hereafter referred to as the Kanab Site. Our field efforts were supplemented by assistance from the BLM Cedar City District Archaeologist, Gardiner F. Dalley, and the BLM Area Archaeologist, Doug McFadden. During this four-week period, work revealed a prehistoric Anasazi village consisting of a habitation unit, several storage cists, outdoor work areas, and an extensive trash (midden) area. It was also discovered that the prehistoric aboriginal group that constructed the principal architectural features at the site was not the first group to inhabit the locale. At a depth of about 75 cm below the present ground surface a second cultural level was encountered, clearly predating the more obvious occupation since the subterranean pithouse of the later group had been excavated through the earlier layer. A distinctive separation between the two components was evident in the artifact assemblages, with the earlier one being entirely lacking in ceramics while pottery sherds were numerous and widespread throughout features associated with the subsequent village.

Excavations at the Kanab Site are important not only because of the stratigraphic superposition of two prehistoric occupations, but also because of a relative scarcity of previous archaeological investigation in the immediate area. Further, there is a total absence of chronometric dates from this area (cf. Bannister et al. 1969) and, as a consequence, the three radiocarbon dates from the Kanab Site represent the first such data. We should note, however, that both the BLM and Southern Utah State College are currently having dates processed for nearby areas. As a result of these efforts and ongoing investigations, it appears that better dating of archaeological manifestations is imminent; however, much analysis of tree-ring and radiocarbon specimens remains to be done before precise chronological information such as that found in other regions of the Southwest can be attained. Finally, the data included herein on nonhuman faunal remains and pollen analysis are similarly initial attempts at such studies for the immediate area. These data, along with limited macrofloral specimens from the site, provide valuable information on prehistoric subsistence activities and permit comparisons between the modern and prehistoric environments.

Location and Setting

The Kanab Site is located on the west side of Kanab Creek about 5 km south of the City of Kanab and 0.6 km north of the Utah-Arizona State line (Figs. 1, 2, and 3). The site is located in the NE 1/4 NE 1/4 NE 1/4, Sec. 8, T.44S., R.6W., Salt Lake Base and Meridian (U.S.G.S. Kanab, Utah-Arizona 15 Min. Quadrangle) at an elevation of 1463 m.

In a larger geographic setting, the Kanab Site is situated at the foot of the Grand Staircase Section of the Colorado Plateau (Stokes 1977). To the north of the site, a series of cliffs, slopes, and terraces rises to the rim of Southern High Plateaus of the transition zone between the Colorado Plateau and Basin and Range physiographic provinces. Immediately north and northwest (ca. 3 km) are the Vermilion Cliffs, which form the bottom step of the Grand Staircase (Figs. 2 and 3). South of the site is the broad sage-covered Antelope Valley which, further to the south, terminates with increasing elevation up to the Kanab Plateau and the North Rim of the Grand Canyon. This area in Arizona north of the Colorado River is frequently referred to as the Arizona Strip. The primary drainage in this area is Kanab Creek, which originates in the cliffs of the Grand Staircase and drains southward to the Colorado River. As a consequence of heading in the High Plateaus and being fed by several springs and small tributaries, the Kanab flows continuously during most of the year.

Geology

The geologic formations that underlie the Antelope Valley and those that rise in the Vermilion Cliffs to the north are representative of widely distributed Triassic age sandstones and shales in this region. From bottom to top, the layers are the Moenkopi, Shinarump, Chinle, Moenave, and Kayenta formations, and the Navajo sandstone. All of these layers, where exposed, are remarkably varied in composition, texture, and color.

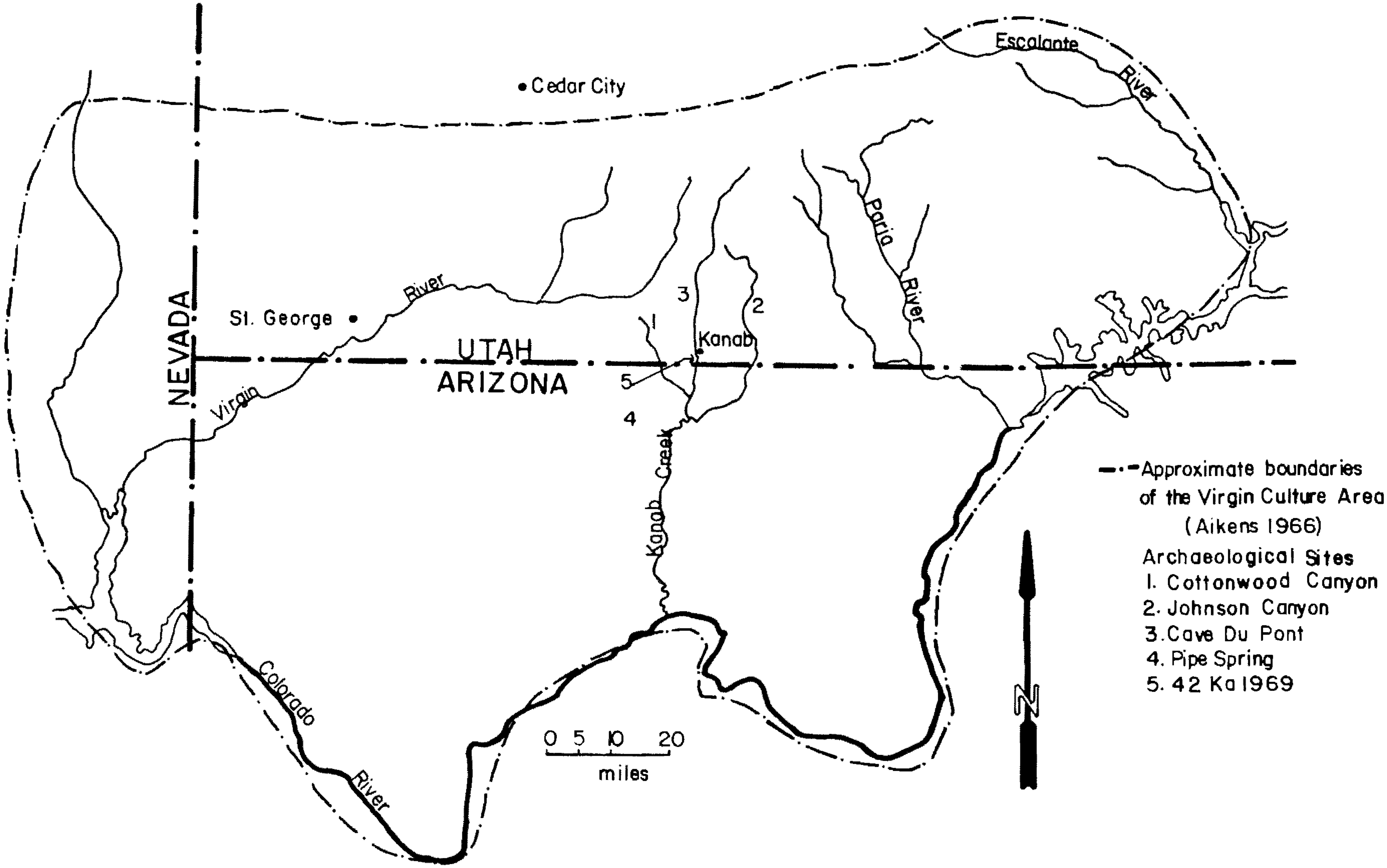

Figure 1. Map indicating the general location of the Kanab Site (42Ka1969) and its relationship to nearby investigated archaeological sites/localities and the prehistoric Virgin Anasazi area.

At the Kanab Site locality, deep profiles of loose, fine sand and silt alluvium have accumulated from the uppermost formations. Based upon observations at the Kanab Site, it may be stated that this accumulation has been slow since the ninth century A.D. since surface features at the site are only slightly buried today. On the other hand, in recent times Kanab Creek has undergone a marked downcutting cycle, evident in Figure 2. According to historical records studied by Gregory (1950:174), at the time of Mormon settlement (1871) Kanab Creek was a shallow, weak stream flowing at the present surface of the valley fill. Shortly after settlement, however, a series of floods, perhaps precipitated by pasture and farming use of the valley, beginning in 1883 initiated channelization and increased flow of the stream. By 1885, the stream had been lowered "about 60 feet beneath the former level, with a breadth of some 70 feet, for a distance of 15 miles." The arroyo-cutting evident at Kanab Creek since ca. 1880 is widespread, occurring in most valleys of the Colorado Plateau (cf. Bryan 1925; Hack 1942).

Another geologic feature which has influenced prehistoric and historic occupation of the area is the north-south trending Sevier fault which is located about 19 km west of the Kanab Site. Water collected along the fault flows southward, surfacing at the well-known Pipe Spring and the neighboring Moccasin Spring, creating a grassy oasis setting in the semiarid countryside. These springs were important to prehistoric inhabitants of the area, historic aboriginal groups (Southern Paiutes), and early Mormon cattle ranchers.

Climate

The Kanab area is characterized as semiarid with wide annual, seasonal, monthly, and daily ranges in precipitation and temperature. Following the figures of Gregory (1963:8), climatic data for the City of Kanab (elevation 1501 m) reveal a mean annual precipitation of 340 mm (13.38 inches). The heaviest precipitation, about 40 percent of the annual total, comes in January, February, and March, and the lightest in April, May, and June. At the Kanab station, the average temperature for January is 0.17° C (32.3° F); for July 23.37° C (74.1° F). The extremes are 41.07° C (106° F) and -28.26° C (-20° F). Under normal conditions the frost-free, or growing, season is 151 days. Snow to a depth of a few inches covers the lower lands intermittently from December through February; the maximum annual snowfall is 559 mm (22 inches). In the higher elevations of the Vermilion Cliffs north of Kanab, snow may fall any time between October and March and remain in sheltered places until April or May, attaining depths exceeding 762 mm (30 inches).

Vegetation

The Kanab Site is located in the Great Basin sagebrush (*Artemisia*) zone (Fig. 3). Associated with this zone are various cacti and grasses, and at places pinyon and juniper. Locally, a narrow band of pinyon-juniper woodland is found along the base of the Vermilion Cliffs (cf. Figs. 2 and 3).

Figure 2. This photo, viewed to the northeast, shows the entrenched Kanab Creek in the foreground and the Vermilion Cliffs in the distance. The Kanab Site is located on the sage-covered flat just above the creek bank, near the center of the picture. The channel erosion evident in this photo has taken place since ca. 1880.

Figure 3. The surface of the Kanab Site just prior to excavation is seen in this photo, looking to the southwest. The staked grid pattern used for control of surface and subsurface data is apparent across the site's surface (Hoffmeister and Durham 1971).

Importantly, several other vegetation communities are situated nearby. Aside from the recently appearing riparian community in the Kanab Creek channel (Fig. 2), a dense pinyon-juniper forest is found on the tablelands north of Kanab, giving way to pine and spruce-fir-Douglas fir forests as the elevations continue to increase in the Southern High Plateaus. South of Antelope Valley, similar vegetation communities occur as elevations increase toward the North Rim.

At the Kanab Site and adjacent environs, plants observed include four-wing saltbush (Atriplex canescens), sage (Artemisia tridentata), greasewood (Sarcobatus vermiculatus), rabbitbrush (Chrysothamnus sp.), Russian thistle (Salsola kali), prickly pear cactus (Opuntia sp.), Indian ricegrass (Oryzopsis hymenoides), Mormon tea (Ephedra sp.), and numerous grasses and flowering Compositae. Greasewood, tamarisk (Tamarix sp.), willows (Salix sp.), and bulrush (Scirpus sp.) are found along the Kanab Creek channel.

Fauna

Animal forms are plentiful in the vicinity of the Kanab Site (Hoffmeister and Durham 1971). Mammals, the animals most important to prehistoric human groups, include a wide range of small to medium species and a few larger game animals. Included among the smaller mammals are the following: Desert cottontail (Sylvilagus audubonii), Black-tailed jack rabbit (Lepus californicus), and chipmunks and squirrels (Sciuridae). Larger artiodactyls include Mule deer (Odocoileus hemionus), Pronghorn (Antilocapra americana), and Bighorn (Ovis canadensis). Bones from all of these mammals were found at the Kanab Site, along with several bird specimens. Although several carnivores are known to be common in the area, no bones of these animals were recovered from the archaeological contexts.

Previous Research in the Upper Kanab Creek Drainage

In this section, we undertake brief examination of previous archaeological and related research which has been conducted in the upper reaches of the Kanab Creek drainage system. This review is undertaken for two reasons: (1) it will serve to provide a cultural context in which to place the results of our research at the Kanab Site; and (2) it can be viewed as a supplement to an earlier overview of previous investigations in the middle and lower reaches of Kanab Creek (Lipe and Thompson 1978). The precise division between middle and upper Kanab Creek is left undefined at this point, being discussed more in terms of previous archaeological work rather than occurring at a specific geographic locale. Based on extant archaeological data, then, the separation between middle and upper Kanab Creek occurs approximately where Johnson Creek enters Kanab Creek from the east, about 10 km south of the town of Fredonia, Arizona. The more important of these previous investigations are shown in Figure 1.

Before detailing previous archaeological endeavors in this region, mention should be made of the initial anthropological work which dealt with the historic Southern Paiute groups who occupied the upper Kanab Creek area and adjacent areas at the time of Euro-American contact. Early data collected from these groups are of obvious interest to archaeologists working in the region for their use as ethnographic analogues. The work referred to here is that performed under the direction of John Wesley Powell, famed explorer of the Colorado River and its canyons. During the years 1870-1873, Powell and his men were in the Kanab area, having a camp at Kanab during the winters of 1871-72 and 1872-73. At every opportunity, Powell recorded vocabulary items, myths, and other information on customs from a band of Kaibab Paiute living near Kanab. In 1873, John K. Hillers became the official photographer for Powell's survey party and, in the same year, took a number of photographs of Southern Paiute. Many of these photographs were taken near Kanab. Powell's data and Hillers' photographs contain a wealth of early information on the historic aboriginal occupation of the area and much of it has been profitably utilized (e.g. Fowler et al. 1961; Euler 1966; Fowler and Fowler 1971) to accurately portray this particular lifestyle. Isabel Kelly (1964) also utilized the information, photographs, and culture material items from the Powell survey as comparative data for her field study of the Southern Paiute in the early 1930s.

Within a few years of the Powell investigations, the first archaeological activity occurred in the upper Kanab Creek drainage; however, precise details of the work are somewhat lacking. As part of his work throughout southwestern Utah, Edward Palmer spent, in 1875, a brief time in Johnson Canyon east of Kanab. Palmer recovered a number of prehistoric artifacts, including a shovel made from the horn of a mountain sheep mounted on a long wooden handle (Palmer 1878). Like the Powell work, the results of Palmer's efforts have been utilized by later investigators. William H. Holmes (1886) illustrated and described several prehistoric ceramic vessels in his classic study of Southwestern pottery, including several pots from the Kanab area. While it is not entirely clear, statements made by Holmes in his report indicate that he too may have visited the Kanab area in his search for prehistoric ruins and pottery. More recently, Fowler and Matley (1978) have documented the entire 1875 Palmer collection from southwestern Utah, and, of equal interest to archaeologists, Bye (1972) has produced an ethnobotanical accounting of specimens of food plants collected in the same year by Palmer from the Southern Paiute Indians.

Despite the subsequent usefulness of the Powell and Palmer data, it may be said that professional archaeological study did not begin in the upper Kanab Creek area until the second decade of the 20th century when Neil M. Judd, working for the Bureau of Ethnology, undertook investigations throughout western Utah and northwestern Arizona during the years 1915 to 1920, inclusive. According to Judd's report, he spent portions of the 1915, 1919, and 1920 field seasons in the Kanab area (Judd 1926). During the first year, Judd described ruins in the town of Kanab, along Kanab Creek, and ruins in nearby Johnson, Cottonwood, and Three Lakes Canyons. Apparently, the 1915 visit to Kanab was primarily to reconnoiter the surrounding area and visit with locals who had antiquities collections or knowledge of ruins.

In 1919, Judd revisited Cottonwood Canyon, investigating eight cave sites and noting several others in the space of two weeks time. In his report, Judd provides fairly detailed discussion of the sites, which contained both Basketmaker and Pueblo remains, and the results of his work. A year later, Judd returned to the Kanab area and spent a short time investigating ruins west of Kanab Creek. A majority of this, the final season of investigation by Judd, however, was spent farther south in northwestern Arizona. All in all, the Judd report, though brief by modern standards, contains valuable information on the prehistoric use of the upper Kanab Creek area. A restudy of the Judd data and artifacts, which are curated in the U.S. National Museum (Smithsonian), would undoubtedly yield much additional knowledge, particularly for the Cottonwood Canyon cave sites.

Concurrent with the final field season of Judd, an important site was being excavated in Cave Lakes Canyon, a tributary of Three Lakes Canyon and of Kanab Creek, about 13 km northwest of Kanab. This site, known as Cave Du Pont (42Ka1168), is one of the most famous Basketmaker II sites in the Southwest. The cave, excavated by Jesse L. Nusbaum (1922), is primarily a storage and cache area, located in a large alcove in the Navajo sandstone. Beneath a surface which was relatively free of artifactual materials was a layer of fibrous material one to one-and-a-half meters thick, composed of grass, juniper bark, corn cobs and husks, and yucca fiber. Under it, excavated into the sand floor of the alcove, were about two dozen vertical sandstone slab storage cists. Some of the cists had been used to bury the dead along with well-preserved artifacts. The cave yielded a wide variety of early Basketmaker artifacts including beds or nests of grass, cradle boards, nets and baskets, snares, digging sticks, and several bundles of raw material for use in basket making.

Aside from the wealth of cultural material recovered from the site, its importance lies in the fact that it is regarded as a pure Basketmaker II site. Unfortunately, attempts to date the occupation have not met with success. In 1936 Nusbaum collected five dendrochronological specimens which had been cached in the cave since his excavations in 1920. Stallings (1941) reported a date of A.D. 217 from one of the specimens, but later reanalysis failed to confirm the date (Bannister et al. 1969:11). Additional wood was collected in 1967 in an attempt to substantiate the date derived by Stallings, but this effort also was unsuccessful. As a result, the only date for Cave Du Pont has been discarded.

The next archaeological work to take place in the upper Kanab Creek drainage was that of Julian H. Steward, who in 1932 undertook reconnaissance of Johnson Canyon and some of its tributaries in hopes of defining chronological trends between Basketmaker and later Pueblo stages. Steward (1941) provides detailed descriptions of numerous sites in the Johnson Canyon system, commenting on architecture and village layout as well as discussions of pottery types noted and other artifacts. He also described and illustrated several petroglyph sites of the area. In his analysis, Steward noted that a majority of the sites in Johnson Canyon date to the late period (i.e. Pueblo II), having several rectangular rooms of coursed masonry forming a semicircle around the northern side of a depression which probably contains a kiva.

At this point in our secular view of previous investigations in the upper Kanab Creek drainage, it is necessary to briefly digress and review developments beginning in 1934 which have led to attempts to define the area of northwest Arizona and southwest Utah in terms of its prehistoric internal and external relationships. This problem, still with us today, centers around the status of the Anasazi groups of this region, known today as the "Virgin Anasazi."

Beginning with the so-called Gladwin Model (Gladwin and Gladwin 1934), Anasazi groups which occupied the area north of the Colorado River were designated as the Nevada Branch and seen as a subbranch of the better known Kayenta Branch of northeastern Arizona. Since its inception, the Gladwin model has undergone modifications, most notably by Harold S. Colton who, in a series of publications, redefined the Nevada Branch as the Virgin Branch. In his 1952 report on ceramics of the Arizona Strip and adjacent areas, Colton presented the following scheme for the Virgin Branch: Muddy River Focus (Basketmaker III and Pueblo I) A.D. 600-900; Lost City Focus (Pueblo II) A.D. 900-1100; and the Mesa House Focus (Pueblo II-Pueblo III transition) A.D. 1100-1150 (Colton 1952:5). This classification remained in use for nearly a decade until Shutler (1961) added an earlier period and revised some of Colton's dates. Shutler's classification includes: Moapa phase (Basketmaker II) 300 B.C. - A.D. 500; Muddy River phase (Basketmaker III) A.D. 500-700; Lost City phase (Pueblo I-Pueblo II) A.D. 700-1100; and Mesa House phase (Pueblo II-Pueblo III) A.D. 1100-1150. This chronology, based primarily on cross-dating of Virgin ceramics with those in the Kayenta area, remains in general use today, although additional work in the Virgin area will likely result in more localized phase sequences in due time.

To date, the most extensive statement on the definition of the Virgin culture is that of Aikens (1966), who employed non-ceramic cultural elements to delineate a separation between the Virgin and the Kayenta Anasazi. In the Virgin area (see Fig. 1), Aikens posits an _in situ_ development from an earlier Desert Archaic base for both groups. Prior to A.D. 900, the Virgin and Kayenta Anasazi were indistinguishable cultural groupings, related in development to other regional Anasazi groups (i.e. Mesa Verde, Chaco, and Little Colorado areas). Around A.D. 900, noticeable features appear to formally differentiate the Virgin Anasazi from contemporaneous Kayenta populations. This includes, in addition to ceramics, an architectural style characterized by a circular or horseshoe arranged room block as opposed to the Kayenta linear or L-shaped structural patterns. Aikens also points to the period A.D. 900-1100 as a time of extensive population growth and expansion in the Virgin area with a movement away from the valley floors to the "heretofore unoccupied uplands." This expansion waned after A.D. 1100, and by 1150 the Virgin Anasazi ceased to exist.

To add the final chapter to Aikens' sequence, Madsen (1975) believes, based on ceramics, that an expansion of Numic-speaking peoples (including the Southern Paiute) occurred throughout the Great Basin ca. A.D. 1000-1300. Apparently, this expansion may have had an effect on the demise of the Virgin Anasazi as well as the Fremont groups to the north. In support of this conclusion, Southern Paiute ceramics are often found associated with Virgin remains (e.g. Shutler 1961; Aikens 1965; Moffit et al. 1978).

To return to our review of archaeological undertakings in the upper Kanab Creek drainage, we note that following Steward's reconnaissance little or no published work took place until the early 1960s when Aikens (1965) excavated two sites in Johnson Canyon and recorded several others in the nearby area. Aikens' investigations, part of the University of Utah Glen Canyon Project, involved excavation of Bonanza Dune (42Ka1076) and the Sand Hill Site (42Ka1060), both Virgin sites dating between A.D. 900 and 1200. Unfortunately, no tree-ring or radiocarbon dates were obtained from the work, the dating being based on cross-dating of the ceramic complex with Kayenta pottery types.

The Bonanza Dune Site was by far the most significant of the two with 21 structures, including a coursed masonry kiva, 11 semisubterranean jacal pithouse dwellings, 3 storage cists, and 6 structures of unknown function. Despite its overall size, however, the population of the site was at any one time small since stratigraphic evidence indicated that no more than four or five structures were occupied contemporaneously. Nearly 99 percent of the pottery was Virgin Series, and Paiute pottery was recovered from the surface and mixed with Virgin sherds in the uppermost meter of fill. Aikens also reports finding remains of corn and several animal bones, principally deer, bighorn sheep, elk, and rabbits, at Bonanza Dune.

Two brief investigations at Pipe Spring National Monument have been reported. Lindsay and Madsen (1978) completed inventory of several water supply system features, recording three prehistoric sites dating to the Pueblo I and II periods (A.D. 700-1000). Ceramics were observed at all three sites, but no types were identified by the authors. Thompson (1978) conducted test excavations at a small prehistoric site located along a right-of-way designated for burial of an electric cable. A collection of 140 pottery sherds indicated an occupation date between A.D. 1100 and 1150, with about 12 percent of the sherds being identified as belonging to the Moapa Series. A majority of the pottery, however, belonged to the Virgin Series.

Finally, mention is made of two publications, each of which has reviewed rock art sites located in the canyons of the upper Kanab Creek drainage. The first of these (Schaafsma 1971) contains a chapter on the rock art of the "Virgin Kayenta" region, including sites in Cottonwood and Johnson canyons. In the second instance, Castleton (1979) provides additional documentation for several petroglyph and pictograph locations in the Kanab Area. In general, the Kanab rock art sites are believed to include styles attributed to Basketmaker and Virgin Anasazi groups, with a considerable variety of geometric, anthropomorphic, and animal forms represented.

CHAPTER II

EXCAVATION AND STRATIGRAPHY

Excavation Procedures

As first reported by Sisson (1978), the Kanab Site consisted of a broad sherd and lithic scatter. The scatter is more or less continuous, stretching to the west bank of Kanab Creek; the site is some 80 meters long on an east-west axis. In a northeasterly direction, the scatter runs into the materials associated with 42Ka1970, a nearby site situated on the Kanab Creek bank nearly 100 meters distant. Isolated artifactual clusters occur throughout the nearby vicinity.

Initial inspection of the Kanab Site revealed a number of clues concerning the structure of the site. A large and dense midden-like surface scatter of sherds and lithics suggested the potential of the site as representing a relatively major occupation. About 15 meters to the north of this area a BLM test trench had revealed the presence of two horizontally-laid sandstone architectural features. Immediately east of this, a vandal's pothole indicated the remains of a similar sandstone-laid structural feature. Additionally, an auger hole coring program conducted throughout the site by the BLM suggested fairly rich cultural deposits occurring as deep as 60 cm. In sum, the initial Kanab Site evidence indicated an extensive occupational area, relatively rich in cultural materials, and containing sandstone-laid architectural features.

The initial step in the field program entailed determining the general boundaries of the site and establishing a coordinate grid reference system. A team of four persons walked close parallel transects over the entire site surface and flagged the general site limits. Within this area a 2 m^2 grid system was established. A site datum was established and labeled "N100 E100" corresponding to 100 meters (true) north, and 100 meters east of an imaginary N00 E00 point. Additional grid squares were then measured meters north and east of this point. The location of each 2 x 2 meter grid was thus taken from its southwest corner. For example, a grid stake labeled N132 E114 represents a grid square extending 2 meters north and 2 meters east from that point. The location of that square is 132 meters north, 114 meters east of the N00 E00 point. The grid layout is evident in Figure 3.

In order to examine site patterning as evidenced by the surface materials, all cultural items or other evidence were collected or noted in each grid square throughout the entire site surface and counted. The result of this procedure offered two kinds of information (Fig. 4). First, the general limit of the site was indicated, and, importantly, the area of the site midden was clearly defined by grid squares with markedly higher artifact counts. Second, it was noted that the northern part of the site contained amounts of unshaped sandstone rubble which turned out to correlate strongly with subsurface cultural features.

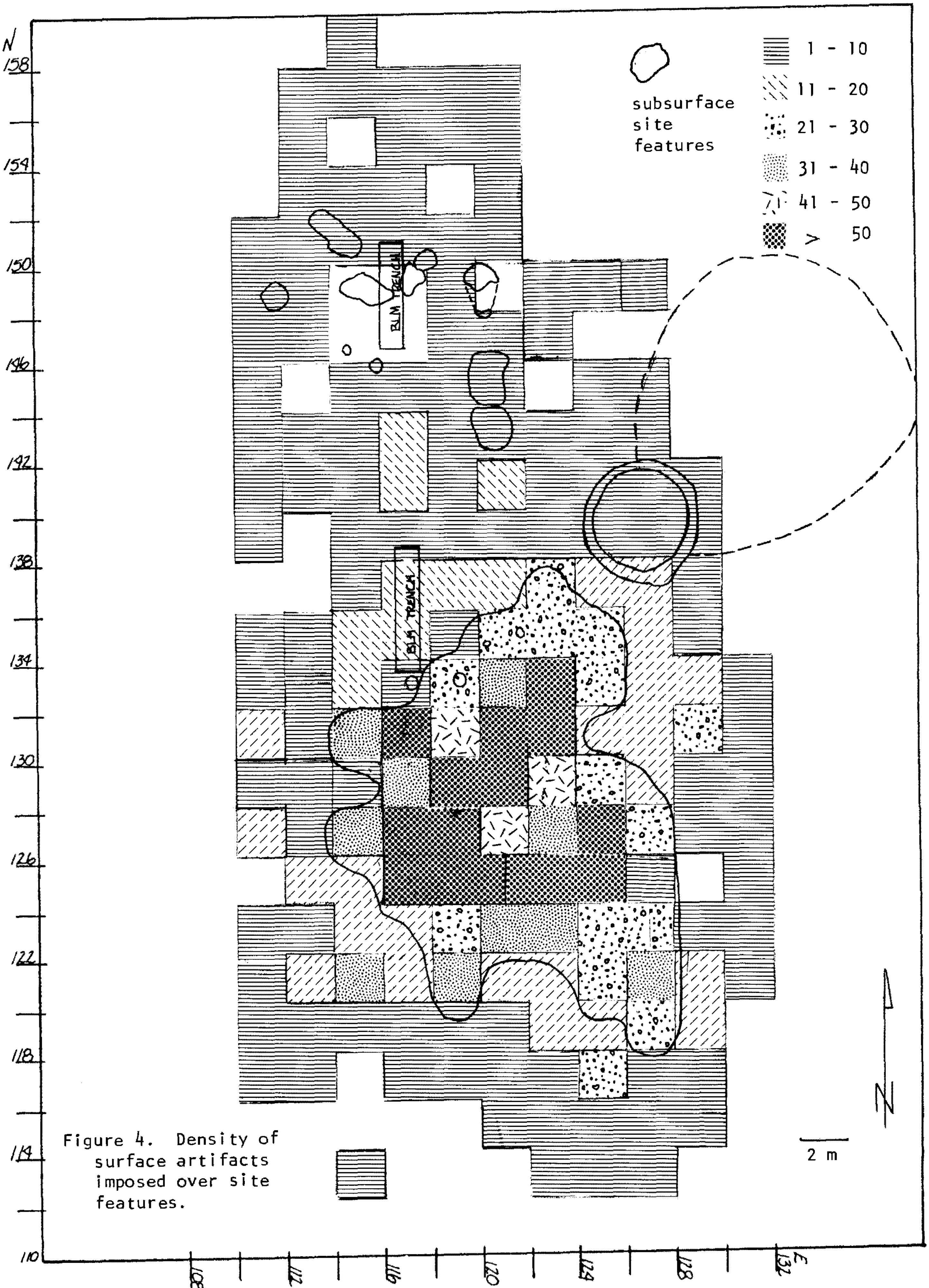

Figure 4. Density of surface artifacts imposed over site features.

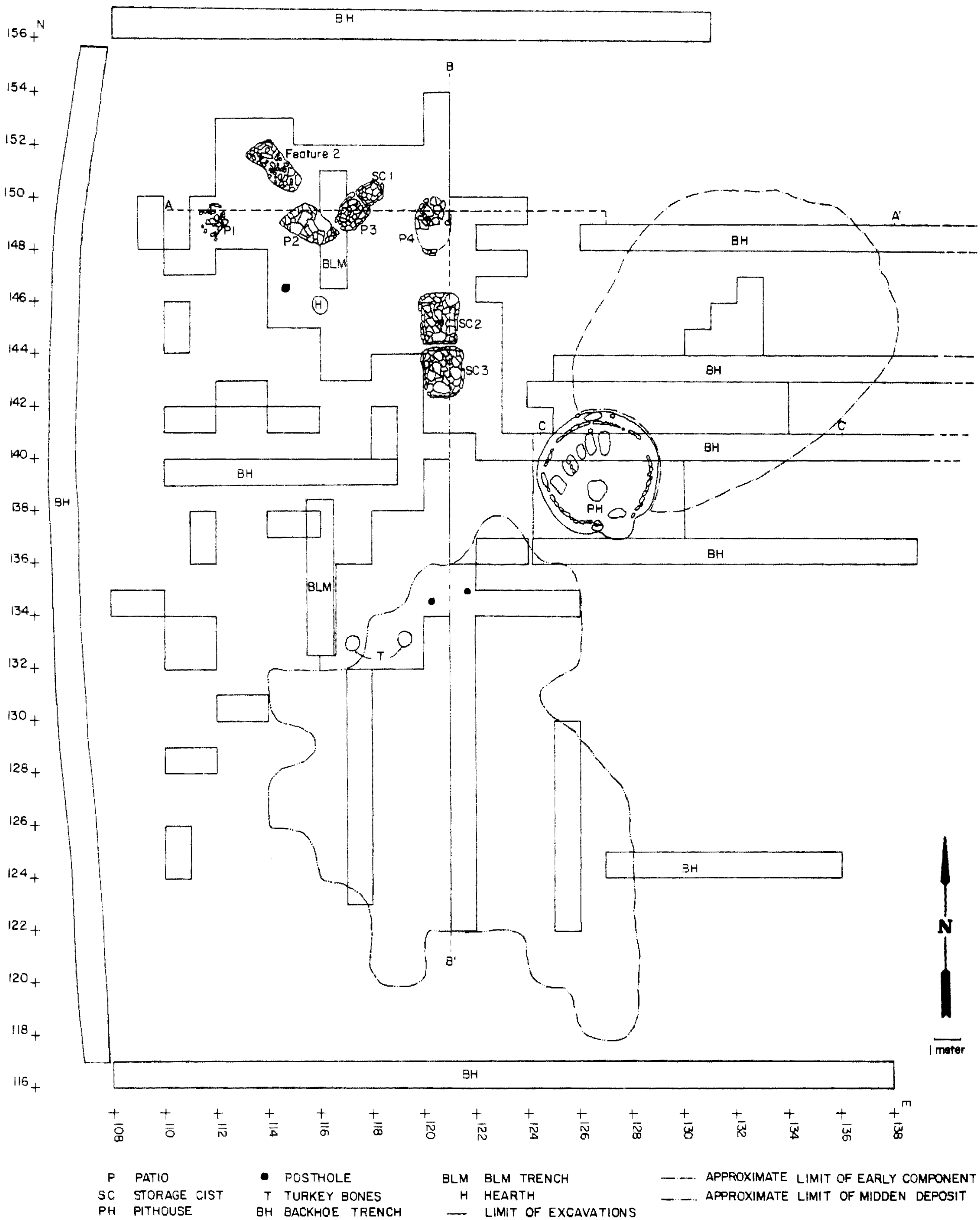

Figure 5. Excavation units and cultural features at the Kanab Site.

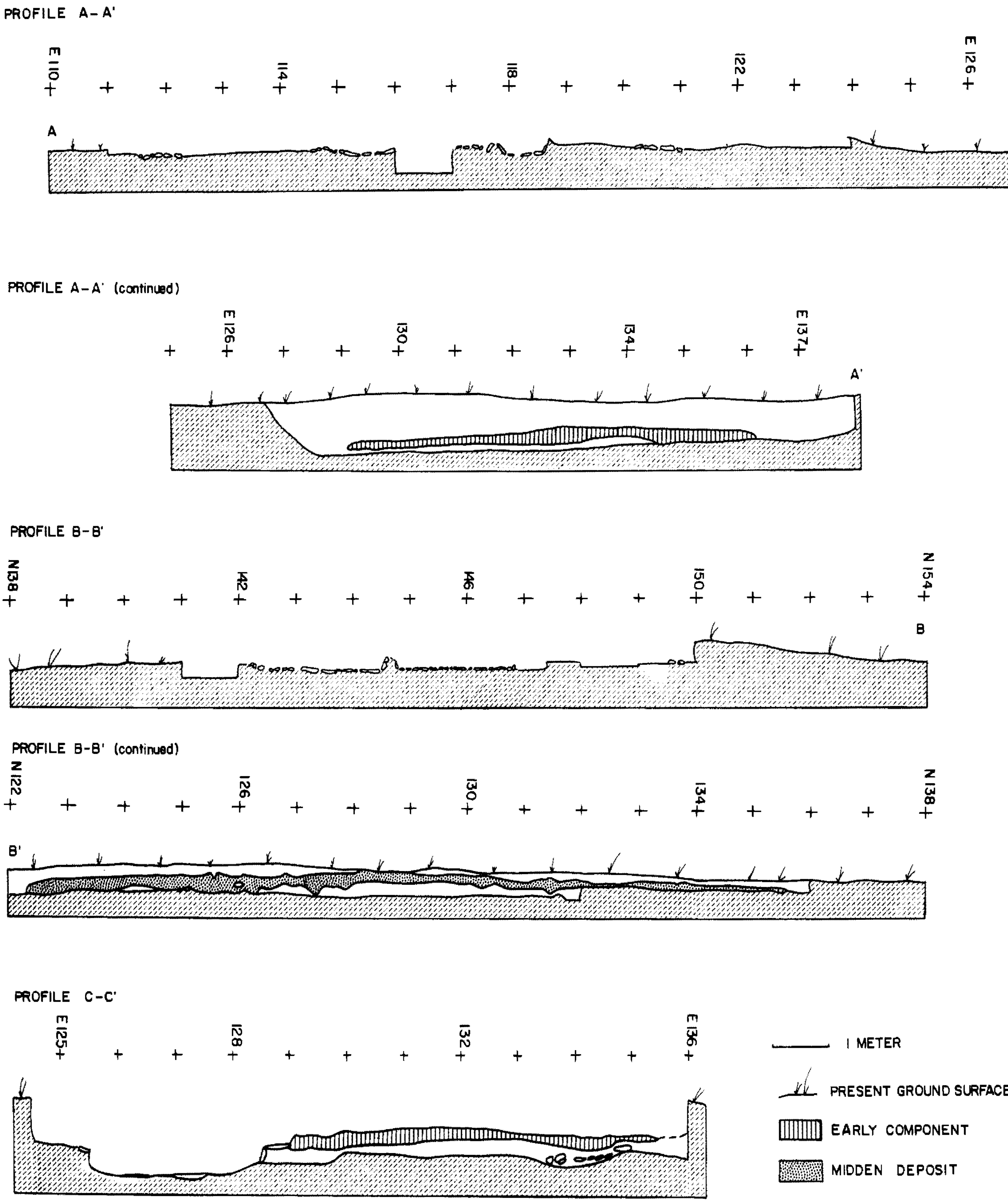

Figure 6. Profiles of cultural features and excavation units.

Based on the surface data, a multistage excavation program was established for the examination of site features (Fig. 5). Following the evidence in the northern BLM trench which indicated two architectural features at a depth of only 10 cm, several test squares were excavated in this area to that depth. The result of this effort was a series of four flat sandstone-laid floors which because of artifact densities and associations were termed "work patios." These typically measured 1-2 meters in diameter. The sandstone was evidently quarried from a nearby mesa about 0.2 km to the southeast. Three storage cists were also encountered with sandstone-laid floors and walls rimmed with low sandstone vertical slabs. These were as large as 2 meters long. Additionally, an anomalous stone feature, a basin-shaped fire hearth, and a post hole were discovered in this area. Importantly, these features occurred at nearly identical depths indicating the original site surface (Fig. 6). Because of these features, this area of the site was designated the "primary occupation area."

A second stage of the excavation program entailed a search for a habitation structure which was believed to be present as indicated by the number of work patios, storage cists, and the size of the midden. One-half of every other grid square between the primary occupation area and the midden was excavated. It was believed that a pit structure should be located in this area because of intra-site patterning observed in other areas of the Southwest. The particular 1 x 2 m half was randomly chosen out of four possible halves (N½, S½, E½, W½). The test squares were excavated to varying depths (minimally 30 cm) based on the density of cultural materials encountered. Maximum depth was 50 cm in a number of squares. When this testing program failed to discover a pit structure, additional tests were intuitively placed throughout the center of the site. This too, however, was unsuccessful in locating a domiciliary feature. As a last resort, a backhoe was utilized to trench the entire perimeter of the site, and at close intervals along the eastern periphery, the only area that had not been extensively tested previously. The backhoe revealed two important features on the eastern edge of the site: a charcoal-laden level about 50-75 cm deep, and a pit house (Fig. 6). The pit house floor was nearly 1.5 meters below the surface, much deeper than expected. It was roughly circular and measured (including benches) nearly 5 meters in diameter. It contained a well-laid clay floor, an antechamber, prepared sandstone walls, floor and subfloor bins, a centrally located hearth, and encircling bench. Importantly, the pit house excavation had clearly truncated a charcoal-laden level (Fig. 6), thereby establishing non-contemporaneity. Excavation of the charcoal-stained level revealed a cultural unit completely devoid of ceramics. The artifactual inventory included only a half dozen flakes, a small grinding slab fragment, two hammerstones, and a projectile point affiliated with the Elko Series (Heizer and Hester 1978).

The third stage of the Kanab Site excavation program involved trenching the midden deposit in order to investigate its nature and to obtain a larger sample of site artifacts. Three trenches were excavated through the midden (Fig. 5). As the surface evidence suggested, extremely high artifact densities were encountered in the midden. Moreover, a true midden "deposit" was encountered in the form of a dark ash and charcoal saturated stratigraphic unit (Fig. 6). All trenches were excavated to the bottom of that unit. In addition to ceramics, lithics, and ground stone, a fairly sizable faunal assemblage was retrieved (Appendix B).

Stratigraphy

The soil matrix at the Kanab Site consisted for the most part of fine-grained uniform sand. The sand was light brown to reddish in color and contained occasional pebbles and small sandstone rocks. Near the western edge of the site (more or less west of the E114 line, Fig. 6) increasingly dense concentrations of dark reddish-brown clay were encountered. This clay was nearly identical in color with the sand and blended with it in many areas. That is, pure sand would gradually grade into a mixture of sand and clay, and this in turn would grade into pure clay.

The dark soil horizon observed in the cutbank of Kanab Creek (Sisson 1978:7), some 40 meters east of the main site area, was not encountered in the excavated areas. A small soil unit of dark gray clay was, however, observed in the wall of the backhoe trench (Fig. 6), near the northeastern edge of the site. This unit proved to be localized and not the soil horizon observed in the creek bank. There is, therefore, no association between the buried soil horizon and the Kanab Site occupations.

All told, a number of natural and cultural stratigraphic units were observed at the Kanab Site (Fig. 6).

1) A uniform sand grading into increasing densities of clay near the western portion of the site, described above.

2) A dark and easily recognized midden deposit (profile B-B', Fig. 6).

3) The level of the stone features (work patios and storage cists, etc.) in the primary occupation area. This level was indicated only by the elevation of the sandstone architecture; no discernible soil change was present (profile A-A', Fig. 6).

4) The aforementioned localized unit of dark gray clay (profile A-A', Fig. 6).

5) The dark, charcoal laden level representing an aceramic occupation (profiles A-A' and C-C', Fig. 6).

6) A non-cultural layer of large stones and cobbles at the base of one of the backhoe trenches (profile C-C', Fig. 6). This unit is probably associated with the depositional history of Kanab Creek.

CHAPTER III

ARCHITECTURE AND SITE FEATURES

General

Architectural and other cultural features encountered during excavations at the Kanab Site fall primarily into three categories: 1) sandstone floor and wall storage cists; 2) sandstone-laid floors proximal to the storage cists, herein referred to as "work patios;" and 3) a pit structure which served as a domicile. Additionally, other features (e.g. midden, isolated post holes, and hearth areas) were found in association with the site's primary features. As noted in the previous chapter, all of these features were quite clearly contemporaneous in nature; however, an earlier component was evident at the site in the form of an aceramic cultural level. Although approximately 50 percent of this earlier level was cleared by hand or backhoe work, no cultural features were uncovered.

Each of the features is described below, along with plan and profile maps for the individual storage cists and work patios and for the pit structure. The relative horizontal and vertical positioning of site features within the larger site context can be seen in Figures 5 and 6.

Storage Cists

Investigations in the primary occupation area of the Kanab Site revealed three storage cists all constructed of finely-fitted thin slabs of sandstone (Fig. 5).

<u>Storage Cist 1</u>. This storage cist (Figs. 7 and 8) is centrally located in the primary work area of the site and may be associated with a sandstone-laid work patio (work patio 3) situated adjacent to the cist. The cist is the smallest of those encountered but is better made. Carefully shaped and laid sandstone slabs averaging 2-3 cm thick line both the floor and the walls of this cist. These slabs were laid in the natural surrounding sand and contained no evidence of surrounding clay or adobe. The cist is elliptical in shape with a maximum diameter of 144 cm and had an original depth of 30 cm. Excavation around the perimeter of the cist produced no evidence of a superstructure. A core and a mano were discovered <u>in situ</u> on the floor of the cist.

<u>Storage Cist 2</u>. This storage cist is located between the pithouse and the primary work area of the site and is adjacent to storage cist 3 (Fig. 9). This cist is nearly identical in size and form to storage cist 3. The sandstone slab floor is extremely tightly laid (Fig. 10). Vertical upright slabs at one time surrounded the cist, but at present only two-thirds of the periphery contains uprights (due probably to erosion caused by the general proximity to the surface). The sandstone

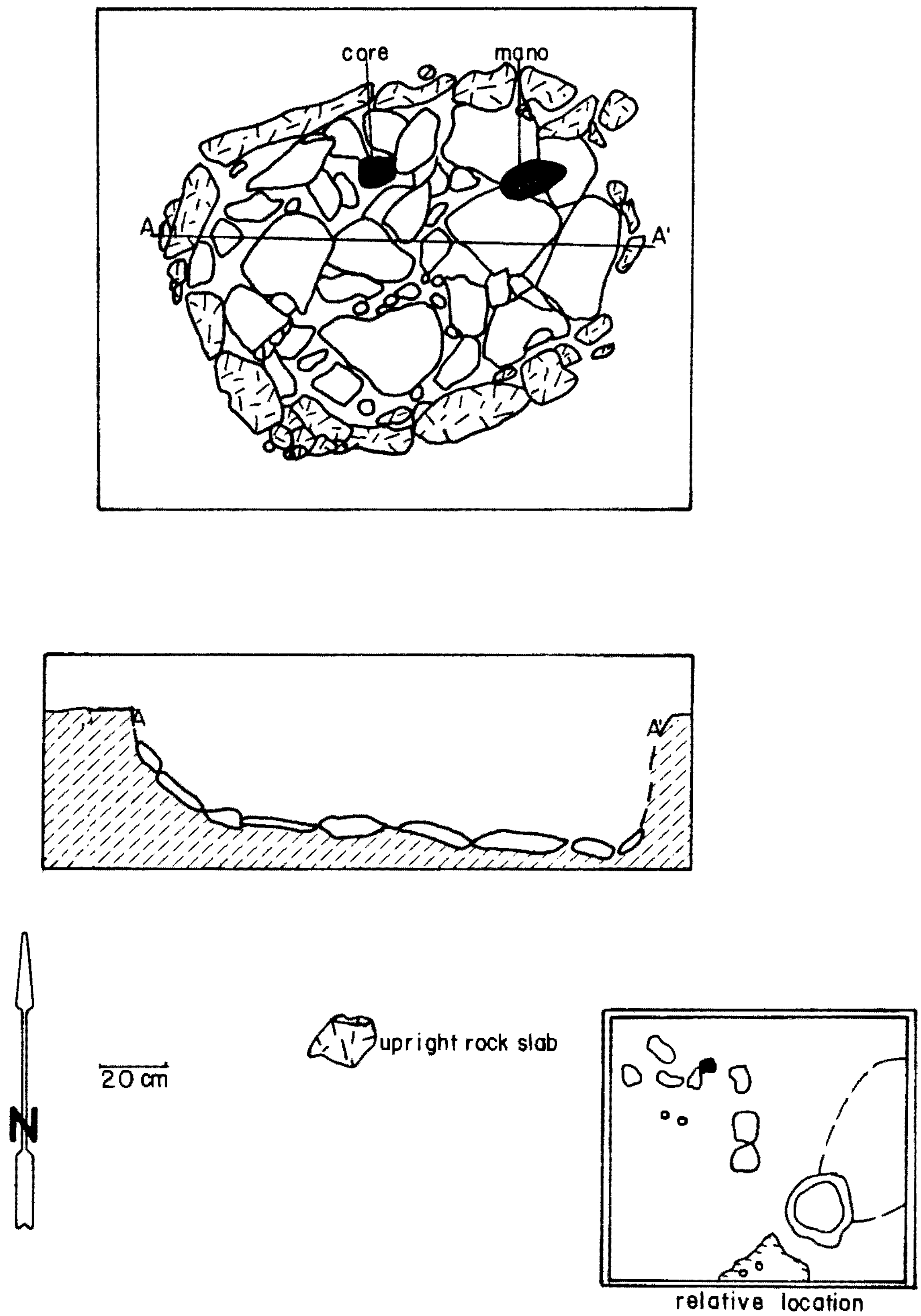

Figure 7. Plan, profile, and relative location of Storage Cist 1.

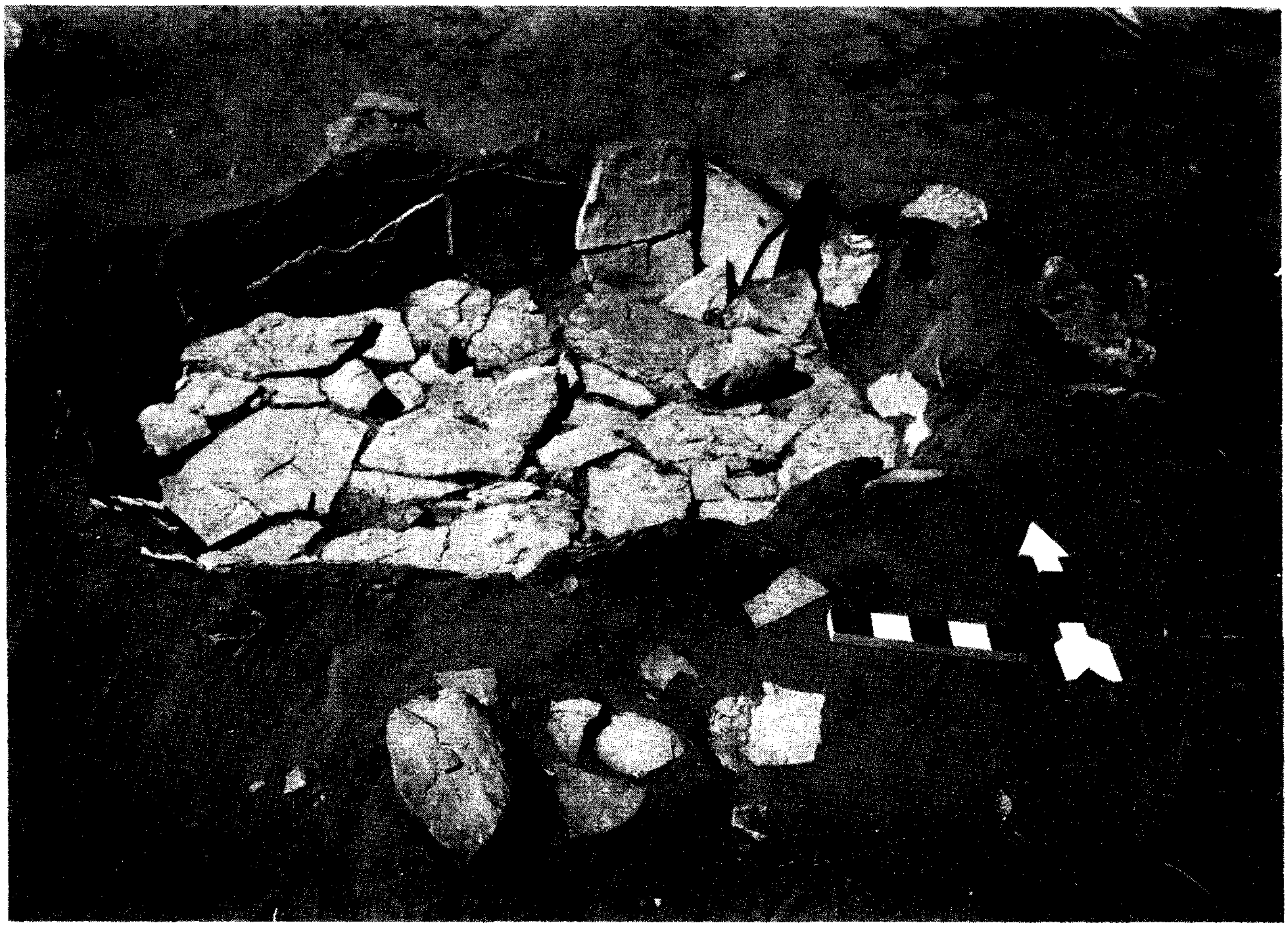

Figure 8. Photo of Storage Cist 1.

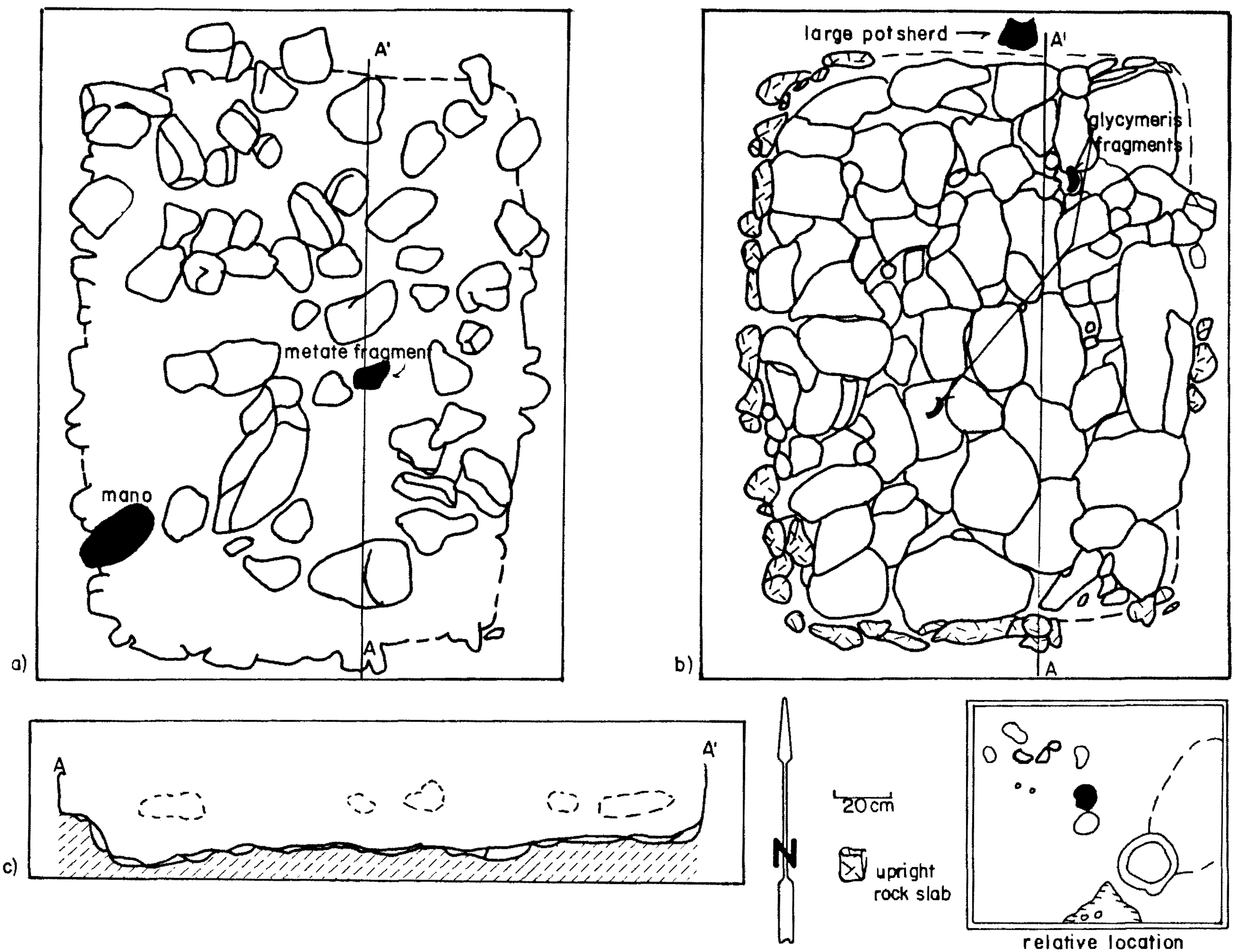

Figure 9. Possible superstructure rockfall evidence (a), floor plan (b), and profile (c) of Storage Cist 2.

Figure 10. Photo of Storage Cists 2 and 3.

was set directly in the native surrounding sand. No evidence of clay or adobe surrounding or on top of the slabs was encountered. This cist measures 212 cm x 172 cm and is 18 cm deep. Two portions of a single *Glycymeris* bracelet were encountered within the cist, one *in situ* on the floor.

This storage cist, like the adjacent storage cist 3, contained possible evidence of a superstructure. An entire level of unshaped sandstone rocks was encountered directly overlaying the cist, with some actually lying on the floor (Fig. 9). The nature and positioning of these rocks strongly suggest wall-fall or possibly even roof collapse. The rocks were strongly aggregated only above the immediate cist vicinity. Importantly, the fill between these rocks in several areas was of a more clay-like nature, perhaps representing a mud or adobe matrix. A large mano and metate fragment are included in this rock level. A careful inspection around the periphery of the cist, however, offered no evidence of post-hole supports. Identical superstructure evidence exists over adjacent storage cist 3, perhaps indicating a single surrounding wall and roof.

Storage Cist 3. This storage cist is nearly identical in every way to the adjacent storage cist 2. The cist measures 220 cm x 166 cm and is 22 cm deep. The floor, however, is not as tightly laid (Figs. 10 and 11). The extreme southern half of this cist was partially exposed at the surface. Consequently, the vertical upright slabs have been removed by erosion in that area (Fig. 11). No evidence of supporting clay or adobe was found in this structure. A shaped and notched sandstone disc possibly representing a hoe was used as part of the floor surface (Fig. 11). Like storage cist 2, a layer of unshaped sandstone rocks was encountered directly over the cist suggesting wall or roof fall. Pieces of hard clay were similarly encountered between these rocks, but because of proximity to the surface they may represent only sun-baked soil, which was commonly encountered at the site. These rocks, however, only cover the south 1 m of the cist (Fig. 11), and may be indicative only of a low wall.

Work Patios

A series of four roughly circular sandstone-laid work areas or "work patios" was encountered in the primary occupation area of the Kanab Site (Fig. 5). These are differentiated from the storage cists in that they do not exhibit the surrounding and steep vertical slabs which characterize the latter. No evidence of superstructures was encountered at any of them. Moreover, these patios were associated with numerous and highly diversified artifactual materials in their immediate vicinities (see Chapter IV). The patios are similar to the one reported by Nickens (1977) at the Wood Rat Knoll site in southeast Utah.

Work Patio 1. This patio consists of tightly laid sandstone slabs (Fig. 12). Because it was only a few centimeters below the surface, it is badly eroded. No artifacts aside from a few sherds and lithic debitage were recovered from its surface. It measures 102 cm in length.

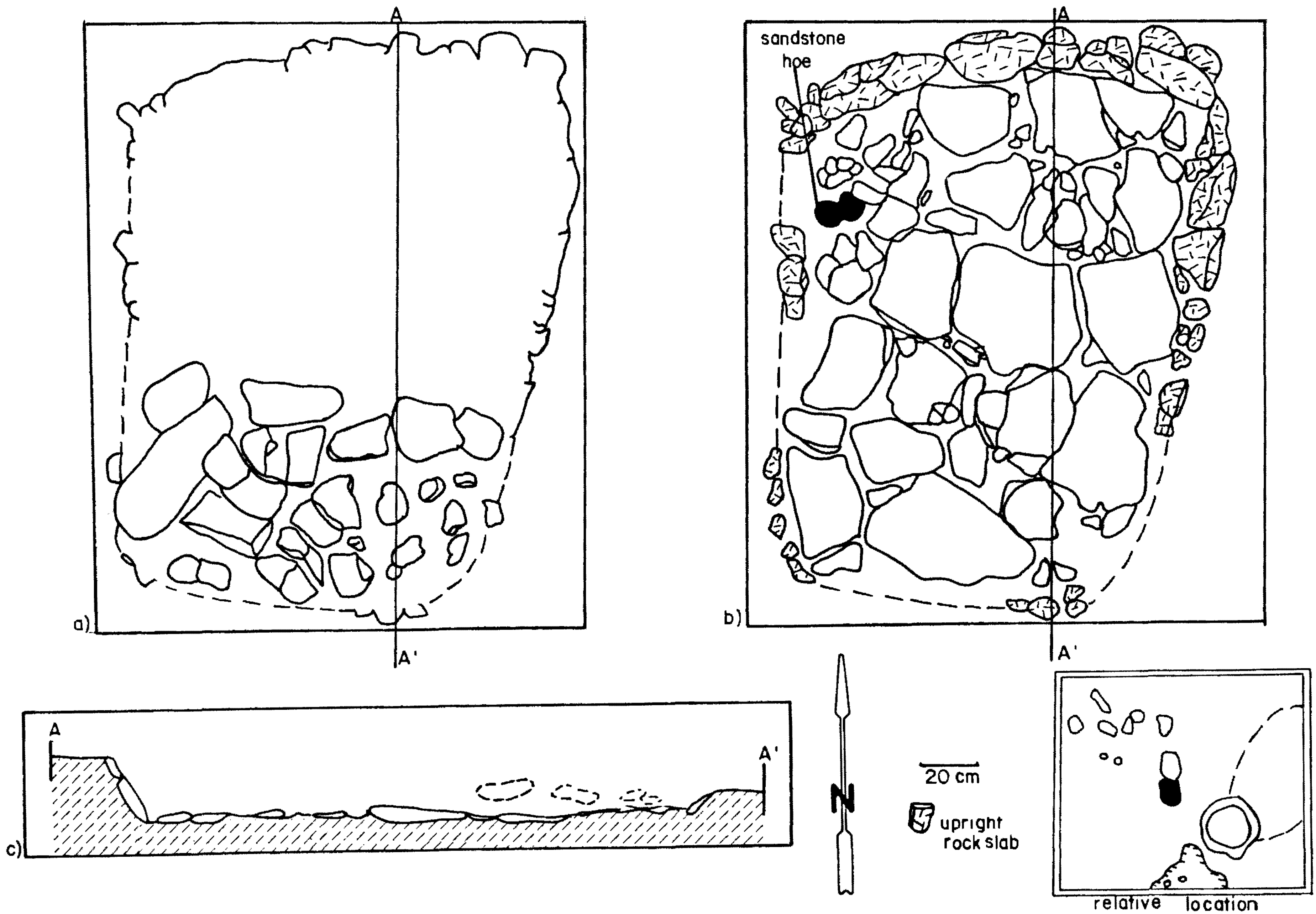

Figure 11. Possible roof rockfall evidence (a), floor plan (b), and profile (c) of Storage Cist 3.

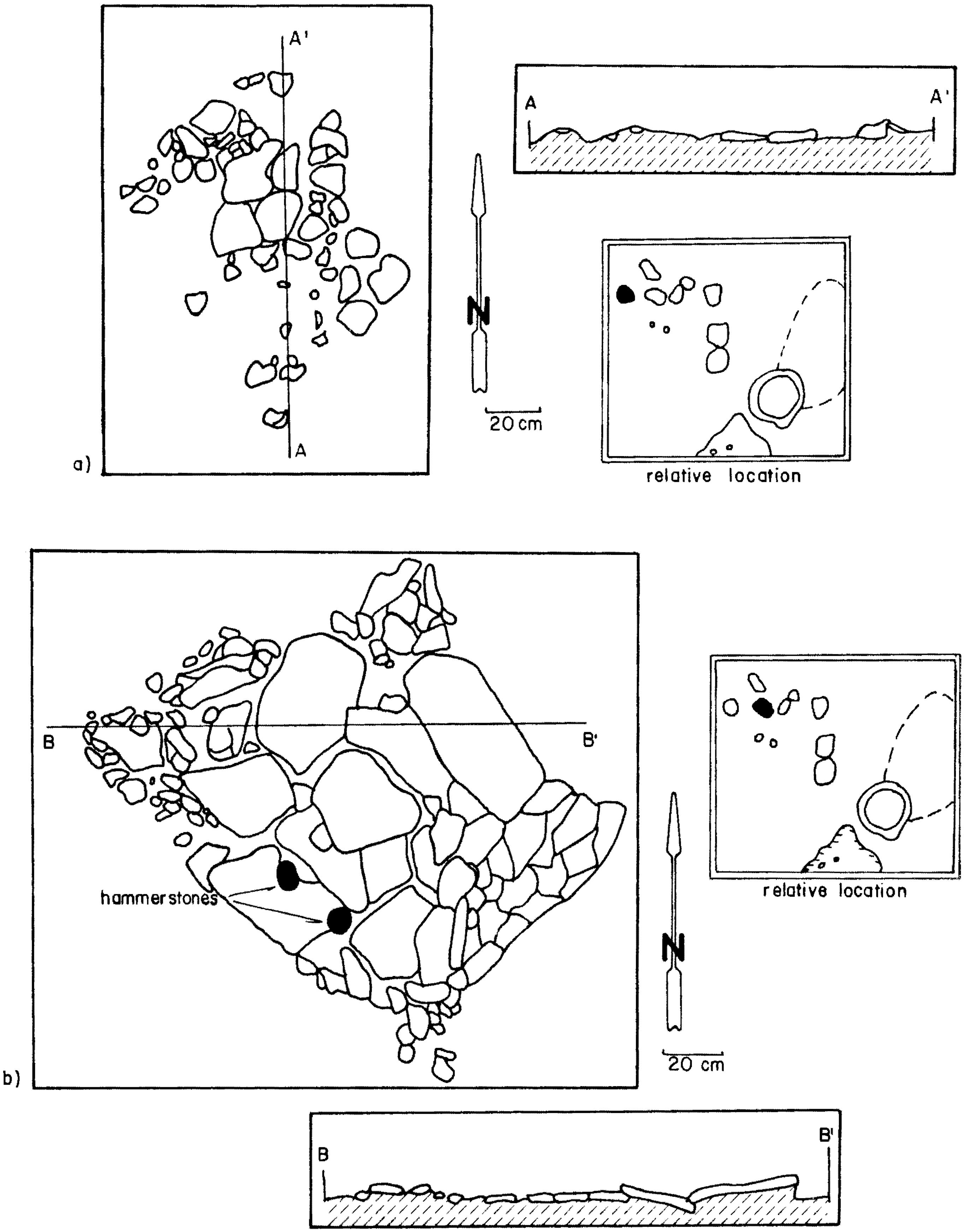

Figure 12. Plans and profiles of Work Patio 1 (a), and Work Patio 2 (b) at the Kanab Site.

Work Patio 2. This patio is the largest and exhibits the most tightly laid sandstone of all the work patios (Figs. 12 and 14). It is centrally located in the main occupation area of the site and may be related to work patio 3 which is in close proximity. This patio measures 164 cm x 130 cm and is roughly rectangular. Two hammerstones were recovered in situ on the sandstone slab surface.

Work Patio 3. This patio is somewhat unusual in that a large proportion of the sandstones used were not flat slabs, but fairly rounded and thick entities. Furthermore, the north and south edges were surrounded by low upright-positioned vertical rocks (Figs. 13 and 14). The vertical rocks rise very low with a maximum depth of only 8 cm. The patio is roughly rectangular with rounded edges measuring 110 cm x 106 cm. A single hammerstone was encountered on the floor of this patio. The patio may be associated with work patio 2 and storage cist 1 since it is in close proximity to both.

Work Patio 4. About one-third of this patio was removed by vandal activity prior to excavation. A large pothole cut directly through the floor (Fig. 13). This patio closely resembles patios 1 and 2, in that it contains tightly laid flat sandstone slabs. It is unique, however, in that a distinct white clay surface approximately 1 cm thick was encountered at a level adjacent to the bottoms of the sandstone slabs. This may represent part of a prepared floor feature such as the clay caulking which sealed the cracks between slabs found at storage cists at the Bonanza Dune Site (Aikens 1965:14). This patio originally measured 200 cm x 110 cm. A single corner-notched projectile point was recovered in situ from the patio floor.

Pithouse

Backhoe excavations revealed a single site pit structure with a floor at a depth of about 150 cm below the surface (Fig. 6). The backhoe did not significantly damage any of the floor and only removed a small portion of one wall. Because of time limitations, the backhoe was used to remove the top 50 cm of fall over the pithouse floor. The entire structure was completely excavated.

Dimensions: The pithouse is nearly circular in shape with a maximum diameter of approximately five meters (including the bench). The floor diameter is approximately 3.8 meters (Figs. 15 and 16).

Walls: The pithouse had been prehistorically excavated into an earlier occupational level, completely truncating that deposit. The walls consisted of thin (2-3 cm thick) sandstone slabs standing a height of 30-40 cm above the pithouse floor. These slabs sloped outward from the floor. The slabs were set in hard red-brown clay and clay was packed between the slabs and slightly over their edges. The identical floor clay was similarly pressed over the bottoms of the slabs (Fig. 15: profile B-B'). One slab was covered with several millimeters of light plaster. The sandstone slabs encircle the entire structure with a major break of about 1.25 meters in the vicinity of the antechamber ramp in the southeast portion of the structure.

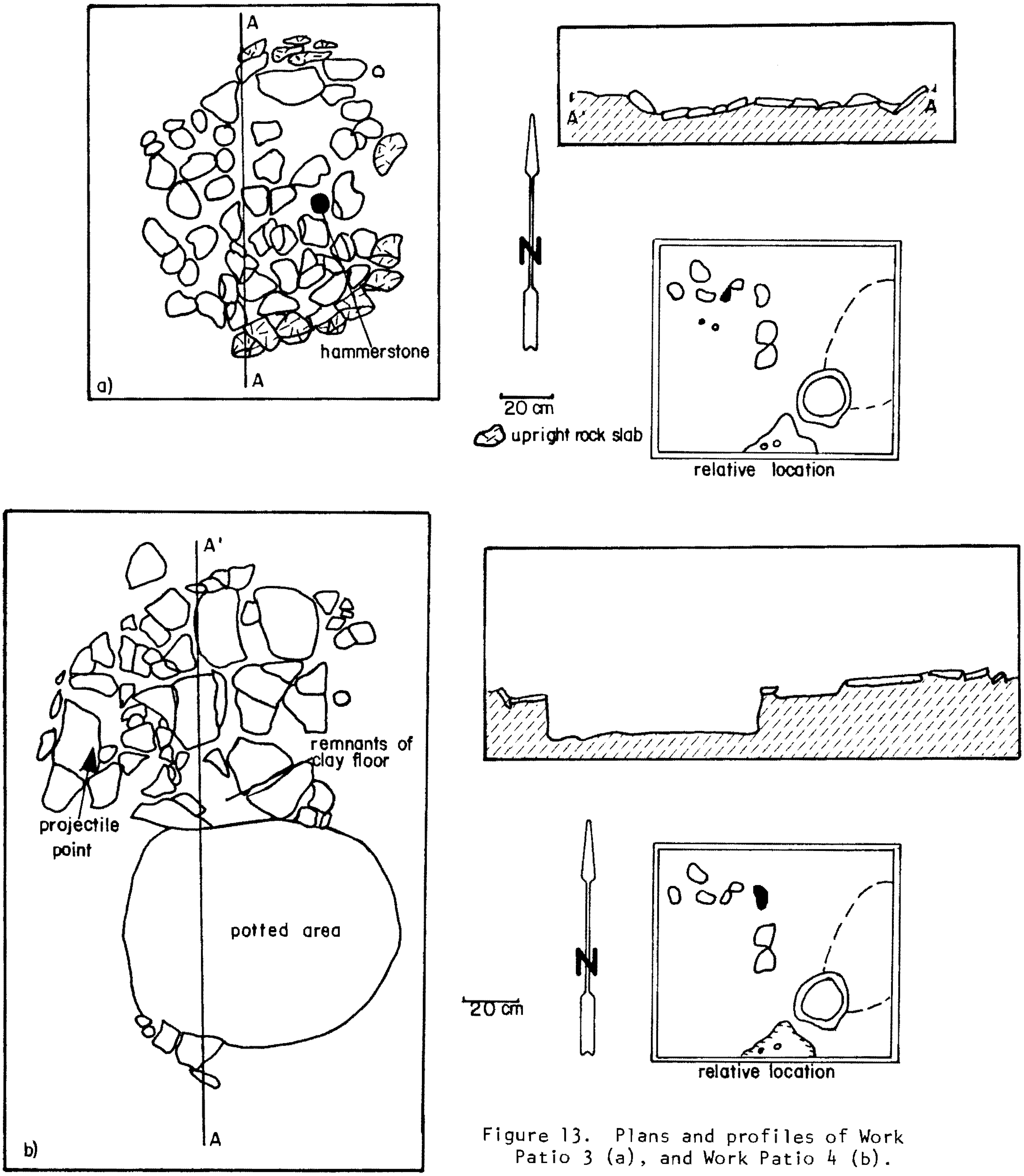

Figure 13. Plans and profiles of Work
Patio 3 (a), and Work Patio 4 (b).

Figure 14. View to the west looking at Work Patios 2 (farthest) and 3.

Figure 15. Plan and profile of the pithouse.

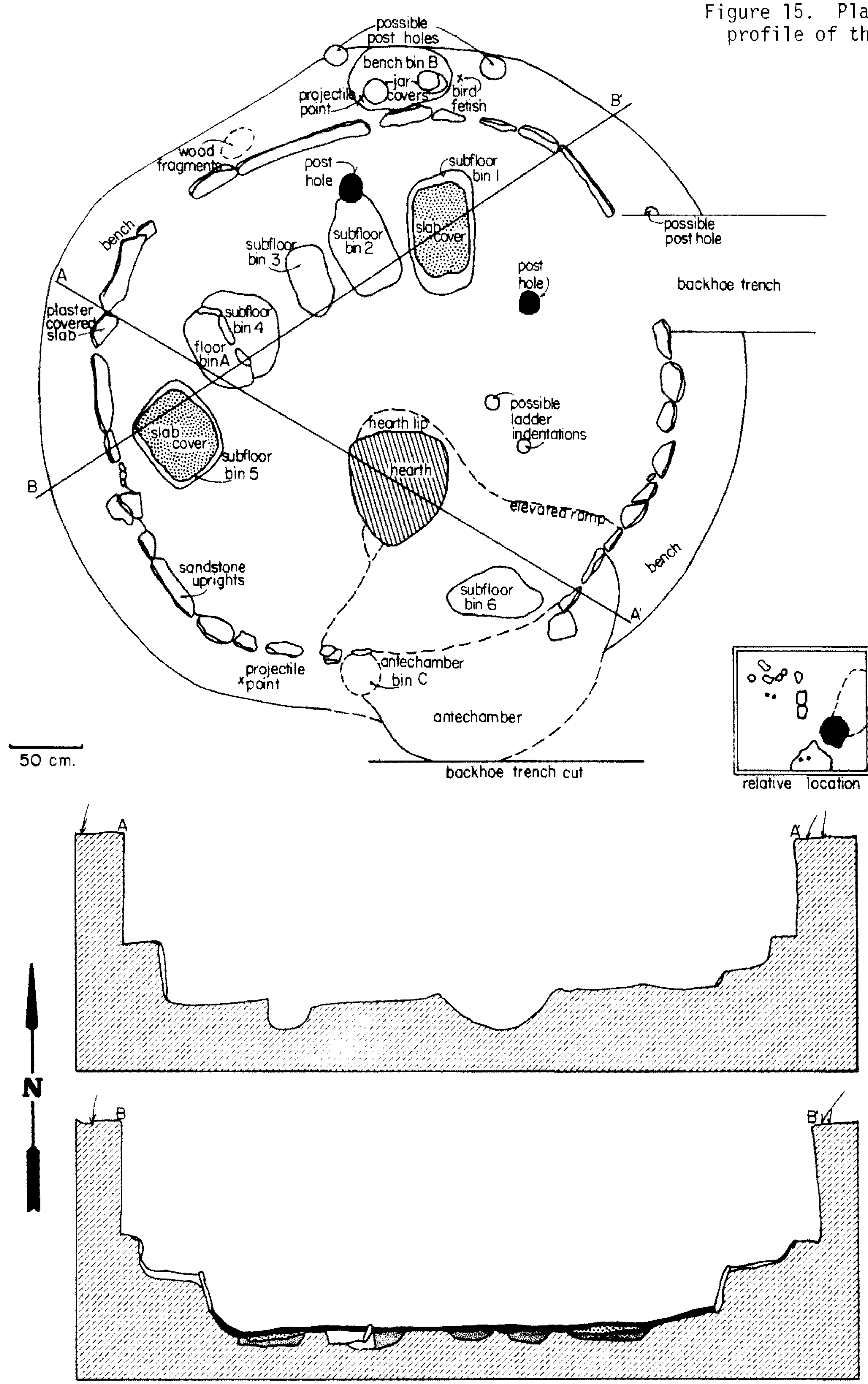

Figure 16. Pit structure after clearing of floor features, looking northwest. The upright slab lower walls are evident, along with several subfloor bins, the clay-lined firepit, and the possible ladder indentations (right of the firepit).

Floor: The floor of the pithouse consisted of a uniform layer of hard red-brown clay about 3-5 cm thick. A thin layer of whitish sand covered most of the floor. The floor was shaped like a basin, sloping dramatically upward in places to meet the surrounding wall. A fire pit was placed off-center and was surrounded by a slight lip in the floor clay (Fig. 15: profile A-A'). The hearth was basin shaped (27 cm deep, and 85 cm maximum length) and was entirely lined with clay. It consisted of rock-hard fine gray ash with very little carbon and no observed seeds or cultural materials. From the fire pit to the southeasterly placed antechamber a distinct upward-sloping ramp consisting of a built-up thickness of floor clay occurred. The ramp continued outward on an even slope through the antechamber.

One floor bin was apparent in the floor and was indicated by a line of rocks which flanked one side of the bin. No cultural materials occurred within this bin. Sealed beneath the clay floor were six subfloor bins or basins which were each sand filled. These bins were only 5-10 cm deep and were lined with a thin layer of clay. Two of these bins (subfloor bins 1 and 5) contained carefully prepared sandstone slab covers about 5 cm thick.

Aikens (1965:24-28), at the Bonanza Dune Site, reported numerous similar sand-filled basins sealed beneath pit structure floors, which also contained flat stone covers. He (1965:28) interpreted these as being of "ceremonial significance," possibly related to the use of pithouses as sweat lodges.

Two roof support post holes each about 15 cm in diameter were encountered in the north and northeast portions of the pithouse floor. Other post holes of this nature were not encountered on the floor. It is possible that the slab cover over subfloor bin 5 may have been used as an anchor support or post rest, although no post depression was found over it. Additionally, the slight floor disturbance caused by the backhoe may have removed evidence of other post holes.

Two distinct indentations about 25 cm apart immediately below the clay floor and to the east of the fire pit were noticed. The indentations were each 5 cm deep, filled with charcoal and, by their positioning and orientation, suggest depressions for a ladder that may have reached through the roof. No such indentations or holes, however, were noticed in the clay floor immediately above these features. They may have been sealed over at a later point in time.

On the clay floor proper, few artifacts occurred aside from several broken pot sherds and lithic chipping debris. This suggests that the pithouse was abandoned and cleared out in an orderly fashion. No evidence of burning existed. No cultural materials were observed beneath the floor.

Antechamber: Access to a small antechamber, rising out of the southeast portion of the pithouse, was through a 1.25 m break in the surrounding wall. The antechamber extends about 1 m south of the pithouse wall and rises gently upward. Unfortunately, its extreme southern end was truncated by a backhoe trench. The antechamber floor consists of the same clay as the pithouse floor although the clay layer becomes faint and indistinct near its southern limit. To the west, the antechamber floor slopes gently upward. Bin C was encountered near the wall/antechamber juncture and was devoid of artifacts. The eastern antechamber portion rises to a steep clay lined vertical wall about 20 cm high (Fig. 15: profile A). No artifacts were recovered in the antechamber aside from a few sherds.

Bench: Surrounding the pithouse at the level of the tops of the vertical wall slabs was a clay lined bench. The bench consisted of 2-3 cm of red-brown clay, and in places a bright red clay was observed. The average width of the bench is about 35 cm. Along its peripheral edge, the bench clay curved sharply upward forming a 20 cm high clay rim wall around the bench. The main bench feature was a large bin. This bin was 70 cm long, and as wide as the bench. It was approximately 25 cm deep. This bin was filled with clean sand and at its surface were three shaped sandstone "jar covers." A number of polishing pebbles were found in the bin and in its vicinity.

Most of the pithouse artifacts occurred close to this bin including a bird fetish, a projectile point, wood fragments, and an anomalous, flaked, polished, and ground chalcedony flake. A second projectile point occurred on the bench in the southern pithouse portion. Along the north and east periphery of the bench, three probable post holes were encountered. These varied from 8 to 20 cm in diameter and may represent leaning beams or roof supports.

Roof: Indirect evidence of a superstructure, aside from post holes, was indicated by a 10 cm thick layer of dark-brown charcoal-flecked clay which uniformly covered the entire pithouse floor and bench. This clay is interpreted as representing the collapsed pithouse roof.

Other Site Features

Feature 2. An anomalous feature of unshaped sandstone and quartzitic cobbles was encountered immediately north of and between work patios 1 and 2 (Fig. 17). The feature is reminiscent of the work patios but the stones are not slabs and are not shaped or well laid. A variety of artifacts, primarily sherds and lithic debris, was encountered within and in the vicinity of this feature. It is possible that mud or adobe may have covered the surface of these rocks. Harder baked clay was encountered between many of them. A second possibility is that much of the feature could have eroded; it was discovered only centimeters below the present surface. Because it is similar to the several work patios in the vicinity, this structure may represent a work patio as well.

Open air hearth. A single basin-shaped circular hearth was encountered in close proximity to work patios 2 and 3 (Fig. 5). The hearth measures 60 cm in diameter, 20 cm deep, and was encountered 15 cm below the present ground surface. A number of burnt sherds were encountered in the hearth, and the general artifact density in its vicinity was high.

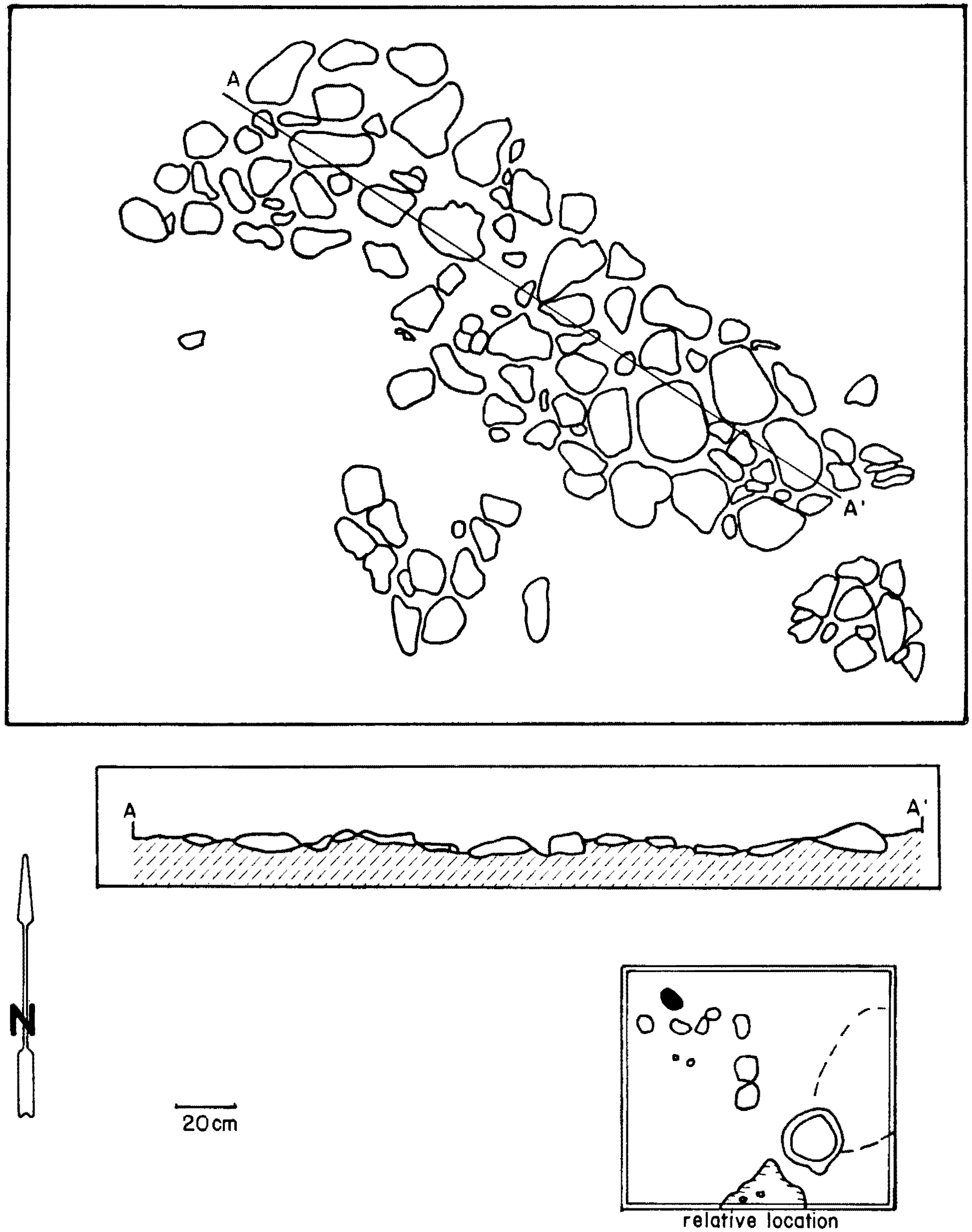

Figure 17. Plan and cross-section of Feature 2, a possible work patio.

Isolated Post Holes. A series of isolated post holes was encountered at the Kanab Site. Two were located near the peripheral midden deposit edge and near the pithouse (Fig. 5). A single post hole was also encountered at the same level and in close proximity to the open air fire hearth. These may represent any number of functions such as ramada supports.

Chronometric Dating of Site Features

Sizeable concentrations of charcoal/wood samples were not common throughout the Kanab Site deposits. No suitable dendrochronological specimens were obtained, and only six radiocarbon samples were secured. Three of the charcoal samples were submitted to Radiocarbon, Ltd. for dating, each of which yielded a date. Table 1 lists the results; general discussion is reserved until the concluding chapter of the report after descriptions of the artifactual materials have been presented.

Table 1. Radiocarbon Dates

Lab No.	Location	Radiocarbon Age years B.P.	MASCA Corrected AD/BC Date
RL-1396	Open hearth	990 ± 110	A.D. 980 ± 120
RL-1397	Pithouse hearth	810 ± 110	A.D. 1150 ± 110
RL-1398	Early component	1460 ± 120	A.D. 520 ± 120

CHAPTER IV

ARTIFACTUAL MATERIALS

General

A number of artifacts were recovered during investigations at the Kanab Site. Artifacts within the various classes are described and illustrated below, along with a series of maps indicating distribution of particular artifact types throughout the site area. Appendix A provides additional data on the measurements, material, and provenience for each of the illustrated artifacts.

Chipped Stone Artifacts

Projectile Points

A total of fourteen projectile points was recovered from the surface or in excavations of the Kanab Site. The predominant style is a deeply corner-notched triangular point with a straight stem and slightly incurving (concave) blade margins (Fig. 18a-j). This typical Anasazi point is commonly found throughout the Southwest in contexts ranging from Basketmaker III to Pueblo II (Morris 1939: pl. 126; Hayes and Lancaster 1975: Fig. 179; Moffit et al. 1978: Fig. 53; Aikens 1965: Fig. 37). A slight variation with serrated blade edges is shown in Figure 18j.

An Elko corner-notched point (Aikens 1970: Fig. 20f; Heizer and Hester 1978: Fig. 3) was recovered in direct association with the deposit described earlier (Fig. 18k). Additionally, the base in Figure 18l may represent a similar point type but was found in the midden deposit of the later occupation. It is possible that this point was prehistorically displaced there during the intrusive pithouse excavations. The occurrence of the Elko type point in a level dated at A.D. 520 ± 120 at the Kanab Site thus provides another example of a previously posited extension of the Elko series projectile points to around A.D. 500-600 (cf. Heizer and Hester 1978:5).

Two points (Fig. 18m, n) which resemble projectile points may have actually served as hafted knives. Their overall flaking is rougher, they both lack distinctive pointed tips, and these bifaces are somewhat thicker.

The distribution of projectile points is shown in Figure 20. Aside from the early component (which contained the point in Fig. 18k), four projectile points were recovered in good association with architectural features of the site. These include three in the pithouse (Fig. 18a, b, m) and one on the floor of work patio 4 (Fig. 18d). The remaining points occurred in the midden vicinity.

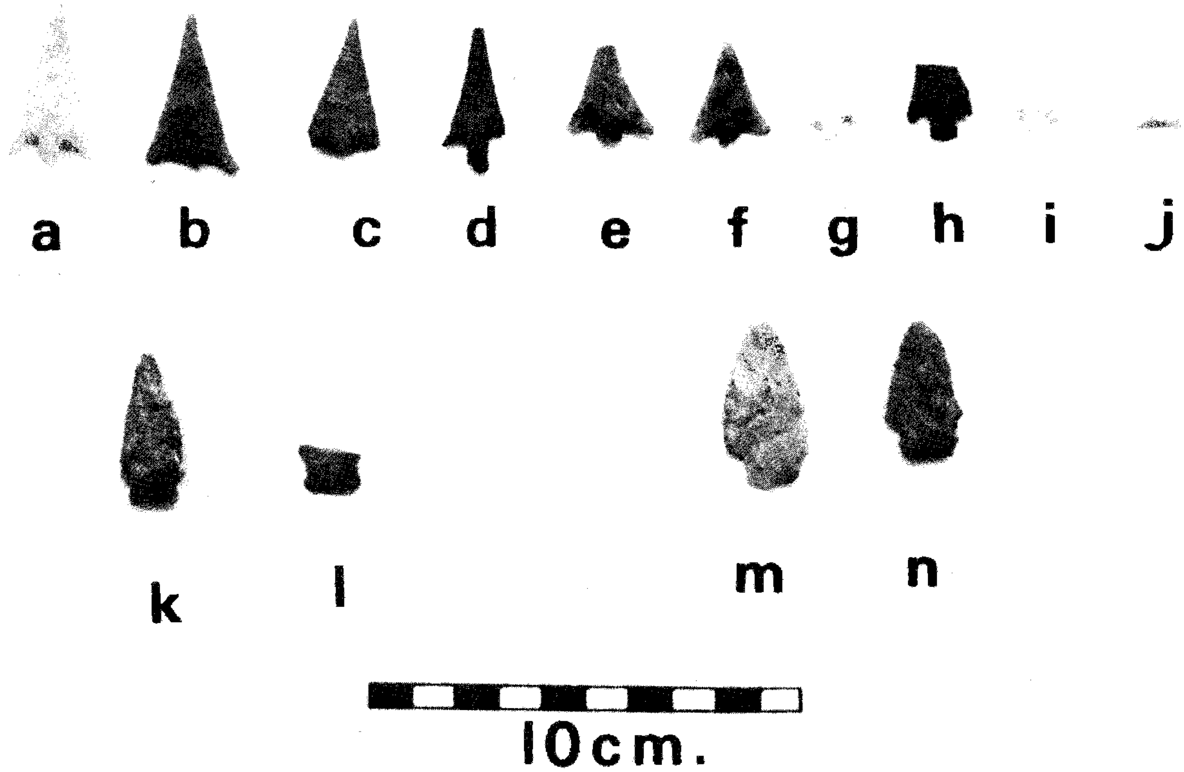

Figure 18. Projectile points and knives.

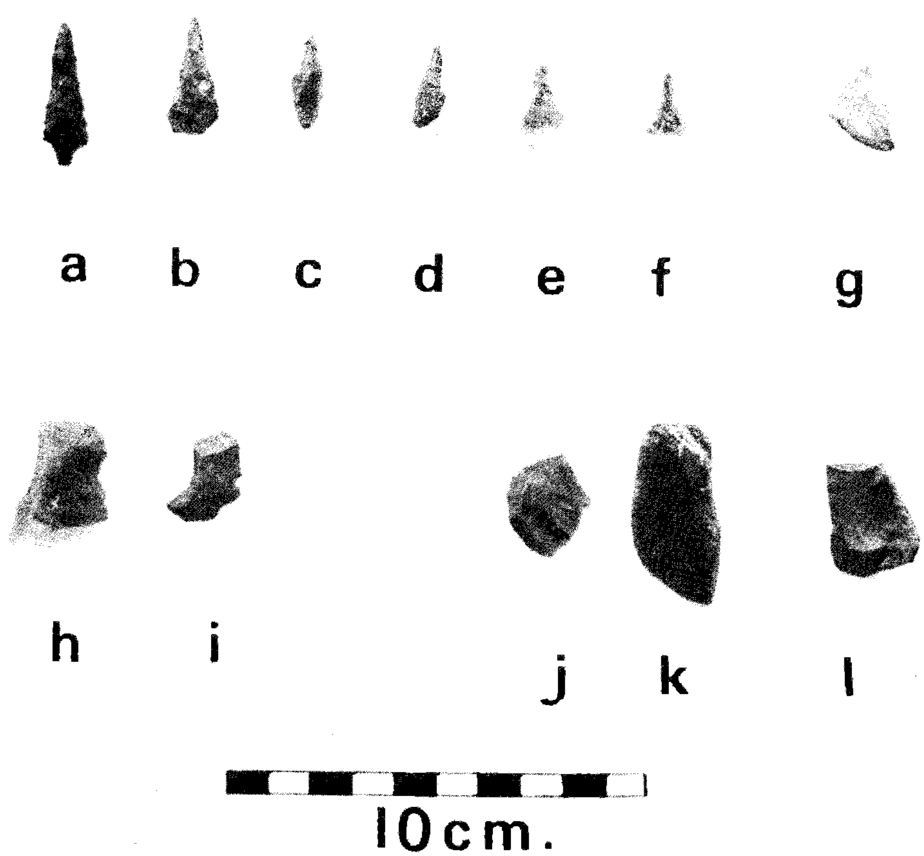

Figure 19. Drills (a-f), perforator (g), notched tools (h-i), and unifacial scraping tools (j-l) from the Kanab Site.

Drills

Six drills were recovered (Fig. 19a-f). Although each was probably hafted, specimen a in the figure is unique in that it bears a distinct hafting stem. Specimens c and e in Figure 19 have heavily polished and worn tips. All were recovered from the vicinity of the midden (Fig. 20).

Perforator

A single (incomplete) perforator was recovered (Fig. 19g). It was probably hand-held and was used for piercing. It was located in the midden deposit (Fig. 20).

Notched Tools

These tools are unifacially flaked and the primary working edge consists of a notch or indentation which has been utilized. The two notched tools recovered from the Kanab Site are illustrated in Figure 19 (h and i). The former was located adjacent to Feature 2 and the latter in the vicinity of the midden area (Fig. 20).

Unifacial Scraping Tools

This category includes tools which have been intentionally flaked or modified on one face only and were used predominantly for scraping tasks. The seven such tools recovered are modified on the long axis only and thus constitute "side scrapers" (Fig. 19j-l). These tools occurred primarily in the midden vicinity (Fig. 20).

Bifacial Blades

Following the terminology of Aikens (1965:105), a series of thin, triangular, and finely flaked bifaces are termed blades. These may have served a variety of cutting tasks and some probably represent unnotched projectile points (Fig. 22a-f). A total of 55 bifacial blades was recovered. These artifacts occur throughout the site and are in good association with a number of architectural features (Fig. 21).

Bifacial Knives

This tool type is distinguished from bifacial blades in that they are generally larger and cruder (Fig. 22g-i). They probably served a variety of cutting tasks and are distributed parallel to bifacial blades (Fig. 21). A total of 32 was recovered.

Choppers

A total of fourteen choppers was recovered. These artifacts are generally large and are characterized by a battered flaked cutting edge (Fig. 22j). They probably served as "hand-axes." Choppers are distributed throughout the site (Fig. 21).

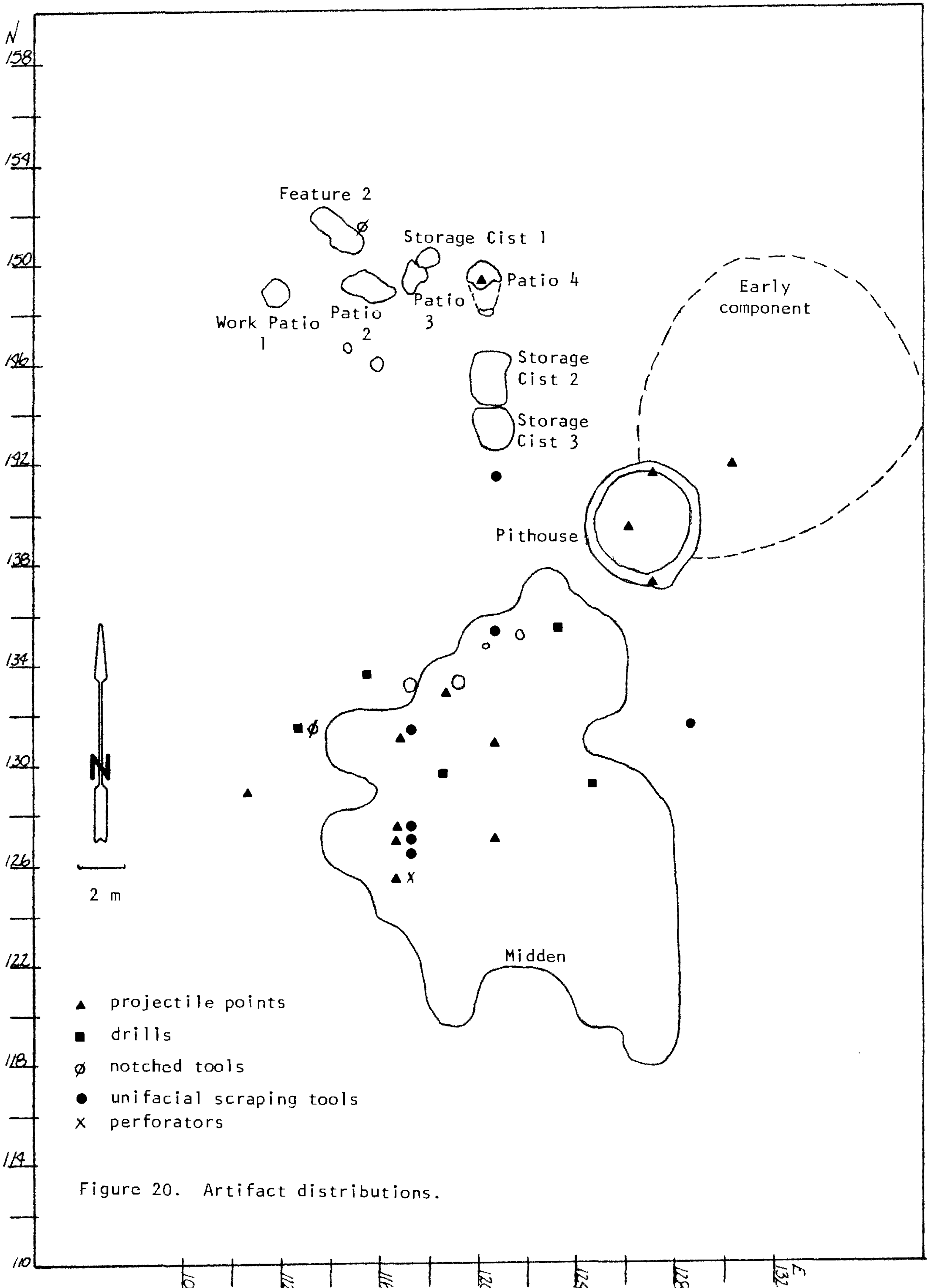

Figure 20. Artifact distributions.

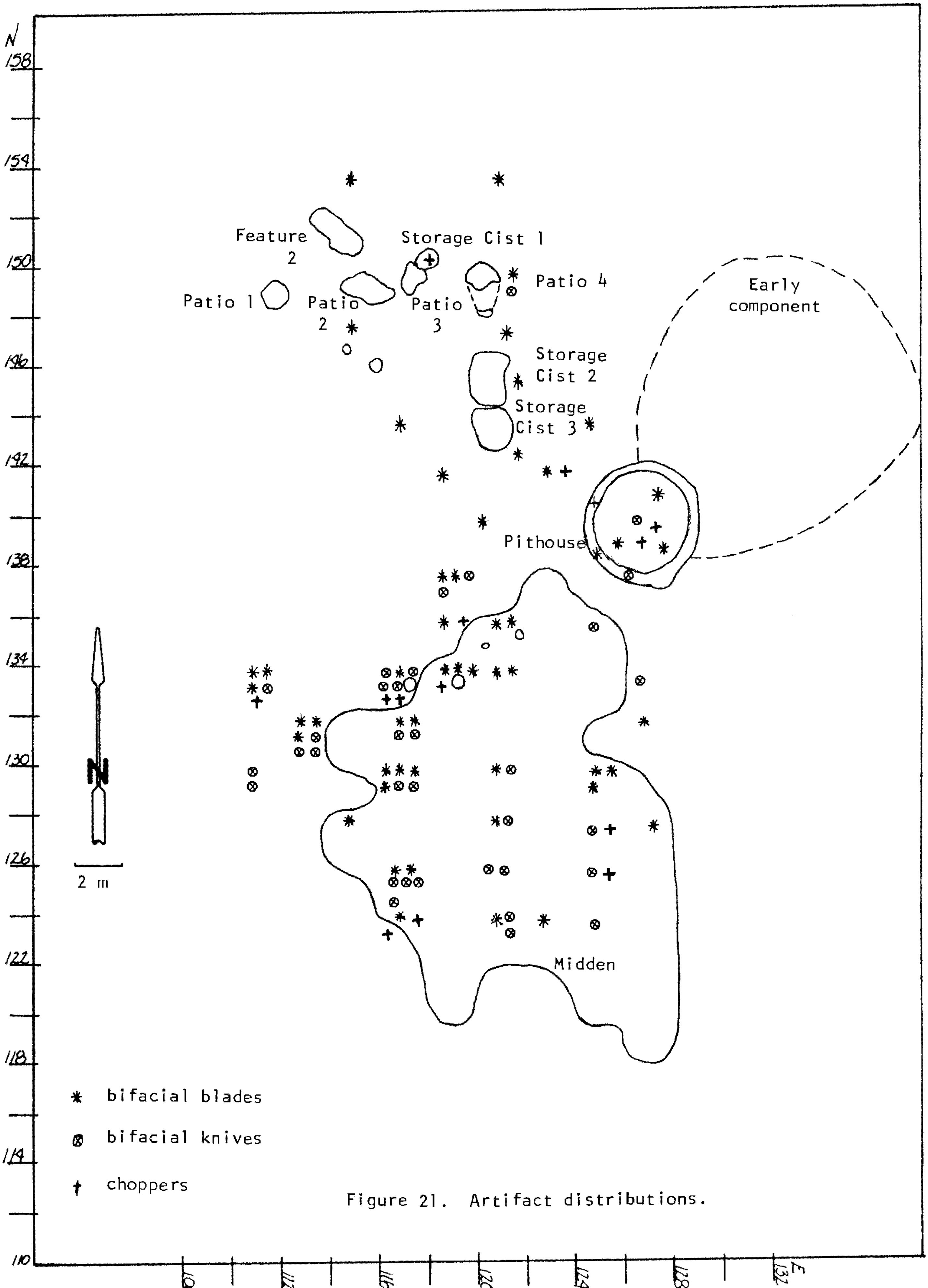

Figure 21. Artifact distributions.

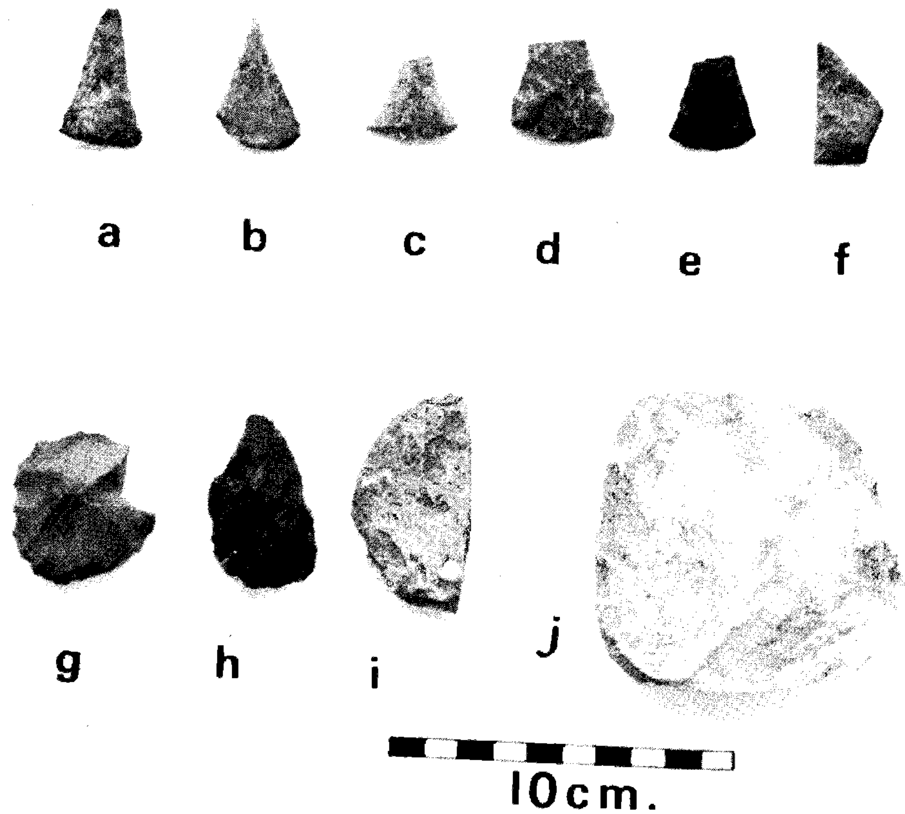

Figure 22. Bifacial blades (a-f), bifacial knives (g-i), and chopper (j).

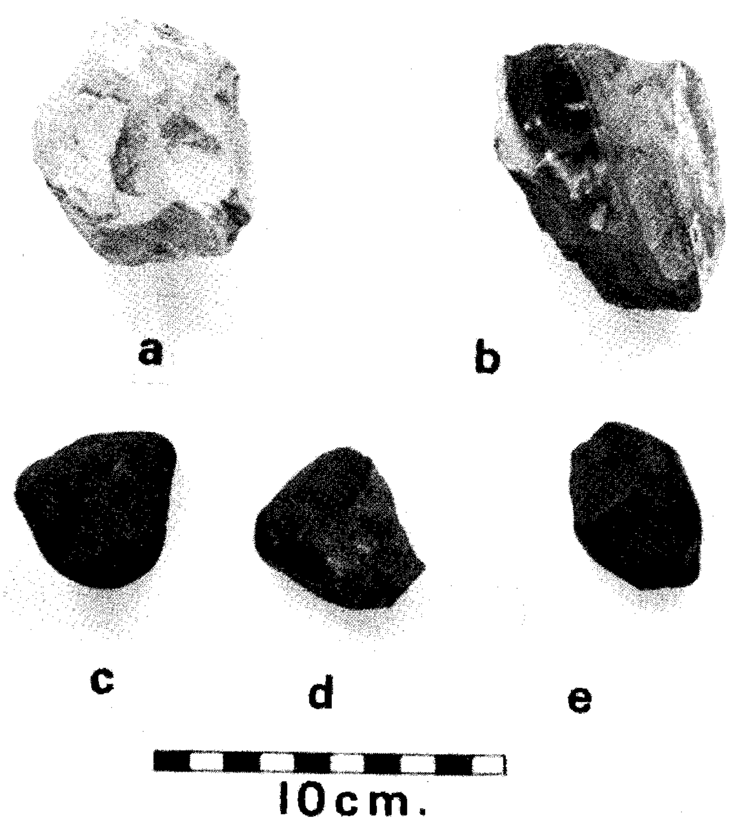

Figure 23. Cores (a-b) and flaked cobbles (c-e).

Cores

Most cores were probably left at the original areas of quarrying. The six cores encountered at the site indicate fairly well prepared platforms with flakes removed sequentially down one side (Fig. 23a, b). Specimen a in the figure was also used as a hammerstone. Cores were found throughout the site with two associated with architectural features (Fig. 24).

Flaked Cobbles

These artifacts are technically cores but exhibit only one or two flakes removed from typically small cryptocrystalline cobbles which are fairly common in the site vicinity (Fig. 23c-e). It is speculated that the flakes removed may have been utilized, or the material of the cobbles was merely being tested. A total of 32 was recovered from all areas of the site with a high concentration near the midden periphery (Fig. 24).

Utilized Flakes and Debitage

A total of 2943 flakes was recovered from the Kanab Site. Of these, eight percent or 247 were utilized as evidenced by the presence of three or more contiguous use-wear flake scars along a single edge (the minimum defining attribute). A very high density of utilized flakes occurred in the pithouse and, in addition to a high density in the midden, the distribution of utilized flakes generally paralleled the other architectural features (Fig. 25). Blades were arbitrarily defined as flakes with lengths twice as great as widths. Three hundred and thirty-five, or 11 percent, of all flakes were classified as blades.

Thirty-five percent (1021) of the flakes recovered possessed a cortical surface. This feature strongly suggests that the primary stage of lithic manufacture, i.e., core reduction, was a key activity at the site. This is somewhat surprising in that only six cores were recovered from the site. Numerous flaked cobbles, however, did occur. The distribution of cortical flakes (Fig. 26) suggests a number of flaking activity areas: the central midden, immediately northwest of the midden, the pithouse, and between work patios 1 and 2. Interestingly, this distribution closely parallels the distribution of recovered cores and flaked cobbles (Fig. 24), further suggesting flaking activity areas.

Chipped Stone Raw Materials

A variety of cryptocrystalline silicate raw materials were used by the inhabitants of the Kanab Site for the production of chipped stone tools. In order to more adequately describe the kinds of raw materials used, each chipped stone lithic item was assigned to a stone-type category. The classificatory system adopted here is similar to that of Judge (1973:143) and is based on attributes of texture, translucency

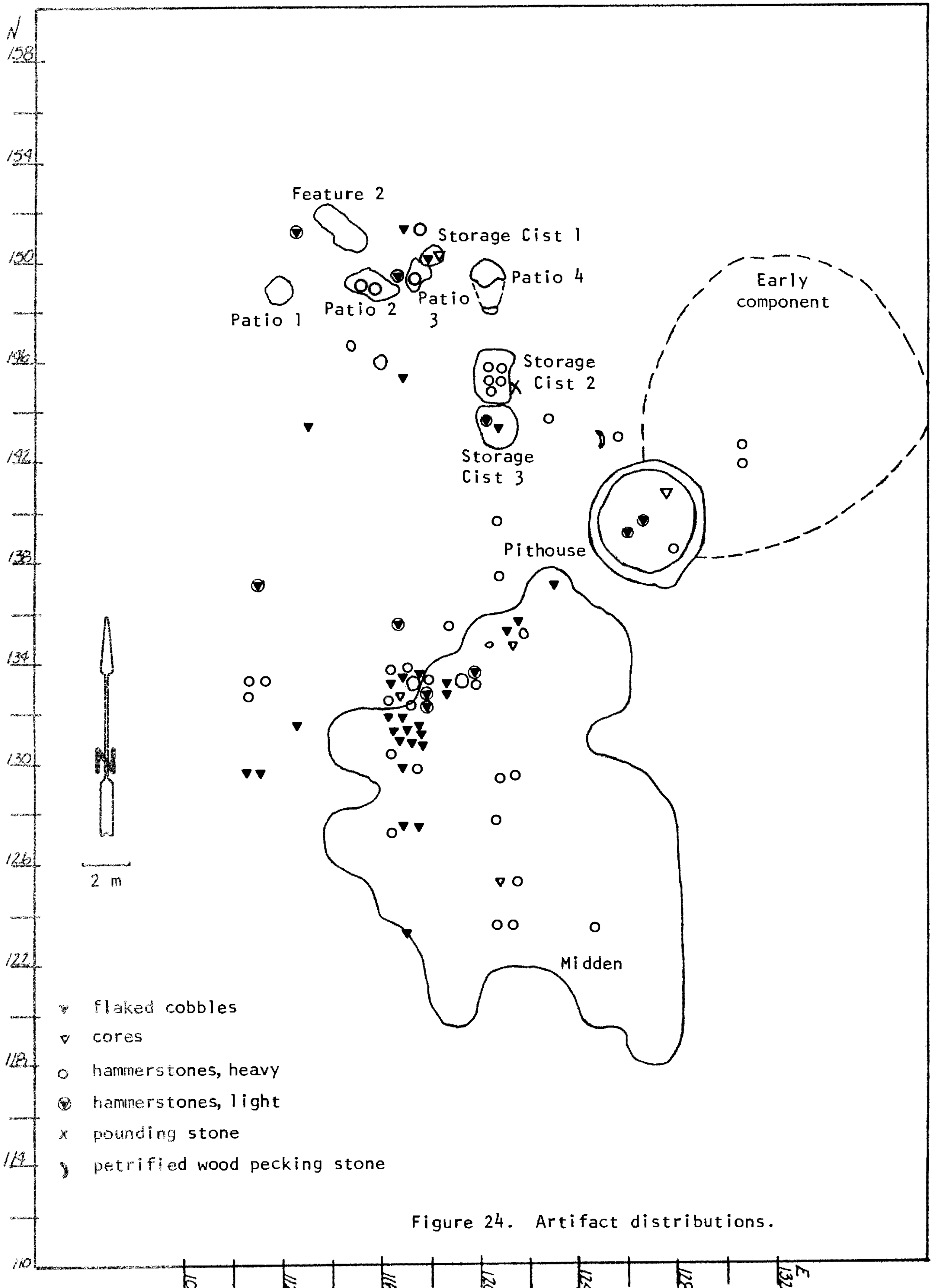

Figure 24. Artifact distributions.

(or opaqueness), color(s), the presence of inclusions, and other impurities. Seven initial stone classes were defined for purposes of this report as follows: 1) Chalcedony is the most translucent of non-volcanic rocks and possesses a generally smooth and "waxy" texture. 2) Cherts are generally opaque and possess a smooth texture. 3) Quartzites are characterized by a coarse, granular texture with individual grains visible. Most quartzites are opaque. 4) Obsidians are highly vitreous and translucent volcanic glasses. 5) Quartz Crystal is transparent and composed of "pure" quartz. 6) Siltstone/Shale is an opaque, fine-grained, poorly metamorphized rock. 7) Petrified Wood is silicified or "fossilized" wood.

These raw material classes were further subdivided into 19 specific stone-type categories based on color, impurities, and inclusions. This was accomplished by comparing each lithic item to an index tray of stone types that was built up from the Kanab Site collection. If the item under examination was similar to a "type" already in the type collection (based on the above attributes), it was assigned to that type. If not, a new type was created and the specimen was added to the type collection as an example of the new stone type. Characteristics of the 19 defined stone types are summarized in Table 2. The distributions of the chipped-stone tool types and flakes by stone type are given in Table 3.

The data indicate a number of interesting patterns. First, the proportion of each stone type represented by debitage is roughly equal to the proportional use of each stone type represented by the stone tools. This suggests that overall, the recovered stone tools were manufactured at the site. That yellow, brown and red chert is better represented by the debitage than tools (63.68% vs. 35.6%) may suggest that a certain number of tools of this material were transported off the site. Conversely, more oolitic chert tools were recovered than debitage (21.2% and 4.4% respectively), suggesting that finished tools of this material were imported to the site. A second observed pattern is that 88 percent of the tools and 84 percent of the flakes are represented by materials possessing superior flaking qualities. This may reflect the fact that quartzites and other rough stones generally possess poorer flaking qualities when compared to more vitreous cherts and chalcedonies (Greiser and Sheets 1979). The preponderance of the latter at the Kanab Site may indicate a preference for that material in manufacturing chipped-stone tools. Interestingly, 67 percent of the choppers and nearly all of the hammerstones (discussed below) are manufactured from coarse-grained materials which are better suited for cruder pounding tasks.

The distributions of three key stone types, clear chalcedony, yellow, brown and red chert, and siltstone/shale, which represent 79 percent of the flakes in the site, are presented in Figure 27. The data indicate generally parallel distributions of flint-knapping areas regardless of stone type. Yellow, brown and red cherts, however, are distributed much more widely throughout the site.

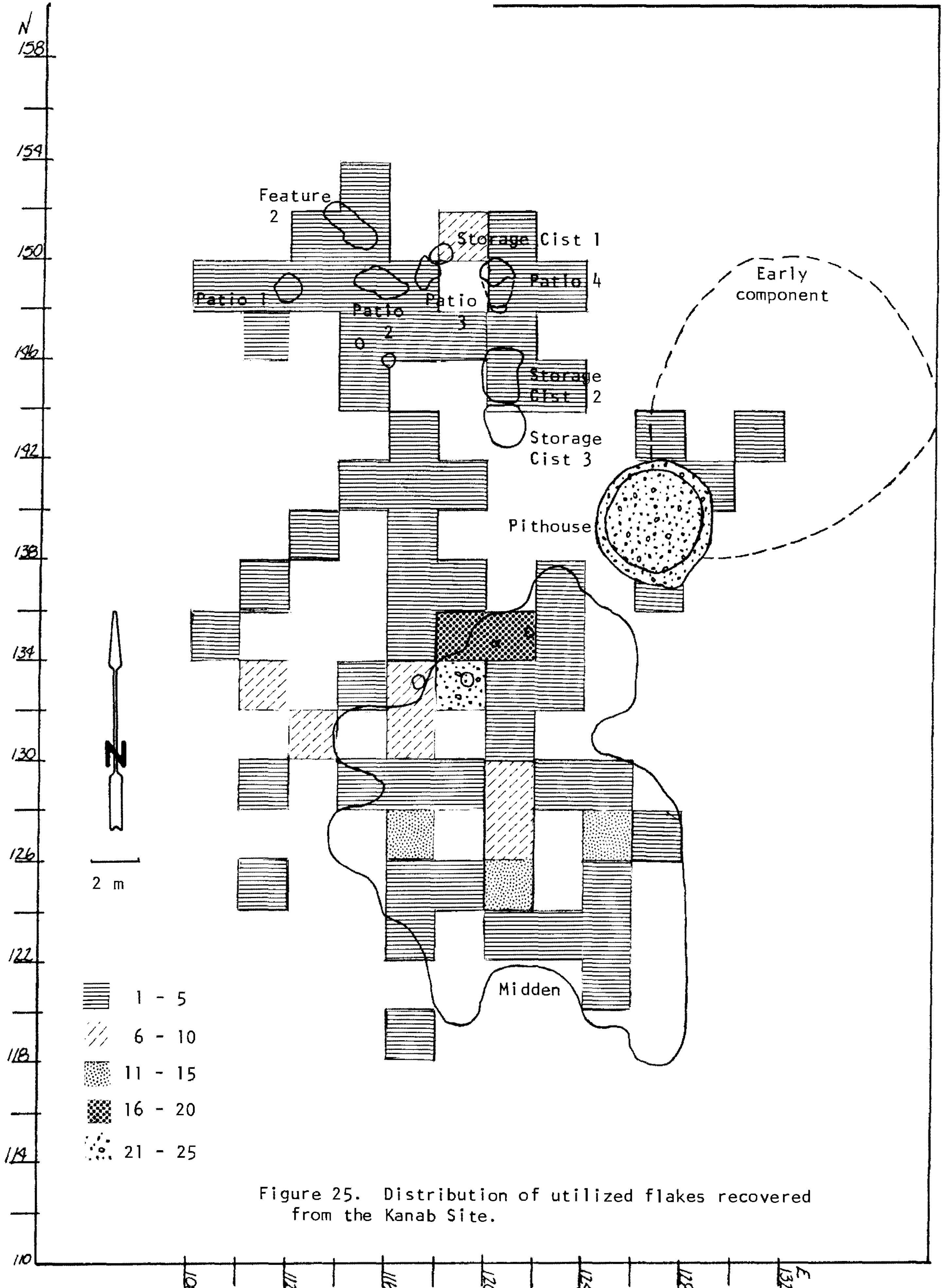

Figure 25. Distribution of utilized flakes recovered from the Kanab Site.

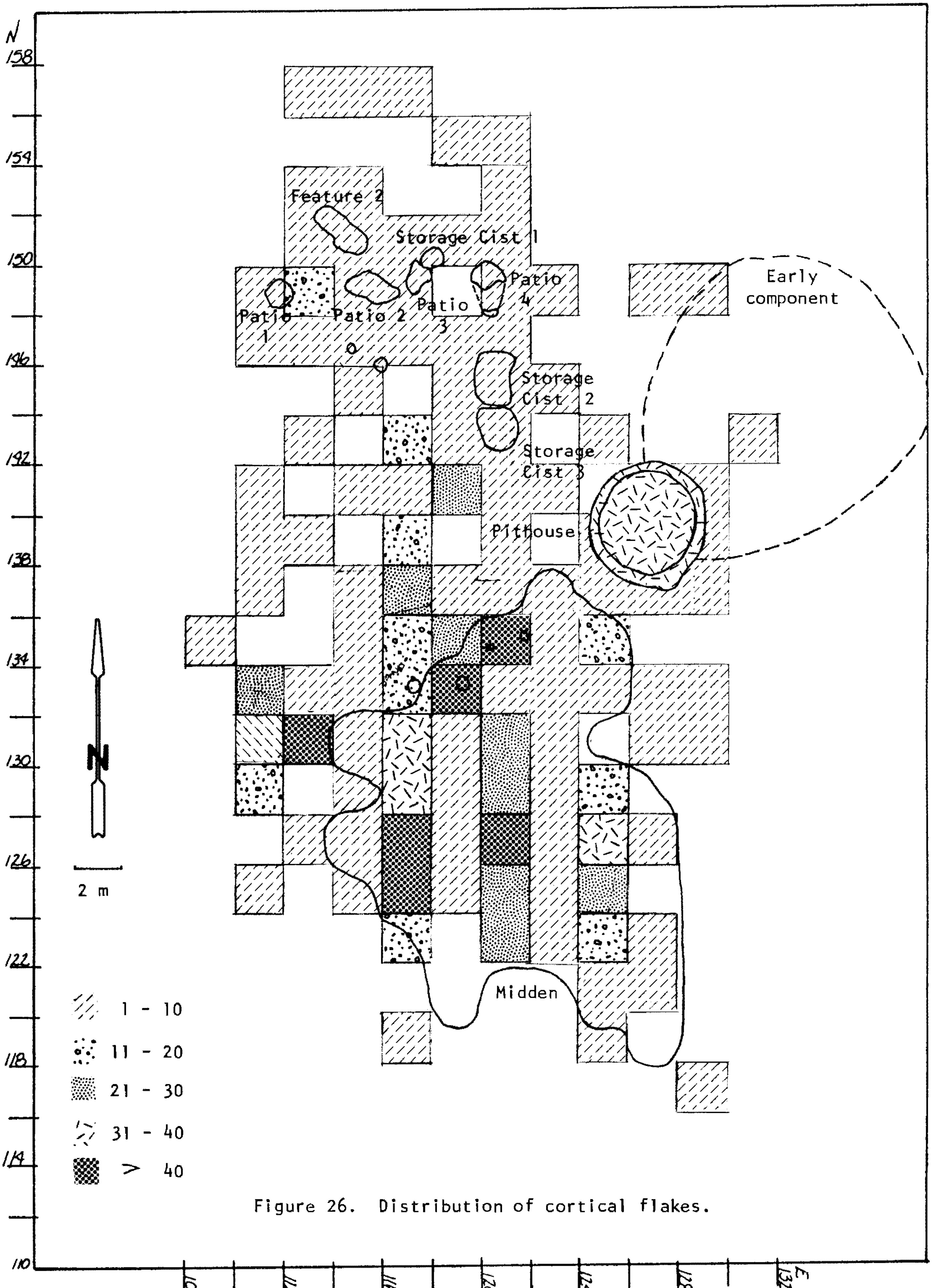

Figure 26. Distribution of cortical flakes.

Table 2. Characteristics of nineteen defined stone types at the Kanab Site.

Type No.	Stone Type Description	Raw Material	Texture	Translucent?	Inclusions	Color(s)
1	clear chalcedony with red, gray, brown inclusions	chalcedony	waxy, glossy	yes	red, brown, gray dots, some dendritic	red, gray, and brown in clear body
2	white chalcedony	chalcedony	waxy, glossy	yes	no	white, tending to clear
3	dark brown chalcedony	chalcedony	waxy, glossy	yes	no	dark brown, reddish brown
4	light brown chalcedony	chalcedony	waxy, glossy	yes	black dots	light brown tending to yellow
5	white chert	chert	smooth non-glossy	no	red dots occasionally, chalcedony inclusions	white to yellow/white with occasional yellow bands
6	brown/gray chert	chert	smooth to fine-grained non-glossy	no	often banded	brown and gray, often banded with occasional yellow bands
7	oolitic chert	chert	smooth non-glossy	no	oolitic	red-brown-gray with white-yellow oolites
8	gray chert	chert	smooth non-glossy	no	no	light gray to black with some white streaks
9	yellow, brown and red chert	chert	smooth, dull to glossy	no	occasional chalcedony inclusions	yellow-orange-red with occasional gray streaks

Table 2, continued

Type No.	Stone Type Description	Raw Material	Texture	Translucent?	Inclusions	Color(s)
10	pink and red quartzite	quartzite	very coarse and grainy	slightly near edges	no	pink and red tending to purple
11	brown quartzite	quartzite	coarse and grainy	no	no	uniform light brown
12	dark brown quartzite	quartzite	medium grained	no	no	dark brown to black
13	gray quartzite	quartzite	coarse grained	no	no	gray to near white
14	black quartzite	quartzite	very coarse grained	no	no	black
15	conglomerate quartzite	quartzite	very coarse grained	no	numerous micro-pebbles	light brown tending to near white
16	obsidian	obsidian	vitreous glassy	yes	no	black
17	quartz crystal	quartz	vitreous glassy	yes	no	clear
18	siltstone/shale	siltstone/ shale	fine grained	no	no	reddish tan to gray
19	petrified wood	petrified wood	smooth to coarse, non-glossy	no	no	predominantly brown to yellow

Table 3. Distributions of chipped stone tools and flakes by stone type at the Kanab Site.

		Projectile points	Drills	Perforator	Notches	Unifacial Scrapers	Bifacial Blades	Bifacial Knives	Choppers	Total Tools	% Tools	Cores	Flaked Cobbles	Flakes	% Flakes
Chalcedonies	1	3(21.4)			1(50.0)	1(14.3)	3(5.5)	2(6.3)		10	7.6			132	4.49
	2	2(14.3)			1(50.0)	1(14.3)		1(3.1)		5	3.8			54	1.83
	3													6	0.20
	4			1(100.0)			1(1.8)		1(6.7)	3	2.3		1(3.1)	14	0.48
Cherts	5	2(14.3)					4(7.3)	1(3.1)		7	5.3			42	1.43
	6	2(14.3)					4(7.3)	5(15.6)	1(6.7)	12	9.1		2(6.2)	117	3.98
	7	1(7.1)	2(33.3)			2(28.6)	13(23.6)	9(28.1)	1(6.7)	28	21.2	3(50.0)	1(3.1)	130	4.42
	8	1(7.1)	1(16.7)				1(1.8)			3	2.3	2(33.3)		52	1.77
	9	2(14.3)	3(50.0)			3(42.9)	29(52.7)	10(31.3)		47	35.6		23(71.9)	1874	63.68
Quartzites	10	1(7.1)							1(6.7)	2	1.5			126	4.28
	11													2	0.07
	12													5	0.17
	13								1(6.7)	1	0.8			2	0.07
	14													5	0.17
	15													1	0.03
Obsidian	16													1	0.03
Quartz crystal	17													2	0.07
Siltstone/ shale	18							2(6.3)	10(66.7)	12	9.1	1(16.7)	4(12.5)	325	11.04
Petrified wood	19							2(6.3)		2	1.5		1(3.1)	53	1.80
TOTALS		14	6	1	2	7	55	32	15	132	100.0	6	32	2943	100.0

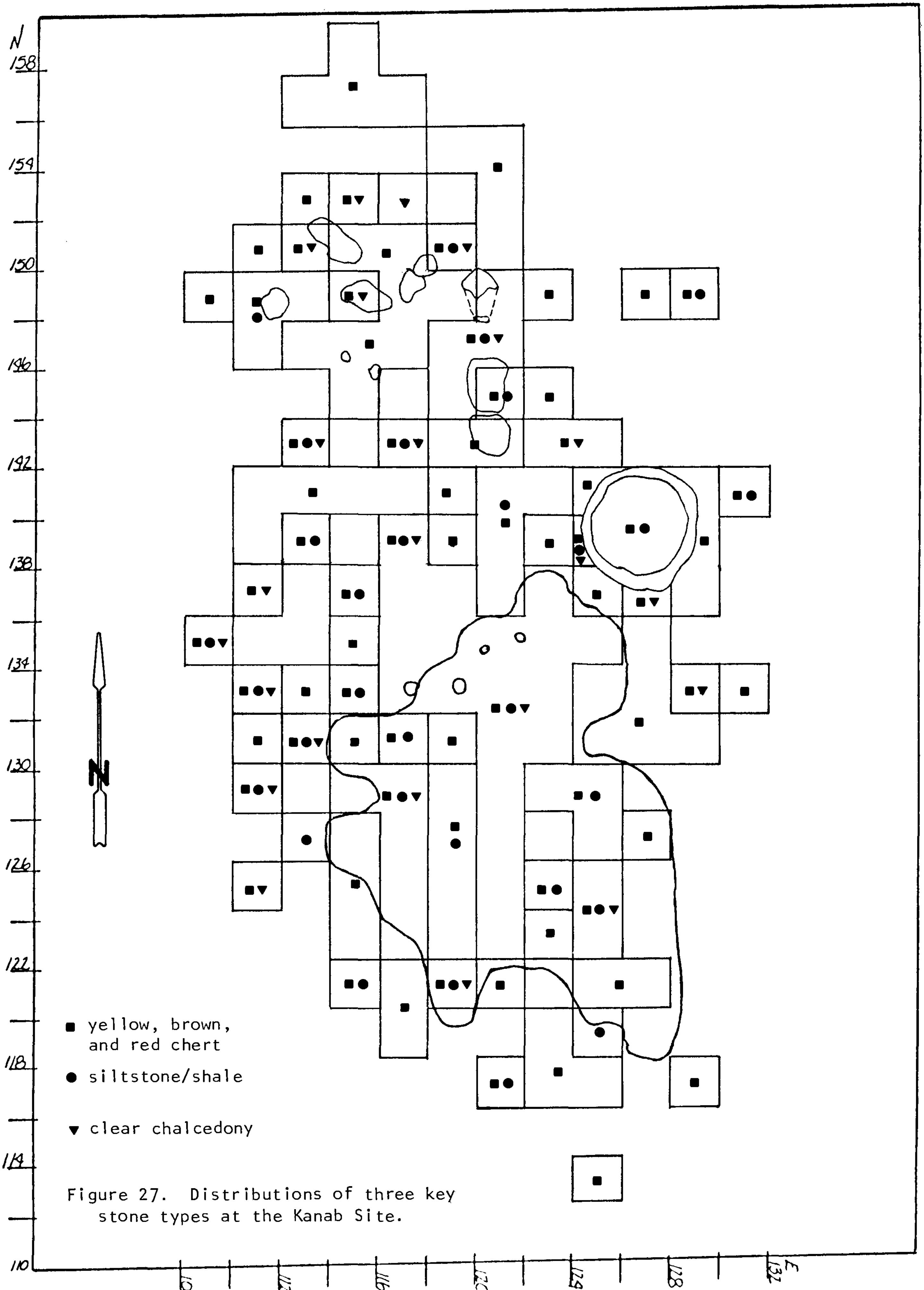

Figure 27. Distributions of three key stone types at the Kanab Site.

Striking Implements

Hammerstones

A variety of hammerstones was recovered from the Kanab Site. For the most part, they consist of fist-sized (average diameter: 7 cm) quartzitic river cobbles evidencing varying degrees of battering. Two general "types" of battering were observed. The chief variety (37 out of 47, or 79%) showed extreme battering, crushing, and edge rounding on virtually all protrusions of the hammerstone (Fig. 28a-c). This type was probably used for heavy tasks such as shaping of the many sandstone slabs used in the site architecture. The distribution of these hammerstones tends to bear out this line of reasoning (Fig. 24). Extremely high densities occur in the vicinities of the sandstone architectural features. A second type of hammerstone shows evidence of much lighter use (Fig. 28d, e). Patterns of wear occur in tight circular areas suggesting use in flint-knapping activities where percussion flaking makes use of small distally projecting portions of the hammerstone. The distribution of these ten hammerstones is centered to the northwest of the midden, in the pithouse, and in the vicinity of work patios 1 and 2 (Fig. 24). This pattern is nearly identical to the concentrations of primary decortication flakes shown in Figure 26, suggesting that these hammerstones may have indeed been used in flint-knapping activities.

Pounding Stone

A single sandstone half-sphere was encountered which has apparently been shaped through pecking or pounding (Fig. 28f). Woodbury (1954:93) attributes a number of possible functions to these artifacts ranging from crushing seeds or plant fibers, to hide preparation, to crushing paint minerals, to dressing building stones. The latter may be likely in this case since it was located adjacent to storage cist 3 (Fig. 24). It measures 4.5 cm in diameter.

Petrified Wood Pecking Stone

A single elongated specimen of petrified wood 4.5 cm in length was recovered with one end rounded due to pecking (Fig. 28g). Woodbury (1954:192) comments that petrified wood was occasionally used for pecking stones in a series of northeastern Arizona sites. Petrified wood is fairly common in the Kanab vicinity. This artifact occurred in the area of the pithouse (Fig. 24).

Hoe

A single flaked and ground sandstone implement may have functioned as a hoe. It was encountered on the floor of storage cist 3 (Fig. 29). This specimen is side-notched and bears evidence of wear on both opposing edges (Fig. 32).

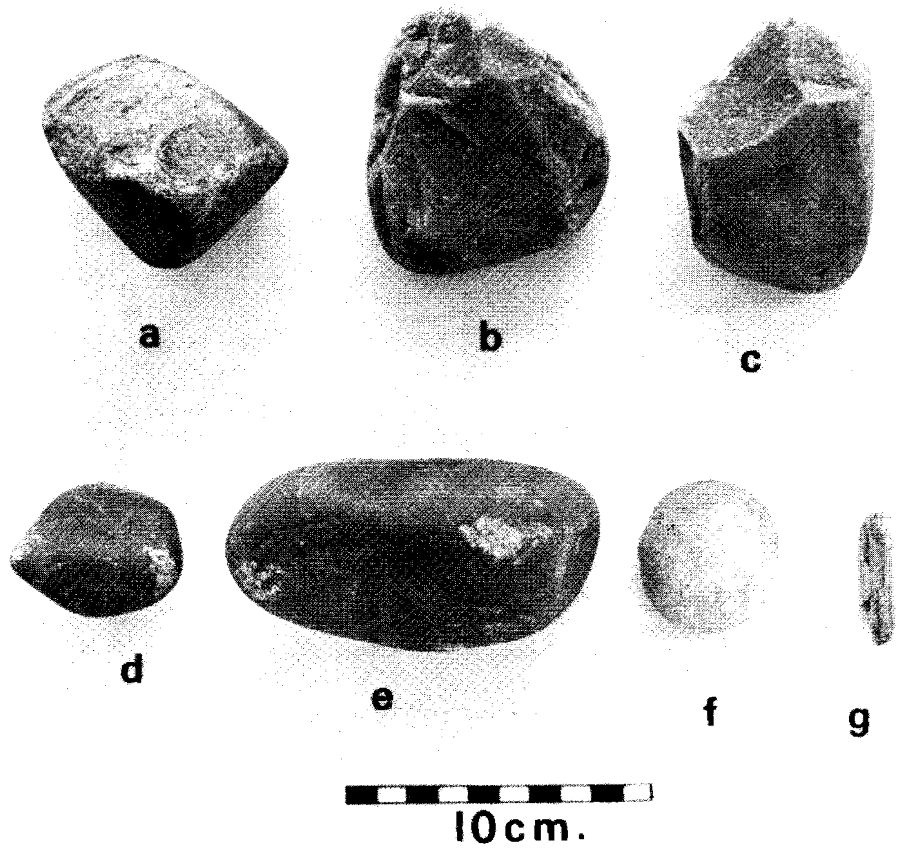

Figure 28. Hammerstones (a-e), pounding stone (f), and petrified wood pecking stone (g).

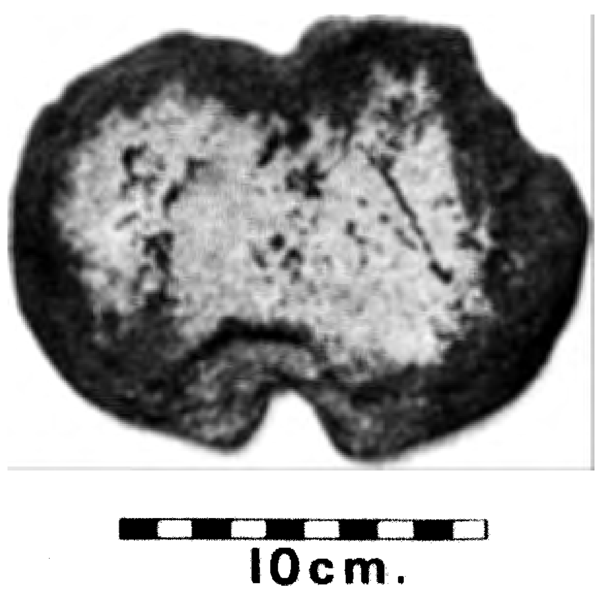

Figure 29. Sandstone hoe.

Grinding and Polishing Stones

Manos

Five manos were recovered from the Kanab Site; four of sandstone, one of limestone. One mano (Fig. 30b) was used in a trough metate and is characterized by a single convex grinding surface with the ends canted or beveled from rubbing against the sides of the trough (Woodbury 1954:67). The remaining four were used on flat metates (see Fig. 30a). One of the latter represents a "grooved and notched" mano (Woodbury 1954: 47) which was evidently reused after breaking in half as a hafted pounding implement (Fig. 30d). The distribution of manos is concentrated in the vicinity of the work patios and storage cists (Fig. 32).

Handstones

Handstones or "one-hand" manos are distinguished from manos primarily on the basis of size and form. Five whole or fragmented handstones were retrieved (Fig. 30c). They are distributed throughout the site (Fig. 32).

Metates

Two fragments of trough metates and three fragments of slab metates were encountered. All contain evidence of trimming and shaping of the lateral edge margins. The former, of course, are characterized by a deeply shaped trough (Fig. 31a, b). All but one were recovered from the work patio/storage cist area (Fig. 32).

Grinding Slabs

These artifacts are differentiated from metates in that they are not carefully shaped tools and consist only of a grinding surface. Although no complete specimens were recovered, pieces representing about 14 such slabs are represented (Fig. 31c). In direct contrast to the metate distribution, virtually all grinding slabs occur near the northwestern periphery of the midden (Fig. 32). This supports differential uses or functions between the grinding implement types.

Rubbing Stone

This artifact consists of an angular piece of petrified wood with a single edge that exhibits extreme polish and rounding (Fig. 31d). This artifact was discovered in the Feature 2 matrix (Fig. 32) and may possibly have served for tasks such as hide rubbing (Woodbury 1954:93). It is 6 cm long.

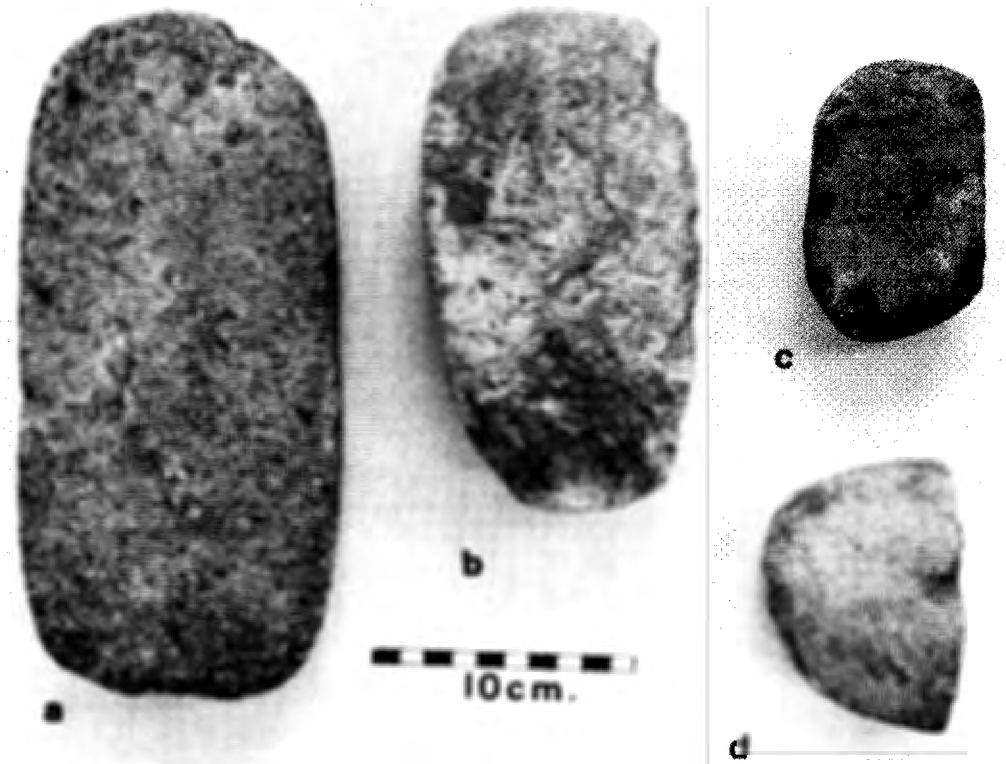

Figure 30. Manos (a-b, d) and handstone (c).

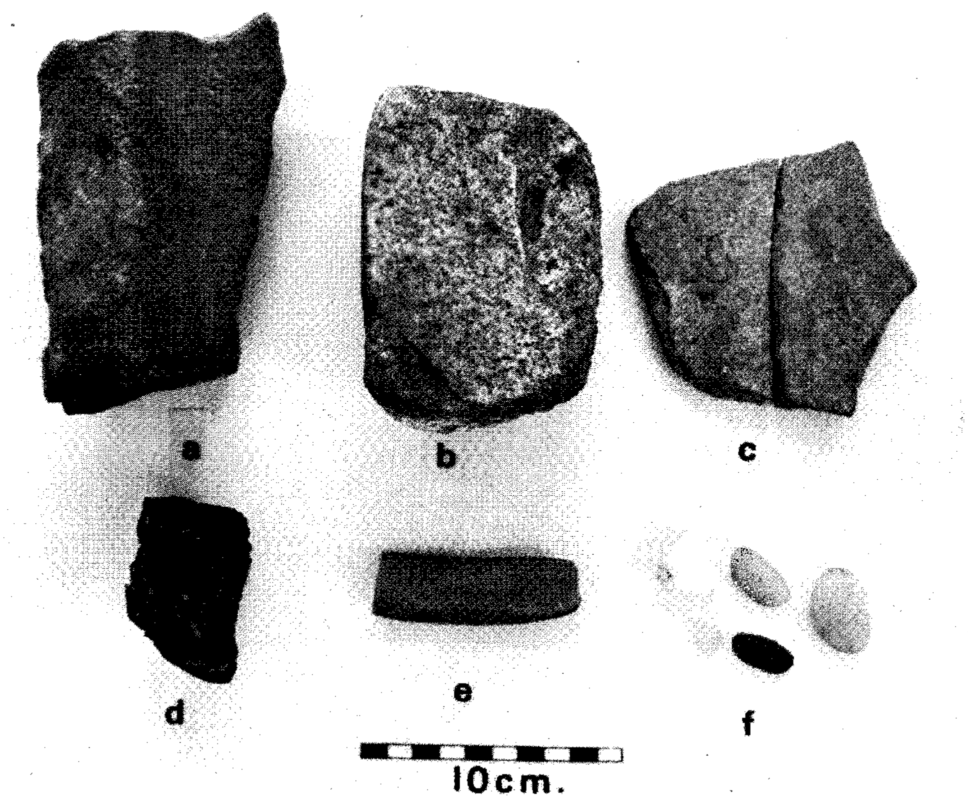

Figure 31. Metate fragments (a-b), grinding slab fragment (c), rubbing stone (d), abrading stone (e), and pebble polishers (f).

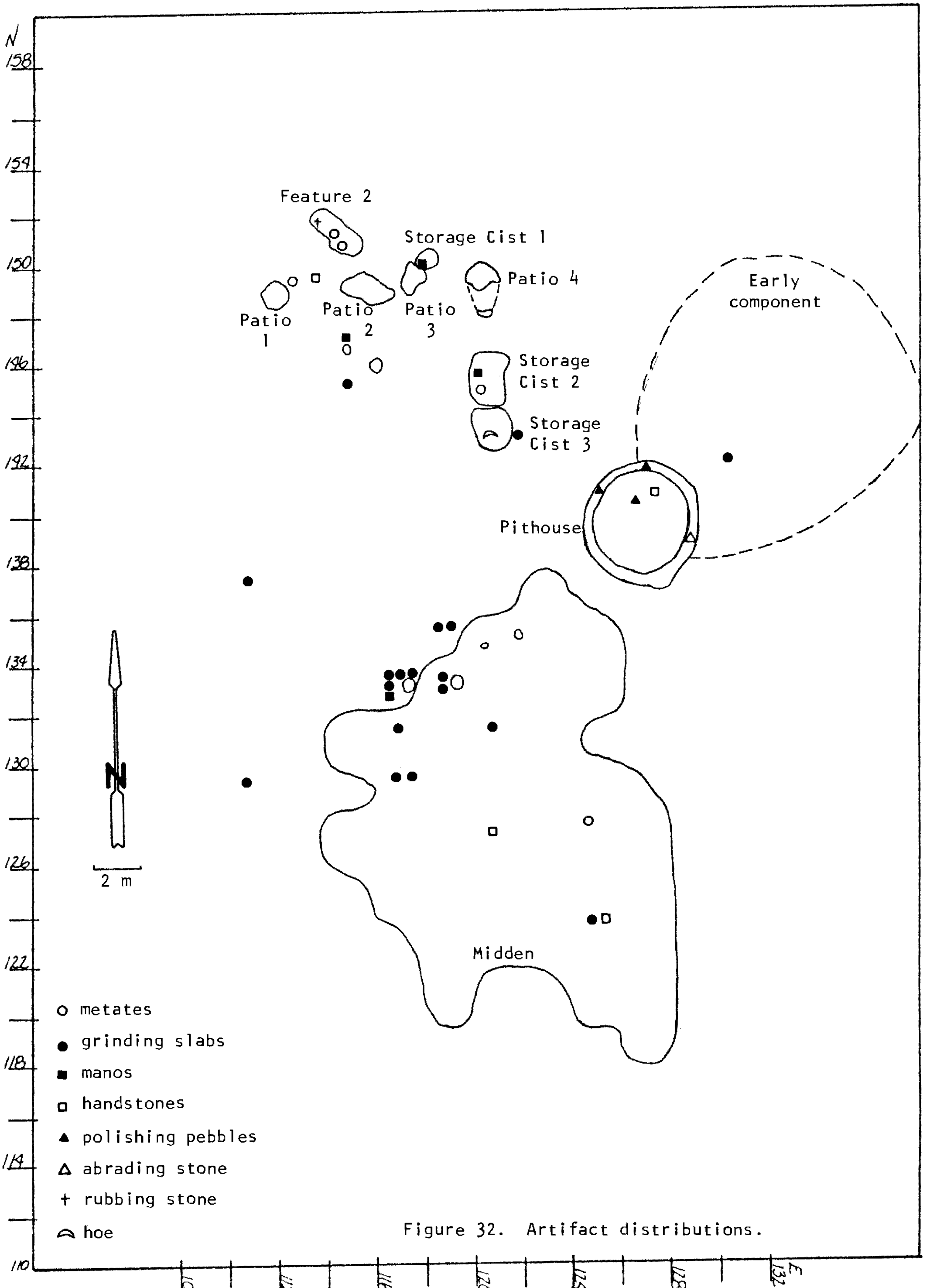

Figure 32. Artifact distributions.

Abrading Stone

An unusual elongated sandstone specimen about 8 cm in length with a lenticular cross-section was encountered in the pithouse (Fig. 32). It is interpreted as an abrading stone (Fig. 31e).

Pebble Polishers

Three quartzitic polished pebbles were encountered in the pithouse (Fig. 32). All are water worn and less than 3 cm in size (Fig. 31f). Their function is commonly attributed to use in pottery vessel manufacture.

Miscellaneous Stone

Jar Covers

Three circular sandstone slabs were recovered on the surface of bin B in the pithouse bench. A portion of a fourth circular slab was also encountered in the midden (Fig. 37). All have been shaped by bifacial spalling around the peripheral edges (Fig. 33a, b). Their average diameter is 18 cm with an average thickness of 1.5 cm.

Sandstone Disks

Two nearly identical sandstone disks about 6 cm in diameter and .75 cm thick were encountered in the vicinity of Feature 2 (Fig. 37). They have been shaped through bifacial flaking or attrition of the outer edge margins (Fig. 30c, d). These are very similar to those encountered at Bonanza Dune (Aikens 1965: Fig. 39) and may represent pendant blanks.

Bird Fetish

A limestone river pebble which has been roughly shaped to resemble the characteristics of a bird was encountered near the surface of bin B on the pithouse bench (Fig. 37). This item measures 3.9 cm in length (Fig. 34a).

Flaked, Polished, and Ground Specimen

An unusual white chalcedony item was recovered near the bird fetish in the vicinity of bin B in the pithouse (Fig. 37). This item is made from a flake, and is technically bifacially flaked although most of the flaking occurs on one side. The flake scars are only in the vicinity of the edges. The specimen is highly polished due possibly to water action, all edges are heavily ground almost to the point of flatness, and limited grinding is apparent on both faces. This specimen served an unknown purpose. It measures 2.9 cm in length, 1.6 cm in width, and 0.5 cm in thickness (Fig. 34b).

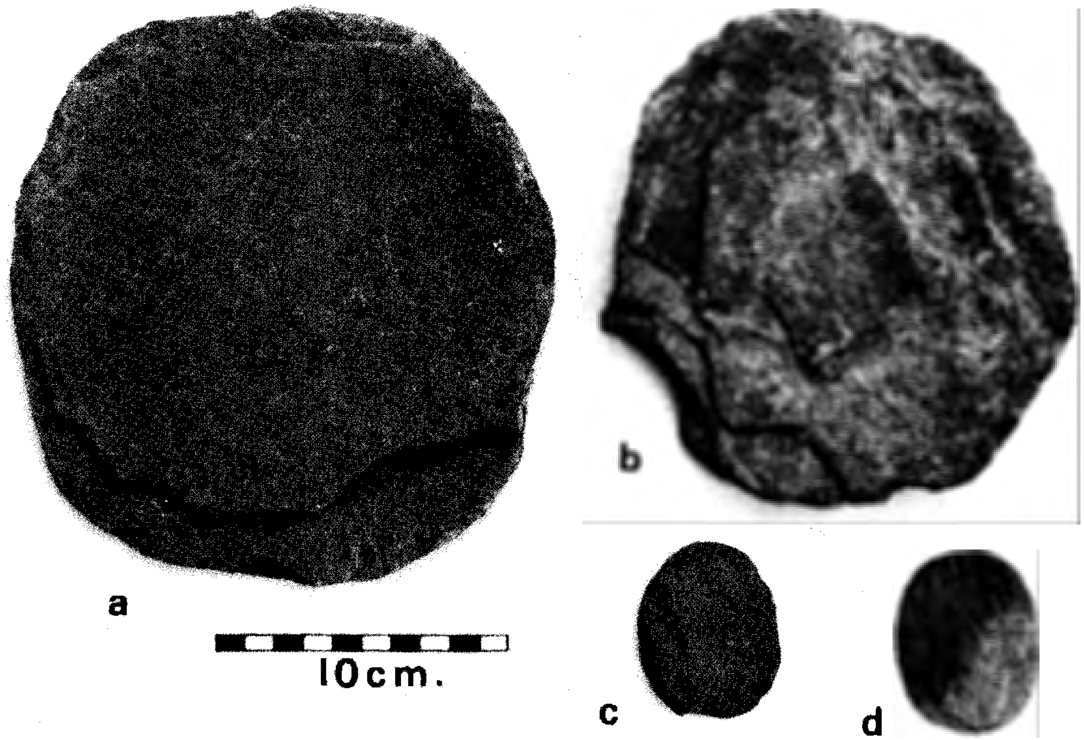

Figure 33. Jar or cist covers (a-b) and sandstone disks (c-d).

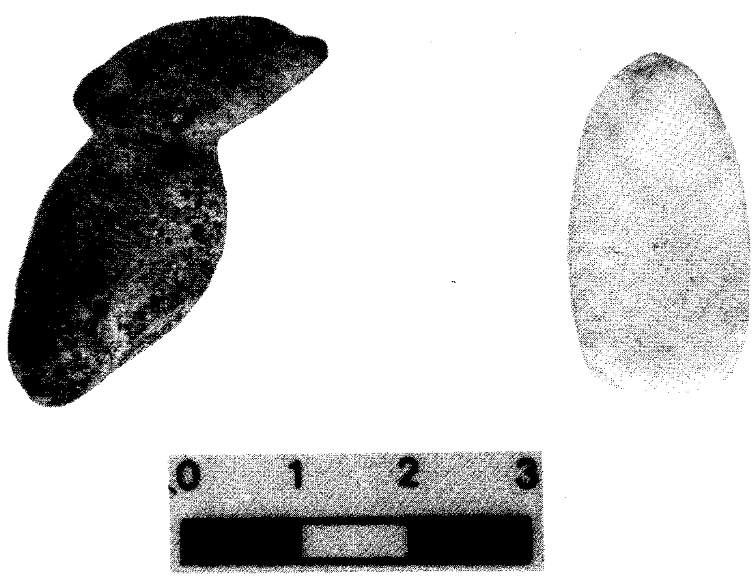

Figure 34. Bird fetish and flaked/polished/ground stone from the pithouse.

Shell Ornaments

Several shell jewelry items were recovered from the Kanab Site. Predominant among this class of artifacts is a series of seven fragments of Glycymeris shell pendants or bracelets (Figs. 35a-g; 37). Each of these pieces is heavily ground and smoothed, resembling similar ornamental specimens commonly found in the Hohokam culture area in southern Arizona (cf. Jernigan 1978:61-63). Three of the Kanab Site specimens have perforations, suggesting use as pendants although they may have functioned as bracelets as well. Of interest is the occurrence of an unworked fragment of Glycymeris shell (Fig. 36a) at the site indicating that some manufacture of these items may have taken place there.

Although due to the fragmentary nature of these shell ornaments the exact number of whole specimens cannot be ascertained, it is apparent that several pendants and/or bracelets are represented in the collection. The occurrence of Glycymeris shells at the Kanab Site is significant since such items are relatively rare in the prehistoric northern and western Anasazi area (Tower 1945; Jernigan 1978). Members of this genus occur only in the Gulf of California, a situation which, along with their infrequent occurrence in the Anasazi area, yields implications for the study of prehistoric trade routes and contacts.

Both Brand (1938) and Tower (1945) have reconstructed a shell trade route from the northern part of the Gulf of California, extending northward along the Colorado River, then up the Fremont River drainage into southwestern Utah. Indeed, Judd (1926: Plate 46) illustrates what appear to be Glycymeris shell artifacts from his work at a Fremont site near the town of Paragonah. One of Judd's specimens was recovered in Cottonwood Canyon, northwest of Kanab. Consequently, it appears that the proposed shell trade route extending up the Colorado River from the Gulf of California may have also served the central portion of the Virgin Anasazi area.

A single Olivella sp. shell bead was collected from the site surface near the location of the pithouse structure (Figs. 36b; 37). Olivella shells are relatively common throughout time in the Anasazi area. Near Kanab, a single Olivella bead was found at the Bonanza Dune site in Johnson Canyon (Aikens 1965:124), and possibly from an early Basketmaker context at Cave DuPont (Kidder and Guernsey 1922:82).

Ceramics

Ceramic sherds were plentiful at the Kanab Site with more than 11,000 pieces represented in the artifact assemblage. No whole or restorable vessels were recovered. The analysis of this class of artifacts followed a somewhat traditional approach with the sherds being separated into typological categories and observations made for temper material, design elements, vessel form, and rim profile.

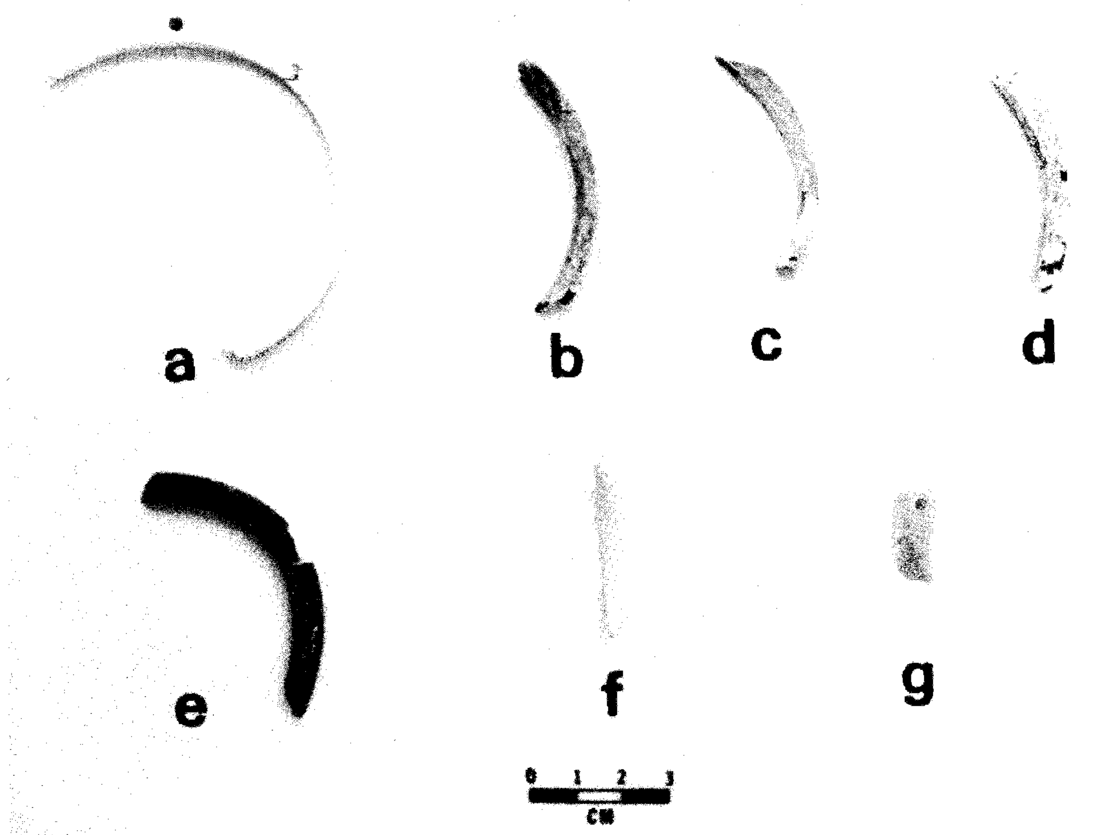

Figure 35. Glycymeris shell bracelet or pendant fragments.

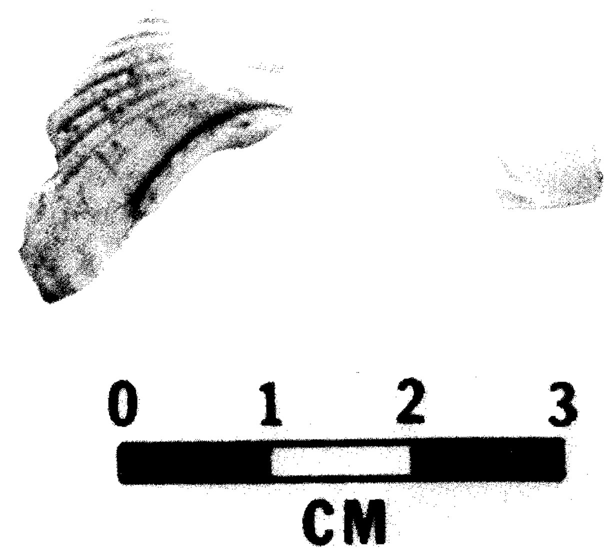

Figure 36. Unworked fragment of glycymeris shell (a) and olivella shell bead (b).

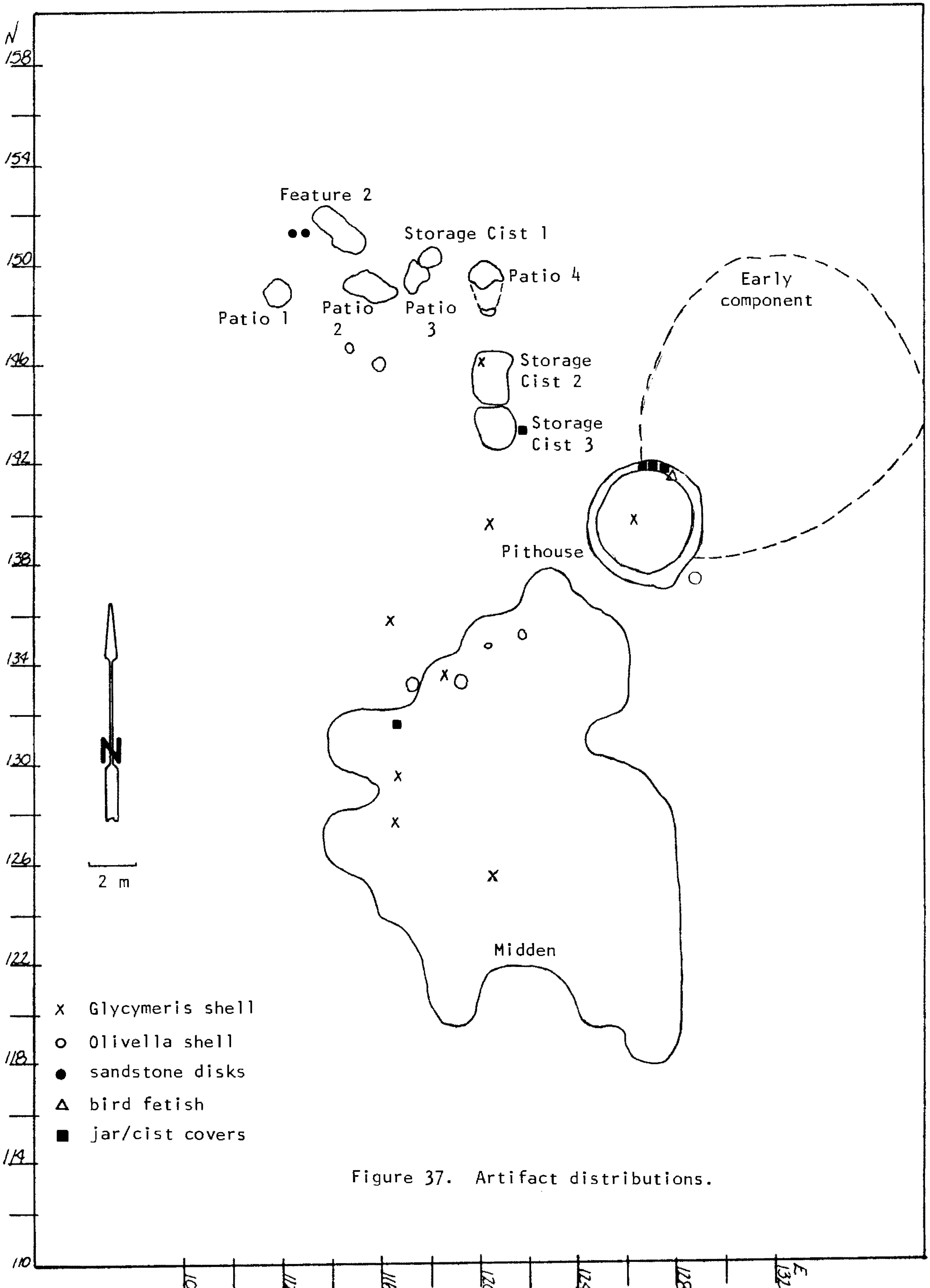

Figure 37. Artifact distributions.

Before summarizing the results of our tabulations, it should be noted that certain situations currently exist which would seem to indicate that a thorough review of Virgin Anasazi ceramic types and their spatial and chronological distribution is sorely needed (cf. Thompson 1980:50-59). Two points are crucial to this situation. First, the delineation of ceramic types for the Virgin area as presented by Herold Colton (1952) was originally based on a limited sample of sherds and, in all probability, was viewed too directly in relation to the better-known Kayenta ceramic series of northwestern Arizona. Colton (1952:13), for example, states that "since the Virgin Branch seems to be a western extension of the Kayenta Branch the pottery of the former cannot be understood without reference to that of the Kayenta Branch." While analogs exist between the two areas, as they do for other parts of the northern Southwest as well, it would appear that Colton's classification for the Virgin case is oversimplified, and that a reconsideration of the problem might well reflect important local variations and developments in Virgin Anasazi pottery manufacture and use.

The second crucial situation to the overall problem concerns a near total absence of chronometric dates from ceramic-bearing sites in the Virgin Anasazi region. This lack of dating control has dictated that investigators continue to extrapolate chronology from the tree-ring dated Kayenta analogs as originally postulated by Colton. As Thompson (1980:56) observes, it is at this time practical to continue to assign Virgin ceramic types to similar time frames as their analogs in the Kayenta area. Since only two radiocarbon dates are available from the ceramic-bearing component at the Kanab Site, our analyses cannot provide substantive data to this problem. Nonetheless, some comments regarding dating of ceramic types in the upper Kanab Creek drainage are offered later in the interpretations.

The results of our ceramic classification (based on Colton 1952) are listed in Table 4. These data indicate a somewhat "pureness" in the presence of ceramic types as our analysis yielded relatively few categories, with the groupings of specimens assigned to a given type being rather clear-cut. We admit to the possibility of some "lumping" in the classification; however, certain traits which are important to regional interrelationships were examined without success. These include sorting for sherds of the Moapa Series (identified by the inclusion of olivine sand in the temper material), and checking for Kayenta types.

With the exception of one type, the ceramics from the Kanab Site reflect local ceramic manufacture, dominated by sherds classified as North Creek Gray. This utility ware comprises 84 percent of the total ceramic sample. A majority of the North Creek Gray rim sherds are of the everted and downturned form (Fig. 38), with both rim and body sherds indicating a globular vessel shape. A single North Creek Gray jar rimsherd exhibited decoration (Fig. 38). Other utility pottery included: North Creek Gray-Fugitive Red (1%); Shinarump Gray (or Brown) (3%); Shinarump Gray-Fugitive Red (.02%); and one sherd of Shinarump Corrugated. The latter sherd came from the surface of the Kanab Site, and in the absence of subsurface sherds of the same type, is probably a post-occupational intrusive from the nearby 42Ka1970 at which corrugated sherds are more plentiful on the surface.

Table 4. Pottery sherd tabulation by provenience and depth.

Excavation Unit/Depth	North Creek Gray	North Creek Gray-Fugitive Red	Shinarump Gray	Shinarump Gray-Fugitive Red	Shinarump Corrugated	Washington Black-on-gray	St. George Black-on-gray	St. George Black-on-gray-Fugitive Red	Bluff Black-on-red	Total
Surface	1116	1	21		1		143			1282
Test Squares										
0-10 cm	469	7	32	1		1	50		2	562
10-20 cm	2964	25	84				422	7	10	3512
20-30 cm	336	6	22	1			50	9	3	427
30-40 cm	900	17	45				129	3		1094
40-50 cm	134	4	4				22			164
50-60 cm	47	3	5				8			63
60-70 cm	34	2	6				7			49
Unknown depth	176		9				12			197
Midden										
0-20 cm	2029	15	68				320	6		2438
20-40 cm	551	13	31				90	1		686
Features										
Feature 2, 0-12 cm	68		3				1			72
Patio 1, 0-8 cm	50						3			53
Patio 4, 0-20 cm	61		2				2	2		67
20-40 cm	42		1				3	1		47
Cist 1, fill	32		15							47
Cist 2, fill	2									2
Cist 3, fill	9		3							12
Pithouse, fill	235		1				14	1		251
0-10 cm above floor	102	9	3			1	5			120
floor and subfloor	6	3	1					9		19
bench	28						8			36
hearth	8	1								9
TOTAL	9399	106	356	2	1	2	1289	39	15	11,209
% OF TOTAL	84%	1%	3%	.02%	.01%	.02%	11.5%	.4%	.1%	

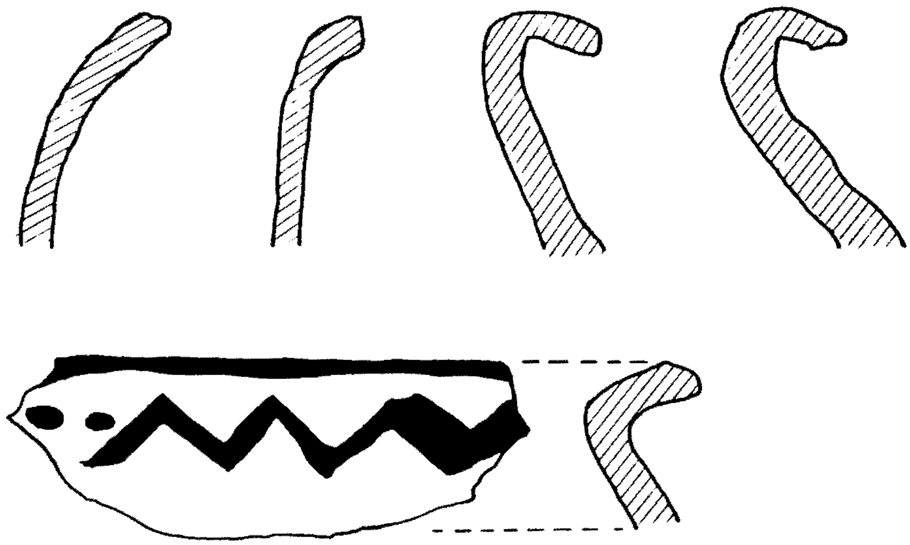

Figure 38. North Creek Gray rim forms and decorated rimsherd.

Decorated pottery is dominated by sherds of bowls which have been classified as being St. George Black-on-gray. Variations in rim profiles and decorative elements in these sherds are shown in Figure 39. A caveat is in order, however, regarding this classification which should be noted for those utilizing our findings in the comparative sense. It seems possible that, based on design elements, some of the sherds in question could be classified as North Creek Gray, Sosi Style, a pottery believed by Colton (1952) to be analogous to Sosi Black-on-white in the Kayenta area.

Based on the available literature, at this point we are not confident such a designation is appropriate and there are several reasons for our hesitance to classify these sherds with Sosi-like designs as North Creek Black-on-gray. One of these is the complete absence of design styles which are called Dogoszhi, a Kayenta contemporary of Sosi Black-on-white. This style occurs in the Virgin area as North Creek Black-on-gray, Dogoszhi Style, apparently a contemporary of North Creek Black-on-gray, Sosi Style (Colton 1952). Secondly, if our estimations of the age of the Kanab Site are relatively accurate (to be discussed more fully in the next chapter), and if the style and dating analogies between the Virgin and Kayenta areas are valid, then there may be a temporal problem. According to Breternitz (1966), the Sosi and Dogoszhi types began a period of popularity in the Kayenta area about A.D. 1075 and 1085, respectively. This is about the time the Kanab Site was apparently abandoned. Finally, we note that the Sosi-like designs found on the Kanab sherds fall within the range of decoration variation for Black Mesa Black-on-white (Colton 1955), the proposed analog of St. George Black-on-gray. As a consequence, then, we are hesitant to assign such sherds to the later North Creek Black-on-gray, Sosi Style category at this time since the point of delineation between it and the later forms of St. George Black-on-gray is not clear-cut. Contextual data indicate to us that the sherds are probably the earlier type (i.e. St. George Black-on-gray).

Fifteen sherds of trade redware were recovered during excavations at the Kanab Site. Investigators familiar with both Kayenta and San Juan redwares have positively identified these sherds as Bluff Black-on-red, based on temper (David A. Breternitz and William A. Lucius, personal communication). This type is a Pueblo I pottery style which enjoyed maximum popularity in the Four Corners area ca. A.D. 759-900 (Breternitz et al. 1974). Of potential importance is another sherd of redware which was collected from the surface of 42Ka1970 and identified for comparative purposes. That sherd was classified as Tusayan Black-on-red, a Kayenta type dated as a trade product between A.D. 1050 and about 1200. Although the evidence is not conclusive, it appears that direct contact and/or trade with the Kayenta area was not present during occupation of the Kanab Site, but did occur in subsequent decades.

Nineteen of the sherds were noted to have been utilized as tools with the following type distribution: plain gray - 15; St. George Black-on-gray - 3; and Bluff Black-on-red - 1. In each case one or more

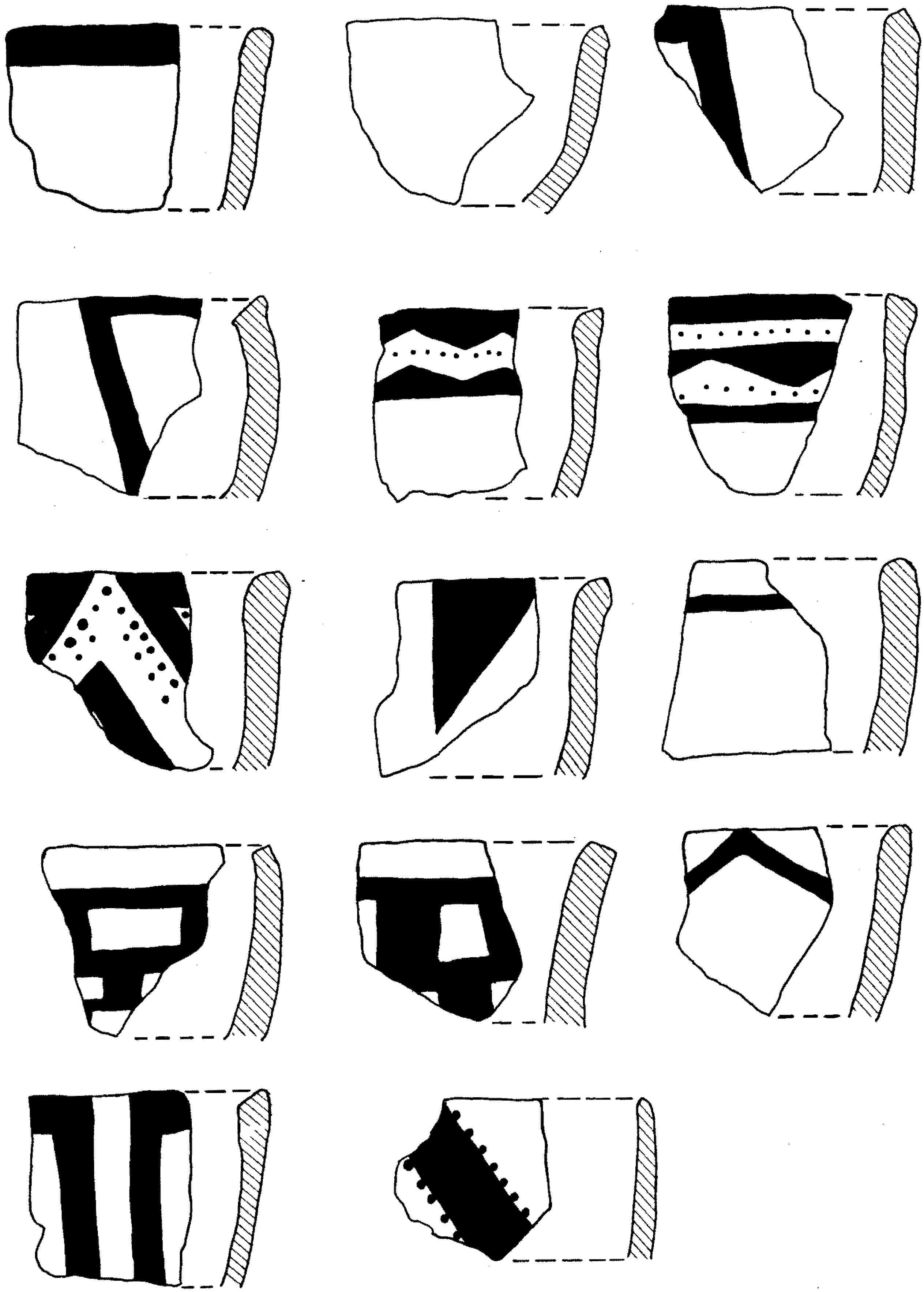

Figure 39. Rim forms and decorative elements of St. George Black-on-gray pottery at the Kanab Site.

edges of the sherd are worn and rounded, indicating utilization as a scraping implement. Two or three of the sherds may be fragments of worked disks or pendants but positive identification as such is impossible.

Due to a paucity of nearby excavated and reported site information, it is difficult to compare the ceramic situation at the Kanab Site with similar results. At the Johnson Canyon sites (Bonanza Dune and Sand Hill Sites), Aikens (1965) reports a similar dominance in North Creek Gray, but with a more relative percentage of Shinarump Gray and, importantly, significant quantities of corrugated sherds in association. At both sites, North Creek Black-on-gray, Sosi and Dogoszhi Styles, was the predominant decorated type. Based on Aikens' ceramic assemblages, it appears that the Kanab Site predates Bonanza Dune and Sand Hill, at the later period of occupation, since Aikens posits a timespan of A.D. 900-1200 for both. Other early ceramic collections from the area (Judd 1926; Steward 1941) are not reported in sufficient detail for comparison.

One point that can be made is that Fremont Culture ceramics are rare or perhaps nonexistent in the upper Kanab Creek drainage, although our present samples are admittedly small. No Fremont sherds were found at the Kanab Site, and only two possible Fremont sherds were identified at the Johnson Canyon sites (Aikens 1965:32).

Faunal and Floral Remains

Remains of animals and plants recovered from the Kanab Site were not plentiful, but those found do provide some insight into the prehistoric subsistence pattern and for correlations between the modern environment and that extant at the time of occupation. The majority of these data result from specialized studies of the faunal remains and pollen samples collected throughout the cultural features at the site. Extended discussions of these analyses can be found in Appendices B (fauna) and C (pollen).

Fauna

Several species were utilized for food at the Kanab Site. As expected these animals reflect the site's location near open grass and shrub lands to the south and the higher elevations of the Vermilion Cliffs to the north. Artiodactyls--deer, pronghorn, and bighorn sheep--are represented as components of the prehistoric diet, along with several smaller species. Turkeys were seemingly kept at the village since bones of both immature and adult birds were recovered. Additionally, numerous pieces of eggshell were found in the midden.

Flora

Corn was certainly a component of the diet since a few charred kernels were noted in the midden and pollen of this plant was found in small quantities in most of the samples analyzed. No macrospecimens or pollen of cucurbits and beans were recovered. The pollen record indicated probable native utilization of chenopods, beeweed, Mormon tea, buckwheat, prickly pear cactus, cattail, and possibly evening primrose.

CHAPTER V

SITE INTERPRETATION AND DISCUSSION

Architecture

The Kanab Site was occupied at least twice in prehistoric times. Evidence for the intial use of the locale ca. 520 $\pm$ 120 is unquestionable; however, a general lack of cultural features and artifacts in the excavated portion of the site permits little interpretation except to say that occupation occurred. In the traditional chronological framework, this time span covers the Basketmaker II and III stages of Pueblo culture, and the Moapa and Muddy River Phases in the Virgin region. Nearby, the only documented site of a similar age is Cave Du Pont (Nusbaum 1922), which is also aceramic although some "pseudo-pottery" (i.e. unfired) was recovered there.

The architectural features at the Kanab Site were contemporaneously utilized and fit the early Pueblo site pattern with a pit dwelling and associated surface storage units and midden area. The domestic unit with its vertically set sandstone slab walls, clay floor, and clay-rimmed fireplace is similar to other early Virgin structures (cf. Aikens 1965, 1966). The resemblance of floor features at the Kanab Site pithouse to those at Bonanza Dune in Johnson Canyon has also been noted. Likewise, the use of flagstone floors in the storage cists is common throughout the region. In the absence of evidence to the contrary, we would agree with Aikens (1966:40) that this construction technique probably aided in keeping rodents away from stored foodstuffs. Although careful scrutiny was exercised, the method(s) of roofing the storage cists could not be ascertained. Some rocks in the fill of storage cists 2 and 3 may be related to this situation.

The site layout is slightly at variance with the expected pattern, although few data are available for this aspect of early Virgin sites. This situation led to a certain degree of difficulty in locating the pithouse during excavation procedures, a circumstance which may be offered as a warning to future investigators in the area. Although certain features were evident (or nearly so) at the surface, detection of the pithouse and early cultural level was greatly aided by extensive use of a backhoe. Without this mechanical assistance, it is likely that these features might have been missed, or that discovery would have required an inordinate amount of time and expense if pursued by manual excavation. Consequently, the use of a backhoe or similar machine is highly recommended at sites of a like nature.

Dating/Demography

Precise dating of the cultural components at the Kanab Site was unfortunately hindered by budgetary constraints; however, as noted in the introduction, three chronometric dates were obtained which represent the first reported chronological determinations for the immediate area. Even so, abundant charcoal was scarce at the site as only three additional radiocarbon samples were collected during excavation. These undated samples will be curated with the artifacts at the Southern Utah State College Museum where they will be available for possible future analysis.

The radiocarbon dates and their associated standard deviations are summarized in Figure 40, along with previously published dates for the Kayenta pottery analogs of the Kanab Site ceramics. By plotting the calculated standard deviations of the two dates from the later component, the overlap of the ranges of time indicates that the Kanab Site was last occupied in the last half of the eleventh century A.D. Of note is the near congruence between the radiocarbon dates and the tree-ring dates for the Tusayan pottery analogs found at the Kanab Site. Further, it may be hypothesized that the manufacture of corrugated pottery did not begin until ca. A.D. 1100 in the upper Kanab Creek drainage. Thus, the presence of corrugated sherds at the nearby 42Ka1970 would indicate a date for that site following abandonment of the Kanab Site.

It may also be possible to posit a cause for abandonment of the Kanab Site, although the validity of such a suspicion must remain circumstantial until additional data are accumulated. Based on their construction of a network of dendroclimatic tree-ring chronologies from several areas within the Southwest, Dean and Robinson (1977) have shown the last three decades of the 1000s to have been a period of subpar climatic conditions (i.e. yearly rainfall and annual temperatures) in this area of the Southwest. Indeed, beginning in A.D. 1070, this situation grew increasingly worse through A.D. 1099, with lower than normal precipitation and above-normal temperatures. During the decade A.D. 1090 to 1099, for example, climatic conditions in the upper Kanab Creek area were 1 to 1.5 standard deviations below normal.

If the radiocarbon determinations from the Kanab Site do indeed reflect a true estimate of occupation at the site, then we feel it is important at this time to note the concordance between a dated occupation and a similarly known period of climatic stress. We would not, of course, based on the data from one site, posit a widespread episode of population abandonment occurring throughout the upper Kanab Creek area during this period, but, on the other hand, numerous instances of climatic stress-related population movements have been previously delineated from areas throughout the prehistoric northern Southwest. Thus, until additional information of either a supportive or non-supportive nature is available, a hypothesis concerning the possibility of population shifts occurring during a climatically stressful period toward the end of the eleventh century is offered for future investigators.

If we look at the only other nearby data from excavated contexts, it appears that long-term village stability was not characteristic of the upper Kanab Anasazi populations during the Pueblo II-III era. Aikens (1965) observes, for example, that the Bonanza Dune site in Johnson Canyon was evidently occupied, abandoned, and reoccupied several times during its cultural sequence (estimated to extend from ca. A.D. 900-1200). This

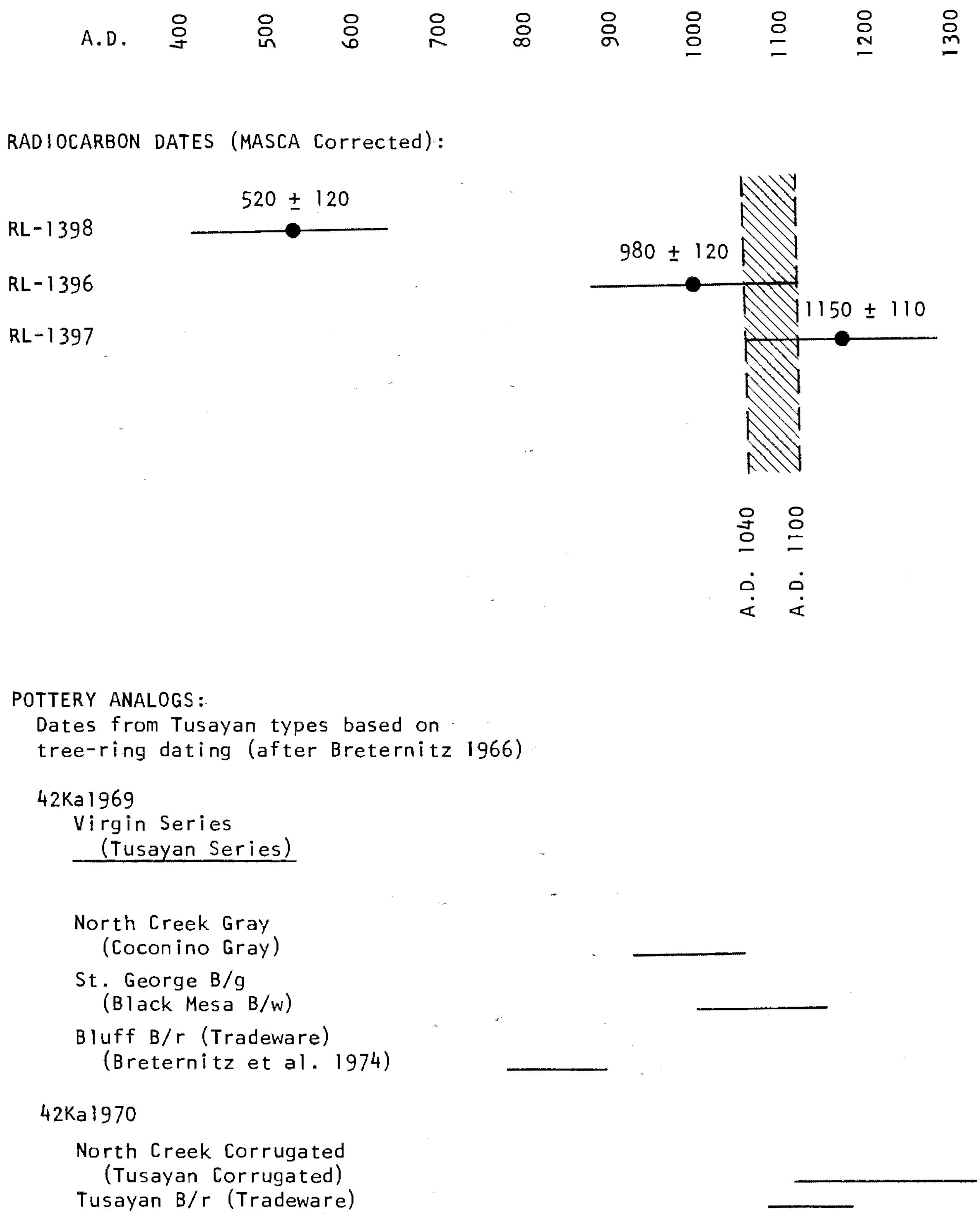

Figure 40. Dating summary for the Kanab Site and comparisons of pottery dates.

intermittent occupation took place despite the presence of a number of environmental factors which made the Bonanza Dune locale an especially suitable village setting. As a consequence, we may conclude, at least for the present, that although the upper Kanab Creek drainage witnessed aboriginal occupation throughout the Virgin Anasazi sequence, periodic population movements are reflected in the extant data. More complete explication of this situation awaits additional dated excavation results, but for now we may point to at least one example of contemporaneity between site abandonment and climatic stress at the Kanab Site.

Prehistoric Environment

Except for the possibility of climatic fluctuation during the latter 1000s, faunal and floral remains from the Kanab Site indicate basic similarity in the biota between that period and the present. Emslie (Appendix B) believes a single bone of sandhill crane from the site may indicate a greater distribution for this species than at the present, but this evidence is inconclusive due to the tentative identification of that particular bone. The only other animal which did/does not occur proximal to the Kanab Site is the bighorn sheep. This species has been documented historically in the Grand Canyon area, Virgin Mountains, and Grand Wash Cliffs of the Arizona Strip (Hoffmeister and Durham 1971), and its occurrence in the faunal assemblage at the site can probably be explained as a result of hunting forays.

Likewise, the pollen from the prehistoric deposits conform fairly well to the modern data. Interestingly, even though Kanab Creek was flowing at the present ground surface earlier (prior to entrenchment of the arroyo in the late 1800s), the pollen data do not indicate that a substantial riparian vegetation zone existed along the creek in prehistoric times, at least in the late 1000s.

Subsistence Economy

By using data from the Kanab Site excavations, and similar information from nearby sites, it is possible to summarize the subsistence patterns employed by the Virgin Anasazi of the upper Kanab Creek area. Undoubtedly these data are incomplete, but are sufficient to allow certain statements. In general terms, these groups are thought to have relied on a mixed subsistence economy based on agriculture and supplemented by the collection of wild flora and fauna. It is not, however, possible to state at this time the relative dependence on one source or the other.

Corn was grown in the area, apparently throughout the Pueblo time frame since great quantities of corn remains were recovered from the Basketmaker II Cave Du Pont (Kidder and Guernsey 1922:66-70), as well as the Kanab Site and Bonanza Dune in Johnson Canyon (Aikens 1965:126). Corn remains have also been reported from Cottonwood Canyon and Upper Kanab Canyon by Judd (1926), and from several cave sites in Johnson Canyon and its tributaries by Steward (1941). The occurrence of corn pollen throughout the Kanab Site deposits, including the floors of several storage cists and the pithouse, indicates use of corn as a foodstuff was prevalent at that site.

Evidence of other prehistoric Southwestern cultigens--squash, beans, and cotton--was nonexistent at the Kanab Site, but limited data from other sites in the upper Kanab Creek drainage indicates they were probably found in the area at one time. Kidder and Guernsey (1922:70) report a squash peduncle and rind fragments from a cist at Cave Du Pont and Judd (1926:148) lists fragments of cotton cloth, as well as spindle whorls made of gourd rinds, from caves in Cottonwood Canyon. All of these specimens are probably of Basketmaker age. Steward (1941:311) discusses the recovery of a single bean from an alcove site in Seaman Wash, a drainage found immediately east of Johnson Canyon. As of this time, no squash, bean, or cotton remains have been recovered from post-Basketmaker contexts in the upper Kanab area; however, as previously noted, opportunities for such discoveries have been limited to date. Consequently, it is not possible to ascertain the relative importance of these plants in the prehistoric diet and for other uses.

A wide array of wild plants and animals was collected by the Virgin Puebloans of the upper Kanab Creek drainage to supplement grown crops. In addition to those detailed in Appendices B and C of this report, other investigators have noted the presence of sunflower, various grasses, yucca pods, and acorns in nearby cave sites, as well as bones of beaver, elk, prairie dog, bobcat, woodrat, and porcupine. Without a doubt, future investigations of micro- and macrofloral specimens and faunal analyses will increase the list of utilized biota.

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APPENDIX A. DESCRIPTION AND PROVENIENCE DATA FOR ILLUSTRATED ARTIFACTS

Figure Number	Description	Length (cm)	Width (cm)	Thickness (cm)	Material	Provenience/depth (cm)
18 a	projectile point	4.0	2.1	.35	white chalcedony	N side bench PH
b	projectile point	3.5	2.15	.30	clear chalcedony with red, brown and gray inclusions	PH 50 cm below surface to top of PH
c	projectile point	3.0	1.75	.35		N126 E116 NE$\frac{1}{4}$ 0-20
d	projectile point	3.25	1.45	.25	brown/gray chert	WP4 N148 E118 NE$\frac{1}{4}$
e	projectile point	2.15	2.00	.30	yellow, brown and red chert	N126 E120 NE$\frac{1}{4}$ 0-20
f	projectile point	2.5	1.9	.25	clear chalcedony with red, brown and gray inclusions	N126 E116 SE$\frac{1}{4}$ 0-20
g	projectile point	1.9	1.2	.2	white chert	N124 E116 NE$\frac{1}{4}$ 20-40
h	projectile point	1.6	1.5	.25	brown/gray chert	N132 E118 N$\frac{1}{2}$ 0-20
i	projectile point	1.7	1.65	.2	white chalcedony	unknown
j	projectile point	2.85	1.5	.45	white chert	N130 E116 SE$\frac{1}{4}$ 20-40
k	projectile point	3.4	1.5	.5	oolitic chert	part of N142 E130 and N140 E130
l	projectile point	1.05	1.45	.45	gray chert	N130 E120
m	projectile point	3.80	1.9	.30	clear chalcedony with red, brown and gray inclusions	PH (S side of bench)
n	projectile point	3.15	1.8	.35	pink and red quartzite	N128 E110 S$\frac{1}{2}$ 0-20
19 a	drill	3.35	1.0	.5	gray chert	N132 E116 0-20
b	drill	2.7	1.2	.35	yellow, brown and red chert	provenience lost
c	drill	2.15	.75	.4	yellow, brown and red chert	N128 E124 NE$\frac{1}{4}$ 0-20

APPENDIX A, continued

Figure Number		Description	Length (cm)	Width (cm)	Thickness (cm)	Material	Provenience/depth (cm)
	d	drill	1.95	.7	.2	yellow, brown and red chert	N130 E112 S½ 0-20
	e	drill	2.05	1.25	.15	oolitic chert	N134 E122 S½ 0-20
	f	drill	1.4	1.05	.25	oolitic chert	N128 E118
	g	perforator	2.25	1.65	.5	light brown chalcedony	N124 E116 SE¼ 20-40
	h	notch	3.4	2.15	.95	clear chalcedony with red, brown and gray inclusions	N150 E114 E½ below occ. 1
	i	notch	2.3	1.2	.2	white chalcedony	N130 E112 S½ 0-20
	j	uniface	2.5	2.0	.7	oolitic chert	N126 E116 NE¼ 0-20
	k	uniface	4.4	2.1	.3	oolitic chert	N126 E116 SE¼ 20-40
	l	uniface	2.75	2.1	.7	yellow, brown and red chert	N126 E116 SE¼ 0-20
22	a	blade	3.75	2.3	.6	yellow, brown and red chert	N134 E118 S½
	b	blade	3.55	2.45	.6	yellow, brown and red chert	N128 E116 SE¼ 0-20
	c	blade	2.35	2.6	.35	yellow, brown and red chert	N124 E116 SE¼ 40-60
	d	blade	2.8	3.0	.45	oolitic chert	N132 E120 NE¼ 0-20
	e	blade	2.7	2.5	.35	yellow, brown and red chert	N132 E116 N½ 30-70
	f	blade	3.4	1.95	.35	oolitic chert	N148 E120
	g	bifacial knife	4.4	4.05	1.8	oolitic chert	N132 E110 20-40
	h	bifacial knife	4.9	2.95	1.3	clear chalcedony with red, brown and gray inclusions	N122 E124 NE¼ 20-40

APPENDIX A, continued

Figure Number	Description	Length (cm)	Width (cm)	Thickness (cm)	Material	Provenience/depth (cm)
i	bifacial knife	6.2	3.5	.7	siltstone/shale	N124 E116 SE¼ 20-40
j	chopper	9.8	9.5	3.25	siltstone/shale	C1
23 a	core	4.6	6.1	5.9	siltstone/shale	N134 E120 SE¼ & W½ 0-20
b	core	8.5	5.0	5.5	gray chert	PH NE¼ 10-0
c	flaked cobble	4.2	5.1	3.0	yellow, brown and red chert	N130 E116 SE¼ 20-40
d	flaked cobble	4.3	4.8	2.75	brown/gray chert	N130 E116 SE¼ 0-20
e	flaked cobble	5.0	3.75	2.5	yellow, brown and red chert	N130 E116 SE¼ 0-20
28 a	hammerstone (heavy task)	7.1	8.1	5.6	pink and red quartzite	C2 N144 E120
b	hammerstone (heavy task)	8.5	7.7	4.45	pink and red quartzite	N126 E120 SE¼ 20-40
c	hammerstone (heavy task)	8.95	6.75	3.65	pink and red quartzite	part of N142 E130 & N140 E130
d	hammerstone (light task)	5.35	5.05	3.25	pink and red quartzite	N132 E116 S½ 20-50
e	hammerstone (light task)	12.15	9.4	6.0	pink and red quartzite	C3
f	pounding stone	4.9	4.6	2.9	sandstone	N144 E120
g	petrified wood pecking stone	4.3	1.1	1.0	petrified wood	N142 E124 S½ 0-20
29	hoe	15.7	11.8	1.15	sandstone	C3 N142 E120
30 a	mano	25.2	11.7	3.9	sandstone	C2 N144 E120
b	mano	18.3	11.0	5.25	sandstone	C1 N150 E118 SW¼
c	handstone	10.5	6.7	3.3	quartzitic	PH NE¼ 10-0

APPENDIX A, continued

Figure Number	Description	Length (cm)	Width (cm)	Thickness (cm)	Material	Provenience/depth (cm)
d	grooved and notched mano	10.0	7.0	5.6	sandstone	N132 E116 0-20
31 a	trough metate fragment	13.1	9.2	7.5	sandstone	F2 N150 E114
b	slab metate fragment	12.2	8.7	5.7	sandstone	C2 N144 E120
c	grinding slab	11.2	10.3	1.2	sandstone	N134 E118 S½ 20-30
d	petrified wood rubbing stone	7.8	4.05	3.2	petrified wood	F2 N150 E11r
e	sandstone abrader	7.9	2.55	1.4	sandstone	PH on bench
f	polished pebbles	2.3 3.3 2.4 2.85 .9	2.2 2.35 1.1 1.4 .9	1.35 1.15 .65 1.1 .45	quartz	N132 E118 S½ (2) PH NE¼ 10-0 Bench Bin B, on bench
33 a	sandstone pot lid	19.5	18.4	1.0	sandstone	PH on top of Bench Bin B
b	sandstone pot lid	16.8	15.8	1.85	sandstone	PH on top of Bench Bin B
c	disk (possible pendant blank)	5.95	4.75	.95	sandstone	N150 E112
d	disk (possible pendant blank)	6.15	4.85	.55	sandstone	N150 E112
34 a	bird fetish	3.9	2.15	1.25		PH (N side of bench)
b	flaked, polished, and ground chalcedony of unknown function	2.85	1.55	.4	chalcedony	PH Bench Bin B bottom
35 a	Glycymeris shell	7.45	.4	.4	shell	C2 N146 E120
b	Glycymeris shell	5.1	.45	.4	shell	PH 50 cm below surface to top of pithouse
c	Glycymeris shell	4.0	.45	.4	shell	N128 E116 SE¼ 20-40

APPENDIX A, continued

Figure Number	Description	Length (cm)	Width (cm)	Thickness (cm)	Material	Provenience/depth (cm)
d	Glycymeris shell	4.6	.45	.4	shell	N138 E120 W½ 0-20
e	Glycymeris shell	5.9	.55	.5	shell	N126 E116 SE¼ 0-20
f	Glycymeris shell	3.85	.45	.4	shell	N132 E118 N½ 0-20
g	Glycymeris shell	2.0	.75	.4	shell	N134 E116 0-20
36 a	Glycymeris shell	2.3	1.25	.15	shell	N124 E120 0-20
b	Olivella sp.	1.0	.50	.50	shell	N136 E128, surface

Key:

C cist

WP work patio

PH pithouse

APPENDIX B

FAUNAL REMAINS FROM SITE 42KA1969, KANE COUNTY, UTAH

by

S. D. Emslie
Center for Western Studies

INTRODUCTION

Excavations of a Pueblo II pithouse and associated features in Kane County, southern Utah, during the summer of 1980 produced a collection of faunal remains dating to the prehistoric occupation. Analysis of these remains is reported on here.

METHODS

Faunal remains were identified to species when possible or to other taxonomic categories using modern comparative skeletons at the Center for Western Studies, Flagstaff, Arizona, and at the Museum of Northern Arizona, Flagstaff. Bones of the cottontail, *Sylvilagus* sp., were identified only to genus as several species exist in the area which are not osteologically distinct.

Minimum numbers of individuals (MNI's) for each taxon identified to genus and/or species were calculated by counting the most common element of the same side, and by comparing young vs. old individuals based on bone growth.

THE DATA

A total of 654 bones and five partial animal skeletons were recovered from the site representing 10 species and 22 taxonomic categories (Table 5). The majority of the bone consists of unidentifiable mammal followed by artiodactyls and rabbits. A list of these bones by provenience, taxonomic identification, and element description is provided in Table 6.

DISCUSSION

All species identified at 42Ka1969 currently occur, or historically occurred, in the site region (Hoffmeister and Durham 1971; Behle and Perry 1975), with the exception of the Common Turkey (*Melagris gallopavo)* which was a domestic bird kept by the Indians. The presence of jackrabbit, antelope ground squirrel, pronghorn, gambel's quail, and short-eared owl

Table 5. Taxons identified at 42Ka1969 with total numbers of bone and calculated minimum numbers of individuals (MNI's).

Taxon	No. bones	MNI
Not identifiable	1	---
Aves or Mammalia	1	---
Mammalia, small	58	---
Mammalia	112	---
Mammalia, large	283	---
Black-tailed Jackrabbit *(Lepus californicus)*	45	4
Cottontail *(Sylvilagus* sp.)	27	5
Rodentia	1	---
Sciuridae	3	---
White-tailed Antelope squirrel *(Ammospermophilus leucurus)*	partial skeleton	1
Pocket Gopher *(Thomomys* sp.)	2	1
Vole *(Microtus* sp.)	1	1
Artiodactyla	38	---
Mule Deer *(Odocoileus hemionus)*	19	1
Pronghorn *(Antilocapra americana)*	13	2
Bighorn sheep *(Ovis canadensis)*	8	1
Aves	30	---
Common Turkey *(Meleagris gallopavo)*	3 partial skeletons 9	4
Gambel's Quail *(Lophortyx gambelii)*	1	1
Sandhill Crane (cf. *Grus canadensis*)	1	1
Short-eared Owl *(Asio flammeus)*	partial skeleton	1
Scrub Jay *(Aphelocoma coerulescens)*	1	1

indicate the presence of large open grasslands and shrublands. Rodent remains are probably intrusive in the site, particularly the partial skeleton of the antelope ground squirrel, and not related to cultural deposits.

The three partial skeletons of turkeys in the site may have been birds intentionally buried by the Indians. Turkey skeletons frequently occur in Anasazi sites, particularly on the floors of pithouses and kivas, and may have been regularly sacrificed in rituals (Emslie 1977). Evidence for turkey domestication in most Anasazi sites in Utah does not appear until the Pueblo II period (Emslie 1980). The turkey skeletons at 42Ka1969, in addition to one isolated bone of an immature (less than three weeks old) individual indicate this species was kept as a domesticate at this site.

The partial skeleton of the short-eared owl (*Asio flammeus*) in the site is of interest as it represents, to the author's knowledge, the first skeleton of this species to occur in an Anasazi site though isolated fragments have been found. This owl may have been a bird kept by the Indians, perhaps for its feathers.

The majority of deer, pronghorn, and bighorn sheep bones in the site consist of tarsals, carpals, and phalanges suggesting these animals were primarily butchered at another location with the skins and the stripped meat only brought to the site. Artiodactyls and rabbits appear to have provided the bulk of the animal diet.

One possible bone of a sandhill crane, too fragmented for positive identification, may indicate a greater prehistoric distribution of this species in Utah. It currently occurs primarily in the north and central portions of the state along rivers, lakes and reservoirs (Behle and Perry 1975). This bird is also highly attracted to agricultural areas and may have occurred at prehistoric fields near streams close to 42Ka1969. Evidence for increased prehistoric distribution of this species has been found in other Anasazi sites.

CONCLUSION

The faunal remains at 42Ka1969 indicate the presence of large open grasslands and shrublands near the site as well as brush-covered slopes and foothills. The prehistoric inhabitants subsisted primarily on artiodactyls and rabbits and also kept the domestic turkey. Large game may have been butchered primarily away from the site and extensive prehistoric agricultural fields probably aided in the range extension of the sandhill crane. Few Anasazi sites have been excavated in this area of Utah and future excavations will provide additional data on prehistoric distribution and faunal utilization by the Indians in this portion of the Southwest.

Table 6. Animal bones identified at 42Ka1969 listed by provenience (bag no.), identification, and element description.

Provenience (Bag No.)	Taxon	Element
12	*Meleagris gallopavo*	partial skeleton - adult male
13	Mammalia	mandible - medial fragment (burned)
	Mammalia, large	2 long bone shaft fragments
	Ovis canadensis	distal metapodia
	Meleagris gallopavo	partial skeleton - adult male
14	Mammalia	caudal vertebra
	Sylvilagus sp.	distal left scapula
	Meleagris gallopavo	partial skeleton
44	Mammalia	small fragment (burned)
72	Artiodactyla	medial tooth fragment
74	Mammalia	long bone shaft fragment (burned)
75	Mammalia, large	long bone shaft fragment (burned)
76	Mammalia, large	2 small fragments (burned)
77	Mammalia, large	2 long bone shaft fragments
80	Artiodactyla	medial tooth fragment
84	Mammalia, large	2 small fragments (burned)
86	*Ovis canadensis*	left scaphoid (burned)
94	Mammalia, large	small fragment (burned)
102	Mammalia, large	long bone shaft fragment (burned)
107	Mammalia	5 small fragments (3 burned)
115	Mammalia, small	2 long bone shaft fragments (burned)

Table 6, continued

Provenience (Bag No.)	Taxon	Element
119	Mammalia	2 small fragments (burned)
121	Mammalia, small	long bone shaft fragment
161	Mammalia, large	long bone shaft fragment (burned)
210	Mammalia	long bone shaft fragment
214	Mammalia, small	10 small fragments (4 burned)
	Lepus californicus	LM^2, proximal rt 2nd metacarpal (burned)
	Sylvilagus sp.	distal metapodia and proximal left 1st metatarsal (burned)
216	Mammalia, large	long bone shaft fragment (burned)
218	Mammalia	3 small fragments (burned)
	Artiodactyla	thoracic vertebra
	Antilocapra americana	proximal left tibia
	Aves	21 small fragments, 1 eggshell fragment
	Meleagris gallopavo	cuneiform, digit 1 of phalanx 2
220	Artiodactyla	distal metapodia (burned)
222	Mammalia, small	2 long bone shaft fragments
224	Mammalia, small	skull fragment, patella
	Sylvilagus sp.	left frontal
	Rodentia	rt femur w/ends broken
	Odocoileus hemionus	2nd phalanx

Table 6, continued

Provenience (Bag No.)	Taxon	Element
225	*Lepus californicus*	medial left ulna and rt radius, rt proximal humerus
	Sylvilagus sp.	rt mandible, thoracic vertebra
	cf. *Grus canadensis*	left ulna, medial, worked
226	Mammalia, large	long bone shaft fragment
	Lepus californicus	distal rt humerus
230	Mammalia, large	2 small fragments, 1 medial rib
	Lepus californicus	proximal left ulna, 1 left distal scapula, 1 left medial scapula, thoracic vertebra
	Sylvilagus sp.	left mandible with proximal end broken
	Artiodactyla	2nd or 5th metapodia w/proximal end broken
	Odocoileus hemionus	distal metapodia, split and worked
231	Mammalia or Aves	small fragment
233	Mammalia, small	2 long bone shaft fragments, 1 proximal rib
	Mammalia, large	medial rib, 12 small fragments (1 burned), 3 long bone shaft fragments
	Lepus californicus	left tibia w/ends broken, proximal rt 3rd metatarsal
	Microtus sp.	left mandible w/m.

Table 6, continued

Provenience (Bag No.)	Taxon	Element
235	Mammalia	20 small fragments
	Sylvilagus sp.	medial rt mandible
237	Mammalia, large	2 long bone shaft fragments (1 burned)
238	Mammalia, large	8 small fragments
243	Not identifiable	small fragment
	Sylvilagus sp.	rt mandible w/proximal end broken
	Artiodactyla	proximal metatarsal, split, worked
244	*Lepus californicus*	medial rt humerus
246	*Asio flammeus*	partial skeleton
263	Mammalia, large	2 long bone shaft fragments
267	*Sylvilagus* sp.	thoracic vertebra
271	Mammalia, large	10 small fragments (1 burned)
272	Mammalia, small	small fragment (burned)
	Mammalia, large	11 small fragments (2 burned), 1 medial rib
	Lepus californicus	proximal rt femur
	Odocoileus hemionus	3rd phalanx
273	Mammalia, large	5 small fragments (burned), 1 long bone shaft fragment
276	*Lepus californicus*	distal rt femur
277	Mammalia, large	5 small fragments (burned), 5 long bone shaft fragments (1 burned), 5 medial ribs (2 burned)
	Sylvilagus sp.	distal rt scapula
	Antilocapra americana	3rd phalanx, rt lunar scaphoid and cuneiform

Table 6, continued

Provenience (Bag No.)	Taxon	Element
280	Mammalia, small	3 long bone shaft fragments (1 burned)
	Mammalia, large	8 long bone shaft fragments, 4 small fragments (3 burned), 4 medial ribs (1 burned)
	Lepus californicus	rt maxilla
	Sylvilagus sp.	proximal left tibia
	Artiodactyla	distal metapodia, medial scapula (burned), distal femur
	Odocoileus hemionus	left astragalus, calcaneum, navicular-cuboid
	Antilocapra americana	ft navicular-cuboid
	Ovis canadensis	distal left tibia, proximal rt metatarsal, left cuneiform
	Meleagris gallopavo	rt tarsometatarsus (length: 125.1 mm, female), medial rt tibiotarsus
281	Mammalia, small	3 long bone shaft fragments
	Mammalia, large	1 long bone shaft fragment (burned)
	Lepus californicus	proximal left femur, immature, distal rt femur, proximal rt radius (burned)
	Sylvilagus sp.	distal rt humerus, rt innominate and mandible
282	Mammalia	2 long bone shaft fragments (1 burned)
	Artiodactyla	medial rt scapula

Table 6, continued

Provenience (Bag. No.)	Taxon	Element
283	*Odocoileus hemionus*	3rd phalanx w/distal end broken (burned)
284	Artiodactyla	patella
285	Mammalia, small	long bone shaft fragment
	Mammalia, large	2 long bone shaft fragments, 1 medial rib, 1 small fragment
	Sylvilagus sp.	proximal left femur (burned)
	Aves	2 medial ribs
	Meleagris gallopavo	ungual phalanx
286	Mammalia, small	2 long bone shaft fragments
	Mammalia	1 small fragment (burned), 1 phalanx
	Mammalia, large	1 medial rib
	Lepus californicus	maxilla, 1 pr. mandibles w/proximal ends broken, medial scapula, left radius
	Sylvilagus sp.	lumbar vertebra
	Antilocapra americana	left astragalus
	Aphelocoma coerulescens	distal rt ulna
	Lophortyx gambelii	rt ulna
291	*Odocoileus hemionus*	tarsal
292	Mammalia, large	long bone shaft fragment
	Ovis canadensis	3rd phalanx
293	Mammalia, small	3 vertebrae
	Mammalia, large	3 small fragments
	Sciuridae	left tibia w/no proximal epiphysis
	Artiodactyla	distal metapodia

Table 6, continued

Provenience (Bag No.)	Taxon	Element
294	Mammalia, large	long bone shaft fragment, vertebra fragment
	Artiodactyla	proximal 1st phalanx (burned)
	Ammospermophilus leucurus	partial skeleton
295	Mammalia, large	8 long bone shaft fragments
296	Mammalia	5 small fragments (2 burned)
	Mammalia, large	2 long bone shaft fragments
	Lepus californicus	distal rt humerus
	Sylvilagus sp.	distal rt humerus, phalanx
	Odocoileus hemionus	2nd phalanx
297	Artiodactyla	proximal calcaneum (burned)
303	Mammalia	2 small fragments
314	Aves	eggshell
331	*Antilocapra americana*	1st phalanx
	Aves	eggshell
332	*Meleagris gallopavo*	rt tarsometatarsus
333	Mammalia, large	long bone shaft fragment (burned), 5 small fragments (4 burned)
334	Artiodactyla	medial left ulna (burned), distal epiphysis of radius
335	Mammalia, small	3 small fragments
	Mammalia, large	20 small fragments (9 burned)
	Sylvilagus sp.	rt tibia shaft fragment
	Odocoileus hemionus	distal metapodia (burned)
	Antilocapra americana	proximal 1st phalanx (burned)

Table 6, continued

Provenience (Bag No.)	Taxon	Element
336	Mammalia	15 small fragments (6 burned)
	Lepus californicus	medial radius
337	Mammalia, large	long bone shaft fragment
	Artiodactyla	medial left innominate
338	Mammalia	3 small fragments (1 burned)
	Mammalia, large	medial rib
	Thomomys sp.	rt mandible w/distal end broken
339	Mammalia	6 small fragments (3 burned)
	Mammalia, large	medial rib
	Lepus californicus	medial left mandible
	Sylvilagus sp.	left scapula w/ends broken
	Artiodactyla	left cuneiform
341	Mammalia, large	8 small fragments (4 burned)
	Lepus californicus	partial left calcaneum
	Artiodactyla	partial left astragalus
342	Mammalia, large	long bone shaft fragment (burned)
343	Mammalia, large	small fragment (burned)
344	Mammalia, small	long bone shaft fragment, medial rib
	Mammalia, large	5 long bone shaft fragments (1 burned)
	Sylvilagus sp.	medial rt femur (burned)
	Artiodactyla	sesamoid (burned)
345	Mammalia, small	long bone shaft fragment, 1 small fragment
	Mammalia, large	5 long bone shaft fragments (burned)

Table 6, continued

Provenience (Bag No.)	Taxon	Element
346	Mammalia, small	long bone shaft fragment
	Mammalia, large	4 long bone shaft fragments (1 burned), 3 small fragments (2 burned)
	Sylvilagus sp.	proximal left ulna
	Artiodactyla	distal left radius, medial innominate (burned), distal metapodia (burned), proximal 1st phalanx (burned)
	Ovis canadensis	LI_1
347	Mammalia	7 small fragments (1 burned)
	Lepus californicus	medial radius, rt ulna, rt maxilla and calcaneum
	Artiodactyla	vertebra centrum, left distal calcaneum (burned)
	Odocoileus hemionus	distal rt tibia
	Aves	3 small fragments
348	Mammalia, small	long bone shaft fragment
	Mammalia, large	4 long bone shaft fragments (3 burned), 15 small fragments (11 burned), 4 medial ribs (1 burned)
	Artiodactyla	medial scapula, proximal metapodia
	Odocoileus hemionus	proximal 1st phalanx

Table 6, continued

Provenience (Bag. No.)	Taxon	Element
349	Mammalia, large	16 small fragments (2 burned)
	Lepus californicus	2 phalanges
	Sciuridae	metatarsal w/distal end broken (burned)
	Artiodactyla	proximal femur
350	Mammalia	5 long bone fragments (2 burned)
	Mammalia, large	12 small fragments (5 burned)
	Lepus californicus	left femur shaft fragment, distal rt tibia, immature
	Odocoileus hemionus	1st phalanx w/distal end broken (burned), left cuneiform (burned)
351	Mammalia, large	long bone shaft fragment, worked, 4 small fragments (2 burned)
352	Mammalia, small	small fragment
	Mammalia, large	3 small fragments (burned), 10 long bone shaft fragments
	Sylvilagus sp.	rt mandible w/proximal end broken
353	Artiodactyla	medial rt calcaneum
354	Mammalia, large	3 small fragments
	Aves	1 small fragment (burned)
355	Mammalia, large	2 small fragments (1 burned)
356	Mammalia, large	9 small fragments (2 burned)
	Thomomys sp.	distal left mandible

Table 6, continued

Provenience (Bag No.)	Taxon	Element
357	Mammalia, small	2 long bone shaft fragments
	Mammalia, large	3 long bone shaft fragments, 10 small fragments (2 burned)
358	Mammalia	12 long bone shaft fragments (1 burned)
	Mammalia, large	3 small fragments (2 burned), 1 proximal rib
	Ovis canadensis	distal rt tibia
	Antilocapra americana	medial metatarsal, 2 1st and 1 2nd phalanges
359	Mammalia, small	3 long bone shaft fragments (2 burned), 1 proximal rib (burned)
	Mammalia, large	6 small fragments (2 burned), 4 medial ribs (3 burned), 6 long bone shaft fragments (3 burned)
	Lepus californicus	proximal left innominate
	Artiodactyla	distal rt scapula, distal rt tibia
	Odocoileus hemionus	2nd phalanx
360	Mammalia	3 long bone shaft fragments
	Mammalia, large	7 small fragments (3 burned)
	Artiodactyla	distal rt femur and humerus (femur burned)
	Antilocapra americana	proximal left tibia
361	Mammalia, small	medial scapula (burned), 2 small fragments
	Mammalia, large	19 small fragments (6 burned), 3 long bone shaft fragments (1 burned)

Table 6, continued

Provenience (Bag No.)	Taxon	Element
361	Artiodactyla	distal left humerus (burned)
362	Mammalia, small	2 long bone shaft fragments (1 burned)
	Mammalia, large	1 long bone shaft fragment, 7 small fragments
	Lepus californicus	phalanx
	Sylvilagus sp.	distal rt calcaneum (burned)
363	Mammalia, small	medial long bone shaft
	Mammalia	medial rib
	Mammalia, large	15 small fragments (2 burned)
	Lepus californicus	partial left calcaneum (burned)
364	Mammalia	2 long bone shaft fragments (1 burned)
	Mammalia, large	5 small fragments (1 burned)
	Lepus californicus	medial left mandible
	Artiodactyla	medial scapula
367	*Odocoileus hemionus*	distal left tibia (burned)
369	Mammalia	medial mandible (burned)
	Mammalia, large	5 long bone shaft fragments (3 burned), 9 small fragments (5 burned), 3 medial ribs (1 burned)
	Odocoileus hemionus	medial rt innominate
	Meleagris gallopavo	distal humerus, immature, less than 3 weeks old
370	Mammalia, large	10 small fragments (3 burned), 3 medial ribs

Table 6, continued

Provenience (Bag No.)	Taxon	Element
370	*Lepus californicus*	distal left humerus
371	Mammalia, small	1 long bone shaft fragment, 1 small fragment (burned)
	Mammalia, large	10 small fragments (3 burned)
	Sylvilagus sp.	left radius w/distal end broken
372	Mammalia, large	2 small fragments
373	Mammalia, large	1 small fragment
374	Mammalia, large	2 small fragments (burned)
	Lepus californicus	distal metapodia, distal rt tibia, immature, rt astragalus
	Artiodactyla	sesamoid (burned)
375	Mammalia, large	small fragment (burned)
	Lepus californicus	medial rt humerus
376	Mammalia, large	2 small fragments (1 burned)
380	Artiodactyla	left tibia shaft fragment
381	Mammalia, large	8 long bone shaft fragments (1 burned), 4 small fragments
	Sylvilagus sp.	rt 3rd metatarsal
	Sciuridae	rt tibia w/proximal end broken
	Artiodactyla	rt femur proximal epiphysis
	Meleagris gallopavo	medial left pelvis, left tibiotarsus w/ends broken

Table 6, continued

Provenience (Bag No.)	Taxon	Element
383	Mammalia, large	long bone shaft fragment
	Artiodactyla	rt humerus shaft fragment
	Odocoileus hemionus	1st phalanx (burned)
384	Artiodactyla	distal metapodia
	Odocoileus hemionus	3rd phalanx (burned)
386	Mammalia	12 long bone shaft fragments
388	Mammalia, large	1 long bone shaft fragment

APPENDIX B

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APPENDIX C

POLLEN ANALYSIS OF 42KA1969

by

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INTRODUCTION

Twelve pollen samples were selected for analysis from several areas within 42Ka1969 (Table 7), a two component site located in south-central Utah. All of the pollen samples were taken from the later component, which was radiocarbon dated to A.D. 980 $\pm$ 120 and A.D. 1150 $\pm$ 110 (both dates MASCA corrected). Five samples were selected for analysis from the pithouse: two from the floor to the northwest and to the southeast of the hearth (15-7 and 15-9), and three from cists (15-11, 15-12, and 15-14). Outside the pithouse, pollen samples were selected from a work patio (3-1), a deep small storage cist (5-2), and two contiguous large storage cists (6-3 and 7-4). The third area sampled for pollen was the midden, which yielded two pollen samples: one from a concentration of turkey bones (within the carcass cavity), and the other a general midden sample. In addition to the three archaeological areas sampled for pollen, a composite pollen sample was taken from the modern ground surface in the vicinity of the site.

The modern pollen sample provides a base of observation concerning the pollen which is distributed and has accumulated in the immediate vicinity of site 42Ka1969. Relatively small amounts of arboreal pollen were observed, composed mainly of *Juniperus* and *Pinus* pollen. A single grain of *Alnus* pollen was noted in the modern pollen sample, although none was observed in any of the archaeological samples. Short-spined composite pollen is the most prevalent pollen type in the modern surface sample, contributing 43% of the total pollen. *Artemisia*, long-spined composite, and Cheno-ams account for most of the remaining pollen in this sample, although small amounts of cf. *Cleome*, *Ephedra nevadensis*- and *torreyana*-types, Graminae, and Rosaceae were also noted. The modern pollen frequencies reflect the modern environment near the site. The stands of pinyon/juniper are confined mainly to the bluffs and mesa tops, which is consistent with the low arboreal pollen frequencies noted. The old floodplain on which this site is located is composed of mixed sagebrush and forbs, with the dominant element being short-spined composites (ragweed and sand-bur).

METHODS

The pollen was extracted from soil samples, which were collected from the proveniences indicated in Table 7. A chemical preparation based on flotation was selected as the most effective method of removing the

Table 7. Provenience of pollen samples.

Pollen Sample Number	Pollen Counted	Provenience
0-1	400	Modern ground surface
3-1	200	Work patio, floor
5-2	200	Outside pithouse, floor of a deep and small storage cist
6-3	200	Outside pithouse, floor of a large storage cist
7-4	200	Outside pithouse, floor of a large storage cist
15-7	200	Pithouse, floor to the northwest of the hearth
15-9	100	Pithouse, floor to the southeast of the hearth and near the antechamber
15-11	200	Pithouse, Cist A in floor
15-12	Scan	Pithouse, subfloor cist 1, which was covered with a shaped sandstone slab
15-14	100	Pithouse, subfloor cist 3, sealed beneath the pithouse floor
16-6	200	Midden, taken within carcass cavity of turkey bones in midden
16-10	200	Midden, general sample

pollen from the large volume of sand, silt, and clay with which they were mixed. Hydrochloric acid was used to remove any calcium carbonates present in the soil. Flotation of the samples, using zinc bromide, was followed with a brief hydrofluoric acid treatment to remove any remaining clay particles. All samples were acetolated for two to three minutes.

A light microscope was used to count the pollen at a magnification of 430x. Oil immersion at a magnification of 970x was employed occasionally to discern the features of certain pollen grains. A total of 200 pollen grains was counted from each sample, where possible (Table 7). Poorly preserved pollen grains were noted in all of the archaeological samples and are noted as a separate category at the right side of the pollen diagram (Figure 41). Each sample was scanned in its entirety following the completion of the standard 200-grain count. Observed pollen types from this scan that were not noted during the 200-grain count are represented as pluses (+) on the pollen diagram. A list of all taxa observed in the pollen samples is given in Table 8.

DISCUSSION

The archaeological pollen samples are divided into three groups for discussion: those occurring in the exterior work area, those from the interior of the pithouse, and those from the midden.

Exterior Work Area

The pollen samples taken in the work area outside the pithouse contain a relatively small amount of arboreal pollen. The work patio (3-1) contains a similar amount of arboreal pollen (15%) to the modern surface sample (16%), but all of the cist samples contain less arboreal pollen (4-9%). The frequencies of short-spined composites in this area are similar to or slightly less than that observed in the modern surface sample. The *Artemisia* and long-spined composite frequencies vary between the samples, but the Cheno-am frequencies remain relatively constant. These pollen types, as well as the arboreal pollen, appear to be indicative of background or ambient pollen at the site. The slight variations in frequencies observed are not sufficient to indicate the utilization of any of these plant types in a single locality. Small quantities of *Sarcobatus*, *Ephedra nevadensis*-type, Graminae, and Rosaceae pollen observed in these samples also appear to be part of the background pollen assemblage. A rather large quantity of *Ephedra nevadensis* pollen (13%) was observed in the sample from the work patio (3-1), which appears to be indicative of the utilization of *Ephedra*. *Ephedra* is noted to have been used as a cure for venereal disease by the Southern Paiute (Bye 1972:90), and by the Hopi (Whiting 1939:63). It was used by the Ramah Navajo in a decoction as a cure for stomach ache or bad cough (Vestal 1952:14). Niethammer (1976:96) notes that Indians roasted *Ephedra* seeds and ground them into flour or made them into a bitter mush, and also made a strong tea from *Ephedra*. While it is impossible to state whether the occupants of this site used *Ephedra* as a medicine or a food (or both), it appears from the large quantity of *Ephedra* pollen in the work patio sample that *Ephedra* was utilized at this site.

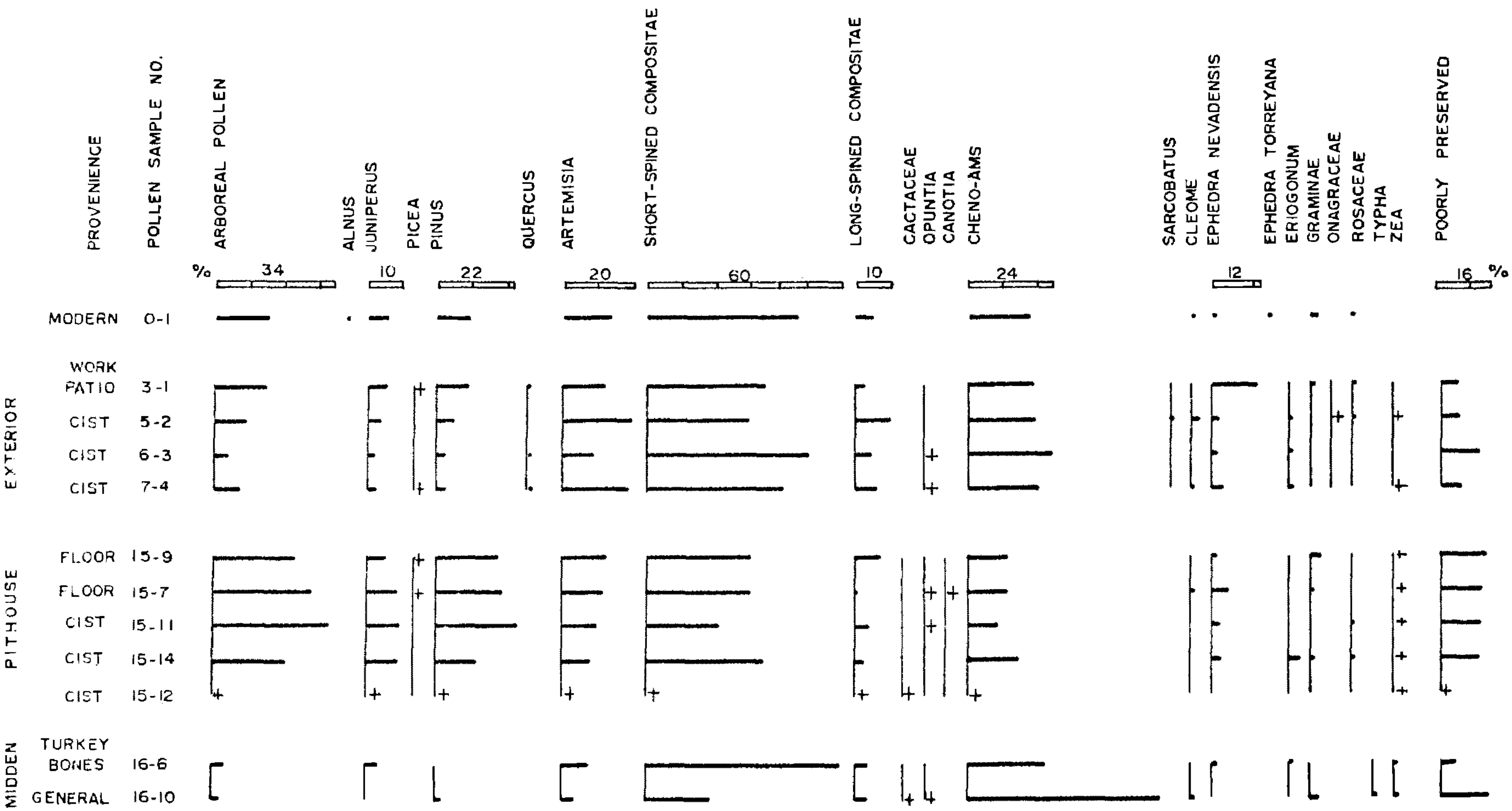

Figure 41. Pollen diagram indicating relative percentages of pollen types.

Table 8. Pollen taxa observed at 42Ka1969.

Scientific Name	Common Name
ARBOREAL POLLEN	
Alnus	Alder
Juniperus	Juniper
Picea	Spruce
Pinus	Pine
Quercus	Oak
NON-ARBOREAL POLLEN	
Artemisia	Sagebrush
Short-spined Compositae	Members of the Compositae (sunflower) family including *Ambrosia* (ragweed), *Franseria* (sand-bur), *Xanthium* (cocklebur), and *Iva* (marsh-elder)
Long-spined Compositae	Members of the Compositae (sunflower) family including *Chrysothamnus* (rabbitbrush), *Helianthus* (sunflower), and others
Cactaceae	Cactus family
Opuntia	Prickly pear cactus
Canotia	Canotia
Cheno-ams	Members of the Chenopodiaceae (goosefoot) and Amaranthaceae (pigweed) families
Sarcobatus	Greasewood
Cleome	Beeweed
Ephedra	Mormon Tea
Eriogonum	Buckwheat
Graminae	Grass family
Onagraceae	Evening primrose family
Rosaceae	Rose family
Typha	Cat-tail
Zea	Maize

Zea pollen was observed during the scan of two cist samples (5-2 and 7-4). Although large quantities of *Zea* pollen were not present, these small frequencies of *Zea* are indicative that *Zea* was used at the site, and was most probably cultivated nearby. The question of the storage of *Zea* within these particular cists is a little more tenuous, but certainly possible.

Other pollen types noted to occur in these exterior cist samples include *Eriogonum* (from all three cists), *Cleome* (2% or less in 5-2 and 7-4), a single grain of Onagraceae pollen (5-2), and *Opuntia* (6-3 and 7-4)(Table 9). *Eriogonum* is noted to have been used as a medicinal plant by the Hopi (Whiting 1939:73), the Ramah Navajo (Vestal 1952:23), and the Zuni (Stevenson 1915:49). Bye (1972:98), however, lists *Eriogonum* as a food plant for the Southern Paiute. *Cleome* was an important food plant and source of pigment for painting pottery for the Hopi and Tewa (Whiting 1939:77-78 and Robbins et al. 1915:59). The Ramah Navajo also used *Cleome* as a source of food (Vestal 1952:29). The Hopi and Ramah Navajo used members of the Onagraceae family for medicinal or decorative purposes (Whiting 1939:86; Vestal 1952:37-38). *Opuntia* is noted as a source of food, with both the joints and fruits being eaten by many Indian groups including the Hopi (Whiting 1939:86), the Ramah Navajo (Vestal 1952:37), Southern Paiute (Bye 1972:97), the Zuni (Stevenson 1915:69), the Tewa (Robbins et al. 1969:62), and others (Niethammer 1976:15-16, 21; Weiner 1972:157-158). The presence of small quantities of these various pollen types from economically important plants within these cists indicates the possibility that some or all of these plants were stored at this site.

Pithouse

Pollen samples taken from the interior of the pithouse show a basic consistency with one another. The arboreal pollen ranges from 21% to 33%, which is considerably higher than that noted in the samples taken from the work area and storage cists outside the pithouse, which contained 4-9% arboreal pollen. It is unknown whether this increased arboreal pollen in the pithouse is representative of the superior trapping capabilities of the pithouse for pollen, or of the use of juniper and pine within the pithouse. Short-spined composite pollen remains the single dominant pollen type within the pithouse, contributing between 21% and 34% of the pollen present. The frequencies of *Artemisia*, long-spined composites, and Cheno-am pollen within the pithouse have decreased relative to the samples taken outside the pithouse. It will be assumed that these pollen types are representative of background or ambient pollen, and that the differences in pollen frequencies between the samples taken inside and outside the pithouse reflect the different nature of these areas as natural pollen traps.

Small quantities of *Ephedra* pollen were noted in most of the samples taken inside the pithouse, and are probably part of the background or ambient pollen assemblage, as are the small quantities of Graminae and Rosaceae pollen observed.

Table 9. Economic pollen types observed in cists.

Pollen Sample Number	Contents of Cist
Exterior Cists	
5-2	*Cleome*, *Eriogonum*, Onagraceae, *Zea*
6-3	*Eriogonum*, *Opuntia*
7-4	*Cleome*, *Eriogonum*, *Opuntia*, *Zea*
Interior Cists	
15-11	*Opuntia*, *Zea*
15-12	Cactaceae, *Zea*
15-14	*Eriogonum*, *Zea*

The two pollen samples from the floor of the pithouse each contain a very small amount of *Zea* pollen (observed during the scan only). In addition, the floor sample to the northwest of the hearth also yielded 1% *Cleome* pollen and *Opuntia* pollen during the scan. Two of the cist samples (15-11 and 15-14) are very similar in contents to the samples from the floor. Both contain small quantities of *Zea* pollen (observed during the scan only), and one sample (15-11) contains *Opuntia* pollen, also observed during the scan. Sample 15-14 from cist 3 also contained 3% *Eriogonum* pollen, which is a larger frequency than that observed in any of the exterior cists. It should also be noted that this is the only occurrence of *Eriogonum* pollen within the pithouse. This appears to indicate that *Eriogonum* was stored in the cists at 42Ka1969, particularly in cist 3.

One other cist was examined from the interior of the pithouse, cist 1, which was covered with a shaped sandstone slab and sealed beneath the floor of the pithouse. Unfortunately, the pollen sample from this cist did not contain sufficient pollen for analysis. A complete scan of the sample yielded pollen from most of the ambient or background pollen types observed within the pithouse, and an unidentified cactus pollen, as well as several *Zea* pollen. Although there were less than 100 pollen grains in the entire pollen sample, four grains of *Zea* pollen were noted during the scan. This is a higher frequency than has been observed at any other location in the pithouse.

Midden

Two pollen samples were taken from the midden at 42Ka1969. Very small quantities of arboreal pollen were observed in both samples, which is probably the result of the rather large quantities of weedy plants which would have been growing on or near the midden during and immediately after the occupation of the site. The midden samples contain most of the same elements as ambient or background pollen as were exhibited in other parts of the site. Both samples also contained *Zea* pollen in the 200-grain pollen count. In addition, small quantities of an unknown cactus, *Opuntia*, *Cleome*, and probable *Typha* were present in the general midden sample, while *Eriogonum* was observed in the midden sample taken around the turkey bones. The most noticeable difference between the two samples is the extremely large quantity of short-spined composite pollen associated with the turkey bones and the very large quantity of Cheno-am pollen from the general midden sample. It is possible that these differences may be accounted for by a difference in the local weed population in the various parts of the midden. It is also possible, however, that the large quantity of Cheno-am pollen is associated with the discarding of food waste by the occupants of the site. Large quantities of Cheno-am pollen have been noted in midden samples by this author (Scott 1976), and others (Martin and Byers 1965).

A single grain of *Typha* pollen was also noted in the general midden sample (16-10), indicating the possibility that *Typha* was utilized at this site.

APPENDIX C

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