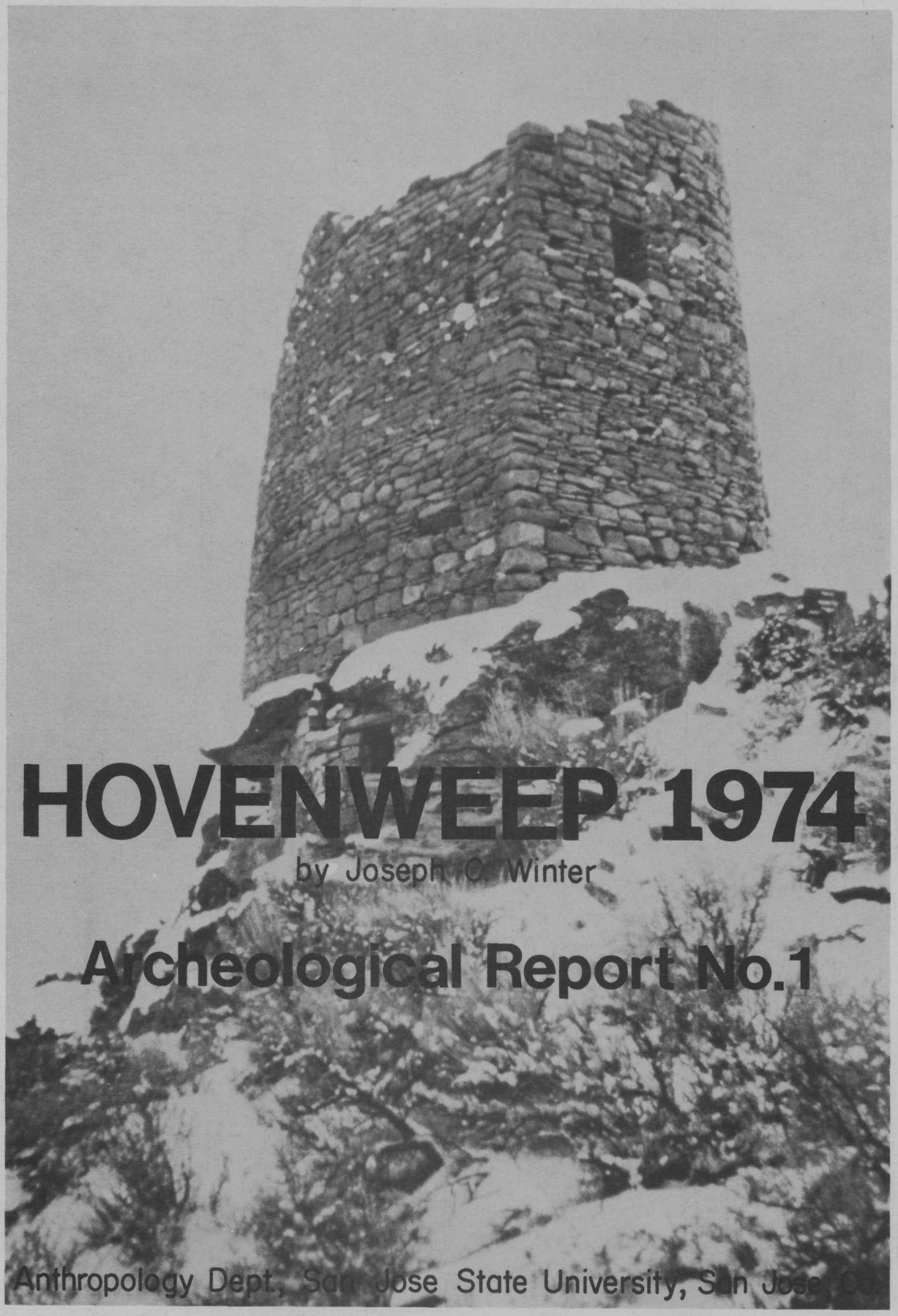


HOVENWEEP 1974

by Joseph C. Winter

Archeological Report No.1

Anthropology Dept., San Jose State University, San Jose, Ca

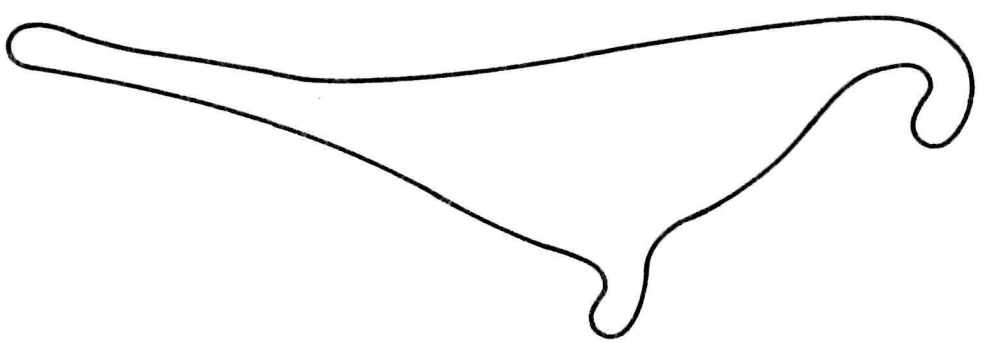
HOVENWEEP 1974

by

Joseph C. Winter

With chapters by Dorothy K. Washburn and
Michael Holst and appendices by
Brad Noisat
William Litzinger
Eileen Camilli
Theodore Rado

Archeological Report No. 1



Anthropology Dept., San Jose State University, San Jose, Ca.
May 1975

PREFACE

PREFACE

The Southwestern Archeology Program is a relatively new aspect of the Anthropology Department at San Jose State University, and its development would have been impossible without the actions of a large number of individuals. It is the purpose of this preface to acknowledge their contributions. The financial support and opportunity for research offered by the University have been invaluable, as has the logistical support provided by the National Park Service. Thus I begin this acknowledgement by first mentioning the enthusiastic administrative atmosphere of the University and the encouragement provided by Mesa Verde National Park, particularly in the persons of Hobert Burns, Academic Vice President of San Jose State University; James Sawrey, Dean of the School of Social Sciences of San Jose State and Ronald Switzer, General Superintendent of Mesa Verde National Park. Colleagues in the Anthropology Department who provided much of the inspiration and support in the early stages of the development of the program, and who continue to aid in various ways include Jack Pierce, Joe Hester and Jim Freeman. Rick Anderson, Earl Ingmanson and Jim Court of the National Park Service, and Frank Shields and Marlyn Jones of the Bureau of Land Management are especially to be thanked for their unceasing enthusiasm. Support staff at San Jose who have contributed invaluably include Nadine Willey, Jo Stuart, Pat Finch and "Red" Terrell. The heads and personnel of various Administrative Departments at San Jose, particularly Purchasing and Building and Grounds, should also be thanked especially for their understanding help each time I called upon their resources and expertise. It is the staff and students of the Hovenweep Archeological Project, however, who probably deserve the greatest vote of thanks, since they willingly participated in the birth of a new program under environmental conditions which left much to be desired. Staff and students who participated in the summer program were Chuck Cecil, Jo Stuart, Vaughan Winter, William Litzinger, Theodore Rado, Mike Brown, Carol Allen, Connie Mendez, Ron Stebbens, Brad Noisat, Pat Hicks, Alex Esparza, Gloria Robertson, Nancy Davenport and Steve Katzenberger. Various

students have also worked enthusiastically under the direction of Dorothy Washburn in the lab, especially Pat Hicks, Alex Esparza, Rob Jackson, Bea Cashmore, Darlyne Tercero and Bill Cope. Certain individuals were also of help in preparing this first of many anticipated Archeology Reports. Ken Kroes is largely responsible for the drafting and photography, while Dorothy Washburn, Mike Holst, Eileen Camilli, William Litzinger, Ted Rado and Brad Noisat have contributed Chapters or Appendices.

JCW
April, 1975

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OBJECTIVES

I OBJECTIVES

As work on Southwestern agriculture progresses, and more is learned about the development of Pueblo food production, our questions and methods have been greatly modified. No longer do we merely ask, "How did Southwestern farming originate?" or, "Why were certain agricultural areas abandoned?" Instead, we are concerned with the processes of the growth and maintenance of farming economies, and the reasons for alterations of regional exploitation systems. In addition, our methods are no longer restricted to excavations and limited by subsurface investigations. Rather, we recognize that extensive environmental analyses and regional surveying programs based on modern sampling techniques are equally important, and are essential in a study of the relations of subsistence patterns, environmental variables, and culture change.

The prehistoric development of agriculture in the Hovenweep area of the northern Southwest is of special relevance to this concern, since the local inhabitants participated in an intense, but relatively short lived food production system in a fragile desert environment. The invitation of the National Park Service to establish an archeological research station at Hovenweep has therefore provided an excellent opportunity for the study of aboriginal agriculture, and the inventory needs and interpretive requests of the Park Service coincide with the requirements of the present research program. The objectives of the project are to investigate agricultural growth and decline at Hovenweep through surface surveying and environmental studies, and thereby determine: 1) how a farming economy spread into the region and why it was accepted by pre-farming foraging groups, 2) how its growth and maintenance were associated with resource distribution and environmental change, 3) why it was eventually abandoned, and 4) how it was related to the farming system of the historic Pueblo Indians.

The Hovenweep Project is specifically aimed at analyzing prehistoric Anasazi farming, in addition to obtaining interpretive data for the National Park Service, and as such it involves an examination of current theories of Southwestern agriculture and water control. It has commonly been assumed,

for example, that the Pueblo farming system is in most respects an outgrowth of prehistoric Anasazi agriculture, and that there has been a general continuity of crop types, technology and environmental adaptations. This assumption has never been seriously tested in a specific environment, and one of the major goals of the Hovenweep Project is to examine it in the field by developing test implications based on historic Pueblo farming techniques and applying them to the Hovenweep data. It is anticipated that new data relating to agricultural maintenance and the processes of farming change will emerge through the project, and that hypotheses concerning the growth, expansion and abandonment of Anasazi food production will be developed.

Toward this end the San Jose State University Archeological Report Series has been created, to insure that the basic data and interpretations are published promptly. Number 1 of the Series (the present Volume) is intended as an introduction to both the project and the Hovenweep area, and presents the preliminary results obtained by the 1974 Survey. Chapter II of this first report reviews previous research in the area, while Chapter XI synthesizes the 1974 Survey results with interpretations derived from the earlier work. Intervening chapters and the appendices discuss data, procedures, survey areas and environmental relations.

ARCHEOLOGICAL SETTING

II ARCHEOLOGICAL SETTING

Hovenweep National Monument and Cajon Mesa are part of a great stretch of sage, juniper and pinyon covered upland extending from Mesa Verde to Comb Ridge and the Abajos. Thousands of Anasazi ruins cover the rugged mesas and crowd the canyons which are drained by the McElmo, Yellowjacket, Hovenweep, Montezuma Creek and other watercourses feeding the San Juan. Many of the local ruins have been visited by archeologists, but surprisingly little is known about the overall pattern of cultural development in the region, and even less is known about the specialized subsistence activities and environmental relations of the farmers and gatherers who inhabited the ruins. It is the purpose of the present study to examine the sequence of cultural development and subsistence techniques of the prehistoric inhabitants of Hovenweep.

Archeological investigations began in this area, as they did throughout much of the Southwest, with the explorations of cattlemen and government surveyors. Jackson (1876,1878) and Holmes (1878) wrote brief accounts of the ruins they observed in McElmo and Yellowjacket Canyons, and the Wetherills conducted visitors to the impressive Ruin Canyon site complex beginning about 1890 (Prudden 1916:7). Other explorers traversed parts of the area and left short accounts of their visits, but it was not until Morley excavated Cannonball Ruin (1908) that archeologists began to fully appreciate the complex prehistory of the region. Like many of the local site complexes Cannonball is composed of two room blocks and adjacent towers situated around a canyonhead, and Morley's excavation of one room block revealed 30 rooms, a round tower, 7 kivas and Mesa Verde-like pottery. The Cannonball study was especially important since it is the only investigation to date which excavated a canyonhead tower complex. Morley also surveyed a number of other sites in the area (Morley and Kidder 1917) and described many of the tower complexes of Ruin and Hovenweep Canyons. Prudden (1903,1914,1916) also began work in the region at this time, and his wide ranging surface reconnaissance and excavation of three sites on Cajon Mesa and two on nearby mesas represents one of the most thorough of

the regional investigations of his era. On the basis of his research on Cajon Mesa, Squaw Point and Bug Mesa, he hypothesized a proto-Mesa Verde or "Middle Period" occupation which preceded the classic "Late Period" cliff dwellings on the Mesa Verde to the east. This early occupation supposedly occurred as scattered and multiple unit type pueblos which were usually located on ridges and at canyonheads. Typical multiple unit pueblos are the Cannonball, Goodman Point, Holly Canyon, Hackberry Canyon, Ruin Canyon, Yellowjacket Springs and Aztec Springs ruins. At about this time Cummings, Kerr and Kidder (Kidder 1910) also initiated an excavation of a multiple unit pueblo on Alkali Ridge just to the west of Montezuma Creek, leading Kidder to later conclude (1924) that two periods of Anasazi use occurred in the region. The earliest period involved scattered and multiple unit pueblos which generally were situated on the open mesa tops, followed by a Classic Mesa Verde period of community houses grouped around canyonheads. In contrast to Prudden, Kidder classified such sites as Hackberry House, Holly House, the Ruin Canyon cluster, Goodman Point, Cannonball Ruin, etc. as belonging to the later period. A more recent excavation by Leh (1938,1939,1940) added more details to this discussion, since he re-excavated the Wilson or Squaw Point Ruin first explored by Prudden and concluded that the scattered unit pueblos were Pueblo II period sites, while the later multiple unit pueblos were Pueblo III period sites. Perhaps the most productive worker of the times was Fewkes, who mapped, studied and named most of the large ruins of the area, including those in Hovenweep National Monument (1918,1919a,1919b,1925). He also assembled and sifted through much of the tower data, and concluded, as did Kidder, that the canyonhead sites were contemporaneous with the Mesa Verde cliff dwellings. The most extensive excavations in the region were carried out by Martin in the Ackmen-Lowry area (1936,1938,1939) and by Brew at Alkali Ridge (1939,1946). Martin's (1938,1939) Ackmen excavations revealed an intensive use of the northern part of Cajon Mesa during the late Basketmaker III - early Pueblo I periods, as indicated by two large villages composed of 10 - 15 pithouses and 80 - 150 surface rooms. Martin also surveyed some 180 sites in a 16.75 mile square area which reached as far south as Hovenweep National Monument, and concluded that the Anasazi

occupied the mesa from the late Basketmaker III to the early Pueblo III periods. He additionally excavated two Pueblo I hamlets, two Pueblo II villages, two large Pueblo II-III unit pueblos and a large rim rock pueblo at the north end of the mesa, along with Lowry Ruin (1936). The latter site is a large, late Pueblo II - early Pueblo III ruin with 80 - 100 rooms, a Great Kiva, a possible reservoir, and Chaco as well as Mesa Verde masonry/ceramic influences. Brew's (1939,1946) work continued the study initiated by Cummings, Kerr and Kidder, but concentrated on a large late Basketmaker III - early Pueblo I site composed of dozens of habitation units and pithouses and several hundred surface rooms. Later sites on Alkali Ridge include typical Pueblo II period unit pueblos which are similar to those found by Prudden, indicating an overall pattern of cultural homogeneity throughout the upland mesas. No excavations have been conducted within the boundaries of Hovenweep National Monument, but Riley's (1948) survey of the five Monument Units on Cajon Mesa and Matheny's (1965) test of a ruin to the south of the Square Tower group have supported the earlier suggestions of a Pueblo II - III period provenience for many of the mesa top and canyonhead sites. Schroeder's (1967-1968) survey of the mesa top between the Square Tower and Holly Monument Units similarily suggested a Pueblo II - III period use of the mid-mesa region, and his work was important in that he observed a dense concentration of water control sites in this area, and concluded that settlement pattern changes had occurred between the Pueblo II and III periods. Matheny (1962; de Haan 1972) has surveyed over 500 sites to the west in Montezuma Canyon, and members of his field school have excavated several large canyon bottom pueblos (Miller 1974). One of these ruins is a large Pueblo I pithouse village, while others are Basketmaker III - Pueblo III complexes. Excavations have also been intensified in the northern part of Cajon Mesa, with Wheat's (1955) and Rohn's (1974) research near Yellowjacket Canyon, and Ives' unpublished work in Negro Canyon. Both Wheat and Rohn have expanded the Ackmen Basketmaker III sequence, and possible earlier sites have been noted as well. Probably the most comprehensive survey to date has been a five year study run by the University of Colorado for the Bureau of Land Management (Martin, Lister and Breternitz 1971) which investigated 278 square miles of land between the Colorado state line and Cortez. 1587 sites were located,

representing Basketmaker III through Pueblo III use of the area, with the heaviest occupation during Pueblo II - III times.

NATURAL SETTING

III NATURAL SETTING

Hovenweep National Monument is located on Cajon Mesa, which covers approximately 500 square miles (1300 km^2) of canyons and ridges on the Great Sage Plain in southeastern Utah and southwestern Colorado (Fig. 1). Although the topography is fairly uniform, variations in rainfall, soil type and plant associations occur through minor elevation and drainage pattern differences. Natural boundaries are formed by the San Juan River on the south, and by Montezuma Creek, McElmo Creek, Cross Canyon and Yellowjacket-Sandstone Canyon, which are seasonal but none-the-less important sources of springtime moisture and summer floods. Permanent springs and seeps are common in canyonheads, especially at the point of contact of the porous Dakota Sandstone which caps the mesa and the underlying, more impervious Morrison Shales. The overall gradient is relatively gentle, and the elevation gradually slopes from 6800 feet in the northern forests to 4800 feet in the southern shrublands. Annual rainfall varies with elevation, with approximately 6 inches falling near the San Juan, 9.3 inches falling in the mid-mesa, and 15 inches occurring in the pinyon forests at the north end. The westerly winds of winter and the southerly summer winds bring the bulk of the precipitation, and 25 - 30% of the rainfall accumulates in July - September and 34 - 36% falls as snow in December-March. Temperature and evaporation are high, with a mean yearly temperature of 52°F, but the growing season is more than adequate for the modern bean fields in the north since it averages 152 days and only one year out of thirteen has a season under 120 days. Soil is generally deficient except in the north, and there are no large areas of deep buildup or dunes. Areas of greatest depth occur in the broader canyon bottoms and on the ridges near the upper reaches of the mesa top drainages, but aside from the well-watered soils of the pinyon forests, the buildup seldom reaches 100 cm.

Ten major environmental divisions can be defined on the basis of plant communities and physiographic variation. Four plant zones partition the mesa top, ranging from pinyon-juniper forests in the north, through juniper-sage and sage areas in the mid-portion of the mesa, to shrubland at the south end

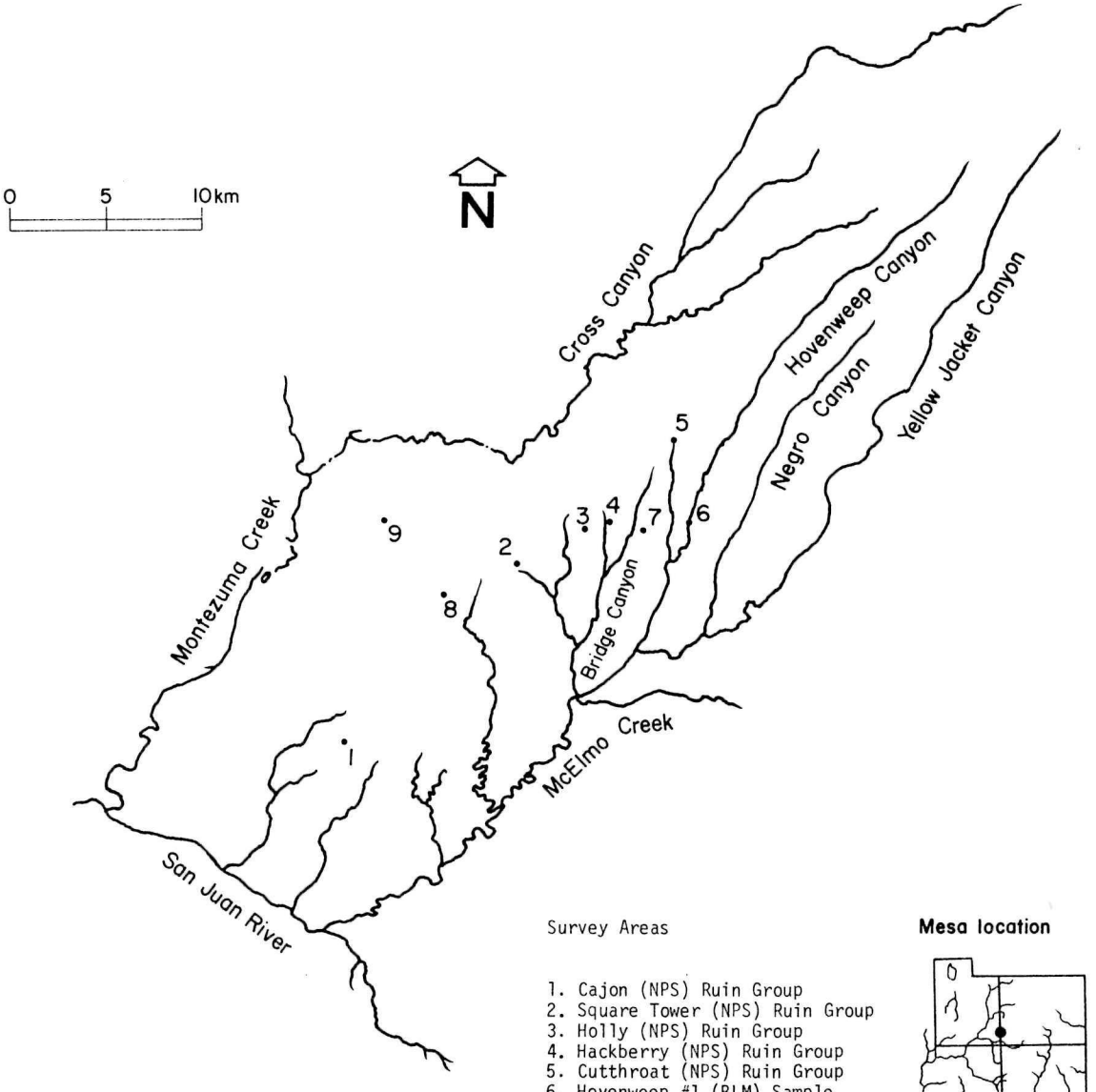


Figure I. 1974 National Parks Service (NPS) and Bureau of Land Management (BLM) survey areas on Cajon Mesa. Hovenweep Archeological Project, San Jose State University.

and in the valley of the San Juan (Fig. 2). Six physiographic divisions (arroyos, ridges, canyonhead springs, canyon rims, talus slopes and canyon bottoms) cross-cut the major plant zones, thereby producing numerous microzones composed of dozens of plant associations. Pinyon pine, rice grass, prickly pear, yucca, wolfberry, rush, cattail, serviceberry and hackberry are the most important food plants (see Appendix I), while deer, rabbit and rodents are the more important animal species (see Appendix II).

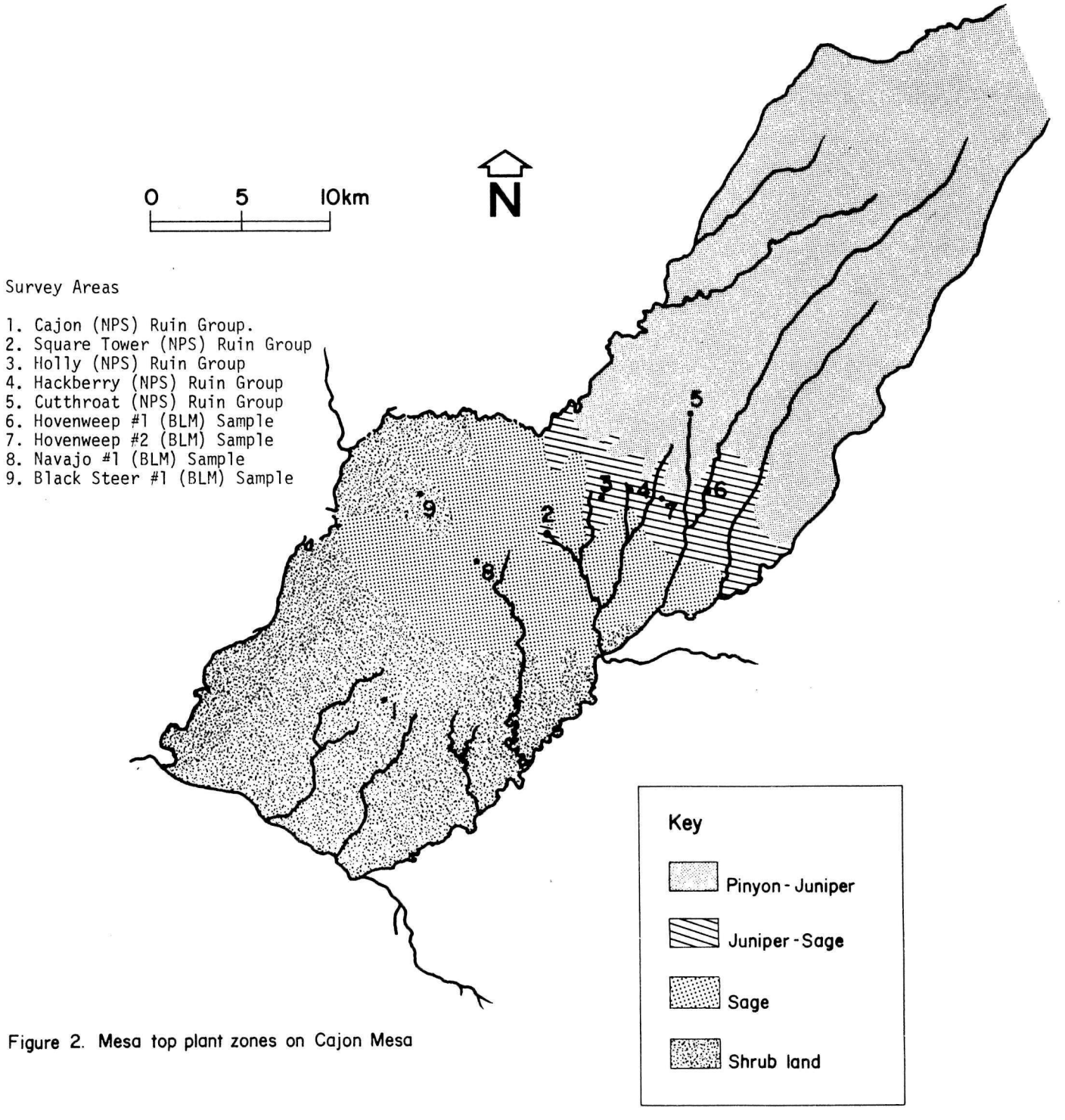


Figure 2. Mesa top plant zones on Cajon Mesa

DATA COLLECTION AND ANALYSIS

IV DATA COLLECTION AND ANALYSIS

The 1974 season was part of a multi-stage program based on surface surveys, environmental studies, experimental gardens and water control and computer assisted data analysis. Eight weeks were spent in the field surveying 656 acres of National Park Service land and 160 acres of Bureau of Land Management land (Fig. 1). Since the National Park Service acreage occurs in five Monument Units which are clustered around canyonheads, four forty acre Bureau of Land Management quadrats were chosen randomly from within other physiographic strata to obtain data on site/environmental relations in non-canyonhead locations. The 1975 survey will continue this approach through an examination of 2000 acres of Bureau of Land Management and State of Utah acreage in pinyon-juniper, sagebrush and shrubland localities.

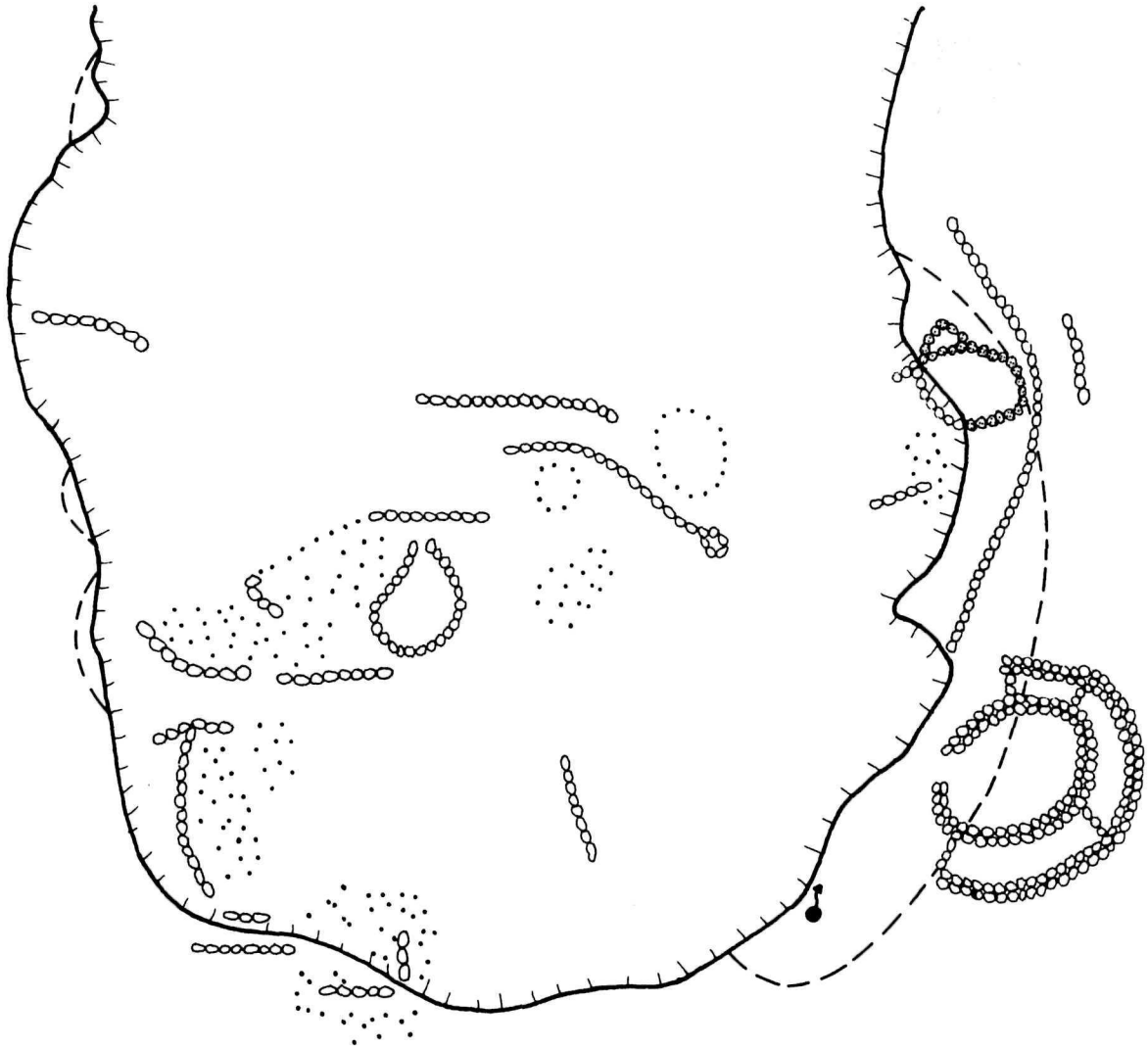
Site Survey Procedure

157 sites were examined in or immediately adjacent to the five Monument Units, and 27 sites were studied in the Bureau of Land Management quadrats. Since both the study of site concentrations in the Monument and the overall composition of the mesa universe are of interest, a combination of systematic nonrandom block surveying and random stratified surveying techniques were employed. Both approaches involved the same cluster surveying technique (i.e. all areas within the survey units were systematically examined; cf. Binford 1964) and differed only in the manner in which the survey units were selected for analysis. The National Monument survey represents a nonrandom block survey, in that all five Monument Units were surveyed, regardless of environmental zone, area size, and previous coverage. This approach did not provide a representative sample of the mesa, but it did obtain data on the major site clusters and provided important information for the Park Service's interpretive program. However, since it was not representative of site/environmental relations, the randomly stratified survey phase was developed to meet the requirements of the research program. Two physiographic areas

in particular (broad canyonbottoms and mesa tops located away from the canyonheads) are under-represented by the Monument Units, and for this reason they were chosen as the strata from which additional survey units were selected. In this way the functional distribution of sites and their environmental relations could better be appreciated, thus permitting the development of a model of the changing patterns of farming locations through space and time. Sample units measuring 400 meters on a side (40 acres total) have successfully been used in prior Southwestern surveys (Lipe and Matson 1971), and four such units were selected randomly so as to avoid biasing the sample. All potential canyon bottom and mesa top survey units on Cajon Mesa were assigned random numbers on USGS topographic maps, and two were chosen out of each strata as the units of analysis.

After the selection of all nine survey areas, aerial photographs of each area, along with National Park Service, Bureau of Land Management and USGS topographic maps were carefully examined so that the survey boundaries could be located with precision. Reconnaissance parties then entered the field and marked off the boundaries at 50 meter intervals. Groups of three - four surveyors spaced ten meters apart examined the units in skirmish lines oriented north/south. Areas where the topography was too rugged (e.g., canyons) were surveyed separately. When artifacts or potential features were encountered, the area was carefully examined. Sites were then located on the topographic map blowups and aerial photographs, numbered, and finally examined by mapping parties. In this manner practically every square meter of each unit was investigated, thereby producing a more thorough survey than has previously been carried out within the Monument boundaries.

"Sites" were defined as containing at least one feature and/or five artifacts in a 25 meter square area, with sizes varying from multi-room tower complexes measuring several hundred meters on a side to small scatters of flakes or pottery. Each site was gridded off using standard compass and chain methods, photographed with both color and black-and-white film, and mapped by a combination of alidade-plane table and compass-chain methods. All features, artifact concentrations and plants were located on the individual site maps, as shown in Figures 3 - 5. An important aspect of the research is the identification of site/environmental relations, and over



0 4 8m

Key

Cliff edge

Standing wall

Rubble area

Cliff overhang

Wall in overhang

Seep

HOV-57 Horseshoe house
Fig. 3

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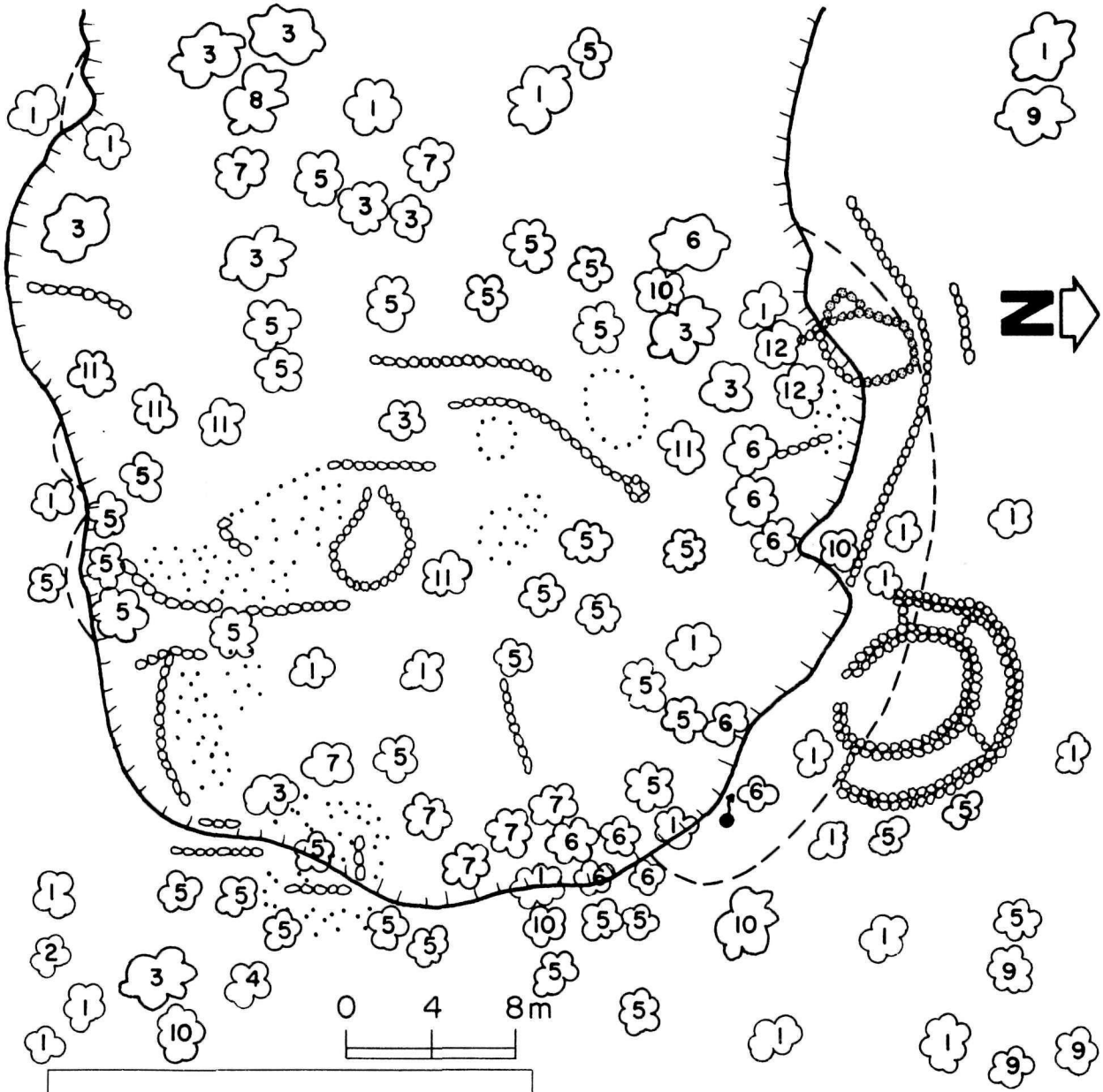


Fig. 4. Floral map of Horseshoe house

- Cliff edge
- Standing wall
- Rubble area
- Cliff overhang
- Wall in overhang
- Seep

Plant location

1	Juniper
2	Yucca
3	Service berry
4	Wolf berry
5	Sage
6	Rabbit bush
7	Oregon grape
8	Squaw bush
9	4 wing salt bush
10	Prickly pear cactus
11	Mormon tea
12	Hackberry

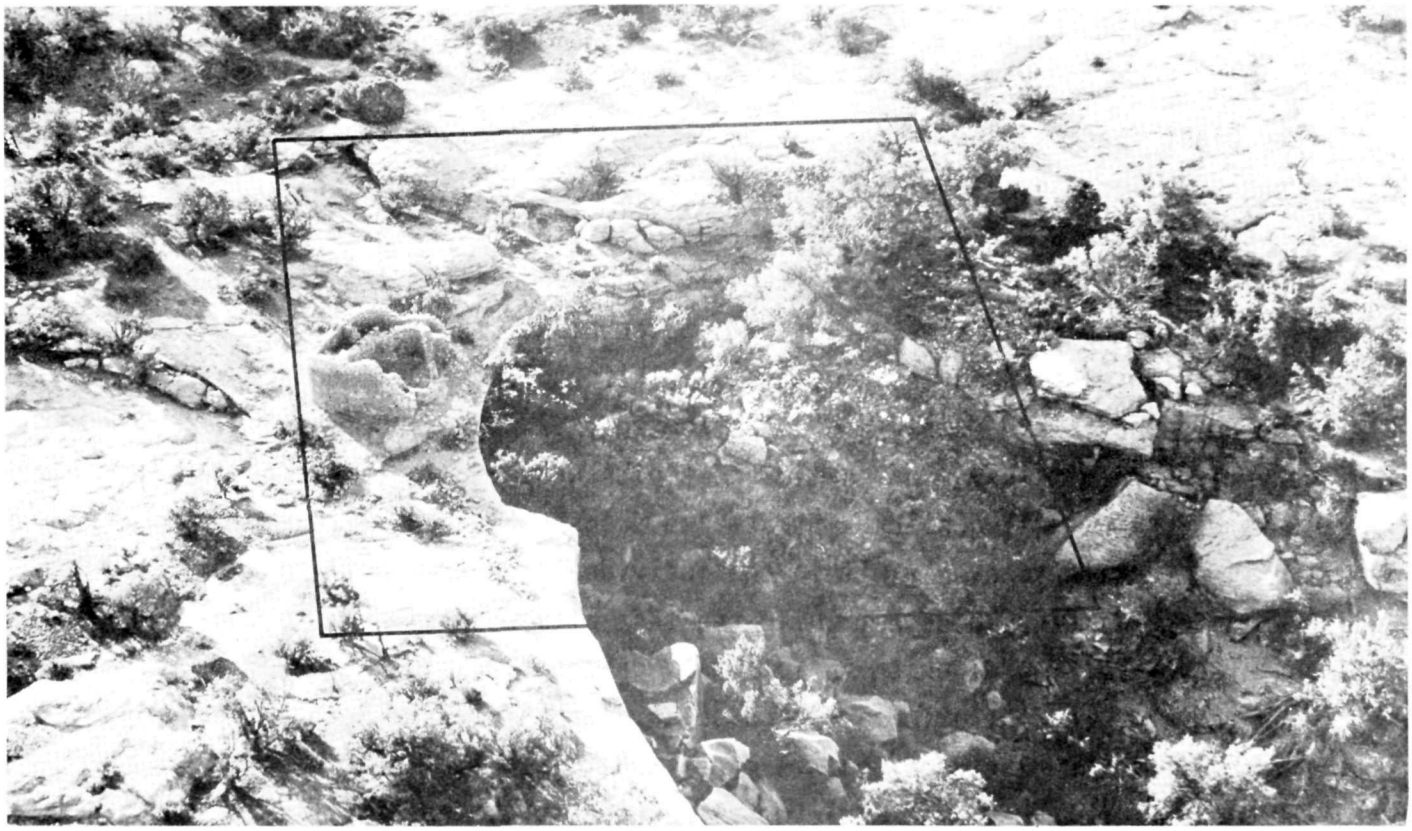


Figure 5. Horseshoe House (Hov. 57-59) survey area. Note grid outline.

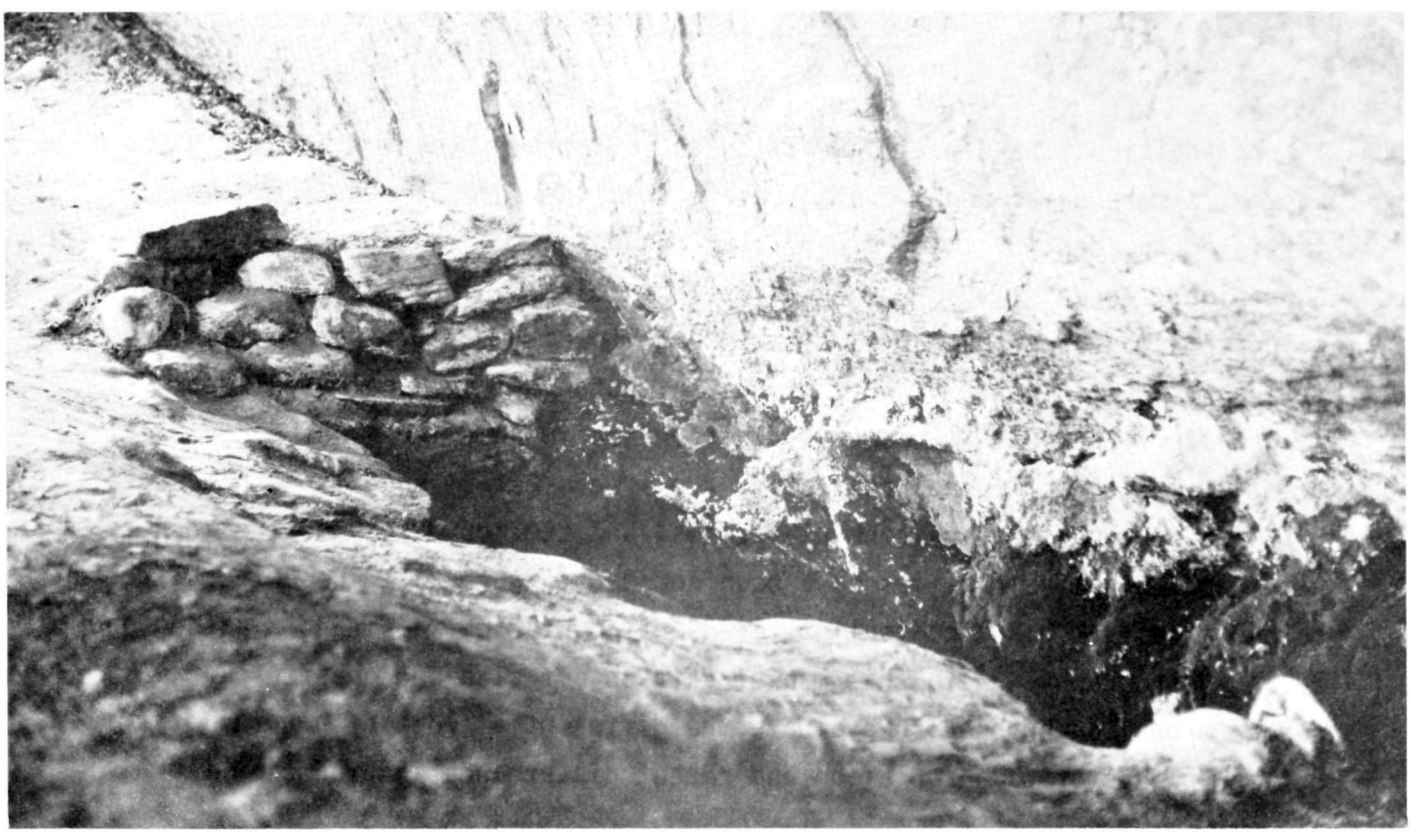


Figure 6. Modified spring (Hov. 3) at the head of Ruin Canyon.

fifty plant species were mapped on the sites while another fifty were mapped in non-site locations (Appendix I). It has been shown that floral distribution can sometimes aid in the identification of locations where prehistoric disturbances or farming occurred (Yarnell 1965), and it is anticipated that the careful mapping of clusters of particular plant species will allow the determination of site functions (Appendix IV). A 25% random surface sample of ceramic and lithic debris was collected to yield data about period of occupation and site use, and shallow test pits were dug to obtain pollen and to determine soil quality. Stratified transect methods were employed to collect artifacts evenly within the individual features so as to avoid the biasing of future studies, while the test pits were limited to one-quarter of a meter wide units in potential garden areas located away from the major site concentration. Extensive environmental data were gathered to supplement the plant and feature maps, and to provide information on landform, drainage pattern, angle of slope, exposure, feature description and surrounding plant community.

Resource Identification

In addition to the environmental data collected at each site during the survey, a more comprehensive study of regional resource patterns has been initiated to identify the broader relations of environmental variation and aboriginal land use. Many prehistoric activities, such as farming and plant gathering, may have taken place in resource zones located several miles from the nearest site cluster, and a program of botanical and zoological analyses is necessary to identify resource distribution in non-site areas. Permanent plant transects and faunal collecting areas were established in each Monument Unit and in the major environmental zones, and the boundaries of the mesa top plant and animal communities have been located (Figure 2). The data collection methods involved plant collecting, transect counts and maps, and close-up and aerial photography. In this manner data on off-site and on-site plant associations can be used to evaluate the differential role of natural distribution, prehistoric manipulation and recent disturbance in producing floral

patterns. 115 plant species have been identified, and 15 appear to have abnormal distributions on site surfaces, which is suggestive of aboriginal use (Appendix I). Animal life includes over 100 species of mammals, birds, reptiles and amphibians, and 68 insect families (Appendix II).

In any study investigating the relationship of archeological sites with resource patterns, the past as well as the present environment must be determined. Since the most feasible method of evaluating the continuum of past and present environmental conditions is palynology, pollen samples were collected at all sites to determine if conditions have changed and to judge the effects of any changes on modern patterns of plant succession and distribution. Pollen can also aid in the identification of past areas of agricultural activities, as demonstrated by Martin and Schoenwetter's (1960) work with ancient corn fields.

Experimental Water Control and Gardening

A program of reconstruction was initiated to analyze the functions of so-called "water control" structures and to study the mechanisms of water control in relation to precipitation, run-off, absorption and ground water flow. 37 of the 184 sites were found to have possible water control structures, ranging from modified springs (Fig. 6), talus dams or retaining walls (Fig. 7), rim dams, arroyo check dams (Fig. 8), reservoirs, cisterns and farming terraces. These designations are based on comparisons with modern Hopi and Zuni water control structures, which represent a variety of moisture manipulating devices that are scattered across many different types of fields so as to insure a harvest in at least one area if drought or unseasonal frost destroys the bulk of the crop. Althought there are some differences between Hopi and Zuni water control methods (Table 1), in both cases the diverse forms of manipulation are scattered at many points along a water course, and each device can be correlated with a particular type of field in a specific environmental location. Table 1 outlines these correlations, following the typology developed by Hack (1942). The most common archeological expressions of these devices include: check dam



Figure 7. Talus dam at Hov. 430 in the Holly Group.

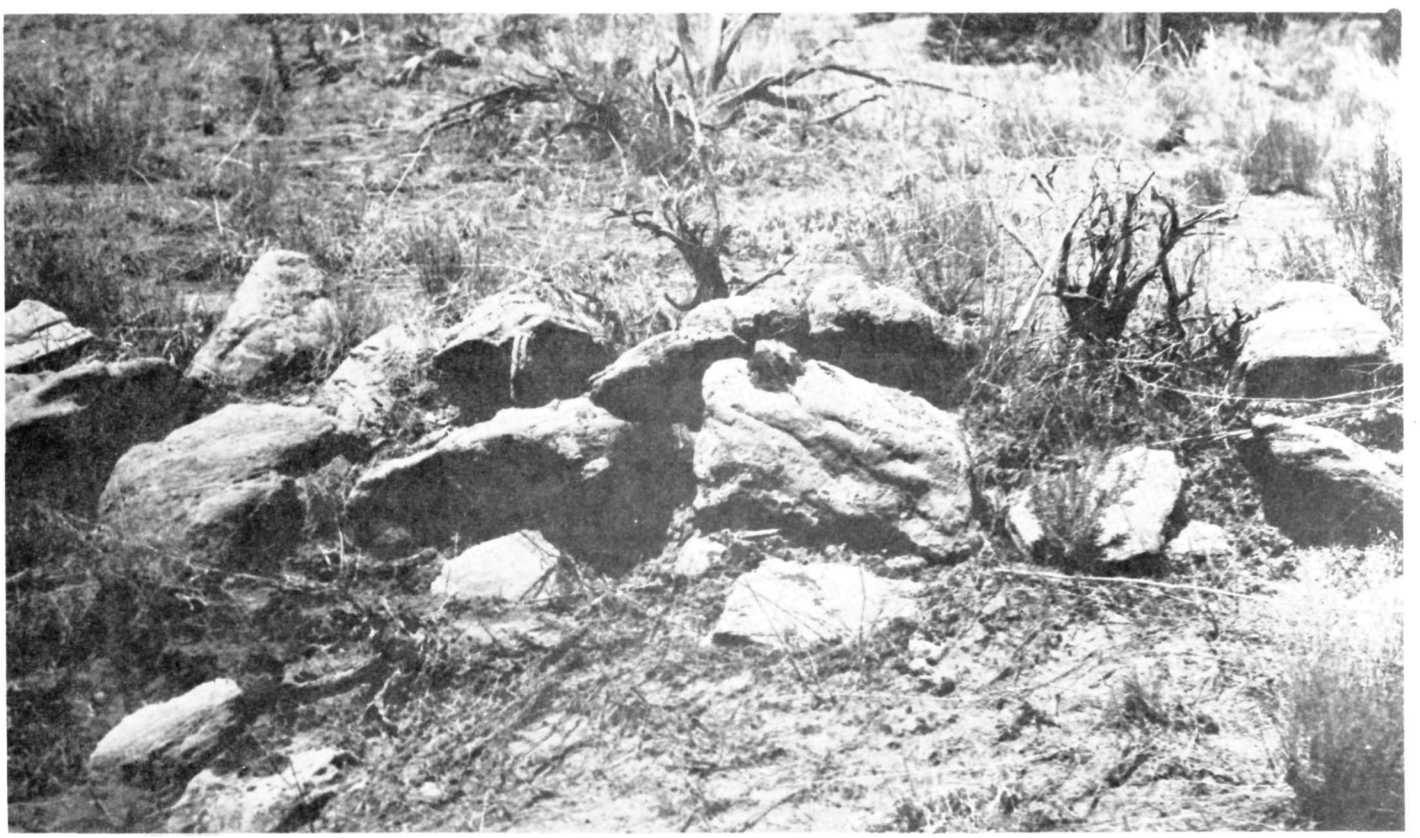


Figure 8. One of ten arroyo check dams at Hov. 437 in the Hackberry Group.

TABLE 1

WATER CONTROL DEVICES, CORRELATED WITH FIELD TYPE

Hopi Field Type	Hopi Water Control Devices (after Hack 1942 and Steward and Donnelly 1943)	Zuni Water Control Devices (after Cushing 1920
Akchin fields	earth banks, ditches and channels	earth and brush dams and barriers
Floodplain fields	earth spreaders and ditches	same as above
Low floodplain terraces	none mentioned	none mentioned
Arroyo bottoms	none mentioned	none mentioned
Arroyo terrace plots	stone and brush dams with terraces	soil, earth and brush banks and terraces
Dune fields	rock and brush windbreaks	none mentioned
Dry fields	boulder terraces and rock lines on gentler terrain	none mentioned
Seepage fields	none mentioned	none mentioned
Wash bottom irrigation	diversion ditches, dikes and banks	dams, log aqueducts, "waffle" plots, ditches, banks, pot irrigation
Spring diversion fields	ditches, reservoirs, dams, banks, boulder terraces, retaining walls	pot irrigation
Hillside terraces	boulder block walls and soil terraces, ditches and banks	none mentioned

terraces with stone and brush dams holding back step-like soil plots in arroyos; hillside terraces (or "trincheras") with rock and brush walls on hillsides holding back step-like soil plots; ditches with stone and mud dams in springside and floodplain irrigation systems and in hillside terrace systems; reservoirs formed from earth banks and stone walls for domestic water; and linear grids and borders of low rock walls and brush piles used for windbreaks, soil conservation and water distribution, often in combination with ditches and terraces. Seven types of Hopi-Zuni water control devices appear to have been used at Hovenweep, and a study is currently underway which is examining their possible functions. One of three rim dams at Hov. 71 above the head of Ruin Canyon has been rebuilt, and one seep (Hov. 109) in a nearby canyonhead has been cleaned. Data on sedimentation, soil buildup, moisture retention and water quality are being collected at the rim dam, and the modified seep is serving as a control for the evaluation of the effects of the rebuilt dam on water percolation to a spring in the canyon immediately below (Appendix III). Four farm plots of wild and domesticated Hopi crops will be established in 1975 in order to obtain data on the potential of different locations for aboriginal gardening. Weather and soil studies will be conducted at each garden to determine if differences in exposure and topography cause variations in frost, precipitation, humidity, evaporation and soil buildup which would effect gardening activities.

Data Analysis

More than 100 presence/absence environmental and cultural variables have been noted at each site, along with several dozen pottery and tool categories and the distributional patterns of over 50 plant species. Since rather subtle relations are present in many instances, a program of computer data manipulation will be used at all levels of the research, particularly for the definition of site/environmental relations. A program oriented around data reduction, cluster analysis and multi-dimensional scaling is being utilized, since this approach permits a relatively simple statistical

measure of the environmental, functional and temporal clusters on the mesa. The cluster analysis is underway in the study of pottery design elements, and the multi-dimensional scaling routine is assessing site floral composition to determine the relations of plant distribution, site location, structural association and time period (Appendix IV).

DESCRIPTION OF SURVEY AREAS

V DESCRIPTION OF SURVEY AREAS

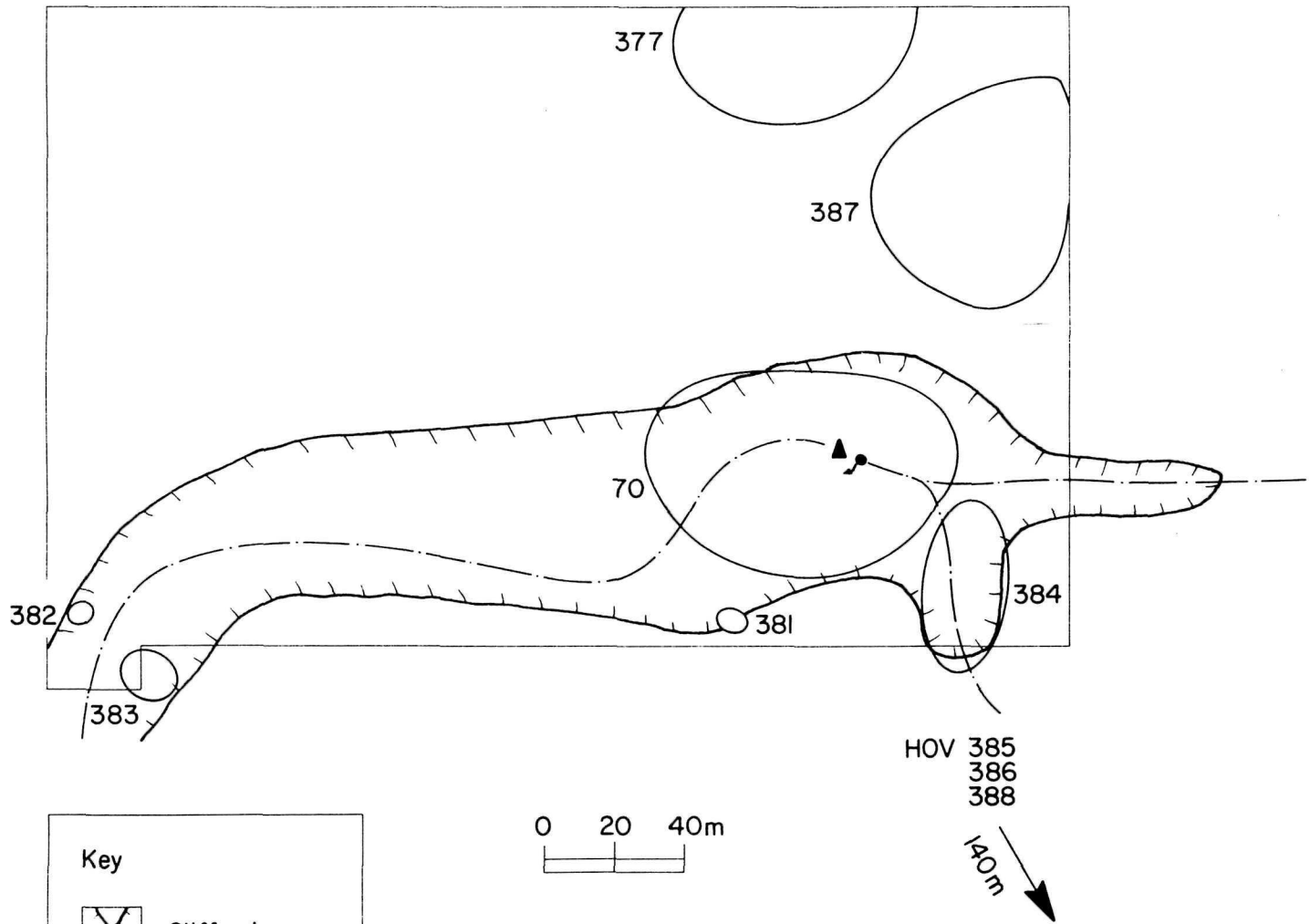
Nine survey units were examined, with the five National Park Service Monument areas varying in size from 14 to 400 acres while the Bureau of Land Management quadrats each measured 40 acres. A general description of each area follows accompanied by relevant maps and photographs. Lists of structural associations, possible site use, pottery and tool types, and apparent temporal provenience are presented in Appendices V - IX. The survey areas are discussed in a north to south sequence.

Cutthroat Castle Monument Unit

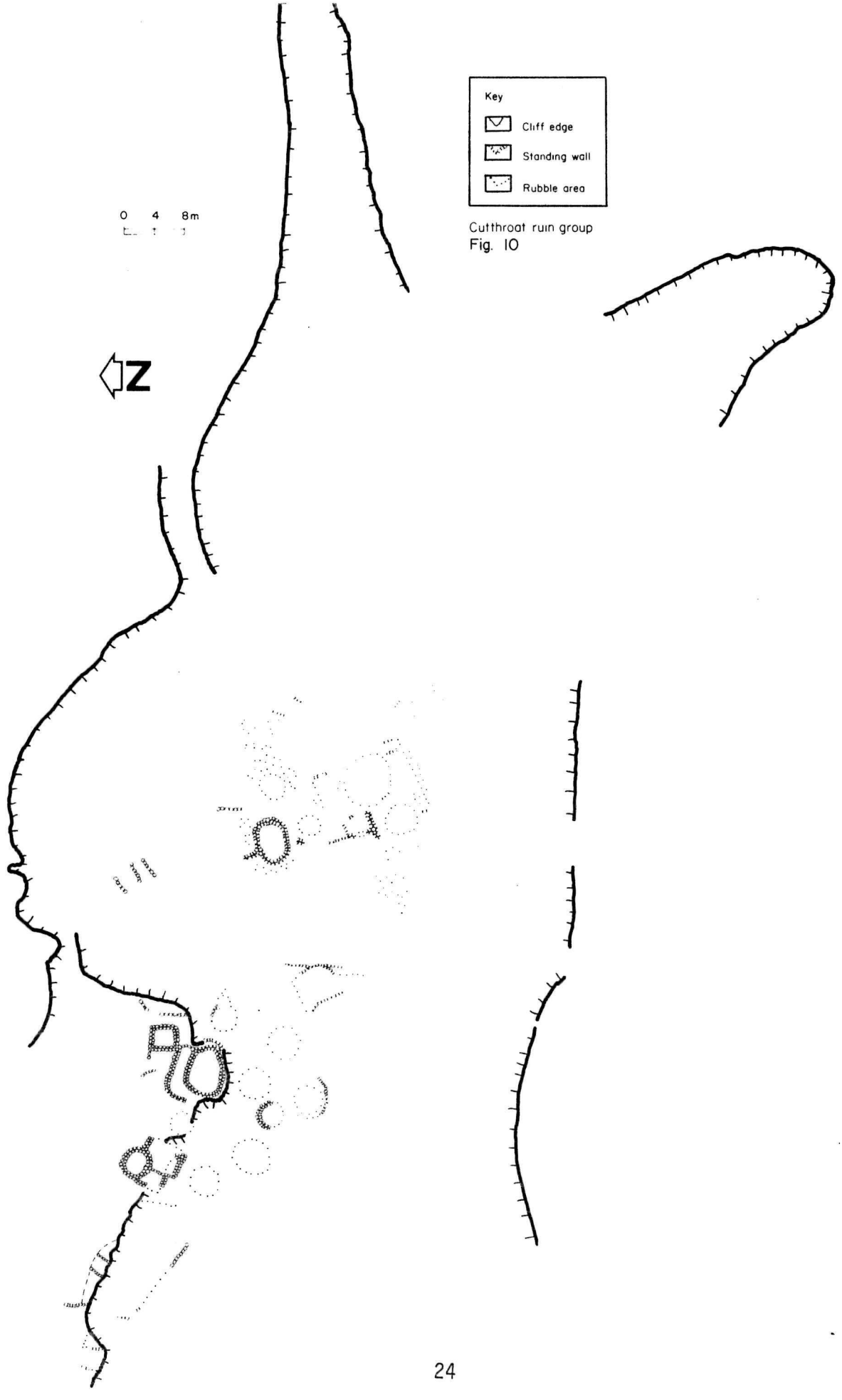
The northernmost survey area was a fourteen acre unit of pinyon and juniper forest located at the head of an unnamed tributary of Hovenweep Canyon (Fig. 9). This unit contained the highest number of sites per acre of all the survey areas, since seven sites were surveyed within the Monument boundaries and three others were discovered on a ridge several hundred meters to the southeast. The major site of the complex is Cutthroat Castle (Hov. 70), a large Pueblo I - III cluster of room blocks, towers, possible kiva depressions, natural shelters, trash areas and talus dams clustered around a spring at the head of the canyon (Figs. 10-11). Other site types within the unit include lithic and ceramic scatters, shelters and possible check dams, while the sites to the southeast are ceramic/lithic scatters, small surface rooms, and a possible Basketmaker II pithouse. The area may have been inhabited as early as Archaic or Basketmaker II times, as indicated by crude points and the pithouse, but the densest use occurred during Pueblo II - III times.

Hackberry-Horseshoe Monument Unit

A dense cluster of 53 sites occurred around the two canyonheads of Hackberry Canyon, in a 137 acre parcel at the north edge of the juniper-sage



Cutthroat castle NPS
base map
Fig 9



Cutthroat ruin group
Fig. 10



Figure 11. Cutthroat Castle Ruin (Hov. 70) and surrounding survey area. Note pinyon-juniper cover.

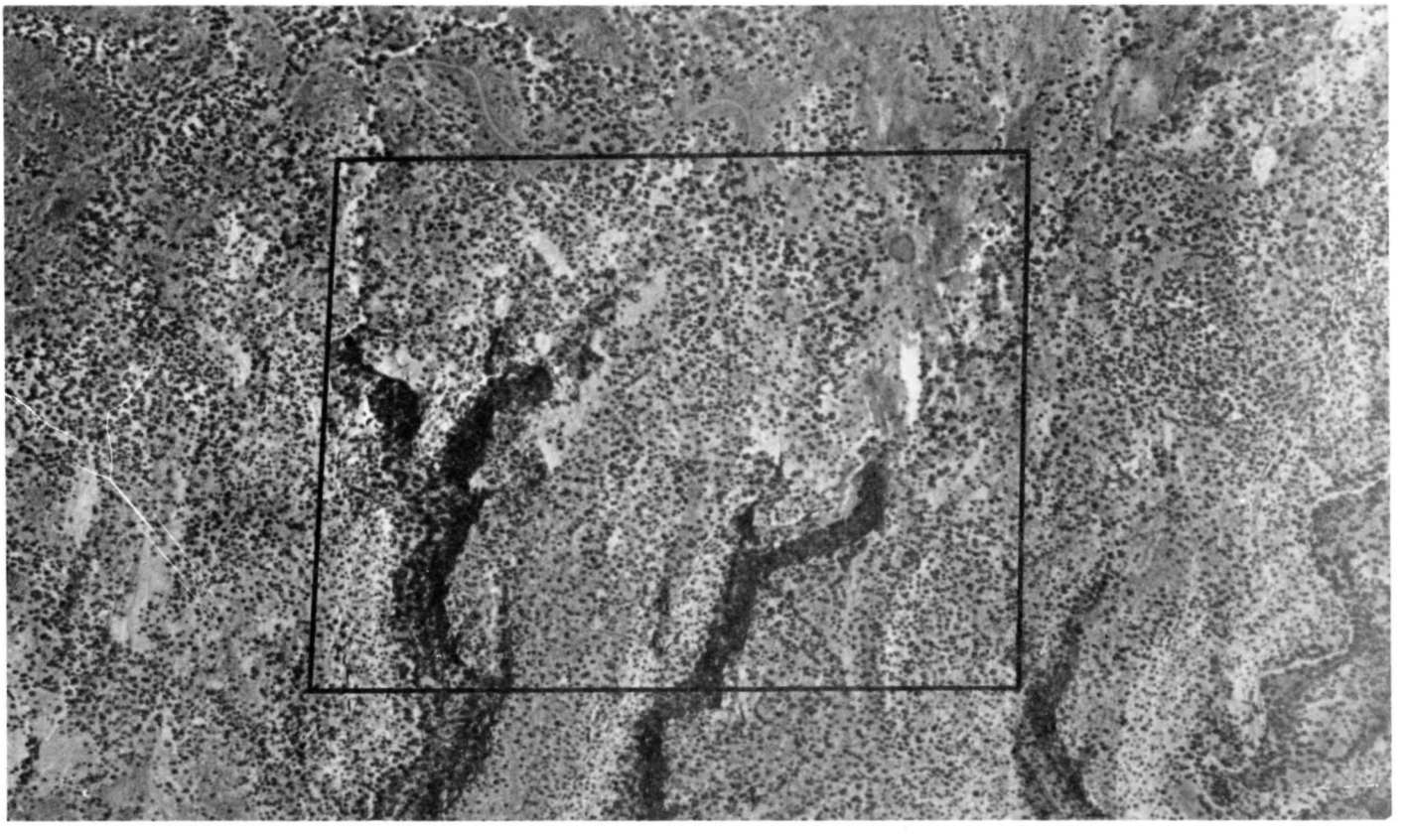


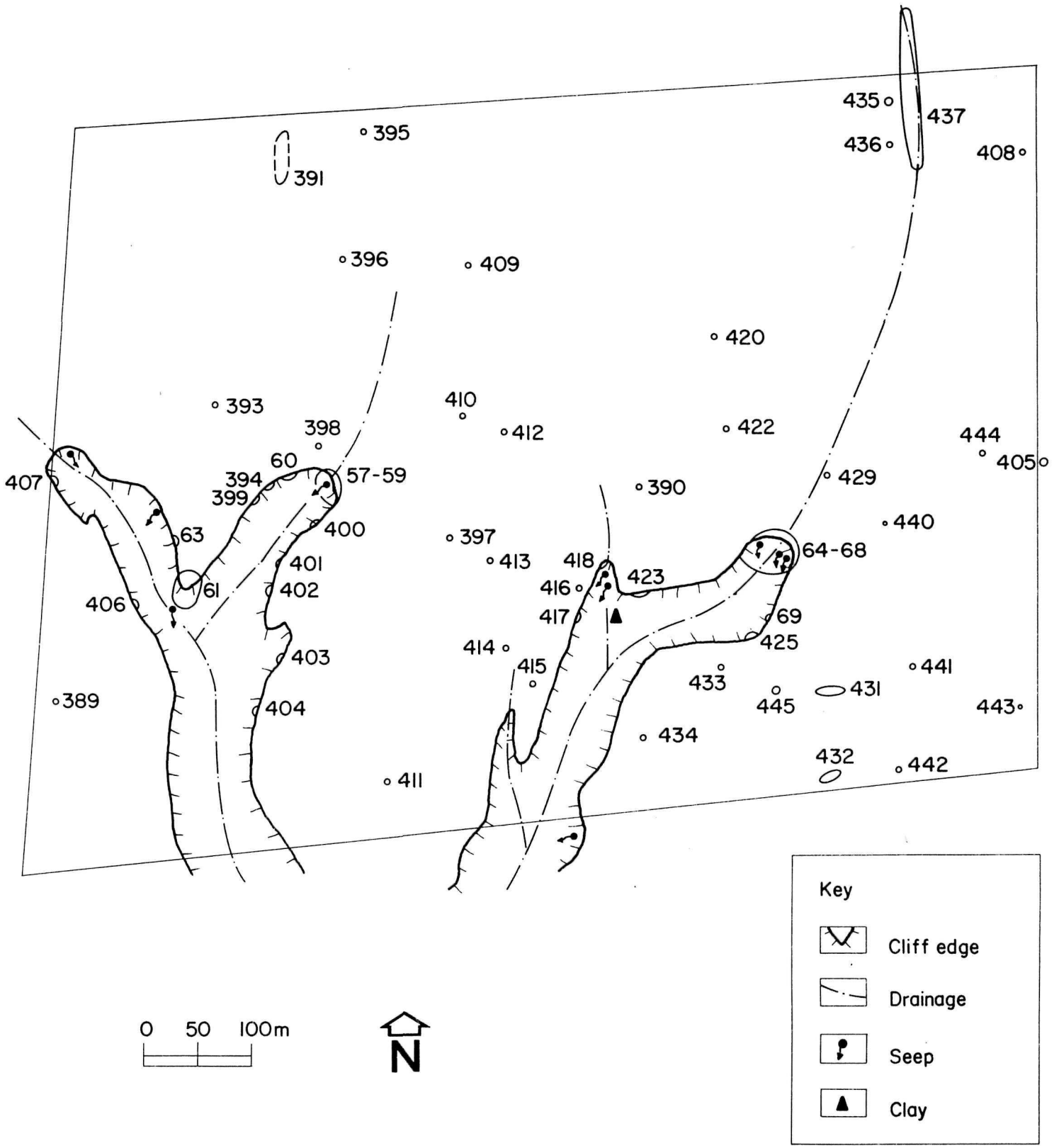
Figure 12. Hackberry-Horseshoe survey area, with typical canyonhead terrain and juniper-sage cover.

zone (Figs. 12-13). The majority of the sites in all of the canyonhead survey areas are clustered around or near the canyons, probably in association with aquifer springs. Hackberry House (Hov. 64-68) and Horseshoe House (Hov. 57-59) are two of the most impressive sites at Hovenweep, and each is composed of towers, room mounds, talus dams, rim dams, possible kiva depressions, shelters and trash deposits (Fig. 14; also see Figs. 3-5). A shelter kiva and a large pictograph panel also occur at Horseshoe House, and a series of storage rooms and several meters of fill occur in the shelter below Hackberry House.

Another preferred location for large multi-purpose Pueblo II - III ruins are the points where two canyons meet, especially when a spring occurs nearby. Tower Point Ruin (Hov. 61), for example, is located approximately one-half mile south of Horseshoe House, and includes a walled off tower at the end of the point, a room block on the mesa beyond the wall, numerous rooms and granaries on the talus, a large midden at the foot of the talus, and a possible terrace system on the floor of the canyon which apparently had been formed from an earlier room block and associated pithouse. Other sites occurring within the unit are canyon wall and talus shelters and granaries which are clustered near the large ruin complexes, strings of arroyo checkdams, unit pueblos, isolated rooms, and numerous ridge top lithic and ceramic scatters. The occupation sequence ranges from Basketmaker III through Pueblo III, with a limited use by recent Navajo.

Holly Monument Unit

16 sites were located within the 65 acre Holly Unit. The area is strikingly similar to the Hackberry-Horseshoe Group in that it is centered around the head of the north fork of Keeley Canyon in the juniper-sage zone, with a large Pueblo II-III multi-room tower complex clustered around the canyonhead (Figs. 15-17). Features associated with Holly House (Hov. 53-56) are a large rim dam, talus retaining walls, possible kiva depressions, several room blocks, middens, nearby shelters and granaries. The overall settlement pattern throughout the unit includes canyon point sites, strings



Hackberry / Horseshoe NPS un..
base map
Fig. 13

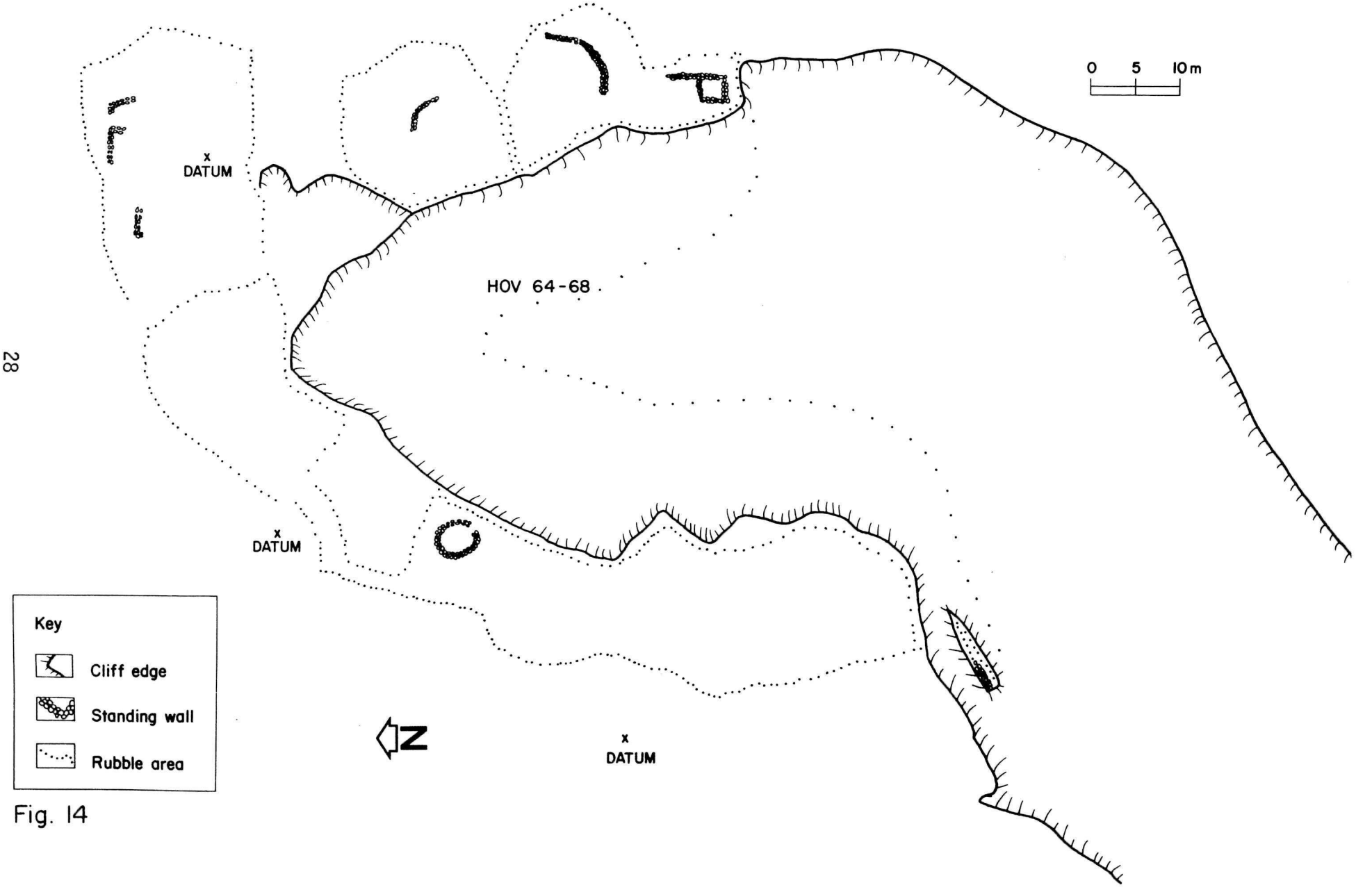
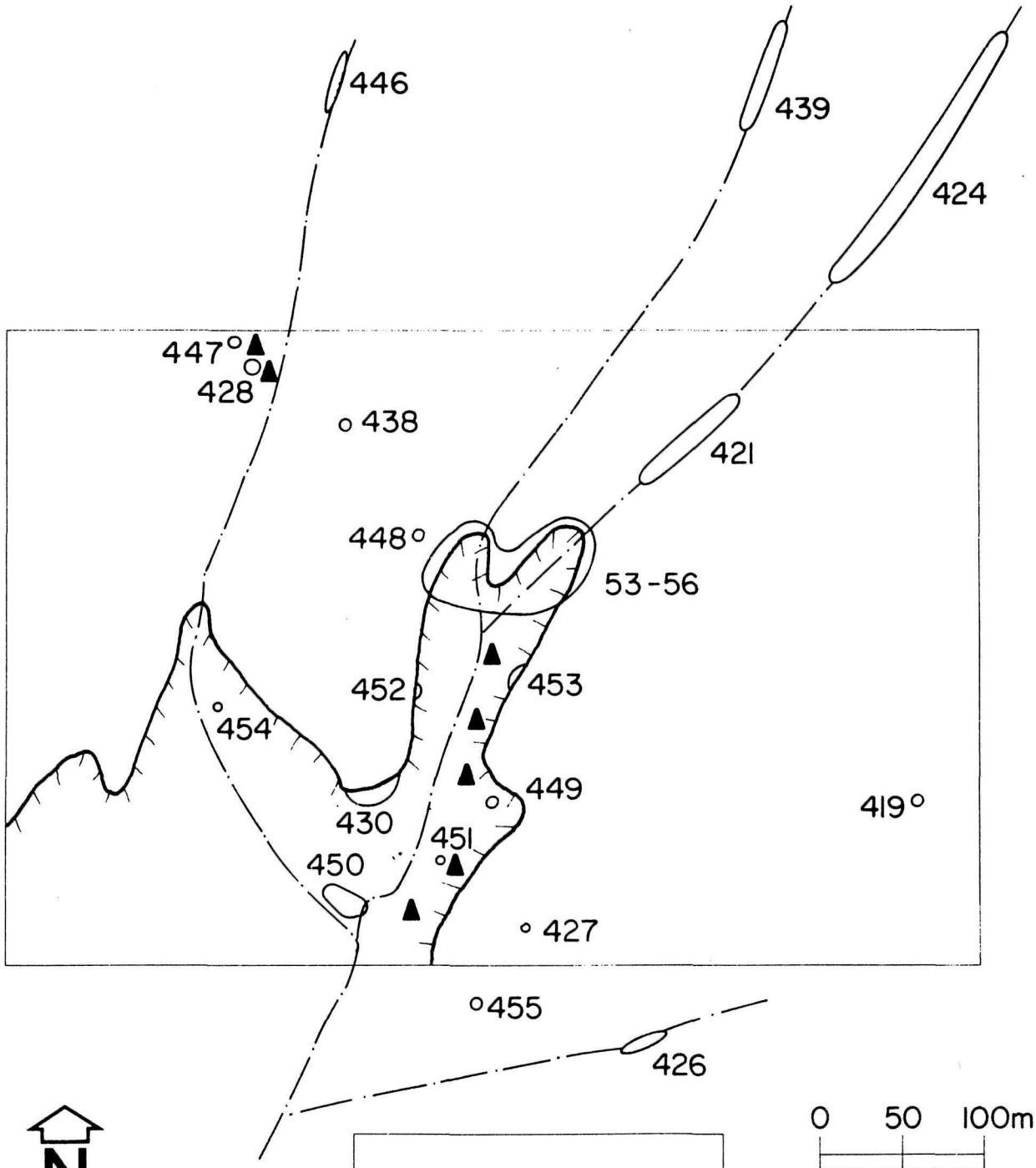
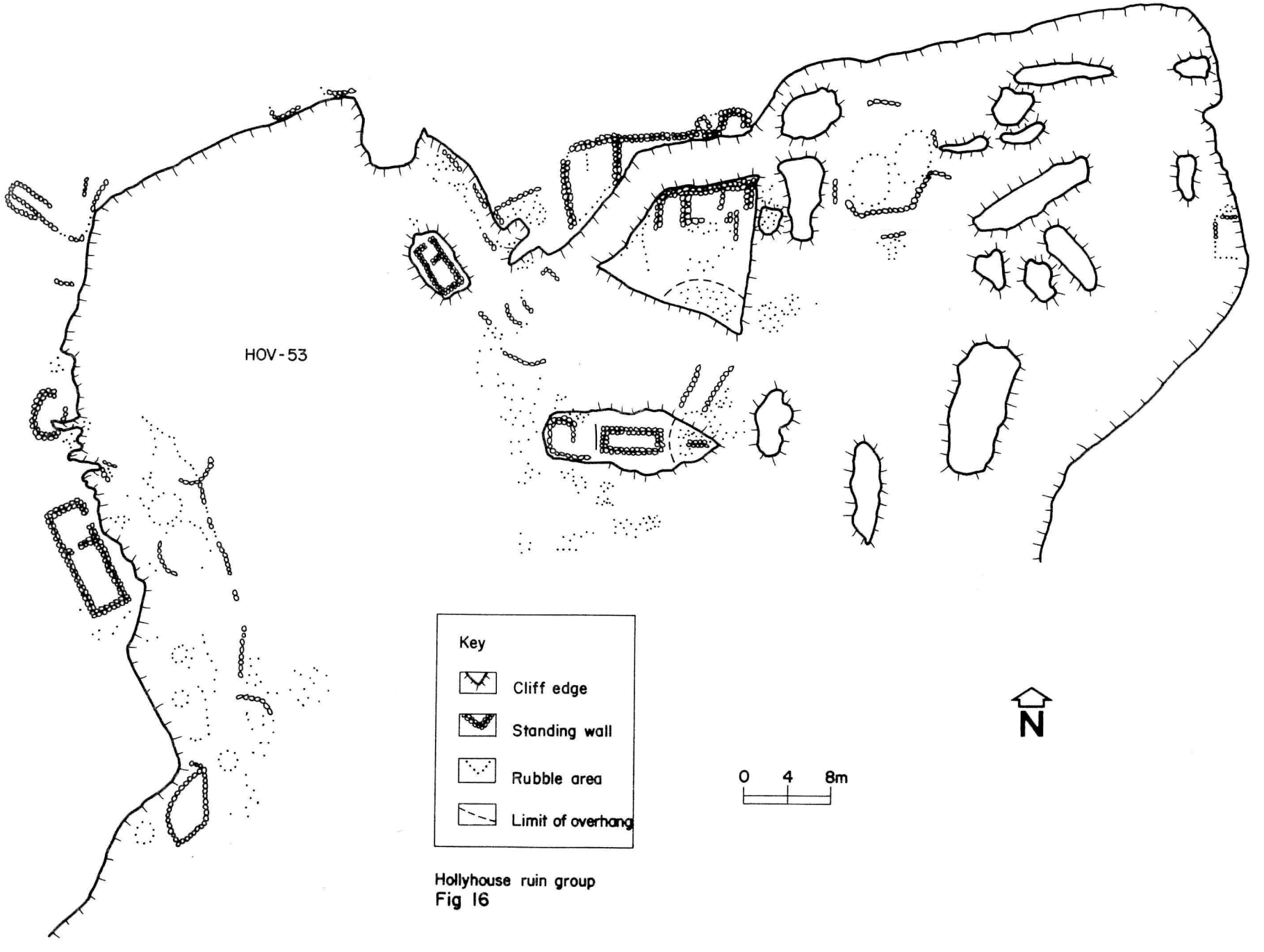

0 5 10 m
HOV 64-68
DATUM
DATUM
DATUM
N
Key
Cliff edge
Standing wall
Rubble area

Fig. 14



Holly NPS group
base map
Fig. 15



Hollyhouse ruin group
Fig 16

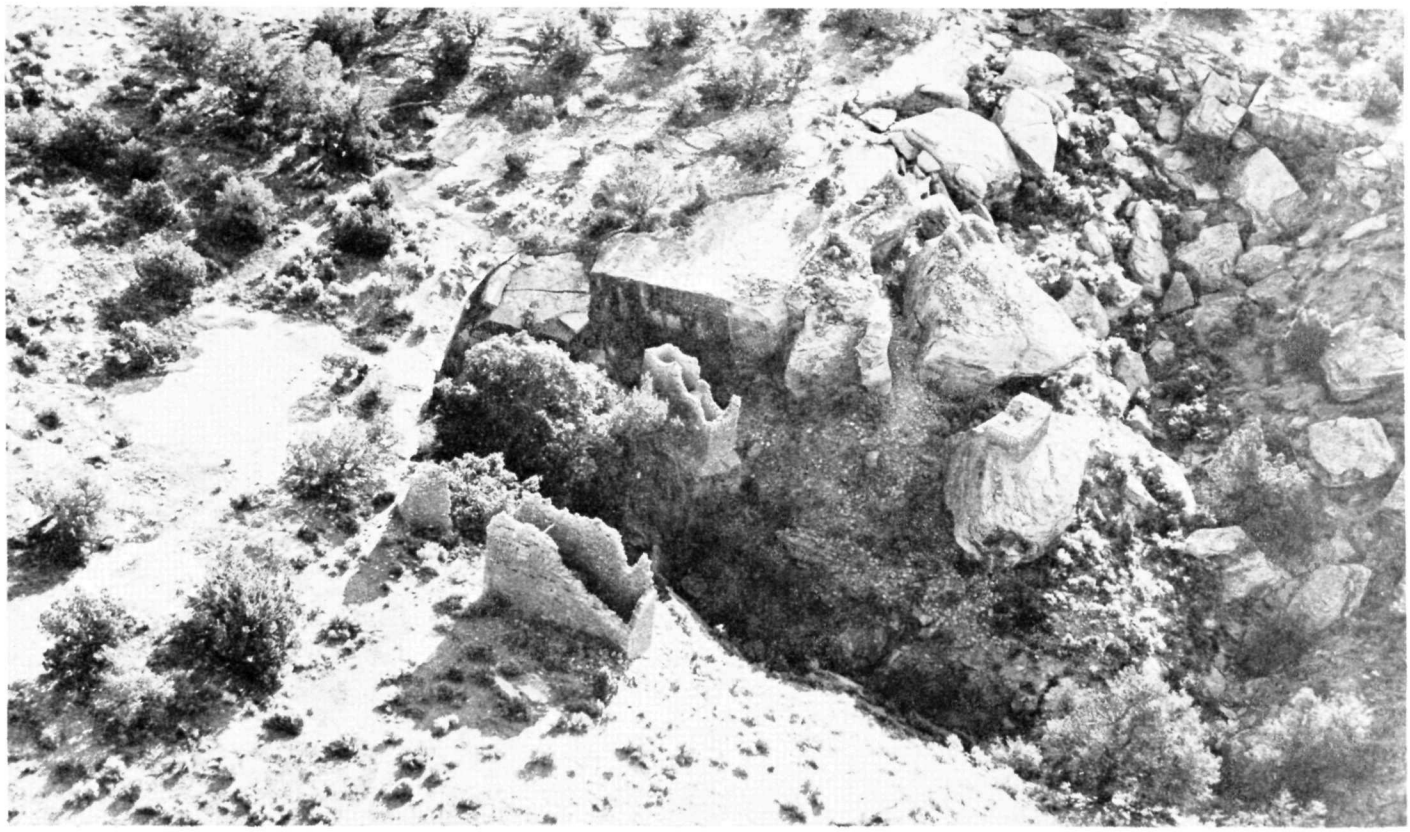


Figure 17. Holly House Ruin (Hov. 53-56) and surrounding survey area.



Figure 18. Hovenweep Canyon #1 Quadrat. Note canyon bottom terrain and juniper-sage community.

of arroyo check dams, granaries, shelters and lithic/ceramic scatters. The area was occupied primarily during the Pueblo II-III period although several possible Archaic, Pueblo I and Navajo sites have been located.

Hovenweep Canyon Quadrat #1

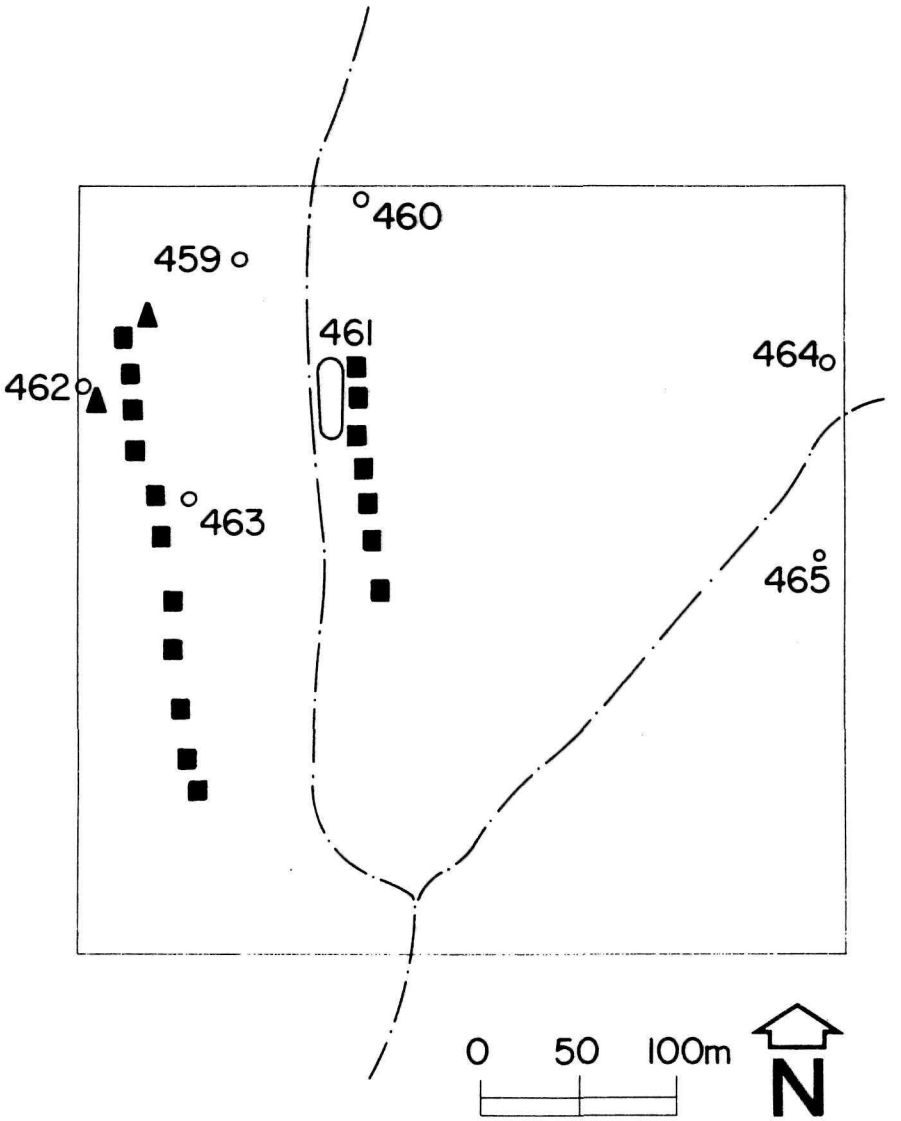
Since areas containing broad canyon bottoms were poorly represented in the National Park Service Units, two randomly selected quadrats from all potential canyon bottom locations on Cajon Mesa were added to the sample. Hovenweep Canyon Quadrat #1 was situated in the juniper-sage zone at the confluence of Hovenweep Canyon with a minor tributary (Figs. 18-19). Neither a spring nor a large ruin was located at this junction, and all seven of the sites in the quadrat were small, apparently limited activity areas. Storage shelters, lithic/ceramic scatters and a quarry were noted. Cultural affiliation was difficult to determine, since most of the sites lacked diagnostic pottery, but the occupation was probably limited to the Pueblo II-III periods.

Hovenweep Canyon Quadrat #2

Mesa tops were also poorly represented in the Monument Units, and it was necessary to select two Bureau of Land Management quadrats to obtain information on mesa top site locations. The first quadrat occurred several miles to the east of the Hackberry-Horseshoe Unit in the juniper-sage zone near the edge of Hovenweep Canyon (Figs. 20-21). Seven sites were located but only one (Hov. 472) yielded evidence of multiple use as a habitation, processing, storage and related activity area. Pueblo II - III sherds were found at five of the seven sites.

Square Tower Monument Unit

The largest survey unit was the 400 acre Square Tower Group which is located in the juniper-sage, sage and shrubland environments (Figs. 22-23).



Key

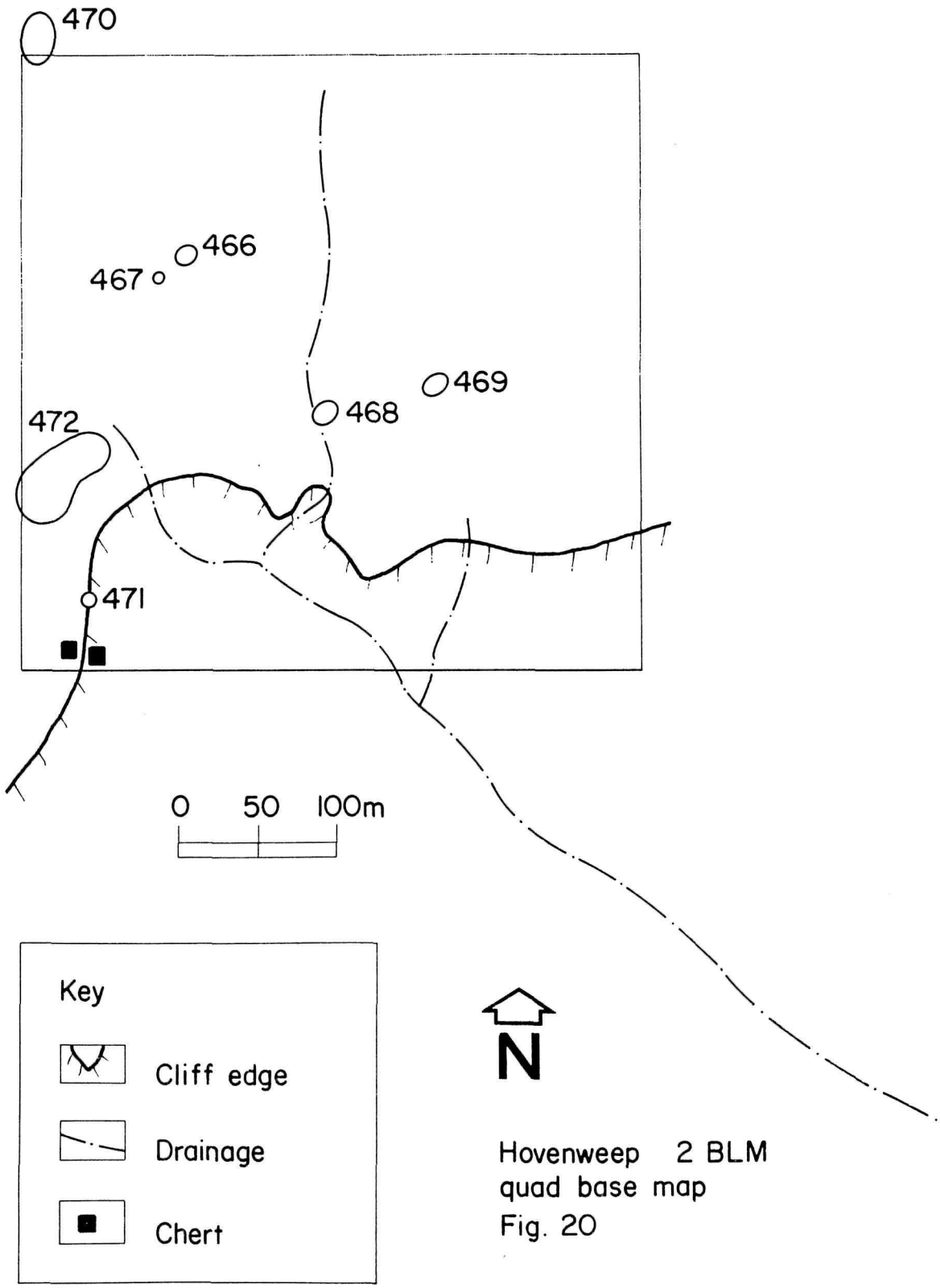
Drainage

Clay

Chert

Hovenweep #1 BLM quad base map

Fig. 19



Hovenweep 2 BLM
quad base map
Fig. 20



Figure 21. Hovenweep Canyon #2 Quadrat, with mesa top terrain and juniper-sage cover.

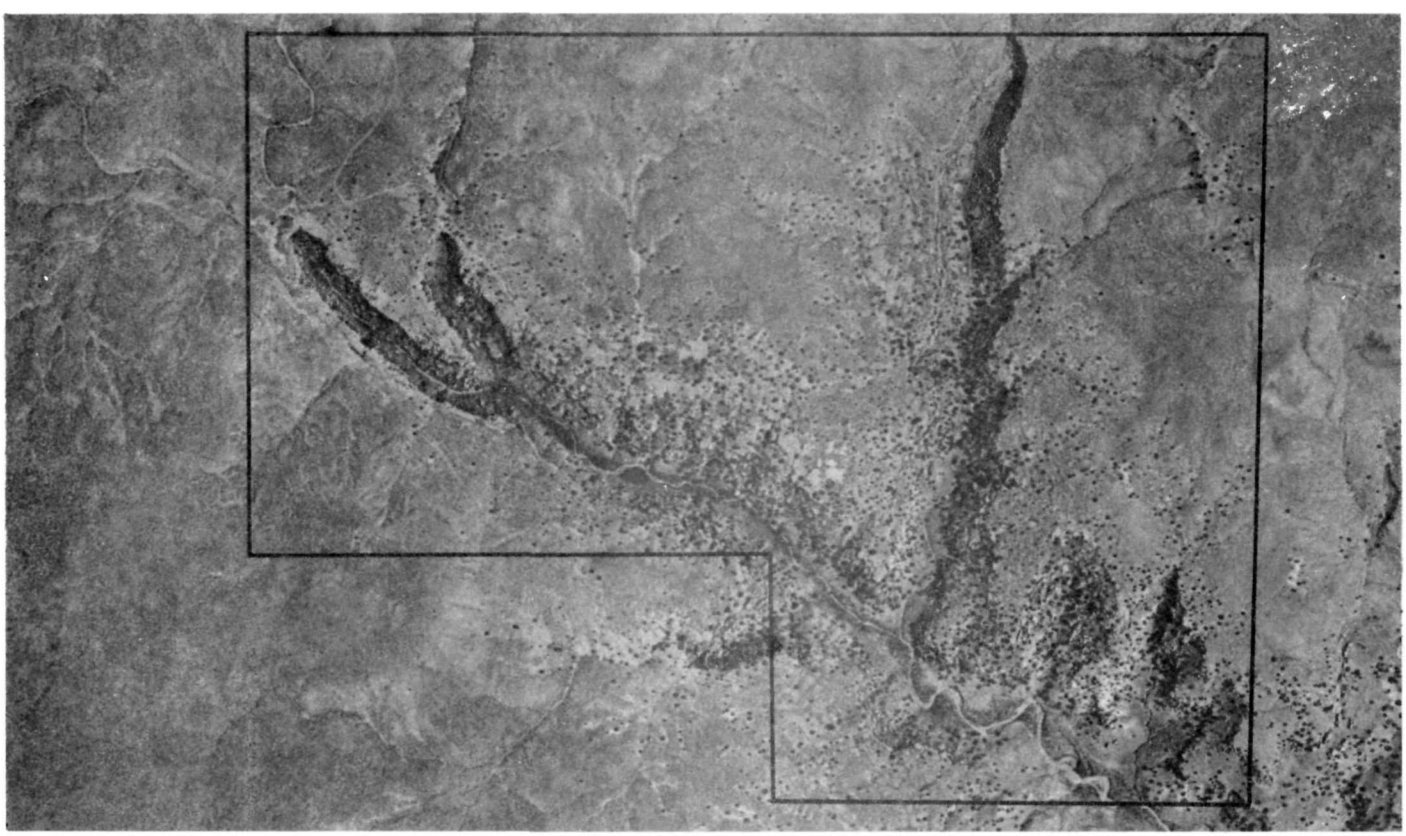
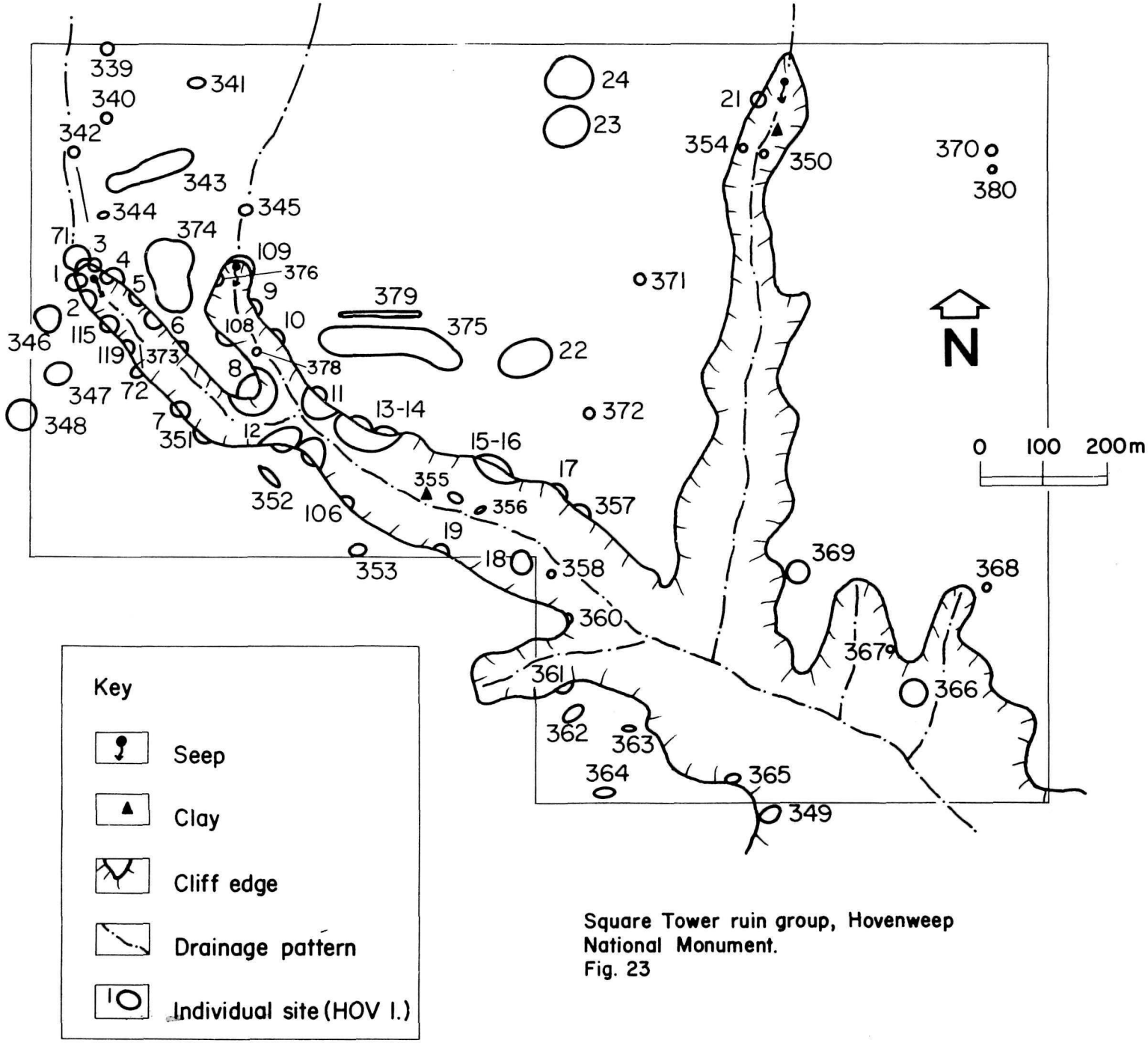


Figure 22. Square Tower Ruin Group survey area. Note canyonhead terrain, arroyos and mixed plant communities.

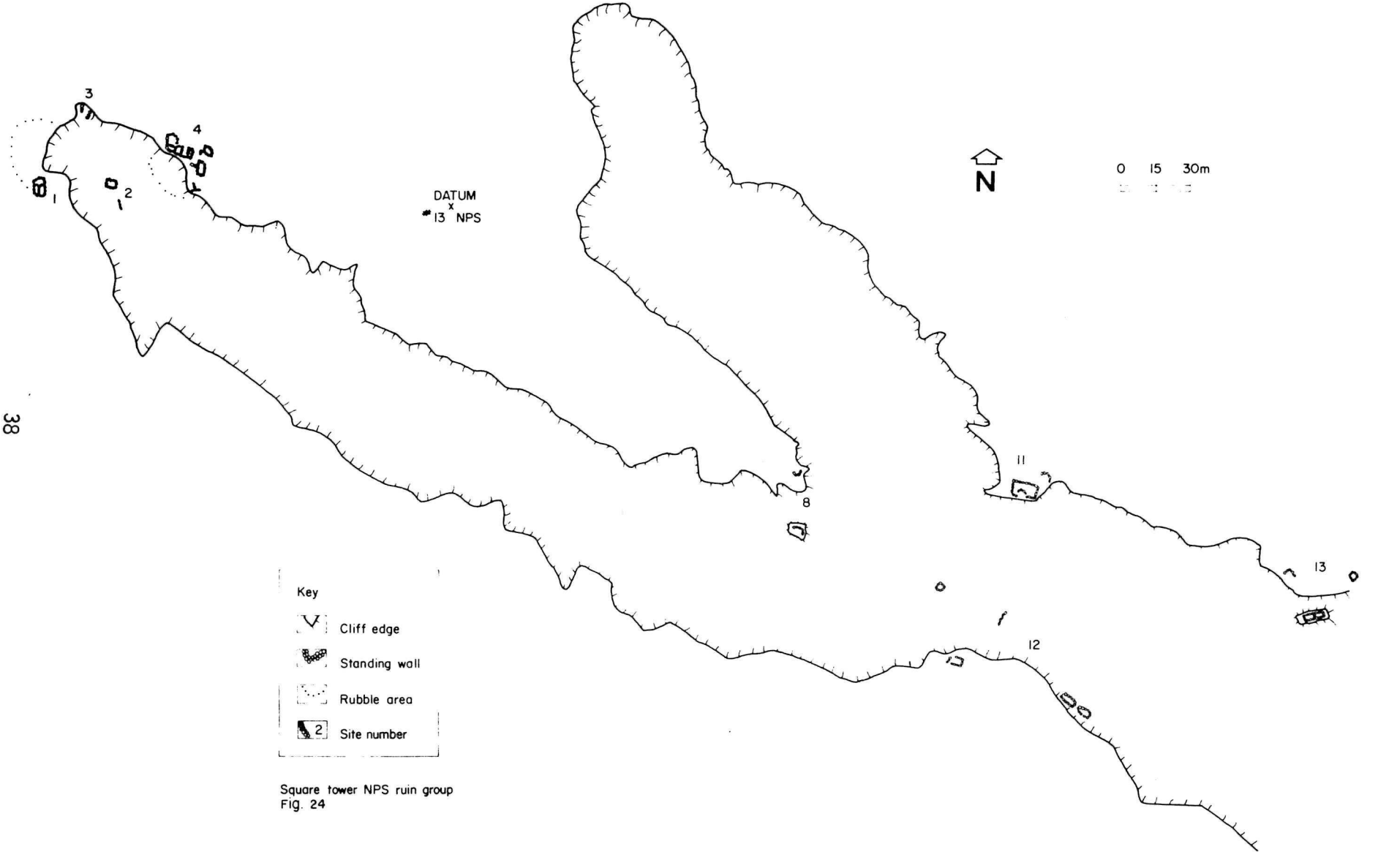


Square Tower ruin group, Hovenweep National Monument.
Fig. 23

Although not as densely settled as the Cutthroat, Holly and Hackberry-Horseshoe Units, 68 sites were located within the Monument boundaries, with the largest cluster occurring around the springs at the head of Ruin Canyon. Five large ruin complexes are clustered around the head of the west fork and on the point separating the west from the east fork (Fig. 24). These are: 1) Hovenweep House (Hov. 1), Hovenweep Castle (Hov. 4), Square Tower (Hov. 2), and Hov. 3 (Fig. 25); 2) Tower Point (Hov. 8,107,114); 3) Twin Towers (Hov. 12,111,112,113); 4) Unit House (Hov. 11); and 5) Stronghold House (Hov.13-14). All of these sites are large Pueblo II-III complexes containing towers, room blocks, possible kiva depressions, talus dams, middens, and nearby granaries and rock shelters. Several of the sites additionally have pictographs, petroglyphs, and rim dams. Other large sites within the Unit are a number of Pueblo II-III unit pueblos on the mesa top (Hov. 22-24) and in the canyon (Hov. 355), and Bobcat Towers (Hov. 366), a sizable complex of talus rooms, towers, retaining walls, petroglyphs and midden in the southeast corner of the unit. A variety of granaries, shelters, sweathouses, rim dams, check dams, room blocks, isolated rooms and lithic/ceramic scatters also occur within the Monument, which span the Archaic through Pueblo III and recent Navajo periods.

Navajo Canyon Quadrat #1

The second randomly selected mesa top quadrat was located in the open sage flats above Navajo Canyon (Figs. 26-27). Only seven sites were located in this unit, but their sizes, associated midden and estimated time range were much greater than the sites in Hovenweep Canyon Quadrats #1-2. The area was utilized from Basketmaker III through Pueblo III times with relatively heavy use during the Pueblo I-II periods. Several of the ruins are large multi-purpose unit pueblos (Hov. 473) or ridge side room clusters (Hov. 477), while the others are midden areas, isolated rooms and shelter/granaries.



Square tower NPS ruin group
Fig. 24

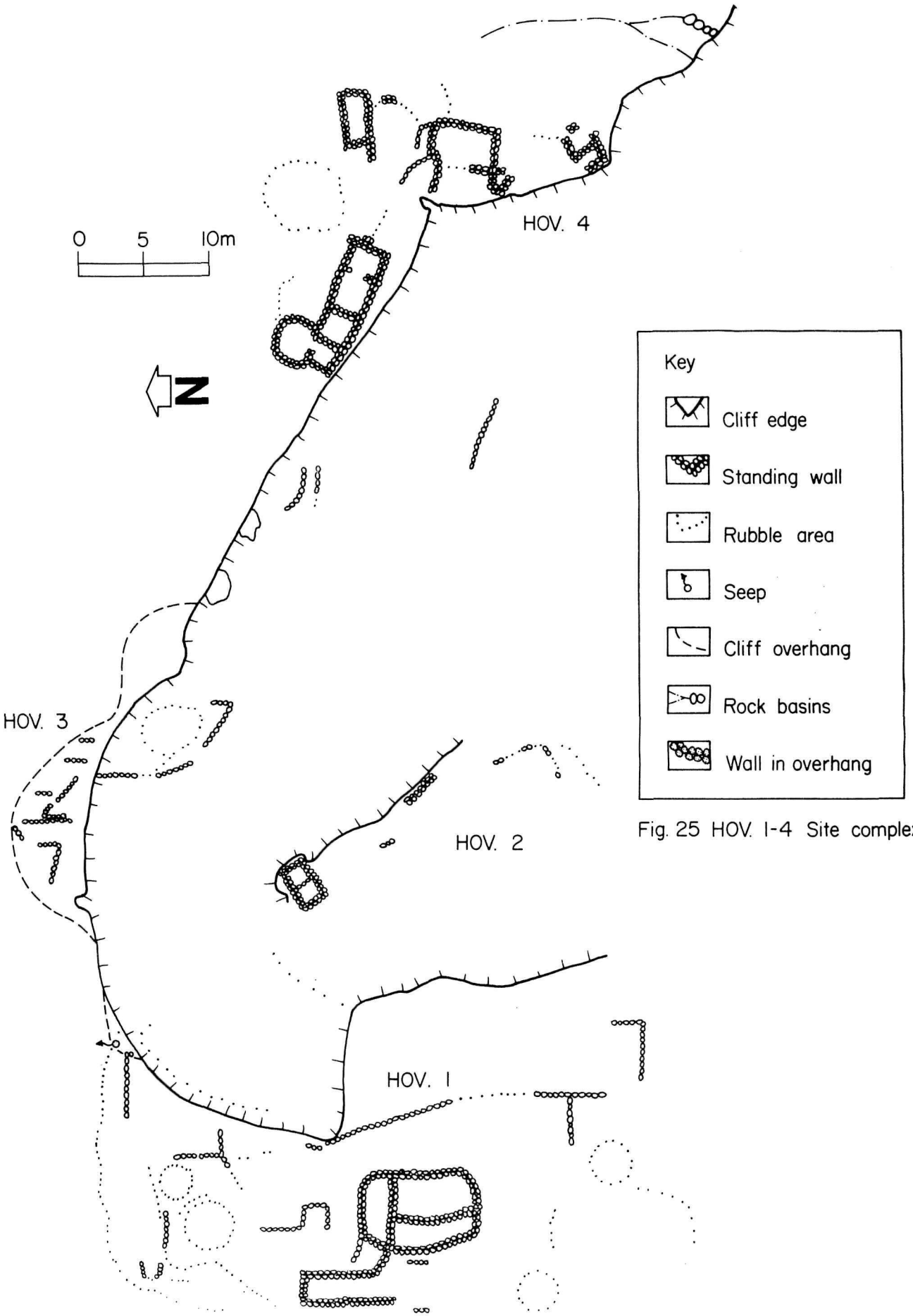
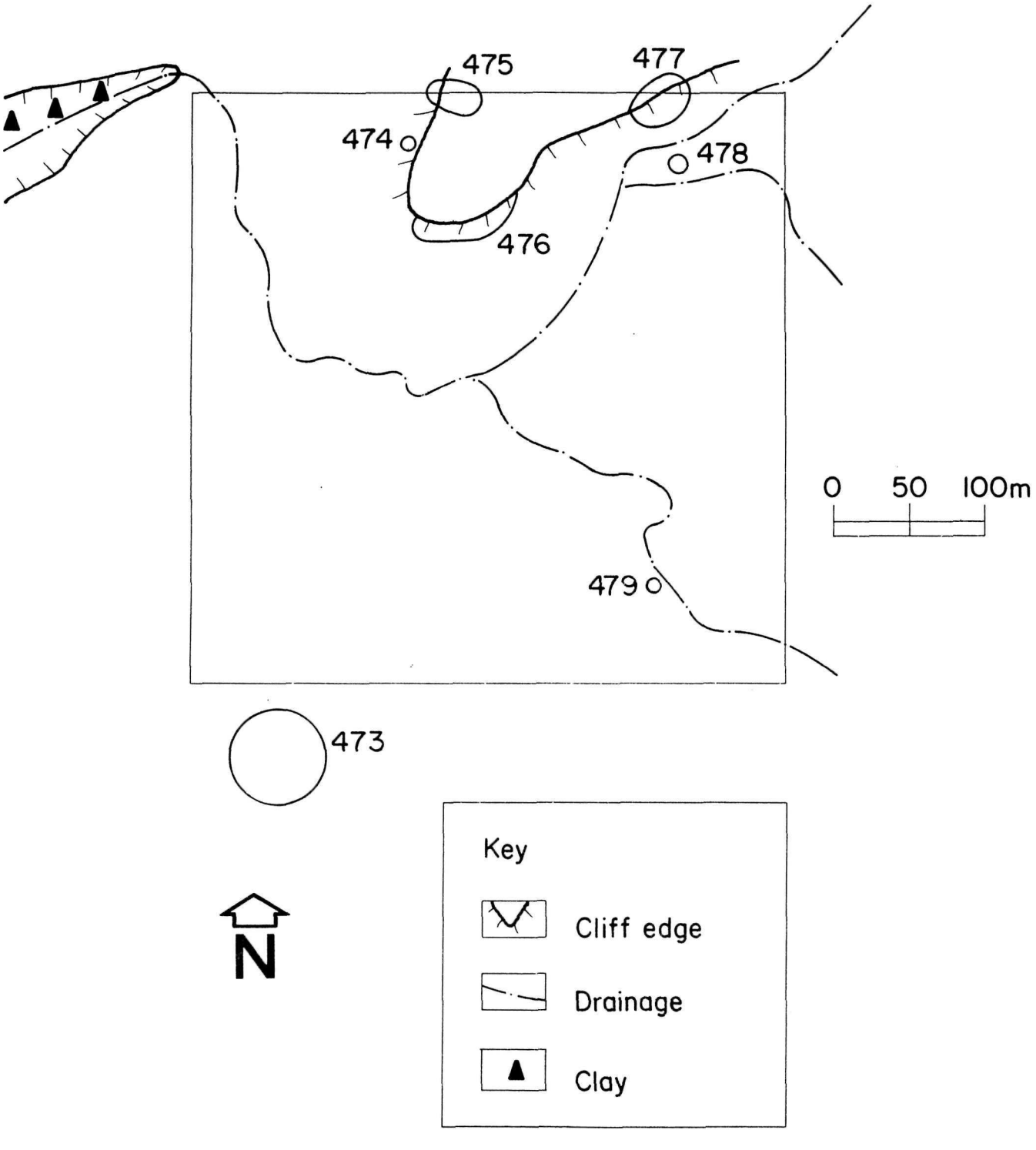


Fig. 25 HOV. 1-4 Site complex



NAV #1 BLM
quad base map
Fig. 26



Figure 27. Navajo Canyon #1 Quadrat in sagebrush environment. Hov. 473 site midden is in foreground, and sites 474-477 are at the foot of the distant ridge.



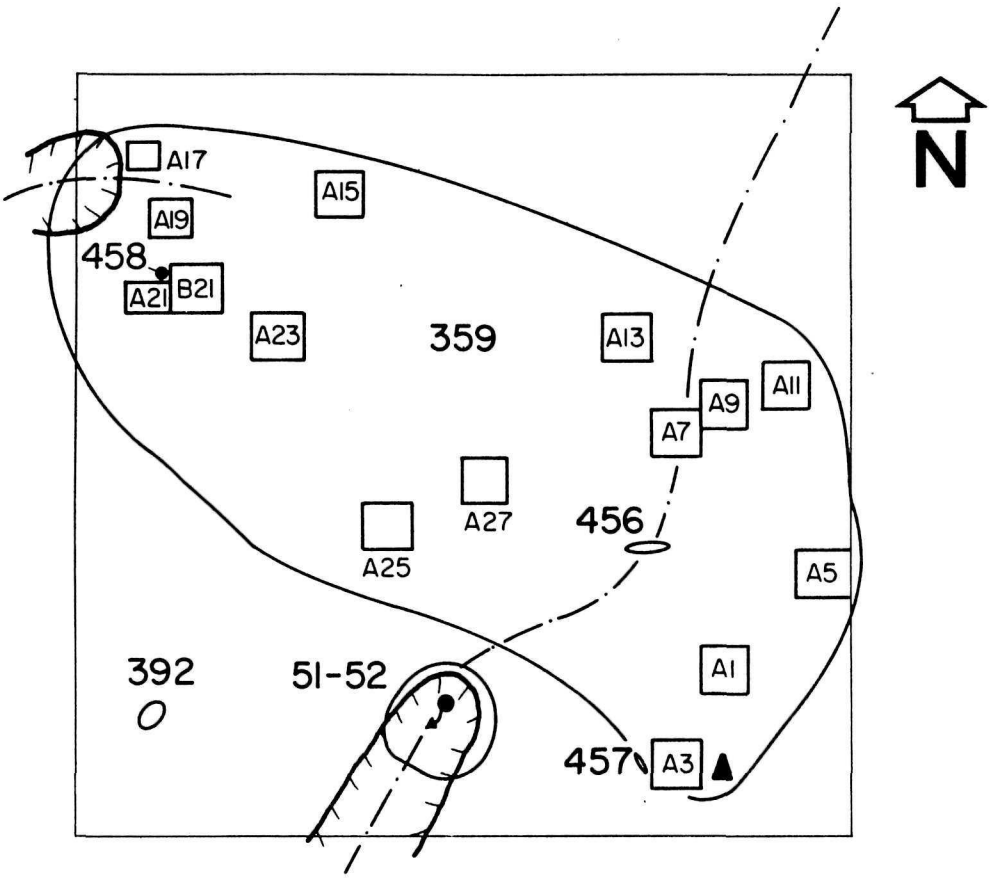
Figure 28. Cajon Ruin (Hov. 51-52) at the head of Allen Canyon in a shrubzone environment.

Cajon Monument Unit

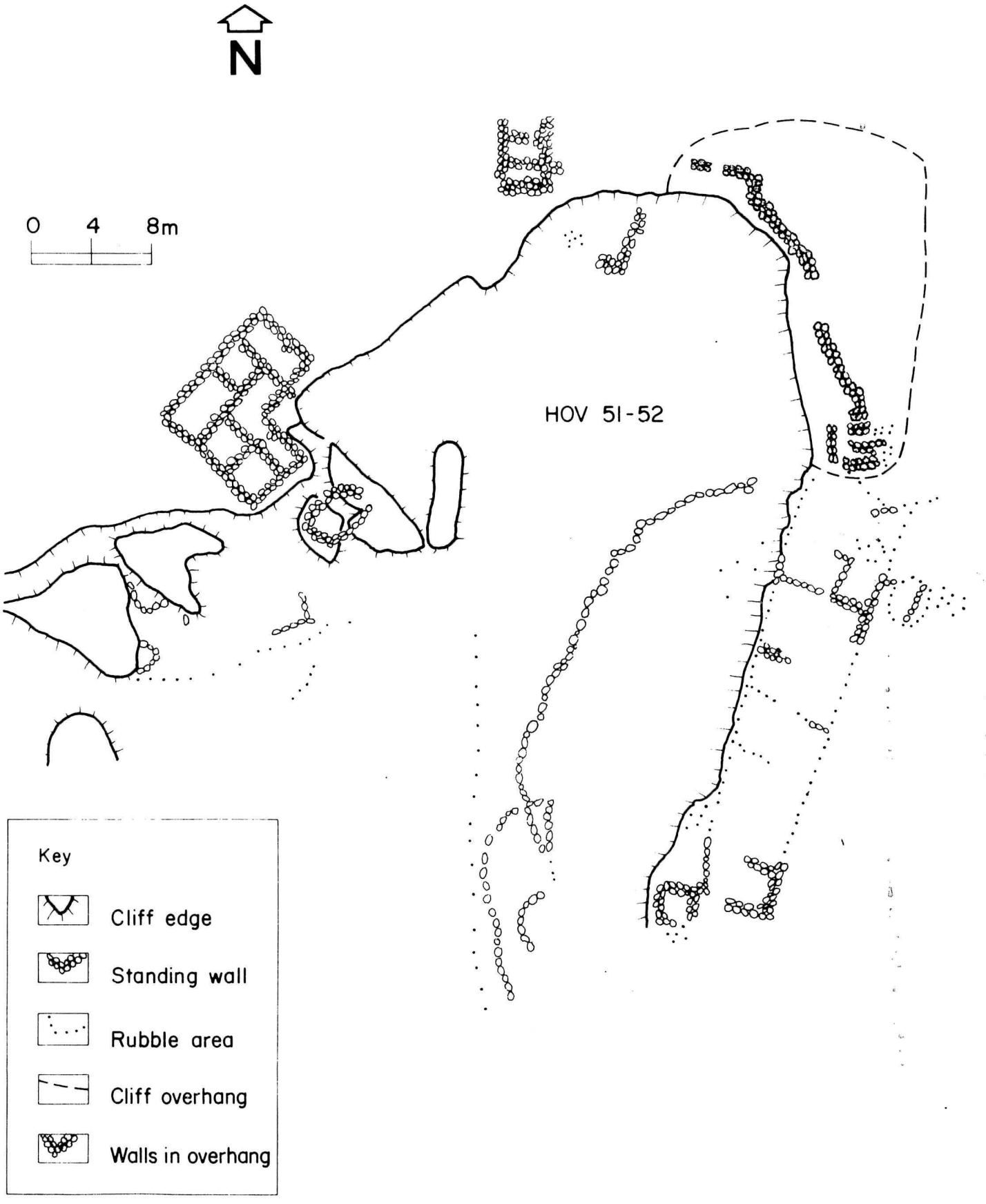
The southernmost survey unit was the forty acre Cajon Monument Unit, located in the shrub zone around a spring at the head of Allen Canyon at the extreme southern edge of Cajon Mesa (Figs. 28-29). Site boundaries in this unit were difficult to determine, since at least twenty of the forty acres were covered with concentrations of lithic debris scattered on ridges, in arroyos and in blowouts. It was possible to distinguish five more or less separate site areas on the basis of structural and artifact categories, with a sixth, the lithic scatter, overlapping into most of them. The largest structural group is Cajon Ruin (Hov. 51-52), a cluster of towers, room blocks, granaries, retaining walls, possible kiva depressions, petroglyphs and midden located around the spring (Fig. 30), and the site was occupied from Basketmaker III through Navajo times with the densest use during the Pueblo II-III period. Other sites include a possible reservoir/check dam complex (Hov. 456-457), a burned hogan or corral (Hov. 458), and a second lithic scatter (Hov. 392). Due to its large size, the lithic area (Hov. 359) was the only site surveyed which was not completely gridded off, mapped and 25% sampled. Instead, fifteen grid units varying in size from 15 by 15 meters to 25 by 25 meters were selected and mapped, and all artifacts within these grids were collected. Over 2600 stone artifacts and at least 50 sherds were recovered from this limited area, and the site seems to have functioned as a hunting, manufacturing and plant collecting station during all periods of its use.

Black Steer Canyon Quadrat #1

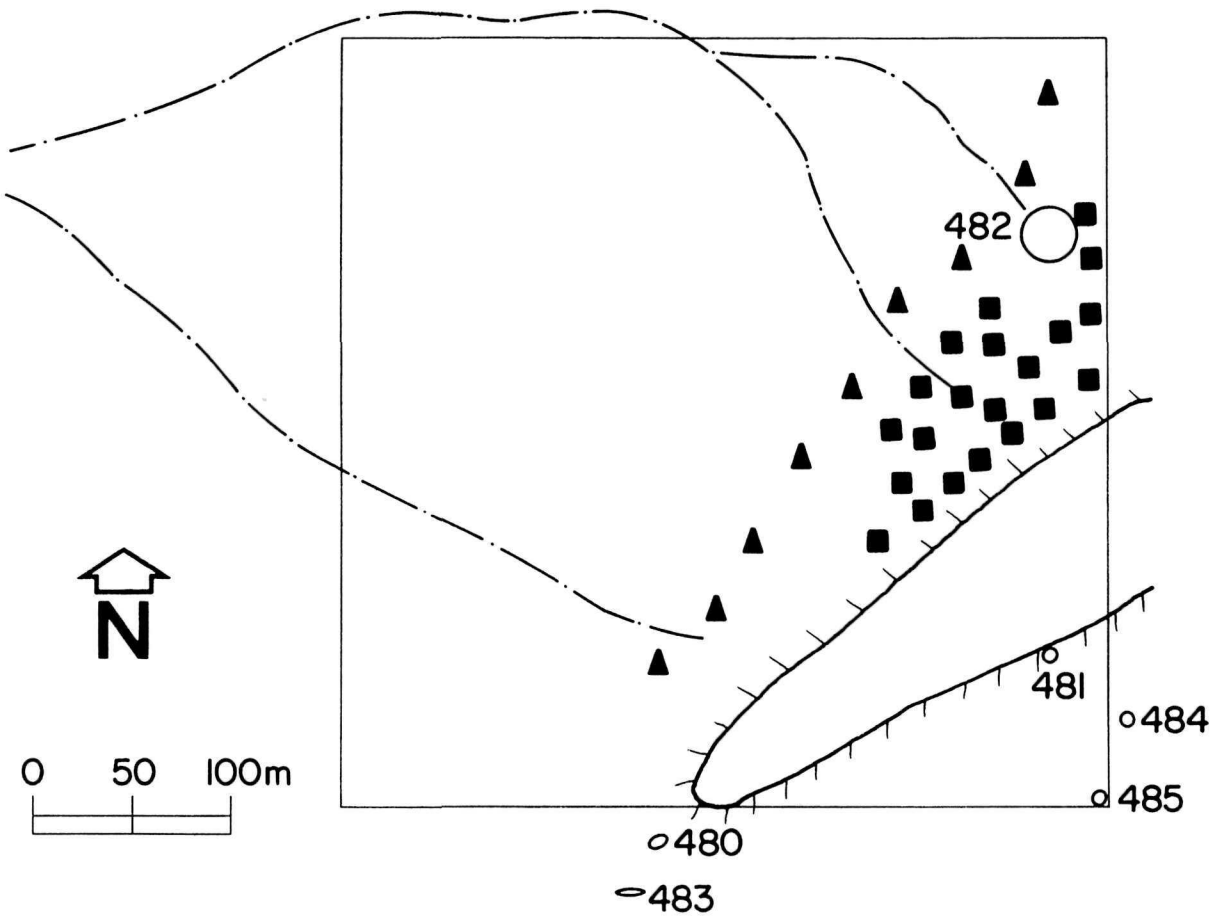
The second randomly chosen canyon bottom quadrat was in the shrubland in Black Steer Canyon, located several miles upstream from its confluence with Montezuma Creek (Figs. 31-32). Only three sites were located within the quadrat while three others were examined immediately outside. These six sites form three complexes: sites 480 and 483 represent an isolated



Base map
Cajon ruin group
Fig. 29



Cajon ruin group
Fig. 30



Key

Cliff edge

Drainage

Chert

Clay

Black steer #1 BLM quad base map
Fig. 31

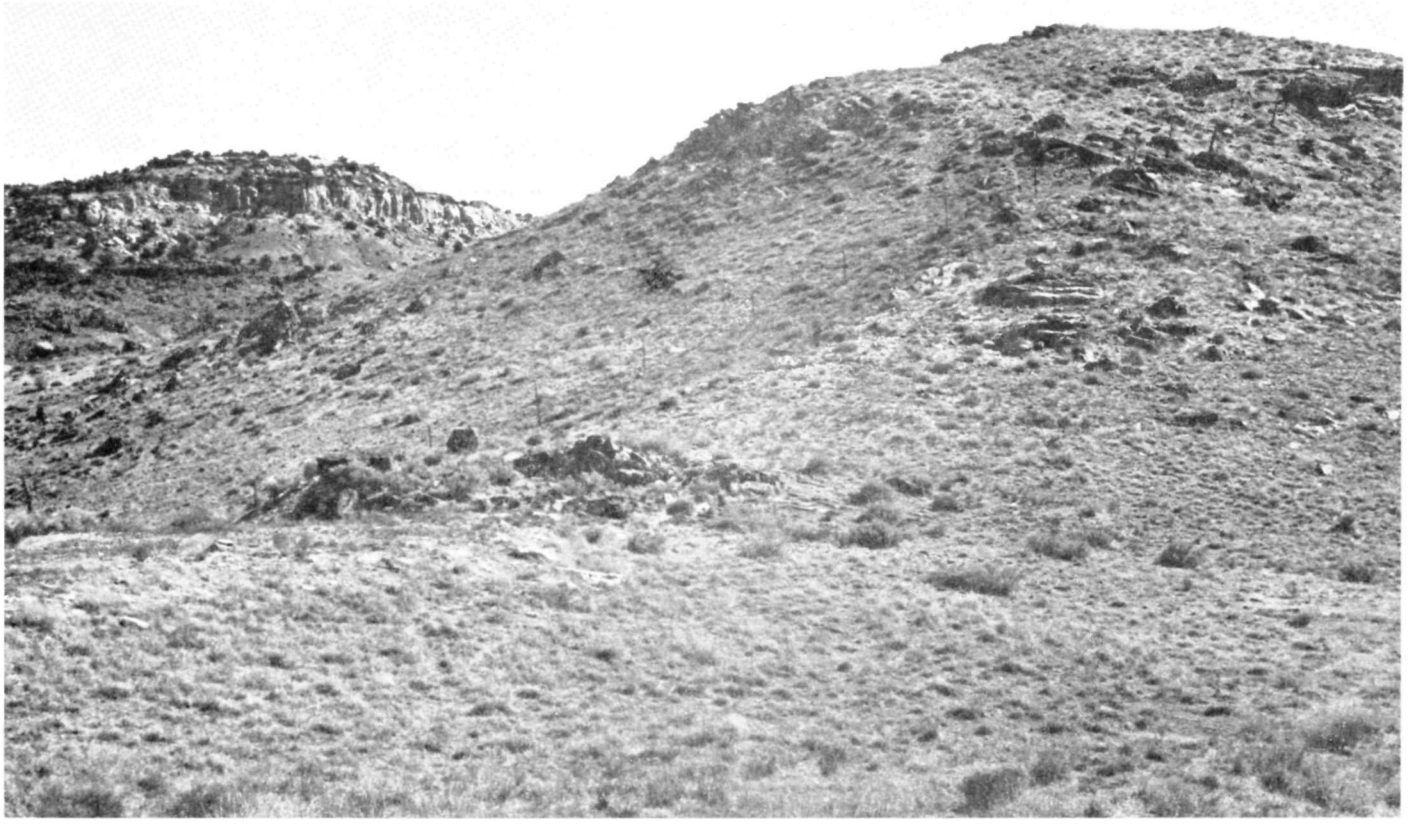


Figure 32. Black Steer Canyon #1 Quadrat with Hov. 480 in the center of the figure. Note the canyon bottom terrain and the shrubland environment.

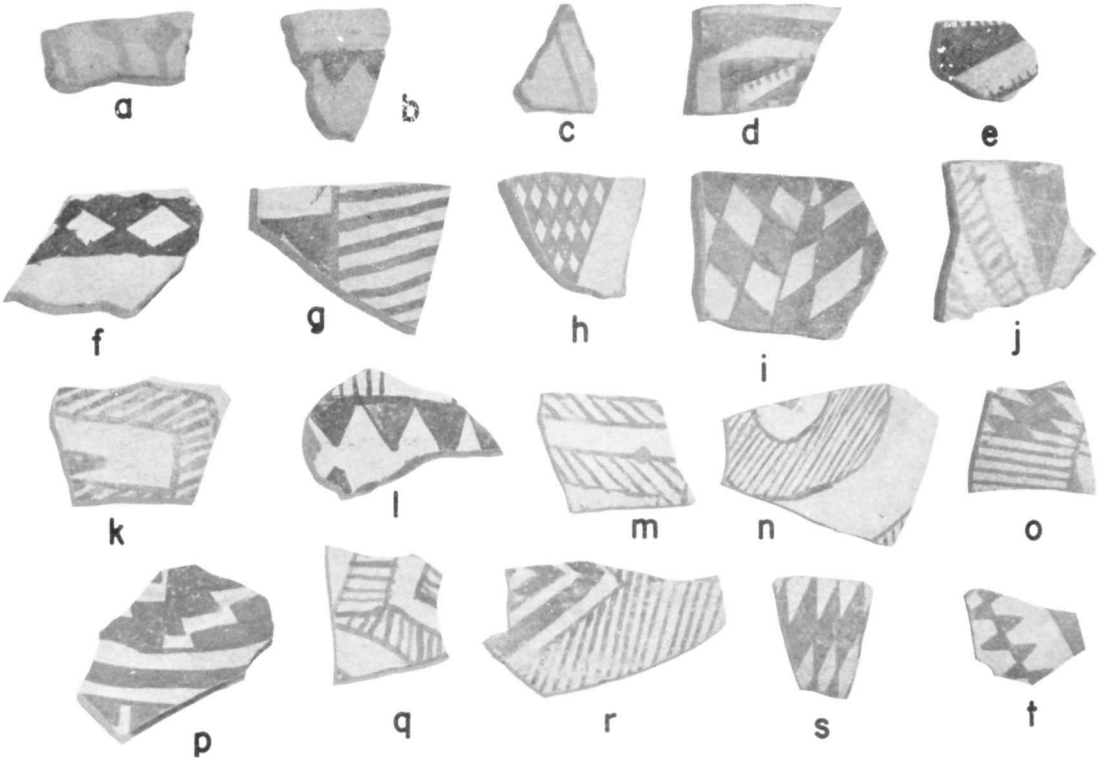


Figure 33. Early Black-on-white pottery types at Hovenweep. a - Chapin Black-on-white; b-c - Piedra Black-on-white; d-e - Cortez Black-on-white; f-t - Mancos Black-on-white.

Pueblo II "farmhouse", petroglyph and agricultural terrace; sites 481, 484 and 485 form a cluster of Pueblo II-III storage rooms; and site 482 is a quarry.

CERAMIC ANALYSIS

VI CERAMIC ANALYSIS

by Dorothy K. Washburn

3440 sherds were collected from the surface of 140 sites at Hovenweep during the 1974 survey season. In order that the ceramics could be used to indicate general chronological position of the sites surveyed, 2073 sherds were classified by the Southwestern typological system. Additional research is ongoing in such areas as design element and motif analysis and statistical correlations of ceramic attributes. Although the results of these latter investigations have not been completed, they will be discussed in future numbers of the Hovenweep Project reports. This publication is designed to present a description of the 1974 ceramics in order that the preliminary interpretations can be used to direct future research of the Hovenweep Project. In addition, prompt publication of this report will provide access to the data for other investigators.

Appendix V and Table 2 show the frequency distribution of the pottery types found at Hovenweep. The new volume of the Museum of Northern Arizona Ceramic Series (Breternitz, Rohn and Morris 1974) has been the primary guide for type identification. The unidentified category includes painted sherds too fragmentary or worn for positive type identification as well as plain body sherds. Black-on-white and corrugated pottery comprise the major ceramic output from the area. The types recovered to date suggest that the heaviest occupation of the area occurred during the Pueblo II-III periods, with a very light occupation during the late Basketmaker III and Pueblo I periods. It is anticipated that the 1975 survey season will produce collections which will either expand the history of human occupation at Hovenweep or reconfirm the restricted use of the area. The following sections present descriptions of the characteristics that each type possesses in the Hovenweep area as well as a discussion comparing the local ceramic output to that from nearby areas. We wish to thank Professor Robert L. Rose and Mr. William H. Raub, Department of Geology, San Jose State University, for assistance in the identification of the temper.

TABLE 2

Distribution of Ceramic Types from the 1974 Surface Survey at Hovenweep

Type	Total	Probable Period of Occurrence			
		BMIII	PI	PII	PIII
Gray Ware					
Chapin Gray	4	x	x		
Moccasin Gray	5		x		
Mancos Gray	19			x	
Hovenweep Gray	107				x
Corrugated Ware					
Mancos-Mesa Verde Corr.	378			x	x
Hovenweep Corr.	744				x
Black-on-white Ware					
Chapin Black-on-white	1	x			
Piedra Black-on-white	3		x		
Cortez Black-on-white	6			x	
Mancos Black-on-white (mineral paint)	276			x	
Mancos Black-on-white (carbon paint)	110			x	
McElmo-Mesa Verde Black-on-white	398				x
Redware					
Deadmans Black-on-red	17		x		
Bluff Black-on-red	2		x		
Abajo Red-on-orange	3	x	x		
Total	2073				
Unidentified White Ware	1000				
Unidentified Black-on-white Ware	339				
Unidentified Redware	28				
	3440	Total sherds collected on 1974 survey			

Early Black-on-white Types

Although the sherd sample recovered from the late Basketmaker III and Pueblo I periods was very small, it is expected that continued surveying in under sampled environmental zones will result in a revision of the suggestion that Hovenweep was sparsely inhabited during late Basketmaker III, Pueblo I and early Pueblo II times. In support of this statement are the investigations of Martin at Ackmen-Lowry (1936,1938,1939) and Brew at Alkali Ridge (1946) which indicate heavy utilization of the northern part of the region during the early Anasazi period.

Six Cortez Black-on-white, three Piedra Black-on-white and one Chapin Black-on-white sherds were identified (Fig. 33). Use of crushed sherd and rock temper began with the earliest type, Chapin Black-on-white, and continued in a long, unbroken tradition throughout the duration of the Anasazi occupation of Cajon Mesa.

The one Chapin Black-on-white sherd is so heavily tempered that the inclusions protrude through the smoothed, but unslipped surface. It is a tapered rim sherd from a bowl with a corrugated exterior. Broad, parallel lines of reddish-brown mineral paint extend from the rim edge into the bowl interior.

The three Piedra Black-on-white sherds from the Pueblo I period are rims from a thin walled bowl, a necked jar, and a ladle or small bowl. Vessel walls range from 3mm on bowls to 6mm on jars, and are slipped with a light grayish white mineral point, embellished by series of parallel lines and rows of solid triangles. Two of the three rims are decorated with ticks which are evenly spaced along the rounded edge. Interestingly, the exterior of the small bowl or ladle is painted with a series of parallel lines. Breternitz, Rohn and Morris (1974:29) have noted that Piedra bowl exteriors are very rarely decorated.

The early Pueblo II period is represented in the 1974 Hovenweep collection by six Cortez Black-on-white sherds. Bowls are slipped on both the exterior and interior, while jars remain slipped only on their exteriors. Jars with flaring necks, however, have slips applied in a band along the interior of the rim. The vessel walls are more evenly

smoothed than on Piedra Black-on-white sherds and are covered with a thicker, gray-white slip. Vessel walls are thinner on bowls than jars, and range from 4mm to 5mm respectively. Rims are rounded, painted with a continuous black line, and vary in form from straight to flaring. Designs are painted in a black mineral paint. Right triangles with dotted hypotenuses and series of narrow dotted lines are characteristic design elements.

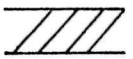
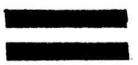
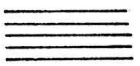
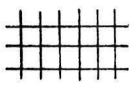
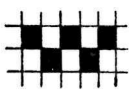
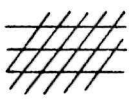
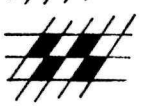
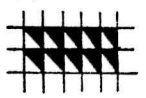
Mancos Black-on-white

386 sherds were identified as Mancos Black-on-white (Figure 33). A Pueblo II period is indicated. In the Hovenweep area there are two varieties of Mancos, separable on the basis of a difference of the paint type used for the black design. 72% or 276 sherds were painted with a predominantly mineral based paint, while 28% or 110 sherds were painted with a predominantly organic based paint. The sherds are tempered with large, angular pieces of crushed rock and sherd. The rock is predominantly quartzite and basalt with some igneous rock and feldspar. The size and amount of temper varies greatly. In heavily tempered vessels the coarse nature of the inclusions causes the fracture line to be very irregular. The paste is fairly porous due to the large size of the temper, the not-too-finely processed clay, and the occasional inclusions of organic material which, upon firing, have burned out leaving holes in the paste. A carbon streak is present in about 50% of the sherds. The surface of both mineral and organic painted varieties has been smoothed and covered with a thin white-to-gray slip which is not well polished. A few of the sherds appeared to be unslipped. Bowls are slipped on both the interior and exterior; jars are slipped only on the exterior. Although no whole vessels were collected, it is possible to state from the sherd evidence that bowls, ladles, and jars are the vessel shapes represented. Vessel wall thicknesses average 5-6 mm; rims are tapered and rounded.

Fourteen design elements characterize the Mancos Black-on-white at Hovenweep (Table 3). Both the entire interior of bowls and the exterior of jars were considered the available field of design by Mancos period

TABLE 3

Distribution of Design Elements on Mancos Black-on-White

	Elements	Mineral Paint type		Carbon Paint type	
		number	percent	number	percent
1		11	5	2	5
2		83	37.5	2	5
3		27	12	17	39
4		28	13	0	0
5		21	9.5	15	34
6		1	.5	1	2
7		10	4.5	1	2
8		6	3	1	2
9		13	6	0	0
10		3	1	0	0
11		5	2	1	2
12		2	1	0	0
13		7	3	3	7
14		4	2	1	2
		T= 221		T= 44	

potters. Designs were boldly applied with large slipped but undecorated areas left between the geometrics. Most patterns were rather poorly painted with a broad brush. Line overlaps were frequent despite prior element outlining. Elements were not usually arranged within banding lines or panels but rather were hung directly from the rim area. Table 3 outlines a preliminary tabulation of the frequency of occurrence of the principal design elements found on the Mancos Black-on-white sherds from Hovenweep. Although the sample of sherds with recordable design elements is small, it is interesting to note the markedly different distributions of design elements between the mineral and carbon varieties. While most of the carbon painted sherds have broad line or triangle motifs, diagonal hatchure is the preferred element on the mineral painted sherds.

McElmo-Mesa Verde Black-on-white

Following the practice of Rohn (1971) and Schroeder (1967-68), who lumped the McElmo and Mesa Verde types together, 398 sherds were classified as McElmo-Mesa Verde (Figure 34). A Pueblo III period of occupation is indicated. Hovenweep area potters continued to temper the paste with crushed rock and sherd except that by this period the temper has been ground more finely, giving the paste a more even texture and fracture. A carbon streak continues to be present in about 50% of the sherds. McElmo-Mesa Verde sherds are well smoothed, slipped with a thick, white-gray slip, and finished with a polishing stone. Crazing appears on the white slip. Wall thicknesses generally range from 6-7 mm. Of the 100 square rim sherds recorded, 55% were ticked, 8% had zigzag line decorations, and 37% were without painted decoration. The paint used for the designs was organic based, in contrast to the predominant use of mineral based paint on the Mancos pottery.

Improvements in the technology which controlled features of temper size, surface finish, and paint type, as well as development of a more formalized design layout make the Pueblo III period McElmo-Mesa Verde pottery easily distinguishable from the preceding Pueblo II period Mancos



Figure 34. Examples of McElmo/Mesa Verde sherds.

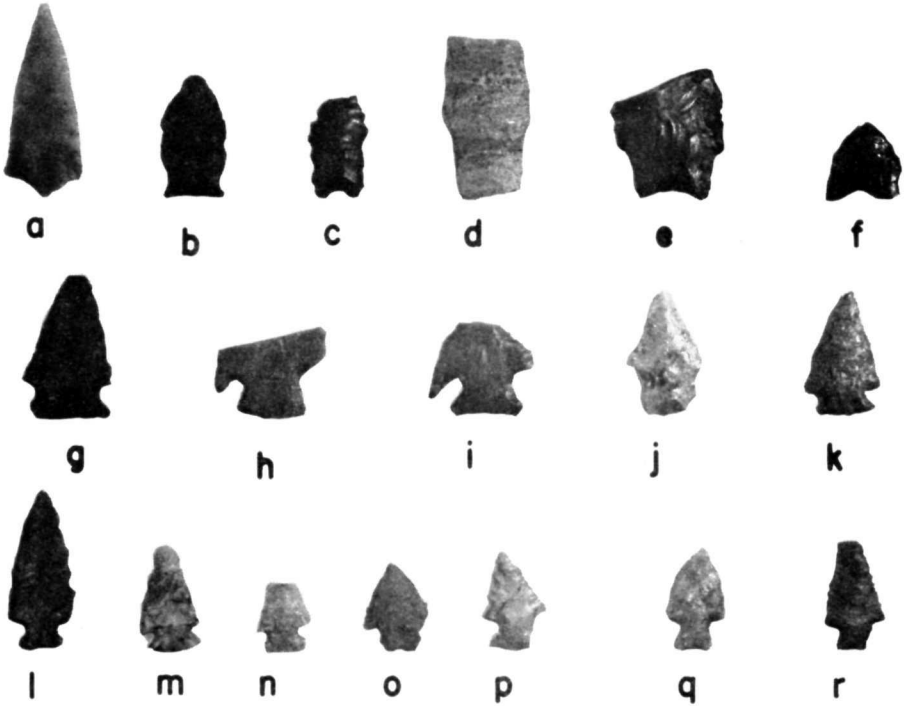


Figure 35. Projectile point types from Hovenweep. Type 1 - a-f; Type 2 - g-i; Type 3 - j; Type 4 - k-r.

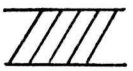
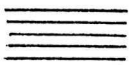
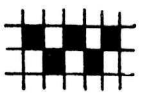
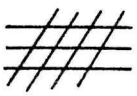
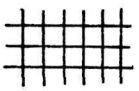
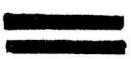
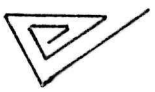
pottery. Even though the Hovenweep sample was comprised only of sherds, it was possible, particularly on the basis of the rim sherds, to recognize the predominant use of symmetrical banded layouts in which balance was achieved not only by symmetry of element shape but also by juxtaposition of light and dark colors. Rim line bands on bowl interiors are generally framed by series of narrow and/or broad parallel lines. Although it is known from the research of other investigators that McElmo designs have more hatching and often extend to the bowl rim without banding lines, while Mesa Verde designs are composed of predominantly solid elements arranged in paneled bands, the size limitations of the Hovenweep sherds collected during the survey precludes separation of these two types on a design element-layout basis.

A comparison of the McElmo-Mesa Verde designs with those from the previous period (Tables 3 and 4) shows continual use of a few favorite geometric elements. For example, the use frequency of 36% of diagonally hatched elements during the McElmo-Mesa Verde period was equally matched by a 37.5% frequency of use of the same element during the preceding Mancos period. Other commonly occurring elements during both Pueblo II and III periods are series of narrow and broad parallel lines, solid terraced units and triangles. However, the critical factor for differentiation of the two types is how the elements are combined into a design and how they are arranged on the vessel. Mancos designs are composed of widely spaced, free ranging, boldly executed elements while those of McElmo-Mesa Verde are generally neatly drawn and constrained within banding lines and panels which are bordered by line series. Thus, for example, line series appear on both Mancos and McElmo-Mesa Verde sherds. However, on the former they are the principal elements, while on the latter they are used in a more subsidiary role to accentuate the bands of design.

In this preliminary report we have chosen to lump the McElmo and Mesa Verde types. Abel (1955) has separated the two types morphologically and temporally so that McElmo Black-on-white, AD 1130-1200, represents early Pueblo III and Mesa Verde Black-on-white, AD 1200-1300, represents late Pueblo III. However, because we have not yet performed stratigraphic tests in our survey area, because the sample is relatively small

TABLE 4

Distribution of Design Elements on McElmo-Mesa Verde Black-on-White

	Elements	number	percent	Survey Areas: Holly	Nav 1	Sq. Tow	Hack	Cut,Caj,Hov.
1		96	36	17	7	27	35	10
2		4	1.5	2	0	0	2	0
3		48	18	12	2	10	21	3
4		33	12	4	3	6	14	6
5		4	1.5	1	0	1	2	0
6		8	3	2	1	3	2	0
7		1	.3	0	0	1	0	0
8		2	.6	1	0	0	1	0
9		13	5	2	1	3	7	0
10		24	9	4	2	12	15	1
11		29	11	1	5	10	7	6
12		2	.6	0	0	2	0	0
13		4	1.5	0	0	0	4	0

T= 268

proportional to the area it represents, and because the sample consists of small sherds and not whole vessels, it has, as yet, been difficult to distinguish the two types. After future surveys and excavations we hope to be able to describe the character of Pueblo III black-on-white pottery from the Hovenweep area more fully.

Red Wares

A relatively small sample of red ware was collected during the 1974 Hovenweep survey. Except for the three sherds of Abajo Red-on-orange which were distinguished from the Bluff and Deadmans Black-on-red on the basis of the colors used for the decoration, the latter two types were very difficult to distinguish. We have followed the name designation of the new Museum of Northern Arizona Ceramic Series Manual; thus La Plata Black-on-red is synonomous with Deadmans Black-on-red.

According to Breternitz, Rohn, and Morris (1974) Bluff Black-on-red and Deadmans Black-on-red are separable on the basis of an absence and presence of a slip respectively. Furthermore, the design motifs used on Deadmans are regular series of parallel lines and hatched areas, while Bluff is characterized by highly varied, bold, and less neatly executed geometrics. Since most of the Hovenweep sherds are very thin walled, well polished, and decorated with fine line hatchure, they have been assigned as Deadmans Black-on-red despite our inability to always determine the presence or absence of a slip due to the heavily worn surfaces. The sherds identified as Bluff are thick-walled, more crudely painted, and do not appear to have been slipped.

According to the new ceramic manual both Deadmans and Bluff Black-on-red were produced during the Pueblo I period and have similar areal distributions. It may be more sensible to forgo the distinction between these two types as Rohn has suggested (in Breternitz et al 1974) until we have a larger sample which will enable us to more fully characterize the red ware from the Hovenweep area. All of the red ware sherds are

heavily tempered with sand, sherd and crushed rock. All surfaces are fairly well smoothed and polished. Vessel walls vary greatly in thickness from 3 to 7 mm. Black mineral paint is used on the Bluff and Deadmans sherds. One polychrome sherd was found of an indeterminate type.

Corrugated and Plain Wares

During the 1974 surface survey 1257 corrugated and plain gray ware sherds were collected from sites in the Hovenweep area. Corrugated ware thus comprises 60% of the identifiable ceramic output from the survey sample. Because no whole vessels were found, it has been very difficult to assign many of these sherds to type categories. It was a common practice to use a combination of plain and corrugated surface treatments on the same vessel. However, upon breakage of the vessel, sherds may show only one of the two treatments and are thus liable to incorrect type assignment. This is particularly a problem with rim sherds which are identical on several of the Mesa Verde area utility types. Nevertheless, some tentative type identifications have been made and are tabulated in Table 2.

In an effort to make a general statement, yet not distort the data, we have chosen to examine the Mancos and Mesa Verde corrugated types as one unit until we are able to enlarge our sample, recover whole vessels, and conduct stratigraphic tests. According to the latest data, both types were produced during the Pueblo III period in other areas. In the Hovenweep area this combination of types is characterized by everted and straight rims, large crushed rock and some sherd temper, and surface treatments ranging from deeply indented, finger-impressed corrugations, to flattened overlapping coils. Often several of these decorative styles were combined on the same sherd.

The largest proportion of the corrugated sherds belong to a type which has recently been designated as a variety of Mesa Verde Corrugated (Breternitz, Rohn and Morris, 1974:22). Since this is the predominant utility ware in the

Hovenweep area, we have chosen to consider it as a separate type, Hovenweep Corrugated, as originally defined by Abel (1955). This type is distinguished by abundant, large, angular, crushed rock temper which, despite smoothing of the vessel walls, often protrudes through the surface. The light gray walls are thicker than those on Mancos-Mesa Verde Corrugated vessels, and range from 5 to 9 mm. The rims are generally everted and either have a broad, plain band of smooth body finish above the corrugation, several narrow plain coils above the corrugation, or corrugation carried up to the rim edge. A characteristic surface treatment present on some but not all of the Hovenweep Corrugated sherds are square corrugations with vertical indentations which are often finger nail incised. This use of the finger nail or some sharp tool to further demarcate each corrugation is not found on the Mancos-Mesa Verde Corrugated sherds in our collection. Statistically, these incisions occur on 28% of the Hovenweep Corrugated sherds. We are continuing our investigations of the occurrence, associations, and distributions of this interesting characteristic.

Although it has been suggested that Hovenweep Corrugated and Mesa Verde Corrugated were produced during Pueblo III times and Mancos Corrugated during Pueblo II times, we have as yet no stratigraphic evidence either to support or negate these temporal assignments. In general, most corrugated wares are not very sensitive time markers. The exception to this seems to be Moccasin Gray, which was apparently manufactured only during Pueblo I times. However, since the Moccasin Gray sample from the Hovenweep survey is so very small, it may be that it was not made locally, but was an import and thus should probably be used with caution for dating purposes. The other Gray and Corrugated types have not been used for dating any of the sites in the present sample.

Another local utility type with wide neck bands is Mancos Gray. This type is particularly distinguished by the deep, wide incisions made along the borders of each coil. There is one clearly tooled sherd in the Hovenweep collection. In addition there are several sherds with narrow clapboards, another reputed characteristic of this type. However, it should be recognized that overlapping, unindented coils were a common form of surface treatment on several corrugated types and thus some of the sherds assigned

as Mancos Gray may indeed be body sherds from some other type, such as Mancos-Mesa Verde Corrugated.

The other plain sherds in the Hovenweep gray ware collection could either be Chapin Gray, Hovenweep Gray, or body sherds from Mancos Gray, Moccasin Gray, Mancos-Mesa Verde Corrugated, or Hovenweep Corrugated. We anticipate that a more intensive petrographic analysis of the temper as well as recovery of whole vessels from future excavations will enable assignment of these sherds within a specific type category.

Comparative Analysis

In order to gain some insight into the variability in regional ceramic output it is useful to relate the Hovenweep ceramics to the known ceramics from neighboring sites. We are fortunate to have comparative material from within as well as without the study area. Of primary importance is Schroeder's surface survey of 31 sites between the Square Tower and Holly Units (1967-1968). He distinguished four varieties of what other investigators refer to as Mancos Black-on-white on the basis of differences in temper, paint type, and character of design elements. Types A and B are mineral painted, rock tempered, and have solid and hatched elements predominating respectively. Type C has rock temper, both hatched and solid designs, but carbon paint. Finally he identified a Mancos Black-on-white type that conformed closely with the established type definition because it is sherd tempered, mineral painted, and decorated with a combination of solid and hatched elements. Although we have not yet performed as detailed a study correlating the paint, design and temper as did Schroeder, we have observed the same range of mineral and carbon paint types, sherd and rock temper, and solid and hatched design elements. The same frequencies of mineral relative to the carbon painted Mancos occurred in our Hovenweep collection as they did in Schroeder's sample. From his sample of 250 Mancos sherds, 81% had mineral based designs while 19% had carbon based paint. In comparison, 72% of our Mancos sherds were mineral painted and 28% were carbon painted.

We were not able to detect, however, the same differences in surface finish, slip, and design elements which led Schroeder to distinguish two types of mineral painted, rock tempered pottery. We have chosen to regard all mineral painted, poorly slipped, and boldly designed sherds as Mancos Black-on-white, and to consider the carbon painted sherds as a second variety. An alternative to the variety status for the carbon painted Mancos sherds has been proposed by Hayes (1964:63-64): Wetherill Black-on-white. We do not wish to enter into a taxonomic debate here other than to point out the existence in the Hovenweep area of two painted treatments of sherds that otherwise have similar attributes.

In the area to the north of the Monument several projects have yielded data relevant to the situation at Hovenweep. At Alkali Ridge (Brew, 1946) and Lowry Ruin (Martin, 1936) the pottery types are very similar to the output thus far recovered from the Hovenweep area. Naturally, the Abajo Red-on-orange sample at Alkali Ridge was much larger and thus Brew was able to observe the range of design elements: wavy lines, triangles, terraces, checks, and straight lines. At Hovenweep, however, only wavy lines were present. Since Lowry Ruin is the type site for Mancos Black-on-white, it is interesting to see that a distance of approximately ten miles has not contributed to much change in the character of the Mancos found at Hovenweep.

The Mancos at Lowry Ruin is limited to mineral painted sherds. Martin must have either not observed any carbon painted Mancos sherds, or classified them with McElmo Black-on-white. At Hovenweep 28% of the Mancos sherds were carbon painted. The corrugated and plain wares found at both Alkali Ridge and Lowry Ruin include the same variety of surface treatments as have been found on the corrugated wares from the Hovenweep area. Brew had also noted the presence of fingernail or tool incised decoration on some of the Alkali Ridge corrugated sherds.

The series of surveys and excavations by Brigham Young University in Montezuma Canyon to the west of the Hovenweep area have resulted in a proliferation of new ceramic types. Since this report presents only a preliminary analysis from one survey season, we have limited our study to general statements about the nature of our data rather than detailed

analyses that might be comparable to the complex typology developed at Brigham Young University (cf. Forsythe 1972). It is notable, however, that the ceramics found in Montezuma Canyon correspond closely with those from the Hovenweep area. Miller's analysis of the ceramics from Three Kiva Pueblo (Miller, 1974) shows a recovery of types proportionally similar to that from the Hovenweep survey. Redwares and trade types comprised only a very small percentage of the collection, while corrugated gray wares were in the majority. It is remarkable that Miller also divides Mustang Black-on-white (Mancos Black-on-white) into two mineral painted varieties according to a difference in design elements. It will be interesting to see whether an increase in our sample size will reveal design element clusters similar to those observed by Schroeder and Miller. We anticipate that correlation studies of design elements and motifs may reveal that these distinctions have zonal or temporal distributions. It is also notable that Miller combines McElmo and Mesa Verde black-on-whites as two organic painted varieties of Mesa Verde Black-on-white. We have followed a similar lumping procedure in order to examine McElmo and Mesa Verde Black-on-whites as one analytical unit.

LITHIC ARTIFACTS

VII LITHIC ARTIFACTS

Chipped Stone

The chipped stone collection from Hovenweep is a rich array of unworked and worked flakes, projectile points, knives, scrapers and similar items fashioned from blades, flakes and cores (Appendix VI). Over 5000 specimens were collected, probably representing but a fraction of the materials once used by the Hovenweep inhabitants for hunting, butchering, plant processing and manufacturing activities. Almost all sites except granaries and water control sites yielded a few tools, with non-utilized and utilized unworked flakes predominating. The majority were formed from various colored cherts obtained locally from marine beds in the Morrison Formation, and from a cream colored quartzite found in local conglomerates. Over 4000 of the items were unworked, many bearing marks indicating past use. These scars are usually not discernable to the naked eye, however, and a typology based on micro-wear analysis as well as macro-morphology has been developed. The possible uses of worked and unworked flakes are especially difficult to infer by morphology, and microscopic analysis permits the determination of certain wear patterns which were presumably produced by use. A micro-wear classification also facilitates a more precise definition of past site function, since it appears that different classes of artifacts were functionally related to specific subsistence and processing activities. A combined macro-morphological and micro-wear typology of thirteen chipped stone categories has therefore been developed. Tools were first classified by morphological criteria, such as shape, form and size, and then samples of each type were analyzed microscopically following techniques developed by Wylie (1973). Four general facts should be emphasized.

1) Terms such as "debitage" or "waste flake" are apparently misnomers, since many flakes which appear to the naked eye to be unused manufacturing debris actually show discernable use marks when examined microscopically.

Most pieces of stone produced during the manufacture of other items appear to have been used at one time or another, primarily for activities associated with cutting and scraping.

2) Several different parts of many tools were used or showed an attempt at use for varying purposes. Certain worked stones were multi-purpose tools, and had commonly been used for a combination of cutting, chopping and scraping purposes.

3) Tools exhibiting the most micro-wear patterns were the intentionally retouched and unretouched flakes. Other types, e.g. unifacial blades, exhibited a certain amount of wear, while still others, such as bifacials, retained virtually no wear patterns whatsoever. Finely flaked items such as projectile points and knives generally do not bear wear marks, although they were obviously used, and for this reason the typology is based upon morphology first, and wear mark second. All tools were basically classified by morphology and supplemented when possible by micro-analysis, thereby permitting tentative inferences concerning possible uses.

4) There are many unknowns involved in a micro-wear study which limit its usefulness. On the one hand, a majority of the nicks, scratches and other marks found on tools are most likely the product of manufacture rather than tool use. Thus many artifacts cannot be classified by micro-analysis, since it is often impossible to separate manufacturing patterns from wear patterns. In addition, many specimens were fashioned from low grade chert or quartzite, which precluded the formation and subsequent identification of wear marks. Finally, even when wear marks are obviously present, the activities which caused their formation are usually difficult to identify, since many different activities often produce the same wear patterns. Wylie's (1973) earlier program of replication provided a model for inferring possible function, since no experimentation with sample tools was performed in the present study.

Categories of Chipped Stone

1) Bifacials - Bifacials are tools which have been finely flaked on both sides, producing thin cutting and piercing edges which probably had primary uses in hunting and butchering. Three main classes of artifacts, broken down into six subclasses, were identified (Appendix VI).

a. Projectile Points - The 44 whole and partial points found at Hovenweep can be classed in four basic "types." A concise point typology with spatial and temporal subdivisions has not yet been developed for the Mesa Verde area, but several authors have discussed overall developments, and it is obvious that the Hovenweep material is generally similar to points found elsewhere in the Mesa Verde region.

Type 1 (Fig. 35, a-f) - The most variable group of points is a variable collection of large, unnotched, shouldered specimens occurring in a variety of shapes and forms (Table 5). These long, thick and heavy points are quite unlike the more delicate side- and corner-notched points usually found in Pueblo I - III contexts. Certain of these points resemble those of the Desert Culture, and for this reason they have tentatively been classified as Archaic. The attributes of one point in particular (Fig. 35, a) bear a striking resemblance to a Gypsum Cave point, except for the finer flaking technique. Local references for early points do not occur in the literature, aside from a brief note by Rohn (1974) on material from the Yellowjacket area, and the mention of a Milnesand (?) point found on Wetherill Mesa (Hayes 1964, Fig. 21).

Type 2 (Fig. 35, g-i) - The second group of points is composed of eight side- and corner-notched specimens which are large and heavy with broad bases and large tangs (Table 5). These points do not clearly fit into any local classification but they probably represent early Anasazi types, perhaps from Basketmaker contexts. They are, in fact, somewhat akin to large Basketmaker II-III specimens illustrated in Morris and Burgh for the Durango area (1954:81-84, Figs. 29c,e,l,m,h). None of the typical

TABLE 5 - Bifacial and Unifacial Tools

Category	#	Length (cm)		Width (cm)		Thickness (cm)		Weight (grams)	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range
Projectile Points									
Type 1	7	3.40	2.40-5.45	2.99	1.75-7.40	.62	.50-.70	4.94	2.45-8.65
Type 2	8	2.77	2.05-4.00	2.50	1.60-3.20	.50	.40-.70	3.09	2.40-6.35
Type 3	3	2.58	2.20-3.00	1.72	1.60-1.80	.49	.45-.50	2.14	1.80-2.45
Type 4	11	2.80	1.55-4.50	1.67	1.10-2.00	.41	.25-.60	2.06	0.45-3.60
Knives									
Ovate	11	6.29	2.00-9.50	3.86	1.86-5.00	1.34	.70-2.00	49.20	2.85-93.50
Triangular	26	4.02	1.80-6.00	2.50	.70-4.70	.53	.10-1.20	7.03	.70-34.00
Unifacials									
Domed Scraper/ adzes	13	4.40	3.10-10.50	3.73	2.40-8.60	2.03	.90-3.70	60.96	6.50-311.0
End Scraper	8	3.92	3.30-4.90	3.19	2.50-4.00	1.11	.60-2.40	17.49	5.90-31.90
Blades	19	3.53	2.20-6.10	1.98	1.00-3.90	.48	.30-.90	4.57	.85-17.20

Basketmaker III - Pueblo I narrow stemmed, sharp tanged points which occurred at Alkali Ridge (Brew 1946) and in the Ackmen Basketmaker sites (Martin 1939) were found in the survey area.

Type 3 (Fig. 35, j) - Three uniformly thin, small and light weight points belong to this category of long stemmed, unnotched specimens (Table 5). Although no particular temporal or geographic associations have been noted, they are probably Pueblo II - III variations.

Type 4 (Fig. 35, k-r) - Many of the points from Hovenweep are small side- and corner-notched artifacts which are commonly found throughout the Mesa Verde region. They are light weight points with convex bases, and usually occur with serrated edges. Several archeologists have noted that they often occur in Pueblo II - III sites (Hayes 1964:129, Fig. 21; Swannock 1969: 135; Brew 1946: 233; O'Bryan 1950: 109-111), and a stratigraphic sequence of Pueblo II - III materials containing this type has recently been excavated in Montezuma Canyon (Miller 1974).

Miscellaneous Points - Fifteen additional specimens could not be assigned to a type category, due to their irregular or fragmentary nature.

b. Knives - Bifacial knives are generally large, finely flaked tools with one or more worked edges which apparently served as cutting, hacking, whittling and piercing artifacts. Two categories can be distinguished.

Ovate Knives (Fig. 36, i-m) - Many of these collaterally flaked tools had all edges worked and were heavy and oval (Table 5). One specimen in particular (Fig. 36, m) is an extremely large, rather unique tool which was notched and probably hafted, and apparently used for delicate pounding or drilling as well as cutting and chopping activities. It was found at a quarry site (Hov. 461) and should probably be classified as a "flaked hammer-axe."

Subtriangular Knives (Fig. 36, e-h) - The basic bifacial knife has a triangular form and is usually much lighter than the larger ovate specimen (Table 5). Several of these thin tools probably served as multi-purpose instruments with a variety of uses ranging from sawing and cutting to drilling and spokeshaving.

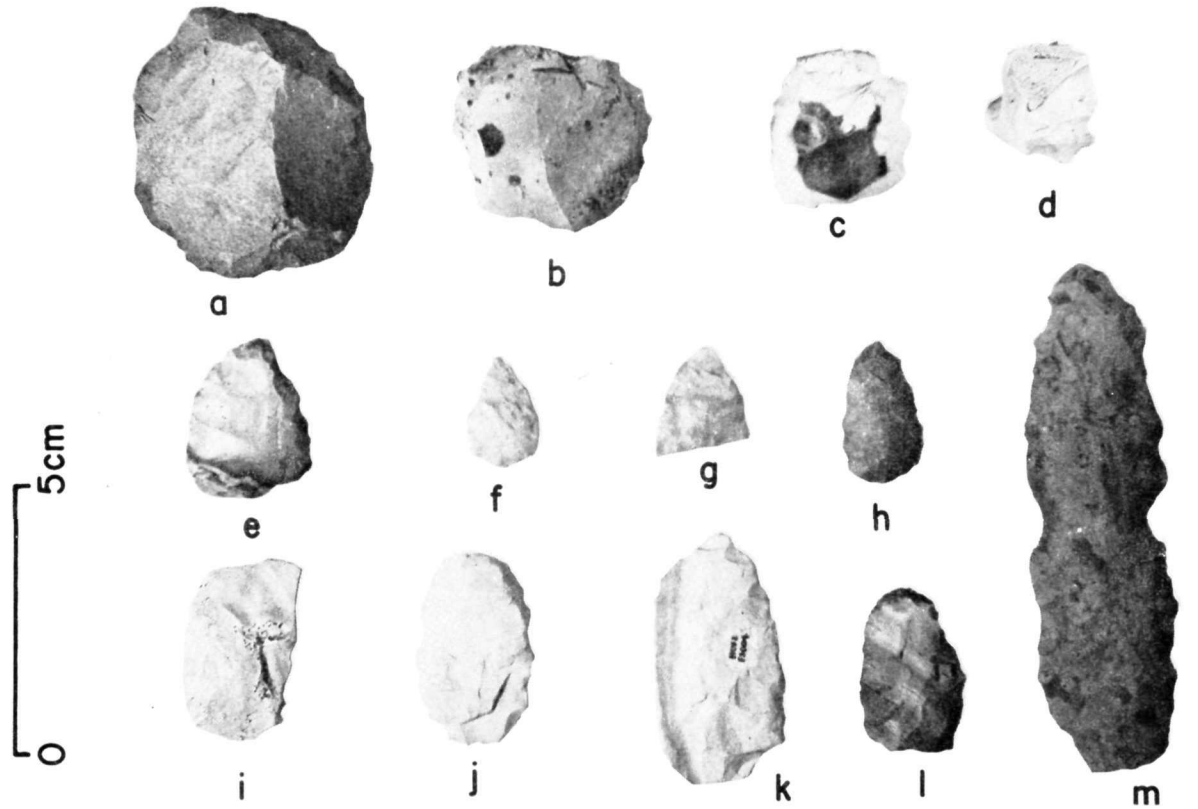


Figure 36. Knife and scraper specimens. Bifacial Knives: Type 1 - i-m; Type 2 - e-h. Unifacial domed scrapers - a-d.

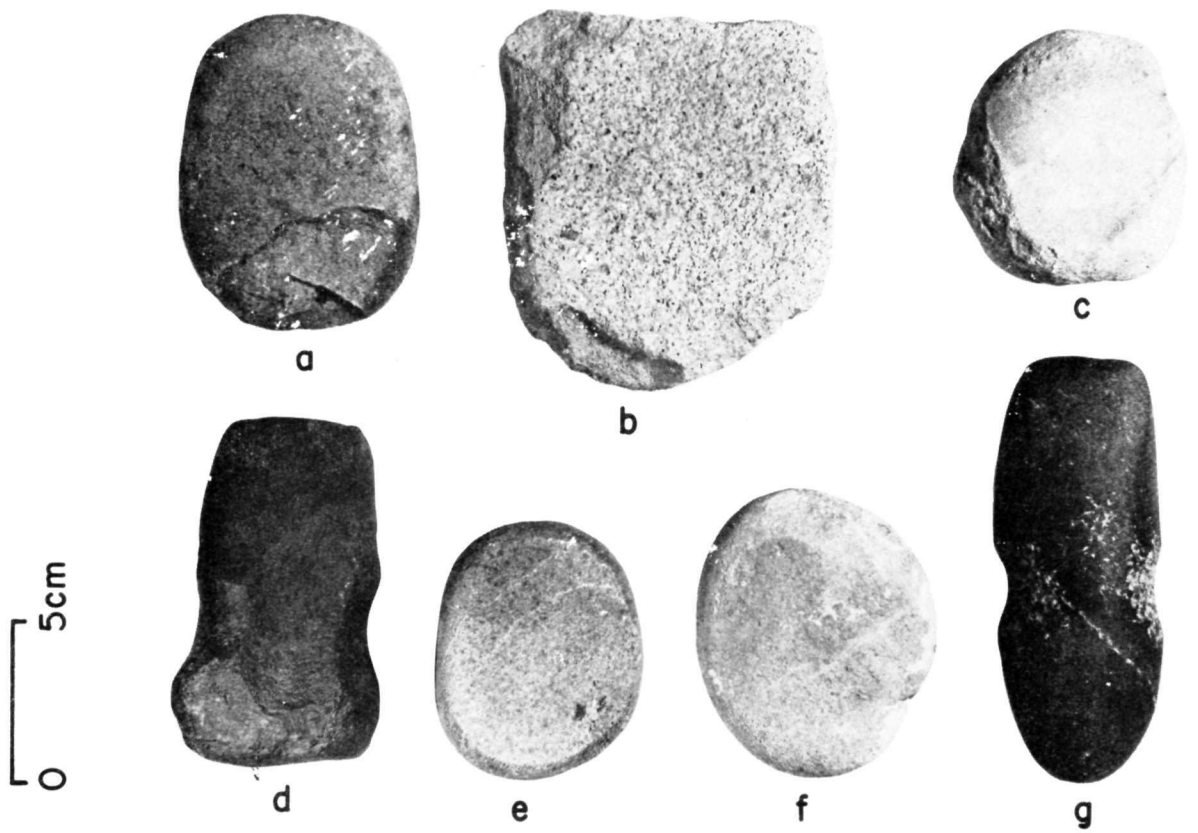


Figure 37. Ground stone artifacts. Manos: Rectangular - b; oval cobbles - a,c,e,f. Axes: d and g.

Miscellaneous - A number of bifacials were artifacts with irregular shapes, and have been grouped with similar unifacials into a "bifacial/ unifacial miscellaneous" category (Appendix VI).

c. Drills - Most of the tools which served as drills were usually parts of other items, particularly unifacial scrapers and multi-purpose worked stones. Only two bifacial specimens appear to have been single purpose drills. Both have long, thin bits, and although one is broken off at the base, the other has a broad base. The fragmentary drill measures 2.4cm by .7cm wide and .3cm thick, and the whole drill measures 4.5cm long by .4cm thick by .7cm wide at midpoint and 1.4cm wide at the base.

2. Unifacials - three categories of tools with secondary flaking on only one side were identified: domed scraper/adzes, end scrapers and blades.

a. Domed Scraper/Adzes (Fig. 36, a-d) - The largest and heaviest unifacials are a group of tools characterized by collateral platform flaking and secondary flaking on all edges (Table 5). Many showed preferred edges for use, with possible functions including adzing, chopping and hide scraping.

b. End Scrapers - Scrapers with only one worked edge were segregated from the domed adzes. Even though they were often ovate and domed, they were much smaller and were probably used for different functions. Several have surface platforms with ridges, others have serrated edges, while still others have rectangular shapes with ovate ends (Table 5). Scraping may have been the major function.

c. Blades - Thin blades struck carefully from cores are characterized by great uniformity in size, shape and flaking technique (Table 5). Most

are curved with single or double ridges and collateral flaking, and a few are very finely retouched along the edges. Their primary functions appear to have been cutting and piercing.

3. Retouched Flakes - Retouched flakes are tools which lack the fine flaking of bifacials and unifacials but which none-the-less have secondary flaking along one or more edges. Only a portion of these artifacts had forms and edge characteristics which permitted pigeon holing in such categories as "scraper" or "denticulate", and most were randomly flaked pieces of debitage which had been worked in only a few places. Microwear analysis aided in the identification of a few functional categories, but many of these artifacts could not be broken down beyond the "retouched flake" or "worked stone" category since most of the wear patterns are too generalized. Possible functions include hide scraping, cutting, drilling, delicate scraping, shaving, chopping, and coarse and fine sawing.

4. Unworked Stone - 4057 pieces of flaked stone lacked any evidence of secondary flaking, but many bore some form of wear pattern, ranging from microscopic nicks and spalls to deep grooves which apparently resulted from spokeshaving and related activities. Utilized flakes were the most common tool found in the survey, and while most sites yielded only a few, certain sites, such as Hov. 359 above Cajon Spring, yielded several thousand.

5. Cores and Hammerstones - Forty-six cores and eight unworked hammerstones were collected. Many of the cores were also apparently used as hammers, choppers and scrapers. The hammerstones were generally fashioned from cobbles and probably served a variety of pounding and battering purposes.

Ground Stone

Hovenweep tools with ground working surfaces are axes, metates and mano/rubbing stones. One of the two axes was fashioned from green granite, while the remaining ground stone tools were made from local Dakota Sandstone or similar material, with grain size varying from extremely fine to conglomerate size.

1. Axes - (Fig. 37, d and g) - Two finely ground, single bitted axes were recovered from a shelter cache (Hov. 119) and an open midden (Hov. 409). Both had also been used as mauls on their poll ends, and one was fully grooved (Fig. 37, d) while the other was notched on two sides (Fig. 37, g). The notched, green granite axe measured 16cm long by 6cm wide at mid-point by 4cm thick at mid-point with .9cm deep and 3cm wide notches. The bit was 4.4cm wide and 5cm long, and the ovate poll measured 1.4cm in diameter. The grooved, dark grained sandstone axe measured 12.7cm long by 6.2cm wide and 4cm thick at mid-point. The maul end was more massive than the rest of the tool, measuring 7.2cm wide and 5.5cm thick, while the groove was 4 - 5mm deep on the sides and 2 - 4mm deep on the faces, and averaged 4.5cm wide. The bit measured 4.6cm wide by 7.7cm long.

2. Metates - Two forms of large grinding stones were probably used to grind corn, wild plant seeds, fruits, pigments and pottery temper or similar hard grained material. All eight of the specimens had single grinding faces, and could have been used with either one-handed or two-handed manos. The edges of all specimens had been modified by chipping or spalling, thereby producing rough rectangular shapes.

Flat Slabs - Three metates were uniformly shaped rectangular slabs averaging 39cm long, 25cm wide and 3 - 10cm thick. Each had been completely

smoothed into a flat, even working surface by dimpling, pecking and grinding.

Plain Faced, Concave Metates - Five grind stones had deeply concave working surfaces. The concavities covered the greater part of the upper surfaces, and ranged from 1 to 3cm deep. One was marred by irregular scratches, while another had a smear of red pigment(?) at one end. All were roughly rectangular, averaging 39.6cm long, 27.55cm wide and 7.7cm thick, and had been formed by pecking and grinding.

3. Manos - Thirty-seven complete or fragmentary implements were manos and probably served in conjunction with the metates as grind stones for corn, wild seeds and pigments. Rocks usually classed as one-handed "rubbing stones" (cf. Rohn 1971:209) were grouped in this category, along with two-handed slabs, since both shared certain regularities in form and probable function. Many of the one-handed manos were formed from fine grained cobbles while most of the two-handed implements were fashioned from both fine and coarse grained sandstone slabs. Two general forms occurred:

Rectangular Two-Handed Manos (Fig. 37, b) - These large, thin, flat slab manos were probably used with the flat slab metates (Table 6). They were often fashioned into a rough rectangle by chipping and spalling along the edges, and one or both faces were ground smooth. One rectangular mano blank was also collected.

One-Handed Cobble Manos (Fig. 37, a,c,e,f) - The small oval grinding stones were most likely used with the concave metates for grinding seeds and pigments. Both one-faced and two-faced specimens were collected (Table 6).

TABLE 6 - Manos

Category	#	Length (cm)		Width (cm)		Thickness (cm)	
		Mean	Range	Mean	Range	Mean	Range
Rectangular							
1 face	9	20.90	13.00-27.30	11.90	10.80-13.60	3.30	2.00-4.80
2 faces	10	18.90	15.00-24.80	11.80	10.50-12.50	2.90	2.00-4.00
Oval							
1 face	3	9.30	9.00-9.60	7.50	6.80-8.20	3.40	3.30-3.50
2 faces	15	10.90	9.00-15.00	9.10	6.60-12.50	4.20	3.00-5.80

MISCELLANEOUS ARTIFACTS

VIII MISCELLANEOUS ARTIFACTS

A number of additional artifacts are listed in Appendix VI and illustrated in Figure 38. One of the most unique is a small animal trap found in a shelter (Hov. 402) in the Hackberry-Horseshoe Unit. The device consisted of a flat rock slab measuring approximately 36cm by 36cm by 3cm, a notched juniper stick and a flat slab of wood (Fig. 38, a). The two wooden items apparently served as two parts of a three or four part trigger mechanism which supported the slab in an upright dead fall position. This device was most likely of Navajo or other recent origin, since the twig had been whittled with a sharp metal blade. Five whole or partial pendants formed of ground stone, thin slate and pottery were also collected (Fig. 38, b-e). Several rocks of soft chert or similar material etched with geometric scratches were also found. Other possible artifacts include hollow rock concretions which may have served as pot rests (cf. Rohn 1971: 243), a piece of ochre, and fossilized shells which commonly occurs in local marine deposits.

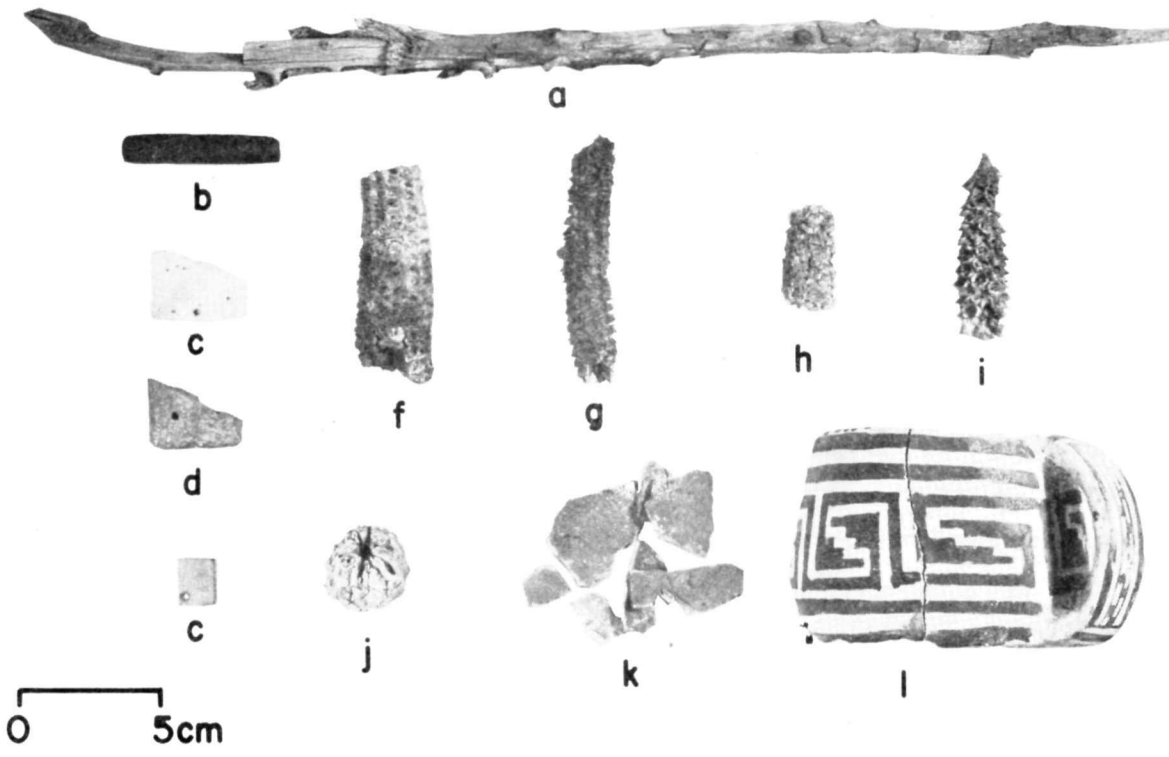


Figure 38. Miscellaneous artifacts. a - deadfall trap trigger; b-e - pendants; f-i - corn cobs; j-k - squash peduncle and rind fragments; l - Mesa Verde Black on White mug.



Figure 39. Navajo sweathouse (Hov. 368).

CULTIVATED PLANTS

IX CULTIVATED PLANTS

The prehistoric Hovenweep farmers raised maize and squash, and probably grew beans, cotton and other cultigens. Squash rinds (*Cucurbita sp.*) and stems (*C. pepo*) were collected from two sites (Hov. 13 and 365) in the Square Tower Ruin Group, while 67 corn cobs were found at thirteen sites in the Square Tower, Holly, Hackberry-Horseshoe and Cutthroat Castle Ruin Units (Fig. 38, f-k). The corn sample is too small to allow a statistically valid study of local maize farming practices, since only one site yielded more than 20 cobs (Table 7), but it does permit a preliminary comparison with maize collections from other sites in the region. The characteristics of the Hovenweep corn agree with distributional patterns observed elsewhere in the Mesa Verde area, and indicate that local farmers may have been growing crops derived from a common gene pool.

Morphology and Relations

Sites at Mesa Verde and in other nearby Anasazi regions have yielded large collections of maize which have permitted an identification of certain of the local maize distributional patterns. Over 10,000 cobs have been collected and studied from Mesa Verde alone (Cutler and Meyer 1965), and nearly one thousand have been analyzed from sites to the west in the Comb Ridge-Cedar Mesa region (Litzinger and Winter 1974) and to the southwest at Betatakin and Kiet Siel (Cutler 1966). All of the maize from Hovenweep is quite uniform, and while some of it might have been grown by recent Navajo, it is more likely late Anasazi material, since the relatively high frequencies of 8-rowed cobs are commonly associated with a Pueblo II-III context. The row number measurements also suggest a close relation with maize to the east, west and southwest (Table 8). An east to west gradient in row numbers evidently existed in the region, since Pueblo II - III collections from Mesa Verde averaged high numbers of 8-rowed cobs (30-46%), and Pueblo II-III collections to the west in the Kayenta area averaged somewhat lower

TABLE 7 - Hovenweep Maize Data

Site	# cobs	Mean Row	% each Row # -6	8	10	12	14	16+	Cob Diam.	Rachis Diam.	Cob/Rachis Index	Cupule Width	Lower Glume Width
8	2	11	0	0	50	50	0	0	1.3 cm	.5 cm	2.6	.55 cm	.35 cm
13	5	10.4	20	0	20	60	0	0	1.54	.7	2.2	.74	.40
15	3	12.0	0	0	33	33	33	0	1.6	.8	2.0	.70	.40
17	5	8.8	0	80	0	20	0	0	1.4	.7	2.0	.70	.42
21	1	8.0	0	100	0	0	0	0	1.7	.6	2.6	.80	.45
60	1	10	0	100	0	0	0	0	1.6	.8	2.0	.65	.45
61	3	10	0	33	33	33	0	0	1.7	.6	2.8	.75	.42
65	6	8	20	50	30	0	0	0	1.4	.7	2.0	.75	.45
70	9	9.7	0	44	22	34	0	0	1.4	.64	2.2	.75	.43
108	4	9.5	0	50	25	25	0	0	1.6	.86	1.8	.75	.42
367	21	10.8	0	24	24	38	14	0	1.6	.77	2.2	.75	.42
401	6	10	0	33	33	33	0	0	1.5	.75	2.0	.68	.45
451	1	12	0	0	0	100	0	0	1.2	.5	2.4	.65	.40
T	67	10	2	32	25	32	9		1.53	.70	2.1	.72	.42

TABLE 8 - Regional Maize Pattern

Site	# Cobs	% 8 - Row
Glen Canyon (42 KA 274)	507	23
Cedar Mesa (NR-4-2)	264	25
Comb Ridge (42 SA 2136)	75	19
Elk Ridge (13 sites)	133	24
Betatakin	83	28
Kiet Siel	349	38
Hovenweep (12 sites)	67	32
Step House	5932	30
Long House	2171	42
Mug House	3621	46

frequencies (19-38%). Although it is premature to compare the Hovenweep material with these samples, considering the small size of the collection, the local corn apparently fits midway between the Mesa Verde maize to the east and the Comb Ridge-Cedar Mesa corn to the west. The local farmers were probably involved in a regional agricultural system, as indicated by the geographic cline of row number measurements. This pattern suggests that farmers in each valley or mesa locality, e.g. Hovenweep, were exchanging corn among themselves, and that seed material was additionally being exchanged from mesa to mesa, thereby producing the gradient of morphological characteristics.

FAUNAL REMAINS

X FAUNAL REMAINS

by Michael Holst, Zoology Department

51 bone elements and numerous splinters were collected from 19 sites at Hovenweep and analyzed for information concerning species, genus and possible use patterns. Since all of the material was found on the surface, most of the bones were probably deposited recently and therefore are of value in supplementing Rado's study of contemporary wildlife on Cajon Mesa (Appendix II). In several instances, however, the nature and context of the bone is suggestive of prehistoric use.

Seven species of mammals and birds were identified (Table 9). Specimen determination and range interpretations are based on the work of Hall and Kelson (1959). Descriptions of the remains follow.

Odocoileus hemionus (Mule Deer)

Mule deer bone accounts for one-third of the sample. This is an unusually large proportion, since the modern sheep herds of the area generally exclude deer through forage competition. Certain of the bones from shelter sites were probably deposited by prehistoric Anasazi hunters, however, since many were charred and mixed with tools and sherds. Others were undoubtedly of recent origin, as indicated by the presence of connective tissues. Osseus materials from both young and mature animals included vertebra, limb bones, ribs, and skull fragments.

Canis sp. (Coyote or Dog)

An intact atlas is the only canid bone. Differentiation between coyote and dog is difficult without the skull and both species commonly occur in the area.

TABLE 9 - Faunal Remains

Provenience	Scientific Name	Remarks
HOV 8	Odocoileus hemionus	Right radius less distal end
HOV 13	O. hemionus	Phalange #1
HOV 18	Lepus sp.	R. Metatarsals II, III
HOV 21	a. Ovis sp.	R. Rib fragment, articular end 6th
	b. Ovis sp.	Rib fragment
	c. Odocoileus hemionus	Thoracic vertebra, neural arch & spine
	d. Odocoileus hemionus	L. Ulna frag. proximal end
	e. Sylvilagus sp.	R. Femur, distal end fragment
HOV 24	Lepus sp.	L. Femur frag. distal
HOV 53	Ovis sp.	R. Metatarsal II & III, cannon bone
HOV 61	Lepus sp.	fragment of long bone, not enough for positive id
HOV 63	Odocoileus hemionus	L. Rib
HOV 65	a. Odocoileus hemionus	R. radius, proximal end
	b. ?	fragment too small to identify
	c. ?	fragment too small to identify
	d. Sylvilagus auduboni	L. Periotic tympanic bulla
	e. O. hemionus	Ungual phalange #3
	f. ?	Long bone fragment, unidentifiable Odocoileus or Ovis, most likely
	g. ?	"
	h. O. hemionus	L. Maxilla frag. with 3PM 1-3M
	i. O. hemionus	Metacarpal frag., young animal missing distal epiphysis
HOV 70	a. Sylvilagus sp.	L. Humerus frag.
	b. Canis sp.	Atlas vertebra
HOV 119	? Odocoileus or Ovis	Cervical vertebra frag.
HOV 318	O. hemionus	Thoracic vertebra frag. basal portion of neural spine
HOV 350	a. O. hemionus	R. femus distal frag.
	b. O. hemionus	2 bone fragments from same bone

TABLE 9 - con't

Provenience	Scientific Name	Remarks
HOV 378	*Ovis* sp.	L. Scapula
HOV 454	a. *Ovis* sp.	R. Mandible shows characteristics of domestic sheep
	b. *Odocoileus hemionus*	L. Ulna frag.
	c. *O. hemionus*	L. Calcaneum
	d. *O. hemionus*	Phalange #1
	e. *O. hemionus*	R. Tibia frag.
	f. *O. hemionus*	Lumbar vertebra
	g. *O. hemionus*	L. Astragalus
	h. ?	Bone fragments
	i. ?	Rib frag.
	j. *Sylvilagus* sp.	Femur frag.
	k. *Sylvilagus* sp.	Femur frag.
	l. *Sylvilagus* sp.	L. Tibia frag distal end
	m. *Sylvilagus* sp.	R. Tibia frag. distal end
	n. *Sylvilagus* sp.	R. Femur frag. proximal end
	o. ? *Odocoileus* or *Ovis*	Long bone frag.
	p. *Sylvilagus* sp.	L. Tibia (7 frag.)
	q. ?	L. Tibia
HOV 454	a. ?	Rib frag. (2 bones)
	b. *Sylvilagus* sp.	R. Femur, distal frag.
	c. *O. hemionus*	R. Femur frag. distal end
HOV 455	a. *Lepus* sp.	Tooth R. upper M2
	b. *Sylvilagus* sp.	R. Maxilla Jugal frag.
	c. *Lepus* sp.	Long bone frag.
HOV 473	a. *Meleagris gallopavio*	L. coracoid
	b. *Lepus* sp.	L. Humerus frag. proximal end
	c. ?	Bone splinters, unidentifiable
HOV 477	*Ovis* sp.	Phalange #1
Unprovenienced	a. *Ovis* sp.	L. Rib frag. #4 to #6?
	b ?	Pelvis frag.
	c. *Lepus* sp.	R. Femur

Sylvilagus audubonii (Cottontail Rabbit)

A left tympanic bulla was identified as *S. audubonii*; other elements could be either *S. sylvilagus* or *S. nuttallii*, since both species are morphologically similar and occur locally. All elements were fragments, and some were charred.

Lepus sp. (Jackrabbit)

Most of the jackrabbit bones are probably from the Black Tailed species, since this form commonly ranges into the Hovenweep area. All bones were fragments and none were charred.

Neotoma sp. (Woodrat)

One uncharred element of a young animal represented this species.

Ovis sp. (Sheep)

Sheep are represented by seven elements, including a mandible, limb bones, a scapula and ribs. None of the material was charred, several of the bones retained connective tissue, and the bulk of the collection was considerably weathered. All are probably the result of recent coyote predation on domesticated herds, since none of the bones were clearly mountain sheep (*Ovis canadensis*). The mandible was quite small and compact, indicating an animal with a short rostrum. This is a characteristic of Navajo sheep.

Meleagris gallopauo (Turkey)

A left coracoid bone was collected from the midden of Hov. 473, a large Pueblo I-III unit pueblo. Its small size suggests that it could be a young female of a modern domesticated breed, a wild bird of either sex, or a bird of a small aboriginal breed. Both wild and small domesticated turkey bones are common at Mesa Verde (Hargrave 1965), and since the bone was collected from an undisturbed midden located several miles from the nearest Navajo settlement, the probability is high that it came from a prehistoric wild or domesticated Indian breed. No modern turkeys have been noted for some time in the immediate area.

Summary

The faunal remains from Hovenweep reflect a combination of recent and prehistoric hunting and domestication activities. Wild specimens which were probably hunted were the mule deer and the cottontail rabbit, and perhaps the wild turkey. Modern Navajo Indians may also have hunted these same species. The domesticated turkey may also have been raised by the prehistoric Hovenweep Indians, as it was at Mesa Verde. Modern species represented by bones include deer, coyote or dog, woodrat, cottontail, jack rabbit and domesticated sheep. All of the modern species have been noted by Rado (this volume) in the area, and his Appendix (II) should be consulted for information on range and habitat preference.

INTERPRETATIONS

XI INTERPRETATIONS

Since the 1974 survey examined only a small part of the total acreage on Cajon Mesa, a specific statement about the overall cultural sequence, subsistence activities and environmental relations of the Hovenweep inhabitants remains to be developed. It is possible, however, to present a preliminary reconstruction based on the current survey program and on the earlier research of Martin (1936,1938,1939), Wheat (1955) and Rohn (1974) in the north, Matheny (1962; Miller 1974) to the west in Montezuma Canyon and the mesa surveys of Schroeder (1967-1968) and Martin et al (1971).

Culture Sequence

The tentative sequence (Appendix IX) suggests an occupation from the late Archaic through the current Navajo periods, with the densest use during the late Pueblo II and Pueblo III Anasazi periods. The Basketmaker III through Pueblo III and Navajo sites were dated by ceramics and architecture, while the Basketmaker II designation is based on the pithouse style and the absence of pottery. The Archaic classification is the most tenuous, since it is based solely on a projectile point typology.

Archaic - Only five possible Archaic hunting and gathering sites have been located on the mesa: a surface site in the pinyon-juniper zone near Yellowjacket (Rohn 1974), isolated sites above the springs at Holly House (Hov. 424) and Square Tower (Hov. 340), and an extensive scatter of lithic debris on the ridges above Cajon Spring (Hov. 359). The latter site consists of nearly twenty acres of flakes, cores, blades, points and ground stone, along with a few sherds and probably served as a hunting, gathering and processing station throughout much of the occupation of the mesa. All of the possible Archaic sites located during the survey occurred near springs, apparently reflecting waterhole hunting and gathering. With the exception

of Hov. 359, each site is composed of only a few points and flakes, suggesting a very limited use of the area. The larger assemblage from Cajon Spring may indicate the main activity area on the mesa, since the spring is one of the largest water sources in an otherwise barren shrubland environment and local hunters would have had a view of several hundred square miles of potential hunting territory.

Basketmaker II (ca. 250BC - AD450) - Only one Basketmaker II site, a slab lined pithouse site on a pinyon-juniper covered ridge above Cutthroat Spring (Hov. 388), was located in the survey area. An area of rubble and fallen slabs, ashy soil and numerous worked and unworked flakes are associated with the pithouse. No other Basketmaker II sites have been reported for the immediate region and the nearest concentrations are to the east in the Durango area (Morris and Burgh 1954) and to the west on Cedar Mesa (Lipe and Matson 1971). The slab structure at Hov. 388 may belong to a later period, since several Pueblo II sites occur nearby on the same ridge, but it might also represent a limited use of the mesa by Basketmaker II farmers and gatherers who moved in from the nearby areas of higher population.

Basketmaker III (ca. AD450 - AD700) - Late Basketmaker III - early Pueblo I villages are common in the area, but are concentrated primarily in the pinyon-juniper zone. Several "stockaded" hamlets consisting of a few pithouses, surface rooms, cists and evidence of a surrounding wall have been excavated by Rohn (1974) near Yellowjacket, and Wheat (1955) excavated a non-stockaded hamlet in the same area. The two late Basketmaker III - early Pueblo I villages excavated by Martin (1939) near Ackmen are as large as Site 13 on Alkali Ridge some twenty miles to the west. They consist of several hundred masonry, slab and jacal surface rooms in concentrations of double rows, dozens of large pithouses to the south, "Great Kivas" up to 80 feet in diameter constructed of masonry and upright slabs, and associated Lino (Chapin?) Gray and Abajo Red-on-orange pottery. At least ten of these sites were noted by Martin in his survey of 16.75 square miles of pinyon-juniper forest at the north end of Cajon Mesa (1938).

Elsewhere on the mesa only four sites with Basketmaker III materials were found during the 1974 survey. Three were multi-component sites where a few Abajo Red-on-orange sherds were mixed with later materials. The fourth multi-component (Hov. 61) site includes a probable slab-lined pithouse with masonry surface rooms and associated Chapin Black-on-white pottery, situated on the floor of Hackberry Canyon near the north edge of the juniper-sage zone. Several other multi-period sites with Basketmaker III components have been noticed in Montezuma Canyon (Miller 1974), and the overall pattern indicates a heavy use of the pinyon-juniper zone by late Basketmaker III groups, and a limited penetration of the mid- and south-mesa areas.

Pueblo I (ca. AD700 - AD900) - The majority of the Pueblo I sites are at the north end of Cajon Mesa and consist of small scattered hamlets containing single pithouses and a few surface rooms (Martin 1938,1939). The much larger, late Basketmaker III pithouse concentrations were inhabited well into the early Pueblo I period, considering their dendrochronological dates of AD700 - AD860, but by late Pueblo I times the larger villages and Great Kivas were no longer being built as the population fragmented into smaller units. The ceramics consisted of a mixture of Lino (Chapin?) Gray, banded neck and corrugated gray types, Abajo Red-on-orange, La Plata Black-on-red and early Mancos Black-on-white. Two small sites in the pinyon-juniper zone dated at about AD850 by ceramics were excavated by Martin, and five others were surveyed. Pueblo I material is more common to the south than earlier evidence, but the pattern still suggests a small scale occupation. An early Pueblo I village similar to the large ones in the Ackmen area was excavated by Matheny (Miller 1974) in Montezuma Canyon, several similar sites were noted in the juniper-sage zone in McElmo and Yellowjacket Canyons (Jackson 1878: 411-450; Holmes 1878: 385-386), and Morley and Kidder (1917:44) spotted a Pueblo I - like village on the "Fortified Spur" above the confluence of the Yellowjacket and McElmo. Pueblo I sherds were collected at fifteen locations in the present survey, many of which were large multi-component pueblos located in the open flats of the sage and juniper-sage environments. Isolated upright slab structures were also

noted at several of these sites, perhaps indicating hamlets similar to those in the north. The evidence thus suggests an expansion to the south as the large Basketmaker III - early Pueblo I villages split up and formed small scattered hamlets.

Pueblo II (ca. AD 900 - AD 1100) - The Pueblo II period "unit pueblo" first described by Prudden (1914,1916) is extremely common on Cajon Mesa, and many of the Pueblo II sites are blocks of contiguous masonry rooms with kiva depressions and middens to the south. These ruins are especially common in the flats of the juniper-sage and sage zones, and are often associated with mineral and organic painted Mancos Black-on-white and corrugated gray pottery types. Numerous Pueblo II period sites have been surveyed on Cajon Mesa, including 76 in the present program. At least nine have been excavated by Prudden (1914,1916), Martin (1936,1938,1939), and Matheny (Miller 1974). Site sizes range from isolated refuse through scattered unit pueblos to large multiple units, such as Lowry Ruin. Many of the large Pueblo III canyonhead community houses have evidence of Pueblo II and earlier occupations, and most of the scattered unit pueblos were inhabited well into the Pueblo III period. In fact, single component Pueblo II or Pueblo III sites are rare, and no clear-cut temporal or geographic differences existed between the two periods. Schroeder (1967-1968: 90-91) suggested that the Pueblo II population was centered in the open sage flats in scattered unit pueblos which had been constructed between AD 1025 - AD 1100, but that by Pueblo III times the inhabitants had abandoned most of the unit pueblos and moved to the canyonheads where they built large tower complexes. Pueblo II sites do commonly occur in the open, as Schroeder noted, but they also occur in many other locations in a variety of forms, usually mixed with later Pueblo III materials. Talus top granaries, mesa edge shelters, ridge top ceramic and lithic scatters, arroyo check dams and even the canyonhead tower complexes more often than not have Mancos Black-on-white as well as McElmo - Mesa Verde Black-on-white pottery. Moreover, almost all of the unit pueblos have later ceramic types associated with Mancos Black-on-white and earlier red wares, although it is

obvious that they were inhabited most heavily during the Pueblo II period. Thus it appears that the tendency towards exploitation of many areas of the mesa which began around AD 800 was well underway by AD 1000, and by AD 1100 most of the arable land, even the barren shrub zone, was being utilized. Water control devices were probably developed during this period as sedentary groups exploited all usable portions of the environment. Pueblo II sites are the most frequently occurring ruins on the mesa, and they are located in all zones and in most physiographic locations, although most are concentrated in open juniper-sage and sage flats.

Pueblo III (ca. AD 1100 - AD 1300) - The "classic" Mesa Verde style Pueblo III sites occur as multi-room tower complexes clustered around canyonhead springs in all environments. The distribution at Hovenweep ranges from Cutthroat Castle (Hov. 70) in the northern pinyon-juniper forests to Cajon Ruin (Hov. 51-52) in the southern shrubland. All archeologists who have worked on Cajon Mesa have noted a close association of the Pueblo III sites with canyonhead springs, and even the large sites on the mesa top, such as Lowry Ruin and the "Cajon Mesa Site" tested by Matheny (1965) to the south of Square Tower, are within several hundred meters of a permanent spring. Most large tower complexes thus have a clear relationship with water, but it is erroneous to assume that all Pueblo III sites are springside complexes of towers, room blocks and granaries. In fact, most of the 74 Pueblo III sites located during the survey occur in a variety of environments, and some, such as Bobcat Towers (Hov. 366) are sizable clusters of rooms, towers and retaining walls located up to a mile from the nearest water. Many of the mesa top ruins were inhabited well into Pueblo III times, and Pueblo III sites even occur in the arid isolated areas of Black Steer Canyon (Hov. 481) and Hovenweep Canyon (Hov. 459). The majority of these outlying sites are small, limited activity areas, however, and it is probable that the densest population centers were clustered near the springs. Most of the outlying sites are small hamlets or special use farming, hunting, gathering and processing locations. It appears that

many of the water control devices which are associated with the large sites, particularly the rim dams and talus walls, were developed or expanded after AD 1100. The inhabitants probably continued to farm and gather in the outlying areas, but after AD 1100 most of the population probably moved to the tower complexes and exploited the canyonhead resources. The springs had been utilized for centuries, as indicated by Pueblo I and II sherds and earlier Archaic-like points, but the major ruin complexes were probably completed no earlier than AD 1200. Several of these springside complexes supported relatively large Pueblo III populations as demonstrated by the cluster of five ruin complexes around the heads of Ruin Canyon (Hov. 1-17) with at least 200 rooms, a dozen towers, and numerous kiva depressions. The enormous complexes at Goodman Point, Yucca House and Aztec Spring were also inhabited during this period, again in association with water.

Navajo (ca. 1850? - present) - The Navajo Reservation begins approximately one mile south of the Square Tower Group, and covers the southern quarter of Cajon Mesa, including the Cajon Monument Unit. The Navajo reservation also coincides with the shrub zone, and although this zonal distinction may in part be due to heavy grazing activities, shrubland is also a natural feature on the mesa since it occurs to the north in Black Steer Canyon and in pockets in the Square Tower Monument Unit. Several dozen Navajo families currently live on the mesa and depend on a sheep herding economy, and prior to the establishment of the Monument their activities extended as far north as the juniper-sage environment in the Holly and Hackberry - Horseshoe Monument Units. Eight possible Navajo sites were mapped during the summer, ranging from a trapping area (see Fig. 38a), three sweathouses (Fig. 39), a brush-fronted shelter, a sherd area, a cistern and a burned hogan or corral. The latter two sites are in the Cajon Monument Unit and were probably associated with the sheep herding activities of a nearby homestead. Other sites probably represent an earlier, pre-Monument phase of settlement, while several of the obviously recent sweathouses may have been constructed by Navajo members of the National Park Service stabilizing crews. Navajo sheep camps occur

throughout the mesa, along with numerous white-American sheep camps, corrals, farmsteads and refuse areas.

Ute - No recognizable Ute sites were found, but they probably exist in the Hovenweep area considering the nearby Reservations and Ute use of nearby localities during the past few centuries. Campsites probably occur at Hovenweep, and many of the "Archaic" points may, in fact, be Ute types.

Environmental Relations

The prehistoric Anasazi Indians exploited the Hovenweep environment for over 1000 years, perhaps beginning before the time of Christ and ending at approximately AD 1300. One of the objectives of the current program is to obtain data about site location, function and environment. Although the 1974 survey area was too small and skewed to provide a representative sample of sites in each environmental zone, since the juniper-sage area was over-represented while the pinyon-juniper environment was under-represented, a number of tentative environmental trends have never-the-less appeared and are detailed in Tables 10-12. The disproportionate sizes of the survey areas have been accounted for in each table, and it is obvious that there are several nonrandom patterns of site location. The pinyon-juniper zone, for example, accounted for 2% of the survey area, and one would expect that 2% of the total sites as well as 2% of the sites by each period would occur in this part of the survey area if sites were distributed randomly across the mesa with no relation to environment. As indicated in Table 10 more sites occur in the pinyon-juniper zone than expected, which compares favorably with Martin's (1938, 1939) earlier observations. Part of this nonrandom distribution is probably due to the fact that the pinyon-juniper survey area was small and restricted to a canyonhead, which is an area of dense site concentration in all environments. The larger survey areas in other environments have equally dense concentrations near the springs, but the greater acreage in outlying areas tends to produce an overall index of

TABLE 10

RELATION OF CULTURE PERIOD AND ENVIRONMENT

Period	Pinyon-juniper	Juniper-sage	Sagebrush	Shrubland	Total
Archaic	0 - observed (0 - expected)	1 (2)	1 (1)	2 (1)	4 (26)
Basketmaker II	1 (0)	0 (.6)	0 (1)	0 (.2)	1 (26)
Basketmaker III	0 (0)	2 (2)	1 (1)	1 (1)	4 (26)
Pueblo I	1 (.25)	9 (9.75)	3 (2)	2 (3)	15 (26)
Pueblo II	8 (2)	56 (48)	10 (11)	2 (15)	76 (26)
Pueblo III	4 (2)	63 (47)	2 (11)	5 (14)	74 (26)
Navajo	0 (0)	6 (4)	0 (1)	2 (1)	8 (26)
TOTAL	14 (3)	137 (116)	17 (27)	14 (36)	182

TABLE 11

SITE DENSITY

Survey Area	Size	# of sites	Sites/acre	Environment
Cutthroat Castle	14 acres	7 (3 other nearby)	1/2	Pinyon-juniper
Hackberry-Horseshoe	137	53	1/2.6	Juniper-sage
Holly	65	16	1/4	Juniper-sage
Hovenweep Canyon #1	40	7	1/5.7	Juniper-sage
Hovenweep Canyon #2	40	7	1/5.7	Juniper-sage
Square Tower	400	68	1/5.8	Juniper-sage, sage and shrubs
Navajo Canyon #1	40	6 (1 other nearby)	1/6.6	Sagebrush
Cajon	40	6 (1 very large)	1/6.6	Shrubland
Black Steer Canyon #1	40	3 (3 other nearby)	1/13.3	Shrubland

TABLE 12

RELATIONS OF PLANT ZONE AND PHYSIOGRAPHY

	Pinyon-juniper	Juniper-Sage	Sage	Shrubland	Total
Ridges	5 observed (4 expected)	52 (63)	14 (6.5)	11 (6.5)	82 (40)
Arroyos	0 (.5)	8 (7.5)	0 (1)	2 (1)	10 (40)
Canyon edges	1 (1.5)	28 (24)	2 (2.5)	1 (2.5)	32 (40)
Canyonhead Springs	1 (1)	16 (13)	1 (1)	1 (1)	19 (40)
Talus slopes	4 (3)	59 (52)	2 (5)	2 (5)	67 (40)
Canyon bottom	2 (1.5)	25 (22)	1 (2)	1 (2)	29 (40)
TOTAL	13 (4)	188 (153)	20 (33)	18 (48)	239

fewer sites per acre. Therefore the size of the survey area is an important factor that determines, in part, the number of sites found within it. However, since density is not always dependent upon survey area size and proximity to a canyonhead, other factors must also be considered. Environmental zone, for example, is an important variable, as demonstrated by Table 11. The Hovenweep Canyon #1 and #2, Navajo Canyon #1, Cajon Monument Unit and Black Steer Canyon #1 Quadrats all measured 40 acres, but the site density is greatest in the juniper-sage areas, moderate in the sagebrush quadrat, and smallest in the shrubzone. The juniper-sage environment has an especially high site density, particularly in the Pueblo II and Pueblo III periods. The sage and shrubland environments, in contrast, have fewer sites than expected, especially during certain periods. In the sage area, for example, Pueblo I and II sites occur as expected, but the number of Pueblo III sites has decreased dramatically. The shrubland zone has fewer sites than expected in all periods except during the Archaic and Basketmaker III periods, when foraging groups may have been attracted to the Cajon Spring area.

Location in relation to physiography is also nonrandom, as shown in Table 12. Again, certain of the areas are underrepresented, such as arroyos in the pinyon-juniper forests, but patterns are still present when the expected and observed frequencies are compared. Sites occur most frequently on ridges, at canyon edges and on talus slopes around springs, and occur less commonly in areas situated away from the springs, particularly along canyon bottoms and in arroyos. All locales were utilized when springs were nearby, but certain non-spring locations were preferred over others, especially during particular time periods. Non-spring canyon bottoms and arroyos, for example, were commonly used only during the Pueblo II and III times, while ridges were preferred site locations througnout most of the occupation sequence. Although these patterns must be rechecked with additional survey data, they do tend to support our preliminary inferences concerning the culture sequence on Cajon Mesa. Archaic sites have a limited occurrence in all environments thus far surveyed, and occur primarily on ridges near the larger springs, where hunting and gathering activities may have been possible. Basket-

maker II sites are restricted to the pinyon-juniper ridges, perhaps in association with moist dry-farming soils, while late Basketmaker III villages appear in both the pinyon-juniper and juniper-sage zones, with an especially heavy concentration on arable ridges in the pinyon-juniper forests. This pattern of Basketmaker III concentrations in the northern areas is not present in the current survey data, because of the small sample, but it is clear in Martin's earlier material. Pueblo I sites are also common in the pinyon-juniper areas, but they additionally appear in the dry farming areas of the juniper-sage and sage flatlands. Pueblo II ruins are common in all environments, with the densest concentration on the ridges of the pinyon-juniper forests, on the open flats, and around the canyons of the juniper-sage areas. Pueblo III sites are common in all zones, but the heaviest concentrations of the large ruins are near the canyonheads and on surrounding ridges, especially in the juniper-sage zone. This tendency towards a clustering of sites of all periods in the pinyon-juniper zone, with additional concentrations of Pueblo I sites in the sage flats, Pueblo II sites in the flats and around canyons, and Pueblo III ruins around canyonheads is especially interesting, and may be related to population dynamics and soil/water variations. Farming conditions may have been optimal up to AD 1000, thus promoting population growth and expansion from the northern core area into all arable environments of the mesa, particularly into areas where dry farming was possible. After AD 1100 deteriorating conditions may have set in, forcing a shift in the population centers from the dry farming zones to the permanent springs. At this time new water control techniques such as springside irrigation, ackhin fields and arroyo check dams were developed and/or intensified.

Structures, Artifacts and Site Functions

Twenty categories of structures and four classes of artifacts constitute archeological "sites" at Hovenweep (Appendix VII). Many finer distinctions could probably be made, especially in the artifact categories,

which would permit more exact functional inferences. Consequently until a larger and more representative sample is obtained this classification will remain tentative. However, it is still possible to define several broad classes of multi-purpose and limited activity sites which are reflected by particular combinations of tools and structures.

Multiple purpose sites are locations where many diverse activities concerned with basic maintenance occurred, perhaps accompanied by socializing and ritualizing. Activities such as farming, food processing, manufacturing, storing, eating and a combination of other resource extractive, processing and consumption activities probably occurred at these sites, along with sleeping and socioreligious acts. Most of these locations comprise large canyonhead tower and room complexes, as well as scattered unit pueblos and pithouse clusters.

Small-scale habitation and use areas are composed of moderate sized clusters of rooms or pithouses in association with a variety of artifacts indicating sleeping, farming, working, socializing and related activities. In both the small scale and the multiple activity locations, many diverse activities probably took place in conjunction with specialized activities at nearby satellite hamlets and special use areas. The sizes of the participating groups at the larger centers and the smaller hamlets would have been much different, however.

Limited activity sites were locations where only a small number of activities occurred, for example hunting, quarrying, water control, plant gathering, manufacturing, food processing, camping, eating or other resource and non-resource related activities. Locations where other actions occurred, e.g. dry farming, have not yet been determined, but it is expected that the floral studies and pollen program will aid towards the resolution of this problem. The presence or absence of particular types of artifacts, e.g. dry farming, have not yet been determined, but it is expected that the floral studies and pollen program will aid towards the resolution of this problem. The presence or absence of particular types of artifacts, e.g. ground stone, ceramic scatters, projectile points, and clusters of processing tools in combination with particular structure, e.g. shelters, granaries and isolated rooms, categorizes the more obvious special purpose

sites. Thus, in addition to the more complex multi-purpose and small scale habitation-activity sites, eight limited activity areas have been defined (Appendix VIII):

1) Ceramic campsites are sites where clusters of sherds occur, sometimes in association with firepits or cists, but where the absence of more permanent structures and other types of artifcats indicate limited, short term use. These sites were probably associated with other nearby limited activity areas, such as hunting and plant gathering stations, and may have been satellite locations for the large villages.

2) Shelters/granaries are small masonry rooms and walled off areas which usually occur in rock overhangs and crevices. Crops and other items were usually cached here.

3) Processing areas are sites where a variety of processing activities took place, including butchering, hide working, tool making, seed grinding, and fiber making. The exact nature of these activities is difficult to discern, considering the small sample of the tools and the overlapping functions of many artifacts, so they have been lumped together under the one term "processing area." These sites are generally indicated by concentrations of flakes, grinding stones, worked tools and other items.

4) Hunting stations are areas at which, or near which hunting took place, as demonstrated by scatters of projectile points and tool making debitage. In at least one instance, trapping may also have occurred, as demonstrated by a small animal trap at Hov. 402.

5) Water control locations are sites where cultigens and wild plants were probably grown, as represented by the remains of terraces, arroyo checkdams, talus walls and dams, rim dams, rock basins, modified springs and reservoirs.

6) Quarries are primary source areas for chipped and ground stone materials. They are represented by large cores and flakes in association with veins and outcrops of the same material.

7) Rock art areas are petroglyph and pictograph locations.

8) Sweat house/hogan sites are locations where recent Navajo medicinal and ritual activities may have occurred (sweat houses) or where herders or other groups of Navajo may have lived (hogans).

In certain cases, the limited activity sites are represented by only one or two of these categories, such as processing and camping. Many small undated sites in the Hovenweep area which occur in this form are located in association with shelters and hunting areas. In other cases the same artifact/structural classes occur grouped with a large number of other site categories, thereby indicating multiple use or small-scale use locations.

Several nonrandom activity patterns which are consistent with the earlier observations appear when these functional categories are compared according to expected and observed frequencies with regard to environmental and cultural location (Tables 13-14). More sites of practically all types occur than expected in the pinyon-juniper zone, for example, with an equally dense concentration of small scale habitation areas, limited activity sites and multiple use ruins. The northern forest environment must have been especially attractive to prehistoric groups of varying sizes and compositions, and probably supported a much larger population than the other zones. Also, it may have attracted seasonal foragers or farmers from further south on the mesa. The deep, well watered soils and large springs offer excellent farming potential, and the pinyon pine stands, relatively large deer herds and abundant seed resources probably account for the diversity of activity areas. The juniper-sage zone also has a larger number of most types of sites than expected, but the contrast between observed and expected is not as great as in the pine areas. This environmental zone has the smallest areal coverage of all of the environments, yet it supported a dense population of farmers and gatherers involved in a multitude of activities throughout much of the occupation sequence. Multipurpose sites were very common here, and far outnumber the small scale habitation-use areas. Camp sites and processing stations were also very popular, and it appears that the ridges and flats were used by foragers throughout the occupation sequence, even after the growth of the canyonhead population clusters. The sage and shrubland environments, in contrast, supported fewer sites than expected in practically every category. The shrubland supported an especially low population, particularly as represented by the limited activity categories of hunting and processing.

TABLE 13 - Relation of Site Use With Culture

	Multiple-Use	Small-Scale Use	Ceramic Camp	Shelter/Granary	Processing	Hunting	Farming	Quarrying	Rock Art	Medicine Herding
Archaic	0 observed (.5 expected)	0 (.5)	2 (1.5)	1 (1.5)	4 (3)	4 (.5)	2 (.5)	0 (0)	0 (0)	0 (0)
Basketmaker II	0 (0)	1 (0)	0 (.5)	0 (.5)	1 (.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Basketmaker III	3 (.5)	1 (.5)	0 (1.5)	3 (1.5)	3 (3)	2 (.5)	2 (.5)	0 (0)	1 (0)	0 (0)
Pueblo I	6 (1.5)	5 (2)	4 (7)	8 (6)	15 (12)	5 (3)	5 (3)	0 (0)	1 (.5)	0 (.5)
Pueblo II	16 (9)	18 (11)	42 (36)	34 (31)	67 (64)	16 (15)	20 (15)	0 (1)	5 (2.5)	0 (2)
Pueblo III	17 (8)	11 (10)	41 (35)	40 (29)	65 (61)	13 (14)	16 (14)	1 (1)	4 (2.5)	0 (1.5)
Navajo	0 (.5)	0 (.5)	5 (3)	2 (2)	3 (4.5)	0 (1)	1 (1)	0 (0)	0 (0)	4 (0)
Unknown	0 (9)	5 (11)	30 (39)	26 (31)	49 (65)	14 (15)	14 (15)	1 (1)	0 (2.5)	0 (2)

TABLE 14 - Relation of Site Use with Environment

	Multiple-Use	Small-Scale Use	Ceramic Camp	Shelter/Granary	Processing	Hunting	Farming	Quarrying	Rock art	Medicine/Herding
Pinyon-Juniper	1 observed (0 expected)	3 (.5)	6 (2)	4 (1)	8 (2.5)	3 (.5)	2 (.5)	0 (0)	0 (0)	0 (0)
Juniper-Sage	18 (13)	16 (16)	76 (61)	60 (47)	116 (97)	25 (23)	29 (20)	1 (2)	3 (2.5)	3 (2)
Sagebrush	1 (3)	4 (5)	9 (14)	5 (11)	15 (23)	5 (5)	1 (4.5)	0 (.5)	0 (.5)	0 (.5)
Shrubland	1 (4)	3 (5)	4 (19)	5 (15)	13 (30)	3 (7)	5 (6)	1 (.5)	3 (1)	1 (.5)
TOTAL	21	26	95	74	152	36	37	2	6	4

Vegetation and faunal resources are sparse in this zone, resulting in a low carrying capacity for farmers and foragers alike.

Temporal patterns also appear in the data, but they are complicated by the multi-component nature of many sites. Structures and artifacts representing several periods are often mixed, and it is probable that particular activities may have occurred during one period at a site but not during another. Water control, for example, was probably non-existant during the Archaic period, and the occurrence of Archaic points with reservoirs and check dams undoubtedly reflects a mixture of activities from different times. Similarly, the presence of Basketmaker III and Pueblo I sherds in the large multiple use sites around canyonheads may merely indicate that small parties of farmers and foragers frequented springside locations well before the construction of the large tower complexes. It is even possible that sites classified as multi-purpose areas during late periods were small-scale habitation or limited use locations in previous times, as suggested by the small numbers of early sherds found at many late ruins. Never-the-less, several tentative temporal patterns are present. The number of multiple use and limited activity sites increased steadily throughout the sequence, for example, while the proportion of one type to the other obviously changed. No large population centers were present during the Archaic and Basketmaker II times, and sites were limited to camping, processing, hunting and small-scale habitation areas. By Basketmaker III and Pueblo I times a diffuse settlement pattern seems to have developed, and the various types of sites were fairly equally divided, with as many campsites and small scale use areas as large multiple use locations. This might reflect a relatively sedentary pattern, with the populations based permanently in the large northern villages and utilizing nearby farming areas and more distant hunting and gathering locations in a satellite fashion. On the other hand, it might indicate a semi-sedentary pattern of seasonal breakup as the larger villages periodically split into smaller units for various activities. It is extremely difficult to distinguish between "seasonal breakup" and "home base- satellite area" at this preliminary point in the survey, since the data indicates that both were viable alternatives during much of the occupation sequence on the mesa. Permanent villages with many symbiotic satellite use areas may have been

inhabited at certain times, the large villages may have been seasonally occupied. However it is interpreted, it appears that by Pueblo II times fairly large population clusters were occupying all environmental zones on the mesa, with many small hamlets and a far higher number of limited use sites. This pattern of numerous limited use sites continued into Pueblo III times, but by late Pueblo III many of the medium sized hamlets and smaller habitation sites had apparently been abandoned in favor of the canyonhead complexes. Most of these had been inhabited by small groups for centuries, but it is possible that a decrease in available moisture favored the shift from outlying dry farming areas to canyonhead springs, with the bulk of the population moving from the flatlands to the areas where water control was possible. Special purpose sites may have ranged outward from these centers, with an overall settlement pattern similar to that of the historic Hopi who live in permanent multi-room pueblos located near dependable water sources, and have many satellite farming and gathering areas.

Predictions

This report summarizes the results of the first of several anticipated seasons of archeological research at Hovenweep, and in no way represents a final statement. Many of the hypotheses which have emerged from the analysis will probably be modified in the future, but they never-the-less summarize our thoughts at this time and provide a predictive framework for the upcoming season's research. These hypotheses are related to both the overall culture sequence and the distribution of past subsistence activities on Cajon Mesa, and are based on a synthesis of 1975 survey data with the earlier research of Martin (1936,1938,1939), Rohn (1974a), Schroeder (1967-1968) and others. The following are some tentative observations about the general character of prehistoric occupation at Hovenweep.

1) Site location on Cajon Mesa is closely linked with site function, environmental location and temporal position. Certain types of sites, such as farm fields and villages, can probably be correlated with water, soil and

plant cover, while others, such as plant collecting areas, hunting sites and resource processing stations, may have been located with respect to access to particular plant and animal communities.

2) Alterations in the location of different types of sites were associated with changes in the availability of critical resources, either directly through environmental alteration or indirectly through technological change or population dynamics.

3) The earliest inhabitants of the mesa were hunting and gathering groups who frequented springs where water was available and where animal and plant resources were abundant.

4) The earliest farmers moved onto the mesa during Basketmaker II times, perhaps in a context of gradual population expansion from more densely inhabited agricultural areas to the east.

5) Small groups of Basketmaker II agriculturists began to dry farm limited areas of the pinyon-juniper zone and perhaps portions of the well-watered deeper canyons where soils were deep and moist.

6) Basketmaker II foraging sites, like the earlier Archaic hunting and gathering sites, were generally situated in areas permitting access to critical resources, especially water and food.

7) Basketmaker III farmers became well-established in the northern pinyon-juniper zone, where they constructed large villages and smaller hamlets near the dry farming areas. Other types of sites also occurred in this environment, as well as in the juniper-sage zone to the south.

8) Transitional Basketmaker III - early Pueblo I villages were constructed in the larger canyon bottoms such as Montezuma Creek where the alluvial soils were deep.

9) By late Basketmaker III times the farmers had expanded southward on the mesa, and had begun to exploit the dry farming areas of the mid-mesa juniper-sage and sage environments.

10) Shifts in settlement pattern between the Basketmaker II and Basketmaker III groups were associated with technological change, population increase and/or resource imbalance.

11) Subsistence alterations which may have been associated with this expansion were the introduction of bean farming and the initiation of wild plant semi-cultivation.

12) Pueblo I farmers continued to concentrate in the pinyon-juniper zone and in the deeper canyons, but scattered farmsteads were increasing in number in the open sage and juniper-sage flats.

13) The appearance of small Pueblo I hamlets in the mid-mesa zones probably reflected increasing population pressure on the resources of the pinyon-juniper forests, and may have been associated with a breakup of the large villages and a dispersal of small farming and foraging groups to the south.

14) The increase in numbers of Pueblo II sites, especially in the sage and juniper-sage environments, represents increased population growth and an expansion of farming into new areas. As a consequence, both large and small habitation sites, as well as limited activity farming and gathering sites were located in areas where soils were rich and dry farming was possible.

15) By middle Pueblo II times limited activity sites were scattered throughout the mesa environments, and the settlement pattern was composed of numerous large and small population aggregates involved in settled and seasonal subsistence activities.

16) Water control was probably developed during the Pueblo II period, as the expanding population placed pressures on the existing resources and necessitated a movement into less productive farming areas, such as the arid shrubzone.

17) Late in the Pueblo II period climatic conditions forced an even greater expansion of water control. Homesteads began to concentrate in areas which were suitable for water management, such as springsides and talus slopes and arroyos where floodwater farming was possible.

18) Continued dessication produced the clustering of large, late Pueblo III multi-purpose habitation sites near permanent canyonhead springs and an intensification of the water management systems.

19) Satellite farms, hamlets, collecting stations and moderate sized outlying villages were scattered across the mesa and in the canyons, but their locations were dependent upon access to critical resources, especially water. The various types of field and water control systems were adapted to specific drainage patterns, gradients and soil quality.

20) A dependence upon wild plant manipulation increased steadily

throughout late Pueblo II and Pueblo III times, with an emphasis upon plants which were available in times of drought, such as wolfberry and wild potato.

21) Lacking extensive dune areas suitable for farm fields, and confronted with continuously decreasing amounts of moisture, the Anasazi farmers finally abandoned Cajon Mesa.

22) Navajo use of the area did not begin until AD 1800 or later when groups of gatherers, pastoralists and semi-sedentary farmers congregated in areas to the south.

23) Small parties of Navajo hunters and gatherers may have ventured as far north as the juniper-sage zone, as indicated by sweat houses and trapping stations, but most of the activity occurred in association with sheep herding in the shrubzone.

24) No clear evidence exists for Ute utilization of the mesa, but small groups of gatherers and hunters may have camped beside the springs and on nearby ridges, leaving small scatters of projectile points and lithic debris.

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APPENDICES

Appendix I

VEGETATION STUDY AND ANNOTATED CHECKLIST OF PLANTS OF CAJON MESA, UTAH

By William Litzinger

Part I - Vegetation Survey

Introduction

This vegetation study was undertaken during the summer of 1974 as part of the Hovenweep Archeological Survey conducted by San Jose State University. In essence this present report is an ancillary study, conducted to (a) provide quantitative data on the plant communities that exist on Cajon Mesa, and (b) outline the plant relationships that occur on specific ruins. Although the transects and plots that were run are of a preliminary nature, in that they provide data that will be used in designing the research methods to be used during the 1975 field season, certain significant site/plant relationships have already been observed. On the basis of the information collected during the 1974 survey, decisions have been made as to which specific areas to concentrate on in the upcoming field season. Also, from the data, the methods employed in the study have been evaluated for their effectiveness and statistical validity.

The vegetation distribution that exists on Cajon Mesa today is exceedingly complex, due mostly to the impact of man on this environment during the past several thousand years. The first premise made regarding the present day plant distribution on the mesa is that it is far from representative of the natural (or potential) climax community types that have been described by various authors (Cronquist, 1972; Kuchler, 1964). One of the goals of this research is to decipher the complex land use history of the mesa and describe how man has affected the natural vegetation.

Methods

Field Techniques

Two types of study areas were utilized during the 1974 field season: long transects and rectangular or square grids placed over archeological sites. The basic unit of area in both types of plots is the 10m x 10m square. This size plot was chosen on the basis of studies done on the effectiveness and statistical validity of using various plot sizes and shapes with particular types of vegetation (Cooper et al, Phillips, 1959). While there are other methods that have been shown effective (Stewart, et al, 1936), the $10m^2$ plot was chosen as a standard since it yields the most usable data.

All plants were counted which had at least half of the crown area of the plant falling within the $10m^2$ plot. The shrubs were counted on the basis of individual root crowns. The grasses, such as Oryzopsis hymenoides were counted as clumps. With the exception of Gutierrezia sarothrae there was little difficulty in making accurate counts. The problem with G. sarothrae was the great number of first year seedlings present in many of the plots. Counts of this species were confined to established plants which had at least one seasons dry flowers present. During the 1975 field season some of the plots that contained numerous first year seedlings will be recounted to determine if there is any substantial changes in the number of established plants.

Long Transects - The long transects can yield several kinds of data (Braun 1935), particularly concerning the relationship of plant associations to physiography. The species composition of each plant association type can also be determined, and on the basis of this information areas may be selected for more detailed study by additional, shorter transects.

The method used in the field was to lay a continuous series of $10m^2$ plots along a compass line. This was accomplished by using a 30m chain marked at 1m, 5m, and 10m intervals, with a side extension of 10m. The chain was moved along the compass line taking data from three plots at a time. This method allows an accurate estimate of the species composition within each $10m^2$ plot, as well as permitting extreme accuracy in setting

the plots along the compass line, an important factor for permanent transects. At the request of the National Park Service, all long transects were established as permanent transects, to facilitate a long range succession study within the protected National Monument areas.

Although the long transects do not constitute a random sample, data collected along each transect will be used in selecting a stratified random sample of each plant association during the 1975 field season.

Rectangular Plots - Fourteen archeological sites were also studied utilizing the plots established by the archeology survey teams. The size of these plots ranges from 20m x 30m to 200m x 50m, and within each plot $10m^2$ grids were established and the plant species were counted as in the long transects. A stratified selection of sites from the various plant communities, physiographic locals and cultural periods was chosen for the 1974 survey. This has allowed an analysis of the species composition in association with each of these variables, as well as again providing a basis for planning the next stage of the research design.

Analytical Concepts

The data collected from the transects and plots has been analyzed on the basis of four basic concepts:

Frequency: the percentage of sample plots in which a given species occurs (an indication of distribution).

Abundance: total number of individuals of one species compared to the total number of individuals of all species counted for the whole series of samples.

Density: the number of individuals of each species per meter.^{2}

% Cover: the measure of the area occupied by a species (in this study this is the area of ground surface covered by the leaves of a plant, based upon a mean area derived from measuring a large sample). The following formula is used to calculate % cover:

$$\frac{\text{(number of species) X (mean basal area in } m^2\text{)}}{\text{area of total population in } m^2} \text{ X 100= \% Cover}$$

There are several ways in which these concepts may be applied in analyzing the transect and plot data. The % cover of each species may be used in determining the physical (not numerical) dominants, codominants and important associates of each plant association. The other three concepts can be used to isolate particular patterns and trends. This information is used in conjunction with notes on physiography, moisture gradients, elevation, edaphic and anthropogenic factors and allows interpretation of how these conditions influence plant associations.

Preliminary Findings

The quantitative data at present does not constitute a large enough sample to define any theoretical parameters of the plant associations found on Cajon Mesa. There are three important facts, however, that can be interpreted from the present data. First, on the basis of the field notes and long transects, the physical boundaries of the major plant associations can be estimated. Within these boundaries a randomized sample will be taken during the 1975 field season, which will hopefully provide an adequate statistical measure of each plant association (more will be said on this below). Second, although their actual theoretical values have not been established, the dominants, codominants and important associates of each plant association can be selected (see Table 1). Third, certain species have been observed to occur non-randomly, in a high degree of association with archeological sites. Oryzopsis hymenoides and Lycium pallidum are obvious in this respect. The following list contains other species which show a significant association with archeological sites:

Ascelepias capricornu
Cirsium utahensis
Clematis reticulatus
Mahonia repens
Mentzelia pumilia
Opuntia sp.
Penstemon virigatus
Poa pratensis
Rumex hymenosepalus
Sphaeralcea sp.
Stanleya pinnata
Townsendia incana
Yucca sp.

As the sampling continues, some of these species may be eliminated and others may be added to the list.

TABLE I:

SPECIES COMPOSITION OF THE PLANT ASSOCIATIONS ON CAJON MESA

Pinyon-Juniper Woodland

Dominants: Juniperus osteosperma
Juniperus utahensis
Pinus edulis

Other Components: Atriplex tridentata, Amelanchier utahensis, Cercocarpus montanus, Chrysothamus depressus, Cowania mexicana, Erigonium ssp., Ephedra viridus, Gutierrezia sarothrae, Quercus gambelii.

Juniper-Sage

Dominants: Artemisia tridentata
Juniperus osteosperma
Juniperus utahensis

Other Components: Amelanchier utahensis, Cercocarpus montanus, Chrysothamus depressus, Cowania mexicana, Erigonium ssp., Ephedra viridis, Gutierrezia sarothrae.

Sagebrush

Dominants: Artemisia tridentata

Other Components: Agropyron pauciflorum, Chrysothamus nauseosus, C. depressus, Ephedra viridis, Gutierrezia sarothrae, Oryzopsis hymenoides, O. micrantha, Sitanion hystrix. Also: Atriplex cansens, Cowania mexicana.

Shadscale (Brushland)

Dominants: Atriplex concentrifolia

Other Components: Chrysothamus depressus, Gutierrezia sarothrae, Oryzopsis hymenoides, O. micrantha, Poa pratensis, Sarcobatus vermiculatus, Sphaeralcea agustifolia.

Problems for Continued Research

Additional sampling will be necessary in order to develop the theoretical parameters of each separate plant association, through the development of a "standard" statistical model for each association from which comparisons can be made. On Cajon Mesa this task is complicated by the long history of vegetational change attributable to man's influence. Also there may have been environmental changes that must have had their effect on plant distribution. During the period of heaviest Anasazi occupancy, in Pueblo II-III times c.a. 1050-1300, the heavy agricultural use of the land may well have carved the mesa top into a mosaic of corn and bean fields and patches of vegetation in various stages of succession.

It may also have been that Pinus edulus and Juniperus sp. were greatly thinned, due to heavy demands for fuel and construction material. After the Anasazi abandonment at ca 1300, the pressure on the land was probably eased greatly, except for scattered bands of Ute and Navajo hunters and gatherers. In the late 1800's grazing was probably introduced (Stewart, 1941), which has continued until the present, particularly on the Navajo Reservation. As a result many of the natural conditions which once prevailed on the mesa top have been severely disturbed. Although Cronquist (1972) speculates that there was little change in the climate in the Cajon Mesa area since the Pleistocene, there may have been regional climatic variations which could greatly effect local community distribution patterns. However the environment changed through natural events, there should have been a stabilization of successional trends in the vegetation associations (Oösting, 1956). With all of the above considerations in mind, the statistical model we are developing will hopefully reflect the original, undisturbed mesa top of 3000 years past. To facilitate the study of recent vegetational trends, several lines of research will be continued. First, numerous short (100 meter) transects should be run within each existing vegetational association on the mesa. The number of such transects can only be determined in the field by employing the criterion proposed by Braun-Blanquet (1932) and Phillips (1959) for determining the adequacy of sample size. For each sample area, an attempt should be made to document a detailed history of

land use based upon archeological reconstruction and historical records. In areas where archeological reconstruction and historical records are particularly well documented, it would be wise to run additional transects for comparative purposes. An additional source of comparative data will come from a survey of existing literature on areas of similar physiognomy, and also from historical accounts of travelers, settlers and explorers from which statistical estimates of the vegetation can be made.

Sampling the vegetation on archeological sites should also be continued. However, due to the increased number of variables the problem of establishing an adequate sample size is greater. Also the total grid method employed during the 1974 field season is extremely tedious and time consuming. It is proposed that several additional methods of sampling be tested at the beginning of the 1975 field season, and a method be selected which will allow a larger quantitative estimate. One good alternative approach may be the line intercept method as proposed by Canfield (1941), which is chiefly used for determing % cover, but also allows estimates of frequency, abundance and density to be made (Buell and Cantlon,1950; Phillips, 1959).

The most important continuing research problem is the study of succession along the permanent transects. By its very nature this is a long range research project that should be continued over 10-20 years or until a relative degree of stability is indicated. This type of study is especially useful in that it may provide some degree of "truth" unattainable by any other means of documentation.

The quantitative data collected pertains to only about 13% of the plants that actually occur on Cajon Mesa. Approximately 40% of the local species are annuals, of which only Penstemon virigatus has been included in the quantitative study. During April and May of 1975 spring transects will be run on the permanent long transects to determine if there is any significant pattern or trend among the annual species. This data will then be included in the overall picture of vegetation associations.

PART II - Preliminary Annotated Checklist of Plants of Hovenweep National Monument

Introduction

This preliminary checklist forms part of the botanical investigations undertaken at Hovenweep National Monument during the summer field season of 1974. Surprisingly little previous botanical work has been done in the monument. Probably only two professional botanists have done any work within the monument proper. These were Roland Richart in 1941 (Richart, 1941) and Lois Arnow in 1967. Richart, actually a biologist, published a scanty list of species for the monument. Lois Arnow, a botanist from the University of Utah at Salt Lake City, made some collections and identifications of monument plants at the request of Tom Haman, USNPS, who was then the Hovenweep District Ranger. Several Park Service personnel have made collections and contributions to the flora of the monument. The most notable and extensive collections were made by Dale Schmidt, USNPS seasonal ranger at Hovenweep in 1973. He collected about 75 plant specimens within the monument, and made permanent mounts of the collected material. Unfortunately, only minimal data was recorded for these collections, e.g. the date of collection, and the monument group from which the specimen was collected. Usually no geographic or ecological data was provided. At the time this survey began there were 95 species recorded within the monument (37 families, 85 genera). The work begun during this survey will hopefully form the basis for an annotated checklist of plants for the monument, as accurate and detailed notes were recorded for each specimen collected. To date about 60 species have been collected, a few of which had not been previously collected within the monument. This work, coupled with the identification of previously collected, unidentified specimens, and several obvious, uncollected species (e.g. *Pinus edulis*, *Yucca baccata*), brings the number of identified species within the monument to 115 (43 families, 97 genera). In addition to these there remain 21 unidentified species (from mounted specimens in the Hovenweep herbarium). Additional work will undoubtedly increase the number of species within the monument

to more than 140.

All of the collections have thus far been confined to five of the monument groups: Cajon, Cutthroat, Hackberry-Horseshoe, Holly and Square Tower. No collections have been made in the undeveloped Goodman Point area. This monument group may yield additional species not found in the other groups, as it is at a higher elevation in the Pinyon-Juniper zone, but is not part of the present study area.

There are four species which have been recorded as observed within the monument which at this time no evidence can be found. Most important of these in terms of the Archeological Survey are the beeweeds, Cleome lutea Hook and Cleome serrulata Pursh. These were both probably important semi-cultivated or managed weeds of the Anasazi.

However these species do occur at Mesa Verde National Park (Welsh, et al 1964), and Cleome serrulata Pursh has been observed on Cajon Mesa near Pleasant View, Colorado. The two other species are Peraphyllum ramosissum Nutt. ex T.&G. and a Sedum sp. No data or specimens for these species exists, and this writer was not able to locate either species within the monument.

Aside from the vascular plants noted in this survey there are two cryptograms that have been identified and collected. The first is a stalked puffball, Tulstloma sp. which was collected on the juniper dominated mesa top near the Horseshoe House Ruin. The second is a moss, Grimmia apocarpa Hedw., which is a soil dwelling moss common as a ground cover in all the monument groups except the Cajon Group. There are undoubtedly more cryptograms within the monument. Numerous rock and soil lichens have been noted. And the many rock faces in the monument provide habitats for additional mosses.

The monument groups provide a good sampling of the vegetation found on Cajon Mesa, as they occur scattered through each of the major vegetation zones found on the mesa top. Physiographically the mesa is a north to south sloping upland, dissected by numerous canyons. Variations in plant associations, as well as rainfall and soil type occur along this north-south gradient. The elevation difference from the mesa edge to the northern uplands is more than 3000 feet overall. Annual rainfall varies with elevation, from approximately six inches on the southern mesa edge,

to 9.3 inches in the mid-portions of the mesa, with 15 inches falling in the north. The greatest percentage of moisture is from winter snowfall (approximately 35%). Most of the remaining precipitation occurs during the summer (25%-30%) and late fall (25%). The evaportation potential is very high at 45 inches per/year.

Four major plant zones occur on the mesa top, each grading into the next, and each modified by six major physiographic divisions. In the north there is a broad Pinyon-Juniper zone which grades into a much narrower zone of Juniper-Sage. This in turn grades into Sage Grassland. Towards the southern portion of the mesa Sage disappears and a Mixed Shrubland zone (Atriplex, Sarcobatus) becomes dominant. Six physiographic areas dissect these vegetation zones creating a variety of habitats. These physiographic divisions include: Mesa tops, canyon rims, canyon heads, talus slopes, canyon bottom alluvium, and springs or seeps. A minor division of mesa tops are sliprock areas. These especially occur adjacent to canyon rims and they create an edaphic condition which apparently extends the range of Juniper to the southern mesa edge. The Juniper sends it roots into deep cracks and spaces in the sliprock. These spaces collect and store rain water that is unavailable to the shallow rooting shrubs and other perennials.

Vegetation studies also carried out during the 1974 summer field season will provide a species composition list for each major plant zone and each of the various habitats created by the physiographic divisions. Also, an important part of both the botanical and archeological investigations was to make a quantitative survey of ruin sites, and determine if there are any special vegetative patterns associated with these ruins. Several species have been found to occur only or predominately on ruins. Some of these species also occur more rarely in recently disturbed habitats (e.g. roadsides). These species include: Oryzopsis hymenoides (R.&S.) Ricker, Spaeralcea coccina (Pursh) Rydb., Lycium pallidum Mires, and to a certain extent Ephedra viridus Coville.

The overall vegetation picture for Cajon Mesa, and hence for all of the monument groups as well, has been greatly disturbed by grazing. This certainly has had a great effect on certain areas, altering the natural species distribution, and complicating the task of deciphering the species

composition of the various habitats. The most visible change resulting from grazing is the presence of Gutierrezia sarothrae (Pursh) Britt.&Rusby, (snakeweed), which has actually become the dominant species in especially overgrazed areas.

Checklist

Anacridaceae

___ 1. Rhus trilobata Nutt. ex T.&G. Squawbush

Common, rimrock and talus slopes. Sq. Tower, less common at other monument groups. Flowers in early spring before leaves appear. 5 May 1973.

___ 2. Ascelepias capricornu Woodson Milkweed

Rare, found in isolated locals, mesa tops, arroyos, disturbed areas. Sq. Tower. Summer 20 Aug 1973.

Berberideceae

___ 3. Mahonia repens (Lindl.) G. Don Oregon Grape

Known from only a single isolated local. Hackberry Group, below Horseshoe House Ruin, on talus slope.

Boraginaceae

___ 4. Lappula redowskii (Hornem.) Greene Stickseed

Arroyo bottoms, waste places. Sq. Tower and Cutthroat Groups.

Cactaceae

___ 5. Echinocactus whipplei Engelm. & Bigle. Fishhook Cactus

Mesa tops, rimrock areas, some talus slopes. Not common.

___ 6. Echinocereus coccineus Engelm. Hedgehog Cactus

Common in all monument groups. Mesa tops, rimrock, talus slopes. Spring flowering.

___ 7. Opuntia davisii Engelm. & Bigel. Ragtail Cactus

Noted in isolated locals. Sq. Tower Group, near the Visitor Center, on mesa top. Cajon Group, again only on the mesa top. Rare.

___ 8. Opuntia hystricina Engelm. & Bigel. Prickly Pear

Common in all monument groups, all habitats. Flowering in the spring and early summer. WJL 331, 25 IV 1974.

___ 9. Opuntia polycantha Haw. Prickly Pear

Rarer than O. hystricina. Mesa tops, Cutthroat, Holly, and Horseshoe Groups.

Chenopodiceae

___ 10. Atriplex canesens (Pursh) Nutt. Fourwing Saltbush

Common in all monument groups. Mesa tops, talus slopes, canyonbottoms. Summer flowering. 22 IX 1972.

___ 11. Atriplex concentifolia (Torr.&Ferm.)S.Wats. Shadescale

Common on the East end of Sq. Tower Group, talus slopes, mesa tops, canyon alluvium. Also at Cutthroat and Holly monument groups.

___ 12. Salsola pestifera A. Nels. Russian Thistle

Common throughout the entire monument. Disturbed areas, roadsides. Naturalized Old World adventive.

___ 13. Sarcobatus vermiculatus (Hook.) Torr. Greasewood

Common only in the SE corner of the Sq. Tower Group, only on canyon bottom alluvium. 14 May 1974.

Compositae

___ 14. Actinea scaposa (DC.) Greene Bitterweed

No data, specimen preserved in Hovenweep herbarium.

___ 15. Antennaria parvifolia Nutt. Pussytoes

No data, specimen preserved in Hovenweep herbarium.

___ 16. Aplopappus sp. Goldenweed

No data, specimen preserved in Hovenweep herbarium.

___ 17. Artemisia dracunculus L. Tarragon

Common on talus and near edges of arroyos. Sq. Tower, Hackberry, and Cutthroat Groups.

___ 18. Artimisia frigida Willd. Fringed Sagebrush

No data. Possibly at the Cajon Group.

___ 19. Artimisia tridentata Nutt. Big Safebrush

Common and sometimes dominant. All monument groups.

___ 20. Aster arenosus Blake Dwarf Aster

Common in all monument groups. Mesa tops, exposed areas.

___ 21. Brickellia californica (T.&G.) A. Gray Brickelbrush

Common on talus slopes and rocky ledges. Sq. Tower monument group.

___ 22. Chrysothamus depressus Nutt. Little Rabbitbrush

Common on mesa tops, canyon bottoms. Sq. Tower, Hackberry, and Holly monument groups.

___ 23. Chrysothamus nauseosus (Pall.)Britt. Big Rabbitbrush

Common along mesa top and canyon bottom arroyos. All monument groups.

___ 24. Cirsium utahensis Petrak Thistle

Common along mesa top and canyon bottom arroyos, disturbed areas and roadsides. Sq. Tower Group.

___ 25. Erigeron sp. Fleabane

No data, specimen preserved in Hovenweep Herbarium.

___ 26. Gutierrezia sarothrae (Pursh.) Britt.&Rusby Snakeweed

Common, all monument groups, all habitats. Dominant in areas, indicating overgrazing.

___ 27. Helianthus petiolaris Nutt. Sunflower

Sq. Tower monument group, in disturbed habitats, especially roadsides.

___ 28. Hymenoxys acaulis (Pursh) Parker Perky Sue

No data, specimen preserved in Hovenweep Herbarium.

___ 29. Lactuca scariola L. Wild Lettuce

Common in disturbed areas, roadsides. Introduced European weed. Observed near the monument Visitor Center 31 VII 1974. Also preserved specimen in Hovenweep Herbarium, 16 VIII 1973

___ 30. Schkuhira integrifolia

No data, specimen preserved in Hovenweep Herbarium.

___ 31. Senecio longilobus Benth. Threadleaf Groundsel

No data, specimen preserved in Hovenweep Herbarium.

___ 32. Senecio multilobatus T.&G.ex A.Gray Groundsel

Specimen preserved in the Hovenweep Herbarium. Sq. Tower Group. 15 VII 1974.

___ 33. Stephanomeria tenuifolia (Torr.) Hall. Desert Pink

No data, specimen preserved in the Hovenweep Herbarium.

___ 34. Townsendia incana Nutt. Easter Daisy

On talus slopes, usually in gravely soil. Hackberry, Cutthroad, and Sq. Tower monument groups. 29 V 1973

___ 35. Tragopogon pratensis L. Salisify

Found in disturbed areas, roadsides. Sq. Tower Group. Introduced from Europe. WJL 306. 20 VI 1974.

Convolvulaceae

___ 36. Convolvulus arvenses L. Bindweed

Introduced weed, confined to roadsides. Specimen preserved in the Hovenweep Herbarium. 6 VIII 1973.

Crasulaceae

___ 37. Sedum sp. Stonecrop
No data.

Cruciferae

___ 38. Arabis pulchra M.E. Jones ex S.Watts. Rockcress
Mesa tops, Cutthroat and Hackberry monument groups. No additional data. Specimen preserved in the Hovenweep Herbarium.

___ 39. Descuriania pinnata (Walt.)Britt. Tansy Mustard
Common along canyon bottom arroyos. Sq. Tower Group. Specimen preserved in the Hovenweep Herbarium. 10 V 1973.

___ 40. Lepidium campestre (L.)R.Br. Peppergrass
Common on mesa tops, always associated with Juniper. Sq. Tower Group. WJL 325. 25 VI 1974.

___ 41. Physaria didymocarpa Gray Bladderpod
Common on talus slopes. Cutthroat, Hackberry and Sq. Tower monument groups. Specimen preserved in the Hovenweep Herbarium. 20 V 1973.

___ 42. Sisymbrium altissimum L. Tumbling Mustard
Common, especially beneath Juniper, and in disturbed areas. Introduced from Europe. WJL 308. 21 VI 1974.

___ 43. Stanleya pinnata (Pursh)Britt. Prince's Plume
Common in rimrock, talus slope, and canyon bottom alluvium at Sq. Tower Group. Found on mesa tops at Cutthroat and Holly monument groups. WJL 314. 24 VI 1974.

___ 44. Streptanthus cordatus Nutt. Twistflower
No data, specimen preserved in the Hovenweep Herbarium.

Eleagnaceae

___ 45. Shepherdia rotundifolia Buffaloberry
Mesa top, Holly Group only. Rare. Specimen preserved in the Hovenweep Herbarium.

Ephedraceae

___ 46. Ephedra viridis Coville — Mormon Tea

Common in all monument groups, all habitats, especially rimrock and mesa tops. Specimen preserved in the Hovenweep Herbarium.

Euphorbiaceae

___ 47. Euphorbia fendleri T.&G. — Spurge

Low ground cover beneath SAge and Pinyon-Juniper. Common in all monument groups. WJL 326. 25 VI 1974.

Fagaceae

___ 48. Quercus gambelii Nutt. — Gamble Oak

In the Sq. Tower Group; restricted to a single local, on the mesa top, east of the Visitor Center. More common at higher elevations in the Hackberry, Horseshoe, and Cutthroat monument groups. Specimen in the Hovenweep Herbarium. 10 XI 1973.

Fumariaceae

___ 49. Corydalis aurea Willd. — Goldensmoke

No data, specimen in the Hovenweep Herbarium.

Gentianaceae

___ 50. Swertia albomarginata (Wats.) Kuntze — Green Gentian

Common in mesa top, Pinyon-Juniper areas. Cutthroat, and Holly monument groups. WJL 333. 10 VII 1974.

Geraniaceae

___ 51. Erodium cicutarium (L.) L'Her — Filaree

Common on mesa tops, disturbed habitats, roadsides, arroyos. Sq. Tower Group.

Gramineae

___ 52. Agropyron pauciflorum (Schwein.)Hitchc. — Slender Wheatgrass

Along an arroyo, Cutthroat Group. WJL 334. 10 VII 1974.

___ 53. Agrostis alba L. Red Top

Common around seeps and springs, canyon bottom arroyos. Sq. Tower and Hackberry monument groups. WJL 323. 25 VI 1974.

___ 54. Aristida fendleriana Steud. Three-awn Grass

Common on mesa tops, especially in disturbed habitats, and roadsides. Sq. Tower Group. WJL 322. 25 VI 1974.

___ 55. Bromus anomalus Rupr. Nodding Brome

Canyon bottom arroyos, usually near or below seeps. Sq. Tower Group, also Horseshoe Group below Tower Point. WJL 319. 25 VI 1974.

___ 56. Hordeum jubatum L. Foxtail Barley

Mesa top arroyos, roadsides. Sq. Tower Group. WJL 321. 25 VI 1974.

___ 57. Oryzopsis hymenoides (R.&S.) Ricker Indian Ricegrass

Common on ruins, disturbed habitats. All monument groups. WJL 302. 18 VI 1974.

___ 58. Oryzopsis micrantha (T.&R.)Thrub. Littleseed Ricegrass

Common ground cover in disturbed Sage areas, nearly all habitats. All monument groups. Introduced from Europe.

___ 59. Phragmites communis Trin Reed

Isolated local in the lower canyon bottom of Ruin Canyon, Sq. Tower Group.

___ 60. Poa pratensis L. Bluegrass

Common in canyon bottom alluvium, Sq. Tower Group. Found in mesa top habitat at the Cajon Group. WJL 317. 25 VI 1974.

___ 61. Polypogon monspeliensis (L.)Desf Rabbitfoot Grass

Along canyon bottom arroyos, below seeps and springs. Sq. Tower Group, also at Horseshoe Group beneath Tower Point. WJL 320. 25 VI 1974.

___ 62. Sitanion hystrix (Nutt.)J.G.Smith — Squirreltail

Common along mesa top and canyon bottom arroyos; rare along roadsides. Sq. Tower Group. WJL 310. 21 VI 1974.

Hydrophyllaceae

___ 63. Phacelia corrugata A.Nels. — Scorpion Weed

No data, specimen in the Hovenweep Herbarium.

Juncaceae

___ 64. Juncus tenuis Willd. — Rush

Along an arroyo near a permanent seep, Hackberry Group. Also along an arroyo below Tower Point, Horseshoe Group. WJL 336. 12 VII 1974.

Labiatae

___ 65. Marrubium vulgare L. — Hoarhound

Frequent in disturbed habitats, along roadsides, Sq. Tower Group.

Leguminosae

___ 66. Astragalus oophorus Wats. — Loco Weed

Occurs in most monument groups. Specimen in the Hovenweep Herbarium, no additional data.

___ 67. Meliotus alba Desr. ex Lam. — White Sweetclover

Common roadside weed, Sq. Tower Group. Introduced from Europe.

___ 68. Meliotus officinalis (L.) Lam. — Yellow Sweetclover

Same as number 67.

Liliaceae

___ 69. Calchortus nuttallii Torr. — Sego Lily

No data, specimen in the Hovenweep Herbarium.

___ 70. Yucca agustissima Engelm. ex Trel. Narrow Leaf Yucca

Frequent in all monument groups, especially on mesa tops.

___ 71. Yucca baccata Torr. Datil Yucca

Rare to frequent on mesa tops in Juniper-Pinyon areas. Cutthroat and Hackberry monument groups.

Linaceae

___ 72. Linum lewisii Pursh. Blue Flax

No data, specimen in the Hovenweep Herbarium.

Loasaceae

___ 73. Mentzelia pumila (Nutt.) T.&G. Blazing Star

On mesa top, usually in rocky soil, Sq. Tower Group. WJL 332. 5 VII 1974.

Malvacea

___ 74. Sphaeralcea coccina (Pursh) Rydb. Globe Mallow

Common on disturbed sites, ruins, roadsides, Sq. Tower and Hackberry monument groups. WJL 303. 19 VI 1974.

___ 75. Sphaeralcea agustifolia (Cav.)Don Mallow

Common on mesa top at the Cajon Group only. WJL 370. 2 VIII 1974.

Nyctaginaceae

___ 76. Mirabilis multiflora (Torr.) Gray in Torr. Four O'clock

Very rare, mesa tops, canyon bottom arroyos. Specimen in the Hovenweep Herbarium. 11 VI 1973.

___ 77. Abronia fragrans Nutt. ex Hook. Sand Verbena

Canyon bottom alluvium, S.E. corner of Sq. Tower Group. WJL 330. 25 VI 1974.

Oleaceae

___ 78. Fraxinus anomala Torr. ex Wats. Single-leaf Ash

Talus slopes, canyon bottom alluvium, Cutthroat, Holly, Horseshoe, and Sq. Tower monument groups. Specimen in the Hovenweep Herbarium. 1 VIII 1973.

Orobanchaceae

___ 79. Orobanche fasciculata Nutt. Broom-rape

Parasitic on Sage. Common on mesa tops, Sq. Tower Group, also collected at Hackberry Group. WJL 350. 15 VII 1974.

Pinaceae

___ 80. Juniperus osteosperma (Torr.)Little Juniper

Common in all monument groups except the Cajon Group. Seems to be more common than J. utahensis, especially at higher elevations.

___ 81. Juniperus utahensis (Engekm.)Lemmon Juniper

Same as number 80, except more common at lower elevations.

___ 82. Pinus edulis Engelm. Pinyon Pine

Common at higher elevations, Cutthroat Group. Rare at Holly and Horseshoe monument groups.

Plantaginaceae

___ 83. Plantago elongata Pursh Common Plantain

Common annual spring herb, mesa tops. Sq. Tower and Cajon monument groups. Specimen in the Hovenweep Herbarium.

Polmoniaceae

___ 84. Gilia leptomeria Gray Scarlet Gilia

Rare, on mesa tops. Cutthroat and Sq. Tower monument groups. Specimen preserved in the Hovenweep Herbarium. 15 V 1973.

___ 85. Eriastrum diffusm (Gray) Mason

No data, specimen in the Hovenweep Herbarium.

___ 86. Phlox longifolia Nutt.

No data, specimen in the Hovenweep Herbarium.

Polygonaceae

___ 87. Eriogonum cernuum Nutt.

Common on mesa tops, Sq. Tower Group. No specimen.

___ 88. Eriogonum densum Greene

Common on mesa tops, all habitats. Sq. Tower, Holly and Hackberry monument groups. WJL 300. 17 VI 1974.

___ 89. Eriogonum inflatum Torr. Desert Trumpet

Common on mesa tops at Cutthroat Group only. Specimen in the Hovenweep Herbarium.

___ 90. Eriogonum ovalifolium var purpureum (Nutt.)Nels.

No data, specimen in the Hovenweep Herbarium.

___ 91. Eriogonum wrightii Torr. ex Benth.

No data, specimen in the Hovenweep Herbarium.

___ 92. Rumex hymenosepalus Torr. Dock

Canyon bottom alluvium, especially the S.E. corner of Sq. Tower Group. Occasional on talus slopes and mesa tops, Sq. Tower Group. Specimen in the Hovenweep Herbarium.

Ranunculaceae

___ 93. Clematis ligusticifolia Nutt. ex T.&G. Virgins Bower

Vining species on Celtis reticulatus L. Found only at the head of Hackberry Canyon.

___ 94. Delphinium nelsoni Greene Larkspur

No data, specimen in the Hovenweep Herbarium.

___ 95. Delphinium scaposum Greene

No data, specimen in the Hovenweep Herbarium.

Rosaceae

___ 96. Amalanchier utahensis Koehne — Serviceberry

Common at all monument groups except the Cajon Group. On talus slopes, rarer in rimrock areas. Spring Flowering. Specimen in the Hovenweep Herbarium.

___ 97. Cercocarpus montanus Raf. — Mountain Mahogany

Mesa tops and rimrock, Cutthroat Group only. Specimen in the Hovenweep Herbarium.

___ 98. Coleogyne ramosissimum Torr. — Blackbrush

No data, specimen in the Hovenweep Herbarium.

___ 99. Cowania mexicana Don. — Cliffrose

Common in all monument groups, mesa tops, rimrock, and and talus slopes. WJL 375. 7 VIII 1974.

___ 100. Peraphyllum ramosissium Nutt. ex.T.&G. — Squawapple

No data, no collected specimen; however, on record within the monument.

___ 101. Prunus virginiana L. — Chokecherry

Along canyon bottom arroyo, Sq. Tower Group only. Specimen in the Hovenweep Herbarium.

___ 102. Populus balsaimfera L. — Cottonwood

Rare, canyon bottom arroyos. Hackberry and Horseshoe monument groups.

___ 103. Populus fremontii Wats. — Cottonwood

Rare, only two plants in Hovenweep Canyon, Sq. Tower Group.

___ 104. Salix exiqua Nutt. — Willow

Common in canyon bottom arroyos, Sq. Tower, Cutthroat, and Hackberry monument groups. WJL 335. 12 VII 1974.

Saxifrageceae

___ 105. Ribes aureum Pursh. Golden Current

Along canyon bottom arroyo, Sq. Tower Group only.

Scrophulariaceae

___ 106. Castilleja chromosa Nels. Indian Paintbrush

Mesa top, Sq. Tower Group. Rare. Specimen in the Hovenweep Herbarium. 1 V 1974.

___ 107. Cordylanthus wrightii Gray Birdbeak

Mesa top, in open areas beneath Pinyon-Juniper Cutthroat Group. WJL 372. 5 VIII 1974.

___ 108. Penstemon barbatus (Cav.)Roth Red Beardstongue

Rare, specimen observed at Cutthroat Group, near a mesa top arroyo.

___ 109. Penstemon virgatus Gray

Mesa tops, common in both Juniper-sage and open sage areas. Sq. Tower Group. WJL 301. 17 VIII 1974.

Solanaceae

___ 110. Datura meteloides Dunal. ex D.C. Devils weed

Seems to be an exotic. Growing in disturbed ground near the Visitors Center, Sq. Tower Group.

___ 111. Lycium pallidum Mires Wolfberry

Noted only on ruins or disturbed habitats, all monument groups. No specimen, spring flowering.

Tamaricaceae

___ 112. Tamerix pentandra L. Salt Ceder

Canyon bottom arroyos, Sq. Tower Group. Introduced from southern Europe. WJL 309. 21 VI 1974.

Ulmaceae

___ 113. Celtis reticulatus Torr. Hackberry

Restricted to canyon heads, below rimrock. Hackberry, Holly, Horseshoe, and Sq. Tower monument groups. WJL 374. 6 VIII 1974.

Umbelliferae

___ 114. Lomatium grayi Coult.& Rose Biscuit Root

No data, specimen in the Hovenweep Herbarium.

___ 115. Cymopteras bulbosus A.Nels.

No data, specimen in the Hovenweep Herbarium.

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Appendix II

A PRELIMINARY FAUNAL STUDY OF HOVENWEEP NATIONAL MONUMENT

by Theodore Rado, Zoology Department

This report represents the first of a number of statements organized around a study of the faunal resources of Hovenweep National Monument and Cajon Mesa, southwestern Colorado and southeastern Utah. The most complete faunal survey prior to 1974 was Richert's unpublished listing of the various plants and animals found within both Hovenweep National Monument and Yucca House National Monument well to the east of Hovenweep. Examination of the animal record files at Hovenweep and field observations this past summer showed that this original survey was incomplete, and it was therefore concluded that a more up-to-date appraisal of the area was desirable. The 1974 animal survey has produced a preliminary list of species and their habitats (Table 1) and will be augmented by more extensive studies in 1975. The total report will serve as the basis of a Master's Thesis.

Animal observations were obtained by a variety of means. Night time searches along roads, stock ponds and seeps in and around the Monument Units yielded abundant information on nocturnal fauna. Stops were made on these excursions at the more permanent water sources, which yielded especially fruitful data concerning the local amphibians. Careful records were also kept of the animals found in each of the survey areas during the daytime archeological investigations and on weekends. Evidence of the area's more uncommon residents, such as the bobcat and midget-faded rattlesnake, was collected in this manner. Background information on some of the extremely rare species, e.g. the milk snake, was obtained in large part from the Park files.

A more in depth faunal study of Cajon Mesa has been planned for this spring and summer. Extensive field sampling based on small mammal trapping

Table 1 - ANIMAL SPECIES PRESENT IN THE MONUMENT AND SURROUNDING AREA, AND THEIR OCCURRENCE AND STATUS IN THE MAJOR PLANT COMMUNITIES

Species	Presence in each of the monument blocks and BLM land near park boundary						Plant Community occupied and status therein*			
	Cajon	Square Tower	Holly	Cutthroat Castle	Hackberry	BLM Land	Sage	Canyon Rim	Talus Slope	Canyon Bottom
Amphibians										
Ambystoma tigrinum (Tiger Salamander)	X	X			X	X	U			U
Bufo Woodhousei (Rocky Mountain Toad)						X	U			
Bufo punctatus (Red-spotted Toad)	X	X		X	X		C	C		C
Reptiles										
Crotaphytus collaris (Collared Lizard)		X	X	X	X	X		C	U	C
Crotaphytus wislizenii (Leopard Lizard)		X					U			
Sceloporus undulatus (Eastern Fence Lizard)	X	X	X	X	X	X	U	C	C	C
Uta stansburiana (Side-blotched Lizard)		X	X			X		C	U	C
Urosaurus ornatus (Tree Lizard)		X	X					U	C	
Cnemidophorus tigris (Whiptail Lizard)	X	X	X	X	X	X	C	C	C	C
Masticophis taeniatus (Striped Whipsnake)	X	X		X			U			U
Pituophis melanoleucus (Gopher Snake)		X				X	C	C		C
Lampropeltis getulus (Common Kingsnake)		X						R		
Lampropeltis triangulum (Milk Snake)		X								
Crotalus viridis (Western Rattlesnake)		X			X	X	U	U		
Birds										
Anas platyrhynchos (Mallard Duck)						X	U			
Cathartes aura (Turkey Vulture)	X	X		X			U	C		

Accipter cooperii (Cooper's Hawk)		X					C				
Circus cyaneus (Marsh Hawk)		X					U				
Buteo jamaicensis (Red-tailed Hawk)	X	X	X		X		C	C			
Aquila chrysaetos (Golden Eagle)						X	R				
Falco sparverius (Sparrow Hawk)		X				X	C				
Lophortyx gambelii (Gambel's Quail)		X					R				
Alectoris graeca (Chuker)		X					R				
Charadrius vociferus (Killdeer)						X	U				
Zenaidura macroura (Mourning Dove)	X	X	X	X	X	X	C	C	C	C	
Bubo virginianus (Great Horned Owl)						X	U				
Asio otus (Long-eared Owl	X	X			X		C	C			
Phalaenoptilus nuttallii (Poor-will)		X				X	C				
Chordeiles sp. (Nighthawk)		X			X	X	C				
Selasphorus platycercus (Broad-tailed Hummingbird)		X		X		X	U	U			
Archilochus alexandri (Black-chinned Hummingbird)		X					U				
Calaptes cafer (Red-shafted Flicker)		X			X			C			
Dendrocopos villosus (Hairy Woodpecker)		X						R			
Tyrannus sp. (Kingbird)		X						R			
Myiarchus cinerascens (Ash-throated Flycatcher)		X	X	X	X			C		C	
Empidonax difficilis (Western Flycatcher)		X						U			
Eromophila alpestris (Horned Lark)		X					C				
Hirundo rustica (Barn swallow)		X						R			
Tachycineta thalassina (Violet-green Swallow)					X			R			
Cyanocitta cristata (Steller's Jay)		X						R			
Aphelocoma coerulescens (Scrub Jay)		X				X	C	C			
Gymnorhinus cyanocephalus (Pinyon Jay)		X						C			
Pica pica (Black-billed Magpie)		X				X		U		U	
Nucifraga columbiana (Clark's Nutcracker)		X						R			
Corvus corax (Common Raven)	X	X				X		C	C	C	
Parus gambeli (Rocky Mtn. Chickidee)	X	X		X				C	C		
Parus inornatus (Plain Titmouse)		X						C			
Psaltriparus minimus (Common Bushtit)		X						R			
Thryomanes bewickii (Bewick's Wren)		X						R			
Salpinctes obsoletus (Rock Wren)		X						R			
Catherpes mexicanus (Canyon Wren)		X		X	X			C	C	C	
Mimus polyglottos (Mockingbird)		X					R				
Oreoscoptes montanus (Sage Thrasher)						X	R				

ANIMAL SPECIES PRESENT IN THE MONUMENT
AND SURROUNDING AREA, AND THEIR OCCURRENCE AND STATUS
IN THE MAJOR PLANT COMMUNITIES

Species	Presence in each of the monument blocks and BLM land near park boundary						Plant Community occupied and status therein*			
	Cajon	Square Tower	Holly	Cutthroat Castle	Hackberry	BLM Land	Sage	Canyon Rim	Talus Slope	Canyon Bottom
Birds										
Turdus migratorius (Robin)		X					R			
Myadestes townsendi (Townsend's Solitaire)		X					R			
Hylocichla guttata (Hermit Thrush)		X		X				R		
Sialia currucoides (Mountain Bluebird)		X						R		
Polioptila caerulea (Blue-gray Gnatcatcher)		X						U		
Lanius ludovicianus (Shrike)		X			X	X	C			
Sturnus vulgaris (Starling)		X						U		
Vireo vicinior (Gray Vireo)		X						U		
Dendroica audobuni (Audobon's Warbler)		X						U		
Oporornis tolmiei (Macgillivret's Warbler)		X						U		
Wilsonia pusilla (Wilson's Warbler)		X								R
Passer domesticus (House Sparrow)		X					U			
Sturnella neglects (Meadowlark)	X	X					C			
Euphagus cyanocephalus (Brewer's Blackbird)		X						C		
Icterus parisorum (Scott's Oriole)		X						R		
Pheucticus melanocephalus (Black-headed Grosbeak)						X	U			
Passerina amoena (Lazuli Bunting)		X						R		
Carpodacus mexicanus (House Finch)		X				X	C	C		
Spinus tristis (American Goldfinch)		X				X	U	U		
Chlorura chlorura (Green-tailed Towhee)		X						U		
Pipilo erythrophthalmus (Rufous-sided Towhee)		X						C		
Amphispiza bileata (Black-throated Sparrow)		X					C			

Junco oreganus (Oregon Junco)		X						C		
Junco caniceps (Gray-headed Junco)		X						C		
Spizella breweri (Brewer's Sparrow)		X					R			
Zonotrichia leucophrys (White-crowned Sparrow)		X					C	C		
Mammals										
Sorex merriami (Merriam Shrew)		X					R			
Myotis subulatus (Small-footed Myotis)		X					C	C		
Myotis californicus (California Myotis)		X					C			
Taxidea taxus (Badger)		X			X	X	U			
Spilogale putorius (Spotted Skunk)		X						U		
Mephitis mephitis (Striped Skunk)						X	R			
Canis latrans (Coyote)		X				X	U	U		
Lynx rufus (Bobcat)	X	X		X		X	U	U		U
Citellus variegatus (Rock Squirrel)		X		X	X			C	C	
Eutamias quadrivittatus (Colorado Chipmunk)		X		X	X			C		
Dipodomys ordi (Ord Kangeroo Rat)		X			X	X	C			
Peromyscus maniculatus (Deer Mouse)		X				X	C			
Neotoma albigula (Whitethroat Woodrat)	X	X	X	X	X	X		C	C	C
Ondatra zibethica (Muskrat)		X								R
Erethizon dorsatum (Porcupine)		X						R		
Lepus californicus (Black-tailed Jackrabbit)		X	X		X	X	C			
Sylvilagus audoboni (Desert Cottontail)		X	X		X	X	C	C	C	C
Odocoileus hemionus (Male Deer)	X		X		X	X	C	C		

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*The status of a particular species refers to its abundance of sightings. A definition of the terminology used in this list would be as follows:

C - common; several sightings each week during the part of the year in which the animal in question is in the area and is active
U - uncommon; at least one sighting per month during favorable times of the year
R - rare; sighted usually less than once per year

**Information given in this chart was done on the basis of analysis of park records and observational data conducted by the author during the months of June through August 1974, and also on the basis of observations made by the monument staff. Since a faunal study of this area is still underway, some corrections and reevaluations of this material may be made as more data become available.

will take place in study quadrats scattered across the mesa, so as to obtain data on plant and animal relations in representative ecosystems which have undergone various degrees of grazing activity. The 1974 species lists are divided into two forms. Table 1 presents a list of the mammals, birds, reptiles and amphibians observed on the mesa, with data on area of observation, habitat range and abundance. Table 2 lists the various insects observed during the summer by Order and Family.

Table 2

Checklist of the Insects of

Hovenweep National Monument

Class Insecta

Order Orthoptera

Family Acrididae (short-horned grasshoppers)

Family Tettigoniidae (long-horned grasshoppers)

Family Gryllacrididae (wingless long-horned grasshoppers)

Family Gryllidae (crickets)

Family Phasmatidae (walking sticks)

Family Mantidae (praying mantis)

Family Blattidae (cockroaches)

Order Isoptera (Termites)

Family Rhinotermitidae (subterranean termites)

Order Hemiptera (True Bugs)

Family Corixidae (water boatmen)

Family Gerridae (water striders)

Family Miridae (plant bugs)

Family Reduviidae (assassin bugs)

Family Phymatidae (ambush bugs)

Family Lygaeidae (seed bugs)

Family Pentatomidae (stink bugs and shield bugs)

Family Cydnidae (Burrower bugs and Negro Bugs)

Order Homptera

Family Cicadidae (cicadas)

Family Cicadellidae (leafhoppers)

Family Fulgoridae (planthoppers)

Family Aphidae (aphids)

Order Ephemeroptera (Mayflies)

Family unknown

Order Odonata (Dragonflies and Damselflies)

Family Libellulidae (common skimmers)

Family Calopterygidae (Broad-winged damsel flies)

Family Coenagrionidae (narrow-winged damselflies)

Order Neuroptera

Family Chrysopidae (lacewings)

Family Myrmeleontidae (antlions)

Order Trichoptera (caddisflies)

Family unknown

Order Lepidoptera (Butterflies and Moths)

Family Pieridae (whites)

Family Lycaenidae (gossamer-winged butterflies)

Family Hesperiidae (skippers)

Family Shingidae (sphinx moths)

Family Arctiidae (tiger moths)

Family Noctuidae (noctuid moths)

Family Geometridae (geometrid moths)

Family Pyralidae (pyralid moths)

Order Coleoptera (Beetles)

Family Cicindelidae (tiger beetles)

Family Carabidae (ground beetles)

Family Histeridae (hister beetles)

Family Dytiscidae (Predaceous diving beetles)

Family Hydrophilidae (water scavenger beetles)

Family Silphidae (carrion beetles)

Family Dermestidae (dermestid beetles)

Family Elateridae (click beetles)

Family Buprestidae (metallic wood-boring beetles)

Family Dascillidae (soft-bodied plant beetles)

Family Coccinellidae (ladybird beetles)

Family Mordellidae (tumbling flower beetles)

Family Tenebrionidae (darkling beetles)

Family Scarabbaeidae (scarab beetles)

Family Cerambycidae (long-honred wood-boring beetles)

Family Chrysomeloidae (leaf beetles)

Superfamily Curculionoidea (weevils)

Order Hymenoptera (Bees and Wasps)

Family Braconidae (braconid wasps)

Family Ichneumonidae (ichneumon wasps)

Family Cynipidae (gall wasps)

Family Chrysididae (cuckoo wasps)

Family Mutillidae (velvet ants)

Family Formicidae (ants)

Family Vespidae (vespid wasps)

Family Sphecidae (sphecid wasps)

Family Apidae (bumble bees, honey bees)

Order Diptera (Flies)

Family Culicidae (mosquitoes)

Family Ceratopogonidae (biting midges)

Family Tabanidae (horse flies, deer flies)

Family Asilidae (robber flies)

Family Bombyliidae (bee flies)

Family Syrphidae (syphid flies)

Family Muscidae (house fly)

Family Calliphoridae (blow flies)

Family Tachinidae (tachinid fly)

Appendix III

WATER CONTROL AT HOVENWEEP

by Bradley A. Noisat

An important aspect of the study of prehistoric agriculture in the Southwest involves the analysis of aboriginal techniques of soil and water management, since information pertaining to the construction, arrangement, and utilization of water control systems provides needed data on how the local environment was effectively used. An efficient method for obtaining this data involves the reconstruction of sites for problem-oriented experiments. In a study of water control technology, the experimental approach has many practical advantages. First, a reconstructed site can be utilized for both short and long term projects. For example, a rebuilt check dam can be observed as silt is deposited and maintained over many years. At the same time, a contemporary garden can be planted in the dam which yields data concerning crop growth for a single season. Moreover, the structure provides future students with a scientific resource for on-going observations or new research objectives, and different experimenters can complement each other's work by sharing methods, results, or hypotheses. Geologists, botanists, archeologists and others can benefit by the communication of such interdisciplinary projects, thereby adding credibility to their research findings. Finally, traditional theories and commonly-held assumptions can be easily tested and re-tested under modern situations simulated to resemble the past. In the reconstruction of water control devices such factors as labor, material, and environmental features, (e.g., weather, water sources, and plant communities), must therefore be duplicated very closely in order to obtain valid results.

Two experiments are currently underway involving rim check dams and canyonhead springs in the Monument. Preliminary interpretations based on the 1974 data (see Chapter X) reveal a shift in settlement pattern from the mesa top dry farming areas which were densely inhabited during Pueblo II

times, to dense clusters of towers and associated habitation sites in Pueblo III times which are centered around canyonhead springs. Associated with these canyonhead sites are a number of water control areas, such as arroyo check dams, walled seeps, hillside and talus terraces, reservoirs, and natural catchments. While certain of these may have been utilized in Pueblo II times, the overall pattern seems to indicate a development or intensification of water control after the settlement shift to the nearby tower complexes. One particularly critical feature of the large Pueblo III ruins is the occurrence of large rim dams immediately above the point where the canyonhead forms, along with springs in the canyon below. Rohn (1972: 214-216) in fact, has suggested that this combination of rim dam and underlying spring may have formed a highly efficient water management unit. He contends that the presence of rim dams increased spring water production by capturing extensive amounts of floodwater and increasing sandstone percolation of this water to the nearby spring. If correct, this system would have been very valuable to the agricultural and domestic water needs of the highly concentrated Pueblo III villages. Several other types of water control systems were also utilized by the Hovenweep inhabitants, but the 1974 study has concentrated on the rim dam/spring system. A considerable amount of additional data on talus dams, grid terraces, reservoirs, and arroyo check dams is available, however, and will be used as the basis for continuing analysis. By the end of the program studies of hydrology and sedimentation will have attempted to identify:

1) soil build-up rates and processes of siltation
2) the amount and length of moisture retention in different devices
3) the relation of flood size, amount of precipitation and drainage area
4) the optimal sizes of check dam walls and reservoir banks, and methods of construction
5) differences in amount and rate of seepage in modified and unmodified springs
6) seepage rate differences as a result of the presence or absence of mesa top rim dams
7) the relation of slope gradient and device function, to determine if certain devices (e.g. check dams) have optimal grades (e.g. 12%) as

suggested by Martin and Plog (1973:285-296) and Plog and Garrett (1972) 8) the number of man hours required to construct and maintain various devices.

The experiments performed during 1974 were intended to test Rohn's suggestions concerning the relations of rim dams and springs. Three thunderstorms occurred during the summer, and the flash flood associated with any one of them should have increased the percolation to a spring below an intact dam, assuming that Rohn is correct. Three sites involving two rim dam/spring systems were studied at the heads of the north and south forks of Ruin Canyon in the Square Tower Group. These are HOV. 109, a small seep at the head of the south fork which was cleaned and reconstructed as a small cistern; HOV. 3 (see Fig. 6), a large cistern which had been walled in during prehistoric times; and HOV. 71, a series of rim check dams about HOV. 3. The check dam immediately above the head of the canyon was reconstructed and mortared with double masonry walls to a height of 1.5 meters and a length of 3 meters. The remains of several other dams (HOV. 376 and 345) also occurred above HOV. 109, but these were left unmodified so that HOV. 109 could serve as a control. Assuming that the reconstruction of HOV. 71 would increase percolation to the spring below, it is expected that an observable increase of water would result in HOV. 3 after a storm, while HOV. 109 would remain unchanged.

The functioning of these systems was viewed in relation to the processes of siltation and sandstone percolation. Data was thus collected from both systems once a week for seven weeks, using the control site to verify the test results. Two experiments were run. Test 1 involved observation and measurement of siltation at the check dam before, during and after thunderstorm flash floods. Test 2 recorded the weekly change in seep volume at HOV. 3 in relation to thunderstorm activity, and compared this volume with water output at HOV. 109.

TEST RESULTS

The results of the two tests are outlined in Table 1. These tests demonstrate that the successful accumulation of silt in a check dam is

Table 1 - Weekly Test Results of Test 1 and Test 2.

	Week of 7-10	7-15	7-19	7-24	7-30	8-2	8-8
	Weekly Results 1974						
TEST 1	Storm 7-7				Storm 7-29	Storm 8-1	
HOV. 71 H_2O Content by depth behind dam	3.5"-5"	1.5"	0"	0"	2"	.5"	0"
HOV. 71 Silt Content by depth	1"-3.5" Wet	1"-3" Moist	2" Loose Fine	2" Dry	1.75" Baked Caliche	.5" Gravelly	.5" Dust Gravel
TEST 2							
HOV. 3 H_2O Volume cubic inches	1584" (cubic)	1848"	1475"	1584"	1488"	1475"	1536"
HOV. 109 Drops per/15 minutes	425	435	420	425	419	420	426

conditioned by several environmental factors. First, if summer storms are not regular and intense, inadequate amounts of moisture will be lost to evaporation within 7-10 days, (as shown in Test 1). Second, deposited silt becomes separated into differing soil layers. High-alkaline gravel settles to the base of the dam while lighter, more neutral soils form the bulk of arable soil. Test 1 suggests that this process is very slow and, without deliberate filling by aboriginal farmers, would have taken many years to achieve a tillable build-up. Finally, numerous intrusive species of wild plants, some of which may have been encouraged, probably competed with the domesticated crop. The combination of these three factors probably formed an important set of farming activities in prehistoric Pueblo times. It seems likely that the construction and maintenance of the check dam, as well as the care required for the domesticated crop, formed the basis of these daily activities.

The results of Test 2 indicate that the production of extra seep water may not be immediately effected by the capture of water by check dams. HOV. 3, with a dam (HOV. 71), showed an increase of water for 1 1/2 weeks after a storm, presumably as a result of percolation. However, the seep at HOV. 109 also showed a similar pattern of water increase despite the absence of an intact dam. Percolation probably occurs for several hundred yards along the arroyo system above a spring, and the presence of a dam may be of little immediate consequence. Rohn's hypothesis may be qualified by further testing if percolated water can be detected after a much longer period of time. The nature of the local hydrological system is still poorly understood, however, and testing in this area is needed, especially in regard to potential sources and quality of seep water. Continuation of these tests in future seasons, including an experimental garden, will add important data to the project's studies of aboriginal agriculture.

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Appendix IV

PLANT DISTRIBUTION, ENVIRONMENTAL CONSTRAINT AND FARM SITE LOCATION AT HOVENWEEP

by

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I. The analysis of site distribution at Hovenweep National Monument is concentrating on the study of two aspects of the prehistoric ecosystem of Cajon Mesa: 1) the constraints placed by the environment on the location of sites, particularly farming areas; and 2) the relationship of past farming activities with the distribution of modern plant species which may have been semi-cultivated and encouraged. The model for the first part of the analysis is based on the concept of environmental niche space elaborated by Hutchinson (1957) and Matson (1974) in which the niche of an organism is defined as an n-dimensional space composed of the variables which effect the organism's survival. The environmental variables represented by the dimensions grade from favorable to restrictive conditions for the organism occupying the niche space, and interact in different combinations. Each dimension can be seen as representing a gradient of environmental constraint on the niche space, which in this case is the distribution of prehistoric hunting, gathering, farming and other activities carried on by the Hovenweep inhabitants at various times on Cajon Mesa. In this way dimensions can serve as descriptive mechanisms to define the environmental parameters of the past settlement pattern and subsistence activities at Hovenweep. The modern geographic location of the niche space is reflected by site "location" which in turn is determined by the interaction of such environmental variables as plant species, drainage pattern, physiography, etc. (see Fig. 4). Foragers and farmers of different time periods would have been dependent upon varying combinations of plants and animals and other types of resources which have specific locations. Since archeological sites are situated in space in

relation to these resources, their niches can be defined on the basis of resource patterning and the dimensions produced by these patterns. Major environmental variables, especially plant cover, therefore allow us to reconstruct in part the prehistoric niche space and begin to understand the environmental constraints placed on the location of certain types of sites, such as water control areas, farm fields, granaries, etc. (Limitation: Modern environmental variables do not necessarily reflect past environmental variables. We can assume, however, that the environment has changed in a recognizable fashion, and that similar gradients existed in the past. Palynology, dendrochronology and paleozoology are being used to interpret environmental change.)

II. The dimensions are being obtained mathematically with the use of a matrix of distance coefficients and a multidimensional scaling routine based on botanical variables. Sites are being compared on the basis of plant species which are coded both present/absent and dominant/subdominant at each site. The coefficient of Jaccard is then used to calculate a matrix of distance coefficients between the sites. This coefficient takes into consideration the mutual presence of plant species at two sites when measuring the similarity between them. The species, in turn, provide information about the environment which can be compared between the two locations. Torgerson's metric multidimensional scaling technique then arranges the sites along dimensions or vectors in space while preserving the order relationships between them as represented in the matrix of distance coefficients. The similarity matrix is thereby transformed into a number of two dimensional vector plots with the most important variable represented by the first dimension, the second variable represented by the second dimension, etc.

III. Since the dimensions of scaled sites represent inter-site relationships based on botanical variables, each dimension is then inspected for continuums representing key plants and physiographic factors. Vectors are also inspected for differences in distribution of sites of separate time periods and of functionally distinct classes of sites. This aspect of the analysis is based on Yarnell's (1965) theory that certain types of plant cover reflect aboriginal disturbances. A dense

cover of plants such as wolfberry or wild tomato, for example, suggests that the site may have been used as a farming area or other location where plant manipulation may have occurred, since these species are commonly manipulated by the modern Pueblos and have been shown to have abnormal distributions on certain archeological sites. The Hopi, for example, actively manipulated eleven wild plant species through encouragement and semi-cultivation, and indirectly altered over fifty species through selective management (Tables 1-2). The genetic structures of many of these plants have been effected by manipulation producing a complex of weeds which frequent gardens, middens, abandoned villages and old farm fields. Beeweed, wild potato, wild tomato, ground cherry, pigweed, lambsquarters, wolfberry, jimson weed, wild tobacco, cattails, dove weed, dock and numerous grasses are especially weedy species, and there is a good possibility that several were aboriginally introduced into the Southwest from Mexico as semi-cultivates along with the true domesticates (cf. Kearney and Peebles 1951; Yarnell 1965). The Pueblo agricultural strategy thus has an established symbiotic relationship with wild plant manipulation, and it is likely that this association extended into the past, especially since many of the manipulated plants are specifically adapted to disturbed habitats. Yarnell (1965), in fact, has suggested that the prehistoric Anasazi manipulated wild tomato, wild potato, wolfberry, beeweed and jimson weed in New Mexico, and it is possible that a similar relationship existed in the Hovenweep area. If so, the consistent occurrence of certain species of weeds on certain types of sites, such as water control locations, could be a very useful tool in inferring past site function. Farming sites, for example, would be expected to support stands of garden-side weeds, while non-plant manipulating sites, such as hunting stations or quarries, should have "normal" distributions of these and other species. The plants occurring on sites at Hovenweep are therefore being scaled in the same manner described above. The vectors produced by this scaling should indicate that past plant manipulating stations are related with respect to a small number of significant vectors associated with weeds and grasses. Hunting, nut gathering, plant processing and other types

Table 1

SEMI-CULTIVATED AND ENCOURAGED WILD PLANTS
OF THE PUEBLOS

	Tewa	N. Tiwa	S. Tiwa	Towa	E. Keres	W. Keres	Zuni	Hopi
Wild tobacco	S		S					S
Wild potato								E
Wild tomato						S		S
Ground cherry							SE	
Chamaesaracha coronopus					E?			
Wild dock								S
Wild buckwheat								S
Beeweed						S	SE	E
Beebalm								S
Devils Claw								E
Cattail								S
Cottonwood								S
Willow								S
Virgins bower			S					
Wild rose			S					
Milkweed							S	

Key: S - Semi-cultivated
E - Encouraged
SE - Both semi-cultivation and encouragement

TABLE 2

MANAGED PLANTS OF THE HOPI-PUEBLO

Wild tobacco - T*, H
Lambsquarters- Z, H
Wolfberry- H, Z
Trompillo- H, Z
Wild potato- H, Z
Wild tomato-H, Z
Ground cherry - H, Z, T
Jimson weed- H
Cryptantha sp.- H
Chamaesaracha sp.- H
Cattail- H
Adenostegia sp.- H
Devils claw- H, T
Dicoria sp.- H
Verbesina sp.- H
Four-winged saltbrush- H
Cycloma sp.- H, Z
Acanthochiton sp.- H
Sand verbena- H
Tripterocalyz sp.- H
Purslane- H
Boerhaavia sp.- H
Beeweed- H, NT
Wild currant- H, Z, T
Wild rose- H
Serviceberry- H
Dove weed- H
Reverchonia sp.- H
Squawbush- H
Globe mallow- H
Blazing star (Mirabilis pumila)- H
Blazing star (M.multiflora)- H
Hedgehog cactus- H
Prickly pear (Opuntia polycantha)- H
Prickly pear (O.hystricina)- H
Prickly pear (O.comanchia)- T
Prickly pear (O.lindheimeri)- NT
Cane cactus- T
Cholla- H, Z
Narrow-leaved yucca- H, Z, T
Broad-leaved yucca-H, Z, T, NT
Milkweed (Asclepias galiodes)- H, Z
Milkweed (A.involucrata)- H
Black grama grass- H
Blue grama grass- H
Sand grass- H
Galleta grass- H
Purple hair grass- H
Rice grass- H
Reed cane- H
Alkalai sacaton- H
Dropseed- H
Giant dropseed- H
Mariposa lily- H
Juniper mistletoe- H
Mistletoe- H
Cottonwood- H
Hackberry- T
Utah oak- T
Chokecherry- T
Skunkbush- T
Panic grass- T
False solomon's seal- T
Pigweed- Z, H
Wormwood- Z
Aster- Z
Ragweed- Z
Hymenopappus- Z
Yellow flax- Z
Cocklebur- Z
Milkvetch- Z
Orache- Z
Eriocoma sp.-Z
Nightshade- Z
Thelypodium sp.- Z
Barberry- Z
Juniper- H, T
Pinyon pine (Pinus edulis)- H, Z, T, NT
Pinyon pine (P.monophylla)- H

*Key:
T - Tewa
H - Hopi
Z - Zuni
NT- Northern Tiwa

of sites should be related to different plant vectors, such as those indicating highland and springside locations, pinyon groves, etc.
(Limitations: The presence of weedy species on an archeological site does not necessarily represent past farming or manipulative activities. Their presence could have resulted from completely unrelated activities, such as: a) other types of aboriginal disturbances, e.g. firewood cutting, back dirt piling, etc.; b) invasion after the abandonment of the site; c) natural distribution in restricted microzones in which the site happens to be located; d) recent disturbances, particularly overgrazing. While these possibilities introduce a number of difficulties, several control experiments are being run to eliminate certain of the problems. First, experimental gardens are being raised on certain of the possible farming areas, and a number of the wild plants are intentionally being manipulated along with Hopi cultigens. Several of these plots will be allowed to run fallow in succeeding seasons, to permit an analysis of the patterns of weed succession on abandoned gardens. If our hypothesis is correct, these weeds should continue to grow on the old farm plots in spite of other types of disturbances. Second, botanical transects and quadrats are being run seasonally, in off-site as well as on-site locations, to analyze weed patterns elsewhere on the mesa. This aspect of the study is especially critical if we are going to be able to determine if the presence of a stand of plants such as wolfberry on a site is the result of prehistoric manipulation, present disturbances, or natural distribution. Wolfberry and related plants are especially susceptible to over-grazing, and for this reason control quadrats have been established in areas of heavy grazing, moderate grazing, and minimal grazing. Finally, pollen profiles are being obtained at each site to determine if the same species occurred in the past, and to find if they ever occurred in association at certain sites with corn and other domesticates. Limited excavations are additionally planned to trench water control sites, granaries and retaining walls for evidence of past cultivation, or for evidence of non-agriculturally related activities.)

IV. Data and Preliminary Results - A total of 58 sites from pinyon-juniper, juniper-sage, sage and shrubland plant communities are being used. These include all Archaic, Basketmaker and Pueblo I sites, and

subsamples of the Pueblo II-III occupation areas. Sites are being scaled in the following manner:

1) All 58 sites are scaled on the basis of the 48 plant species which were noted as occurring on site surfaces during the 1974 field season. This scaling should identify the factors responsible for environmental constraint on the distribution of sites, e.g. elevation, distance to water, soil quality, exposure, etc. Native vegetation is regarded as the best indicator of the totality of the environment, and thus is an excellent reflection of the environmental constraints placed on site location.
2) All 58 sites are then scaled using 14 species noted this summer on site surfaces which have been semi-cultivated or encouraged by native Southwestern and Great Basin groups. This species are:

wheatgrass	blazing star
ricegrass	willow
shadscale	cottonwood
goosefoot	cattail
dock	bullrush
wolfberry	mint
tansy mustard	milkweed

This scaling should aid in the identification of locations where manipulative activities occurred, assuming that plant distribution is a key to areas of prehistoric disturbance.

3) All possible water control sites are then scaled in the same manner as in Steps 1 and 2. This scaling should allow a determination of the overall environmental constraints on water control on Cajon Mesa, as well as aid in the identification of the wild plants which may have been grown on water control farm fields along with cultigens.

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APPENDIX V

1974 HOVENWEEP SURVEY POTTERY TYPES

Appendix V - 1974 Hovenweep Survey Pottery Types

SITE # / SQ.	Gray Ware				Corrugated Ware			Black-on-White Ware							Red Ware		
	Chapin Gray	Moccasin Gray	Mancos Gray	Hovenweep Gray	Mancos-Mesa Verde Corrugated		Hovenweep Corrugated	Chapin B/W	Piedra B/W	Cortez B/W	Mancos B/W Mineral Pt.	Mancos B/W Carbon Pt.		McElmo-Mesa Verde B/W	Deadmans B/R	Bluff B/R	Abajo R/O
1					1		2							1			
2						1								1			
3					2		3									1	
4				3	2		7							1			
5					2		3					1		1			
6					3									1			
7																	
8				4	7		8							3			
9																	
10																	
11				4	6		21				3	2		10			
12					6		14				2	3		13			
13-14				14	24		66				6	5		19			
15-16				5	18		17				3	4		18			
17																	
18				1		1											
19																	
21																	

| | | |

Appendix V cont'd

SITE # / SQ.	TOWER	Gray Ware: Chapin Gray	Gray Ware: Moccasin Gray	Gray Ware: Mancos Gray	Gray Ware: Hovenweep Gray	Corrugated Ware: Mancos-Mesa Verde Corrugated	Corrugated Ware: Hovenweep Corrugated	Black-on-White Ware: Chapin B/W	Black-on-White Ware: Piedra B/W	Black-on-White Ware: Cortez B/W	Black-on-White Ware: Mancos B/W Mineral Pt.	Black-on-White Ware: Mancos B/W Carbon Pt.	Black-on-White Ware: McElmo-Mesa Verde B/W	Red Ware: Deadmans B/R	Red Ware: Bluff B/R	Red Ware: Abajo R/O
357																
358													1			
360				1		1	3				2	1				
361																
362																
363																
364																
365				8		1	7						2			
366			1	3		29	35				9	7	25			
367																
368																
369			1	1												
370																
371				1									1			
372																
373																
374		1				1										
375													1			

| | | |

Appendix V cont'd

SITE #	Gray Ware				Corrugated Ware			Black-on-White Ware						Red Ware		
	Chapin Gray	Moccasin Gray	Mancos Gray	Hovenweep Gray	Mancos-Mesa Verde Corrugated		Hovenweep Corrugated	Chapin B/W	Piedra B/W	Cortez B/W	Mancos B/W Mineral Pt.	Mancos B/W Carbon Pt.	McElmo-Mesa Verde B/W	Deadman B/R	Bluff B/R	Abajo R/O
CUTTHROAT																
70		1		3		4	25				3	2	9			
377				1		1	1				1					
381						1					1	1	2			
382												1				
383			2									1	2			
384						3										
385			1								3					
386											2					
387				1		3					3		3			
388																
CAJON																
51-52				4		6	18					2	3			1
359		2	2	5		3	2				2	1	5	1		
392											1		1			
456						1										
457													1			
458																

HOV. 1

| | | |

Appendix V cont'd

SITE #	Gray Ware				Corrugated Ware		Black-on-White Ware						Red Ware		
BS 1	Chapin Gray	Moccasin Gray	Mancos Gray	Hovenweep Gray	Mancos-Mesa Verde Corrugated	Hovenweep Corrugated	Chapin B/W	Piedra B/W	Cortez B/W	Mancos B/W Mineral Pt.	Mancos B/W Carbon Pt.	McElmo-Mesa Verde B/W	Deadmans B/R	Bluff B/R	Abajo R/O
480										2					
481												1			
482															
483															
484						4									
485															
HACK-HORSE															
60						4				2					
61-62	1		2	9	20	97		1		12	5	71			
63					2	3									
64-68	1		9		9	38				5	6	5			
69						2				1		2			
57-59					3	17				2	3	6			
389															
390												1			
391						1				3					
393															

| | | |

Appendix V cont'd

SITE # HACK-HORSE	Gray Ware				Corrugated Ware		Black-on-White Ware						Red Ware		
	Chapin Gray	Moccasin Gray	Mancos Gray	Hovenweep Gray	Mancos-Mesa Verde Corrugated	Hovenweep Corrugated	Chapin B/W	Piedra B/W	Cortez B/W	Mancos B/W Mineral Pt.	Mancos B/W Carbon Pt.	McElmo-Mesa Verde B/W	Deadmans B/R	Bluff B/R	Abajo R/O
422					1	6				4	2	7			
423				1	3	12				5	6	6			
425					1	3						2			
429															
431						1						2			
432												2			
433					1										
434															
435				2	1	16				8	1				
436						1									
437					1	1				3		1	2		
440															
441															
442															
443															
444															
445															
Total	4	5	19	107	378	744	1	3	6	276	110	398	17	2	3

APPENDIX VI

LITHIC ARTIFACTS FROM HOVENWEEP

Appendix VI — Lithic Artifacts From Hovenweep

SITE # / SQ. TOWER	Unworked Stone	Worked Stone	Cores	Hammerstones	Ovate Knives	Triangular Knives	Domed scraper/adzes	End Scrapers	Misc. Bifacials/ Unifacials	Projectile Point #1	Projectile Point #2	Projectile Point #3	Projectile Point #4	Misc. Points	Rectangular Mano	Oval Mano	Metate	Other
1	11	10								1								
2	1				1	1			1					1				
3		4																
4	3																	
5	4	4																
6	1																	
7																		
8	7	2												1				
9																		
10	1																	
11	7	2	1															
12	21	9																ochre
13-14	55	22	1												1			pendar
15-16	26	9	2														1	
17																		
18	3	1																
19	1	1																
21		2																

| | | |

Appendix VI cont'd

SITE # SQ. TOWER	Unworked Stone	Worked Stone	Cores	Hammerstones	Ovate Knives	Triangular Knives	Domed Scraper/Adzes	End Scrapers	Misc. Bifacials/ Unifacials	Projectile Point #1	Projectile Point #2	Projectile Point #3	Projectile Point #4	Misc. Points	Rectangular Mano	Oval Mano	Metate	Other
357	77																	
358	1																	
360	3																	
361																		
362	8	7																
363	5	5																
364	3	1																
365	13	1																
366	22	11																
367	1																	
368																		
369	13	3																
370	4	1												1				
371	4	4																
372	4																	
373																		
374	59	20				1			1					3				
375	44	15	1						2									

| | | |

Appendix VI cont'd

SITE #	Unworked Stone	Worked Stone	Cores	Hammerstones	Ovate Knives	Triangular Knives	Domed Scraper/Adzes	End Scrapers	Misc. Bifacials/ Unifacials	Projectile Point #1	Projectile Point #2	Projectile Point #3	Projectile Point #4	Misc. Points	Rectangular Mano	Oval Mano	Metate	Other
CUTTHROAT																		
70	17	4											1		1			pendant
377	8	13							2			1		1				
381		1																
382																		
383																		
384		1																
385	3																	
386	7	4							1			1						
387	2	2																
388	9	1																
CAJON																		
51-52	31	10																
359	2,347	266	9		3	6	6	4	8	2				2		5		drill
392	114	14														1		
456	12	2								1						1		
457	4																	
458	2	2	1															

HOV. 1

| | | |

Appendix VI cont'd

SITE #	Unworked Stone	Worked Stone	Cores	Hammerstones	Ovate Knives	Triangular Knives	Domed Scraper/Adzes	End Scrapers	Misc. Bifacials/ Unifacials	Projectile Point #1	Projectile Point #2	Projectile Point #3	Projectile Point #4	Misc. Points	Rectangular Mano	Oval Mano	Metate	Other
BS 1																		
480	6	2	1															
481		1																
482	1		1														1	
483																		
484	1																	
485																	1	
HACK-HORSE																		
60	2	1																
61-62	26	14									1			1	1	1		
63	1																	
64-68	51	12	2						1								2	Carved rock
69	3	3																
57-59	14	4																Pendant
389	2		1								1		1					
390	10	5				1				1			1					
391	24	9		1	1				1				1					
393																		

394 ..... 1 .....

395 2 .... 1 .....

396 2 .... 4 .... 1 .....

397 17 .... 5 ..... 2.... 1 .....

398 16 .... 8 ..... 1 .... 1 ..... 1 .....

399 2 .....

400 ....

401 1 .... 1 ....

402 1 ..... 1 .....

403 1 ....

404 1 .....

405 4 .... 2 .... 1 .....

406 ... .

407 ....

408 ....

409 3 .... 2 ..... 1 ..... axe

410 5 .... 3 .... 1 .....

411 3 ..... 3 .....1 .....

412 2 .... 5 ..... 1 .....

413 59 ... 25 ..... 1 ... 1 .... 2 ..... 1 ..... 1 ..... 1 .....

414 .....

415 .....

416 5 .... 6 ..... 2 ..... 2 ..... 2 .....

417 .... 1 .....

418 1 ..... 1 ....1 .....

420 2 .... 1 ..... 1 ..... 1 ..... 1 ... .

Appendix VI cont'd

SITE # HACK-HORSE	Unworked Stone	Worked Stone	Cores	Hammerstones	Ovate Knives	Triangular Knives	Domed Scrapers/Adzes	End Scrapers	Misc. Bifacials/ Unifacials	Projectile Point #1	Projectile Point #2	Projectile Point #3	Projectile Point #4	Misc. Points	Rectangular Mano	Oval Mano	Metate	Other
422	10	4																
423	10	1																
425		1																
429	3	1									1							pendant
431	22	4					1								1	2		
432	4	1																
433	2	2				1												
434	10	2	1															
435	13	1						1										
436	12																	
437	3		1		1	1												Carved Rock
440	5	1									1		1			1		
441																		
442																		
443																		
444	6	3																
445	5	3				1							1		1			
Total	4057	866	46	8	11	26	13	8	28	7	8	3	11	15	19	18	8	

APPENDIX VII

CATEGORIES OF FEATURES AND ARTIFACTS

AT HOVENWEEP

Appendix VII - Categories of Features and Artifacts at Hovenweep

[illegible]	Granary	Shelter	Prudden Unit	Multiple Unit Pueblo	Tower	Kiva Depression	Pithouse	Small Room Cluster	Isolated Cist	Isolated Firepit	Pictograph	Petroglyph	Ceramic Trash	Ground Stone	Hunting Tools	Processing Tools & Debris	Quarry	Shrine	Arroyo Dam	Talus Dam or Wall	Rim Dam	Modified Spring	Reservoir	Rock Basin	Farm Terrace	Sweat House	Hogan	Grooved Rock	Deadfall Trap
36. HOWEP																												
1				x	x	x							x			x												
2				x	x	x							x		x	x												
3		x				x		x					x			x						x						
4				x	x								x			x				x				x				
5		x											x			x												
6		x											x			x												
7	x	x																										
8		x		x	x	x					x	x	x		x	x				x								
9	x	x											x															
10	x	x											x			x												
11	x	x		x	x	x							x			x				x								
12				x	x	x							x			x				x	x			x				
13-14				x	x	x							x	x		x				x	x							
15-16	x	x						x			x	x	x	x		x		x									x	
17	x	x											x															
18	x	x						x					x			x				x								
19	x	x														x												
21	x	x						x								x					x							

| | | |

Appendix VII cont'd

SITE # SQ. TOWER	Granary	Shelter	Prudden Unit	Multiple Unit Pueblo	Tower	Kiva Depression	Pithouse	Small Room Cluster	Isolated Cist	Isolated Firepit	Pictograph	Petroglyph	Ceramic Trash	Ground Stone	Hunting Tools	Processing Tools & Debris	Quarry	Shrine	Arroyo Dam	Talus Dam or Wall	Rim Dam	Modified Spring	Reservoir	Rock Basin	Farm Terrace	Sweat House	Hogan	Grooved Rock	Deadfall Trap
357	x	x														x												
358	x	x											x			x												
360		x						x					x			x				x								
361	x	x																										
362																x												
363																x												
364													x			x												
365	x	x						x					x			x												
366					x	x		x				x	x			x				x							x	
367	x	x														x												
368																									x			
369													x		x	x												
370															x	x												
371																												
372																												

| | | |

Appendix VII cont'd

SITE #	Granary	Shelter	Prudden Unit	Multiple Unit Pueblo	Tower	Kiva Depression	Pithouse	Small Room Cluster	Isolated Cist	Isolated Firepit	Pictograph	Petroglyph	Ceramic Trash	Ground Stone	Hunting Tools	Processing Tools & Debris	Quarry	Shrine	Arroyo Dam	Talus Dam or Wall	Rim Dam	Modified Spring	Reservoir	Rock Basin	Farm Terrace	Sweat House	Hogan	Grooved Rock	Deadfall Trap
CUTTHROAT																												
70	x	x		x	x	x							x	x	x	x				x								
377													x		x	x												
381	x	x											x			x												
382		x							x				x															
383	x	x											x															
384													x			x			x									
385								x	x				x			x												
386													x		x	x												
387								x					x			x												
388							x									x												
CAJON																												
51-52	x	x		x	x	x						x	x			x				x		x					x	
359		x											x	x	x	x												
392													x			x												
456														x	x	x							x					
457																x			x									
458													x			x										x		

HOV. 1

459		x	x										x			x				
460		x	x																	
461		x	x													x	x			
462													x			x				
463																x				
464																x				
465																x				

HOV. 2

466													x		x	x				
467								x					x			x				
468													x			x				
469															x	x				
470		x	x										x			x				
471		x	x										x			x				
472		x	x				x						x		x	x				

NAV. 1

473				x		x							x	x		x				
474													x			x				
475			x										x			x				
476		x	x				x						x			x				
477			x				x						x	x		x			x	
478							x						x	x		x				
479													x							

Appendix VII cont'd

SITE # BS 1	Granary	Shelter	Prudden Unit	Multiple Unit Pueblo	Tower	Kiva Depression	Pithouse	Small Room Cluster	Isolated Cist	Isolated Firepit	Pictograph	Petroglyph	Ceramic Trash	Ground Stone	Hunting Tools	Processing Tools & Debris	Quarry	Shrine	Arroyo Dam	Talus Dam or Wall	Rim Dam	Modified Spring	Reservoir	Rock Basin	Farm Terrace	Sweat House	Hogan	Grooved Rock	Deadfall Trap
480								x				x	x			x												
481	x	x														x												
482														x		x	x											
483																								x				
484	x	x						x					x			x												
485	x	x											x	x														
HACK-HORSE																												
60		x						x					x			x				x								
61-62	x	x		x	x	x	x	x					x	x	x	x								x				
63	x	x											x			x												
64-68	x	x		x	x	x							x	x		x				x	x							
69	x	x											x			x												
57-59	x	x		x	x	x					x		x			x				x	x						x	
389															x	x												
390													x		x	x												
391								x					x		x	x												
393													x															

| | | |

Appendix VII cont'd

SITE # HACK-HORSE	Granary	Shelter	Prudden Unit	Multiple Unit Pueblo	Tower	Kiva Depression	Pithouse	Small Room Cluster	Isolated Cist	Isolated Firepit	Pictograph	Petroglyph	Ceramic Trash	Ground Stone	Hunting Tools	Processing Tools & Debris	Quarry	Shrine	Arroyo Dam	Talus Dam or Wall	Rim Dam	Modified Spring	Reservoir	Rock Basin	Farm Terrace	Sweat House	Hogan	Grooved Rock	Deadfall Trap
422									x				x			x												
423	x	x											x			x				x								
425	x	x											x			x												
429													x		x	x												
431								x					x	x		x												
432													x			x												
433													x			x												
434																x												
435			x			x			x				x			x												
436													x			x												
437													x			x			x									
440														x	x	x												
441																									x			
442								x					x															
443													x															
444																x												
445														x	x	x												

APPENDIX VIII

MULTIPLE USE, SMALL SCALE HABITATION, AND LIMITED ACTIVITY SITES

Appendix VIII - Multiple Use, Small Scale Habitation, and Limited Activity Sites

SITE # / SQ. TOWER	Multiple Use Habitation Complex	Small Scale Habitation/ Use Complex	Ceramic Campsite	Storage/ Shelter	Processing Sites	Hunting Sites	Water Control Sites	Quarry	Rock Art	Sweat House/ Hogan
1	x				x					
2	x				x	x	x			
3	x			x	x		x			
4	x				x					
5			x	x	x					
6			x	x	x					
7				x						
8	x			x	x	x	x		x	
9			x	x						
10			x	x	x					
11	x			x	x		x			
12	x				x		x			
13-14	x				x		x			
15-16		x		x	x				x	
17			x	x	x					
18		x		x	x		x			
19				x	x					
21		x		x	x		x			

| | | |

Appendix VIII cont'd

SITE # SQ. TOWER	Multiple Use Habitation Complex	Small Scale Habitation/Use Complex	Ceramic Campsite	Storage/ Shelter	Processing Sites	Hunting Sites	Water Control Sites	Quarry	Rock Art	Sweat House/ Hogan
357				x	x					
358			x	x	x					
360		x		x	x		x			
361				x						
362					x					
363					x					
364			x		x					
365		x		x	x					
366	x				x		x		x	
367				x	x					
368										x
369			x		x	x				
370					x	x				
371			x		x					
372					x					
373				x						
374			x		x	x				
375			x		x					

376				x		x		x
378		x			x	x		
379				x		x		x
380		x						
HOLLY								
53-56	x				x	x	x	x
419				x		x		
421				x				x
424				x		x	x	x
426								x
427				x		x	x	
428				x		x		
430		x			x	x		x
438				x		x		
439				x				x
446								x
447				x		x		
448				x				
449				x	x	x		
450				x		x	x	x
451				x	x	x		
452				x	x	x		
453				x	x	x		
454				x	x	x		
455		x			x	x		

Appendix VIII cont'd

SITE #	Multiple Habitation Complex	Small Scale Habitation/Use Complex	Ceramic Campsite	Storage/ Shelter	Processing Sites	Hunting Sites	Water Control Sites	Quarry	Rock Art	Sweat House/ Hogan
CUTTHROAT										
70	x			x	x	x	x			
377			x		x	x				
381			x	x	x					
382			x	x						
383			x	x						
384			x		x		x			
385		x			x					
386			x		x	x				
387		x			x					
388		x			x					
CAJON										
51-52	x			x	x		x		x	
359			x	x	x	x				
392			x		x					
456					x	x	x			
457					x		x			
458			x		x					x

HOV. 1								
459			x	x	x			
460				x				
461				x				x
462			x		x			
463					x			
464					x			
465					x			
HOV. 2								
466			x		x	x		
467			x		x			
468			x		x			
469					x	x		
470			x	x	x			
471			x	x	x			
472		x		x	x	x		
NAV. 1								
473	x				x			
474			x		x			
475			x	x	x			
476		x		x	x			
477		x		x	x	x		
478		x			x			
479			x					

Appendix VIII cont'd

SITE #	Multiple Habitation Complex	Small Scale Habitation/Use Complex	Ceramic Campsite	Storage/ Shelter	Processing Sites	Hunting Sites	Water Control Sites	Quarry	Rock Art	Sweat House/ Hogan
BS 1										
480		x			x				x	
481				x	x					
482					x			x		
483							x			
484		x	x	x	x					
485				x	x					
HACK-HORSE										
60		x		x	x					
61-62	x			x	x	x	x			
63			x	x	x					
64-68	x			x	x		x			
69			x	x	x					
57-59	x			x	x		x		x	
389					x	x				
390			x		x	x				
391		x			x	x				
393			x							

394			x	x	
395		x		x	
396		x		x	
397		x		x	
398		x		x	x
399		x	x		
400			x		
401		x	x	x	
402		x	x	x	x
403		x	x	x	
404		x	x	x	
405	x			x	
406		x	x		
407		x	x		
408				x	
409		x		x	x
410				x	
411				x	
412		x		x	
413		x		x	x
414		x		x	
415		x			
416		x		x	x
417		x	x	x	
418		x	x	x	x
420		x		x	x

Appendix VIII cont'd

SITE # HACK-HORSE	Multiple Habitation Complex	Small Scale Habitation/Use Complex	Ceramic Campsite	Storage/ Shelter	Processing Sites	Hunting Sites	Water Control Sites	Quarry	Rock Art	Sweat House/ Hogan
422			x		x					
423			x	x	x		x			
425			x	x	x					
429			x		x	x				
431		x			x					
432			x		x					
433			x		x					
434					x					
435	x				x					
436			x		x					
437			x		x		x			
440					x	x				
441										x
442		x								
443			x							
444					x					
445					x	x				

APPENDIX IX

CULTURAL PROVENIENCE OF SITES SURVEYED DURING 1974, BASED PRIMARILY ON CERAMIC MATERIAL

Appendix IX - Cultural Provenience of sites surveyed during 1974, based primarily on ceramic material

SITE # SQ. TOWER	Archaic	Basketmaker II	Basketmaker III	Pueblo I	Pueblo II	Pueblo III	Navajo	Densest Occupation
1						X		PIII
2						X		PIII
3				X	X			PII
4						X		PIII
5					X	X		PII-III
6						X		PIII
7								
8					X	X		PII-III
9								
10								
11					X	X		PIII
12					X	X		PIII
13-14					X	X		PIII
15-16					X	X		PIII
17								
18								
19								
21								

22			X	X	X		PII-III
23			X	X	X		PII
24		X	X	X	X		PII
71							
72							
106					X		PIII
108					X		PIII
109				X			PII
115				X	X		PII-III
119				X			PII
339							
340	X						Archaic
341							
342							
343							
344							
345							
346				X			PII
347							
348				X			PII
349							
350				X			PII
351							
352							
353				X			PII
354					X		PIII
355				X			PII
356						X	Nav.

Appendix IX cont'd

SITE # SQ. TOWER	Archaic	Basketmaker II	Basketmaker III	Pueblo I	Pueblo II	Pueblo III	Navajo	Densest Occupation
357								
358						X		PIII
360					X			PII
361								
362								
363								
364								
365						X		PIII
366					X	X		PII-III
367								
368							X	Nav.
369								
370								
371						X		PIII
372								
373								
374								
375						X		PIII

376						
378			X		X	PI-III
379				X		PII
380				X		PII
HOLLY						
53-56				X	X	PIII
419				X	X	PII-III
421				X		PII
424	X			X		PII
426						
427						
428				X	X	PII-III
430			X	X	X	PIII
438				X	X	PII-III
439						
446						
447				X		PII
448				X	X	PII-III
449					X	PIII
450				X		PII
451				X	X	X PII
452					X	PIII
453					X	PIII
454					X	PIII
455				X	X	PII-III

Appendix IX cont'd

SITE #	Archaic	Basketmaker II	Basketmaker III	Pueblo I	Pueblo II	Pueblo III	Navajo	Densest Occupation
CUTTHROAT								
70				X	X	X		PII-III
377					X			PII
381					X	X		PII-III
382					X			PII
383					X	X		PII-III
384								
385					X			PII
386					X			PII
387					X	X		PII-III
388		X						BMII
CAJON								
51-52			X	X	X	X	X	PII-III
359	X			X	X	X		Archaic-PIII
392					X	X		PII-III
456	X					X		PIII
457								
458							X	Nav.

HOV. 1					
459				X	PIII
460					
461					
462			X		PII
463					
464					
465					
HOV. 2					
466					
467					
468				X	PIII
469			X		PII
470			X		PII
471				X	PIII
472			X	X	PIII
NAV. 1					
473		X	X	X	PII
474			X		PII
475			X		PII
476		X	X		PII
477	X	X	X		PII
478			X		PII
479			X		PII

Appendix IX cont'd

SITE # BS 1	Archaic	Basketmaker II	Basketmaker III	Pueblo I	Pueblo II	Pueblo III	Navajo	Densest Occupation
480					X			PII
481						X		PIII
482								
483								
484								
485								
HACK-HORSE								
60					X			PII
61-62			X		X	X		PIII
63								
64-68					X	X		PII-III
69					X	X		PII-III
57-59					X	X		PII-III
389								
390						X		PIII
391					X			PII
393								

394					
395					
396		X	X		PII-III
397		X			PII
398			X		PIII
399			X		PIII
400					
401		X	X		PII
402		X	X	X	PIII
403			X		PIII
404		X	X		PIII
405	X	X	X		PII-III
406			X		PIII
407		X			PII
408					
409					
410					
411					
412		X	X		PII-III
413		X	X		PII-III
414					
415		X	X	X	PII-III
416			X		PIII
417			X		PIII
418					
420	X	X			PII

Appendix IX cont'd

SITE # HACK-HORSE	Archaic	Basketmaker II	Basketmaker III	Pueblo I	Pueblo II	Pueblo III	Navajo	Densest Occupation
422					X	X		PII-III
423					X	X		PII-III
428						X		PIII
429								
431					X	X		PII-III
432						X		PIII
433								
434								
435					X			PII
436								
437				X	X	X		PII
440								
441							X	Nav.
442								
443								
444								
445								
Total	4	1	4	15	76	74	8	