ARCHEOLOGICAL REPORT NO. 3

FOREST SERVICE
INTERMOUNTAIN REGION
OGDEN, UTAH

LITHIC SITES OF THE LASAL MOUNTAINS

SOUTHEASTERN UTAH

By
Dee F. Green
Regional Archeologist
Southwestern Region

Part I: Archeological Report

Part II: Management Considerations

Manti-LaSal National Forest
USDA Intermountain Region
1974

PREFACE

In the last few years, the United States Forest Service has taken serious steps toward the proper management of archeological resources under its jurisdiction. This report documents one of these steps by providing a technical paper on the archeology as well as a section devoted to management considerations.

Archeological resources are nonrenewable and, as such, require special management techniques. Unlike a tree plantation which can be reseeded if it fails, an archeological site, once destroyed, can never be replaced. Special care, therefore, must always be taken to insure that as much of the heritage of the past as possible is preserved. Such preservation is best accomplished under the guidance of an archeologist who is trained in the intricate detail necessary to extract as much information as possible from the evidence left in and on the ground. In many cases, preservation of data about the past can only be accomplished by removing it from the ground. Relic collectors, erosion, and other natural forces may combine to destroy an archeological site long before an archeologist can apply his talents to its preservation.

Proper management of archeological resources, however, does not end when the field work is finished. Archeological data placed on a shelf and forgotten is analogous to a forgotten or neglected piece of land. Neither produces what it is capable of. Management of archeological resources must include the extraction of information about past lifeways based on laboratory analysis as well as field data. And, of course, such information must be made publicly available through written reports, or there is little use in preserving the information in the first place.

This document fulfills these management requirements for 25 archeological sites which were investigated in the fall of 1971 in connection with a proposed chaining project on the Moab Ranger District. The areas surveyed were Slaughter Flats, Amasa Back, and Dorry Ridge, all on the western flanks of the LaSal Mountains.

The site survey was undertaken to provide management information on possible conflicts between archeological resources and the proposed chaining project. All archeological sites discovered in the

area proved to be surface lithic hunting and gathering stations. Most of the sites were salvaged during the survey and no longer constitute any conflict with chaining operations since they no longer exist on the ground. However, in reducing or eliminating the chaining-archeological conflicts, we developed management responsibilities for the archeological materials recovered. As indicated above, this report attempts to discharge these archeological management responsibilities. We are not implying that all information has been extracted from the data and included in this report. It does, however, provide a test hypothesis about the subsistence behavior patterns of hunting and gathering peoples who inhabited the western pediments of the LaSal Mountains in prehistoric times. The conclusions are suitable for use in Forest Service interpretive programs. Others who may wish to pursue research projects may do so by arranging to examine the artifacts first hand.

In addition, a second part of this document provides a background of archeological goals against which managers may judge the effects of other potential resource conflicts with archeology. Chaining and archeology do not necessarily pose antithical management problems. In some cases, archeology can derive absolute benefits from chaining as will be pointed out in Part II.

TABLE OF CONTENTS

LIST OF FIGURES

LITHIC SITES OF THE LASAL MOUNTAINS SOUTHEASTERN UTAH

Dee F. Green, Archeologist
U. S. Forest Service

PART I: ARCHEOLOGICAL REPORT

INTRODUCTION

With the exception of a survey by Alice Hunt between 1949 and 1952 (Hunt 1953), we are unaware of any archeological research reported and conducted by a professional archeologist on the LaSal Mountains of southeastern Utah. Perhaps Hunt's discovery of only lithic surface sites within the mountains and adjacent foothills has discouraged archeologists from doing studies in this area. Yet such sites are important to a total understanding of life in the past.

Some southwestern archeologists are beginning to suspect that views of the Anasazi and especially the Fremont peoples as basically horticulturalists may be incorrect. While none would argue that both peoples didn't grow crops, some, the writer included, suspect that horticultural products played far less of a role in the total economic activities than previously suspected. It may have been that the majority of the actual food consumed by these peoples in a year's time came from hunting and especially gathering activities. Corn may not have been a staple at all, but rather an important subsidy for getting the population through the difficult late winter and early spring months when hunting and gathering were not so profitable.

The above view reflects a bias on the part of the author born of working in the Fremont and with smaller Anasazi sites. Viewing the Anasazi from the large centers (Mesa Verde, Chaco, Tsegi), it is difficult to account for such large concentrated populations subsisting on anything but a horticultural base. And, indeed, there is no reason to assume otherwise. However, that is no necessary reason to extend such a notion to include the hinterland peoples scattered throughout the rest of the Four Corners region. The latter constituted the vast majority of the Anasazi and are much more typical of how the average Anasazi lived as Jennings (1966:63) has so astutely pointed out.

If we are correct in assessing hunting and gathering as the major economic activity of Fremont and Anasazi peoples generally, then obviously the importance of hunting and gathering sites looms large in any attempt to understand the economic base of the peoples involved. The current emphasis within archeology on cultural ecology can only make sense if hunting and gathering sites, as well as horticultural stations, are investigated for those societies where the former activity played an important role. The LaSal Mountain sites, therefore, loom large in importance since, on the basis of Hunt's survey and my own work herein reported, all the sites so far discovered in both the mountains and along the flanks appear to be nonhorticultural stations.

The present survey was undertaken by the United States Forest Service in an effort to assess the possible impact of a chaining project on the archeological resources. Our concern in this part of the report, however, is with the archeology _per se_ rather than with chaining management. The survey was conducted in three areas on the western slopes of the LaSal Mountains at elevations between 7,000 and 8,000 feet.

Since Hunt (1953) had already reported that no structure sites were discovered at elevations above 6,000 feet, one archeological problem was to confirm or refute her findings. A season of intensive site survey (Green 1971) on the south slopes of the Abajo Mountains 50 miles to the southwest of the LaSal's has revealed numerous dwellings and several water control sites at elevations between 7,000 and 8,000 feet. In some areas, such as Milk Ranch Point, the intensity of occupation is such that a total hunting and gathering subsistence is difficult to postulate even if such were accompanied by permanent or semi-permanent habitation structures. It is therefore reasonable to assume that the Anasazi were in possession of horticultural techniques which allowed them to grow crops at elevations above 7,000 feet and below 8,000 feet. Superficially, at least it would also seem that such techniques could have been extended 50 miles north to the LaSal's. However, my survey confirms Hunt's results. No structures which could be attributed to non-Anglo populations were encountered in the areas surveyed. In fact, no structures which might have been the results of gathering activities, such as pinyon roasting bins, were found despite a conscious and systematic effort to do so.

Hunt (1953) considers the area to have been utilized by both Anasazi and Fremont peoples. If Fremont groups maintained the major control over the area, the Anasazi were probably not able to expand their high elevation horticultural knowledge into the area. The Fremont seem to have possessed no such knowledge since their major village areas are located below 7,000 feet and center around permanent streams and/or in valleys (Aikens 1966, 1967; Ambler 1966; Green 1961; Marwitt 1968; Morss 1931; Sharrock and Marwitt 1967). On the other hand, ecological factors such as temperature, etc., may have been prohibitive to horticulture in just the 50 miles difference between the Abajo's and the LaSal's. Whatever the reason, it is so far evident that no permanent dwellings were erected above 7,000 feet on the LaSal's and, therefore, presumably no horticulture of the kind requiring rather constant tending was practiced at these elevations.

Based on the above assumption, the archeological focus of the project as herein reported is centered on the investigation of what are thought to be hunting and gathering sites.

ENVIRONMENT

Geology

The Colorado Plateau is penetrated by 15 laccolithic mountain groups which upthrust through late Paleozoic and Mesozoic sedimentary rocks during the Tertiary. The LaSal Mountains are composed of three of these laccolithic formations: North Mountain, Middle Mountain, and South Mountain. Each group is distinct, both topographically and geologically. Our concern here will be with Middle and South Mountains since the archeological survey was conducted on the western flanks of these intrusives. Each mountain forms a dome which is attributed to the physical injection of a stock from which a number of laccoliths radiate. The laccoliths are mostly diorite porphyry which is often exposed at the higher elevations and may be found in stream beds many miles from the mountains. Peak elevations range well over 12,000 feet, and passes separating the major mountain areas range to 10,000 feet (Hunt 1958).

As the stocks thrust upward, they upwarped Jurassic and Cretaceous rocks. The lower Jurassic beds were pushed up past the Cretaceous along the stock margins and were exposed at higher elevations. Of particular importance archeologically was the exposure of the Morrison formation which contains black, gray, red, and white chert. All were used for the manufacture of tools, especially the white chert which is abundant. Hunt (1958) reports for Middle Mountain a black chert pebble conglomerate and a lenticular limestone which contains the red and white chert in nodules and veins. A few archeological sites are located on the Morrison formation, although most are found in areas underlain by Cretaceous sandstones.

The upwarping resulted in a decided tilting of the Jurassic and Cretaceous beds from east to west along the western flanks of the mountains, forming a steep sloping bench at elevations between 7,000 and 8,000 feet. Except for minor saddles and canyons, the area has a decided west to southwest exposure. The bench area has few permanent streams, although springs are fairly common especially at the Jurassic-Cretaceous seam where the underlying upper Morrison member is a firmly cemented sandstone less aquiferous than the overlying Cretaceous sandstones which include the poorly cemented Ferron member.

The springs are exposed in canyons which cut the bench area to reveal the underlying Morrison, thus exposing the chert-bearing limestone member along the canyon sides as well as along the margins of the stocks. Quarry sites, therefore, should be located either in the canyons where the chert is exposed or at elevations usually above 8,000 feet where the Morrison is exposed along the stock margins. Site 4-10-4-24 is such a quarry site. The only one discovered, it is located near Pack Creek in the Morrison formation where a white chert-bearing limestone is exposed. Since other survey areas were located for the most part on Cretaceous sandstone benches, additional quarry sites were not found. However, a systematic survey of the exposed limestone member of the Morrison along canyons and stock margins would undoubtedly turn up many quarry sites given the abundance of chert tools and waste scattered over the bench areas.

Soils

Benchland soils are of quaternary origin with Cretaceous sandstone and shales forming the parent material. The soils range in depth from shallow to moderately deep and have gravelly loam textures with lime accumulations in the subsoil (Ronald Tew, personal communication). In the canyon bottoms, diorite from the laccoliths mixes with the Cretaceous sandstones and shales forming alluvial soils along the canyon bottoms. These soils tend to be highly gravelly due to the presence of the dioritic porpherys. In some areas where the Morrison formation is exposed, the soils formed by this member support very little plant life.

Climate

The LaSal Mountain pediments can be characterized as semi-arid. Annual precipitation averages between 12 and 15 inches per year (Stoddart 1946, Figs. 4,5) with the majority falling as winter snow. Summer storms are usually violent and may cause flash flooding in the canyons below. Mean maximum and minimum January temperatures are 35° to 10°. For July, the mean temperatures are 84° maximum and 54° minimum. The frost-free season is about 90 days from approximately July 9 to September 7. For fuller details, see Hydrologic Atlas of Utah (1968).

Flora

Present-day plant resources in the survey area are those normally associated with a pinyon-juniper dominated Upper Sonoran life zone. No paleoecological data is available to us for determining whether or not substantial change has occurred in the plant environment since the archeological sites were occupied. It is, of course, possible that the Canadian life zone, which now begins just above 8,000 feet, was lower in the past and covered the southwestern benches when the sites were occupied. However, the shallow quaternary soils with their high gravelly content and limey subsoils probably would not have supported the richer Canadian zone vegetation. We shall, for the purposes of this report, therefore, assume that the area was much like it is today except that grasses and forbs would have been more abundant in the past before grazing was introduced.

Utilization of plants from the Upper Sonoran life zone by aboriginal peoples was certainly multiple faceted although food was undoubtedly most important. However, tools must also have been manufactured from plants as well as medicines gathered, and probably plants with ceremonial significance also used. Plants also furnished important forage for game animals hunted in the region.

Fauna

Animal resources available to aboriginal populations probably included deer and rabbit as favored food along with various of the Rodentia (ground squirrels, chipmunks, mice). Bighorn sheep may also have occupied some of the cliff and rimrock areas. Also, various insects and grubs could have been utilized, either as preferred food or during hard times.

PROBLEM

Theory

A major theoretical approach to the understanding of human behavior is called cultural ecology by archeologists. Green (1969) has defined cultural ecology as ". . . the interplay of the cultural and natural environments and their effects on human behavior." This concern by archeologists over the relationships of man to his environment is a direct result of the fact that so much of archeological data is directly or indirectly relatable to the physical environment of man. This is not to say that archeologists have no interest in man as a social being. On the contrary, recent currents in archeological thinking have been specifically oriented in that direction as the works of Binford (1970), Brown (1971), Deetz (1965), Hill (1970), and Longacre (1970) clearly show. However, trends in the direction of elucidating social organization have been, for the most part, tied to cultural ecology as anthropologists have realized the important influences which environment has had on the way many, if not all, social activities are carried out. See especially Forde (1934), Manners (1959), Sahlins (1958), Sanders (1962), and Steward (1936), among others. Archeologists do not usually argue an environmental determinist position a la Huntington (1959), but rather espouse the notion that human social institutions are affected in some ways by ecological factors. Study of these relationships, therefore, has become a significant theoretical position within archeology.

Archeological data consists of any fact which will help the archeologist test generalizations about human behavior in the past. In concrete terms, this usually turns out to be items of information related to artifacts which are, of course, the products of human behavior. However, facts from the physical environment may also be important items of archeological data and often result in clarifying or adding new dimensions to information gleaned from artifacts. Certainly, artifacts constitute the major reservoir of facts which an archeologist can use in interpreting human behavior, but other kinds of data should not be ignored. And this is especially true of data from the physical environment when the archeologist is concerned with subsistence behavior systems. On the other hand, artifacts may lend themselves to the clarification of data from the physical environment. Since most artifacts are manufactured from products provided by the physical environment, and since the majority

of artifacts used in subsistence behavior are intended to modify the physical environment, the interfacing of the artifacts with the physical environment is important.

Of the many cultural subsystems available for archeological investigation, we will be concerned in this study with subsistence behavior. The nature of the data gathered imposes certain parameters on which subsystems of subsistence behavior can be investigated. Archeological sites in the area surveyed did not appear to be horticulturally related sites. This is not to say that the peoples who occupied these sites may not, in some measure, have been horticulturalists. But, it is assumed that they were not practicing horticultural behaviors on the sites under study. Thus, the problem of this study is to elucidate behaviors associated with the hunting and gathering subsistence subsystem of prehistoric peoples occupying the southwestern bench areas of the LaSal Mountains in the Upper Sonoran life zone.

The above theoretical statement contains a number of assumptions implicit both in the statement and in the preceding discussion. An explicit statement of the assumptions follows:

Assumption 1: Human behavior is influenced by the physical environment.

Assumption 2: Artifacts carry information about the relationships between human behavior and the physical environment.

Assumption 3: Artifacts recovered by the site survey herein reported represent hunting and gathering behaviors.

Assumption 4: The Upper Sonoran life zone was the ecological niche being exploited by the peoples who deposited the artifacts.

In order for the hypothesis which follows to have any testable validity, the above assumptions must be accepted as true. The hypothesis itself will, of course, have additional assumptions as will the test statistics employed. However, the above represent the set of assumptions, which are not directly testable, necessary to the theoretical position taken for purposes of this study.

Hypothesis

Under the assumption (2 above) that artifacts are indicators of the behavioral patterns of a people, it should be possible to isolate sites where hunting and gathering subsistence activities took place. The artifacts recovered from such sites should consist of: tools used in the direct extraction of animal and vegetable products from the environment, tools used to manufacture other tools, waste products from tool manufacture, and waste products from tool maintenance. An hypothesis has been devised for examining the above proposition. The hypothesis will be tested through the formation of an explicit predictive model based on artifact classification, and that model will be compared with the field data. Arguments of relevance pertaining to the hypothesis, as well as the assumptions necessary for testing the hypothesis, are presented. The hypothesis is formulated in two parts: one to distinguish between hunting and gathering sites, and the second to distinguish between gathering sites which also emphasize tool maintenance.

The hypothesis states: Hunting sites can be differentiated from gathering sites primarily on the basis of site size and also on the basis of classes of artifacts recovered; gathering sites can be subdivided into gathering-tool manufacture and gathering-tool maintenance on the basis of artifact classes.

Following are the arguments of relevance in support of the hypothesis:

Argument 1: Congeries of artifacts reflect the uses to which tools are put and the kind of waste associated with that use.

Argument 2: Hunting camps (or kill sites) will contain few tools and little waste since hunters travel light.

Argument 3: Tools at hunting sites will be less specialized than tools at gathering sites.

Argument 4: Hunting sites will be less extensive in terms of numbers and kinds of artifacts distributed over the landscape, both because there are fewer artifacts and because the activities will center around the kill rather than around gathering activities.

Argument 5: Time is not a significant variable since hunting sites of one period will be more like hunting sites of another period than either will be like gathering sites.

Argument 6: Stylistic differences between artifacts of the same class are less important than functional differences between artifact classes.

The assumptive basis of the hypothesis includes the four theoretical assumptions listed above, the six arguments of relevance just iterated, and the assumptions of the statistical tests used. The latter will be specified below in the section on statistics.

TECHNIQUES

Field

The major concern on each site discovered during the survey was adequate sampling. Except for four sites, every artifact encountered on the surface was removed from every site. Sample bias for these sites, therefore, consists only of artifacts removed from the site through such activities as erosion or relic collecting and artifacts which remain under the soil. The sample on these 21 sites is as good as it is possible to get using surface survey techniques.

Of the four remaining sites, one (site 10) located at a spring has been highly disturbed by recent earth-moving activities associated with cattle grazing and a mining road. The small sample (20 artifacts) is considered to be too biased for this disturbed site to be used in testing the hypothesis. Another site (24) is clearly a quarry site and has no bearing on the hypothesis. The other two sites (11 and 18) are very large sites with numerous artifacts present. It was impossible to pick up every single artifact in the time allotted to our survey activities so a sample of these sites was taken. Our procedure was to select a transect through the site and pick up <u>every</u> artifact (tool, waste product) encountered. It is felt that such a procedure avoids any unconscious selection on the part of the surveyor and prevents the introduction of bias, especially that of selecting tools over waste. The samples taken from these two large sites are themselves large (297 artifacts from site 11 and 1,124 artifacts from site 18); and the sites, therefore, are included with the 21 already mentioned to bring the site sample used to test the hypothesis to 23.

The sample of sites themselves has a distinct bias introduced by the fact that the survey was conducted on lands designated for chaining. As already mentioned, only one quarry site was discovered. However, this is not critical to the hypothesis. Far more serious is the fact that we did not obtain site samples from nonchaining areas. In some cases, it is known that such sites exist as they were seen from the jeep roads leading to survey areas or were encountered when walking from one survey area to another. Since time was short and the primary concern was the chaining areas, such sites were not collected. Few sites were seen or recorded on steep side slopes or in narrow stream bottoms. Most were located on benchlands, along canyon rims, or in saddles between small hills. Despite the presumed bias thus introduced, the site sample is probably adequate for the hypothesis under test.

Laboratory

Sorting the artifacts into the various classes used in this analysis was done by intuitive visual inspection. Time considerations have unfortunately prevented a detailed attribute analysis which would have made at least the tool categories more meaningful. Waste artifacts have few attributes which result from human behavior, and their classification is thought to be quite adequate for purposes of this study. Our inability to predict, in some cases, how a particular tool class relates to our model (see below) is a direct result of the lack of detailed attribute analysis on tools.

METHODS

Classification

All artifacts from the 23 sites were placed in one of 18 classes under two broad categories: waste and tools. Waste products are those artifacts or debris which result either from the manufacture of a tool or from maintenance of a tool; i.e., sharpening, dulling, reshaping, etc. Tools are artifacts which show modification induced either through purposeful shaping (retouch) of the artifact or as a result of use. Names, definitions, and sorting criteria for each artifact class are given below.

Waste

Blocks--small, usually square or rectangular pieces of stone, some with rounded sides. These specimens do not have flakes removed, nor do they show any retouching or use marks.

Cores with heavy cortex--these specimens are characterized by surfaces with 30% or more of the cortex intact, but which also have flake scars.

Cores with light cortex--most or all of the surface area on these specimens is covered with flake scars, little cortex remains.

Flakes with heavy cortex--specimens with 50% or more of their surface area covered with cortex. These flakes have all been struck from the outside of the nodule by percussion.

Flakes, broken--small specimens which show breakage and usually use marks. They are too small to be considered tools, and most of them appear to have resulted from breakage off of utilized flakes.

Flakes with retouch scars--specimens which show pressure flaking scars usually on one side only. Most specimens are small and appear to result from maintenance activities which require reshaping of already retouched tools. Some could be the products of manufacturing processes if a tool was modified after some pressure flaking had already been done.

Flakes, general--any flake which did not readily fit into any of the above classes. Most appear to be debris from tool manufacture, struck from a nodule after the cortex was removed and are either too small or too ill formed to make good tools. This is the most abundant waste product found throughout the survey area.

Tools

Hammerstones--large core tools with rounded edges which show battering marks.

Choppers--large core tools with cutting edges usually formed by percussion flaking.

Projectile points--any bifacially retouched small piercing tool of a general triangular shape thought to have been used as the lead edge in a projectile. All specimens recovered appear to have been made from flakes.

Knives, retouched--bifacially retouched implements larger than projectiles whose primary function is thought to be cutting. They may have been hafted, but not necessarily so. Size and weight would rule out any use as a projectile, although they could have been hafted for thrusting.

Planes, scraper--large tools made from a cobble with at least one plane surface which is unmodified. The lead edge, however, shows use flakes removed on the surface perpendicular to the plane.

Gravers--tools with thin narrow points thought to have been used in scoring or engraving types of operations. The point is usually, but not always, formed through pressure retouch, and all are made on flakes.

Multiple tools--tools of any class found together on a single specimen. These are usually notches and scrapers, and all are made on flakes.

Scrapers, retouched--tools similar to planes (above) except that they are made on flakes, are therefore usually much smaller, and show pressure retouch along an edge perpendicular to a plane surface.

Blades--tools which have four parallel sides and are twice as long as they are wide. In this collection, they have been purposely struck from prepared cores in such a manner that the long sides produce very sharp edges. All specimens show use marks on these edges. Most of the blades have had both the proximal and distal ends either removed or broken in use.

Notches--tools with one or more notches present made on a flake. The notches are formed either by pressure flaking or through use. These tools are distinguished from flakes which have notched edges as accidents of manufacture. The latter edges show no wear or retouch.

Knives/scrapers on utilized flakes--tools thought to have been used in cutting and scraping operations analogous to those of the retouched knives and scrapers listed above. These specimens, however, lack any retouch for shape or edge modification. They are the most abundant tool found throughout the survey area.

The appendix lists the number and percentage of each of the above classes of artifacts by site.

Predictive Model

Taylor (1948) has pointed out that simply documenting the presence or absence of particular artifacts is inadequate to real understanding of past cultures. The absence of a particular tool at a site does not necessarily indicate that the site's occupants did not use that tool. Perhaps it was simply not recovered when the site was sampled. Furthermore, the presence of the same tool at two different sites does not necessarily indicate similar behavior patterns, particularly if many tools are found at one site and only one or two at the other. Assuming that tools are made to exploit some natural resource, a site which shows an abundance of one tool type may indicate the exploitation of different resources than another site, despite the fact that both contain the same classes of tools. Quantity, then, becomes an important consideration in any attempt at formulating a model for explaining behavior systems in past societies. Furthermore, when quantities of artifacts are available for analysis, statistical methods can be profitably employed to test assumptions about artifacts.

An examination of the appendix reveals that nine sites from our sample of 23 had fewer than 15 artifacts. Our hypothesis indicates that hunting sites should be low in terms of number of artifacts recovered. These sites, therefore, are candidates for hunting stations. However, because the artifact count is so low, statistical tests cannot be used with confidence. As a result, these smaller sites will be considered apart and dealt with on an intuitive basis in the "Conclusions" section. The predictive model will be formulated to deal with the remaining 14 sites, all of which have artifact samples of at least 25 specimens or more. The model will be set up to test the differences between gathering stations which may emphasize secondary activities such as tool manufacture or tool maintenance.

Differences between sites in terms of emphasis on tool manufacture and tool maintenance should be reflected both in the kinds of waste produced and in the kinds of tools present. Tool manufacturing sites, for example, should have higher percentages of: blocks, cores with a lot of cortex remaining, flakes with heavy cortex, and general waste flakes. They should also include such tools as hammerstones, gravers, multiple tools, and notches, all of which could be used to manufacture other tools. Sites which emphasize maintenance activities on the other hand should be higher in their percentages of: cores with little cortex, broken flakes, and flakes with retouch scars. Tools such as choppers, planes, scrapers, blades and knives which are more apt to be used in direct food processing should be more abundant on such sites. Projectile points should occur primarily on hunting sites, although broken specimens would be more typical of tool manufacturing areas than they would be of tool maintenance. This division of tool classes forms a model which can be statistically tested to verify whether indeed such a division is justified.

Statistics

Two statistics have been used to test the hypothesis: percentage frequency and cluster analysis. Percentage frequency is a descriptive statistic which is used to equalize the sampling differences between sites. Attempting to test the 14 sites with samples large enough for statistical treatment on the basis of artifacts counts would introduce intolerable bias since the site

samples vary from 26 to 1,124 artifacts. By computing the percentage of total site sample for each artifact class, all sites can then be placed on an equal basis before testing with an inductive statistic. The percentage figures are given in the appendix.

Actually, each site could be individually inspected against the model in order to see if its percentage frequencies were high or low for a given class of artifacts and then sorted into the two predicted activities if warranted. Such a procedure, however, is intuitive and the use of a decision-making or inductive statistic is preferred. Cluster analysis was chosen as the preferred statistic in this case because, with only a few (14) objects (sites) to be clustered, it could be done with economy. Furthermore, its assumptions are admissible and, in some cases, preferable for the kind of data being dealt with. The assumptions of the cluster statistic are four:

Assumption 1: Cluster formation occurs only within the context of the material under study.

Assumption 2: Attributes are equally weighted.

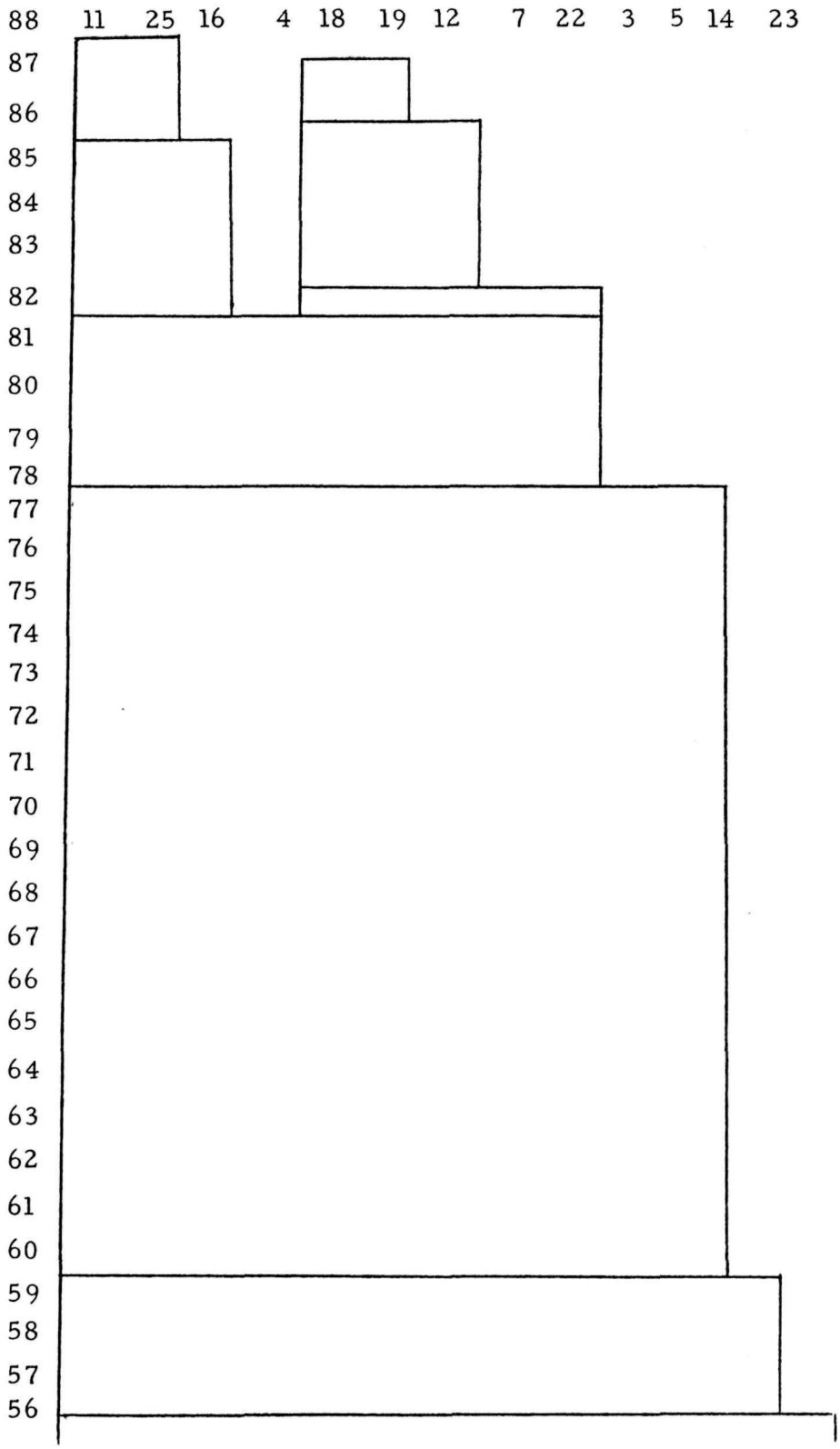
Assumption 3: All objects are eventually clustered.

Assumption 4: The grouping is hierarchical with larger groups subsuming smaller groups.

Cluster analysis is a statistical procedure for grouping like objects based on the mathematical relationship of every object being grouped with every other object being grouped. This mathematical measure is called a correlation coefficient, or C-value, and may be computed in a number of ways. In this case, the C-value for any two sites was found by subtracting the percentages of each artifact class, dividing by 18 (the number of artifact classes), and then subtracting the resultant value from one so that the sites which are most alike will have the highest C-value. When C-values for every mutual pair of the 14 sites have been calculated, it is then possible to arrange the sites into clusters or groups based on the C-value. Again, there are several ways of doing this, but a technique called average link has been employed here. Average link clustering adds members to a group on the basis of their affinity to the mathematical mean of all cluster members rather than on the basis of affinity with

a single member. Average link clustering, therefore, results in groups with closer affinity and tends to add individuals at lower C-values than does single link clustering. The results of the cluster analysis are given in Figure 1.

Figure 1
Cluster Analysis of 13 Sites from the Moab District



TEST OF HYPOTHESIS

Results of the cluster statistic show two major groups of three sites each (11, 25, 16; 18, 19, 12), two lesser groups of two sites each (7, 22; 3, 5), and three sites (4, 14, 23) which do not group well (Figure 1). If our hypothesis is correct, there should be noticeable differences between the artifact classes of the two major groups. Furthermore, these differences should be of the same order as those predicted by the model. In order to observe whether or not this is so, each of the two major groups has had the mathematical mean of each artifact class computed. The results are shown in Figure 2. Intuitively, it is now possible to examine Figure 2 and see if the predicted differences actually exist.

An examination of the waste products confirms the hypothesis except for the artifact class cores with light cortex. Site group 11-25-16 shows higher frequencies of broken and retouched flakes indicating an emphasis on tool maintenance. Site group 18-19-12 shows higher frequencies of all other waste products indicating more of an emphasis on tool manufacturing. That the 18-19-12 site group contains more cores of both classes is not really surprising; and, although it does not support the model as stated, few would argue that tool manufacturing sites should not produce more core specimens. In terms of waste products, then the distinction between tool maintenance and tool manufacturing is supported.

Turning to tools, a look at Figure 2 shows that the predictive model is not confirmed. This does not necessarily mean that the distinction between tool maintenance and tool manufacturing is spurious, however. It may simply be that our model is not a good predictor of this distinction when it comes to tools.

Figure 2. Percentage Comparison of Site Groups

Sites	Blocks	Cores with Heavy Cortex	Cores with Light Cortex	Flakes with Heavy Cortex	Flakes Broken	Flakes with Retouch Scars	Flakes General	Hammer-stones	Choppers	Projectile Points	Knives Retouched	Planes Scraper	Gravers	Multiple Tools	Scrapers Retouched	Blades	Notches	Knives/Scrapers on Utilized Flakes
11-16	1.63	.05	1.57	6.59	8.82	10.46	46.37	0	0	.85	.68	.11	0	.11	.22	3.83	1.56	17.11
18-12	4.79	.80	5.35	8.79	5.81	9.09	32.10	.03	.54	.09	1.06	.96	.06	.18	1.98	3.69	1.71	22.90
11-16	1.63	.05	1.57	6.59	8.82	10.46	46.37	0	0	.85	.68	.11	0	.11	.22	3.83	1.56	17.11
7-22	3.14	.58	2.67	11.22	6.54	8.70	20.04	0	0	0	1.36	.93	.58	.62	1.23	4.72	2.63	35.03
11-16	1.63	.05	1.57	6.59	8.82	10.46	46.37	0	0	.85	.68	.11	0	.11	.22	3.83	1.56	17.11
3-5	5.33	.73	0	13.41	12.38	4.12	27.14	0	0	0	0	0	0	0	0	6.33	1.92	28.62
18-12	4.79	.80	5.35	8.79	5.81	9.09	32.10	.03	.54	.09	1.06	.96	.06	.18	1.98	3.69	1.71	22.90
7-22	3.14	.56	2.67	11.22	6.54	8.70	20.04	0	0	0	1.36	.93	.58	.62	1.23	4.72	2.63	35.03
18-12	4.79	.80	5.35	8.79	5.81	9.09	32.10	.03	.54	.09	1.06	.96	.06	.18	1.98	3.69	1.71	22.90
3-5	5.33	.73	0	13.41	12.38	4.12	27.14	0	0	0	0	0	0	0	0	6.33	1.92	28.62
7-22	3.14	.56	2.67	11.22	6.54	8.70	20.04	0	0	0	1.36	.93	.58	.62	1.23	4.72	2.63	35.03
3-5	5.33	.73	0	13.41	12.38	4.12	27.14	0	0	0	0	0	0	0	0	6.33	1.92	28.62

21

CONCLUSIONS

Site size is not a totally adequate indicator of hunting vs. gathering activities among prehistoric peoples. While it is clear that larger sites of the kind discovered in this survey were gathering and tool working stations, the smaller sites may have been used either for hunting activities or for gathering, perhaps as an overnight camp for gatherers moving to a major food source area. If the problem is to be solved, at least two things must be done. First, a larger sample of the small sites needs to be taken. Second, more detail must be devoted to attribute analysis of the tools recovered. It may also help to correlate ecological data.

Distinguishing gathering sites which emphasize tool maintenance from tool manufacture is well confirmed on the basis of the kinds of waste products produced. More study, however, is needed of the tool attributes in order that tools themselves can be better identified as to use. Once such steps have been taken, a better picture of the way in which prehistoric peoples used their environment can be painted.

PART II: MANAGEMENT CONSIDERATIONS

INTRODUCTION

During the fall of 1972, five days were spent in a preliminary field reconnaissance to assess the possible impacts on archeological resources of proposed pinyon-juniper treatment of the Dorry, Amasa Back, and Slaughter Flats areas of the Moab Ranger District.

The survey area is located on the western flanks of the LaSal Mountains at elevations between 7,000 and 8,000 feet. The area consists primarily of benchlands covered with pinyon-juniper forest and open sage and brushlands. Previous archeology in the area consisted of an earlier survey by Alice Hunt conducted from 1949-1952 and reported in the Anthropological Papers of the University of Utah Number 14. Examination of Mrs. Hunt's report reveals no evidence that she worked directly in the proposed treatment areas, although she has reported sites in nearby Pack Creek.

Archeologically, the proposed treatment area is characterized by lithic sites which lack structures. Sites with thousands of artifacts scattered over large areas and small sites with a few concentrated artifacts were discovered in the preliminary reconnaissance. No test pitting was done; therefore, it is indeterminate whether any sites extend below the ground surface or whether there is any stratigraphy present on sites in the area. There was some variability in site density and size between treatment areas. In the Dorry area, only a single site was discovered in treatment blocks, but followup intensive survey will probably reveal more sites. Amasa Back had a number of small sites in all treatment blocks. The largest sites were discovered in the Slaughter Flats area, particularly on the north end. Based on the preliminary reconnaissance, it is safe to predict that an intensive survey would reveal many more sites than are presently reported. However, it is doubtful that any sites containing prehistoric structures will be found.

The scientific value of sites in the treatment areas is considerable. The LaSal Mountains are surrounded archeologically by a prehistoric semi-horticultural population. At least two cultural traditions were present in the past: Anasazi and Fremont. These cultural traditions seem to have met around the LaSal Mountains and the area;

therefore, it is important as a prehistoric laboratory for the study of culture contact. Archeological sites in the survey area seem to have been exclusively non-horticultural stations where people were involved in such activities as hunting, gathering, tool manufacturing, etc. Such sites could have been occupied by peoples devoted almost exclusively to hunting and gathering subsistence; to peoples who were horticulturalists but used the area to supplement horticultural subsistence with hunting and gathering; or by peoples with both kinds of economic systems. Also, any combination of the above could have occurred through different periods of time in the past. Regardless of which interpretation is preferred, hunting and gathering formed an important part of the economic behavior of the peoples occupying the sites. Furthermore, the particular ecology exploited was devoted only to hunting and gathering. In this respect, the area is also unique to southeastern Utah since at similar elevations on the southern slopes of the Abajo's, there is accumulating evidence that horticulture was practiced in prehistoric times. The LaSal Mountain flanks, therefore, offer unparalleled opportunities to study a hunting and gathering economic system in a relatively pure context, but one which is surrounded by horticultural activity. This, together with culture contact studies and general problems in culture ecology, give the area unique and important scientific value.

Archeology as a discipline has as its goal the understanding of past human behavior. Such understanding may be put to a number of uses including: (1) deriving laws of human behavior based on a scientific analysis of past human behavior; (2) elucidating culture history; and (3) providing general public education about the above through classroom, museum, and other interpretive programs. Because the data from which archeologists work is fragile, non-renewable, and limited, any activity which harms that data base may severely limit the accomplishment of archeological goals.

At any archeological site, the data base consists primarily of two things: artifacts and natural conditions. Artifacts are any products of human behavior and include everything from arrowheads to house structures. Natural conditions include any item from the natural environment which provides data for helping the archeologist understand past human behavior. Such items may be anything from the location of water resources to the fossil pollen recovered from the floor of a house.

Usually artifacts provide the bulk of the data base for an archeologist and they also, of course, represent direct behavioral acts of human beings. The behavioral acts, themselves, can be divided into two categories: factual acts and inferred acts. As reflected in artifacts, the factual acts are three: attributes, locus, and quantity. Attributes are defined as the chemical-physical properties of the artifact which have undergone direct modification by human beings. For example, a triangular stone object measures three centimeters in length. Locus refers to the position of the artifact relative to all other artifacts or natural conditions, and quantity is the number of artifacts found. Why these facts are important and their relationship to inferred acts is illustrated by the following hypothetical example.

Inferred acts may be many depending on what the factual acts in concert with natural conditions suggest. For example, our triangular stone object referred to above might be called an "arrowhead," inferring a behavior of shooting with a bow. However, if the physical properties (size, weight) of the object suggest that it is too large to have been shot effectively from a bow, then perhaps a different inference is in order; i.e., it was a ceremonial point not intended to be shot, or it was a dart point for use with a spear thrower, or it was hafted to a lance for thrusting. Here locus may become important. If found near a spring, it may have been used with a spear thrower to hunt game. If found in a grave with other goods, it may indicate ceremonial use, or perhaps that the individual's hunting equipment has been buried with him. Now quantity helps the inferential process. If many highly similar projectiles have been found in various loci, especially hunting type environments, then our artifact may just have accompanied its hunting master to the happy hunting ground. But, if the projectile is exotic, if it is the only one found or there are only a few all found in burial contexts, then perhaps it was specially manufactured for ceremonial purposes, perhaps funerary.

It is obvious from the above illustration that any activity which changes the attributes, loci, or numbers of artifacts will change either the factual or inferrential, or both, basis for understanding the past. Any considerations, therefore, of potential conflicts between resources must consider how such conflicts will affect the attributes, loci, and numbers of artifacts given that the artifacts, themselves, are fragile, nonrenewable, and limited.

POTENTIAL CONFLICTS

It is obvious that surface disturbance by tractors and chains on a revegetation project might appreciably change the attributes, loci, and numbers of artifacts. However, the degree of change and whether or not such change matters archeologically is affected by a number of variables. Let us consider each artifact area in turn.

Artifact Attributes

On lithic sites, neither tractors nor chains would change the chemical properties of an artifact. Its physical properties, however, could be altered through breakage or through abrasive action if the artifact were dragged far enough against an abrasive agent.

A number of other variables should be considered. Walking a tractor over lithic artifacts which rest on soft or damp ground may only result in pushing them into the earth and do no damage whatsoever. If the ground is very hard or frozen, breakage may occur. Another consideration would be artifact density and size. If the site has a high artifact population, artifacts might be violently thrown against each other resulting in breakage. This could also happen on sites where artifacts were mixed with non-artifactual material, especially stone, but also tree trunks, etc. Even temperature might affect the process if cold made the artifacts more brittle and thus more apt to break. As there is no factual data on what actually happens to surface lithic artifacts under these conditions, it is not possible at this point to evaluate the conflicts; we can only point out that they may or may not be present depending on conditions.

Artifact Locus

It is immediately apparent that movement of tractors and chains over a site will result in movement of artifacts. However, such movement is only a conflict if it results in the loss of information about human behavior. If, for example, the site has already undergone a great deal of erosion prior to equipment encroachment, then further displacement need not result in any information loss since the artifacts are already out of a cultural meaningful context. Furthermore, on very small sites where only a single behavior pattern is

involved (butchering a kill for example), the disposition of the few artifacts involved relative to each other is probably of little importance, although their relationships to the natural conditions and other sites are extremely important. Thus, such a site could suffer mild movement without undue harm. Any movement, however, which resulted in scattering the artifacts to positions where they could not be interpreted as belonging to the same behavioral pattern would be intolerable. Slope of the ground on which the site occurs is an obviously important variable in this regard. Again, no studies have been done which allow for judgments on these matters.

Artifact Numbers

Conflicts in this area would arise only as a result of not controlling conflicts in artifact attributes and locus. If artifacts are broken, they may be listed as two or more specimens rather than one. If artifacts are removed from the site by displacement artificially creating a new site, or if two sites are merged into one by dragging artifacts into areas previously unoccupied, then the quantitative measures would be intolerably altered. As with the above areas, no controlled studies allow us to form a judgment of the probability of such things occurring.

Other Conflicts

Conflicts may also occur by changing natural conditions which contribute to archeological understanding. For example, covering a source of lithic material, exposing a source of lithic material which may be misinterpreted as having been available in the past, or other such processes. More serious, especially at gathering sites, may be vegetation changes. Predicting the degree to which any present environment duplicates past environments is difficult at best. Yet, such predictions are absolutely necessary for studies in cultural ecology. Revegetation changes may destroy the data base, or at least make such studies much more difficult.

MANAGEMENT ALTERNATIVES

This section will concern itself not only with the impacts of archeology on chaining management, but with the impacts of chaining on archeological management.

Chaining Management

There are a number of alternatives open to managers of chaining projects, and these include:

1. Ignore the archeology. This alternative is legally unacceptable and, in any case, irrelevant so far as the Moab District is concerned since archeological investigations have already begun.

2. Preliminary reconnaissance. This step is self evident from this document. The results of the reconnaissance indicate:

a. Archeological resources are present.

b. The archeology has high scientific value.

c. The probability is very low that any of the sites should be considered for the National Register of Historic Places.

d. Chaining is apt to result in intolerable conflicts with the archeological resources unless such resources are preserved or salvaged prior to chaining.

e. Intensive survey will be necessary to determine and record all site locations.

f. A few small chaining blocks have no archeological resources and constitute no conflict.

g. A few areas within blocks have already had the sites salvaged as part of the preliminary reconnaissance. However, since there is a time lag between preliminary reconnaissance and chaining, which includes an erosion period, some rechecking

will be necessary in order to determine if artifacts are still present on inventoried sites. This can be accomplished in connection with intensive survey.

h. Testing of selected sites will be necessary in order to determine if any depth or stratigraphy is present and whether or not this will cause conflict through uprooting and other soil disturbance.

3. Intensive survey and testing. This step would locate all archeological values in the chaining blocks and accomplish "h" above. As normally practiced, intensive survey includes sampling the artifact content from a site. In the case of small sites such a procedure would remove the site and eliminate chaining conflict at that point. In the case of large sites, the survey team could be instructed to remove all surface material which would also remove the site from any conflict, provided there was no subsurface occupation. Or the survey team could take a sample from the site and a determination made later whether to return and salvage the site or exclude it from the chaining block.

4. Intensive survey and testing could be conducted either by a Forest Service team headed by a qualified archeologist or under contract to an appropriate university. Variables affecting this choice would include:

a. Training. Initially, student archeologists from a university would operate more efficiently. However, a Forest Service crew could be trained (in two to three days) to handle efficiently the type of survey required on the Moab District.

b. Duration. A university would probably finish the project in fewer man-days than the Forest Service because they are not bound by overtime and civil service regulations.

c. Artifact loss. Archeology students generally view artifacts as data rather than as having any intrinsic value, thus exotic or well-made specimens are more apt to appear in the official collections than in private collections.

d. Laboratory analysis. Field work must be followed by proper laboratory analysis in order to evaluate the archeological results and prepare the technical report. Presently and in the near future, this can be better handled by a university due to personnel shortages in the Regional Archeological Laboratory.

e. Technical report. If the survey is handled by the Forest Service, the report would have to be prepared by the Forest Service Archeologist. If handled through a university, the report could be prepared by a graduate student as a major paper or thesis under the direction of a qualified archeologist at less cost.

5. Our inability to predict direct results of chaining on artifact attributes, locus, and numbers argues for the need for a scientific study of this matter. The Moab District is ideal for such a study, and full consideration should be given to its implementation. In this case, Forest Service archeologists probably should be used on a team with a range conservationist. The study could be run as a part of the project itself.

Archeological Management

Archeologists are interested in the preservation of data because without such preservation they have no way of understanding past human behavior. Preservation, however, does not necessarily mean leaving the archeological site in or on the ground. In some cases, preservation clearly means removing the site to the laboratory; and failure to do so will result in a complete or nearly complete loss of data. Such conditions exist where extreme natural surface erosion is going on, where human activity in the form of surface relic collecting and/or digging occurs, and where sites are disturbed through chaining, road building, and similar type activities. In southeastern Utah, archeologists are well aware that the human collector and digger is far and away the most destructive agent presently acting on archeological sites.

So long as chaining requires that archeological data must be gathered before the chaining can proceed, then chaining constitutes a positive benefit to the management of archeological resources. In fact, such a statement could be made for any resource management effort. And such a statement will remain true so long as human impacts from relic collecting and pot hunting continue as the single most destructive force on archeological sites.

REFERENCES

Aikens, C. Melvin

1966 Fremont-promontory-plains relationships. Anthropological Papers Number 82. Department of Anthropology, University of Utah.

1967 Excavations at Snake Rock village and the Bear River No. 2 site. Anthropological Papers Number 87. Department of Anthropology, University of Utah.

Ambler, Richard J.

1966 Caldwell Village. Anthropological Papers Number 84. Department of Anthropology, University of Utah.

Binford, Lewis R., Sally R. Binford, Robert Whallon, and Margaret Ann Hardin

1970 Archaeology at Hatchery West. Society for American Archaeology, Memoir 24.

Brown, James A. (editor)

1971 Approaches to the social dimensions of mortuary practices. Society for American Archaeology, Memoir 25.

Deetz, James

1965 The dynamics of styalistic change in Arikara ceramics. Illinois Studies in Anthropology Number 4. University of Illinois Press, Urbana.

Forde, C. Daryll

1934 Habitat, economy, and society. London, Methuen and Co.

Forest Service

1937 Range plant handbook. United States Department of Agriculture, Government Printing Office, Washington, D. C.

Green, Dee F.

1961 Archaeological investigations at the G. M. Hinckley farm site, Utah County, Utah 1956-1960. Brigham Young University, Provo.

1969 Reading in cultural ecology. Selected Academic Readings, New York.

1971 The Elk Ridge archeological project Manti-LaSal National Forest: summary of the 1971 field season. United States Department of Agriculture, Forest Service, Intermountain Region, Ogden.

Hill, James N.

1970 Broken K. Pueblo: prehistoric social organization in the American southwest. Anthropological Papers of the University of Arizona Number 18. University of Arizona Press, Tucson.

Hunt, Alice

1953 Archeological survey of the LaSal Mountain area, Utah. Anthropological Papers Number 14. Department of Anthropology, University of Utah.

Hunt, Charles B.

1958 Structural igneous geology of the LaSal Mountains, Utah. Geological survey professional paper 294-I. United States Government Printing Office, Washington.

Huntington, Ellsworth

1959 Mainsprings of civilization. Mentor Books, New York.

Jennings, Jesse D.

1966 Glen Canyon: a summary. Anthropological Papers Number 81. Department of Anthropology, University of Utah.

Longacre, William A.

1970 Archaeology as anthropology: a case study. Anthropological Papers of the University of Arizona Number 17. University of Arizona Press, Tucson.

Manners, Robert A.
1959 Habitat, technology and social organization of the southern Paiute. America Indigena 19(3):179-191.

Marwitt, John P.
1968 Pharo Village. Anthropological Papers Number 91. Department of Anthropology, University of Utah.

Morss, Noel
1931 The ancient culture of the Fremont River in Utah. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University. Cambridge.

Sahlins, Marshall
1958 Social stratification in Polynesia. University of Washington Press, Seattle.

Sanders, William T.
1962 Cultural ecology of nuclear Mesoamerica. American Anthropologist 64(1):34-44.

Sharrock, Floyd W., and John P. Marwitt
1967 Excavations at Nephi, Utah, 1965-1966. Anthropological Papers Number 88. Department of Anthropology, University of Utah.

Steward, Julian
1936 The economic and social basis of primitive bands. Essays in Honor of A. L. Kroeber. University of California Press, Berkeley.

Stoddart, L. A.
1946 Seeding arid ranges to grass. Agricultural Experiment Station, Circular 122. Utah State Agricultural College, Logan.

Taylor, Walter W.
1948 A study of archaeology. American Anthropological Association Memoir 69.

APPENDIX: SUMMARY OF ARTIFACTS RECOVERED BY CLASS

	Blocks		Cores with Heavy Cortex		Cores with Light Cortex		Flakes with Heavy Cortex		Flakes Broken		Flakes with Retouch Scars		Flakes General		Hammer-stones		Choppers		Projectile Points		Knives Retouched		Planes, Scraper		Gravers		Multiple Tools		Scrapers, Retouched		Blades		Notches		Knives/Scrapers on Utilized Flakes		All Specim Total
1	0		0		0		0		0		0		0		0		1	16.67	1	16.67	1	16.67	0		0		0		0		2	33.33	0		1	16.67	6
2	1	7.69	0		0		0		2	15.39	0		3	23.08	0		0		0		2	15.39	0		0		0		0		1	8.69	0		4	30.76	13
3	2	2.95	0		1	1.47	13	19.12	9	13.23	3	4.41	16	23.52	0		0		0		0		0		0		0		0		6	8.82	0		18	26.47	68
4	9	5.23	1	.58	0		21	12.20	10	5.82	24	13.96	60	34.89	0		0		0		1	.58	0		0		2	1.16	0		12	6.97	4	2.33	28	16.27	172
5	2	7.70	0		0		2	7.70	3	11.53	1	3.84	8	30.76	0		0		0		0		0		0		0		0		1	3.84	1	3.84	8	30.76	26
6	0		0		0		0		0		0		4	50.00	0		0		0		0		0		0		0		0		0		0		4	50.00	8
7	4	2.46	6	3.71	1	.61	17	10.50	8	4.93	15	9.25	35	21.61	0		0		0		0		3	1.85	1	.61	2	1.24	4	2.46	10	6.17	5	3.08	51	31.48	162
8	0		1	20.00	0		0		0		0		0		0		0		0		0		0		0		0		0		0		0		4	80.00	5
9	0		2	50.00	0		0		0		0		1	25.00	0		0		0		0		0		0		0		0		0		0		1	25.00	4
0	0		3	15.00	0		0		1	5.00	0		1	5.00	0		0		0		0		0		0		2	10.00	0		2	10.00	1	5.00	10	50.00	20
	5	1.68	5	1.68	0		22	7.40	21	7.07	37	12.45	123	41.41	0		0		4	1.34	2	.67	1	.33	0		1	.33	2	.67	11	3.70	8	2.69	55	18.51	297
2	5	2.42	9	4.40	4	1.95	21	10.25	11	5.36	18	8.78	72	35.12	0		0		0		1	.47	0		0		1	.47	2	.96	6	2.92	5	2.42	50	24.40	205
3	3	5.08	1	1.69	1	1.69	2	3.39	4	6.76	3	5.08	11	18.64	1	1.69	2	3.39	1	1.69	0		1	1.69	0		1	1.69	1	1.69	0		0		27	45.76	59

APPENDIX: SUMMARY OF ARTIFACTS RECOVERED BY CLASS

	Blocks		Cores with Heavy Cortex		Cores with Light Cortex		Flakes with Heavy Cortex		Flakes Broken		Flakes with Retouch Scars		Flakes General		Hammer-stones		Choppers		Projectile Points		Knives Retouched		Planes, Scraper		Gravers		Multiple Tools		Scrapers, Retouched		Blades		Notches		Knives/Scrapers on Utilized Flakes		All Spec Tot
14	1	3.12	1	3.12	0		5	15.62	4	12.50	3	9.37	1	3.12	0		0		0		0		0		0		0		2	6.25	2	6.25	2	6.25	11	34.37	32
15	0		0		0		0		0		1	16.66	1	16.66	0		1	16.66	0		0		1	16.66	0		0		0		0		0		2	33.33	6
16	5	.76	4	.61	1	.15	57	8.71	63	9.63	68	10.39	336	51.37	0		0		0		1	.15	0		0		0		0		19	2.90	5	.76	95	14.52	654
17	0		0		0		0		1	9.09	0		3	27.27	0		0		0		1	9.09	2	18.18	0		0		0		0		1	9.09	3	27.27	11
18	84	7.47	68	6.04	5	.45	93	8.27	60	5.34	107	9.52	372	33.10	1	.08	6	.53	3	.27	18	1.60	7	.62	2	.17	1	.08	18	1.60	41	3.65	18	1.60	220	19.57	1124
19	4	4.49	5	5.62	0		7	7.86	6	6.74	8	8.99	25	28.09	0		1	1.12	0		1	1.12	2	2.25	0		0		3	3.38	4	4.49	1	1.12	22	24.72	89
20	0		1	10.00	1	10.00	2	20.00	1	10.00	0		1	10.00	1	10.00	0		0		0		0		0		0		0		0		0		3	30.00	10
21	0		0		0		0		1	9.09	0		2	18.18	0		0		0		0		0		0		0		0		1	9.09	0		7	63.63	11
22	7	3.81	3	1.64	1	.55	22	11.95	15	8.15	15	8.15	34	18.47	0		0		0		5	2.71	0		1	.55	0		0		6	3.26	4	2.18	71	38.58	184
23	1	3.70	2	7.40	0		4	14.81	2	7.40	0		4	14.81	0		1	3.70	1	3.70	1	3.70	1	3.70	0		1	3.70	0		0		0		9	33.34	27
24	0		1	10.00	3	30.00	1	10.00	0		0		0		0		0		0		0		1	10.00	0		0		0		0		0		4	40.00	10
25	2	2.44	2	2.44	0		3	3.66	8	9.76	7	8.54	38	46.34	0		0		1	1.22	1	1.22	0		0		0		0		4	4.88	1	1.22	15	18.29	82