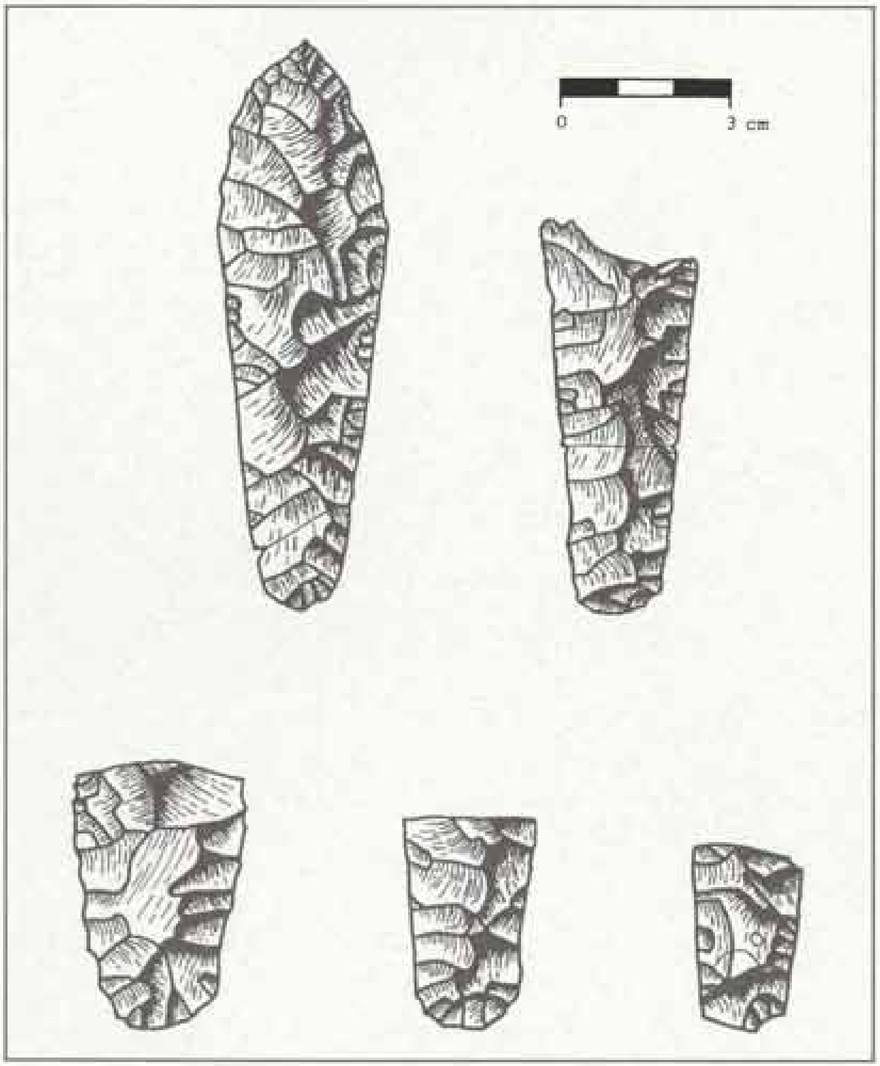
UTAH ARCHAEOLOGY 1993



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UTAH ARCHAEOLOGY 1993

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Editors: Kevin T. Jones, Utah Professional Archaeological Council
Robert B. Kohl, Utah Statewide Archaeological Society

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Front Cover: Haskett Points from the Running Antelope Site (see Russell this volume).
Inside: Rock art images by Julie Maurer

MESSAGE FROM THE EDITORS

Thank you for your patience. We know many of you have anxiously awaited the publication of this volume of *Utah Archaeology*. We hope its delay hasn't caused you any inconvenience. As you may know, we have faced some challenges since we started work on this edition, including making sure that the primary supporter of the publication, the Utah Statewide Archaeological Society, could continue its support without overspending its limited budget. With the help of a number of people, including Corinne Springer, Jill White, and Dave Clark, we have solved that problem and made sure that *Utah Archaeology* will be on sound financial footing for the coming years.

We have also had some technical difficulties in transferring the journal from BYU to the Division of State History, especially in keeping the format we have all become accustomed to. With the recent purchase of new computer equipment, and a tremendous amount of work and learning by Renae Weder, we are on track, and will be able to get back on schedule very quickly.

We think the contents of this volume illustrate why archaeology in Utah is so interesting and fun, from Simms' observations about consultation with American Indians, to O'Connell's article on ethnoarchaeology, to Fawcett's investigation of the effects of surface collecting, to Russell's discovery of a PaleoIndian site, to Stuart's report of an excavation by the Promontory-Tubaduka Chapter of USAS, there is plenty here to enjoy, to ponder, and to spur new thinking and further learning. We thank the many people who helped us in bringing this volume to press, including the authors, the officers of U.S.A.S. and U.P.A.C., the reviewers, Joel Janetski, Kathy Driggs, Dave Schmitt, Julie Maurer, and especially Renae Weder.

Kevin T. Jones, UPAC editor
Robert B. Kohl, USAS editor

THE PAST AS COMMODITY: CONSULTATION AND THE GREAT SALT LAKE SKELETONS

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ABSTRACT

Flooding of the Great Salt Lake exposed dozens of human remains beginning in 1987. A consultation process commenced to assess ownership, plan action, discuss scientific analyses, and seek state legislation for repatriation. This case study finds: consultation has no end, merely punctuations of decision; claimants to the past are myriad and dynamic; avocational and professional archaeologists must not be alienated from the process because without them more, not fewer Native American skeletons will be destroyed; relative to preservation, less value is placed on learning about the past, despite the fact that preservation has value only in light of potential knowledge to be gained; the most exciting analyses are those requiring modification of bone, and the most far-sighted stance is to stand up firmly for scientific study; burial vaults offer the best solution for curation, but unless costs are controlled, politicians will be unwilling to fund them.

INTRODUCTION

The past as commodity? But the past is done--over. Of course, archaeologists already know that the past has served power interests throughout history (e.g., Fowler 1987). In the power relations of the present, "ownership" of the past is relevant when speaking of human burial remains and an ever-expanding list of commodities pertaining to cultural patrimony. But what do we mean by ownership? Is this just another signal of a contemporary world willing to make a commodity out of anything the selfish interests of people lead them to "consume"? Larry Zimmerman makes the point that "Burial sites are not fixed locations, and they cannot be abandoned or disrupted. No individual or group can 'own' the remains of another person" (1988). In a philosophical and spiritual sense this is surely so. In a legalistic and regulatory sense however, ownership of the past has come of age. Bones, objects, and in some cases, perhaps even unpublished notes, photos, and maps are a potential commodity to virtually *anyone* who may become empowered by control over these things.

Of course, archaeologists know all this . . . don't we? Most archaeologists acknowledge that there are multiple legitimate interests in the past, but the profession seems torn by the irony of following what is often seen as the morally and politically correct route of giving primacy to native interests, while living with the knowledge that in doing so they may be sacrificing scientific and educational values pertinent to the common public good (cf. Goldstein and Kintigh 1990; Meighan 1992). Competition is the engine behind any resource monopoly. Thus, the process of making a commodity of the past requires the taking of sides, despite the rhetoric of compromise that accompanies the reburial issue. The fact that decisions about cultural patrimony are now in the arena of our judicial and governmental regulatory systems under the aegis of law ensures that sides must be chosen. Both of these systems, the regulatory -- and especially the judicial -- are at heart, adversarial.

In the absence of an ability to confront, much less solve these philosophical and social ironies, decisions about cultural patrimony are made via what has come to be called the "consultation process." This is the term given in a spirit of conciliation to moderate the vulgar aspects of making the past a commodity subject to power brokering for transitory benefit. Consultation is a pragmatic response to the uneasy reality glimpsed by the various "sides" in the reburial controversy.

I have been involved in a consultation process since the summer of 1988 involving a case of 85 human burials from 500 to 1,200 years old. The unfolding of that process is what I describe here. Perhaps the experience can flag characteristics of consultation, or support some observations of use to others as we encounter the full brunt of cultural patrimony in the near future.

My story begins with the well-documented transgression of the Great Salt Lake, Utah, to its

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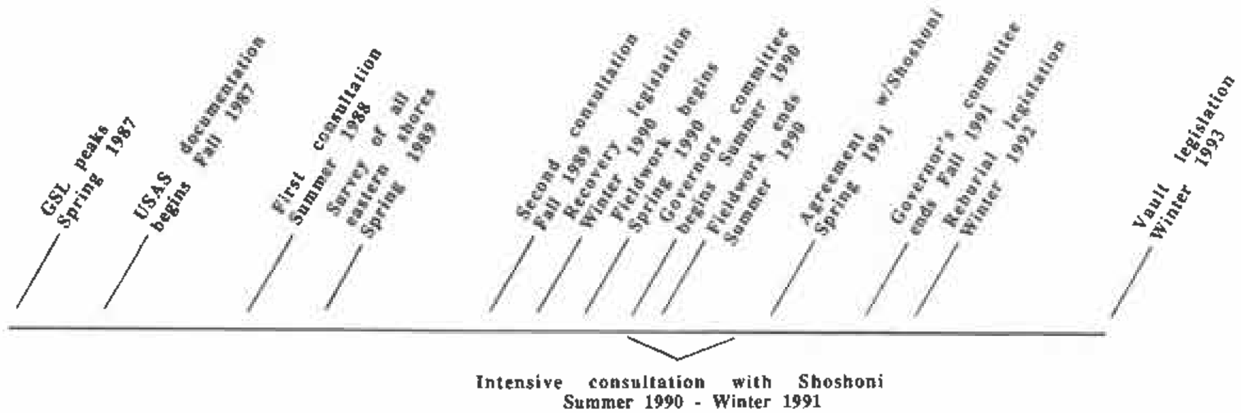

Figure 1. A time line for the consultation process in the case of the Great Salt Lake skeletons.

highest level in recorded history, reached in spring 1987. Since the gradient of the lake bed is shallow, vast tracts of what were once lush wetlands, ponds, and streams were inundated. During the Fremont period (A.D. 400–1350) and early in the subsequent Late Prehistoric period, wetlands along the eastern shores of the Great Salt Lake between the modern sites of Salt Lake City, Ogden and Brigham City were home to population densities perhaps as high as any region in prehistoric Utah. Over 500 archaeological sites were exposed by waves and ice-action during transgression and subsequent regression of the lake. Among these were human skeletons. Vandalism began immediately and the ground surface deflated up to half a meter, leaving lag deposits of artifacts and human bone (Simms et al. 1991; Fawcett and Simms 1993). Only a few members of the Utah Statewide Archaeological Society (USAS), local, non-Indian people who lived in the Ogden area, initially knew about the skeletons. Over many fall and winter weekends in 1987 and 1988, they walked the mud flats and documented locations, tried to rebury exposed human remains and lobbied for official action.

The first glimmer of a consultation process was seen in summer 1988, when the Utah Division of State History held a meeting in Salt Lake City among representatives of federal and state land managing agencies, archaeologists, and the Northwestern Band of the Shoshoni Nation, at the time officially based in Ft. Hall, Idaho. By the Spring of 1989 archaeologists were determining the impact to archaeological resources, especially burials, but no collections were made.

Subsequent consultation proceeded incrementally, in both time and in terms of those involved (Figure 1). This fact can raise problems (and costs) as you proceed, but largely results from differential access among potentially interested parties to knowledge about discoveries of human remains, whether they are found in the field or in museum collections. As word spreads and information about provenience and circumstance of recovery becomes known, additional players attach themselves to the consultation, or must be notified because they are seen as indispensable to a "level playing field" (Goldstein 1992). Given the taking of sides characteristic of the process, there will be enough divisiveness, contrast in perspective, and suspicion to go around without any extra baggage.

Knowledge of the Great Salt Lake skeletons was dependent on a grassroots effort, and without the avocational and professional archaeologists, the human remains would not have come to the attention of Native Americans, leaving the "resource" for other "users" of the past (vandals in this case). Thus, another contributor to successful consultation is the realization by all parties that no one interest group can operate without the others. This point is important because the complete exclusion of the non-Indian interests from a voice in the disposition of human remains will only promote the destruction of more, not fewer remains of Native American ancestors.

Decisive consultation began in November 1989, when another meeting in Salt Lake City included agencies, archaeologists, USAS, the Northwestern

Band, and the Ute Indian Tribe, the latter based in Ouray, in northeastern Utah. Again, notice the incremental character of consultation. In this meeting, the first order of business was to establish which Native American group, or groups, held an interest in the land in question. There is ethnohistoric evidence indicating that the area north of Salt Lake City was Shoshoni and land to the south was Ute. Both groups described how their people overlapped in this area, but the Utes representing the tribe at the meeting were satisfied it was a Shoshoni problem. I discovered several years later that this decision was not supported by a segment of Utes. This highlights the reality that consultation has no end, because an enormous number of players can claim an interest in the past.

Next, Shoshoni representatives were asked if the exposed remains should be left in place, or removed. If remains were exposed, how much should be visible to warrant removal? The two elderly men who had represented the Northwestern Band on various issues over the years as council and tribal members and who took deep interest in the problem were convinced that all visible bones and associated skeletons should be removed. After all, vandalism and erosion had been working on the remains for over a year and a half and photographs of human bone scattered across the landscape are compelling. Later this decision became controversial because as others attached themselves to the consultation process the decision was questioned, as was the status of the Shoshoni representatives in light of subsequent changes in tribal political leadership and in light of divided opinion among tribal members. Again, consultation was not really "over."

What then is the relationship between consultation and action? Consultation will always walk a fine line between timely action and adequate input, but in many cases, bones will not wait for the lengthy process common to the judicial system, the system of public land management, or exhaustive consultation. Consultation has no end, it is merely a process punctuated by decisions. Thus, it is not enough to focus exclusively on fairness, inclusiveness, or consensus. Natural forces and vandalism do not wait for such things and hard choices *must* be made.

Next came the problem of burial removal, not only raising the question of funding, but of the ultimate fate of the skeletons. All of the archaeologists affiliated with the process acknowledged that it was time Utah addressed the issue of cultural patrimony. Under pressure from Native Americans, and intentionally subtle support from archaeologists (few politicians are going to act on behalf of archaeologists *per se*), the Utah Legislature passed a bill (Senate Bill 214) in January 1990 funding removal of the exposed human remains.

Now consultation had entered the world of serious politics. There was an atmosphere at times during the legislative process that the problem must be encouraged to disappear. There were worries that the burials would be used to resuscitate old treaties regarding ownership of sovereign lands on the floor of the Great Salt Lake. It is important to point out that *scientific interests were virtually irrelevant at this stage of the process, despite the fact that the scientific value of cultural resources is already established by state and federal laws*. Indeed, a proposal was offered at one point to hire a construction firm to mechanically remove the skeletons and deposit them in a mass grave rather than using archaeologists. In a perverse sense, this is consistent with "sharing" the past by including the construction business.

Consistent with the low priority placed on learning about the past, the funding allocated was restricted to removal of the bones from the field and designation of a temporary curation site pending further consultation. Funding did not include any assessment of the context from which the burials came or study of the recovered material. I was the principal investigator managing this project and this was one of those instances in which my agreement to this incomplete solution hinged on the need for timely action since the bones had been exposed for nearly two years. Limited analysis was agreed upon through direct consultation between myself and the Shoshoni and this was subsequently volunteered by researchers or funded via limited, basic research channels. The lesson I learned from this is that advocates for scientific study are but one user of the past and cannot rely on the fact that *learning about the past has been the mandate for the establishment of most cultural resource legal and management apparatus in the United States*.

By summer of 1990, most of the burials were removed from the impact area, but without provision for any subsequent handling beyond temporary curation. At this point the consultation process became disconnected from state bureaucracy, lost continuity and became narrowly conceived. In retrospect, allowing this to happen was a mistake, but I remain torn, having to face the choice of seeking full resolution of all aspects of the issue back in 1990 prior to action vs. risking the loss of skeletons that all parties agreed needed to be moved immediately or lost. The former option would have been politically difficult, perhaps impossible. The latter choice was risky, but served the scientific values of the remains while attempting to be consistent with the ethic of preservation for reburial.

A farsighted aspect of the legislative bill provided funds for a Governor's Committee on Reburial to broaden the consultation process to a statewide level and advise on future legislation pertaining to reburial and cultural patrimony. At this stage consultation took two courses, overlapping at times, but with different goals. One was that of the Governor's Committee working toward future legislation, eventually passing in January 1992 (Senate Bill 128) which was similar to existing federal legislation. The other continued to address the case of the Great Salt Lake skeletons and seemed to fall to me since I had agreed to remove them. Consultation along these lines continued to broaden, but now involving debate *within* the Northwestern Band of the Shoshoni. Numerous phone conversations and trips to Idaho, as well as visits to the field sites enabled discussion with an ever changing quorum of tribal legal council, tribal council members, and tribal members. The geographically scattered settlement of the Shoshoni and large rural distances were a significant source of dynamism in the group composition during consultations and exemplify a common pattern among contemporary Native American populations. The slowly emerging process was able to inform the Shoshoni of the scientific value of the remains, *some* of which interested *some* of the participants. Discussions centered around descriptions of prehistory, the types of study, what can be learned, whether the bones should be reburied in a vault or in open ground, and where this should be. In turn, I learned of perspectives on time and the past, on government, and on archaeologists. I heard oral history from tribal members and learned of views on human remains and how these views are formulated. Positions on what should be done with the burials ranged from doing nothing, to burial in open ground, to burial in a vault, to support for study, to an angst expressed only as sorrow for the tragedy that had transpired.

About one year after removal of the bones from the field, in March 1991, an agreement was voted on by the tribal council of the Northwestern Band of the Shoshoni Nation (now based in Blackfoot, Idaho) that agreed to limited analyses, and stated a desire for a burial site agreeable to the Shoshoni, and preference for a burial vault. The latter enables limited future access to the remains via a defined process, with access ultimately determined by the tribe.

Discussions leading to this agreement also covered "destructive" analysis and a suite of these were agreed to using a single small bone or bone fragments from each individual (AMS/^{14}C, stable isotopes, DNA extraction). The term "destructive" is unfortunate since this refers to a growing class of studies that can be extremely constructive in determining what the past was like. Scientists would probably help their cause if the term was replaced with a less pejorative label—perhaps something like "direct analyses," or "substance analyses." While permission for the more psychologically palatable "nondestructive" analysis may seem easier to achieve, the unfortunate prospect is that many bones are going to be reinterred in the United States when new techniques in substance analysis are becoming capable of assisting the determination of ownership. This seems tragic given that determination of ownership is central to a just pursuit of the federal Native American Graves Protection and Repatriation Act (NAGPRA).

After a relatively quiescent interval, the consultation process was again punctuated in January 1993, when the efforts of the Shoshoni and two Utah legislators resulted in a bill (House Bill 368) funding a reburial vault at Pioneer Trail State Park in Salt Lake City. Implementation of the previously passed reburial laws also began and continues. Future study of the remains is not ruled out, but one caution can be offered. Cost control pertaining to vaults should be a paramount concern. Without it vaults may become politically infeasible in the future, despite their value in providing the last hope of achieving legitimate scientific study. In one sense this consultation can be touted as a success story involving the public, Native Americans, archaeologists, legislators, and public servants creating a shared past. On the other hand, there is a lesson that consultation *per se* cannot solve the philosophical and political dilemmas surrounding cultural patrimony and the pursuit of knowledge. Despite the central role given to consultation, without a firm stance on the philosophical issues, the scientific and educational values to the public will be given secondary consideration or none at all. Meanwhile, the term "consultation" is a seduction, rolls easily off the tongue, appears in many guises and can apply to any of the myriad claimants to the past. It is about territory, careers, demagoguery, and transitory power—a reflection of contemporary culture and a reminder that the past is only with us in the present.

ACKNOWLEDGMENTS

Thanks to Leonard Alex, Mae Perry, Frank Timbimboo, George Worley, Gloria Valdez, Susie Wright, Larry Neaman and many other members of the Northwestern Band of the Shoshoni Nation. Thanks also to Jack Ross, tribal legal council, Mark Stuart, Dann Russell, Jim Hartwell, Bill and Sarah Yates, Gary DeMastrie and other members of the Utah Statewide Archaeological Society; a large contingent of Utah State University students; David Madsen, Kevin Jones, and Wilson Martin of the Utah Division of State History; and Carol Loveland of Utah State University. A version of this paper was read at the Great Basin Anthropological Conference, October 1992, Boise, Idaho. The perceptions described here are of course, the responsibility of the author.

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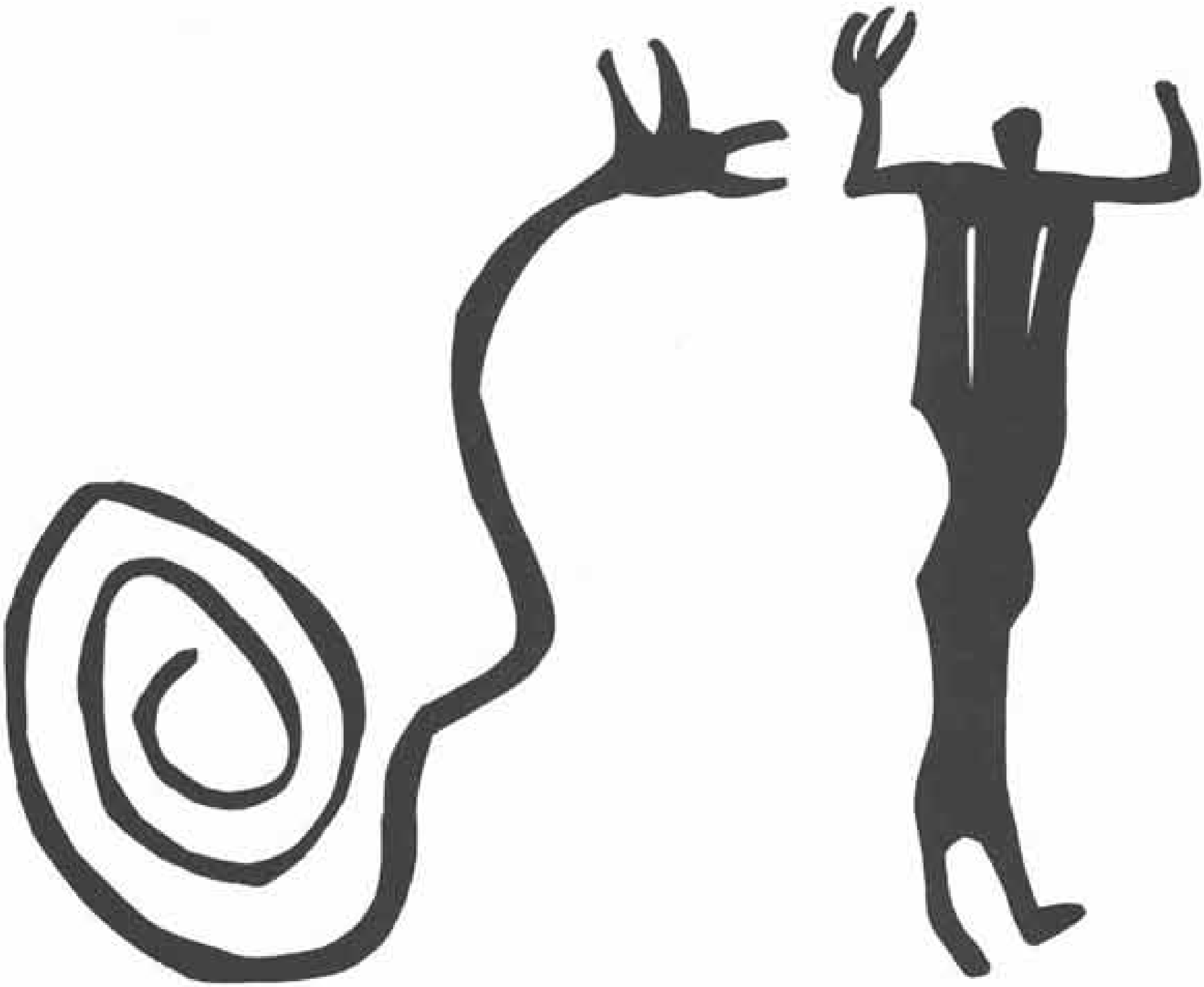

WHAT CAN GREAT BASIN ARCHAEOLOGISTS LEARN FROM THE STUDY OF SITE STRUCTURE? AN ETHNOARCHAEOLOGICAL PERSPECTIVE

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ABSTRACT

Prehistoric site structure is commonly seen as a promising source of information about past human behavior. Ethnoarchaeological studies indicate that research on site structure may require costly adjustments in conventional approaches to data recovery, with no commensurate increase in real knowledge except under narrowly defined circumstances, none of which are common in the Great Basin. Nevertheless, it should still be pursued whenever possible, partly to assess the validity of predictions based on ethnoarchaeological analogies, partly (and probably more importantly) as a means of controlling differences in assemblage composition related to the widespread practice of size sorting in secondary refuse disposal.

INTRODUCTION

Broadly speaking, the term "site structure" pertains to the horizontal distribution of artifacts, faunal and floral remains, hearths, structures, and other features deposited at about the same time within an archaeological site. Often, it is applied more narrowly to patterns in the distribution of refuse and features on well-defined "living surfaces" or "floors." Archaeologists began searching for these patterns as early as the 1920s. Standard elements of the work now include large-scale areal exposures and precise distribution maps (so-called "piece-plots") of features and debris, the latter often subjected to complex statistical analyses. Familiar examples are found in reports on Olduvai Gorge (Leakey 1971), Star Carr (Clark 1954), Pincevent (Leroi-Gourhan and Brezillon 1972), and the dry caves of Tehuacan (MacNeish et al. 1972). Aspects of the excavations at Gatecliff Shelter (Thomas 1983), Orbit Inn (Simms and Heath 1990), Nawthis Village (Metcalfe and Heath 1990), and the Diamond Valley complex (Zeier and Elston 1992) illustrate recent interest in the topic among Basin specialists.

Most research on site structure assumes the existence of a direct, fairly simple relationship between the nature and distribution of activities, the refuse they produce, and its distribution within sites. If this assumption is accurate, then it should be possible to reconstruct past activities from careful description and analysis of prehistoric site structure. In practice, this often turns out to be more difficult—and less rewarding—than one might expect. Archaeologists working on the problem often find themselves in the position of the apocryphal "TV-watching dog," captivated by the patterns they discover but not at all sure how to interpret them.

Ethnoarchaeological research provides a potential solution in that it enables one to observe human behavior and its archaeological reflection simultaneously. If consistent relationships between the two exist, then it should be possible to identify them in the living world, learn why they occur, and predict the range of circumstances under which they should be present. More precisely, given some well-supported expectations about past behavior, one should be able to make predictions about related patterns in prehistoric site structure. To the degree these predictions are met, confidence in one's understanding of the past may be increased. Even if they are falsified, one is at least more certain about what the past was *not* like.

Despite their potential utility, ethnoarchaeological investigations of site structure have so far produced mixed results. Many of the specific assumptions that once commonly guided archaeological research on the topic have been shown to be inaccurate; but beyond that there is no clear consensus among ethnoarchaeologists about what to expect regarding site structure in strictly archaeological contexts or about how to look for it. Nor is it obvious in many cases how patterns already discovered on ancient "floors" or "surfaces" might best be explained. This situation may (or may not) be improved by further ethnoarchaeological research.

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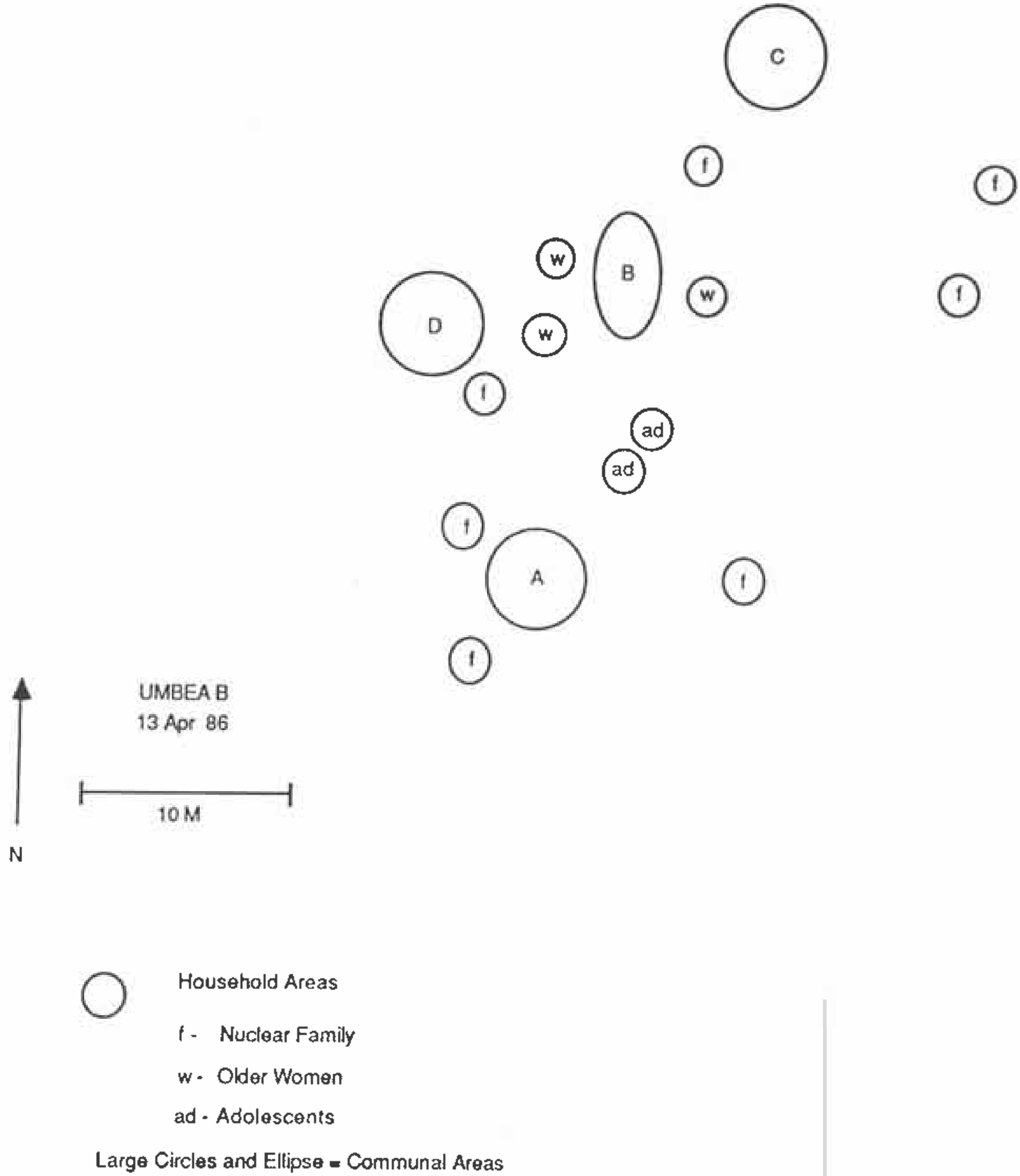

Figure 1. The distribution of household and communal activity areas at a Hadza residential site (Umbea B). Household compositions vary as indicated in the legend. Communal areas A and B were used by both men and women but in sexually segregated groups; C and D were used almost exclusively by men. The only special activity areas were defecation zones 20–30 m offsite, mainly to the northwest.

Pending such improvement, how should Great Basin archaeologists proceed? Should they spend more time and resources on the study of site structure; and if so, what precisely should they do? What questions can they address most productively, and how? Alternatively, should they see the current uncertainty among ethnoarchaeologists as a reason to avoid the study of site structure entirely, at least for the moment, and devote their attention to other aspects of the prehistoric record until guidelines for research on past site structure are better developed?

To answer these questions, I briefly review the history and current status of research on site structure, with special attention to aspects most likely to be of interest to Great Basin archaeologists, notably the nature of patterns likely to be encountered in local prehistoric sites and the scales at which they may be apparent. Four implications for local research follow, three for investigations of site structure, one—probably the most important—for assessments of assemblage composition. I then identify the kinds of research needed to pursue these implications and review some results of work already undertaken along these lines.

ETHNOARCHAEOLOGICAL RESEARCH ON SITE STRUCTURE

Ethnoarchaeological interest in site structure dates to the 1960s, and was provoked in part by the recognition of patterning in debris scatters on ancient land surfaces at sites like Star Carr and Olduvai. Investigators assumed that these patterns were "maps" of past human activity and interpreted them accordingly. Several assumptions were inherent in most treatments: (1) humans routinely divide sites into discrete, activity-specific areas; (2) each activity is associated with a distinctive set of artifacts; (3) artifacts in each set are discarded at their location of use along with other refuse generated by the activity; (4) proportions of artifacts discarded in connection with each activity are constant; (5) artifact frequency varies directly with the frequency of the associated activity.

Ethnoarchaeological research was undertaken partly as a means of testing these assumptions, and partly to broaden the basis for inference about ancient site structure. In the past 30 years, well over 100 studies have been reported (see O'Connell 1995 for review and recent references; also Gamble and Boismier 1991; Kroll and Price 1991; MacEachern et al. 1989 for critical commentary, case studies and comprehensive references to the pre-1988 literature). Most are concerned with residential sites occupied by hunter-gatherers and small-scale farmers. Societies in the Americas, Africa, and Australia are relatively well represented in the sample. Behavioral data on site use have been obtained from informant reports, direct observations, or both. Informant reports pertain to periods up to 30 years prior to the interviews. Direct observations cover spans ranging from a few hours to several months. Most have been informal and unstructured, but a few are more systematic, some involving periodic "scan samples" of all activities in progress at a site. Related archaeological observations are equally variable in kind and quality, ranging from general descriptions of individual sites to detailed piece-plots of all refuse items and features recovered at many locations. Analyses typically take behavior as a given and focus on its relationship with the resulting archaeology, especially with the size, form, and content of refuse concentrations and their relationship with household or task-group size and composition, duration of use, and nature of associated activities. Many treat these relationships in broad descriptive terms, but some involve comprehensive quantitative treatments. Only a few undertake cross-cultural comparisons.

SOME RESULTS OF RESEARCH PERTINENT TO THE GREAT BASIN

Many studies of hunters (e.g., Bartram et al. 1991; Binford 1983, 1986, 1987, 1991a; Fisher and Strickland 1989, 1991; Janes 1983; Jones 1993; O'Connell 1987; O'Connell et al. 1991; Yellen 1977) and, to some extent, those of small-scale farmers and pastoralists (e.g., Arnold 1990; Dodd 1993; Graham 1989; Hayden and Cannon 1983; Killion 1990; Siegal 1990; Simms 1988; Staski and Sutro 1991) suggest a common residential site plan, consisting of three types of activity areas: household, communal, and special (Figure 1). Household areas are used by nuclear families or sets of adolescents and/or older adults of the same sex (Figures 2–4). They witness a wide range of domestic activities, including food preparation and consumption, tool manufacture and maintenance, and sleep. They usually contain a main shelter and in some cases secondary structures, such as sunshades or meat drying racks. Hearths and sometimes roasting pits are commonly associated with household areas. Hearths are typically located in or at

Figure 2. Household areas at a Hadza residential site (Umbea D, September 1988). Each hut is occupied by a single household; each contains a hearth just inside the entrance. Refuse sometimes accumulates in small patches at the side of entrance, sometimes called "door dumps" (Binford 1983:165). The open, refuse-free zone in front of the huts is used by members of several households as a communal activity area. Left of center is a rock-lined hearth; right of center a simple meat drying rack. Plant material in the right foreground marks a secondary disposal zone.

the entrance to the main shelter, but are sometimes found elsewhere in the area as well.

Communal areas are used for the same range of activities as are household areas, but generally by members of several different households (Figure 5). Often they are segregated by sex. In some cases, household areas may play the additional role of communal activity areas in that they routinely witness activities involving people from other households, especially during the daylight hours. For example, Alyawara men from throughout a residential base typically congregate daily at a men's household; Alyawara and Hadza women often come together in a particular nuclear family area or at a women's household (see O'Connell 1987, O'Connell et al. 1991 for additional details). Communal areas located away from household areas are distinctive in that they usually contain hearths but not structures.

As the name suggests, special activity areas are restricted to the performance of particular activities, usually those that require exclusive use of space for long periods of time or space with characteristics unsuitable for the performance of other activities (Figure 6). Examples include pit roasting, food storage, hide preparation, bedrock seed or nut grinding, motor vehicle repair, and defecation.

Expression of this general pattern varies in several dimensions, the first involving the distribution of tasks within activity areas. Among "foragers" (*sensu* Binford 1980; e.g., Alyawara, !Kung, Ache, Efe), activities are relocated frequently as a function of changes in the physical and social conditions of performance, including shifts in light, shade, wind direction, and the number and identity of actors present. The cost of such relocation is usually low. Other groups, including both "collectors" (e.g., Nunamiut, Mackenzie Basin Dene) and farmers (e.g., Raramuri, Guarijio), are more consistent in the positioning of activities, probably because of increased investment in shelters and other facilities, greater

Figure 3. Household area at an Alyawara residential site (Bendaijerum, September 1974). Occupied by two adults, two children. Most of the activity area is covered by the shelter, apart from the small cleared space in foreground. Note hearth marked by white ash just inside the shelter entrance. Note also nearest neighboring household areas 20–30 m distant in right and left background, respectively. This structure had been in use less than a month when the photograph was taken.

Figure 4. Household area at an Alyawara residential site (Gurlanda C, September 1973). Occupied by three adults (one man, two women). Main shelter is the tarp-roofed brush windscreen at right. Note hearth area marked by white ash at left side of entrance. Further left is a flat-topped sun shade. Scatter of metal cans and other large objects at margin of cleared space (center and right foreground) marks secondary disposal zone. Dark stain in center foreground marks a small roasting pit.

Figure 5. Communal activity area at a Hadza residential site (Dubunghela, May 1986). This area is located at the margin of the site and is used by men from several different households. The man at left shapes a metal arrowhead on a rock anvil using a metal hammer; the man at top works on a wooden arrow shaft; man at right sews a leather bag. Others recline, watching.

Figure 6. Special activity area at an Alyawara residential site (Bendaijerum, 1975). Woman and child have placed two kangaroo in a roasting pit; woman adds the tails before covering the animals with coals and earth. The fire that produced the coals was kindled to the left of the pit; the scatter at the right marks coals and earth from previous cooking episodes. In the background left is a sunshade, background right a single family household area. Both areas have been cleared of rocks and swept clean of larger refuse items.

stability in physical circumstances (more consistency in the distribution of light and shade, less interference from wind or other elements), and higher costs associated with rearranging space.

It is often assumed that among hunters, households are independent or at least semi-independent economic units. This implies that household areas will be the main centers of activity within residential camps, and that they will be broadly similar in terms of spatial organization and the composition of associated refuse and feature assemblages. This is apparently so in many cases (e.g., Yellen 1977), but the Hadza show a surprisingly different pattern. Systematic quantitative observations indicate that at some camps, 85 percent of all refuse-producing activities are performed in daylight are carried out in communal areas, and less than 15 percent in household areas (O'Connell et al. 1991). The reason for this pattern and the apparent contrast with other groups is not clear, but its existence has obvious implications for variation in the spatial distribution of refuse at residential sites. The situation is further complicated by indications that more, and more varied, special activity areas may be found among collectors, farmers, and pastoralists.

Activity areas vary greatly in size within and between groups. At the extremes, individual Ache household areas in short-term forest camps are no more than 2 m in diameter while Alyawara household areas at long-occupied sites are up to 30 m (Figure 7). Variation in the size of communal and special activity areas is equally substantial. Among low latitude foragers, household area is determined in part by household size and duration of occupation. Interestingly, in the two best described groups, !Kung and Alyawara, household area increases with household size and span of occupation at about the same rates (O'Connell 1987:Figures 17 and 18). Why this should be so is not clear, although Binford (1983:144–192) has suggested that consistency in

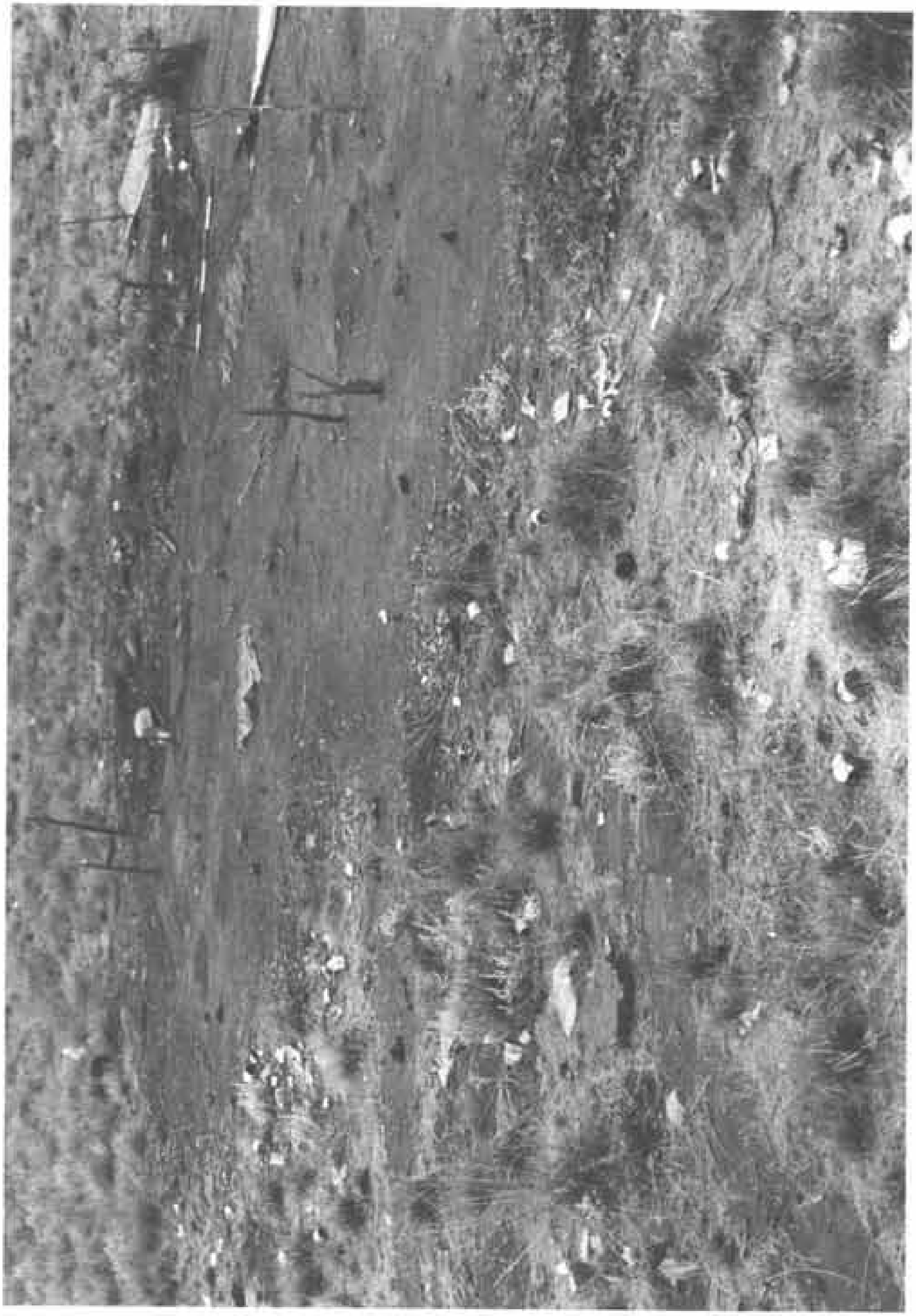

Figure 7. Abandoned household area at an Alyawara residential site (Bendaijerum, September 1974). Cleared space marks the activity area. The main shelter was formerly located at back edge of this zone, covering the oblong depression flanked by several upright poles. The three poles at right center are sunshade support posts. Note the secondary refuse disposal area marked by metal cans and other large items, foreground and left center, downwind of the activity area.

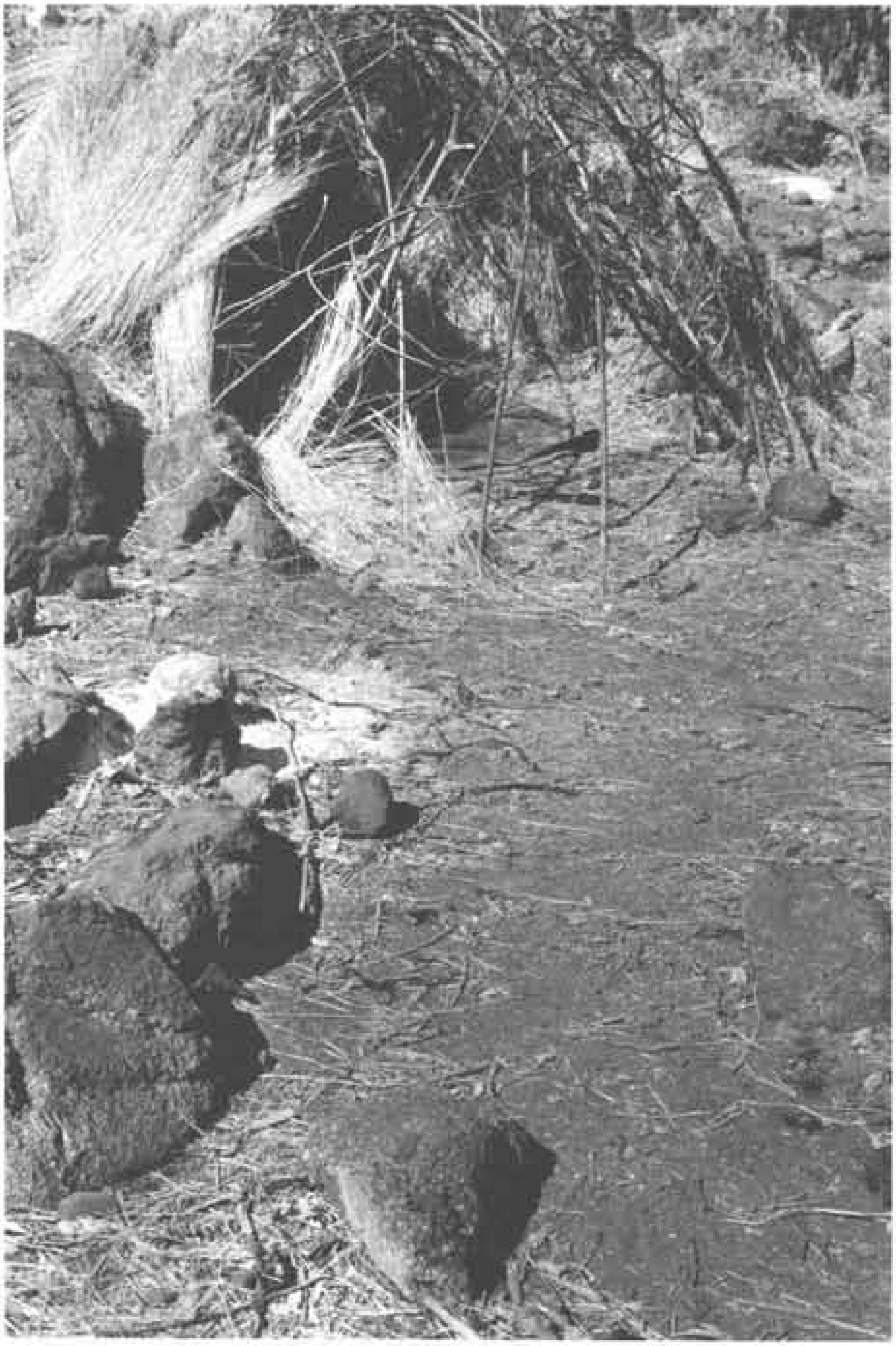

Figure 8. Abandoned household area at a Hadza residential site (Tsipitibe, September 1985). Grass-covered main shelter (height ca. 1.5 m) at top of photograph; cleared open activity area right foreground; margin of secondary refuse disposal zone at left. Note also hearth marked by white ash at margin of activity area, just outside entrance to main shelter.

Figure 9. Abandoned household area at Hadza residential site (Tsipitibe, September 1985). Secondary disposal zone immediately to left of activity area shown in Figure 8. Note large pile of plant refuse amid rocks at right center, broken bones of large animals at left center.

human body size and the range of activities performed may be a factor. If so, relationships between household size, duration of occupation, and household area may be similar across many cases.

Activity areas may be flanked by spots (so-called "secondary disposal zones") where refuse produced in the course of various activities is dumped (Figures 2–4, 6–9). The presence of these features is probably explained by several factors, including the size of refuse items produced, the production rate, the investment in facilities (e.g., hearths, drying racks, storage structures) associated with the activity area, and the length of time the area is in use. In general, the larger the refuse items produced, and the faster they are produced, the more they interfere with continued use of the area. Sooner or later occupants face the choice of moving the refuse (especially the larger, more troublesome items) or the activity that produced it, a decision that probably turns on the relative costs of these alternatives, including the cost of repositioning facilities. The longer an area is in use (even discontinuously), the more likely refuse accumulation will become a problem.

Spacing between activity areas also varies greatly within and between groups (Figures 1 and 10). This has implications for the relative positions of different types of activity areas. Among the Ache, nearest neighboring household areas average about 3 m apart (Jones 1993); among the Hadza and !Kung 4–7 m (O'Connell et al. 1991; Yellen 1977). In these cases and others like them, separate communal and special activity areas are often at the margins of sites, just outside the array of household areas. In base camps occupied by the Alyawara and other central Australian groups (e.g., Gargett and Hayden 1991, Gould and Yellen 1987; O'Connell 1987), nearest neighbors are 25-40 m apart; among the Nunamiut up to 200 m apart, depending on the season (Binford 1991a). In these cases, households are often grouped in well-defined clusters which may themselves be dispersed

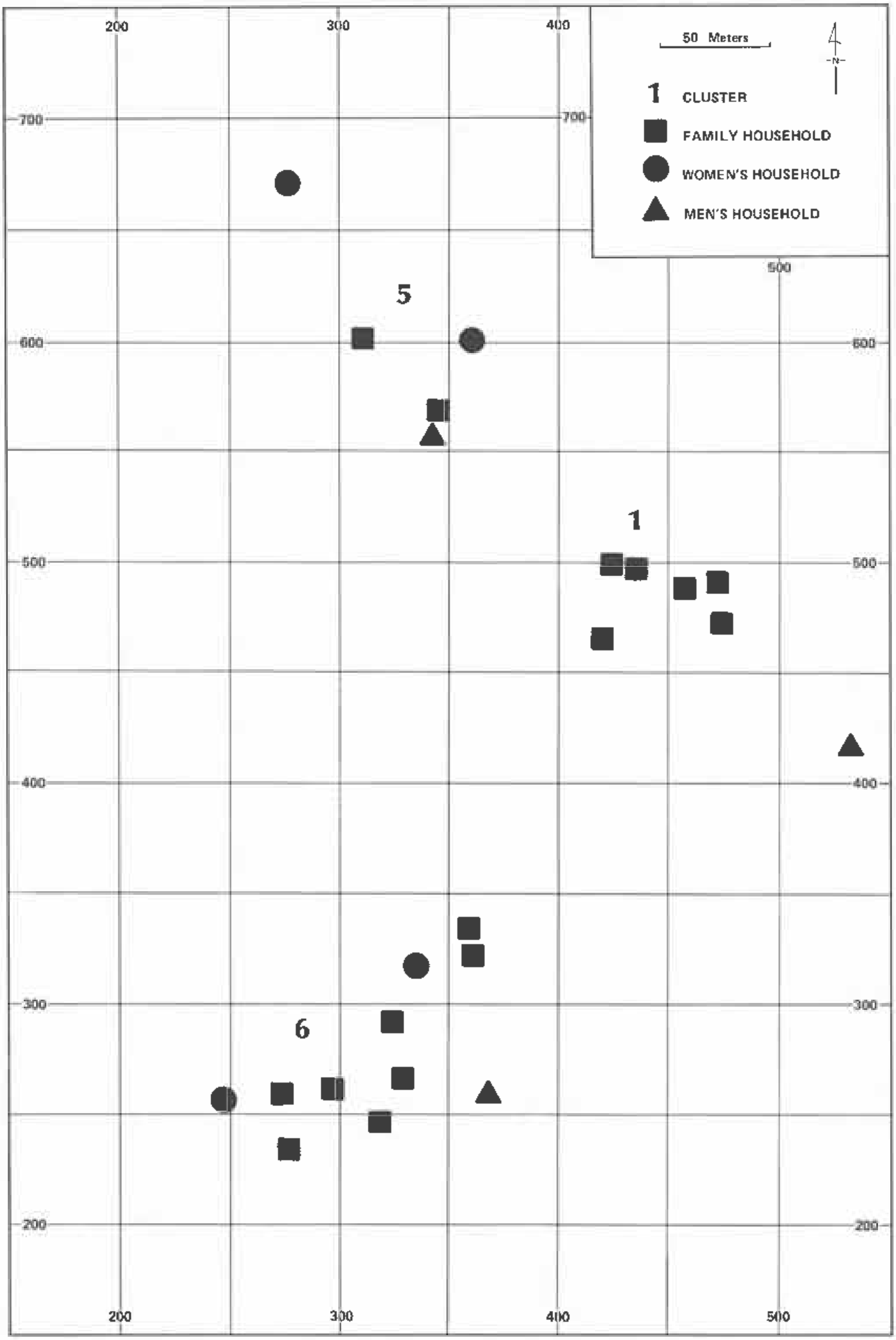

Figure 10. Distribution of household activity areas at an Alyawara residential site (Bendaijerum, September 1974). Note scale and contrast with interhousehold spacing at the Hadza site shown in Figure 1.

up to several hundred meters apart (Figure 10; see also Marshall 1994). Communal and special activity areas may be located within the clusters, at their margins, or at the margins of the site itself. Factors suggested as possible contributors to variation in household spacing include the degree of inter-household food sharing and the presence or absence of predators, proximity being correlated with high frequencies of sharing, high predator threat, or both (Binford 1991a, 1991b; Fisher and Strickland 1991; Gargett and Hayden 1991; Gould and Yellen 1987, 1991; O'Connell 1987; Whitelaw 1991).

Finally, overall site size varies with site population, inter-household spacing, and duration of site occupation. Observed on any given day, occupied parts of residential sites range from about 10-50 m^2 among the Ache to 10^4-10^5 m^2 among the Alyawara and Nunamiut. Okiek residential localities are even larger, though many archaeologists would identify different household areas as separate sites (Marshall 1994). The relationship between site area, site population, and inter-household spacing is intuitively obvious. Consistent relationships between population and site area have been observed within groups (e.g., O'Connell 1987; Yellen 1977); but are not evident between them, largely because of differences in inter-household spacing. The link between site size and span of occupation reflects the relocation of activity areas for various reasons and at various time scales. At Alyawara sites, for example, occupants routinely move activity areas in response to such factors as changes in camp population and refuse buildup. These shifts are usually apparent over periods of several weeks. Over the longer term, such movement may create very large archaeological sites, covering several hundred thousand square meters or more, depending on the terrain (Figure 11).

IMPLICATIONS, ESPECIALLY FOR GREAT BASIN ARCHAEOLOGISTS

Cautionary Points

Applying these observations to the prehistoric record is problematic in two respects. First, they are based on a small data set; only about half a dozen cases are well-described and analyzed. This suggests that the range of within- and between-case variation now evident is low relative to that likely to be encountered in a larger sample, especially one that includes more sedentary, storage-dependent groups.

Second, with some exceptions, neither behavior nor its patterned reflection in site structure is *explained* in these studies, in the sense that either could be confidently predicted outside the situations in which they are described (see O'Connell 1994 for extended discussion). For example, most treatments of residential site structure note the existence of households that vary in size and composition. Factors that might account for the existence of "households" or their variability are not an object of inquiry; the analyst simply takes them as given. This begs a central question for archaeologists: When does one expect "households" to be a basic unit of organization? How should they vary in composition, and why? What other forms of residential organization are possible, and when should they be anticipated?

Similarly, though !Kung and Hadza camps are essentially identical at first look (compare Figure 2 with Lee and DeVore 1976: 47, 73; Yellen 1977: 79), closer inspection reveals real differences in the spatial distribution of activities and resulting archaeological site structure (household vs. sex-specific communal activity foci). Until these are accounted for in broadly applicable terms, there is little basis for predicting one or the other pattern or interpreting its significance if discovered archaeologically.

Recently there have been attempts to address this general problem (e.g., through investigations of relationships between interhousehold spacing, sharing and predator pressure [see references above], and of the factors that affect size sorting and secondary disposal [Metcalfe and Heath 1990]) but much remains to be done. Until it is, the current literature on site structure provides a basis for little more than cautionary tales and empirical generalizations.

Predictions about Site Structure in the Great Basin

Granting this limitation, but also recognizing that archaeological research on site structure and related phenomena will proceed regardless, it is useful to discuss the patterns that might be present in prehistoric Great Basin site structure, the information about past behavior that might be gained from investigating them, and the risks that are probably associated with ignoring the issue entirely.

This exercise requires three important assumptions: (1) prehistoric Basin populations were grouped into households like those reported from the !Kung, Hadza, Alyawara, and many other ethnographically

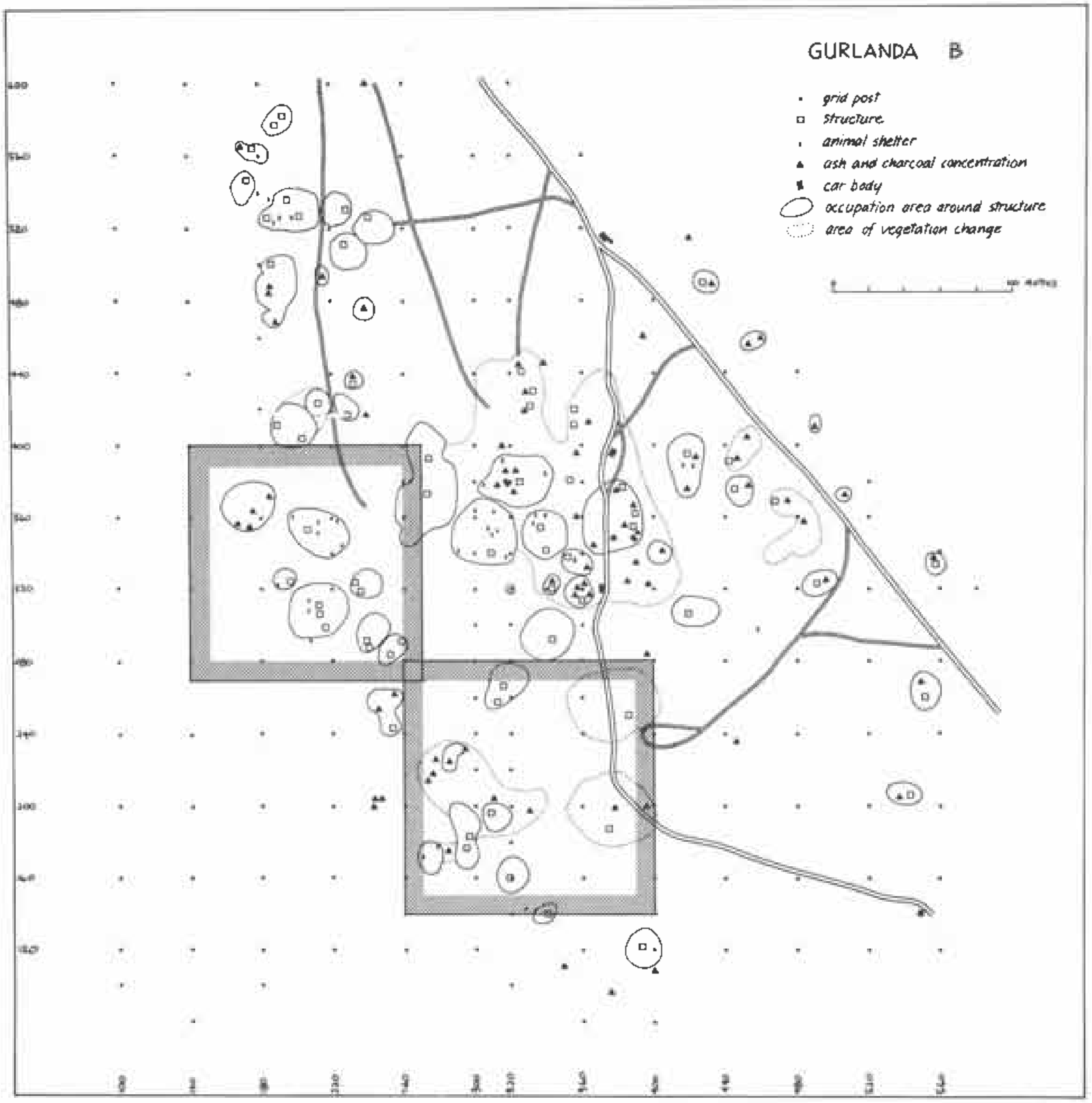

Figure 11. Distribution of structures, major ash and charcoal concentrations and certain other features at Gurlanda B. North at top. Rough circles and irregular circular patches indicate approximate limits of refuse and disturbed vegetation surrounding each household activity area. Hatched squares are sample quadrats in which surface refuse was mapped and collected. Note the size of this site. Note also that it represents only one of four localities all similar in size, all used as residential sites, all located on exposed sand ridges at distances of 200–400 m from the same central water source. All are part of the same site.

known hunter-gatherers; (2) they spent much of their time in more or less well-established residential base camps; (3) these camps were divided into household, communal, and special activity areas, just as they are among the !Kung, Hadza, Alyawara, and at least some other ethnographically known groups.

Given these assumptions, one can develop some general expectations about the spatial organization of activities at these sites and its archaeological implications. For instance, one can predict that most on-site activities took place in household and communal areas and that both types of locations witnessed roughly the same range of activities. Household areas might be distinguished by the presence of structural remains, though in a region like the Basin, where shelters were often ephemeral, this may not be a useful marker. Distinctions may be complicated to the degree that activities were spatially segregated by sex of actor(s) as well as along household lines, as they are among the Hadza and Alyawara but not the !Kung. If the !Kung model were operative, one might expect to see mostly household areas, all broadly similar in form and in the composition of associated assemblages, except where differences in household size and duration of occupation influence variation in assemblage size and composition (e.g., Jones et al. 1983). If the Hadza model were operative, the most obvious archaeological features might be communal areas, distinguished in some but not all cases by sex-related differences in associated refuse (see O'Connell et al. 1991: Table 3 and related discussion). At present, there is no basis for predicting either of these models or any as yet undescribed alternatives in any given archaeological situation.

Special activity areas might be identified by distinctive, activity-specific sets of refuse and features. They may be especially common at sites where food storage and related processing activities were common; for example, at pinyon processing camps, Fremont rancherias, or winter residential sites in general.

The degree to which any of these areas were structured internally should depend in part on investment in facilities, including hearths and structures. Where this was high, stability in the physical circumstances affecting the performance of activities should also be high, as should the cost of moving the facilities. Activities should be spatially segregated and performed redundantly at the same locations, yielding an internally patterned area (see Binford 1983:144–192 for discussion). Fremont domestic and storage structures might both display such patterns, as might pit dwellings in general. Where facilities were more ephemeral, as they apparently were over most of the Basin through most of the Holocene, less internal patterning might be anticipated.

Size sorting and secondary disposal should be expected under the circumstances outlined above: in general, where the presence of refuse interferes with continued use of an area and where the cost of shifting the activity exceeds that of moving the refuse. These conditions should be very common. They might be expected at sites occupied for long periods of time, in recurrently used situations where space was limited (e.g., caves and rockshelters), in cases where investment in facilities was substantial (e.g., Fremont residential sites), and even in relatively short term occupations where the rate of refuse output was high (e.g., in connection with bulk plant processing or lithic reduction).

Activity areas should vary with the nature of associated activities, the number of people involved, and in some cases the length of time the area was in use; but there is no firm basis for predictions about the quantitative aspects of these relationships. One might suggest from inspection of ethnographic photographs that individual areas might have varied widely in size, from several to several hundred square meters in extent.

Spacing between areas is equally difficult to predict. Although arguments have been offered concerning links between interhousehold spacing, local predator pressure and/or food sharing, only the Ache case provides even a partial basis for quantitative assessment of these relationships. Ethnographic photos (e.g., Fowler and Fowler 1971; Merriam 1955) may be read to suggest patterns comparable to those reported for the mobile Hadza and !Kung (O'Connell et al. 1991; Yellen 1977). Since these vary situationally, probably as a function of differences in interhousehold food sharing (e.g., Brooks et al. 1984), prehistoric Basin patterns may also vary, perhaps over a sizeable range.

In summary, this line of argument suggests fairly weak spatial patterning at most residential sites, with refuse clustered at relatively large scales, few consistent differences between clusters distinguishable from sample size effects, and little consistent patterning within clusters except commonly as a function of size sorting in connection with secondary disposal. Exceptions may include situations in which greater investment was made in structures and facilities, especially where food storage and related processing were important. Fremont residential sites are among the obvious possible examples.

Research Implications

Four very general implications follow from this. The first is methodological and involves several elements:

1. Research designed to investigate site structure must be pursued at very large spatial scales. The available ethnographic data suggest potentially informative patterns will be apparent only in exposures in the high 10^2–10^3 m^2 range, not only in residential sites but in other locations as well (e.g., O'Connell et al. 1992). Where material is clustered, many clusters must be sampled as the basis for comparative analysis. By definition, no statement about *patterns* in distribution, size, or internal organization is possible from examination of one or two clusters.
2. Such research must often attend simultaneously to the distribution of small-sized refuse items. (Available data [e.g., Metcalfe and Heath 1990; O'Connell 1987] suggest that "small" means a maximum diameter < 20 mm.) Micro-refuse dropped at or near the point of production is less subject to cleanup and secondary disposal than larger debris, and is most likely to reveal spatial segregation within activity areas.
3. Both observations point to a necessary trade-off with respect to precision in data recovery. Current research on site structure often entails the routine practice of piece-plotting. The more effort devoted to this, the less spent on increasing the scale of exposure. Emphasizing one or the other in any particular case depends entirely on the archaeological situation and the question(s) being asked. In my view, piece-plotting is often practiced *only* because the investigator considers it the conservative, "scientific" approach. In some instances, it may well be the right one. On the other hand, ethnoarchaeological work indicates that where questions of site structure are at issue, effort is better directed at gaining a sense of the larger picture. In such situations, recording provenience more precisely than, say, nearest square meter will often be counter-productive.

The second implication pertains directly to the Great Basin. Site structure research will be most informative where the archaeological record is intact and relatively fine-grained chronologically, most tractable where little excavation is necessary. Situations that meet both criteria are rare in the Basin. The best possibilities include undisturbed surface or near-surface sites with brief occupation histories (Zeier and Elston 1992), buried sites planed by erosion (e.g., Raven and Elston 1988; Simms et al. 1991), and sites with substantial structures. Deep stratified sites with complex histories are not good candidates, except in unusual circumstances (e.g., Thomas 1983).

Third, and also directly pertinent to the Basin: Even where it can be pursued, research on site structure may not be particularly revealing if the major dimension of patterning in most local sites is size-sorting within refuse clusters. Some may object that this is a potential index of household size or the length of time a site, or at least an activity area, was in use. This presumes household areas can be identified consistently, that a representative sample of areas can be investigated, that consistent quantitative relationships pertain between all pertinent variables, and that the zone of primary deposition can be measured accurately. All are problematic. With respect to the area-time relationship, note that if size-sorting and secondary disposal are prompted by "interference" considerations, they may be initiated over *very* short time spans depending on the immediate circumstances. At Hadza bedrock grinding stations, size-sorted piles of plant food waste can be seen at the end of a single afternoon's work. In other situations, where refuse output is slow, it may take days or weeks for an archaeologically recognizable pattern of size sorting to develop.

For reasons already indicated, pursuing other traditional targets of site structure research such as activity-specific areas and associated "toolkits" seems an unlikely prospect in most local contexts. Exceptions may include the floors of substantial structures. Again, Fremont residential sites are a possible example.

This leads to the fourth and most important implication. Given the preceding, one might well be tempted to ignore the issue of site structure entirely, focusing instead on some version of archaeological "business as usual." *This would be a mistake.* Size-sorting and secondary disposal are widespread phenomena. Depending on the patterns they produce and the ways these are sampled, they may affect the relative frequencies of refuse items recovered, the characterization of assemblage composition derived, and the resulting inferences drawn about past activities. Samples from secondary disposal areas may be very different from unsorted debris or size-sorted primary deposits. Treating any of them as representative of the site as a whole is clearly inappropriate; mixing them uncritically runs the risk of creating artificial, potentially quite misleading patterns. Investigators must be aware of this at all stages of sampling and analysis, even where site structure is not a central focus of inquiry.

An example from my own work may illustrate the point. Excavations at several sites in Surprise Valley produced evidence of significant differences between mid- and late Holocene faunal assemblages (O'Connell 1975; O'Connell and Hayward 1972; see also James 1983). Ungulates comprised more than 50 percent of total MNI in the former; less than 20 percent in the latter. In both periods, waterfowl and small mammals made up the balance. The original reports (O'Connell 1975; O'Connell and Hayward 1972) took this as evidence of an important change in diet.

If I were reanalyzing these data today, I would note that although the late Holocene materials were recovered from a variety of depositional contexts, including shallow house floors and undifferentiated midden, the mid-Holocene fauna came almost entirely from deep, semi-subterranean pithouse fill. The investment made in these building structures suggests that they were probably kept clean of animal bones and other large refuse items while in use. Once abandoned, however, the open pits apparently attracted secondary refuse, as indicated by the presence of many large metate and mortar fragments, both on floors and in overlying fill (O'Connell 1971: Table 20). Some of the animal bones recovered from these deposits, including all the larger ones, may also be products of secondary discard.

If so, interpretation of the difference between mid- and late Holocene faunas becomes problematic. It could measure a change in diet, as originally suggested. It could also reflect the effect of size sorting in connection with clean-up and secondary disposal. Large animal bones may have been more likely to be collected and dumped in unoccupied housepits than were small bones; housepit fills contributed a much greater fraction of mid- than late Holocene remains recovered and analyzed; hence, large animal bones may be more common in the mid-Holocene sample, *independent of any real pattern in diet through time.* Large animals might have been more important, less important, or similarly important relative to small animals in mid-versus-late Holocene times. From the data available, it is impossible to tell.

At a minimum, resolving this issue requires a better sample of mid-Holocene materials. Obtaining it requires developing some expectations about the range of depositional contexts that might be anticipated, the scales at which they might be identified, and the proportions in which they might be sampled in order to yield an accurate indication of overall assemblage composition. In fact, the same exercise ought to be conducted for the late Holocene deposits as well. Both necessitate an understanding of factors likely to affect site structure.

This example is probably not unique. I would expect that many arguments about assemblage composition based on data collected without regard to the effects of size sorting and secondary disposal are open to question on similar grounds. Both phenomena will be important wherever sites are occupied (continuously or recurrently) over long periods of time, where refuse output rates are high, where some fraction of the refuse produced includes large items, and/or where activities are tied to particular places within a site. Many local sites—caves, rockshelters, hunter-gatherer base camps, Fremont rancherias—fit one or more of these criteria. Many have been sampled in ways that do not permit the analyst to control for the effects of size sorting: excavations have been too small relative to the "grain" of patterning in site structure commonly produced by size sorting and secondary disposal. Quantitative treatments of these samples are meaningless with respect to potentially important arguments about past behavior unless the samples adequately reflect the composition of assemblages from which they were drawn.

SOME PRELIMINARY TESTS

Despite my skepticism about the insights on past behavior potentially available from the study of local site structure, further inquiry on the topic is important for at least two reasons. First, my predictions are based on descriptive generalizations from a small ethnoarchaeological data set. The local picture could be quite different. The only way to tell is by direct examination. Second, the ethnoarchaeological research needed to further our understanding of site structure, here and elsewhere, will be prompted by the identification of recurrent patterns in the archaeology. Good ethnoarchaeology develops initially from the recognition of specific archaeological problems. Local research has produced few if any in the realm of site structure; hence the need for exploratory work.

For a start, one might assess my predictions by appeal to local ethnography. Although direct observation of traditional foraging and farming groups is no longer possible, there should be enough photo-archival data to test them. Specifically, one might examine a range of nineteenth and early twentieth century photographs to see whether Paiute, Shoshone or Washoe residential sites are organized along the same lines as those of !Kung, Hadza, or other foragers, whether similar ranges of activities are indicated, whether they are distributed in similar ways, and at what scales whatever patterning is indicated might be evident. One might do the same with photos of full or part-time horticultural groups such as the Southern Paiute. Second, one might test the predictions archaeologically. In fact some work along the lines suggested above has already been undertaken. Three sites illustrate its potential and some of its limitations (see also Simms and Heath 1990; Zeier and Elston 1992). Simms (1989) reports the distribution of refuse and features at the Bustos site, a short-term residential base southwest of Ely, Nevada. Raven (1992) analyzes refuse distribution over two large tracts at the Tosawihi quarry, north of Battle Mountain, Nevada. Metcalfe and Heath (1990) report the distribution of micro-refuse on the floors of a large, multi-roomed, adobe-walled Fremont structure at the Nawthis site, near Salina, Utah.

All three sites display patterns in site structure at least partly consistent with expectations developed above. All contain spaces readily interpreted as household and special activity areas. Household areas are marked by relatively diverse refuse assemblages; at Bustos and Nawthis by the remains of domestic structures. Special areas contain more restricted assemblages: at Bustos and Nawthis, food processing tools and food debris respectively, both associated with probable storage facilities; at Tosawihi, quarry pits, and toolstone extraction and reduction debris. None of the three showed any area that might be interpreted as "communal," but given the ambiguity of key criteria, this should not be surprising.

Activity areas at the open sites are unpatterned internally (Robert Elston, Christopher Raven, Steven Simms, personal communication). The absence of size sorting and secondary disposal may reflect short spans of occupation, low rates of durable refuse output, and/or small numbers of large refuse items. At Nawthis all rooms analyzed display internal variation in the density of micro-refuse; the largest room shows clear patterns in the distribution of different kinds of refuse, probably indicating the consistent spatial separation of certain, possibly sex-related activities.

At Nawthis activity areas of all kinds are relatively small and contained within the same structure; at the open sites they are large and widely dispersed. At Bustos household areas cover roughly 20-40 m^2 each and are separated from special activity areas by distances of several hundred meters. Special activity areas cover 30,000–150,000 m^2 and are not readily subdivided on the basis of the published illustrations. Total site area measures about 500,000 m^2. At Tosawihi all activity areas are large features, most in the 10^3–10^5 m^2 range, up to two orders of magnitude larger than predicted above. Bustos and Tosawihi are so large that parts have been assigned separate site numbers. The potential for confusion about assemblage composition is obvious.

These studies also illustrate some general problems associated with study of site structure, notably that of interpreting the patterns recognized. At Nawthis and Bustos, investigators rely heavily on a combination of local ethnographic analogy and common sense in assessing behavioral significance. Their interpretations are probably correct but none are in any sense tested nor are potential alternatives evaluated. At Tosawihi Raven appeals to a series of optimality arguments in developing predictions about the locations of residential areas relative to possible subsistence resources, and about extraction and processing areas and their associated assemblage characteristics relative to toolstone extraction points. The argument is testable but unusual in studies of site structure in terms of the questions addressed and the availability of an appropriate, well-developed theoretical framework (see Metcalfe and Barlow 1992 for additional development). In a sense, the exercise is more a study of settlement pattern than site structure. It illustrates the potential utility of a theoretically-driven approach while implicitly underlining its absence in most research on this topic.

SUMMARY

Despite the existence of a large ethnoarchaeological literature on site structure, the absence of a coherent theoretical framework makes its lessons difficult to apply broadly except in cautionary terms or as empirical generalizations. Neither contributes much to learning anything new about the past. Ethnoarchaeologists may be able to improve this situation by focusing more on site-related behavior and its determinants. This is the only way to develop well-warranted expectations about behavior and its archaeological implications in situations not observed ethnographically.

Until this happens Basin archaeologists interested in site structure are stuck with highly speculative predictions and interpretations grounded in some combination of local ethnography, exotic ethnoarchaeology, and their own intuition. Limited as these sources of information are and cautious as one must be in developing arguments from them, the returns they suggest may emerge from local research are slim indeed, except in a very few cases. Identifying and investigating those few will be expensive.

Recognizing these limits does not imply this line of inquiry ought be abandoned. *Quite the contrary.* Given both the speculative nature of my predictions and the importance of their implications for the assessment of assemblage composition, further investigation of local site structure is important. It will succeed to the degree it takes advantage of the lessons of ethnoarchaeology while recognizing their current limitations.

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REPORTS

ESTIMATING LOAD SIZE IN THE GREAT BASIN: DATA FROM CONICAL BURDEN BASKETS

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INTRODUCTION

The importance of plant foods in Great Basin subsistence is well documented by ethnographers (Chamberlin 1911; Fowler 1989; Palmer 1878; Steward 1938; Stewart 1941; Wheat 1967). Historically women transported plant resources on foot in large conical baskets, called "burden baskets" or "seed baskets" in ethnographic literature. These plants were often distributed in widely scattered patches, and historic Great Basin residents responded to the spatial distribution of utilized resources by locating their residential sites close to some resources and collecting and transporting others relatively long distances (Fowler 1989; Steward 1938). In a recent synthesis of ethnographically documented transport distances, Rhode reported that Great Basin plant foods were carried up to 90 km (Rhode 1990; Steward 1938).

Archaeologists working in the Great Basin have recently begun to investigate the costs and benefits associated with transporting plant resources and the probable effects of these costs and benefits on plant procurement strategies. Jones and Madsen (1989) predicted maximum expected transport distances for a variety of Great Basin resources, Zeanah (1992) evaluated the effects of transport costs on the optimal location of residential camps, and Barlow and Metcalfe (1995; Barlow 1990; see also Metcalfe and Barlow 1992) suggested that transport distance should determine the types and quantities of plant parts returned to camp by central place foragers. A critical assumption common to these models is that an individual's success (calories per hour) in collecting resources and transporting them back to a base camp is constrained by the amount of resource that can be carried in a single load (Metcalfe and Barlow 1992; Orians and Pearson 1979). For food resources, the energetic benefit of a load is simply the amount of edible resource or calories in the transported load. Two variables determine this quantity: (1) the caloric value of the resource load per unit weight or volume, and (2) the weight or volume of a load of the resource.

The caloric value of plant food per unit weight or volume varies between resources, and also with the proportions and caloric values of the different plant parts in the resource load. Elsewhere two of us (Metcalfe and Barlow 1992) have suggested the circumstances in which foragers are expected to increase the caloric value of the transported load by field processing, or removing parts of relatively low utility at the resource patch. The other variable that determines the benefit gained by returning a load of resource to a central place is load size.

LOAD SIZE: ESTIMATES AND OBERVATIONS

Jones and Madsen calculated the maximum Great Basin load size at 64.3 liters, based on the dimensions of the "largest Great Basin conical carrying basket in the Utah Museum of Natural History ethnographic collections" (1989:529). They estimated the weights of 64.3 liter loads of Great Basin plant resources as ranging from 7.74 to 47.67 kg, based on weights and volumes reported for resources experimentally collected and processed to a predetermined stage (Jones and Madsen 1989; Simms 1987). Zeanah (1992) employed these and similar estimates to calculate the caloric return rates for transporting loads of pine nuts and shadscale to camp locations. A load of pine nuts was estimated to weigh 39.9 kg, a load of shadscale 21.5 kg. These estimated load weights seem unusually large, as 3 to 15 kg of plant resource appears to be the range typically carried by modern foragers traveling on foot.

Several modern ethnographic studies include observations of load size. Of particular interest are references to the weight of plant resources carried by women on foraging trips. Lee (1969:70) reported that 10–15 kg of mongongo nuts was the average load size carried by !Kung women, although they

Table 1. Conical Baskets in the Utah Museum of Natural History

UMNH Acquistion Number	Measured Volume (liters)	Height (cm)	Max. Diameter (cm)	Min. Diameter (cm)	Average Diameter (cm)	Predicted Volume (liters)	Weave Type [c]	Appears Used	Carry Strap	Base Broken	Base Repaired/ Reinforced	Source
21758.245	32.5	43	55.5	52.5	54	32.83	1	yes	no	yes	yes	Washoe
247.1	19.5	43	35.5	31	33.25	12.45	2	yes	yes	yes	no	So. Paiute
21758.244	23	42.5	48	43.5	45.75	23.29	1	no	no	no	no	Pomo
21758.242	17	37.5	46	42	44	19.01	1	no	no	no	no	Pomo
21758.237	5.5	29	27	27	27	5.53	1	no	no	no	no	Pomo
21758.241	43	55	58.5	53.5	56	45.16	1	no	no	no	no	Pomo
21758.240	61	59.5	63.5	61	62.25	60.36	1	ind.	no	yes	no	Pomo/Papago
21758.201	2	12.5	22.5	19	20.75	1.41	1	yes [a]	yes	no	no	indet.
no number	5.5	27	29	28.5	28.75	5.84	1	no	no	no	no	indet.
6886	5	24.5	30.5	28	29.25	5.49	1	no	no	no	no	indet.
18712	19	43.5	43.5	41.5	42.5	20.57	2	yes	yes	no	yes	Goshiute
24145	-	73.5	-	-	48.5	45.26	2	yes [b]	yes	indet.	yes	indet.

[a] Finely braided, plaited handle for suspension, attached to the rim of the basket in four places. Not a burden basket. This basket was not included in the used basket sample.

[b] This basket was very fragile, worn and stored flat in the museum. Circumference and length were measured, and diameter, height and volume were calculated from these parameters. This basket was not included in the measured volume sample.

[c] 1 = Close twined, 2 = Open twined.

sometimes carried loads of up to 20 kg.

O'Connell and Hawkes (1981:105–106, 118–119) report Alyawara women traveling approximately 10 to 12 km (round trip) on foot to collect corms or tubers, lizards, berries and sometimes larvae in central Australia. Data collected during six of these events indicates that women carried an average of 1 to 3 kg of resource.

Hawkes, O'Connell and Blurton Jones (1989) studied the costs and benefits of foraging among Hadza women in Tanzania. They observed adult women carrying approximately 3 to 8 kg of tubers during collection trips in the 1985 dry season (Hawkes, O'Connell and Blurton Jones 1989; Metcalfe and Barlow 1992:348)[1]. They also observed foragers traveling 10 to 15 km (round trip) to collect Salvadora berries during the 1988 dry season (Hawkes, O'Connell and Blurton Jones 1995). Hadza women carried an average of 5.53 kg of berries per load during these trips (*max* = 9.3, *s.d.* = .324, *N* = 51).

Other studies indicate that the load size carried by adult women foragers may be constrained by the weight of a carried child and/or the potential cost of an injury if the load is too heavy for the carrier (Blurton Jones 1986; Blurton Jones and Sibley 1978). We suggest that employing the largest burden basket may be appropriate for estimating the maximum potential load size, but does not represent the load size commonly carried by Great Basin foragers. In this paper we attempt to estimate a range and distribution of load sizes likely to have been carried by Great Basin foragers from a larger sample of burden baskets.

DATA COLLECTION

Two data sets were collected to estimate the range of load sizes for burden baskets: 12 conical baskets from the Utah Museum of Natural History (UMNH) were described, measured and photographed, and a survey of basket collections reported in the literature yielded dimensions, descriptions and photographs of an additional 22 conical baskets. The volumes of 11 UMNH baskets were calculated by lining each with tissue, filling them with Styrofoam "peanuts," and measuring the "peanuts" to the nearest .5 liter. Minimum and maximum diameter and basket height were recorded to the nearest .5 cm. Weave type and density were recorded, as was any evidence that the basket had actually been used (i.e., carry straps, stains, apparent wear or breakage from use, and repair or reinforcement patches) (Table 1). When available, information about the source, date of collection and use of the basket were also recorded. With the exception of volume measurements, the same variables were collected for baskets reported in the literature (Table 2). The measured volumes of the UMNH baskets were compared to volumes predicted from basket dimensions with the formula for calculating the volume of a cone ($V = 1/3\ \pi\ r^2\ h$). Basket height and diameter predicted ca. 98 percent of the variability in basket volume (Figure 1). This allowed us to estimate the volumes of the conical baskets reported in the literature with considerable confidence.

RESULTS

The volumes of all recorded conical baskets are displayed by the stippled columns in Figure 2. The mean basket volume is 25.6 liters, with a range of 2 to 84.74 (*s.d.* = 18.5, *N* = 34). Eighty-five percent of the baskets have volumes of 3 to 45 liters. Note that the frequency distribution is strongly skewed to the right; very small baskets are nearly as common as medium-sized baskets, but large baskets are relatively rare. However, many of the small conical baskets may have been replicas of burden baskets rather than baskets used to transport plant foods.

Basket collecting became popular beginning in the early 1900s and stimulated the construction of baskets for sale or trade rather than use. Apparently many attributes of baskets produced by Native Americans in the Great Basin and adjacent regions changed during this time, including the materials used in construction, stylistic designs, weaving techniques, and the shapes and sizes of baskets (Fowler and Dawson 1986:729–735). Four conical burden baskets recorded during the literature survey were identified as "miniature" or smaller than normal (Table 2). Others were identified more generally as the "type" of basket used to carry seeds. An unambiguous association of plant procurement and transport activities with individual baskets was described only in a few cases. Consequently a second distribution of burden basket volumes, including only those baskets with physical indications of use, is also graphed in Figure 2 (white histogram). We do not know the specific behaviors represented by each basket: the particular species they were used to carry, how they were carried or the distances that they were

Table 2. Conical Burden Baskets found in the Literature Survey

Institution	Acquistion Number	Height (cm)	Diameter (cm)	Predicted Volume (liters)	Weave Type [f]	Appears Used	Carry Strap	Base Broken Repaired or Reinforced	Date Collected	Source
[a] Smithsonian	14669	44.0	40.5	18.89	1	yes	yes	yes	1870's	So. Paiute
Smithsonian	11812	55.0	54.5	42.77	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	10770	52.0	53.0	38.24	4	indet.	yes	indet.	1870's	So. Paiute
Smithsonian	14673	55.0	52.8	40.14	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	14671	53.0	51.5	36.80	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	14668	30.5	37.0	10.93	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	11811	70.0	68.0	84.74	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	11808	47.0	48.5	28.94	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	11806.2	33.0	41.6	14.95	4	indet.	yes	indet.	1870's	So. Paiute
Smithsonian	11806.1	53.0	48.0	31.97	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	14677	51.0	48.0	30.76	1	indet.	yes	yes	1870's	So. Paiute
Smithsonian	14670	47.5	44.5	24.63	1	indet.	yes	yes	1870's	So. Paiute
[b] private 1	47	39.4	44.5	20.43	1	yes	no	no	unknown	Maidu
private 1	126	11.4	33.0	3.25	5	yes [g]	yes	yes	unknown	Pima
private 1	19	36.8	43.2	17.98	1	indet.	no	no	unknown	Wintu
private 1	18	34.3	45.7	18.75	1	indet.	no	no	unknown	Achumani
private 1	22	50.8	55.9	41.56	1	indet.	no	no	unknown	Pomo
[c] private 2	217	31.8	20.7	3.57	3	indet. [h]	indet.	indet.	unknown	Washoe
private 2	216	24.5	19.4	2.41	3	indet. [i]	indet.	no	unknown	Washoe
[d] Bowers	107	30.5	47.6	18.09	1	indet.	indet.	indet.	unknown	W. Apache
Bowers	75	38.1	37.5	14.03	2	indet. [j]	no	no	unknown	Paiute
[e] NMM	9	57.8	56.5	48.31	6	indet.	indet.	no	1912	Washoe

[a] J. W. Powell Collection (Fowler and Matley 1979)

[b] Clay P. Bedford Collection (Bedford 1980)

[c] private collection (Cohodas 1979)

[d] Bowers Museum, Santa Ana, Ca. (Bowers Museum 1977)

[e] National Museum of Man, Ottawa: loan from Judith Hillburg (Cohodas 1979)

[f] 1 = Close twined, 2= Open twined, 3 = indet. twined, 4 = Close coiled, 5 = Open "netting", 6 = indeterminate.

[g] As discussed in text, this basket was probably "manufactured for small girl who would .... practice carrying the burden". Not included in the used basket sample.

[h] "twined miniature burden basket"

[i] "miniature burden basket"

[j] "this basket is the typical shape and weave of burden baskets, but most were larger"

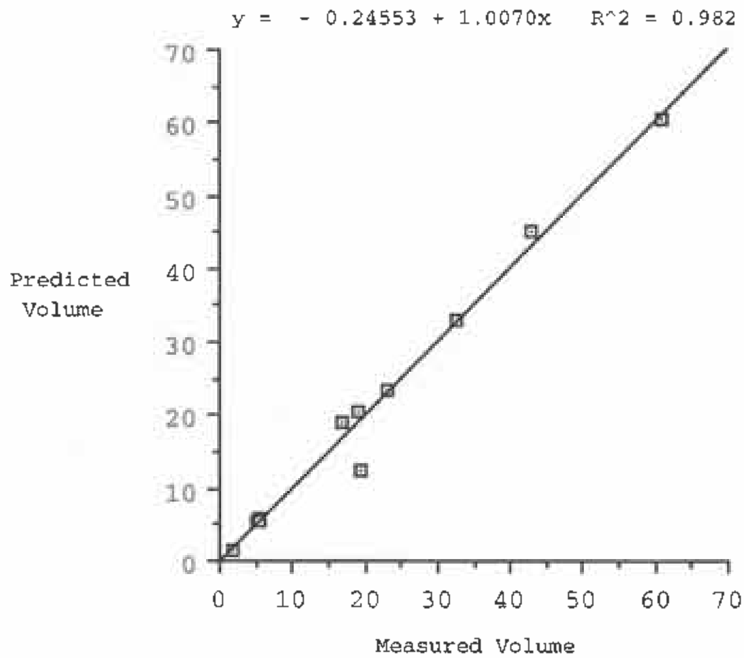

Figure 1. The measured and predicted volumes of cone-shaped baskets in the Utah Museum of Natural History ethnographic collection.

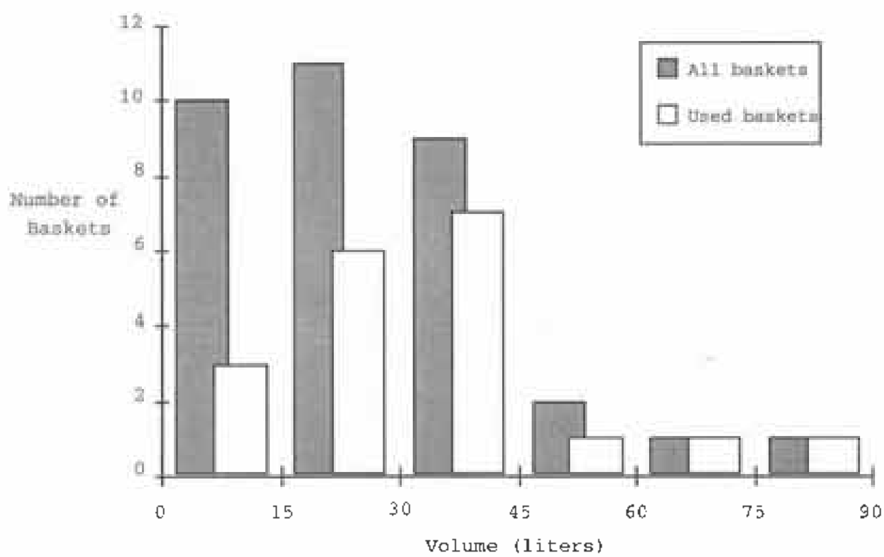

Figure 2. Frequency distribution of the volumes of all baskets (strippled columns, measured or estimated volumes from Tables 1 and 2), and the volumes of baskets with evidence of use (white columns, volume data presented in Table 4).

Table 3. Data from Pinyon and Pickleweed Processing Experiments (Barlow and Metcalfe 1994)

Resource	Sample Number	Weight (kg)	Volume (liter)	Density (kg/liter)	Average Density (kg/liter)
Pinyon *(Pinus monophylla)*					
Pine Nuts in Green Cones	1	2.2282	13.0	.17	.19
	2	2.4136	11.0	.22	
	3	2.5088	19.5	.13	
	4	3.9366	17.8	.22	
Pine Nuts	1	.4289	.9	.48	.48
	2	.4532	.9	.50	
	3	.6100	1.3	.47	
	4	.8876	1.9	.47	
Pickleweed *(Allenrolfea occidentalis)*					
Whole Green Plants	1	11.9	51.5	.23	.23
Threshed from Plants	a	.200	.95	.21	.23
	b	.231	1.05	.22	
	c	.104	.40	.26	
Hand Rub and 1st Winnow	1(a)	.0251	.070	.36	.34
	2(a)	.0260	.070	.37	
	3(c)	.0319	.105	.30	
2nd Winnow	1	.0159	.035	.45	.46
	2	.0173	.035	.49	
	3	.0214	.050	.43	
3rd Winnow	1	.0141	.030	.47	.53
	2	.0150	.026	.58	
	3	.0161	.030	.54	
4th Winnow	1	.0127	.025	.51	.54
	2	.0135	.024	.56	
	3	.0137	.025	.55	

transported. However, most of these baskets have both carrying straps and a base that was either broken or patched, and appear consistent with ethnographic descriptions and historic photographs of baskets used by Great Basin women to transport resources on foot (Tables 1 and 2).

The mean volume of used burden baskets is 31.8 liters, with a range of 3.25 to 84.74 (*s.d.* = 18.7, *N* = 19). The baskets in the zero to 15 liter class have estimated volumes of 14.94, 10.93 and 3.25 liters. Eighty-three percent of the used burden baskets have measured or estimated volumes of approximately 15 to 45 liters. The smallest burden basket was unusual in design, being equipped with support rods extending out of the top of the basket. It was identified as a Pima burden basket of the type used to carry wood. This particular basket was described as being smaller than normal, probably "manufactured for a small girl who would fill the netting in order to practice carrying the burden" (Bedford 1980:64).

Following Jones and Madsen (1989) and Zeanah (1992), we multiplied the measured or estimated volumes of used burden baskets by the weight/volume density of experimentally collected and processed plant foods to estimate the potential range of weights that were carried in these baskets. However, both the caloric benefit of a basket of a particular resource and the cost of transporting it vary with the processing stage, or the types and quantities of waste that are removed from the resource prior to transport (Barlow and Metcalfe 1995; Metcalfe and Barlow 1992). Most important for this study, the weight of a basketload may increase dramatically as a result of removing bulky waste such as pine cones or large quantities of chaff from the nut, seed or edible component of the resource. Consequently, we calculated a range of weights for the 18 used burden baskets by using the mean density (kg/l) of samples of pinyon (*Pinus monophylla*) and pickleweed (*Allenrolfea occidentalis*) measured at different stages during processing experiments (Table 3, data from Barlow and Metcalfe 1995). The potential range of resource weights (kg) per basket was calculated by multiplying the minimum and maximum resource density (kg/liter) by basket volume (Table 4). The lightest resource is whole pine cones with a density of .19 kg/l. The minimum weight (kg) of a basket-load of resource is shown as the lower tick of each line in Figure 3. Based on the density of pine cones, the average weight of a load of unprocessed resource is 6.35 kg (*range* = 2.08–16.1 kg, *s.d.* = 3.4, *N* = 18). The heaviest resource is winnowed pickleweed seed with a density of .54 kg/l. However, three used baskets were constructed with an open-twined weaving technique. Although they could hold small seeds if lined with leather or a tightly woven textile of some kind, they appear to have been constructed to hold larger items. The maximum density used to calculate the weight of these basket-loads is pine nuts with a density of .48 kg/l.[2] The maximum weight of each basket-load of resource is shown as the upper tick of each line in Figure 3. Based on the density of pine nuts and pickleweed seed, the average weight of a load of processed plant resource is 17.76 kg (*range* = 5.9–45.76 kg, *s.d.* = 9.69, *N* = 18).

LOAD SIZE AND GREAT BASIN FORAGING STRATEGIES

Data collected from a sample of Great Basin burden baskets and plant processing experiments suggest that basketloads of plant resources may have been approximately 15 to 45 liters by volume, or 3 to 20 kg by weight. This range is considerably smaller than the 64.3 liter, 7.74 to 47.67 kg loads of Great Basin plant resources estimated in previous studies, and appears consistent with the weights of plant resource loads carried by modern foragers.

Jones and Madsen (1989) assumed the net caloric value of a load of processed resource determined the maximum energy that Great Basin foragers would expend transporting resources, and estimated the maximum transport distance of loads of plant resources based on the largest potential load size. Their calculations suggest that Great Basin archaeologists should expect variation in the distances that different kinds of resources were transported. Jones and Madsen caution that their estimated maximum transport distances were not intended to predict the absolute distances that specific resources were transported. Nevertheless, if the energetic values of basketloads of plants were the primary constraint on the distances they were carried by Great

Table 4. Volumes (l) and Load Weights (kg) of Used Burden Baskets

Volumes of Used Baskets (liters)	Weave Type	Load Weight (kg) Minimum Density	Load Weight (kg) Maximum Density
3.25	open "netting"[a]	-	-
10.93	close twined	2.08	5.90
14.95	close coiled	2.84	8.07
18.89	close twined	3.59	10.20
20.43	close twined	3.88	11.03
24.63	close twined	4.68	13.30
28.94	close twined	5.50	15.63
30.76	close twined	5.84	16.61
31.97	close twined	6.07	17.26
36.80	close twined	6.99	19.87
38.24	close coiled	7.27	20.65
40.14	close twined	7.63	21.68
42.77	close twined	8.13	23.10
84.74	close twined	16.10	45.76
32.50	close twined	6.18	17.55
19.50	open twined	3.71	9.36
61.00	close twined	11.59	32.94
19.00	open twined	3.61	9.12
45.26	open twined	8.60	21.72

[a] As discussed in text and Table 2, this basket was probably used to transport wood.

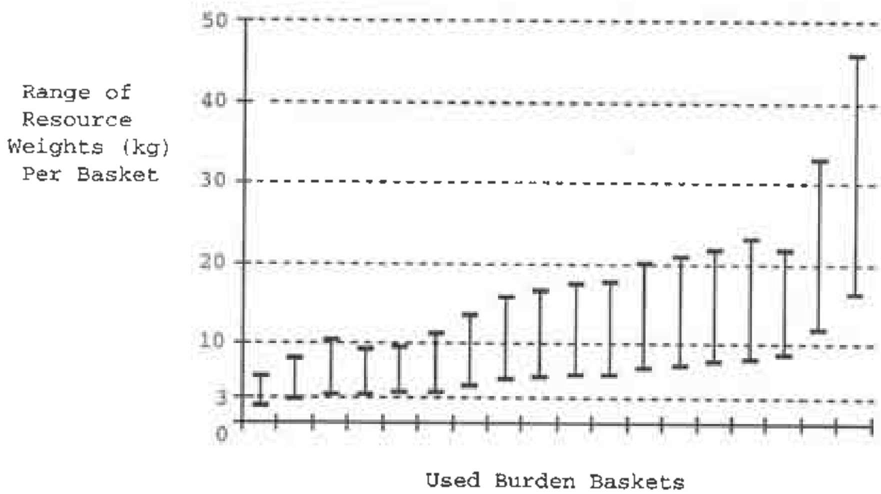

Figure 3. The estimated range of weights (kg) for each used burden basket in the sample. Minimum and maximum wieghts were calculated by multiplying basket volume and the weight/volume densities of Great Basin plant resources (Tables 3 and 4).

Basin foragers, their estimates indicate that some plant resources should have been carried much greater distances than were reported ethnographically (Rhode 1990). For pine nuts, maximum transport distances of greater than 800 km were estimated, although the maximum distance they were actually reported to have been transported on foot is approximately 90 km (Rhode 1990). This difference is striking, and suggests that the energetic costs associated with transporting resources may have been underestimated (Brannan 1992), the caloric values of resource loads may have been overestimated, or perhaps that Great Basin foragers did not transport resources until they operated at an energetic deficit.

The average size of burden baskets in our sample is 31.8 liters, slightly less than half the size of the basket used by Jones and Madsen. We recalculated the expected maximum transport distances of resources for a 31.8 liter basket and the data reported in Jones and Madsen (1989), and it is not surprising that the maximum expected transport distances dropped 39 to 49 percent (Table 5). However, the maximum transport distances predicted with this model are still considerably greater than those reported for historic Basin foragers.

In addition to experimental resource procurement and processing studies (Barlow and Metcalfe 1995; Jones and Madsen 1991; Simms 1987), the load size estimates presented here may be useful for calculating the costs and benefits associated with collecting, processing and transporting plant resources in the Great Basin, and developing expectations about the deposition of material remains associated with those activities. Archaeological assemblages often consist of the material remains from hundreds to thousands of years of these activities. The plant procurement and transport strategies likely to be most visible are those that were commonly employed by prehistoric foragers. If prehistoric foragers often repeated those plant procurement, processing and transport strategies that resulted in the greatest amount of food returned to a base camp during foraging time, then the material remains associated with these activities should exhibit patterning consistent with expectations derived from central-place foraging theory.

ACKNOWLEDGMENTS

This study was partially supported by a University of Utah Graduate Research Fellowship, and Ann Hanniball of the Utah Museum of Natural History generously provided access to the ethnographic basket collection. We especially thank Kathy Kankainen of the UMNH for her time, advice and assistance in measuring baskets and providing information about the collection. We also thank Kristen Hawkes, Kevin Jones, Steven Josephson, David Madsen,

Table 5. Maximum Transport Distance calculated for 64.3 liter (Jones and Madsen 1989) and 31.8 liter Basketloads

Jones and Madsen 1989, Basket = 64.3 liters

Resource	Cal/hr	Cal/kg	Kg/ Basket	Cal/ Basket	Hr/ Basket	NET Cal/ Basket	Transport Cost Cal/km	Maximum Transport Distance (km)
Grasshoppers	272,649	3,010	11.44	34,431	0.13	34,392	114	301
Bulrush seeds	1,699	3,050	39.54	120,592	71.00	99,292	149	664
Tansy mustard seeds	1,307	3,600	47.67	171,623	131.30	132,233	160	829
Pinon nuts	1,083	4,880	32.31	157,695	145.60	114,015	140	812
Shadscale seeds	1,033	2,790	21.55	60,111	58.20	42,651	127	336
Peppergrass seeds	684	3,160	43.67	137,986	201.70	77,476	155	501
Sunflower seeds	486	3,650	28.25	103,116	212.20	39,456	135	292
Bluegrass seeds	455	3,340	17.81	59,492	130.80	20,252	122	166
Wild rye seeds	370	2,800	7.74	21,672	58.60	4,092	110	37
Indian ricegrass seeds	364	2,740	22.52	61,702	169.50	10,852	128	85
Foxtail barley seeds	2,206	3,070	19.93	61,186	297.00	-27,914	125	-
Carex seeds	202	2,590	29.48	76,344	377.90	-37,026	137	-
Pickleweed seeds	111	2,430	39.34	95,608	861.30	-162,782	149	-

Basket = 31.8 liters

Resource	Kg/ Basket	Cal/ Basket	Hr/ Basket	NET Cal/ Basket	Transport Cost Cal/km	Maximum Transport Distance (km)
Grasshoppers	5.66	17,030	0.06	17,010	107	159
Bulrush seeds	19.55	59,642	35.11	49,108	124	395
Tansy mustard seeds	23.58	84,872	64.94	65,391	129	505
Pinon nuts	15.98	77,978	72.01	56,376	120	470
Shadscale seeds	10.66	29,735	28.78	21,100	113	186
Peppergrass seeds	21.60	68,247	99.75	38,322	127	302
Sunflower seeds	13.97	50,995	104.94	19,512	117	166
Bluegrass seeds	8.81	29,419	64.69	10,012	111	90
Wild rye seeds	3.83	10,718	28.98	2,024	105	19
Indian ricegrass seeds	11.14	30,517	83.83	5,368	114	47
Foxtail barley seeds	9.86	30,260	146.88	-13,806	112	-
Carex seeds	14.58	37,761	186.89	-18,307	118	-
Pickleweed seeds	19.46	47,278	425.96	-80,511	124	-

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NOTES

1. Hawkes, O'Connell and Blurton Jones (1989:349, 345) reported the mean benefit (kg/hour) and cost (min/trip) for Hadza women of different age classes collecting tubers. Elsewhere in the text the authors report that ca. 39 percent of these tubers were consumed in the field. Multiplying the average time spent in tuber exploitation (hrs/trip) by the mean return rate (kg/hr) for tuber exploitation, and subtracting 39 percent of the total return to adjust for field consumption, yields a rough estimate of 3.1 to 7.8 kg of tubers returned to camp per adult woman per tuber collecting trip on average.

2. The greatest density used to calculate load weights for pine nuts is that of pine nuts still in hulls, although our samples of this resource continued to increase in density with further processing. However, our next processing steps consisted of parching and hulling the nuts, winnowing the nutmeats, further cleaning the nutmeats by hand, and parching the nutmeats. In our experience, hulled and cooked nutmeats deteriorate very rapidly. They may not have been transported in that state, even though with an average density of .71 kg per l, our samples of parched nutmeats had an energetic value 6560 Kcal per kg (Barlow and Metcalfe 1995).

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WHY SHOULD IT MATTER IF I TAKE ANOTHER POTSHERD? THE IMPACTS OF CONTEMPORARY ARTIFACT COLLECTING AT ANASAZI VILLAGES

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INTRODUCTION

Studies of the vandalism of archaeological sites focus primarily on visible evidence, such as potholes, in sites on public lands. More informal, but equally illegal, surface collecting significantly alters the surface assemblages of archaeological sites. A statistical analysis of potsherds from excavated puebloan sites provides estimates for the proportions and numbers of decorated potsherds that should occur on the surface of uncollected sites. According to this formula, approximately 75 percent of the decorated potsherds have been previously, and probably illegally, collected from 20 Anasazi villages in southwestern Utah. Predictors of vandalism derived from other studies confirm the accuracy of the estimates. The utility of this approach for assessing the integrity of site surfaces prior to more costly studies of site structure and human settlement is explored.

Contrary to popular perceptions, much of what we learn about the past comes from archaeological surveys of landscapes and surface remains, rather than from more expensive and labor intensive archaeological excavations. Through regional surveys and syntheses of smaller surveys, we gain insights into the organization, growth, collapse, and persistence of earlier and contemporary societies. Regional studies, such as those concerning the Chacoan roads, reveal scales of interaction and organization that is often invisible to the site-focused excavators.

In both excavations and surveys, archaeologists invest considerable time and energy in recording and analyzing material remains. The bulk of their studies often focus on so-called diagnostic artifacts, perceived to be projectile points and decorated potsherds (e.g., Reid 1984; Sullivan 1984). There is a long history of using these artifact classes for

Table 1. The Number of Potsherds from Excavations of Habitation Villages Occupied by the Virgin Anasazi

Site Name	Site Number	Number of Potsherds: Plain	Decorated	Reference
ZNP1	42KA—	193	5	Schroeder 1955
ZNP3	42KA—	1,232	315	Schroeder 1955
ZNP5	42KA—	272	38	Schroeder 1955
ZNP52	42KA—	231	10	Schroeder 1955
Three Forks	42KA331	179	44	Fowler and Aikens 1963
Bridgette	42KA346	206	55	Fowler and Aikens 1963
Mudhole	42KA354	196	115	Fowler and Aikens 1963
Golden Stairs	42KA524	293	60	Fowler and Aikens 1963
Bonanza Dune	42KA1076	5,584	991	Aikens 1965
Kanab	42KA1969	8,665	1,187	Nickens and Kvamme 1981
Dune 1	42WS39–40; 45–56	2,441	560	Day 1966
—	42WS162	85	20	Walling et al. 1986
Frei	42WS164	714	190	Pendergast 1962
Goosenecks	42WS173	900	159	Aikens 1965
Reusch	42WS173	645	94	Aikens 1965
—	42WS268	396	25	Walling et al. 1986
—	42WS288	1,453	15	Walling et al. 1986
—	42WS388	640	74	Walling et al. 1986
—	42WS390	607	75	Walling et al. 1986
—	42WS392	1,348	502	Walling et al. 1986
—	42WS395	1,882	460	Walling et al. 1986
Little Man 1	42WS404	491	45	Dalley and McFadden 1988
Red Cliffs	42WS503	4,804	441	Dalley and McFadden 1985
Little Man 2	42WS1346	5,494	574	Dalley and McFadden 1988
Little Man 4	42WS1348	128	5	Dalley and McFadden 1988
Little Man 3	42WS1349	2,248	330	Dalley and McFadden 1988

Note: Decorated sherds include black-on-white and black-on-gray sherds. Plain sherds are various undecorated gray and white wares. Redwares, corrugated and black-on-red sherds excluded, along with excavations with < 100 sherds.

relative dating and assigning cultural affiliation to sites. Other forms of material culture have only rarely been given the same sort of attention by archaeologists (for elaboration upon this point see Gero and Conkey 1991).

Archaeologists assume that a site is relatively intact unless vandalism, potholes, or other disturbances are visible on the surface. Increasingly, we devote greater effort to off-site collection strategies, piece-plotting, and controlled surface collections aimed at understanding site structure. But as part of such intensive and expensive research efforts, we need to pay greater attention to the impacts and biases created by prior illegal and legal investigators.

Most studies of vandalism to archaeological sites have concentrated on the more visible evidence of disturbance, such as potholes and the defacement of rock art (e.g., Green and LeBlanc 1979; Nickens et al. 1981; Williams 1978; U.S. General Accounting Office 1987). Casual artifact collecting has largely been ignored. With the passage of laws making artifact collecting and vandalism illegal, evaluating the integrity of surface distributions becomes much more difficult, since collectors and vandals fear prosecution if they reveal their finds. Throughout this article, I do not differentiate between the destructive activities of artifact looters and vandals.

During a recent survey of the Muddy Creek-Orderville area in Kane County, Utah, a team from Utah State University encountered 20 Anasazi villages on which thousands of undecorated potsherds lay on the surface, but only a handful, if any, decorated sherds remained. We suspected that years of artifact collecting had stripped these sites of the decorated potsherds.

This article examines a statistical method for estimating the impacts of collecting the decorated sherds from archaeological sites. First I examine the statistical relationship of decorated to undecorated potsherds at a excavated sample of Virgin Anasazi villages. The derived regression formula then is used to estimate the number of decorated sherds that once existed on the surface of 20 villages in the Muddy Creek-Orderville area. The accuracy of these estimates is supported by introducing other predictors of vandalism, developed in studies with more visible vandalism and interviews with collectors. I conclude with a discussion of ways to incorporate these findings into regional studies, directing the results in a positive fashion beyond another cautionary tale.

LINEAR REGRESSION OF EXCAVATED SAMPLES OF POTSHERDS

Lightfoot and Francis (1978; Lightfoot 1978) examine the effects of artifact collectors on ceramic assemblages in two studies that are exceptions to digger-oriented investigations of vandalism. They propose that collectors prefer decorated sherds over plain sherds, larger sherds over smaller ones, and potsherds over other artifacts (Lightfoot and Francis 1978:88; Lightfoot 1978:99). The decline of decorated sherds over time due to multiple-episodes of collection is well documented at the Baker site, a major Fremont village on the Nevada–Utah border (Talbot et al. 1991:Table 1). The problems prior collection poses for cross-dating of sites, assessing research significance, and examining models of human settlement are detailed in Henderson's (1987) case study on the Pecos River in New Mexico.

Pots of different shapes and sizes often have different functions, and vary in the quantities of decoration (Blitz 1993; Hally 1986). In the American Southwest, bowls—often used for serving food—have much more painted decoration than jars which were probably used for food storage and preparation. Because the ratios of jars to bowls sometimes correlates with site function, the analyses presented here concentrate on habitation villages. This focus minimizes functional variability. Extensive middens and refuse surround the architectural debris and walls at habitation villages. These villages receive greater attention from vandals, due to their rich artifactual assemblages, including decorated pottery.

By examining the correlation between decorated and undecorated potsherds from excavated contexts, presumably unaffected by surface collecting, it should be possible to estimate the true proportions. This relationship should be constant as long as: the amounts of decoration on various vessel forms remain constant, along with the proportions of different vessel forms and the degree and rates of breakage (or fragmentation) of pottery vessels. Selective reuse of sherds would alter the relationship. I assume that the excavated samples of sherds are representative of the population of decorated and undecorated sherds for the entire site.

A high ($r = .927$; $p < .01$) linear correlation was obtained between the numbers of decorated and plain potsherds from 26 Virgin Anasazi villages without resorting to multiple-regression to control for the effects of different vessel forms (Table 1). The

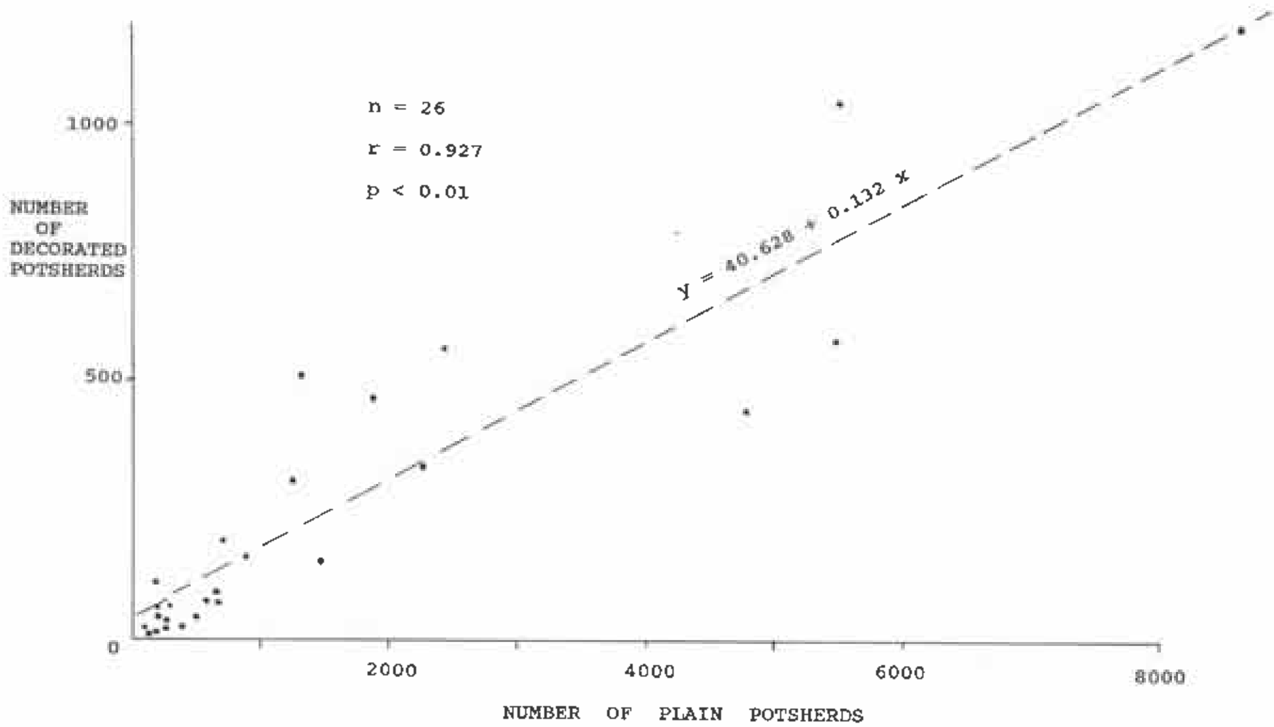

Figure 1. Linear regression of numbers of undecorated potsherds against numbers of decorated potsherds (data from Table 1).

scatter-plot exhibits a strong linear relationship (Figure 1).

Only those sherds from excavations were tabulated for each village. Few of the excavators screened (or sieved) the deposits from which the sherds were obtained. Rather than being detrimental to this study, the absence of screened samples probably makes the collections more closely resemble the in-field tabulations we completed on the surface of villages in the Muddy Creek–Orderville area.

PROJECTIONS TO SURFACE SAMPLES AT VIRGIN ANASAZI SITES

The formula derived through the regression of excavated samples can be used to predict the expected number of decorated sherds on the surface of the sites in the Muddy Creek–Orderville area. These expected numbers can then be compared to the observed numbers occurring there today, in order to infer the extent of past artifact collection. In doing so, I assume that the surface artifacts are representative of those still buried within the sites.

Today about 29,500 decorated and 884,550 plain potsherds remain on the surface of the 20 village sites (Table 2). The regression projects an expected value of 116,800 decorated sherds. On the average only 25 percent of the expected number of decorated sherds occur on the site surface. At 4 sites, no decorated pottery was recorded. The percentage of the remaining decorated potsherds only exceeds 50 percent of the expected number at 4 other sites.

Evaluating the accuracy of these predictions poses a dilemma because the artifacts were collected in the past by persons who are usually unwilling to discuss their illegal activities. Instead, we can examine how the estimates correlate with other predictors of vandalism developed in various other studies.

COMPARISONS WITH OTHER PREDICTORS OF VANDALISM

In southwestern Colorado, vandals most often target the latest village sites with masonry architecture within 0.1 kms of a road, but further (> 12 kms) from towns (Nickens et al. 1981). Lightfoot and Francis (1978:89) found a similar

Table 2. Potsherds and Indicators of Vandalism on the Surface of Habitation Villages in the Muddy Creek-Orderville Project, Kane County, Utah

	Number of:		Expected Number of Decorated	Percent Remaining Decorated	Distance to Nearest (km):			
42KA	Plain (X)	Decorated (Y)	(Y)	(Y/Y)x100	Road	Paved Road	Town	Pothole*
3900	750	50	150	33	1.0	2.5	3.2	A
3901	7,000	500	950	53	1.2	2.3	3.0	A
3902	15,350	550	2,050	27	.9	2.2	3.0	A
3903	8,600	400	1,200	33	.8	2.0	2.7	A
3904	2,750	50	400	13	.6	1.9	2.7	A
3905	13,200	400	1,800	22	.1	.1	5.5	A
3907	14,550	450	1,950	23	.1	.3	5.4	P
3908	23,100	1,600	3,100	52	.2	.2	6.5	P
3911	288,600	11,400	38,150	30	.0	.6	6.0	A
3912	18,000	0	2,400	0	.1	.1	7.0	A
3913	+117,450	+2,550	15,550	< 16	.5	1.3	6.0	P
3915	19,100	500	2,550	20	.5	1.1	6.3	P
3921	56,300	3,700	7,450	50	.7	.7	1.8	P
3922	4,600	400	650	62	.2	.2	1.3	P
3927	97,550	2,450	12,900	19	.3	1.0	3.7	P
3934	115,550	4,450	15,300	29	.3	.8	4.7	P
3936	9,600	0	1,300	0	.3	4.6	7.5	A
3940	40,000	0	5,300	0	.5	1.7	4.2	P
3944	1,300	50	200	25	.3	2.0	5.9	A
3945	31,200	0	4,150	0	.1	2.5	6.3	P
Totals	884,550	29,500	117,500	25	—	—	—	—

NOTE: Numbers of potsherds rounded to nearest 50. *P = Presence or A = Absence.

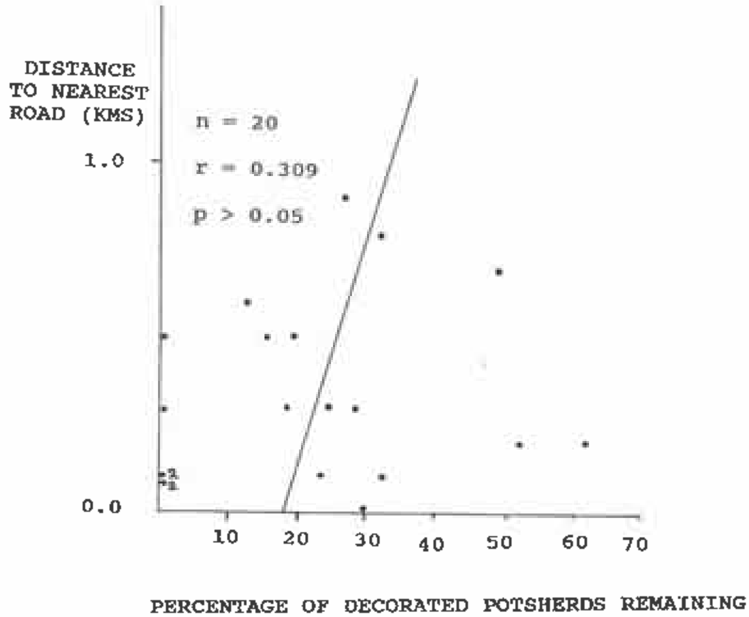

Figure 2. Linear regression of percentage of remaining decorated potsherds against distance to nearest road (data from Table 2).

Table 3. Association between prevalence of decorated pottery and distance to the nearest road

Percentage Decorated Potsherds Remaining	Distance to Nearest Road in (km) ≤.5	> .5	Total
≤ 30%	12	2	14
> 30%	2	4	6
Total	14	6	20

Chi-square = 5.6; d.f. = 1; p = .02

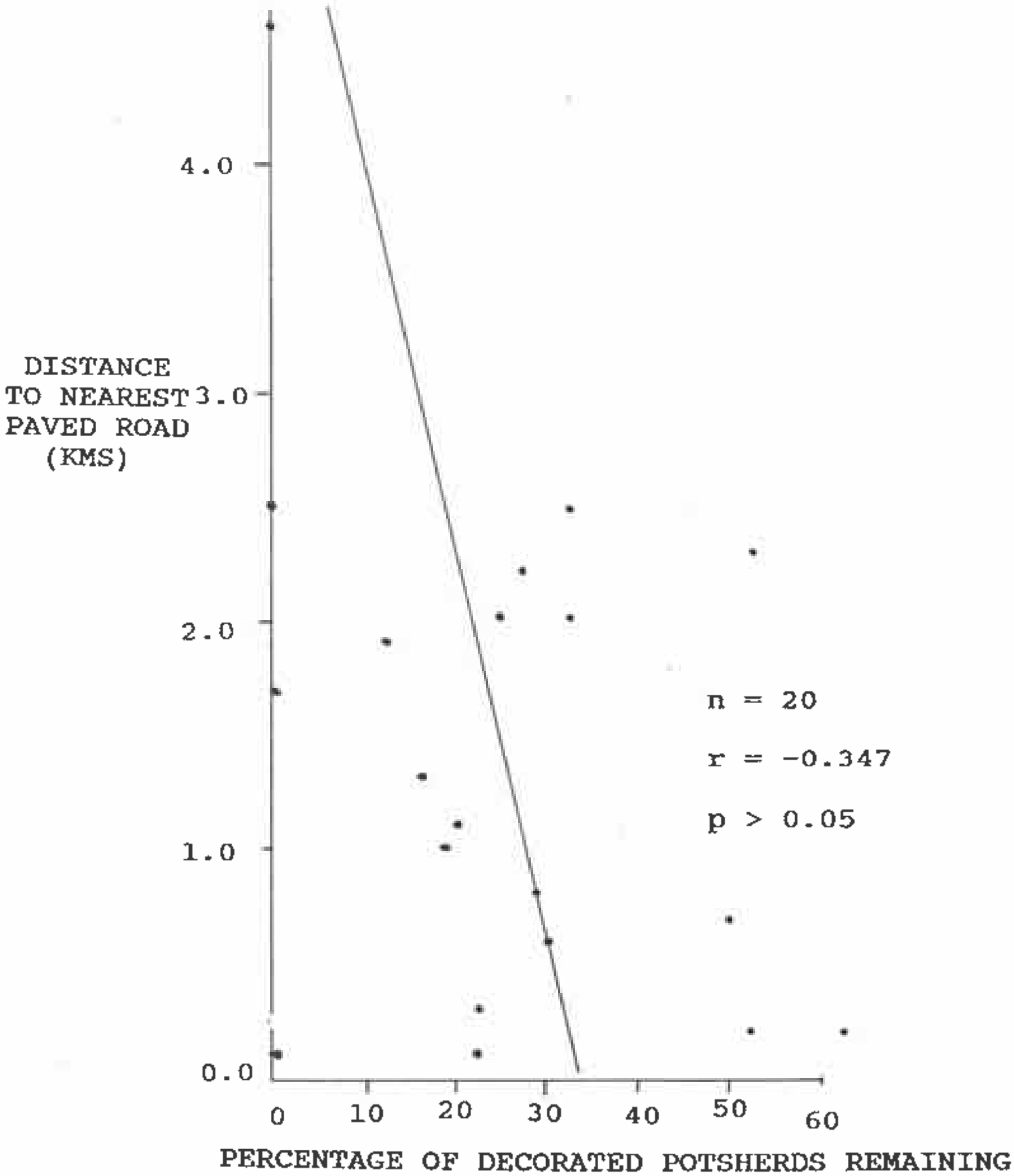

Figure 3. Linear regression of percentage of remaining decorated potsherds against distance to nearest paved road (data from Table 2).

association of vandalism with proximity to roads to eastern Arizona. Interviews with collectors conducted as part of Nickens et al.'s study indicate that they gain access to sites with automobiles along familiar roads. Illegal diggers concentrate on middens rather than in architectural rooms (Nickens et al. 1981:61).

In eastern Arizona, larger, more visible sites with less vegetation cover are the most likely to be vandalized (Lightfoot 1978:99). Over the broader area of the Rocky Mountain West, Williams' (1978) polling of government personnel indicates that vandals targeted less accessible and remote sites with less chance of detection by other visitors and government officials.

All of these studies focus on public lands, where artifact collection and site vandalism is illegal. In recent years, law enforcement and prosecution have increased in an attempt to suppress the activities of vandals and collectors. On public lands, considerable

Table 4. Association Between Prevalence of Decorated Pottery and Distance to the Nearest Paved Road

Percentage Decorated Potsherds Remaining	Distance to Nearest Road in (km)		
	≤ 1.3	> 1.3	Total
≤ 28%	7	6	13
> 28%	4	3	7
Total	11	9	20

Chi-square = .01; d.f. = 1; p = .99

Table 5. Association Between Prevalence of Decorated Pottery and Evidence of Potholes

Percentage Decorated Potsherds Remaining	Distance to Nearest Road in (km)		
	Potholes Absent	Present	Total
≤ 30%	7	7	14
> 30%	3	3	6
Total	10	10	20

Chi-square = .000; d.f. = 1; p = .995

effort might be devoted to avoiding detection, something that would be less of a concern on private lands.

The Muddy Creek–Orderville data are unique because the sites are mostly on private lands, where the owner potentially has greater control over the activities of collectors and vandals. As the chances of detection and prosecution increased on federal and state lands, collectors and vandals may have shifted their efforts to private lands. We might expect the intensity and extent of their efforts to differ between private and public lands. Strategies would probably differ between surface collection and digging for artifacts.

As in other vandalism studies a positive, but weak, correlation exists between the distance to the nearest road and the percentage of decorated potsherds that remain on the surface. More decorated pottery occurs on the surface of sites located further from any road (Figure 2). While the correlation coefficient ($r = .309$) is not statistically significant ($p > .05$), a chi-square test on a contingency table with the same data is strongly significant (Table 3). While a statistically significant trend is supported by the chi-square, the relationship in the scatter plot (Figure 2) is not very linear. Notice also that none of the sites occur at tremendous distances from roads.

More people travel along paved roads, increasing the likelihood of detection of vandalism. The partial avoidance of sites close to paved roads by collectors is suggested by the weakly negative ($r = -.347$) and slightly nonsignificant ($p > .05$) correlation between

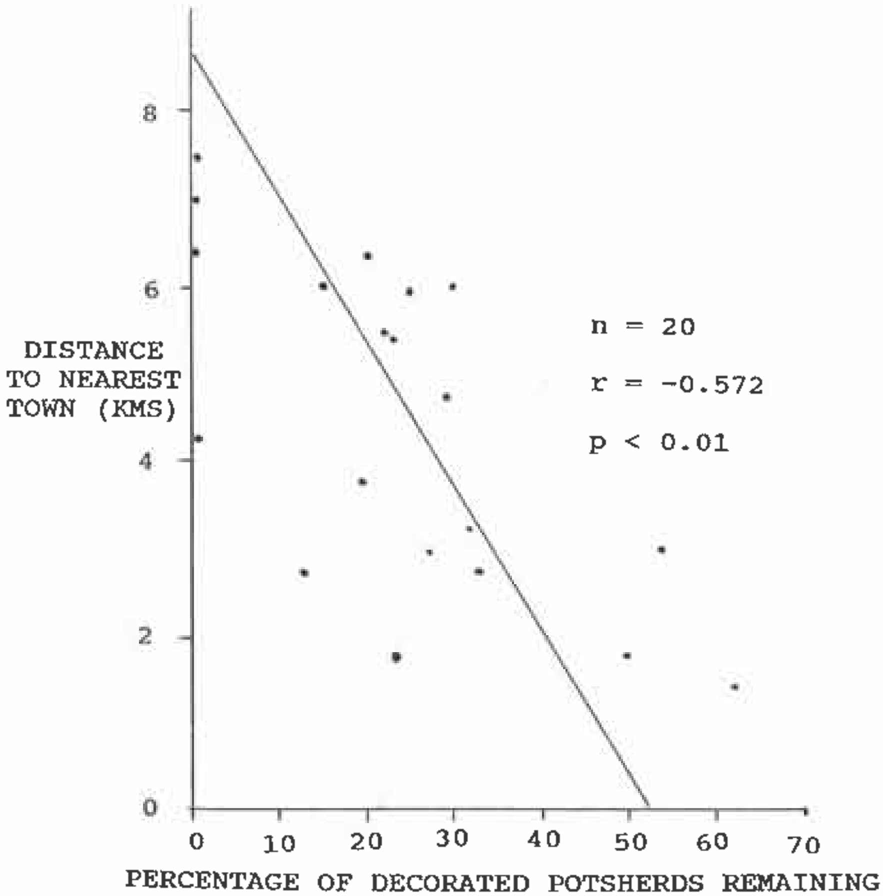

Figure 4. Linear regression of percentage of remaining decorated potsherds against distance to nearest town (data from Table 2).

the distance to paved roads and the percentage of decorated potsherds that remain on the sites (Figure 3). Chi-square calculated on Table 4 is also not statistically significant.

An effort to avoid detection may account for the highly significant negative correlation ($r = -.572$, $p < .01$) between distance from towns and the amount of decorated pottery that remains (Figure 4). Collection-induced bias is higher at remote sites.

Visible evidence for vandalism (in the form of potholes or other nonprofessional excavations) is not common at sites where fewer decorated potsherds exist on the surface, due in part to prior collection (Table 5). Based on this finding, I propose that surface collecting is done independently of digging for artifacts. Surface collection may be more casual and opportunistic, in contrast to more serious looting oriented towards discovering marketable artifacts. This proposal requires further evaluation, perhaps through ethnographic research on vandalism.

The agreement of independent predictors of vandalism with the estimates of the intensity of surface collecting of decorated potsherds at 20 Anasazi villages in the Muddy Creek–Orderville area, adds further support to the accuracy of those estimates. In most cases only a small fraction of the decorated sherds that probably once existed on the surface of the sites remain today.

DISCUSSION AND CONCLUSIONS

By using linear regression to describe the statistical relationship between decorated and plain potsherds, estimates can be made of the quantities of decorated sherds that have been removed from the surface of a site. In the Muddy Creek–Orderville area of southwestern Utah approximately 75 percent of the expected number of decorated potsherds have been removed, presumably by artifact collectors, from the surface of 20 village sites. The correlation between these estimates of the intensity of artifact collection with other predictors of archaeological vandalism supports the accuracy of the estimates.

This study provides a method for estimating the impacts of surface collecting on specific archaeological sites that is independent of more visible evidence of vandalism. In combination with taphonomic and other middle-range approaches to site formation/transformation processes, it offers a means for rapidly assessing which site surfaces offer greater integrity (i.e., are more pristine). Assessing the degree of prior artifact collection benefits more costly and intensive studies of site structure by allowing us to focus our efforts at piece-plotting and controlled surface collecting/recording on those sites with less biased and more intact surface assemblages.

Additional potsherds are created (through breakage) and exposed (through various natural and cultural processes) over time, but they are derived from a finite number of vessels within a particular site. Previous studies at other sites (Talbot et al. 1991:Table 1), as well as this one, indicate that repeated surface collecting gradually decreases both the numbers and diversity of decorated potsherds on the surface. This effect hinders our efforts to determine the cultural affiliation, time period(s), and functions of the occupation(s), and increasing the difficulty of making accurate statements about human settlement and societal organization. While the effects of surface collection cannot be eliminated, they can be evaluated and incorporated into anthropological studies by using the technique presented here.

On the other hand, some categories (e.g., chipped-stone debitage, smaller undecorated sherds, ecofacts) and size-classes (e.g., micro-refuse) may be ignored by artifact collectors. Yet, these materials often receive less attention from archaeologists than the decorated pottery and formal tools, such as projectile points. Increasing the attention paid to less impacted classes of refuse provides a way of coping with collector-induced biases.

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FREMONT CORN AGRICULTURE: A PILOT STABLE CARBON ISOTOPE STUDY

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INTRODUCTION

Great Basin archaeologists have long debated the role of corn agriculture in Fremont subsistence. Standard approaches to dietary reconstruction, including plant macrofossil and pollen analyses, have proven inconclusive. Here I report the results of a recent stable carbon isotope study designed to address this issue. Results suggest that corn may have been an important component of Fremont diet in certain contexts.

FREMONT SUBSISTENCE

The Fremont are conventionally thought of as an eastern Great Basin/western Colorado Plateau Formative complex roughly contemporary with the Anasazi (Jennings 1978; Madsen 1989). The majority of known Fremont sites date to A.D. 800–1300 (Talbot and Wilde 1989) and are characterized by clusters of pithouses, frequently in association with substantial adobe and/or masonry granaries (Jennings 1978). This represents a marked departure from earlier Archaic and subsequent Late Prehistoric sites, which were less intensively occupied and contain little evidence of domestic architecture (Wilde and Newman 1989). With few exceptions, Fremont residential sites are located where conditions were favorable for corn cultivation, along or above perennial water courses or at the base of alluvial fans, at elevations with maximum summer precipitation and a 120–150 day frost-free growing season (Lindsay 1986:237–239). Although evidence of irrigation is rare (see Metcalfe and Larrabee 1985 for an exception), recovery of corn macrofossils is common (see Metcalfe 1984 for a comprehensive summary).

Despite clear indications that at least some Fremont populations were engaged in agriculture, the dietary importance of corn is disputed. Some hold that while corn may have been less important to Fremont groups than to the Anasazi, Fremont settlement patterns were determined primarily by reliance on domesticates (e.g., Berry 1974; Jennings 1978; Marwitt 1970). Differences in the location, scale and apparent permanence of Fremont residential sites, relative to those of earlier and later periods, are cited in support of this position.

Others argue that Fremont subsistence exhibited marked spatio-temporal variability. Settlement patterns were not uniformly influenced by exploitation of domesticates (e.g., Madsen 1989; Simms 1986; Winter and Hogan 1986). During favorable periods (see Talbot and Wilde 1989), heavy reliance on agriculture may have supported large Fremont bases (e.g., Evans Mound [Dodd 1982], Median Village [Marwitt 1970]) along the southern rim of the eastern Great Basin, but residential sites in central Utah (e.g., Backhoe Village [Madsen and Lindsay 1977], Wild Bill Knoll [Metcalfe 1984]) are thought to reflect greater dependence on wild resources. Although situated in locations suitable for corn agriculture, diversity rather than uniform reliance on domesticates is said to have characterized subsistence at these sites (see Simms 1986).

These issues remain unresolved by standard methods of dietary reconstruction. Both corn and other plants are common in Fremont macrofossil assemblages, yet their respective dietary contributions cannot be readily assessed; pollen is even a less clear indicator of prehistoric diet. A different approach is necessary.

STABLE CARBON ISOTOPE ANALYSIS

Stable carbon isotope analysis provides a basis for quantitative investigation of prehistoric diet, independent of archaeologically recovered botanical remains. The principle is relatively simple (see Ambrose 1993; Schwarcz 1991; Sillen et al. 1989 for reviews). Terrestrial plants vary in the photosynthetic pathway employed to metabolize atmospheric carbon (CO_2). These pathways differentially discriminate against uptake of ^{13}C, the heavier stable carbon isotope. Plants employing a C_4 pathway are relatively enriched in ^{13}C (Chisholm et al. 1982), while C_3 plants discriminate against its incorporation (Smith and Epstein 1971). This bias is reflected in the stable carbon isotope ratio ($^{13}C/^{12}C$) of plant tissues and the tissue and bone of their consumers (Price et al. 1985; van der Merwe 1982). Through mass spectrometry, the stable carbon isotope ratio of human bone collagen is determined, providing an estimate of the contribution of C_3 versus

Table 1. $\delta^{13}C$ Values for Human Remains from Four Fremont Sites

Site	Burial	$\delta^{13}C$
Evans Mound	fs210.57	-7.56
Evans Mound	fs267.16	-10.22
Evans Mound	fs1276.83	-8.70
Backhoe Village	76AS1.16.20	-7.42
Backhoe Village	76AS1.37.51	-7.56
Caldwell Village	3	-8.82
Caldwell Village	2	-8.41
Caldwell Village	4	-8.22
Caldwell Village	6	-11.02
Nawthis Village	—	-9.47

C_4 plants to the diet of sampled populations. Because corn is a C_4 plant and most wild resources are C_3, carbon isotope ratios are commonly used to assess prehistoric corn consumption (Bender et al. 1981; Buikstra and Milner 1991; Bumsted 1984; Schwarcz et al. 1985; van der Merwe and Vogel 1978; Vogel and van der Merwe 1977). A number of recent studies have employed this procedure to investigate the role of corn in southwestern economies with compelling results (Decker and Tieszen 1989; Ezzo 1992; Spielmann et al. 1990; Wolley 1988).

Stable carbon isotope ratios are expressed in δ notation, as parts per thousand (‰) difference from an internationally recognized marine limestone standard. Because the standard has more ^{13}C than modern plants and animals (Craig 1953, 1957; Rounick and Winterbourn 1986), $\delta^{13}C$ values for food resources are negative; the more negative, the greater the dietary reliance on C_3 resources.

METHODOLOGY

To evaluate the contribution of corn to Fremont diet, I conducted a pilot isotope study of human skeletal material from four Basin/Plateau Formative sites: Evans Mound (Dodd 1982) on the southeastern rim of the Great Basin, Backhoe Village (Madsen and Lindsay 1977) on the central eastern Basin rim, Nawthis Village (Metcalfe 1984) in the Basin/Plateau transition zone, and Caldwell Village (Ambler 1966) situated on the northwestern margin of the Colorado Plateau. Bone consisted of rib in good condition, well provenienced and from separate adult individuals. An EDTA collagen extraction protocol (Tuross et al. 1988) was followed. Resultant collagen extracts were combusted in a Carlo Erba elemental analyzer prior to cryogenic purification in a triple trap VG Micromass SIRA 10 isotope ratio mass spectrometer. Atomic C:N ratios were within the 2.9–3.6 range considered indicative of *in vivo* collagen (DeNiro 1985). Internal standards were interspersed every tenth sample. Experimental uncertainty for stable carbon isotope analysis, with respect to fossil bone collagen, is $\pm$ 0.5‰ due to combined errors from pretreatment, combustion, and diagenic alteration (Stafford et al. 1988).

Dietary reliance upon C_4 resources is calculated by the following formula (modified from Schwarcz et al. 1985):

$$\%C_4 = \frac{|\delta_3| - |\delta_s| - D_{dc}}{|\delta_3| - |\delta_4|} \times 100$$

where δ_3 = δ value for C_3 dietary component
δ_4 = δ value for C_4 dietary component
$D_{dc} = D_{diet} - D_{collagen}$ (+ 5‰ fractionation)
δ_s = δ value of bone collagen sample

Table 2. Summary of Southwest Carbon Isotope Studies

Site/Location	n	[a]Cultural Affiliation	[b]Date	$\delta^{13}C$‰	$\%C_4$	Ref.
Nawthis Village, UT	1	Fremont		-9.5	73	1
Caldwell Village, UT	4	Fremont		-9.1	75	1
Badger House, Mesa Verde, CO	6	Pueblo I		-8.9	[c]76	2
Evans Mound, UT	3	Fremont		-8.8	77	1
Site 820, Mesa Verde, CO	5	PII-PIII		-8.7	[c]77	2
Two Raven House, CO	9	Pueblo II		-8.6	[c]78	2
Pecos Pueblo, NM	8	Period VI	Post A.D. 1675	-8.5	[c]79	3
Marcos Canyon, CO	4	Pueblo III	A.D. 1450–1550	-8.3	[c]80	2
Unprovenienced, CO	1	Bskt Mkr III		-8.3	[c]80	2
Badger House, Mesa Verde, CO	10	PII–PIII		-8.3	[c]80	2
Pecos Pueblo, NM	9	Period IV	A.D. 1550–1650	-7.8	[c]83	3
Pecos Pueblo, NM	10	Period III	A.D. 1450–1550	-7.7	[c]84	3
Pecos Pueblo, NM	8	Period I	A.D. 1300–1400	-7.7	[c]84	3
Polly Secrest, UT	2	Fremont	A.D. 1300	-7.7	79	4
Pecos Pueblo, NM	11	Period V	A.D. 1600–1675	-7.6	[c]84	3
Backhoe Village, UT	2	Fremont		-7.5	85	1
Pecos Pueblo, NM	7	Period II	A.D. 1400–1450	-7.5	[c]85	3
Pecos Pueblo, NM	8	Black-on-White	A.D. 1200–1300	-7.5	[c]85	3
San Antonio Pueblo, NM	3	Late Anasazi	A.D. 1300–1400	-7.4	80	4
Tijeras Pueblo, NM	5	Late Anasazi	A.D. 1300–1400	-7.0	83	4

[a]Listed as cited in reference.

[b]Dates listed if cited in reference only.

[c]$\%C_4$ not given in reference; calculated by author per equation 1.

Ref: (1. Coltrain, this study), (2. Decker and Tieszen 1989), (3. Spielmann et al. 1990), (4. Wolley 1988) δ values used for C_3 and C_4 dietary components are -26.5‰ (Price et al. 1985); and -10‰ (Tieszen and Fagre 1993), respectively. Although the mean δ value for modern C_4 plants is -12.5‰ (Price et al. 1985), recent research has demonstrated a more positive δ value for prehistoric corn, attributed to the absence of fossil fuel ^{13}C depletion of atmospheric carbon (Tieszen and Fagre 1993). Hence, use of -12.5‰, the modern mean δ value, over estimates the relative importance of C_4 resources in prehistoric diets. Until δ values for corn macrofossils from the sites in question are obtained, -10‰ will be used as a best estimate of dietary C_4 δ.

RESULTS

Results of analysis are shown in Table 1. Mean site $\delta^{13}C$ values are listed in Table 2. These range from -7.49‰ to -9.47‰, demonstrating that C_4 resources comprised 73–85 percent of the diet at sampled sites. For comparative purposes, Table 2 also includes results from similar studies of Southwestern diet.

DISCUSSION

Recent treatments (e.g., Madsen 1989; Simms 1986) argue that Fremont subsistence was characterized by marked adaptive diversity. Simms (1986) proposes three likely concurrent strategies: (1) some Fremont foraged logistically supplementing agricultural yields with wild resources but remained sedentary at large agricultural "village" sites like Evans Mound or Median Village; (2) some Fremont practiced a more mixed strategy, abandoning smaller "rancheria" residential bases, such as Backhoe perhaps, seasonally and/or during periods of agricultural shortfall, exhibiting greater mobility and dependency on wild resources than their logistical counterparts; and (3) some Fremont were full time hunter-gatherers, highly mobile and largely dependent on wild resources.

These strategies as distinguished by variability across two correlated dimensions: (1) the importance of domesticates, and (2) the degree of mobility. Because burials sampled in this study were recovered from large residential bases and smaller "rancheria" sites, data reported here speak *explicitly* only to the first two strategies, and solely to the role of domesticates in mixed economies. In this regard, isotope values from all four sites are consistent with the proposition that corn predominated in the diets of people living at these locations.

In contrast, patterns of mobility cannot be determined directly from these data. However, this we do know. Adult bone collagen turns over very slowly. Mean residence time, or the average time for replacement of bone collagen carbon by an equivalent amount of carbon, is thirty years (Stenhouse and Baxter 1977, 1979:333; see also Harkness and Walton 1972, and Libby et al. 1964). Carbon isotope ratios provide a weighted average of dietary intake over approximately three decades. Hence, short term variability in Fremont diet, perhaps correlated with increased mobility, undoubtedly existed but remains undetected by isotopic analysis. While reported stable carbon isotope values demonstrate that, over the course of three decades, C_4 resources comprised approximately 75 percent of sampled Fremont diet, Fremont likely depended more heavily on these taxa during some periods and less heavily during others. In periods of extreme shortfall, even large agricultural sites may have been abandoned in favor of a mobile foraging strategy. Apparent intermittent occupation of some Fremont residential bases as well as short term campsites dating to the Formative (e.g., Simms 1986) suggest this and Fremont bone chemistry does not preclude it.

An additional factor warrants consideration. Plant communities in the Intermountain West contain a number of native C_4 taxa. Some were exploited as food resources by protohistoric foragers (Table 3). A few (*Atriplex nuttalli*, *A. confertifora*, *Echinochloa crus.*) yield relatively high post-encounter returns (Simms 1987). Although carbon isotope values from the Formative Period are conventionally interpreted to indicate the role of corn agriculture, native C_4 taxa may be responsible for an unknown portion of Fremont isotopic enrichment, reducing the role of corn. Consumption of isotopically enriched animal protein would have the same effect.

These factors are seldom considered in studies of Southwest diets. Distinguishing their importance necessitates analysis of a larger sample of skeletal material, including both faunal material from sampled Fremont sites and post-Fremont human remains. At European contact, eastern Basin populations subsisted primarily on a wide range of wild C_3 species (e.g., pinyon [*Pinus* spp.], indian rice grass [*Oryzopsis hymenoides*], sunflower [*Helianthus* spp.],

Table 3. C_4 Non-domesticates Exploited by Eastern Great Basin Ute, Paiute, and Gosiute

Genus and Species	Common Name	Remarks	Reference
Amaranthus spp.[1]	Amaranth	Cultivated Very Important	Chamberlin 1911 Palmer 1878
Atriplex canescens[5]	Saltbush	Used	Chamberlin 1911 Palmer 1878
A. confertifolia[5]	Shadscale	Very Important	Chamberlin 1911
A. spp.[5]		Used	Chamberlin 1911 Palmer 1878
Carex spp.[4]	Sedge	Medicinal Use	Chamberlin 1911
Echinochloa crusgalli[2]	Barnyard Grass	Used	Steward 1938
Eragostis oxylepis[3]	Lovegrass	Used	Steward 1938
Euphorbia albomarginata[5]	Spurge	Medicinal Use	Train et al. 1957
Sporobulus cryptandrus[1]	Sand Dropseed	Much Used	Palmer 1878
Suaeda depressa[5]	Seepweed	Used	Chamberlin 1911
S. torreyana[1]	Seepweed	Medicinal Use	Train et al. 1957

(1. Downton 1975), (2. Cerling n.d.) (3. Raghavendra and Das 1978), (4. Smith and Epstein 1971), (5. Welki and Caldwell 1970).

goosefoot/pigweed [*Chenopodium* spp.]), plus the small suite of C_4 non-domesticates listed in Table 3. Post-Fremont stable carbon isotope ratios will indicate the role of wild C_4 elements in diets lacking tropical domesticates. Comparison with Fremont samples, including data from a larger number of individuals, will facilitate a more precise reconstruction of Great Basin diet.

In conclusion, data reported here are preliminary to an expanded study of Fremont diet. Although not entirely in keeping with current views on Fremont subsistence, sample size is too small among other things, to warrant adopting a revisionist position. Nevertheless, these results can be viewed as one data point among an accumulating set of studies undertaken by numerous researchers, all of which jointly give form to the elusive Fremont.

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INVESTIGATING THE SPATIAL STRUCTURE OF LITHIC SCATTER SITES FROM AN ETHNOARCHAEOLOGICAL PERSPECTIVE: EXAMPLES FROM UTAH AND NEVADA

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INTRODUCTION

Information derived from ethnoarchaeological studies of modern hunter-gatherer site structure can improve interpretations of shallow, open lithic scatters by helping us predict the types and locations of features, facilities, and refuse deposits that might be present on a site, select field methods that will adequately uncover extant site structure patterns, and better understand the function, duration of occupation, and occupational history of some lithic scatters. Data from one site in northern Nevada and one site in eastern Utah are used as examples of how information derived from ethnoarchaeological studies of hunter-gatherer site structure can improve archaeological site interpretations.

Shallow lithic scatters are ubiquitous in the Desert West. These sites are often investigated by excavating isolated test units directly into visible surface concentrations and analyzing assemblage composition and diversity to derive site interpretations. However comfortable we may feel with these techniques, they are empirically based and subject to distortions of the sample size effect (Jones et al. 1983). Faced with investigating numerous lithic scatters in the context of cultural resource management work, we wanted to find ways of improving site interpretation. Toward this end, we began to analyze the intrasite spatial patterning of selected sites from an ethnoarchaeological perspective as part of our research strategy.

Intrasite spatial patterning, or site structure, is the three-dimensional distribution of artifacts, features, facilities, and other phenomena within a site (Binford 1983:144; O'Connell 1993). Recent ethnoarchaeological research has shown that site structure is affected by such diverse activities and behaviors as duration of occupation, site function, rate of refuse output, the role of food procurement, sharing, and storage, predator avoidance, and anticipated mobility, among others (e.g., Binford 1983, 1987; Gamble and Boismier 1991; Gould and Yellen 1987; Kroll and Price 1991; O'Connell 1987; O'Connell et al. 1991; Whitelaw 1983). Such studies are critical to understanding the meaning of site structure patterns because they link the observed patterns with the behavior that created them (O'Connell 1987:75; O'Connell et al. 1991:75). In principle, such information can be used to help interpret archeological site structure in terms of human behavior (Bartram et al. 1991:77; Simms 1988:198).

Based on the studies to date, there is too much variability and too few cross-cultural patterns in modern hunter-gatherer site structure for the process to be as simple as matching every archaeologically observed pattern to an ethnoarchaeological analog. Palimpsest occupations can confound the patterns making site structure more complex and difficult to interpret (O'Connell 1987:90–91). The patterns can be significantly altered by postdepositional disturbances (Binford 1981). In an archaeological context, we lack the methods needed to retrieve data relevant to most of the issues noted above (O'Connell 1987:104–106). In addition, most ethnoarchaeological studies lack a higher order theoretical framework which can be used to firmly interpret variability in spatial patterning in terms of human behavior or postdepositional processes (Hudson 1993:349–351; O'Connell 1993, 1994).

In spite of these limitations, ethnoarchaeological research on hunter-gatherer site structure is still useful on a practical and methodological level; it can contribute, if even in a small way, to the interpretation of archaeological sites. This paper discusses two sites to show how we have used such information to help (1) predict the presence of features and refuse deposits, (2) forecast how sites might be structured so we can implement appropriate field strategies to locate the features and other important site elements, and (3) determine site function/duration of occupation on one category of lithic scatters. These two sites lacked significant postdepositional disturbance (Tipps 1988; Tipps in prep.) and were thus judged suitable for site structure analysis.

ETHNOARCHAEOLOGICAL OBSERVATIONS APPLIED TO FIELD STRATEGIES

Successful identification of site structure patterns requires examination of a sufficiently large proportion of a site to adequately reveal the patterns in each type of area (e.g., household, special activity, refuse, etc.) present on a site. Large block excavations are typically called for (O'Connell 1987:104; Simms 1988), but minimum block size is dependent on site function and size.

For example, a single residential area on short-term !Kung residential base camp could be exposed in 40 m^2, but as much as 300–400 m^2 would likely be required to adequately identify patterning on the whole !Kung camp (O'Connell 1987:104; see also Yellen 1977). Kua San and Hadza base camps could require excavation and analysis of 460 and 1250 m^2, respectively (Bartram et al. 1991:Table 3; O'Connell et al. 1991:Table 1), but excavation and analysis of more than 1000 m^2 might be required to identify the spatial patterning of a *single* household on a long-term Alyawara residential site (O'Connell 1987:104).

Short-term field camps and specialized extractive sites require smaller overall exposures because they tend to be smaller sites. At the Nunamiut Mask site, Binford (1978) identified a short-term field camp in 100 m^2. An Aché overnight camp could probably be excavated within 30 m^2 (Jones 1983, 1993:Table 6-1). Kua San transient camps might involve 70 m^2 (Bartram et al. 1991:Table 3), whereas Efe camps might require 44–532 m^2 (Fisher and Strickland 1991:220). Ethnoarchaeological descriptions of extractive locations (Bartram et al. 1991:Table 3; Binford 1983, 1984; Binford and O'Connell 1984) suggest that individual activity areas could be identified in exposures of 25–100 m^2.

The size of the areal excavation blocks can be reduced if the field archaeologist can judge where an activity area is located before the excavation is opened. For example, on Alyawara and Nunamiut residential sites, Binford (1987) was able to document in 400 m^2 the same kinds of spatial patterning that O'Connell documented in 1000 m^2 but Binford knew, *a priori*, where the individual households were located. Archaeologically, it may be possible to emulate Binford's approach through careful study of local ethnographic literature and ethnoarchaeological information on sites expected to be similar to those being investigated.

In sum, it is not just that large-scale excavations are mandated for ethnoarchaeologically informed site structure studies. What is critical is exposing enough of a site that the extant patterns can be reliably identified.

ETHNOARCHAEOLOGICAL EXPECTATIONS FOR DURATION OF OCCUPATION

Cross-cultural ethnoarchaeological studies (e.g., Bartram et al. 1991:141; Binford 1978, 1987; Fisher and Strickland 1991:230–231; Hitchcock 1987:416; Jones 1983, 1993:104; O'Connell 1987:100, 1993; Simms 1988:208) have noted a relationship between the length of occupation and refuse disposal practices, specifically, that refuse is deliberately managed on sites occupied for longer periods of time but not on sites occupied for shorter periods of time. The threshold at which refuse control begins is related to the number of site occupants, size and rate of refuse output, mobility, potential for site reuse, and substrate characteristics, etc. (Binford 1983; Fisher and Strickland 1991:231; Simms 1988:208) but, in general, sites occupied for shorter periods of time (perhaps up to 10 days) will be characterized by primary refuse deposited directly within the immediate context of its use. Sites occupied for longer periods of time will have primary refuse plus redeposited (secondary) refuse as a result of waste management. Secondary refuse will generally be distributed in disposal zones away from main activity areas because the latter areas are swept, cleaned, and otherwise maintained (Bartram et al. 1991; Binford 1983, 1987; O'Connell 1987; Yellen 1977).

Size plays an important role in whether a piece of refuse will be discarded in a primary or secondary context (Binford 1978, 1983; Hayden and Cannon 1983; Jones 1983, 1993:104; Kent 1984; O'Connell 1987:93–95, 100; Simms 1988:207). Small items (less than 3–5 cm) are more likely to be discarded in place (in a drop zone) as primary refuse because they are less visible and less obtrusive than large items. Once deposited, they are also more likely than large items to retain their general horizontal positioning because they are more easily trampled into the substrate (Gifford-Gonzalez et al. 1985) and less susceptible to transport by foot traffic (see Stevenson 1991:271–272). On sites occupied for long periods of time, they are also more likely to remain in place after clean up efforts because they are harder to see and, thus, more difficult to amass and redeposit. Small items, therefore, will predominate in areas that have been cleaned up on long-term sites.

On short-term sites, larger items may be discarded in place or expediently tossed or brushed aside (Binford 1978, 1983; Stevenson 1991:275). On sites occupied for longer periods of time, large items tend to be removed to a secondary refuse dump during more formalized post hoc maintenance efforts (e.g., Clark and Kurashina 1981; Hayden and Cannon 1983; Kent 1984:169; O'Connell 1987:95; Simms 1988:207). As a result, on longer-term sites, large items will be clustered in peripheral areas and secondary refuse zones.

Because they provide the needed qualities of warmth, light, energy, and protection, hearths are frequently the center of hunter-gatherer activities (e.g., Binford 1978, 1983, 1987; Gamble 1991:11; Jones 1983, 1993:104; Kroll and Price 1991:197). Hearths should therefore be present on long- and short-term camps alike. The size of the activity area around a hearth varies according to the number of people simultaneously using the hearth and the type of activities conducted, but the usable space around a hearth is limited and ethnoarchaeologists have observed that hearth-focused activity areas frequently extend from 2 to 6 m from the windward side of the hearth (e.g., Binford 1978, 1983:149–159; Hayden 1979:166; Jones 1983, 1993:101–104; Nicholson and Cane 1991:340). On short-term camps, refuse should therefore exhibit a slightly offset, but tight concentration around fires. Size sorting of artifacts should be absent other than that caused by toss and drop zones. On long-term camps, small artifacts should show this same clustered pattern but large artifacts should primarily be found in secondary refuse locations.

Finally, ethnoarchaeologists have observed that as hearth-focused activity areas are used for longer periods of time, the need for maintenance such as cleaning and repositioning increases and the centroid of hearth features begins to drift (Binford 1978:158). In addition, hearths and other facilities in long-term activity areas tend to be more numerous, more formal, and more elaborately prepared (Binford 1987, 1990; Brooks et al. 1984; Hitchcock 1987).

In summary, hearths on short-term camps should be informal, with little or no evidence of repositioning, drift, or maintenance, and will often be the central locus of the site functioning as a source of heat, light, and energy for food preparation. Refuse should exhibit a tight—though perhaps slightly offset—focus around fires, be in primary context, and lack size sorting other than a toss zone.

Long-term sites should contain a larger variety of features such as hearths, structures, and storage facilities. Large refuse will concentrate in secondary deposits away from main activity areas. Maintained areas should primarily contain small debris resulting in clearly definable size sorting. Occasionally, some types of debris may be spatially concentrated in special activity areas peripherally distributed around the main activity areas especially if specialized tasks requiring large amounts of space were frequently performed.

FIELD AND LABORATORY METHODS

Application of ethnoarchaeological site structure studies to archaeological sites requires three steps: adequately exposing the site structure, describing and defining extant patterns, and/or interpreting the observed patterns in terms of natural disturbance and human behavior.

Like most sites excavated in a cultural resources management environment, excavations of the scope advocated by ethnoarchaeologists to uncover spatial patterning (O'Connell 1987; see above) were not feasible on the two sites described here. However, we were still able to obtain an overview of each site's large-scale spatial patterning through complete controlled surface collection. This technique was appropriate for the two sites reported here because they are exposed on the surfaces of stable deposits and the surface distributions accurately reflect the overall spatial patterning at the sites. Surface artifact distribution in conjunction with site layout expectations derived from local ethnographies, previous work in the area, and ethnoarchaeological studies were used to select excavation areas that had the potential of providing information needed to support or falsify our hypotheses.

To the extent possible, surface collection and excavation blocks were larger than the predicted behavioral units to allow complete exposure of the patterns within and between these units. We also tried to investigate more than one similar behavioral unit on each site so that we could be reasonably certain we were looking at repeated patterns (cf. O'Connell 1987:104) and not elements of a larger or alternate pattern. Excavations were accomplished in contiguous 1- by 1-m units.

A variety of approaches have been used to identify spatial patterns on archaeological sites (e.g., Kintigh and Ammerman 1982; Rigaud and Simek 1991; Whallon 1984). Because we wanted to study duration of occupation, ours focused on the presence and spatial distribution of primary and secondary refuse relative to each other and to features. Spatial patterns were identified through examination of the physical distribution of artifacts, features, and other site phenomena without reference to artifact type (e.g., knife, scraper, debitage, etc.)

To attempt to distinguish primary from secondary refuse by size, we subdivided the site assemblages into arbitrary size categories to study their physical distribution. Numerous arbitrary size categories were utilized as we experimented with the procedure (e.g., .32 cm [1/8 in], .64 cm [1/4 in], 1.27 cm [1/2 in], 2.54 cm [1 in], 5.08 cm [2 in], 10.16 cm [4 in] etc.) but they were ultimately collapsed during statistical analysis and for graphic presentation.

Statistical analyses were used to examine the relationships of the various size categories. We then used isopleth maps of artifact counts by size to illustrate the distributions identified during the statistical analysis and to examine the positioning of refuse relative to features.

The isopleth maps were generated using the Grid and Topo routines of the SURFER program (Keckler 1994). The maps were interpolated using the inverse distance averaging method because it inversely weights the influence of each data point relative to its distance from the grid value being generated. A standard interpolative grid twice the size of the site grid and search radius of three x-units were used on all maps, except when excessive zero values required a less dense grid and larger grid radius to generate complete contours.

CARORRA'S CAMP

Carorra's Camp was a Late Prehistoric, Eagle Rock Phase (A.D. 1300–1600) site on the stable surface of a gentle ridge in Little Boulder Basin, north-central Nevada. P-III Associates excavated this site in 1987 (Tipps 1988). Surface manifestations consisted of approximately 250 Tosawihi Chert flakes, 6 Desert Series projectile points, and 11 other chipped stone implements. With the exception of a few outlying tools, these artifacts were concentrated in a 5- by 6-m area.

At the time, sites like Carorra's Camp were routinely interpreted as chipping stations with no depth or interpretive value. As such, data recovery was rarely recommended (e.g., Jaynes 1981; Matranga 1985; Spencer 1985). However, our reading of local ethnographies (Harris 1940; Steward 1938) suggested that such sites might have more interpretive potential. In particular, ethnographic accounts of White Knife Shoshoni seasonal rounds implied that Little Boulder Basin would contain the remains of short-term, hunter-gatherer, summer base camps and fall field camps. Various ethnoarchaeological studies noted above further suggested that such sites would contain hearths.

We surface collected 100 m^2, considerably more than the entire surface manifestation of the site, to allow identification of the site's complete spatial patterning. Subsurface investigations had to be terminated after excavation of a 16 m^2 block due to inclement winter weather. Despite this limitation, most of the major surface artifact concentration was excavated, as were some peripheral areas. A circular, shallow, unlined heath was found in the area north of the main debris scatter (Figure 1).

Sediments at Carorra's Camp were screened through .64 cm mesh. Large (> 1.27 cm) and small (< 1.27 cm) artifacts are significantly correlated within the excavation block (r = .93; $p < .05$) indicating no size sorting in the artifactual assemblage. Note the similarity between the distribution of large and small artifacts in Figures 2*a* and 2*b*, respectively. In addition to the lack of size sorting, artifacts at Carorra's Camp are tightly focused in a 5- to 7-m-diameter area with the hearth slightly offset from the main artifact scatter; there is no evidence of feature maintenance, drift, or repositioning. These characteristics are all consistent with ethnoarchaeological expectations for a short-term, hearth-centered camp.

It would have been preferable to excavate more units beyond the major artifact concentration and hearth to verify that the observed spatial patterning is not part of a larger site phenomenon. In this case, this issue can be addressed with the surface assemblage because (1) the distribution of surface and subsurface artifacts in the excavation block is significantly correlated (r = .76; $p < .05$) and (2) the entire site area plus a buffer was completely

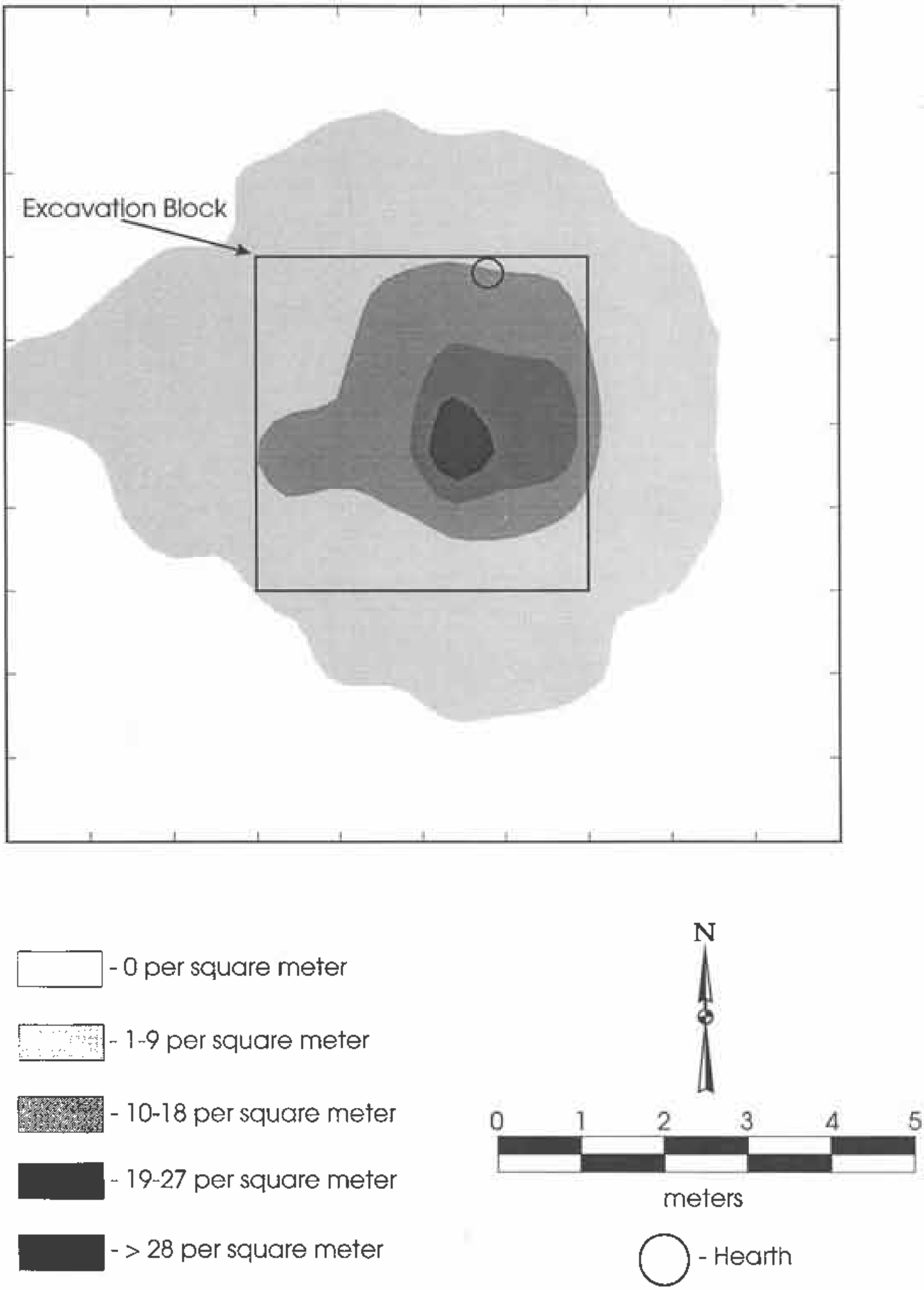

Figure 1. Map of Carorra's Camp showing the boundaries of the surface collection and excavation blocks, the location of the feature, and an isopleth representation of surface artifact distribution by count.

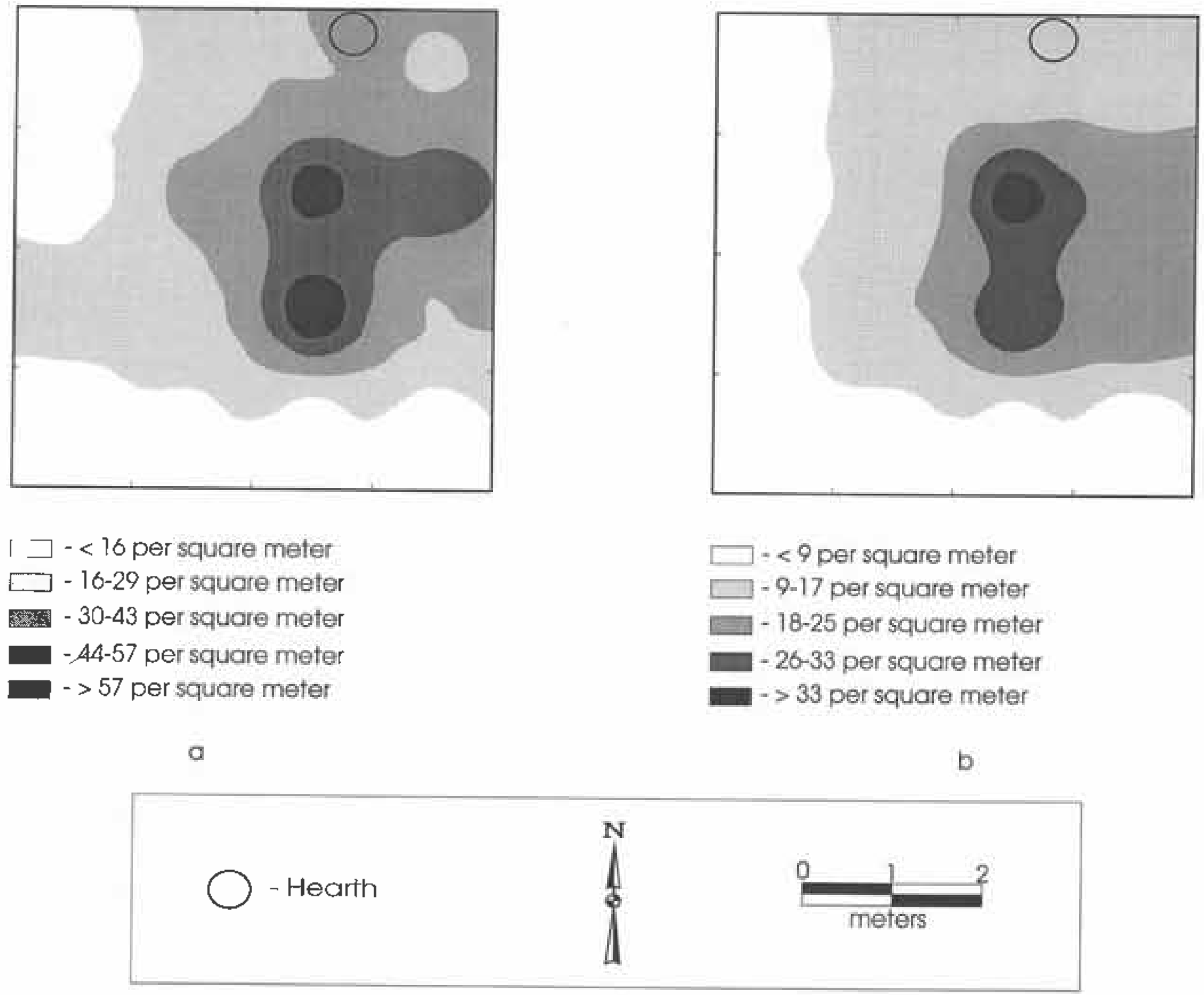

Figure 2. Isopleth map of artifact distribution by count in the excavation block at Carorra's Camp: *a*, large (>1.27 cm); *b*, small (<1.27 cm).

surface collected. The distribution of surface artifacts relative to the feature for the entire site clearly demonstrates that the observed pattern constitutes the entire site and is not part of some larger phenomenon (see Figure 1).

In sum, expectations from local ethnographies and ethnoarchaeological site structure studies led to predictions that the site was a short-term camp which would contain one or more hearths, and that any such hearths would be slightly offset from the main debris concentration. While most archaeologists would be comfortable characterizing the site as short-term based on its small size, discrete nature, and the composition of its artifact assemblage, the site structure approach and study provided an independent line of evidence supporting this interpretation.

More importantly, it led to the prediction and identification a hearth which few would have suspected on an open site in the area, particularly a site as small and nondescript as Carorra's Camp. This, in turn, resulted in the recovery of a radiocarbon date (590 ± 50 [Beta-23900; wood charcoal], with a tree-ring corrected age range of A.D. 1300–1430 at two standard deviations [Stuiver and Pearson 1993]). In an area where few absolute dates were available and the cultural chronology was still being developed, the discovery of a dateable hearth was a welcome discovery.

Without reference to ethnoarchaeological site structure studies, it is unlikely that data recovery would have been recommended. Even if it had, excavation of isolated 1- by 1-m units in the major surface artifact concentrations may have missed the hearth and the chronological data it contained and resulted in a different functional classification for the site.

BARTLETT CAMP

Bartlett Camp, excavated by P-III Associates in 1991 (Tipps in prep.), was a Late Prehistoric lithic scatter covering 4400 m^2 along the rim of a small box canyon in the northern Canyonlands uplands of eastern Utah. It was situated in the pinyon-juniper woodland at an elevation of 1700 m. On the surface, the site was manifest by multiple clusters of debitage and bone closely associated with hearths and a slab-lined feature amidst a light artifact scatter (Figure 3).

Based on the size and composition of the surface artifact assemblage, site layout, and previous excavation results from other Late Prehistoric sites in area (Davis et al. 1989; Osborn 1990), we hypothesized that the site was a short-term camp with multiple contemporaneous activity areas produced by multiple camp groups, or a palimpsest of short-term camps, each typified by one or several horizontally separated activity areas (Zeanah 1991:9–10). However, the presence of a slab-lined feature, possibly a storage cist, led us to consider whether the site could instead represent a longer duration residential base. Local ethnographies indicate that short-term transient forager camps are typical of Southern Paiute and Ute mesa top or pinyon zone settlement patterns but long-term base camps were occasionally positioned in the pinyon zone to take advantage of abundant fuel and stored pinenuts (Callaway et al. 1986; Kelly 1964; Kelly and Fowler 1986).

After collecting the entire site surface, we excavated most of the deposits around the hearth and slab-lined feature on the ledge at the south end of the site. The cultural remains in this area are temporally unrelated to those in the central portion of the site, and also too limited and too disturbed for site structure analysis. The remaining effort concentrated around and between the two hearths in the central portion of the site. A total of 69 m^2 was excavated in this area. If the site was a long-term occupation, this would maximize the probability of finding a central activity area or structure in the low surface artifact density area separating the two hearths. Simms (1989) has noted that open-air hearths frequently occur within 3 m of structures (see also Simms and Heath 1990), and various ethnoarchaeologists (e.g., Fisher and Strickland 1991; O'Connell 1987; Yellen 1977) have reported the presence of exterior hearths positioned outside of structures or around long-term activity areas on long-term residential bases. Based on these observations, the most likely area for a long-term activity area or structure was the low surface artifact density area between the hearths in the central portion of the site (Figure 4).

Sediments were screened using a .32 cm mesh allowing us to sample smaller artifacts than Carorra's Camp. However, like Carorra's Camp, all size grades show significant correlations. Large items (> 1.27 cm) are significantly correlated with medium (.64–1.27 cm; r = .88; p < .05) and small (< .64 cm; r = .65; p < .05) items. Medium and small items are also significantly correlated (r = .81;

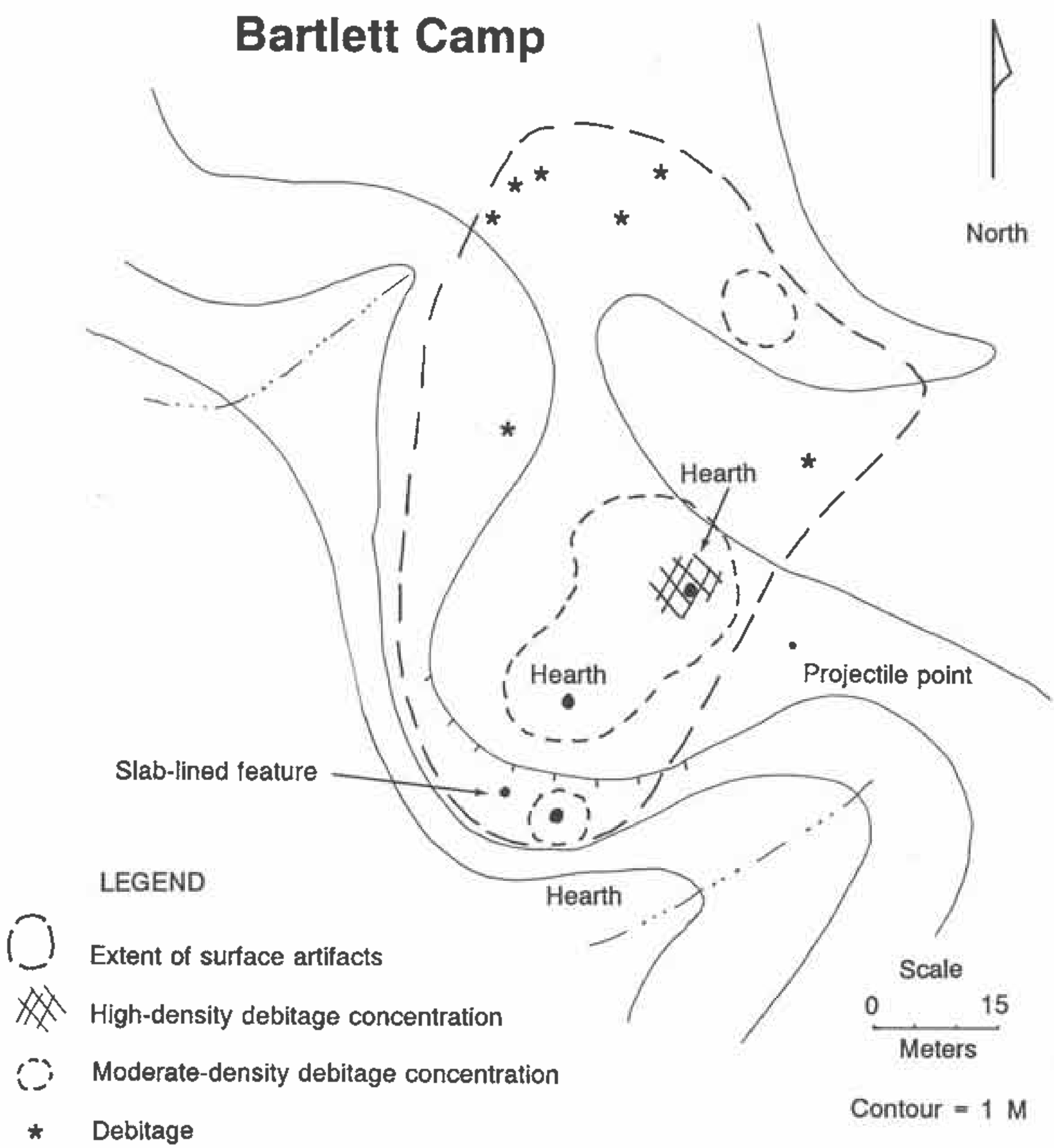

Figure 3. Plan map of Bartlett Camp.

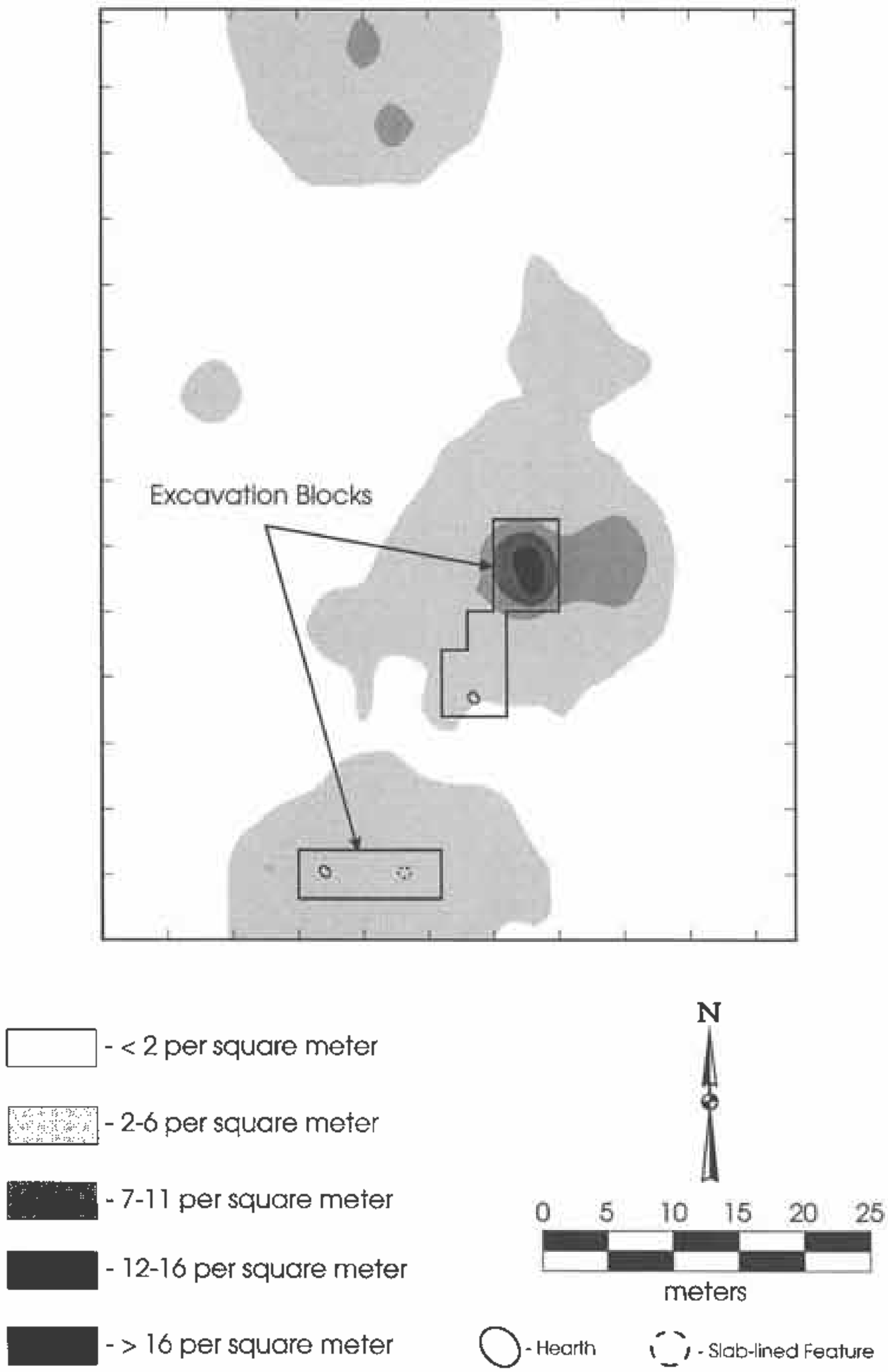

Figure 4. Map of Bartlett Camp showing the boundaries of the surface collection and excavation blocks, the locations of features, and an isopleth representation of surface artifact distribution by count.

$p < .05$). Figure 5 shows the distribution of large (> 1.27 cm) and medium/small (< 1.27 cm) artifacts in the excavation block. Note the similarity of the patterning to that of Carorra's Camp. Both large and medium/small artifacts cluster within 5 to 7 m of, but peripheral to, the hearths. Bone, primarily burned and unburned artiodactyl and rabbit, exhibits a similar clustered distribution peripheral to the hearths. Like Carorra's Camp, there is no evidence of features drifting, being maintained, or being repositioned. Note that no small-sized debitage or bone was recovered from the area separating the two hearth clusters as would be expected if the clusters were positioned around a central activity area or structure on a longer term site. The spatial patterning of the artifacts and features supports our suspicion that the activity areas are the result of short-term occupations.

Other more traditional forms of data support this interpretation because they show that the two clusters represent separate occupations. The southern hearth dates to 620 $\pm$ 60 (Beta-49374; wood charcoal) with a tree-ring corrected age range of A.D. 1280–1430 at two standard deviations (Stuiver and Pearson 1993). The northern hearth dates to 940 $\pm$ 80 (Beta-49198; wood charcoal) with a tree-ring corrected age range of A.D. 970–1280 at two standard deviations (Stuiver and Pearson 1993). In addition, the lithic material surrounding the two hearths differs significantly. Both artifact clusters contain regionally available Cedar Mesa Chert but the northern cluster is dominated by exotic, nonlocal raw material. The southern cluster has mostly local Bartlett Flat Chert.

While we would have learned that the artifact clusters and hearths represent separate occupations without the site structure approach, the radiocarbon dates and toolstone data say nothing about the duration of occupation represented by each cluster. If we had not paid attention to site structure, our assessment of duration of occupation would have been limited to a qualitative assessment of assemblage composition and diversity. This assessment can now be bolstered and supported with the independent evidence from site structure.

DISCUSSION

These examples of Carorra's Camp and Bartlett Camp illustrate some ways that archaeologists can use ethnoarchaeological spatial patterning information to enhance archaeological research. Information derived from ethnoarchaeological analyses of hunter-gatherer site structure combined with a complete surface collection/block excavation field strategy and site structure analysis provided a line of evidence concerning site function and duration of occupation on short-term camps independent of that provided by assemblage composition and diversity. In addition, this approach has helped us anticipate how sites might be structured so that we could allocate available excavation units in ways that directly test hypotheses, and focus on features, activity areas, and refuse deposits. The latter use resulted in the recovery of previously unexpected chronological information.

These results were obtained even though we were unable to excavate the large block exposures frequently called for by ethnoarchaeologists. We emphasize that we are not advocating site structure analyses based on small areal excavations. We are simply saying that attention to site structure in conjunction with traditional techniques was valuable on small- to medium-sized, short-term lithic scatter sites despite limitations due to the size of the excavation blocks.

In addition, we have found that patterns can be identified with smaller excavation blocks if we have some idea about what we are looking for, at least on short-term camps. To maximize available field time and manpower, field strategies should be developed on the basis of site layout expectations derived from local ethnographies, previous work in the area, and ethnoarchaeological site structure studies. We also want to emphasize that site structure studies can be successfully accomplished using 1- by 1-m excavation blocks rather than by piece plotting individual artifacts.

Based on our work to date, we think that the potential benefits of site structure analysis to Desert West archaeology are promising. In many parts of the western United States, small lithic scatters accompanied by few or no obvious features are ubiquitous. Being able to predict and locate features and to obtain additional lines of evidence concerning the duration of occupation and site function greatly enhances our ability to learn from these sites.

However we also offer some notes of caution. In the two cases presented here, the inferences derived from site structure were supported by additional lines of evidence that archaeologists commonly collect. I believe this is a critical aspect of the site structure

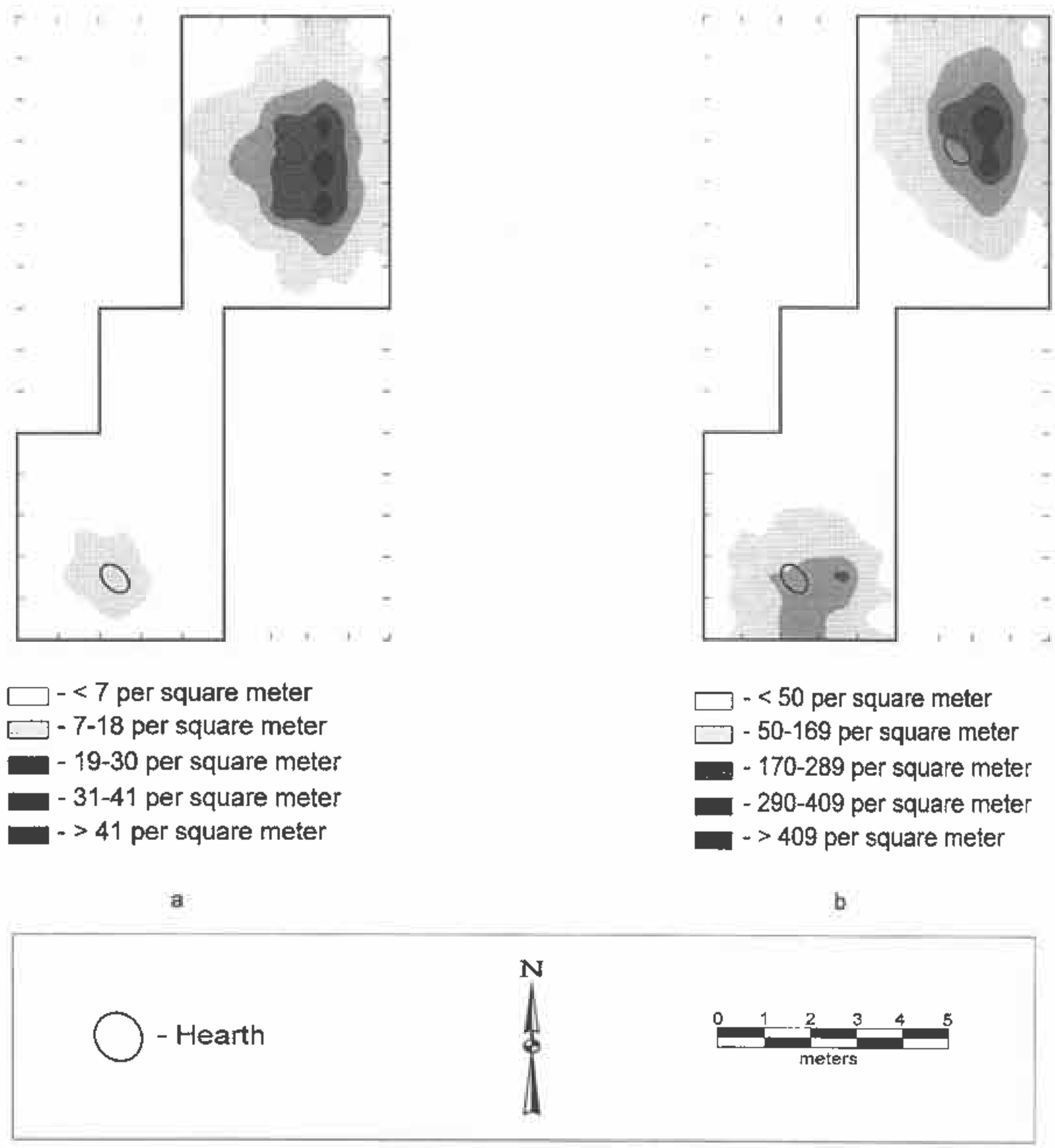

Figure 5. Isopleth map of artifact distribution by count in the main excavation block at Bartlett Camp: *a*, large (> 1.27 cm); *b*, medium/small (< 1.27 cm).

approach and that site structure analyses should only be attempted on sites capable of providing independent evidence.

In addition, many types of sites are not appropriate for site structure analyses because they are disturbed, have multiple overlapping occupations that have confounded the patterns, or are too complex for available analytical approaches. Ethnoarchaeologically focused site structure studies on such sites are likely to provide disappointing results. Given currently available techniques, short-term sites and multiple occupation sites with horizontally separated components may be the best candidates for archaeological site structure studies because they tend to have more intact patterns that can more easily be linked with past behavior. In addition, sites ". . . with a structure that is clear to the naked eye provide the best opportunity for successful site structure studies" (Kroll and Price 1991:5).

I also wish to stress that while we have been successful at identifying the pattern expected for Binford's hearth-centered activity model on short-term sites, we have yet to successfully identify patterns indicative of other activities and behaviors, and occupation other than that of short duration. Although preliminary, our work to date suggests that this will be more difficult in the archaeological context. We have encountered several cases where palimpsest occupation had significantly disrupted the patterns and one case where the observed pattern did not fit any known postdepositional or behavioral model; this latter problem may be because the excavation block was too small for us to recognize the extant patterning.

More work is clearly needed to determine whether a site structure approach will ultimately be useful to identify the function and duration of sites other than short-term, hearth-focused camps. However, even if site structure proves ineffective for this purpose, it will still be useful on a practical methodological level on many sites if for no other purpose than successfully locating site elements that are critical to site interpretation (e.g., Simms and Heath 1990).

Finally, I want to respond to an issue that has been the subject of considerable verbal debate: are the results of using a site structure approach worth the effort? This question is premature. It is unrealistic to expect site structure to provide immediate and spectacular results despite its potential. A fair and adequate test of its potential range of applicability and usefulness will take time, more applications to determine suitable methods and limiting factors, and continued interaction with ethnoarchaeologists. We hope that ethnoarchaeologists will be amenable to such interaction and that agency archaeologists in decision making capacities will be supportive of this effort.

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SALVAGE EXCAVATIONS AT THE FIRE GUARD HEARTH 42WB54 WEBER COUNTY, UTAH

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INTRODUCTION

The purpose of this paper is to document the results of salvage excavations at the Fire Guard Hearth, 42Wb54 Weber County, Utah and report one of the first ^{14}C dates from an upland site east of the Great Salt Lake. Excavation of this feature was undertaken by the Promontory/Tubaduka Chapter of the Utah Statewide Archaeological Society as part of their ongoing research into the archaeology of the Great Salt Lake region of Northern Utah. The project was under the direction of Dr. Bill Fawcett of Utah State University with Mark Stuart serving as field supervisor. Chapter members who participated were Gary and Carl DeMastrie, Bill and Sara Yates, Steve Hansen, Ann Cornell, Jason Jones, Lisa Pringle, Richard James, and Sarah Halverson. They donated a total of 45 hours in the completion of this project. Their labor of love is greatly appreciated.

SITE SETTING

The Fire Guard Hearth is a prehistoric feature within the large archaeological site 42Wb54 locally known as the "The Basin." It is located at the mouth of Weber Canyon less than ½ mile north of the Weber–Davis county border. The site proper lies in the eastern portion of the Town of Uintah, Weber County, Utah (Figure 1). The site is currently owned by the Union Pacific Railroad and several private individuals.

Site 42Wb54 lies within a small protected basin on a large sand and gravel alluvial delta created by the Weber River during pleistocene Lake Bonneville times. The site has a commanding view of the surrounding terrain, abundant fauna, flora and water resources and lies close to Weber Canyon which provided access to the Wasatch hinterland. These conditions provided a favorable environment for prehistoric inhabitants.

The Fire Guard Hearth overlooks the Weber River which is presently located ½ mile to the south. Old

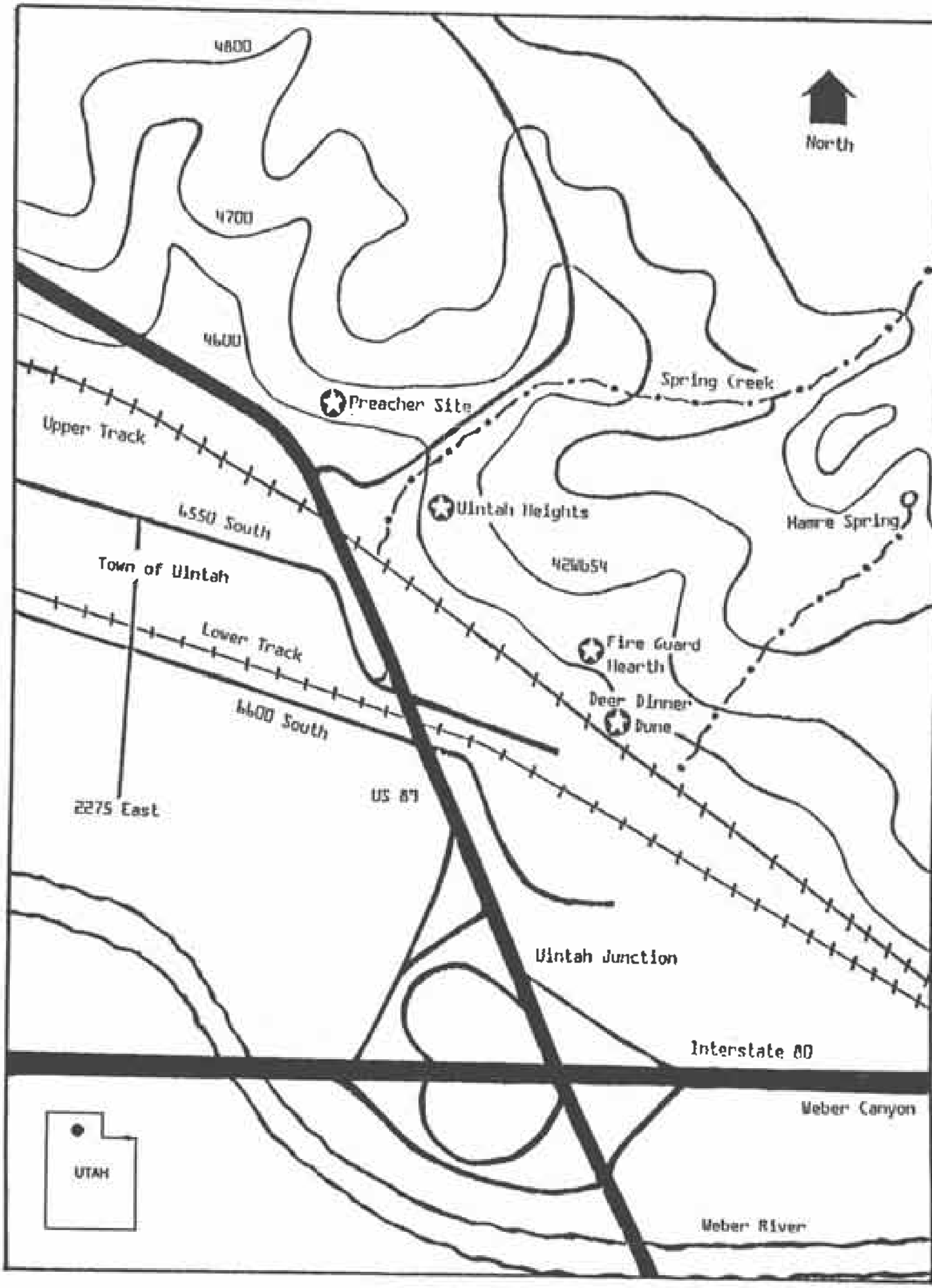

Figure 1. Location of Fire Guard Hearth and Other Archaeological Features on Site 42Wb54.

stream channels indicate that the Weber River once flowed much closer to the site.

Spring Creek and three perennial springs are also located within a ¼ mile radius. The fauna of the area includes, bobcat, jack rabbit, cottontail rabbit, ground squirrel, skunk, badger and a variety of lizards, snakes, and song birds. During the winter and early spring mule deer by the score and elk use the area as wintering grounds. Bison, black bear, antelope, and mountain sheep were formerly in the area. Several varieties of fish inhabit the nearby Weber River.

Flora of the area is typical of a pinyon-juniper habitant with sego lily, prickly pear cactus, cheat grass, wheat grass, bunch grass, sage brush, oak brush, and juniper. Flora along the streams includes willow, oak brush, river birch, cottonwood, box elder, Himalayan berry, and chokecherry.

PREVIOUS ARCHAEOLOGICAL WORK

The Town of Uintah contains numerous archaeological sites (Stuart 1980), but the "Basin Site" is the largest and best preserved. Several features of this site have been reported over the years beginning with a report by Malouf (1944) who mentioned the existence of stone tepee rings containing flat bottomed Shoshoni pottery. The site was formally recorded in the Utah Statewide Archaeological Survey files by Pendergast (1965) and Stuart (1980) who mention over 60 loci containing prehistoric features on the site. The site is also briefly reported by Polk (1982).

Two salvage excavations at 42Wb54 have been conducted under the auspices of the Utah Historical Society Antiquities Section by Mark Stuart. The first of these was at the Uintah Heights feature (Stuart 1982) discovered during road construction activities. It consisted of several dark circular stains containing Fremont pottery and a large fire pit feature containing numerous animal bones (mostly mule deer), chipped stone tools, and Late Prehistoric pottery.

The second feature is Deer Dinner Dune (Stuart 1986) which was disturbed and partially destroyed by Union Pacific Railroad maintenance work. The Deer Dinner Dune feature was a large 11 x 7 m loci of blackened sand containing numerous chipped stone tools, projectile points, and hundreds of small burned bone fragments and quartzite debitage.

Two concentrations of fire-cracked rock were noted within the blackened sand. The first concentration was associated with 20 Elko Corner-notched projectile points, end scrapers, and bifaces. It is tentatively dated to the Late Archaic period ranging from 1800–1100 B.P. based on Holmer's (1983) chronology for Elko Corner-notched points. The second rock concentration contained four Rosegate Corner-notched arrow points, two Bear River Side-notched arrow points, stone tools, bone gaming pieces, ground stone, and several fragments of highly decorative unfired clay figurines. This suggests reuse of the feature by Bear River phase Fremont peoples dating between 1500–1000 B.P. (Marwitt 1970). Faunal bone identified at Deer Dinner Dune includes rabbit, ground squirrel, unidentified bird, bison, and hundreds of deer bone from which the feature derives its name. Most of the bone was burnt and broken suggesting that bone marrow extraction was practiced there.

A third fire pit feature known as the "Preacher Site" has been recorded on a IMACS site form. It was destroyed by the construction of the Combe Road Foursquare Gospel Church in 1992. The feature contained one-handed manos and both Elko Corner-notched and Humboldt projectile points.

FIRE GUARD HEARTH

The Fire Guard Hearth was exposed by in an old Union Pacific Railroad bulldozer cut constructed to prevent fires caused by trains. The feature first appeared in July 1989 as a dark discoloration in the north wall of the fire guard. This stain along with several diagnostic artifacts was recorded as a possible Late Prehistoric feature by Mark Stuart, a member of the Promontory/Tubaduka Chapter. Over the next two years he noted that the feature was being eroded by strong Weber Canyon east winds and winter storms. Since little is known about the Late Prehistoric period in upland sites along the Wasatch front away from the Great Salt Lake wetlands the feature was deemed to be significant and worth salvaging. In the Fall of 1991 the Promontory/Tubaduka Chapter applied for and received a Certified Local History Grant through the auspices of the Utah State Historical Society for monies to salvage this feature. The goals of this project were to obtain charcoal for ^{14}C dating, gather data about Late Prehistoric adaptive strategies and use the excavation as a training exercise in archaeological methodology for Level III Certification students.

EXCAVATION AND STRATIGRAPHY

Excavation began with the cleaning of the vertical profile exposed in the fire guard to reveal natural stratigraphy. The feature appeared ca. 90 cm below the present ground surface as a black stain containing fire-cracked rock and bone fragments. This stain was assigned the feature number F3. The eroded slope below the feature was littered with fire-cracked rock, burned and split bone fragments, obsidian flakes and an obsidian Desert Side-notched Sierra subtype arrow point. Several small potsherds of Late Prehistoric pottery were also observed.

The stratigraphy of F3 consists of four strata (Figure 2). The top stratum (F4) consisted of 50 to 60 cm of tan sand mixed with black railroad cinders dating to after A.D. 1902 when the upper tracks of the Union Pacific Railroad were constructed. The surface of this stratum is covered with rice grass. Stratum F4 is underlain by a clean tan sand stratum (F5) measuring ca. 20 to 30 cm in depth. Underneath stratum F5 is a culturally sterile stratum of clean white sand (F6) of unknown depth. F3 was dug into sterile F6 sediment.

A 1 x 1 m grid system was established for excavation control. F3 was photographed and a profile sketch drawn. Excavation proceeded by natural stratigraphic levels. All excavated fill was screened through 1/8 mesh screen and recovered artifacts bagged by Field Specimen numbers corresponding to location and depth. Also collected were two, 2 liter bags of excavated fill for floatation analyses.

F3 is ca. 180 cm long and ranges from 8 to 20 cm in depth. The outer edges of the feature are orangish tan sand mixed with black charcoal and contain numerous fire-cracked quartzite rock. This probably represents debris left from the use of the feature. The center of F3 is 110 cm long and consists of very dark, black greasy sand containing large pieces of juniper wood charcoal. A concentration of large deer bone fragments mostly rib and leg bones, obsidian flakes, and an obsidian flake scraper were found in situ in this stratum. Excavation of the east portion of F3 revealed the presence of two large 80 to 100 pound boulders that had been purposefully placed at the edge of the feature. They may have been placed there to serve as a wind break against canyon east winds. Excavation ceased when the lower edge of F3 was reached in the vertical profile and sterile F6 was encountered.

ARTIFACTS

Artifacts recovered from the excavation of the Fire Guard Hearth feature were limited to stone, ceramics and bone.

Stone: Fifteen obsidian, three white quartzite tertiary flakes, and an obsidian flake scraper were recovered in situ from F3. Eight obsidian flakes, the basal portions of two Desert Side-notched Sierra subtype arrow points, an obsidian core, and a small fragment of a sandstone slab metate were also collected from the eroded slope below F3. Three weeks later a well-made end scraper of brown chert was collected from the eroded slope on a revisit to the area.

Ceramics: Six small fragments of crude and poorly fired Late Prehistoric ceramics were collected from the eroded slope below F3. It is probable they were once associated with the feature. The pottery is coiled made and is tempered with quartzite derived from a granitic source. No vessel shape could be determined due to the small size of the fragments.

Bone: Thirty three bone fragments were recovered in situ from F3. All of the bone fragments were split and 13 were burnt probably due to bone marrow extraction. All of the bone was identified as mule deer and consisted of rib and leg bone fragments. Eight exhibited what are probable butchering/cut marks (Earl Jenne, Weber State University Zoology Department, personal communication 1993). This suggests that the deer were killed elsewhere and selected portions then carried to the feature for cooking.

DATING

Before excavation began it was estimated that F3 dated from A.D. 1600 to 1800 based on the type of diagnostic artifacts observed on the eroded slope. A 2-liter plastic bag of juniper wood charcoal was recovered in situ from the undisturbed center of F3. Care was taken to ensure that the sample was not contaminated during excavation. A great deal of charcoal was also found in the screen but was not collected. The sample was sent to Beta Analytic Inc. in Miami, Florida for analysis and given the lab number Beta-59416 (Tamers 1993). The sample yielded the date of 210 ± 50 B.P. This date yields a range of A.D. 1690–1790 with a midpoint of A.D. 1740 ± 50 years at a 65 percent confidence level at one standard deviation. When calibrated to a 95

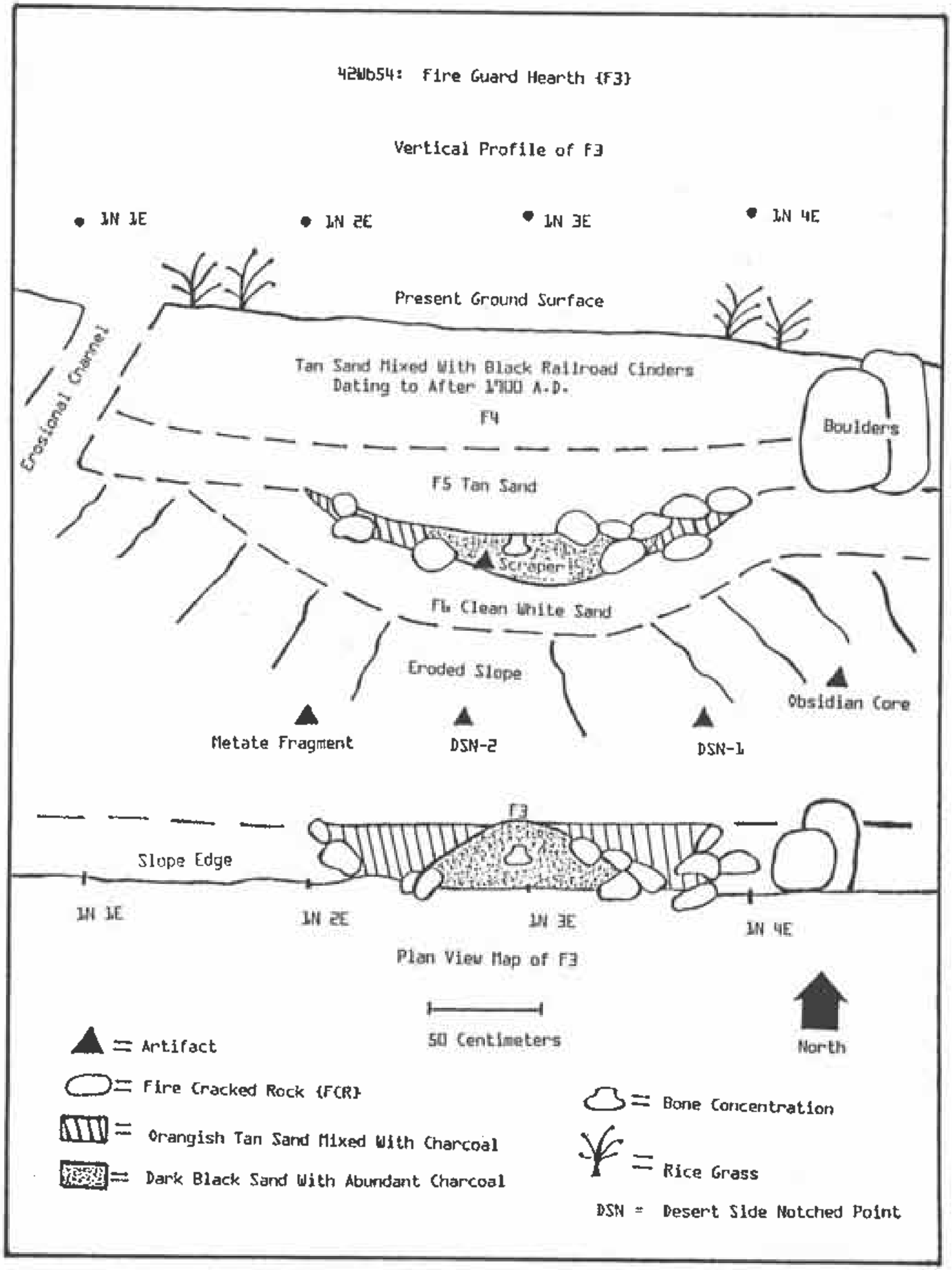

Figure 2. Vertical Profile (top) and plan view map (bottom) of Fire Guard Hearth (F3) at Site 42Wb54.

percent confidence level at two standard deviations the range is A.D. 1515–950 with a midpoint date of A.D. 1732 ± 18 years (Klein et al. 1982). Although the date is within modern age, and is therefore subject to possible contamination because of the Industrial Revolution, we accept it as a valid date.

DISCUSSION

Salvage excavations of the Fire Guard Hearth at site 42Wb54 generated useful though limited information about prehistoric use of the Wasatch Front uplands. This feature is a single use Late Prehistoric hearth used for the cooking of mule deer. The cultural affiliation is based on diagnostic cultural material and a radiocarbon date of 210 ± 50 B.P. Modification of the feature was limited to the construction of the fire pit in sterile sediment and possibly placing two large boulders to serve as a windbreak. Other activities in addition to cooking took place around the hearth. These appear to have included repairing of broken hunting equipment and the resharpening of stone tools. Such is indicated by the recovery of lithic debitage and broken stone tools in situ. Evidence of seasonality is limited, but the lack of seeds in the feature suggests a possible winter or early spring use. Indirect support of seasonality comes from historic records (Stuart 1976) that indicate use of the site area by the Weber Ute band of Northwestern Shoshoni for the hunting of big game which congregated in large herds at the mouth of Weber Canyon during the winter months.

Attributes of the Late Prehistoric have been documented through research conducted in northern Utah wetlands by Janetski (1986, 1990, 1991) in Utah Valley, Simms and Heath (1990) at the Orbit Inn Site at the Brigham City airport, Aikens (1966) at the Injun Creek Site west of Ogden, and in the Great Salt Lake wetlands of Weber and Box Elder Counties (Simms et.al. 1990, 1991; Fawcett and Simms 1993). This research suggests that the Late Prehistoric period was a more dynamic time than most archaeologists acknowledge. Preliminary evidence suggests that significant change may have taken place from the early Late Prehistoric to the Protohistoric time. For a description of these possible changes see Fawcett and Simms (1993:Chapter 2). At this stage, it is difficult to specify differences within the Late Prehistoric and begs research aimed at detecting change during this period.

While the evidence from the salvage of Fire guard Hearth at site 42Wb54 is not overly impressive it is indicative of the habitual use of sand dune sites which is common throughout the Great Basin (Madsen 1976). To date it is one of the few such sites to be investigated in northern Utah. More importantly, the radiocarbon date and associated diagnostic artifacts document use of this upland site during the Protohistoric phase of the Late Prehistoric period. This is a time for which we currently have little archaeological evidence. Most of which we know of the Protohistoric phase comes from adaptive models based on ethnohistoric descriptions (Madsen 1982; Janetski 1986; Fawcett and Simms 1993). What is needed is a test of these models such is presently going on in Utah Valley (Janetski 1986, 1990, 1991; Janetski and Baker 1992) and the wetlands of the Great Salt Lake (Fawcett and Simms 1993; Simms et.al. 1990, 1991). This kind of test would lessen the reliance on the ethnographic present as a crutch for scientific investigation.

Single site analysis, like that presented here, is not particularly informative. But if this analyses is incorporated into the context of a regional project of both systematic survey and excavation it may be possible to test these adaptive models of the Protohistoric. In the Great Salt Lake region other upland Late Prehistoric sites are known (Stuart 1980) but are poorly documented. Artifacts such as flat-bottomed pottery and historic trade goods suggest some of these sites date to the Protohistoric (Madsen 1982). To date, only the Burch Creek Site has been tested (Stuart 1982). Like 42Wb54, this sand dune site has a long occupational history from the Archaic to the late Prehistoric periods. Salvage excavations at this site revealed the presence of several buried hearth features associated with artifact (Flat-bottomed pottery, Desert Side-notched and Cottonwood arrow points) and faunal assemblages similar to that of Fire Guard Hearth at 42Wb54. Although undated, the evidence suggests these features are Protohistoric. The findings from the Burch Creek Site and the FireGuard Hearth suggest that a database exists to test the adaptive models of the Protohistoric mentioned above.

The excavation of Fire Guard Hearth by the Promontory\Tubaduka Chapter of the Utah Statewide Archaeological Society demonstrates the contribution a group of trained avocationalists can make to the archaeological record. The entire project from beginning to end was all undertaken by chapter members under the direction of professional chapter advisers. Hopefully, avocationalists can be involved in future projects.

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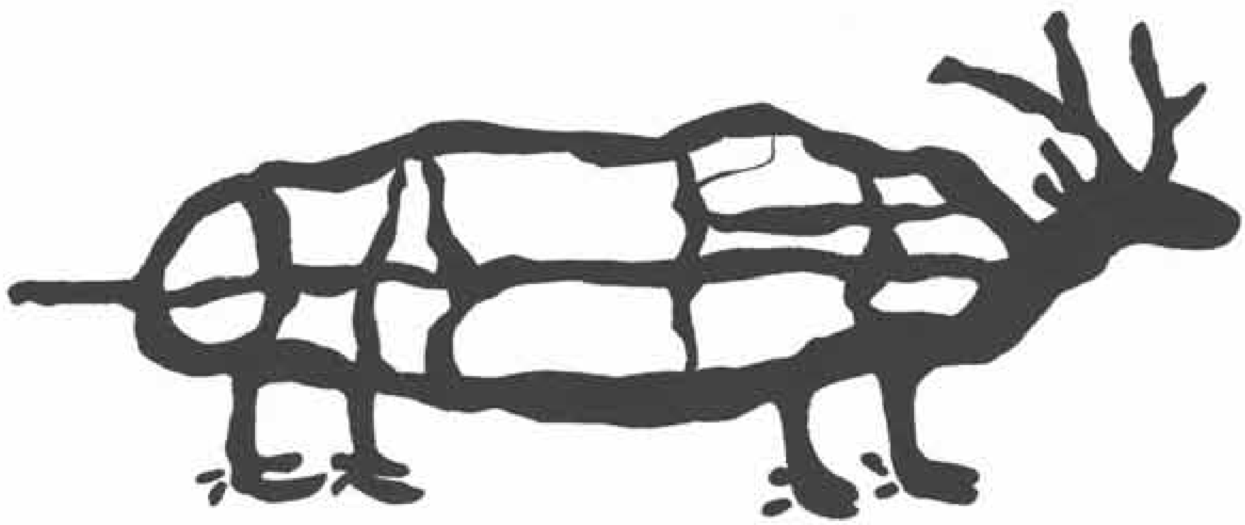

RUNNING ANTELOPE: A PALEOINDIAN SITE IN NORTHERN UTAH

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INTRODUCTION

The Western-Stemmed Tradition of lanceolate projectile points is represented by a variety of styles. One style of this tradition is called a Haskett. The purpose of this report is to present information on a recently discovered Paleoindian site containing this style of the Western-Stemmed Tradition, next to present information on Haskett points and site locations where they have been found, and then to speculate on the value and relationship of this new site to these other Haskett sites.

SITE DISCOVERY

Years ago in Northern Utah a hunter found a large broken spear blade of unknown origin and material associated with an apparent prehistoric camp site. The broken blade and area where it was found was brought to my attention and I took the pieces to Mark Stuart, of the Utah Statewide Archaeological Society for identification. Mark identified it as a Haskett biface. Knowing the area, yet never having prepared an (IMACS) form, I took Mark to the area to assist me in recording the site.

RUNNING ANTELOPE

When this site was first discovered a herd of Antelope was observed running across its western edge, so it was named "Running Antelope." Officially recorded as 42Bo538, the Running Antelope site is located southwest of Snowville, Utah (Figure 1). It exists in a water-eroded area on a low beach terrace of the extinct Lake Bonneville. On-site materials consist of loose tan dirt combined with assorted gravel including tiny rounded particles of sheet obsidian. Scattered across the site were 200+ secondary and tertiary flakes of high quality obsidian. Concentrated at the northern and southern ends of the site were Haskett bases, most of which showed evidence of basal edge grinding. Scattered throughout the site were additional bases. Also located at the southern end were several chert scrapers, utilized flakes, and one obsidian flake knife. The whole Haskett was reportedly found at the northern end of the site. High quality obsidian, black and nearly opaque, seems to be the preferred material for the bifaces. However, several bases made of olive green chert were observed. The flake knife was manufactured from the same obsidian as the bifaces. Illustrations of the bifaces, flake knife, scrapers, and a utilized flake are shown in Figures 2 and 3. Tabularized information on each of these artifacts is provided in Table 1.

HASKETT PROJECTILE POINTS

Haskett points are so named after their discoverer, Parley Haskett of Pocatello, Idaho. Haskett found several points in the mid-1960s weathering out of a sand borrow area in an ancient sand dune on the Snake River Plain. The site is located 8 miles southwest of the American Falls Reservoir. Collectors reported finding many early point types in this sand dune, including both Clovis and Folsom points. After discovering the site, Haskett, with the help of members of the Upper Snake River Prehistoric Society of Idaho Falls, Idaho, and members of the geology faculty at Idaho State University, studied the area in detail and additional specimens of Haskett points were recovered in place (Figure 4). Along with the points, several flake knives and many pieces of bison tooth enamel were also recovered.

Two types of Haskett points were recovered and designated as Type 1 and Type 2. Type 1 Haskett points are broadest and thickest near the tip, and this end accounts for only one-third of the overall length of the point. The stem portion of the Type 1 point tapers in and down to a thin, somewhat rounded end. The edges of the stem are ground or dulled, probably to facilitate socketing the point into a handheld spear shaft (Butler 1978:64). The Type 2 Haskett points are considerably longer and heavier than the Type 1 points. The edges are uniformly excurvate from the tip to the base, with the broadest and thickest part of the point midway between the two ends. The edges are ground or dulled near the basal end, possibly indicating that most of the point was exposed (Butler 1978:64). Type 1 points were the most common found. Because of the lack of suitable materials at the site, it was not possible to determine its age with

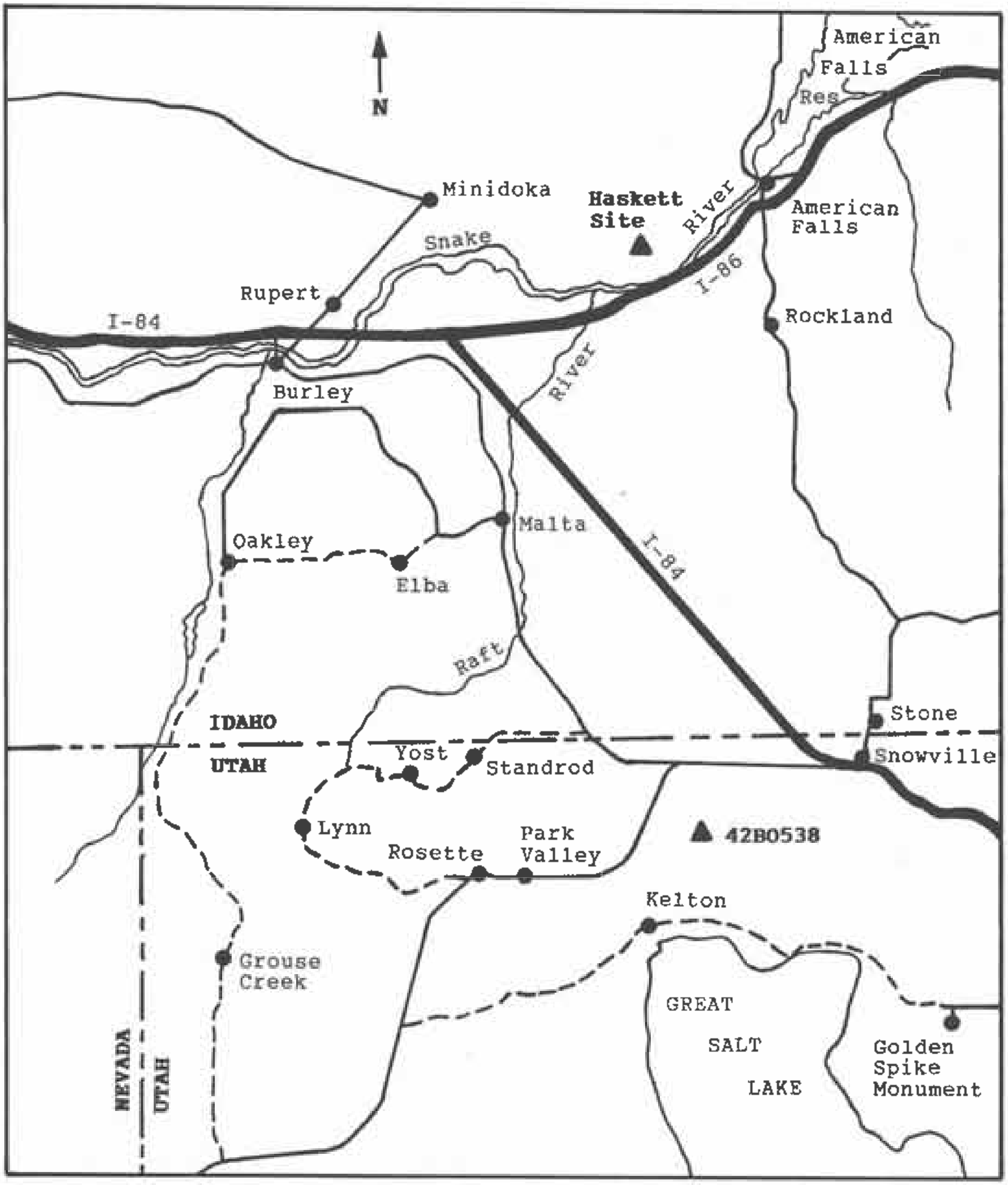

Figure 1. Location of Running Antelope Site (42Bo538) in Northern Utah.

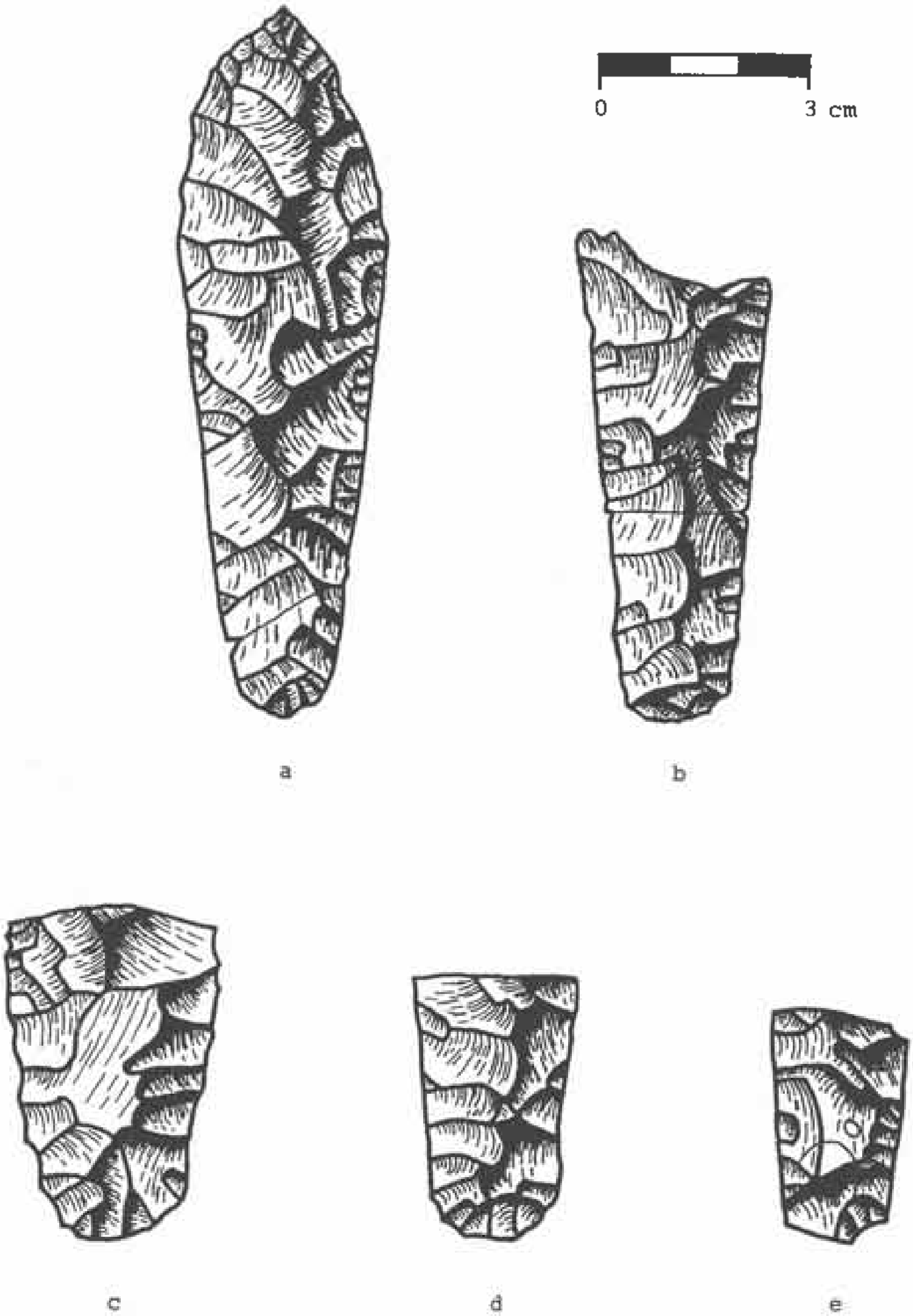

Figure 2. Haskett Points from Running Antelope Site.

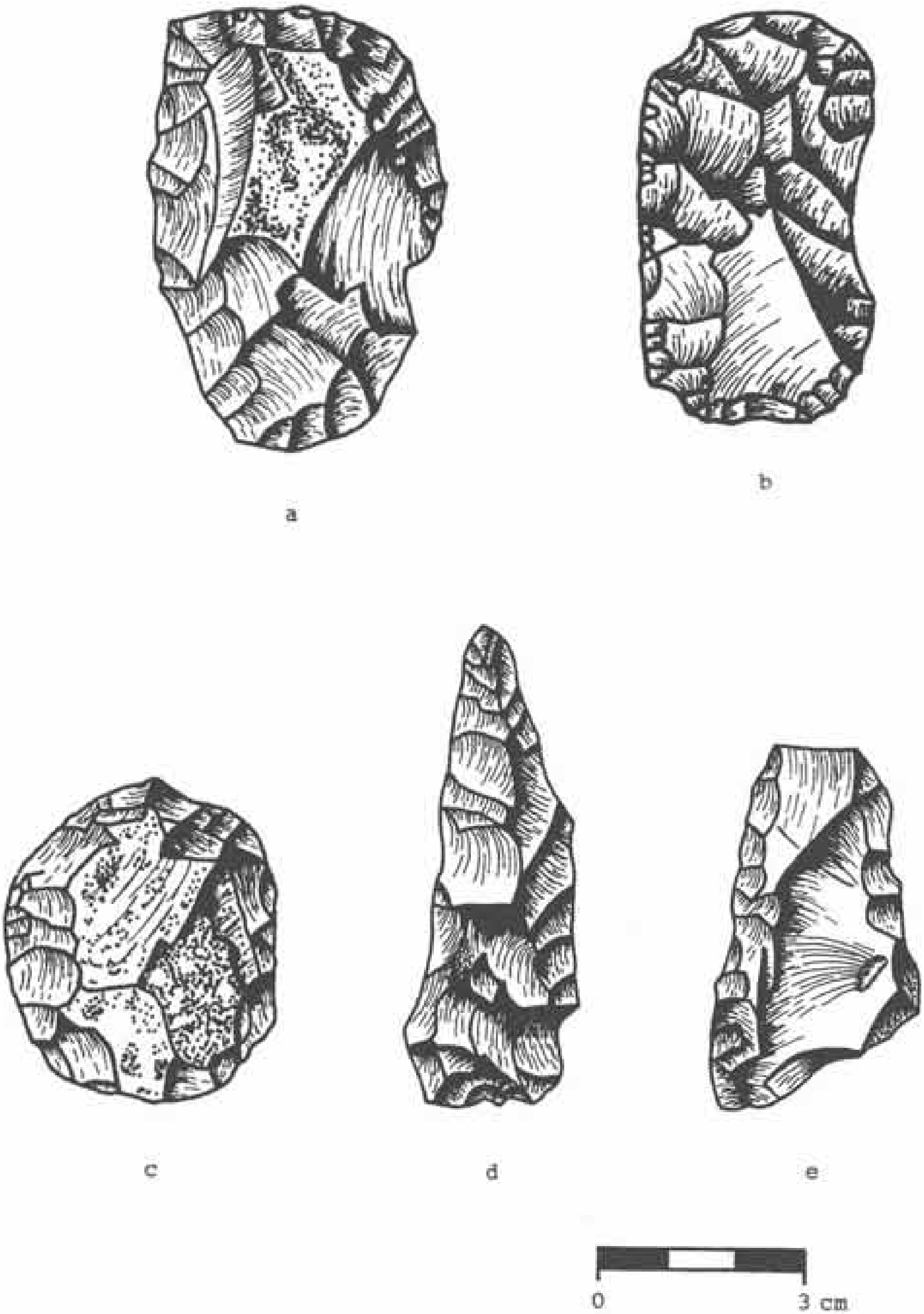

Figure 3. Scrapers (a,b,c), Flake Knife (d), and Utilized Flake (e) from Running Antelope Site.

Table 1. Biface and Scraper Descriptions

Figure	Artifact	Material	Basal Grinding	Dimensions (cm)		
				Length	Width	Thickness
2*(a)*	Haskett (Type 1)	Obsidian	Yes	10.0	2.9	1.0
2*(b)*	Haskett (Type 1, Partial)	Obsidian	Yes	7.3	2.6	1.0
2*(c)*	Haskett Base	Olive Chert	No	4.8	3.0	0.9
2*(d)*	Haskett Base	Obsidian	Yes	3.7	2.3	0.9
2*(e)*	Haskett Base	Olive Chert	Yes	3.1	2.0	0.7
3*(a)*	Scraper	Olive Chert	N/A	6.3	4.3	1.4
3*(b)*	Scraper	Olive Chert	N/A	5.9	3.4	1.3
3*(c)*	Scraper	Red Chert	N/A	4.6	3.9	1.7
3*(d)*	Flake Knife	Obsidian	N/A	6.9	2.4	0.9
3*(e)*	Utilized Flake	Olive Chert	N/A	5.2	3.1	0.7

N/A: Not Applicable

any degree of certainty.

During the summer of 1972 Haskett points were uncovered at Redfish Lake, which drains into the upper Salmon River in the high mountains of central Idaho (Butler 1978:65). A cache of Type 1 Haskett points was found enclosed in a sequence of geological deposits that had accumulated in a rockshelter near the lake outlet. No faunal or food remains were recovered from the deposits, however sufficient charcoal was present for radiocarbon dating. Charcoal from a rocklined hearth near the cache of points yielded a radiocarbon date of 9,860 ± 300 B.P. while charcoal from an earlier layer overlying a layer containing a Haskett midsection yielded a radiocarbon date of 10,000 ± 300 B.P. A series of cave sites in the Fort Rock Lake Area of South-central Oregon also yielded Haskett points which were reported to be of the same cultural tradition (Butler 1978:65). In addition to these sites, Haskett points have also been found in Nevada in the Lake Tonapah Locality (Tuohy 1988:221), and in Jakes Valley (Price and Johnston 1988:240) and Sunshine Well (Hutchinson 1988:305) both south of the Long Valley Locality.

DISCUSSION

Paleoindian influence in Northern Utah could be large, especially when one looks at its association to the Snake River Plain in Idaho (Titmus and Woods 1988), and it needs more study. A Folsom point was found in the Curlew Valley on the Utah–Idaho border (Butler 1978:Figure 33; Schroedl 1991:Figure 6), a Scottsbluff was found at Hogup Cave (Schroedl 1991:8), and a Scottsbluff, Birch Creek, and Clovis points have all been found by rabbit hunters in the Locomotive Springs area (Mark Stuart, personal communication). Haskett points at Running Antelope are now added to the list. No other Haskett sites are known to have been reported in Northern Utah, although the author has seen one complete Haskett in a private collection that was said to be found north of Snowville. Also, one base (provenance unknown) was included in a group of projectile points that Fran Hassel, a local avocationalist, donated to Weber State University in the early 1980s (observation made by the author and Mark Stuart).

The discovery of Running Antelope could be significant. According to Alan R. Schroedl of P-III Associates, the absence of Paleoindian kill sites has

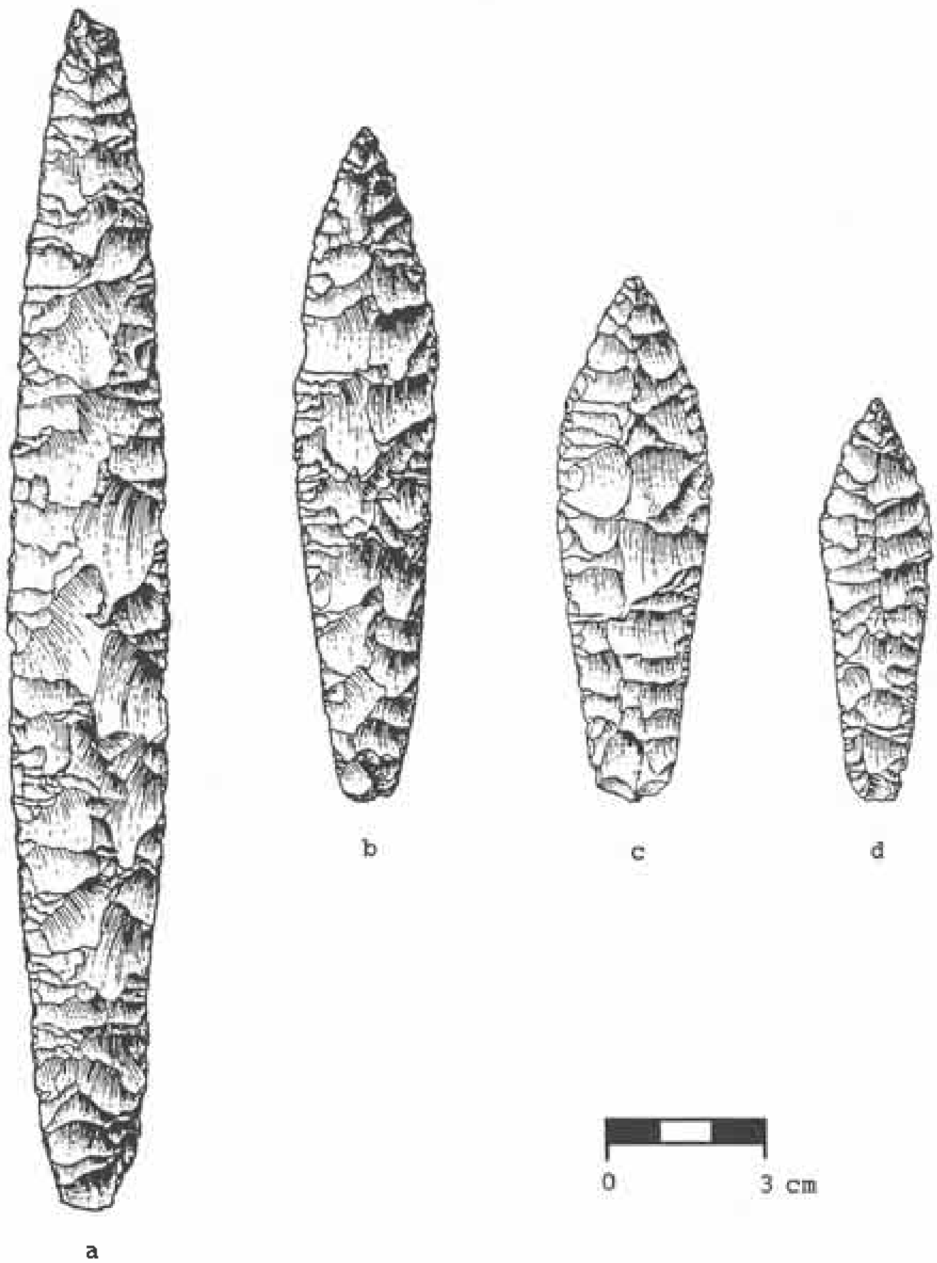

Figure 4. Type 1 (b,c,d) and Type 2 (a) Haskett Points from Haskett Site.

led researchers to assume an Archaic subsistence pattern for paleo sites. "Subsistence data from the earliest components at the three dated Paleoindian sites in western Utah, Danger Cave, Hogup Cave, and 42Md300, are limited but do seem to support the notion of Archaic or mixed hunting and gathering lifeway in a lakeside-marsh setting" (Schroedl 1991:7). The number of Haskett bases with basal grinding and hide scrappers would suggest that this site could have been a processing area with a kill site nearby. This site could add to that subsistence data if it was seriously studied by professionals.

Running Antelope could also help define possible migration and hunting routes from the Snake River of Idaho to the shores of the Great Salt Lake in Utah and the pluvial lakes of Nevada. Note that Running Antelope is directly south of the original Haskett site. It is conceivable that a group of Paleoindian hunters could follow a herd of megafauna down the Raft River valley to the Great Salt Lake shoreline in a relatively short time span. From there travel would be across what is now the northern edge of the Great Salt Lake Desert and into Nevada. Surely one could deduce that there should be other Haskett sites between Running Antelope, the original Haskett site, and those in Nevada. Serious research and investigation with the local farmers and ranchers in the Raft River Valley of Idaho and those between Park Valley, Utah to Ely, Nevada could provide this information. This and investigation at Running Antelope could further our understanding of that transitional time between Paleoindian and the Archaic Period and provide subsistence data and possible skeletal remains of what was being hunted and butchered with these large stemmed bifaces.

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SOME ENIGMATIC STATIONS OF THE PONY EXPRESS AND OVERLAND STAGE BETWEEN SALT LAKE CITY AND NEVADA

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INTRODUCTION

Since its inception in 1860, the Pony Express has been an important part of the opening of the west to the American public. However, prior to the 1970s, there was little serious scholarly work on it. In conjunction with the nation's bicentennial, several serious studies were conducted in the 1970s, including Bluth (1978), Fike and Headley (1979) and Berge (1980).

THE PROBLEM

Despite these advances, serious questions remain about several of the stations. Where were they located? Were they actually used by the Pony Express? When were they built? What was life like at the stations? What became of them? What is their condition today? It is the purpose of this study to extend previous arguments on these questions about the most problematic stations of the Pony Express and Overland Stage west from Salt Lake City to the Nevada border. We will also report new information about these stations and collect in one place the descriptions from the relevant accounts of the time.

Documentation on the location and use of the Pony Express stations varies widely. There is accurate information about stations at Salt Lake City, Traveller's Rest, Joe's Dugout, Camp Floyd, East Rush Valley, Lookout Pass, Riverbed, Fish Springs and Deep Creek. Berge (1980) excavated the stations with the best preserved visible remains (Simpson Springs, Boyd, and Round) and removed them from the doubtful list.

Fike and Headley (1979) make an argument for stations at Government Creek and Six Mile (between Callao and Round), which heretofore, had not been considered Pony Express stations. They generated a major controversy over the location of the station at Willow Springs (Callao). Other stations which are still questionable are Rockwell's, Faust, Dugway, Blackrock, and Burn't. Research is continuing on Rockwell's, Faust, and Burn't. This article will discuss Dugway, Blackrock, and Willow Springs (Callao).

METHODS

Archaeological survey techniques complimented by standard historical research methods seem well-suited to answer these questions. Hawkins and Madsen summarize the advantages.

> This is perhaps the most exciting aspect of historic archaeology. The combination of the written documentation with archaeological excavation techniques allows a more detailed investigation and interpretation of the material remains that are the subject matter of archaeological research. At the same time, the detailed examination of physical remains allows a direct assessment of the tall tales, rumors, and myths that tend to collect around well-known historical events . . . [Hawkins and Madsen 1990:5].

Interpretation of some historical documents needs to be done with care. Early maps, photographs, and sales records provide fairly dependable data (although we found one Cadastral map and two early photographs were seriously flawed). Diaries of observers contemporary with the Pony Express and Overland Stage vary in their accuracy. Sir Richard Burton (1861), Horace Greeley (1860), and J. H. Simpson (1876) were careful observers and recorders. Howard R. Egan (1917), though intimately involved with the Pony Express as a rider and son of the superintendent of the Utah stations, did not record his recollections until he was over seventy years old, nearly a half century after the events occurred. He explicitly denies the accuracy of his dates and claims only an impressionistic record.

Interviews with local informants offer equally diverse data. Some local residents are remarkably well informed. In other cases people who claim to know "exactly" where a station was located become vague when pressed for details. Two conflicting claims exist for the station at Willow Springs (Callao), and four different interpretations have been made for the location for Rockwell's prominent Hot Springs Brewery Hotel just 20 miles from downtown Salt Lake City.

Archaeological survey data can be equally difficult to interpret. While significant artifacts still remain at a few sites, it is almost impossible to associate them with the Pony Express, where the riders travelled light, the Express lasted for only a brief 18 months, and the sites were frequently occupied for several decades before and after the Pony Express (See Bluth 1978). Indeed, we are convinced that virtually all of the artifacts one sees along the trail and most of them on the station sites were associated with the Overland Stage, freighting operations, and even the Lincoln Highway (that operated over much of the same route between 1913 and 1927).

It has been our attempt to weigh a variety of historic and archaeological data, eliminate the most implausible claims, and develop a triangulation from several dependable sources which will support the most plausible argument. Some questions can now be answered with some degree of confidence. For some stations, we have eliminated some possible claims with other questions remaining, and a few problems may never be answered with a high degree of confidence.

In addition to the diaries and historic sources listed in the References, we examined all available indexes of less scholarly sources in order to discover personal accounts of life at the stations (e.g., Bloss 1978, Hafen 1969, Jackson 1972, 1985, Majors 1893, Reinfeld 1966, Trimble 1989, Twain 1980). Under the titles of "Pony Express," "Overland Stage," "Trails," "Roads," and "Egan," we perused the indexes of *The Improvement Era, L.D.S. Periodicals, Our Pioneer Heritage* and *Treasures of Pioneer History*. We examined the index to the more scholarly *Utah Historical Quarterly* as well as the computerized index of the collections of private papers contained in the scholarly libraries in Utah. Finally, we examined the extensive collection of newspaper clippings from several western newspapers on items of interest to Utah assembled by Dale Morgan and housed in the library of the Utah State Historical Society.

This search was not altogether satisfying. Most of the articles were either brief summaries of the stations containing no new information or recollections of people who visited the stations around the turn of the century; in other words, long ago and long after the events. In the case of the story of the Fausts hosting Horace Greeley, we located the source of the story but placed it at Pleasant Valley instead of Rush Valley, which is claimed by most writers (see Carter 1960).

Local informants provided information on several sites. Mr. and Mrs. David Bagley, and Joseph Nardone were particularly helpful.

STATIONS

Dugway

Dugway (also Shortcut Pass), is the nineteenth contract station in Utah. It is located east of the pass between the Thomas and Dugway Mountain Ranges. To locate this station from the monument at Simpson Springs travel about 16 miles (8 past Riverbed) west on the Pony Express Road. The station is about a mile to the south of the main road near a CCC monument.

Site description: The site consists of a depression and rock pile northeast of the CCC monument and south of an arroyo running west to east and dividing the site in half. North of the arroyo is a rectangular rock alignment (foundation?). North of the rock alignment is the remnant of a clearly distinguishable trail/road.

Discussion: Dugway Station began as a tent for the workers on Egan's road (Simpson 1876). Greeley (1860) stopped to rest and water his mules at Dugway and described it as ". . . about the forlornest spot I ever saw." A year later, Burton (1861:555) described the Dugway Station as, "a mere dug out—a hole four feet deep, roofed over with split cedar trunks, and provided with a rude adobe chimney." Following Greeley and Burton, Fike and Headley (1979:71) conclude, "nothing very permanent was ever constructed at the site."

Our on-site survey indicates more development than was earlier supposed, but raises more questions. First concerning the road, the undisturbed road north of the site, which seems to have gone unnoticed by previous investigators, runs for at least a mile in either direction so is clearly more than a driveway. The road south of the arroyo has been used for access over the years and so is difficult to interpret. It is probable that the original road runs on the north side of the arroyo and the road on the south side was made by the CCC in order to gain access to the monument construction area. The observation that this road does not extend past the site lends support for this interpretation.

The presence of window glass on the south side of the arroyo and a rock foundation on the north side raises additional questions. Why would they build a substantial structure with a stone foundation on the north side of the arroyo near the road and live in a modest dugout south of the arroyo? If they lived in the structure to the north, why are the window glass sherds on the south?

The answer may lie in Bluth's claim that in the 1890s the location was utilized as a halfway stop by the Walters and Mulliner Stage Company on the route between Fairfield and Ibapah (Bluth 1978:96). Perhaps the Pony Express Station was a modest dugout, and the structures with the stone foundation and window class were added during its later use as a stage station.

Water for Dugway Station had to be hauled from Simpson Springs and Riverbed. Although three wells were dug (one reaching a depth of 153 feet) no water was found.

An interesting description of the early development of this station is contained in Simpson's journal.

> My party moved at quarter to six. Course nearly southwest, across desert, . . . thinly covered with short . . . sage to "Short Cut Pass," . . . Through this pass Chorpenning & Company, the mail contractors, have made a road, but it is so crooked and steep as to scarcely permit wagons to get up it. In other respects, road today good.
> At the foot of the pass we find a couple of men of the mail-party living in a tent. They are employed in improving the road through the pass, and digging for water. They have been digging for two weeks in different places in the vicinity, and as yet have found none. At the well, near this tent, they had got down ten feet, and came to hard rock [Simpson 1876:49].

Greeley also describes life at the Dugway Station.

> Though at the foot of a low mountain, there was no water near it; that which was given our mules had been carted in a barrel from Simpson's Spring, aforesaid, and so must be for most of the year. An attempt to sink a well at this point had thus far proved a failure. The station keeper here lives entirely alone—that is, when the Indians will let him—seeing a friendly face but twice a week, when the mail stage passes one way or the other. He deeply regretted his lack of books and newspapers; we could only give him one of the latter. Why do not men who contract to run mails through such desolate regions comprehend that their own interest, if no nobler consideration, should impel them to supply their stations with good reading matter! I am quite sure that one hundred dollars spent by Major Chorpenning in supplying two or three good journals to each station on his route, and in providing for their interchange from station to station, would save him more than one hundred dollars in keeping good men in his service, and in imbuing them with contentment and gratitude. So with other mail routes through regions like this [Greeley 1860:223].

Burton (555–556) also describes his visit to Dugway in some detail.

> After twenty miles over the barren plain we reached, about sunset, the station at the foot of the Dug way. . . . The tenants were two rough young fellows—station master and express rider—with their friend, an English bulldog. One of them had amused himself by decorating the sides of the habitation with niches and Egyptian heads. Rude art seems instinctively to take the form which it wears on the banks of the Nilus, and should some Professor Rafinesque discover these traces of the aborigines, after a sepulture of a century, they will furnish materials for a rich chapter for anti-Columbian immigration. Water is brought to the station in casks. The youths believe that some seven miles north of the 'Dug way' there is a spring, which the Indians, after a fashion of that folk, sensibly conceal from the whites. Three wells have been sunk near the station. Two soon led to rock; the third has descended 120 feet, but is still bone dry. . . . The workmen complained greatly of the increasing heat as they descend. . . . The youths seeing me handle the rubbish at once asked me if I was prospecting for gold.
> After roughly supping we set out, with a fine round moon high in the skies, to ascend the "Dug way Pass" by a rough dusty road winding round the shoulder of a hill, through which a fiumara has burst its way. Like other Utah mountains, the highest third rises suddenly from a comparatively gradual incline, a sore formation for cattle, requiring draught to be at least doubled. Arriving on the summit we sat down, whilst our mules returned to help the baggage wagons, and amused ourselves with the strange aspect of the scene [Burton 1861:555–556].

Dugway station was still in use when Egan passed in 1862. He recalls—

> That riverbed (referring to the previous station) was no place for a station, but they built one there and dug a well that furnished very good, but brackish, water, which they hauled to the Dugway Station, where there were three men and a change of horses for the mail coach. One man tended the horses and acted as cook. The other two were digging a well for water. I was let down that well when they had reached a depth of one hundred and thirteen feet. I have never seen anything like that before or since. The surface soil at this place is a white clay that is very sticky when wet. The walls of this well are of the same material from top to bottom and about the same dampness from three feet down to

the bottom, where I cut my name in the side about two feet above. The wall was very smooth and plumb, no need of curbing and no danger of caving in. Some time after men were put to work boring with a well auger in the bottom. They bored some forty feet and found no change. Then the job of trying more to find water there was given up and it made a nice place to dump the stable cleanings [Egan 1917:219].

Water was dear in the west desert.

Blackrock

Blackrock (also Butte, Blackrock Springs) was the twentieth station in Utah (noncontract). There were possibly two stations near Black rock. The first was located near the CCC monument near the black basalt mesa for which the site was named. Another possible station was located about two miles east on the east bank of a wash on the old trail/road about one-third of a mile north of the modern road. Both sites are owned by the Bureau of Land Management (BLM).

Description: The site near the monument consists of eight rock piles (more like graves) associated with a few dozen artifacts dating to the proper period. The second site is an artifact scatter 160 feet in diameter straddling the old trail/road. The assemblage includes fragments of metal and milled wood as well as several sherds of brown, light green, and purple glass bottles. No coins, horseshoes, or complete bottles are present.

Discussion: Fike and Headley (1979:73) were unable to locate either site. They report, "Reconnaissance and infrared photographs have also failed to produce any evidence. . . . Informants say the station site lies west and north of the volcanic out crop known geographically as Black rock." Following Fike and Headley, our team surveyed the area near the monument as well as around to the north and west of the "black rock." Although we found some prehistoric sites, there was no sign of a station.

In a 1993 interview, Mr. and Mrs. David Bagley[1] reported a rock pile and artifact scatter 200 feet northwest of the monument that might have been this station. Following the Bagleys, we located the site described above.

Although most writers list "Black rock" as a Pony Express Station, Bluth (1978) claims a stone structure, that was constructed from the abundant black basalt stones surrounding the mesa, was an improvement undertaken by the Overland Mail Company in July, 1861, a few months at the earliest before the end of the Pony Express.

Before we located the stage station, we also surveyed the well-defined trail/road 1 mile west and 4 miles east of the monument to ascertain if the station was farther away from the black mesa. We discovered several isolated artifacts that could be associated with the Overland Stage and even the Lincoln Highway. We also found a piece from a wood stove about 2 miles east of the monument. Later, an intensive survey and mapping of the area near the stove piece revealed the circle of artifacts described above.

In his recollections, published 56 years after the Pony Express, Egan (1917) reports," . . . we passed Butte Station about a mile, where there is a very steep pull going west. . . ." This description corresponds to the location of the above "stove" site. Furthermore, it would have been almost equidistant between the stations at Dugway and Fish Springs, while the site at the CCC monument is 13.7 miles over the difficult run from Dugway and 10 miles on the flatter run to Fish Springs.

But what of other possible locations of "Butte" Station? There is no rise in terrain a mile west of the black basalt outcrop where the site has previously been thought to have been. The account by Egan could be construed to place "Butte" station west of Fish Springs where the Boyd Station was located. However no rise in terrain exists west of Boyd either. The last alternative is a Butte Station that is known to exist in Nevada. Its terrain fits Egan's description and is a distinct possibility (Joseph Nardone, personal communication 1993).

Based upon our examination of the documents and our on-site surveys, we consider it possible that there were two stations near "Black rock." The "stove station" may have briefly served the Pony Express, but would never have been more than a Sibly tent with a wood stove and a corral. More likely, it was a construction camp for the transcontinental telegraph. The stone structure would have been constructed to serve the Overland Stage. Not needing to be equidistant between the two adjacent stations to conserve the energy of the ponies, it was located at the point 2 miles to the west near the "Black rock" mesa that provided an abundant supply of building material. It is also interesting to note that undisturbed stones are still scattered over the low rise to the west and northwest of the CCC monument, while the area to the east and northeast of the monument is completely barren. Since the rather large CCC camp at Simpson Springs, 30 miles east, is constructed of similar material, it is possible that the CCC crew used this area as a quarry for their building material.

Simpson (1876:50) appears to have missed Blackrock, having chosen to turn south along the west slope of the Thomas Range before heading west around the south edge of the Black Rock Hills to Fish Springs.

Greeley does not mention Blackrock but Burton followed the road around the north edge of the Black Rock Hills where the station was later to be built and then south around the south edge of what is now Fish Springs Wildlife Refuge. Burton describes the area—

> Having reached the plain (west of Dugway Pass) the road ran for eight miles over broken surface, with severe pitch-holes and wagon tracks which have lasted many a month; it then forked. . . . We chose the shorter cut, and after eight miles rounded Mountain Point (Black Rock Hills), the end of a dark brown butte falling into the plain. Opposite us under the western hills, which were distant about two miles, lay the station (Fish Springs), but we were compelled to double, for twelve miles, the intervening slough, which no horse can cross without being mired [Burton 1861:557).

Burton was right. A year later, in 1862, Howard R. Egan (1917) attempted the same passage with less successful results.

> When I reached the desert just east of Fish Springs, the road was very bad, mud hub deep, and my work oxen gave out when I was about four or five miles from Fish Springs and could not budge the wagon another foot. I had the driver unhitch from the wagon, take some grub for himself and the Indians, who had gone ahead with the cattle, and also take my pony and drive the team to water and feed, and come back next morning with one of the Indians to help get the wagon over to hard ground.
>
> When they came back next day we moved the wagon about one-half a mile, where the road was still worse than before. There were three empty coaches stuck in the mud within a half mile of us. Well I had to get out of there some way. There was a part of the load I must not leave alone. So this is how I managed it: We had a double cover on the wagon. We took them off and spread them out on the mud alongside the wagon and loaded the most of the valuables on it and folded the sides and ends tight over all, hitched the oxen to the end and away we went as easy as pulling a sleigh over a good snow road.
>
> It was easy after that. All was over but the wagon by night. Next day I sent the driver and one Indian back to get the wagon if they had to take it all apart and haul it on the wagon cover, which did not appear to be damaged at all after about ten miles' drag with a load over creamy alkali, sand less but sticky mud. The inside of the wagon wheels had the appearance of an old-fashioned wooden butter bowl. On the outside there would be no hub or spoke in sight, and mud would pile on till of its own weight a portion would fall off, but at next turn of the wheel would be on the job again [Egan 1917:219-220).

Easy indeed. Egan finishes his story—

> Well we made it across all right and had no more trouble till we passed Butte Station about a mile, where there is a very steep pull going west and, as the snow had drifted very heavily over the crest, our team gave out just about a couple of rods below the summit and, as there was not expected a mail stage for at least ten or twelve hours, we left the wagon right in the center of the road where there was no passing around it with a wagon or sleigh. So when the stage that night came up to that point, the driver unhitched his leaders, hooked on the back of our wagon and dragged it back down the hill to near the bottom. This we did not know till next morning, when the driver and one of the Indians went back after the wagon, as we were camped some distance off the road and had not heard the Mail pass. My driver made some bad talk, so the Indian said, when he found the wagon down at the bottom, but he hooked on and did not have the least bit of trouble getting over, and when he came to camp was in good spirits and seemed to think it had all worked out for the best [1917:220].

Willow Springs

The twenty-third contract station in Utah was Willow Springs. While the exact location and ownership have been disputed (see discussion below), we believe it was on the David Bagley property in Callao, Utah.

Description: An 1868 engraving shows the Pony Express station as a small adobe building with a thatched roof. The stage station is a larger adobe structure with a door and two windows in the front and a barn attached to the right end and another barn a few yards to the rear.

Discussion: Considerable controversy surrounds the location of the Willow Springs Station. Local informants and the CCC monument place it on the

Bagley property in Callao, Utah. An adobe structure that could have been the stage station remains in good condition near an excellent usable spring. Initially, the station at Willow Springs may have consisted of only a tent and corral (Bluth 1978). In 1870 George W. Boyd purchased this location in order to supply hay, water, and wood to the Overland Stage under a contract signed in 1867 (Bluth 1978). Although an 1882 Cadastral plat shows no Willow Springs Station, it does show Boyd's home at the above location and the home of F. J. Kearney three-fourths of a mile to the southeast.

Based upon the 1882 map, Fike and Headley (1979) tentatively place the station on the Dorcey Sabey property north of the F. J. Kearney boarding house. Fike and Headley's (1979:80) excavations revealed a foundation and associated mound of adobe, "dating to the proper period and similar to the structure depicted in the sketch from an 1868 photograph."

However, Burton's (1861:560) description of his approach to Willow Springs is clear, "As we advanced the land improved, the salt disappeared, the grass was splendidly green, and approaching the station we passed Willow Creek, where gopher-holes and snipes, willows and wild roses, told of life and gladdened the eye. The station lay on a bench beyond the slope."

To the casual observer this area of Callao appears to be flat rather than containing "benches" and "slopes." However, both the USGS map and aerial photographs show a prominent drainage named Basin Creek that runs just east of the Bagley (Boyd) location. Perhaps Burton was calling this "Willow Creek." Further, the 1882 maps cited by Fike and Headley show no creek east of the Sabey location, but an unnamed creek east of Boyd's (or Bagley's). Finally, Burton describes a stop at a spring six miles beyond the Willow Springs Station, the precise location of Six Mile Spring.

In an attempt to resolve the issue, we investigated the terrain east of both locations. The area east of the Sabey property (on the east edge of Callao) is flat and devoid of major vegetation or water save for a circle of trees. As we walked west toward Bagley's the vegetation improved until we encountered a lush, cultivated field. Just before reaching the Bagley property from the east we crossed a creek. Finally, the source of water at Bagley's is a flowing spring while at Sabey's it is a small bog that once was a well. On the basis of Burton's description of the topography, he visited the Bagley location.

However, Burton calls both station's claims into question when he clearly describes the station as a "log hut." Nick Wilson also describes a log structure at "Willow Creek" (Visscher, reprinted in Carter 1960). Perhaps the station at Willow Springs was originally log and was replaced by an adobe structure.

In response to the controversy raised by Fike and Headley's claim, Don L. Reynolds, Director of the St. Joseph's Pony Express Museum wrote to the associate director of the BLM. Based upon extensive reading and three visits to Callao in 1959, 1961, and 1970 Mr. Reynolds states, "So far as I know, . . there has never been any dispute among local people as to the present Willow Springs Station location on the Bagley Ranch." He concludes, "Since the present Bagley location for the Willow Springs Station building has been regarded as correct for so long by so many, absolutely positive information to the contrary would be needed to change that location now" (Reynolds 1980). Bluth takes essentially the same position as do we.

There is little doubt that both sites existed within a mile of each other along the original trail/road. The Bagley location was almost certainly the stage station. Furthermore, it is unlikely that the stable on the Sabey property served the Pony Express separately since Burton claims an "Express Rider" was at the stage station at the time of his visit. In any case, the structure on the Bagley Ranch remains as a well-preserved example of an adobe structure, faced with wood for durability, that was common construction at the time of the Pony Express and Overland Stage.

Burton (1861) continues the description of his visit,

> The express rider was a handsome young Mormon, who wore in his felt hat the effigy of a sword; his wife was an Englishwoman, who, as usual under the circumstances, had completely thrown off the Englishwoman. The station-keeper was an Irishman, one of the few met amongst the Saints. Nothing could be fouler than the log hut, the flies soon drove us out of doors; hospitality, however, was not wanting, and we sat down to salt beef and bacon, for which we were not allowed to pay. The evening was spent in setting a wolf-trap, which consisted of a springy pole and a noose: we strolled about after sunset with a gun, but failed to bag snipe, wild-fowl or hare, and sighted only a few cunning old crows,

> and black swamp birds with yellow throats. As the hut contained but one room we slept outside; the Gosh-Yuta are apparently not a venturesome people, still it is considered advisable at times to shift one's sleeping quarters, and to acquire the habit of easily awaking [Burton 1861:560).

"Nic" Wilson relates an interesting incident that presumably occurred at Willow Springs Station,

> I rode from Shell Creek to Deep Creek, and one day the Indians killed the rider out in the desert, and when I was to meet him at Deep Creek, he was not there. I had to keep right on until I met him. I went to the next station, Willow Creek, the first station over the mountain, and there I found out that he had been killed. My horse was about jaded by this time, so I had to stay there to let him rest. . .
>
> About four o'clock in the afternoon, seven Indians rode up to the station and asked for something to eat. Peter Neece, the station keeper, picked up a sack with about twenty pounds of flour in it and offered it to them, but they would not have that little bit, they wanted a sack of flour apiece. Then he threw it back into the house and told them to get out, and he wouldn't give them a thing. This made them pretty mad, and as they passed a shed about four or five rods from the house, they each shot an arrow into a poor, old lame cow, that was standing under a shed. When Neece saw them do that, it made him mad too, and he jerked out a couple of pistols and commenced shooting at them. He killed two Indians and they fell off their horses right there. The others ran. He said, "Now boys, we will have a time of it tonight. . . ." Well, just a little before dark, we could see a big dust over towards the mouth of the canyon, and we knew they were coming. It was about six miles from the canyon to the station.
>
> Pete thought it would be a good thing to go out a hundred yards or so, and lie down in the brush and surprise them as they came up. . . . Finally the Indians got close enough for us to shoot. Pete shot and jumped to one side. I had two pistols, one in each hand, cocked all ready to pull the trigger, and was crawling on my elbows and knees. Each time he would shoot, I saw him jump. Soon they were all shooting, and each time they shot, I would jump. I never shot at all.
>
> After I had jumped a good many times, I happened to land in a little wash, or ravine. I guess my back came pretty nearly level with the top of it. Anyhow, I pressed myself down so I could get in it. I don't know how I felt, I was so scared. I lay there and listened until I could hear no more shooting, but I thought I could hear horses' hoofs beating on the hard ground near me, until I found out it was only my heart beating. After a while, I raised my head a little and looked off towards the desert, and I could see those humps of sand covered with grease-wood. They looked exactly like Indians on horses, and I could see several of them near the wash.
>
> I crouched down again and lay there for a time, maybe two hours. Finally everything was very still, so I thought I would go around and see if my horse was where I had staked him, and if he was, I would go back to my station over in Deep Creek and tell him that the boys were all killed and I was the only one that had got away all right. Well, as I went crawling around the house on my elbows and knees, . . . with both pistols ready, I saw a light shining between the logs in the back, part of the house. I thought the house must be full of Indians, so I decided to lie there awhile and see what they were doing: I lay there for some time listening and watching and then I heard one of the men speak right out a little distance from the house and say, "Did you find anything of him?" Then I knew it was the boys, but I lay there until I heard the door shut, then I slipped up and peeped through the crack and saw that all three of them were there all right. I was much too ashamed to go in, but finally I went around and opened the door. When I stepped in Pete called out, "Hello! Here he is. How far did you chase them. I told the fellows here that you would bring back at least half a dozen of them." I think they killed five Indians that night [Visscher, reprinted in Carter 1960:79-80).

In May 1886, Charles Bagley sold his land in Rush Valley to the owners of Faust ranch, bought the Willow Springs Station from George Boyd and moved to Callao (bill of sale in possession of David Bagley). In 1992 his descendant, David Bagley, retains the old adobe house as a small, private museum and is gracious in entertaining visitors and spinning yarns about the Willow Springs Station.

CONCLUSIONS

On the basis of our research, the current status of these enigmatic stations of the Pony Express and Overland Stage seems to be as follows:

1. Dugway: The exact location is well known. Our survey and mapping identified the original road, corral and stone foundation north of the arroyo. We demonstrated that the station was improved and life became more refined over the years than was previously thought.
2. Blackrock: Two sites were discovered where none were previously known. Remains that appear to have been the stone stage station were located near the CCC monument. A second site was located along the old road two miles to the

east and equidistant between the two adjacent stations. This could have been either a Pony Express/Stage station or a construction camp from the transcontinental telegraph.

3. Willow Springs: Our comparison (on the ground and on historic maps and aerial photographs) of Sir Richard Burton's description of his approach to Willow Springs with the topography and water sources adjacent to the two disputed locations, makes it virtually certain that the Bagley location served the Overland Stage and probably the Pony Express as well.

The data suggest that at the inception of the Pony Express, there were stations either contracted from existing owners or constructed on approximately twenty mile intervals at Rockwell's, Camp Floyd, Faust, Lookout Pass, Simpson Springs, Dugway, Fish Springs, Willow Springs and Deep Creek. Stations were added during the life of the Pony Express and Overland Stage at approximately ten mile intervals. Most stations evolved over the years. Many began as a Sibley Tent and corral and, if they survived more than a few months, were improved into a crude log structure or dugout. Those located at key intersections or reliable water survived into the twentieth century. They were more permanent structures of stone or adobe faced with wood.

Research continues on stations at Rockwell's, Faust and Burn't. Although we have considerable information as to life style and interesting events at these stations, questions remain as to their location, construction and demise.

NOTE

1. David Bagley, personal interviews conducted in 1991 and 1993.

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NOTES

CULTURAL AFFILIATION AND AGE OF THE BROADBENT CACHE SITE

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INTRODUCTION

In a recent *Utah Archaeology*, Broadbent (1992) describes a cache site in Daggett County, Utah, that contained 39 projectile points and 1 biface. These artifacts were apparently stored as a cache in one of the cracks in a large rock outcrop in a rockshelter in a high mountain valley near Sheep Creek at about 8,280 ft.

The artifacts were analyzed and measured by James C. Wood and Gene Titmus who apparently did not offer any typological identification. Broadbent suggests that these points might be typeable as the Sand Dune Side-notched type (Geib and Ambler 1991; Tipps and Hewitt 1989). Although there are some superficial similarities between the Broadbent cache points and the Sand Dune Side-notched points, the points from the cache are not morphologically similar to Sand Dune Side-notched points. The Sand Dune Side-notched point, an Early Archaic point type, is generally narrower, smaller, and more symmetrical, and appears to be geographically restricted to the highly dissected Canyonlands section of the Colorado Plateau in southern Utah and northern Arizona (Betsy L. Tipps, personal communication 1993).

Morphologically, the projectile points pictured by Broadbent (1992:Figure 4) are best classified as Mount Albion Corner-notched points, the defining point type for the Mount Albion Complex centered in the southern Rocky Mountains province (Benedict 1978a).

MOUNT ALBION CORNER-NOTCHED POINTS

Mount Albion Corner-notched points were defined by Benedict (1978b) in the mid-1970s based on an assemblage of 40 of these points from the Hungry Whistler site in Colorado (Figure 1). Benedict (1978b:47–48) notes that the Mount Albion Corner-notched point is "a medium-sized dart point with heavily ground corner or side notches and a heavily ground convex base. Variation in size, blade shape, and symmetry are primarily the result of repair of broken specimens, and attrition due to wear and resharpening during secondary use as hafted butchering tools." On this point type, the notching varies from medium to shallow side and corner notches with a slightly to greatly expanding stem. The base varies from straight to strongly convex and the Hungry Whistler specimens show evidence of grinding around the stem and the hafting element. The specimens range in length from 2.2 to 5.6 cm, 1.5 to 2.6 cm in width, and 0.4 to 0.8 cm in thickness. "Cycles of breakage and repair, use, and resharpening have resulted in size reduction, exaggerated asymmetry, and irregular blade configuration" (Benedict 1978b:49).

Schroedl (1980; see also Walker [1992:132–142]), following Holmer's (1978) discriminant analysis procedures, conducted a multivariate analysis of five Early Plains Archaic projectile point types including the Mount Albion Corner-notched. The discriminant analysis of the Mount Albion Corner-notched type demonstrated a statistical asymmetry for this artifact type. The asymmetry, the extent of resharpening and rejuvenation, and the grinding around the hafting element, all noted by Benedict, suggest very strongly that Mount Albion Corner-notched "points" functioned primarily as hafted knives rather than projectile points. Because the Hungry Whistler and other Mount Albion Complex sites are in high altitude stone poor areas, few specimens were discarded until the absolute end of their use life. Consequently, complete specimens are rare. The five complete Mount Albion Corner-notched points in the discriminant analysis have a mean length of 4.5 cm while the Broadbent cache points are much longer, ranging in size from 5.5 to 10.3 cm.

Not only are the points from the Broadbent cache much longer but they are also thicker than the points from the Hungry Whistler site. Given that the Broadbent points were cached, they were not at the end of the use life cycle. On the other hand, virtually all of the Hungry Whistler specimens were

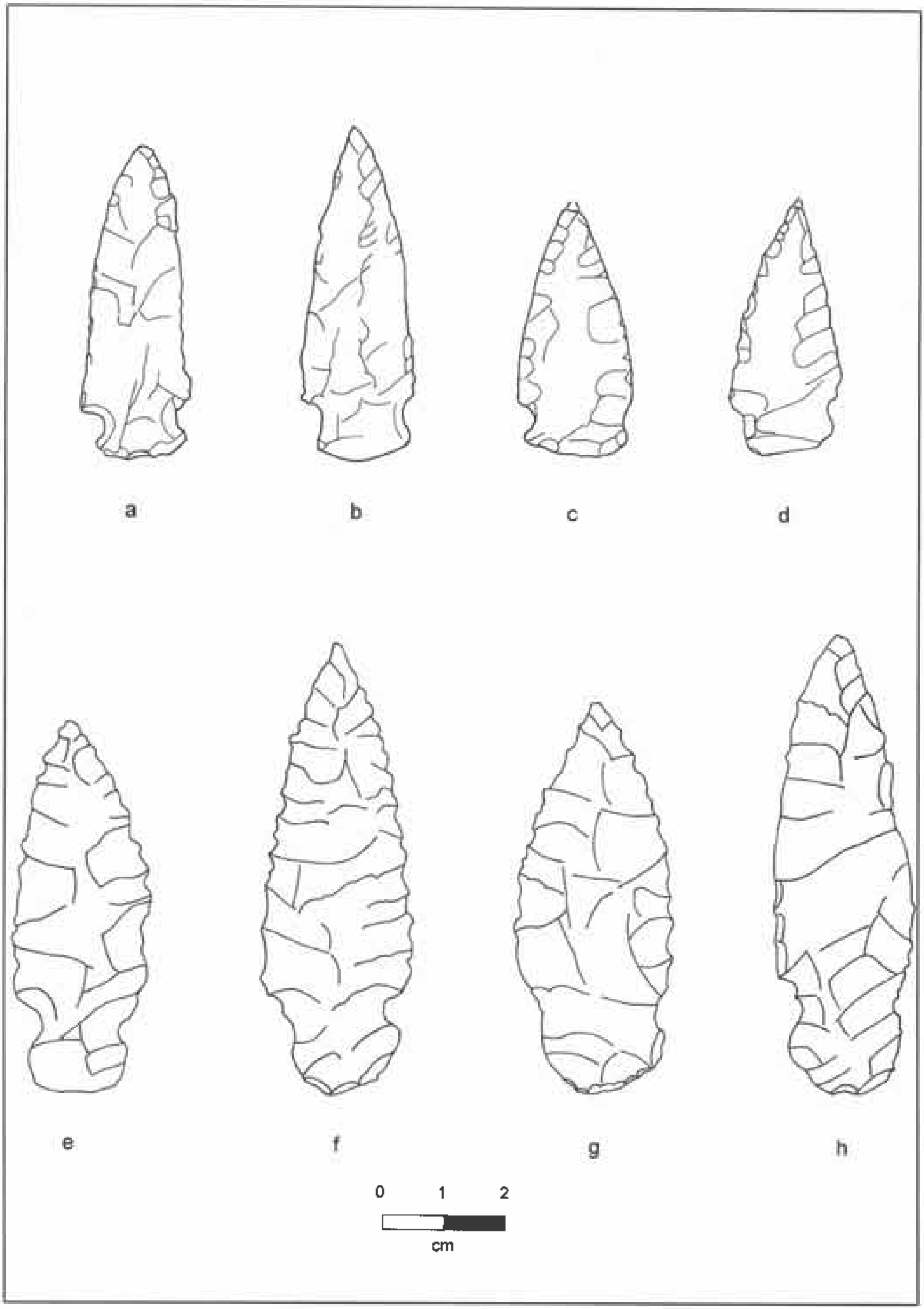

Figure 1. a-d, Albion Corner-notched points from the Hungry Whistler site in Colorado, redrawn from Benedict (1978: Figure 37); e-h, points from the Broadbent cache (Broadbent 1992: Figure 4).

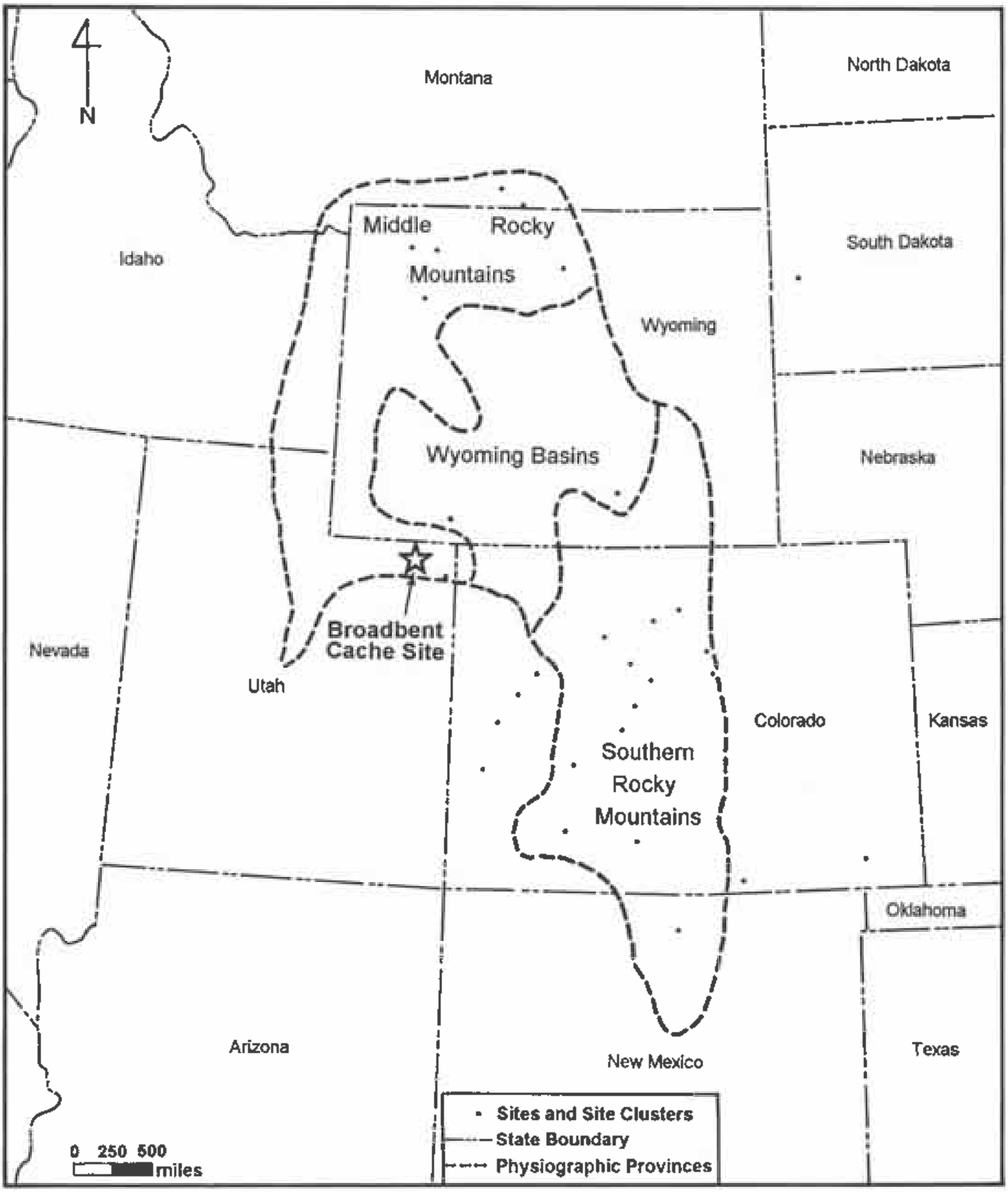

Figure 2. Location of Broadbent cache site in relation to other Mountain Tradition sites (adapted from Black 1991: Figure 1).

discarded because they had exceeded their use life. The differences in length between the Broadbent cache and the Hungry Whistler specimen is explained by their relative position in the use life trajectory. Throughout the sequence of use-breakage and/or resharpening, a projectile point will decrease in size through the process of resharpening and rejuvenation. While projectile points do not often lose medial mass through reworking, bifaces that are used as cutting tools often lose this mass over the course of resharpening and working (André D. La Fond, personal communication 1994). The proposed use of Mount Albion Corner-notched points as butchering tools would explain the thinner discarded specimens at the Hungry Whistler site.

CULTURAL AFFILIATION AND AGE

Mount Albion Corner-notched points are a diagnostic artifact type of the Mount Albion Complex identified by Benedict (1978a). At the Hungry Whistler site, one Mount Albion Corner-notched point was associated with a radiocarbon date of 5800 ± 125 radiocarbon years (I-3267), 4800–4500 B.C. (calibrated), and two others with a radiocarbon date 5520 ± 190 radiocarbon years (I-9434), 4540–4160 B.C. (calibrated) (Benedict 1978b:51). This complex is found in the higher elevations of the Southern Rocky Mountains and is believed to represent Altithermal populations who retreated to mountain refugia during the Altithermal Period (Benedict 1978c).

Black (1991) includes the Mount Albion Complex and a variety of other high-altitude complexes into the Mountain Tradition. According to Black, the Mountain Tradition is geographically restricted to the Middle Rocky Mountains, the Wyoming Basins, and the Southern Rocky Mountains (Figure 2) and represents a discrete archeological cultural area that maintained a separate cultural identity throughout most of the prehistoric period.

In summary, the altitude of the Broadbent cache site (8,280 ft), the location of the site on the southern periphery of the Middle Rocky Mountain physiographic province, and the morphology of the points suggest that this cache represents an assemblage of Mount Albion Corner-notched points associated with the Mount Albion Complex of the Mountain Tradition and may date between 4800 and 4100 B.C.

ACKNOWLEDGMENTS

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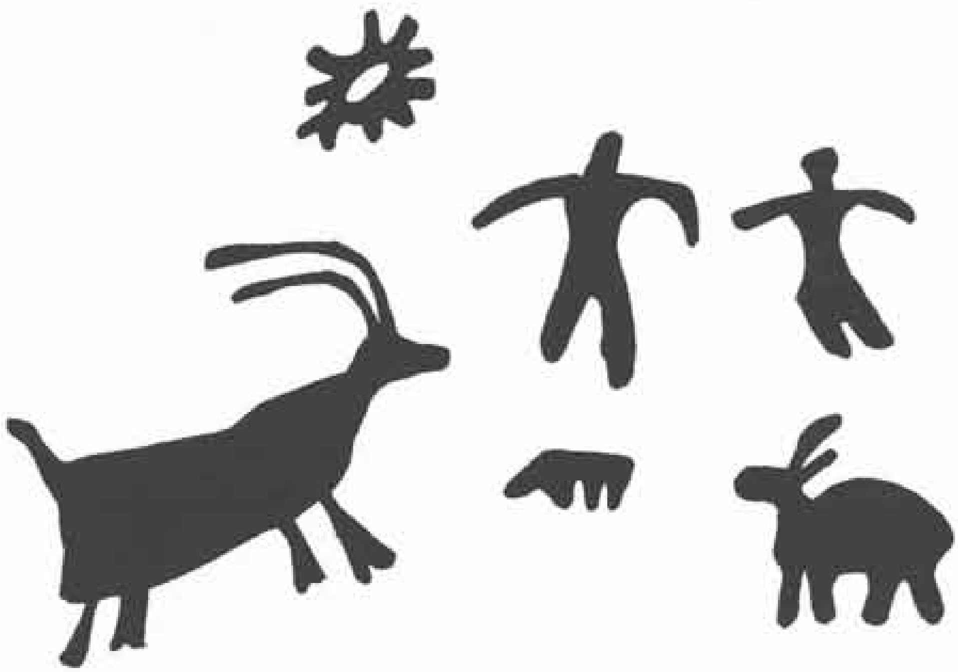

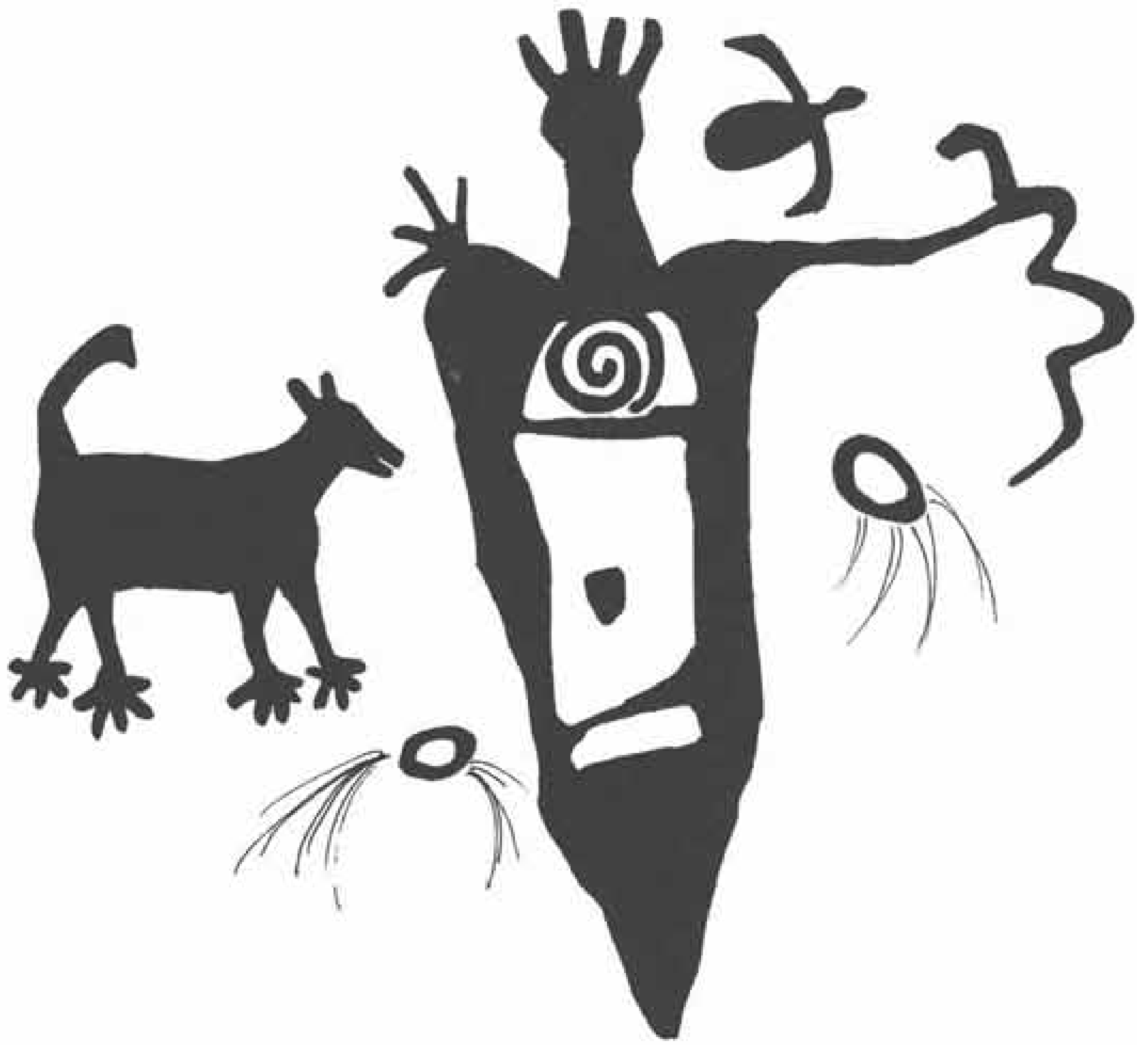

REVIEWS

Games of the North American Indians Volume 1: Games of Chance, and ***Games of the North American Indians Volume 2: Games of Skill***, by Steward Culin. University of Nebraska Press, Lincoln. 1992. 382 pages and 464 pages. $13.95 each.

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These two volumes, now published in paperback, are reprints of the 1907 edition, originally published in the Twenty-fourth annual report of the Bureau of American Ethnology, 1902-1903.

In his introduction, Dennis Tedlock writes, "When it comes to sports and games that are deeply rooted in this very continent, by which I mean games that were played here well before a certain European mariner tried to sail the wrong way around to India, there is no source as broad and rich as this one".

Tedlock, known as the translator of the Mayan Popol Vuh, is a professor of English at State University of New York at Buffalo. He adds to the original text his own follow-up investigation of Indian games, showing that those described in detail by Culin are still played today.

Culin was able to show that the games of North American tribes were remarkably similar in method and purpose, even in the styles of gaming paraphernalia which had apparently been passed down through the ages from prehistoric peoples.

In Volume 1, Culin found that games using dice of various materials—wood, cane, bone, animal teeth, fruit stones—existed among 130 tribes belonging to 30 linguistic groups. They are described in detail and include the popular guessing games using sticks and wooden disks and involving hidden objects. The games, more appropriately termed gambling, went on for hours and sometimes for days without intermission.

In Volume 2, Culin describes the practice of archery and games like snow snake, in which darts or javelins were hurled over snow or ice. Played throughout the continent north of Mexico were the hoop and pole game and its miniature and solitaire version called ring and pin.

Culin discusses ball games, including racket, shinny and football, and includes minor amusements such as shuttlecock, tip cat, quoits, pop gun, bean shooter, and cat's cradle. The latter -- weaving of cordage between the fingers of two hands -- is not a "white man's" game, but was apparently invented independently by Indian peoples of centuries past. It was not only an interesting pastime for child and adult alike, but a religious significance was added to some of the early string figures.

Both volumes are lavishly illustrated with drawings of museum specimens including collection numbers and accession data. Thus the reader gets a peek into the curation sanctuaries of many of the nation's museums. Along with provenance data, the books include the field reports of the collectors, many dating to the early 1800s.

While the books offer fascinating casual reading they are a storehouse of information for the professional archaeologist. For example, an incised bone gaming piece recovered from a southwestern excavation assumes an entirely new perspective with the consultation of Volume 1 Games of Chance. The excavator can learn how the game was played, how it was counted, what prizes went to the winner, and how it matched with games played in far-flung corners of the nation.

Moreover, the format of both volumes is sectioned according to tribes. In the greater west and southwest these include Hopi, Navajo, Apache, Keres, Pomo, Pima, Papago, Paiute, Shoshone, Tewa, Maricopa, Mojave, and Zuni, but the volumes cover tribal games from coast to coast and into Alaska.

These volumes are highly recommended as a stellar example of great readability and archaeological research.

Of Blood and Stone: Investigations into Southeastern Utah Archaic, edited by John W. Hohmann and John A. Hotopp. Louis Berger & Associates, Inc., Phoenix. 1992. 297 pages. $18.00.

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Rarely do we directly criticize professional archaeological reports but this weighty volume might be cynically reviewed in paraphrase of Shakespeare as "much ado about very little".

It is a report of a highway mitigation contract at two small open-air sites located along US Route 191 in the Spanish Valley about 8 miles south of Moab, Utah. Earlier recording of the site area was Phase I by Deborah Westfall in 1987, and initial testing by Abajo Archaeology as Phase II in 1988. Additional investigation by the authors in two months of late 1988 is listed as Phase III.

The authors roundly criticize the earlier investigator for not probing deeply enough and then, in self-aggrandizement, proclaim that theirs was an "intense investigation" with "full data recovery." Indeed, the report contains 300-plus pages and may set a new record for sheer verbiage as well as being a candidate for perusal under the Federal "Paperwork Reduction Act."

In what most editors would describe as "padding" the authors quote at length from 233 references. There is an overkill of redundancies and repetitions, numerous non-essential full-page figures of strata and other graphics, and fancy sectional title pages.

All of this preponderance of polysyllabic profundity covers two very small and shallow alcoves, variously reported as rockshelters and as open-air sites, two middens and the work surfaces in between. Most of the excavation was by back hoe with narrow trenches, only a few of which were expanded by hand-digging.

The two sites, 42Sa20040 and 42Sal8241, revealed a small artifact assemblage which is discussed at great length. In total it included 24 projectile points (mostly fragmentary), 12 cores, 3 scrapers, 5 preforms, 5 metates (some fragmentary), 28 manos, 16 "ceramics" (actually sherds), and thousands of flakes, some of them utilized.

Features included nothing habitational, two hearths, a small ring of stones, and a possible storage pit. But the authors then devote nine pages to report the recovery of 235 glass fragments and 18 different tin cans.

Perhaps the greatest distraction in the report is its catchy title, "Of Blood and Stone." There are repetitive mentions of "blood analysis" and the great importance it had to the investigation. However, in sum and substance, the authors reveal that the basic "analysis" was of some tools by the "Chemstrip" method.

These small test strips are used by hundreds of thousands of diabetics to test finger-pricked blood samples for sugar content. When questionable residue is indicated on a prehistoric tool, then moistened and placed in contact with a Chemstrip it will reveal the probable presence of blood, nothing more.

It will not indicate whether it is human, bird, or animal blood, whether it came from an accidentally-cut finger or from a deer or rabbit during butchering.

The authors note that they sent a small selection of chipped stone artifacts to the Department of Anthropology, University of Delaware, Newark. The report on three items was, "yep, it's blood."

The authors of the site report, however, just tease with the title. They write, "However, all artifacts yielding a positive reaction (to blood residue) have been curated in an unwashed condition so that future species identification analyses may be attempted when the reliability of such Chemstrip techniques have been improved."

We would not minimize the minimal discoveries at the sites, mainly the determination of dating to the Archaic period. But, this long, long report, its claims for blood "analysis," and its "Blood and Stone" title are excellent reminders to "never judge a book by its cover."

The Sagebrush Ocean: A Natural History of the Great Basin, by Stephen Trimble. University of Nevada Press, Reno. 1989. 248 pages. $34.95.

Reviewed by: **David M. Jabusch**
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Until recently my impression of the Great Basin was grim. In my Oregon State class in Natural History of Oregon, the Steens Mountains were characterized as the last uncharted wasteland in the United States. Raised in the rain forests of the Pacific Northwest, my first impression of the drive from Reno to Salt Lake City (not changed by thirty annual treks to my Redwood roots) was that of endless miles of sagebrush and salt.

Two recent events have changed that impression, somewhat. The first was a project of surveying the Pony Express Stations across Utah and the other was the appearance of Stephen Trimble's *The Sagebrush Ocean*. Trimble provides a scientifically sound, stylistically interesting and visually enticing survey of the natural diversity of the Great Basin.

He sets the stage with a geographical overview of the "four great basins" as well as the climatological origins of its "desert" ecology. Trimble develops the "Biogeography" of the Basin as he discusses the subtle changes in natural communities, the dynamic and dramatic development of its geologic past and "Mountains as Islands."

Trimble then provides the reader with a fascinating vicarious visit to the wide variety of plant and animal communities in the Great Basin. He takes you through Playas and Deserts, Shadscale, Sagebrush, Dunes, and the surprising abundance of water in the desert wetlands.

Moving up in elevation the author visualizes the Pinion-Juniper Woodland, Mountain Brush and Aspen Glens, Subalpine Forests and Alpine Deserts. He concludes his tour with the Transition Forests of the Western Wasatch and Eastern Sierras.

Lacking the abundance of easily observed flora and fauna of wetter and more temperate climates, Trimble directs the attention of the reader to the less obvious but no less diverse plants and animals of the Basin. But this is not merely an enumeration (however fascinating) of the flora and fauna of the Great Basin. Trimble skillfully represents these natural communities as the complex, ever-changing ecological systems they are found to be in nature. While his discussion of the impact of human beings as an integral part of the Basin ecology could have been more fully developed, Trimble does point out the role of humans and their domesticated animals upon the change (he might say degradation) of the Basin ecology.

The Sagebrush Ocean transcends enjoyable reading. Technically sound, it will provide a useful reference for avocational (and perhaps an occasional professional) archaeologists when struggling to distinguish among choices under "environmental data" on their IMACS forms.

In his review of *The Sagebrush Ocean*, David Madsen laments the excellence of Trimble's book for its potential "to attract the L. L. Bean crowd," and make the Great Basin "just like California." As a native Californian, I have neither Madsen's love nor his knowledge of the Basin, but I agree that Trimble's interesting, accurate and beautiful book should attract a wide readership to the once solitary diversity of the Great Basin.

Northern Anasazi Ceramic Style: A Field Guide for Identification, by William A. Lucius and David A. Breternitz. Center for Indigenous Studies in the Americas, Publications in Anthropology No. 1. 1992. Cost $10.00, pages 61.

Reviewed by: **Mark Bond**
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The typological identification of ceramic artifacts, and associations of these artifacts, is one of the more significant tasks faced by the field archaeologist while recording Formative Period prehistoric archaeological sites in the American Southwest. More often than not, inferences concerning the cultural affiliations, and hence chronological associations, of these archaeological sites are based on the field identification of the ceramic types observed and recorded. However, differentiation between similar types often depends on analytical techniques and tools not available to the field recorder. Given the large number of ceramic types that may be present on the surface of a Formative Period site, the similarities in the appearance of different types from potentially far removed cultural areas, and the difficulties involved with differentiating between various technological attributes exhibited by small sherds with only macroscopic examination, or at best a 10x hand lens, the potential for misidentifying ceramic types must be considered high. It is too easy to make too many assumptions in the field. The problem is compounded when "no-collection" policies prevent the archaeologist from removing a sample of the artifacts to the laboratory for amplified examination or inspection by the "experts." This situation results in the implicit, and even explicit, mistrust of archaeological data bases by many archaeologists who are familiar with how they are compiled and their potential problems (i.e., junk in—junk out!).

Northern Anasazi Ceramic Styles: A Field Guide for Identification is a welcome, and long awaited, attempt to ameliorate this situation. It is focused on the prehistoric ceramic traditions found in the northern Anasazi portion of the Colorado Plateau. This area is defined to exclude the Little Colorado and Virgin Anasazi areas. The book describes a field method of ceramic identification for sherd based assemblages using a relatively small number of easily recognizable technological attributes. These include painted design motifs, firing atmosphere (neutral or oxidizing), and paste surface manipulation (polish, smoothing, banding vs. corrugating, and rim shape); all attributes which can be readily perceived with the naked eye. While this technique does not identify specific types, and associated cultural affiliation, it does serve to place a given archaeological site into the Pecos Classification System, and hence, into a chronological framework. For black-on-white decorated ceramic sherds this system relies heavily on recognition of design style and differentiation between design motifs. For utility gray ware sherds the system relies on vessel surface manipulation and rim shape. The advantage of this system of ceramic identification is that a field archaeologist does not have to memorize, or otherwise have ready access to, the large volume of data concerning ceramic technology and typology that is available in order to adequately record a Formative Period site. Given the confusing, and occasionally contradictory nature of these data, as well as the volume, the advantage of this system is readily apparent.

It should be noted that *A Field Guide for Identification* will not do it all for you. It is not an excuse for not learning. A certain amount of experience handling ceramic sherd assemblages and knowledge of the area archaeology is a prerequisite for using this book. For instance white wares are defined as having at least one polished surface although, in southeastern Utah, Chapin Black-on-white often exhibits the characteristic design motifs painted on a smoothed but unpolished surface. A sherd from one of these vessels lacking a portion of the painted design would be undifferentiatable from a sherd from a similar shaped Chapin Gray vessel. However, given proper experience and knowledge, this book can be extremely useful as a recording tool. Gray ware surface manipulation techniques are illustrated by photographs in the book. Painted design motifs on white ware ceramics are also illustrated, though given the wide variety of motifs that exist, only a small number are illustrated. A larger number of motifs could have been included using pen and ink drawings if photographs were not available. Given that this book is intended as a field identification tool, it would seem that the more illustrations the better. I also feel that a more in-depth introduction and discussion of design styles and their origins would be appropriate in the introductory chapters of this book. Giving the authors their due, they may well feel that this information is some of the knowledge they imply a user of this book should already have under their belt.

It is refreshing to note that sherds that do not exhibit sufficient attributes for traditional typological placement are covered in a useful manner by this system of identification. In the past such sherds have often been assumed to be of the same types as those that could be easily identified in a particular assemblage. Anyone familiar with the various archaeological data banks has observed the site forms in which all of the white ware sherds, painted and unpainted, were given type names. In such a case a site exhibiting 5 sherds of Mancos Black-on-white and 75 non-diagnostic white ware and/or black-on-white sherds may have been recorded as exhibiting 80 sherds of Mancos Black-on-white. This indicates not only poor methodology but also the high potential for faulty data in the data bank. Unfortunately, these site forms are common. *A Field Guide for Identification* addresses this problem by introducing the concept of

Grouped Style Categories; general style categories into which non-diagnostic sherds can be easily placed without artificially inflating specific categories. Grouped Style Categories can be useful for rough chronological interpretations and the identification of different cultural components reflected by the sherds within a single assemblage.

In closing I would note that *A Field Guide for Identification* is a field tool, in convenient 5.5 by 8.5 inch format, that, if used properly, can greatly aid the various survey archaeologists working in the northern Anasazi area of the Colorado Plateau. The identification system it describes can, and will, reduce the potential for faulty data finding its way into the various archaeological data banks. This book is a step towards correcting a problem. The initial step was to recognize and accept that there was a problem. The next step will be to educate the keepers of the various data banks and to modify the various forms, such as the Intermountain Archaeological Computer System (IMACS) form, to accept ceramic styles as a legitimate form of data. The final step will be for those of us who are out there doing the archaeological footwork to get with the program. It will be a long trek but this book represents a start. I hope to find many dog-eared and worn out copies among the field gear of my fellow southwestern archaeological field workers in the years to come.

The Main Ridge Community at Lost City. Virgin Anasazi Architecture, Ceramics, and Burials, by Margaret M. Lyneis. Anthropological Papers No. 117. University of Utah Press, Salt Lake City. 1992. xi, 96 pages, 22 figures, 71 tables on included computer diskette. $25.00 paper.

Reviewed by: **Douglas A. McFadden**
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This volume considers the Anasazi settlement along the Muddy River in southern Nevada popularly known as "Lost City." It is the westernmost pueblo an occupation and is part of the Virgin Anasazi culture area that spans the adjacent uplands of northern Arizona and southern Utah. Located in the Mohave Desert at less than 2,000 feet above sea level, it is one of the most extreme adaptations of the Anasazi culture. While not a marginal manifestation, it is unquestionably a peripheral one. Initially excavated during the 1920s and never adequately published, accounts of Southwestern culture history have virtually ignored the area. Lyneis, conducting both archival research and her own field investigations has created order of this "old" data and provided us with a modern perspective of it. In so doing, this corner of the Anasazi world can now find its place in Southwestern prehistory.

Mark R. Harrington, fresh from Lovelock Cave, began excavating sites in Moapa Valley in 1924. This was his first experience with the Anasazi; his perspective was essentially synchronic for he called the entire area "Pueblo Grande de Nevada." Eventually, 121 sites (over 600 rooms) were investigated (or as he termed them, "houses"). Forty-four of these were concentrated on "the main ridge." The area was largely ignored until Shutler's 1961 dissertation considered the entire occupation and imposed some temporal order by describing chronological phases. Recently Main Ridge has been recorded as 26CK2148, a single site that covers an area 750 m by 900 m. The forty-four "houses," which consist of nearly 200 rooms, are the subject of this monograph's analysis.

Unfortunately no unexcavated sites are left on Main Ridge with which to test hypotheses, provide dates or additional analyses. This situation makes a strong case for the modern preservation ethic of leaving something to dig in the future. Harrington's excavation methods, the resulting categories of data and its quality, while perhaps in accord with the standards of the day, perforce structure the modern study of Main Ridge as a community. For instance we learn that Harrington was not careful about differentiating artifacts in room fill and those on the floor (page 26) nor were any drawings made of the structures. Lyneis assumes the task of developing the available data on architecture, ceramics, mortuary practices, and trade goods and brings it to bear on her central concern which is social organization. These analyses are followed with a chapter that summarizes the Main Ridge findings and a final chapter that considers the Moapa Valley occupation in a regional context.

Chapter One presents the central issue of this volume, Main Ridge social organization, as a dichotomy: do the "houses" (read sites) constitute a contemporaneous group of families with some form of integrating organization—that is, do they represent a community? Or, are they "... **simply** (emphasis mine) the composite result of sequential habitation by a small number of families over a period of years?" This question of contemporanity of architecture is particularly relevant to interpretations of site layouts and clusters elsewhere in the Virgin area where evidence for long-term site occupations is strong. Lyneis's interpretation is that the Main Ridge occupation indeed is an essentially contemporaneous community but that it represents a **special** situation.

Chapter Two details description of individual "house" layouts, their architecture and distribution over the ridge. Lyneis salvaged scale plans of these structures from the rising waters of Lake Meade during the 1980s. Their random settlement pattern is considered to be a product of rugged topography with clusters of individually constructed but usually "conjoined" rooms located on each suitable flat spot. Considerations of room function, habitation/storage ratios and their capacities provide excellent comparative data. The assessment of the settlement pattern at this point, hinting at the special status of these sites, is that the high household densities and their distance upslope from the floodplain "indicate that something about the location encouraged an unusual community to develop." Following analysis of the artifactual material, Lyneis concludes that Main Ridge community occupied a gateway location that facilitated trade with the uplands.

Chapter Three considers the case for contemporaneity of structures and burials during mid-PII (A.D. 1050–1100) by comparing ceramic collections from her fieldwork and vessels from burials curated at the Museum of the American Indian. An excellent discussion of ceramics, the ceramic chronology and considerations of external contact and its implications are covered. Dating of the Main Ridge occupation is indirect. It is based on three ^{14}C dates that bracket the ceramic assemblage whose diagnostic types fall ca. A.D. 1050–1100. This is a vast improvement over using Shutler's Lost City Phase (A.D. 700–1100) but it should be considered suggestive—many more dates are necessary to confirm this period. Of concern to those interested in developing chronologies via seriation is the finding that the frequencies of major wares are independent from the rest of the Virgin culture area.

Chapter Four discusses ceramic variability. A significant contribution for those working with ceramics elsewhere in the culture area is the definition of the new ceramic type called Shivwits Brown. Made in the uplands, it demonstrates a strong link between the two areas. A disconcerting characteristic of this mid PII type is that its rim form appears more similar to styles common during the Pueblo I period—another indication that Virgin ceramics might require the development of **local** chronologies. Finding difficultly in fitting this new type into Colton's classification system Lyneis calls for an overhaul of Virgin Anasazi ceramics.

Chapter Five describes the 45 burials found on Main Ridge (of the 289 excavated by Harrington). They were found in roughly equal numbers on or beneath the floors of structures, in the ruins of structures, and in the trash deposits. Significantly, the burials are not considered to reflect a ranked society but rather an egalitarian one. As Lyneis points out, we should probably not expect to find ranked societies or chiefdoms anywhere else in the culture area either.

Chapter Six "Local Products and Nonlocal Goods" discusses the evidence for inter regional connections—shell from as far as the coast, salt and turquoise from local sources, and ceramics from the uplands as far away as the Kayenta area. Considerable weight is afforded to these items. Lyneis's conclusion is "that red ware, shell beads, and other identifiable long distance trade items moved on the back of linked local exchange of perishable materials." This well-reasoned, essentially functional interpretation also accounts for the large percentage of Shivwits Brown (14 percent) on Main Ridge. Taking into account the difficulty of transporting bulky perishables (and also congruent with the data) is the alternative hypothesis that a relatively few perishable items of economic consequence might have accompanied an essentially ritualistic relationship that served to integrate people of the Moapa Valley in a wider social sphere. Lyneis suggests that this relationship would be better understood if only upland workers would screen—possibly, but at great cost. Perhaps some protocol is in order to satisfy this important research inquiry.

Settlement pattern and artifactual analysis combine to support the conclusion that "... (Main Ridge community's) reason for existence was its position at the gateway from the Moapa Valley to the lower reaches of the Virgin Valley and beyond." A well developed model, but surely the valley floor at this point was arable and of economic importance as well.

As Lyneis pointed out early in the volume, the proximity of Main Ridge to both the Moapa Valley and the Virgin River could have provided insurance in the event of crop failure—as well as access to the north. With local sources of data exhausted, testing the conclusion that regional trade took precedence over local produce will need to take place in the uplands.

In a sense "Main Ridge" is salvage archeology. It provides us with a modern analysis and interpretation of material collected over half a century ago. The Virgin culture area consists of several diverse environmental localities. This volume develops and summarizes the data from one of them—a welcome contribution that allows comparison between the areas. The Virgin Tradition, that umbrella of cultural attributes that integrates the entire area, is also addressed via the mechanisms of local and regional exchange that surely supported and defined that tradition. I hope we can look forward to similar volumes that describe, as well as offer explanation, from each of the Virgin culture area localities.

The volume comes supplied with a 3 ½-inch diskette using Microsoft 4.0 for Macintosh requiring the reader to print some 76 pages of tables that accompany the monograph. I suppose this represents the "cutting edge" in publishing. If it reduces costs it may be worthwhile, but it is awkward to use. In the future, I suggest that the more critical tables be incorporated into the text while those that might ordinarily be in an appendix be placed on the diskette. A choice of software programs might also be offered.

Quest for the Origins of the First Americans, by E. James Dixon. University of New Mexico, 1992, Albuquerque. 1993. 154 pages, 44 illustrations. $22.96 (including shipping).

Reviewed by: **Roy Macpherson**
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If you are interested in paleoindians you will want to read *Quest for the Origins of the First Americans*. Technically the new ideas are not fully substantiated with hard facts, but the concepts are very interesting. The most striking new theory is that the Clovis or Llano culture came to Alaska from the south or the middle part of North America and not from Asia over the Bering Straits, and that the culture was developed in North America.

Dixon describes three cultures that were present in Alaska during the 12,000–9,000 B.P. period. The Nenana and Paleoartic traditions came to Alaska from Asia and the Clovis tradition came from central North America. He bases these traditions on the differences in the lithic assembles of these traditions that have been excavated in Alaska and in the associated ^{14}C dates. He gives particular credence to recent findings (last 10 to 15 years). Dixon states that man could have come to the Americas 30,000 to 40,000 years ago by water craft from Asia, adapting and establishing cultures first in a coastal environment and then working inland. He bases the boat theory on the fact that Australia was peopled by watercraft over 40,000 B.P. Dixon accept T. D. Dillenay's chronology data from Mount Verde in Chile and Jim Adovasio chronology data from Meadowcroft Rock shelter in Pennsylvania. By doing this he places man in the new world Prior to 12,000 B.P.

Of particularly interest is Dixon's explanation and use of hemoglobin crystallization on the residuals from paleo points for identifying extinct animals. He also writes about accelerator mass spectrometry (AMS) in ^{14}C dating paleo artifacts and how it has improved our chronologic capability.

The book is written more like a novel than a scientific text. Dixon includes many personal experiences he had while he was developing the data for Quest for the Origins of the First Americans. His experiences while writing and having the book published are also included.

The new theories in the book are controversial and probably will not be generally accepted without a great deal of discussion and additional substantiating information. Again, if you are interested in paleoindians you will want to read *Quest for the Origins of the First Americans*.

The Desert's Past: A Natural Prehistory of the Great Basin, by Donald K. Grayson. Smithsonian Institution Press, Washington, D.C. 1993. xix, 356 pages, 90 figures, 45 tables. $44.95 cloth.

Reviewed by: **Dave N. Schmitt**
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Let's get right to the point. Donald Grayson's *The Desert's Past* is an elegant, well-written, and compelling book. Whether it finds its place on your coffee table or in your office library or classroom, *The Desert's Past* is a must.

The primary focus of Grayson's research over the past two decades has been Pleistocene and Holocene mammalian biogeography, and one might expect that he produce a book on the natural prehistory of the Great Basin that was largely oriented toward Great Basin mammals. Well, the mammals are there, but so is just about everything else. Combining a story-teller's narrative with scientific data and prose, Grayson offers an engrossing portrait of 20,000 years of Great Basin hydrology, geology, vegetation, and human history. Whether it's Pleistocene extinctions, early Holocene climatic change in the southern deserts, prehistoric Numic expansion, or the fate of the Donner Party, Grayson covers all the bases, often addressing a number of regional debates that result in captivating, thought provoking text.

Aside from its well-integrated content and extensive bibliography, yet another highlight of *The Desert's Past* is its structure. Each chapter concludes with a "Notes" section that offers regional tidbits (e.g., "the Churchill County Museum is located at 1050 South Main Street, in Fallon. Whether or not you opt for the Hidden Cave tour, this excellent museum is well worth the visit.") and directs the reader to the specifics outlined in the text (e.g., "Van Devender [1990b] presents his arguments for strengthened monsoons in the Sonoran Desert during the middle Holocene; those who feel the Sonoran Desert middle Holocene was warm and/or dry include, among others, S. A. Hall [1985] and Spaulding [1991]").

The Desert's Past is an impressive synthesis of Great Basin natural history and archaeology; given its detailed coverage, I am surprised that Grayson, himself, did not discover and report John Fremont's howitzer.

MANUSCRIPT GUIDE FOR *UTAH ARCHAEOLOGY*

UTAH ARCHAEOLOGY is a journal focusing on archaeological research within or relevant to Utah. Articles on either prehistoric or historic archaeological research are acceptable and both are encouraged. All articles must be factual technical writing with some archaeological application. The journal is sponsored by the Utah Statewide Archaeological Society (USAS), the Utah Professional Archaeological Council (UPAC), and the Utah Division of State History. The journal is published annually.

Authors submitting manuscripts are requested to follow Society for American Archaeology (SAA) style in text references and bibliography (see October 1992 issue of *American Antiquity*). If you do not have access to a copy of the style guide, write to Kevin Jones requesting a photocopy. Authors are asked to submit one original and three copies of their manuscripts as all submitted articles will be reviewed by three readers. Reviewers will be selected on the basis of paper topic. Manuscripts should be double spaced with margins adequate to allow for comments and should include a short abstract if the manuscript is intended for an article rather than a report or a comment.

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Citation examples:

Beck, Charlotte, and George T. Jones
 1994 On-Site Artifact Analysis as an Alternative to Collection. *American Antiquity* 59:304-315.

Janetski, Joel C.
 1991 *The Ute of Utah Lake*. Anthropological Papers No. 116. University of Utah Press, Salt Lake City.

O'Connell, James F., Kristen Hawkes, and Nicholas Blurton-Jones
 1991 Distribution of Refuse-Producing Activities at Hadza Residential Base Camps: Implications for Analyses of Archaeological Site Structure. In *The Interpretation of Archaeological Spatial Patterning*, edited by Ellen M. Kroll and T. Douglas Price, pp. 61-76. Plenum Press, New York.

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