

NEVADA ARCHAEOLOGICAL ASSOCIATION

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THE DESIGN OF THE NAA LOGO WAS ADAPTED BY ROBERT ELSTON FROM A GARFIELD FLAT PETROGLYPH

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Manuscripts should be submitted to Nevada Archaeologist, c/o Susan Murphy, 9785 Tropical Parkway, Las Vegas, Nevada 89129.

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EDITOR'S CORNER

This thirteenth volume of the Nevada Archaeologist contains three papers, each exploring very different and important research areas in Nevada archaeology. Bryan Hockett's preliminary report on the Spring Creek Mastondont is an excellent example of how observant individuals can further scientific research. Several people realized the significance of bones encountered inadvertently during construction of a waterline near Elko and brought these finds to the attention of paleontological specialists. Their efforts led to the scientific excavation of the site, discussed in Hockett's article.

The variability in artifacts and features found at Fremont sites has led to the postulation of several strategies by which the Fremont adapted to their environment. Marc Kodak develops hypotheses for two of these strategies. His hypotheses focus on toolstone and lithic technology and their representation in the archaeological record. He then applies these models to extant archaeological data sets by elevational and biotic zones. Marc Kodak gives us much to think about and, as often is the case, his article makes us want to find more Fremont archaeological sites on which to continue testing his ideas.

Interest in prehistoric rock art increases every year and with more research, more ideas on its meaning to its makers come to the forefront. Bob Krautz, Don Tuohy and James Hutchins' article discusses a most unusual cupule (pit-and-groove) petroglyph which is in the shape of an effigy head. (Cover illustration by Jerry W. Oothoudt). This petroglyph is discussed within its archaeological context, an often overlooked component in discussions of rock art sites. The effigy head originally was located outside of Reno. Through the authors' efforts and the Washoe Indian tribe, it now resides at the Nevada State Museum in Carson City.

We thank the authors for their contributions to Nevada prehistory and for their patience, understanding and cooperation during the preparation of this volume. All errors and omissions are ours alone. Thanks are due to Evelyn Faulkner for preparing this volume for publication and to Diane Winslow for her review comments.

Thanks also to the members of the Nevada Archaeological Association. This volume exists because of your participation in the organization.

I.

Colleen M. Beck James D. Wilde

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THE SPRING CREEK MASTODONT: A PRELIMINARY REPORT by Bryan Scott Hockett

Bureau of Land Management, Elko, Nevada

In April, 1995, bones of the American Mastodont (Mammut americanum) (spelling of 'mastodont' after Kurten and Anderson 1980; Haynes 1991:4) were inadvertently uncovered in the Spring Creek area of northeastern Nevada, approximately 6 miles southeast of Elko (Figure 1). These bones, as well as those recovered during later excavations, are currently being cleaned and pieced They will be placed on together. permanent display in the Northeastern Nevada Museum in Elko sometime in 1996. This paper discusses the discovery of the bones. subsequent the paleontological excavations conducted at the site, and some of the preliminary conclusions that have been reached about the site. The interpretations in this report are tentative because identification and analysis of the bones is continuing. A more complete report on the bones and their geological setting is also in progress.

Background

Bones of a large animal were discovered in April, 1995, during the backhoe excavation of a small trench for the installation of a waterline. Several people that live near the construction site reported hearing loud snapping noises during the excavation of the trench. Upon closer inspection they noticed large bones in the backdirt pile and protruding from the sidewalls of the trench. At least three individuals collected bones and bone fragments from the site.

One of those individuals was Beverly Brothers, who subsequently took the bones that she had collected to a museum in Montana. Museum personnel tentatively identified the bones as either mammoth (Mammuthus sp.) or giant ground sloth (Megolonyx sp., Nothrotheriops sp., or Glossotherium sp.). Based on Olsen (1979), I identified a single carpal and several phalanges as elephantid and assumed them to be mammoth. During a subsequent visit to Mrs. Brothers' residence, I examined several complete and nearly complete carpals that she had collected from the backdirt pile of the discovery trench. Closer comparisons of these bones to the mammoth and mastodont bones illustrated in Olsen (1979) revealed that the Spring Creek bones most closely resembled those of the mastodont.



Over the next several weeks, Mrs. Brothers assembled all of the bones collected from the discovery trench. In early May, 1995, I showed six carpals, metacarpals. several numerous phalanges, right and left distal radii and ulnae, and a partial right humerus to Dave Gillette, Utah State Paleontologist. We took the bones to the College of Eastern Utah Prehistoric Museum in Price. Utah. and compared them to those of the Huntington Mammoth, one of the most complete Columbian Mammoths (Mammuthus columbia) found to date (Gillette and Madsen 1993). The Spring Creek bones did not closely resemble those of the Huntington Mammoth. In late May, 1995, I took the bones to the Denver Museum of Natural History, and compared them to the Dent Site mammoth bones (Figgins 1933), and to casts of bones of a mastodont that was unearthed in Indiana. The Spring Creek bones most closely resembled those of the mastodont.

Excavation Strategy

A scientific excavation of the site was proposed in order to recover any remaining in situ mastodont bones and to determine the age and mode of burial of the bones. A general excavation strategy was designed and members of the Elko Chapter County of the Nevada Archaeological Association completed many logistical tasks, such as securing the permit to excavate, insurance, and coordinating volunteers to assist in the excavation.

The site was excavated between June 5 and June 11, 1995. An arbitrary datum was established to the southwest of the discovery trench (see Figure 2). North-south and east-west lines were established, the immediate region was gridded into 2 m x 2 m units using the letter-number system. The vast majority of <u>in situ</u> bones were found in units I26, J26, and J27 (Figure 2).

The excavation procedure is briefly discussed here. The soil and sediment that was backfilled into the discovery trench was removed by shovel and screened. Numerous bones, including complete carpals, phalanges, sesamoids, and the right proximal radius were recovered from the trench. A backhoe was then used to strip away the Holocene-aged topsoil above the bone bearing stratum. Fred Nials of the Desert Research Institute was the project By comparing the aeomorphologist. sandy sediment encrusting the discovery trench bones to soil and sediment samples collected earlier by a hand auger, Nials was able to accurately predict the general depth of the bones below present ground surface. He directed the backhoe operator to excavate until the sandy sediment that held the bones was encountered. After removal of the majority of the Holocene soil by backhoe, the remaining soil was removed by shovel. The edges of the discovery trench were delineated with trowel, and in the process several in situ bones were uncovered along the edges of the trench within the sandy sediment.

Figure 2. Location of the excavation units and the soil/sediment trench in relation to datum, Spring Creek Mastodont Site.

Several 2 m x 2 m units were gridded, and excavation proceeded with small picks and shovels until bone was encountered, after which the bones were uncovered with trowel and brush. All bone that measured greater than approximately 3 cm in length was pieceplotted (including orientation), mapped, and photographed. All sediment was screened through 1/4 inch mesh screen, and random sediment samples were wet screened through 1/16 inch mesh screen.

Age of the Bone Deposit

Based on his initial stratigraphic analysis, Nials estimated in the field that the bones probably are Late Tertiary (Late Pliocene) or Early Quaternary (Early Pleistocene) in age. Thus, the bones may be between 1.5 and 2 million years in age. Further analysis by Nials will be necessary to determine if a precise age can be determined for the site.

The Spring Creek Mastodont bones were located in a sandy matrix that has been extensively eroded. This erosion has created a series of terraces within the original Tertiary-aged terrace sands. These later terraces were cut by eastwest trending drainages, and by northsouth drainages coming off of the Elko Hills to the north (see Figure 1). The mastodont bones were not found within one of these later drainage systems. They were found within the stream deposits that helped form the original terrace itself.

It may also be noted that the stratum

lying approximately 30 cm below the mastodont bones consisted of greenish clayey sand that probably formed under relatively flat, calm waters such as those found in swamps or bogs. Nials indicated that this stratum may preserve diatoms which could help date the site as well as aid in the paleoenvironmental reconstruction of the region.

The Bonebed

Figure 3 illustrates the bones that were uncovered and mapped in place during the excavation. All of the bones recovered from the discovery trench and from the excavations appear to be from a single individual. The Spring Creek Mastodont specimen consists of at least one femur, one tibia, one fibula, one patella, eight metatarsals, five tarsals, one astragalus, one calcaneus, one scapula, two humeri, two ulnae, two radii, 16 carpals, seven metacarpals, 25 phalanges, four sesamoids, 16 rib fragments, two thoracic vertebral spines, and several hundred unidentifiable bone fragments. In more general terms, the majority of both front limbs, one complete hind limb, one partial hind foot, and fragments of ribs and vertebrae were recovered. Conspicuously absent was the skull, mandible, tusks, one hind limb, one scapula. the pelvic airdle (innominates and sacrum), and the vast majority of the vertebrae and ribs.

The pattern of disarticulation of the Spring Creek Mastodont is interesting. Nearly all of the axial skeleton was missing, yet the majority of limb elements

The Spring Creek Mastodont bonebed. Bones recovered from the Discovery Trench include six right carpals, three metacarpals, five phalanges, one seasmoid, right distal humerous, right ulna, right radius, and several rib fragments. The numbers above correpsond to the following bones:

1-17	rib and long bone fragments	33	left proximal radius and ulna (Note: the bore hole
18	metacarpal		Destroyed the diaphyses of these two bones, and
19	thoracic vertebral spine		the distal ends were recovered as part of the
20	right trapezoid		"Discovery Trench" sample)
21	right trapexium	34	left femur
22-27	rib fragments	35	left tibia
28	right navicular	36	left tibia (Note: the fibula was broken at midshaft,
29	rib		And the proximal end was lying perpendicular to
30	left front foot (eight carparls, four		the distal end)
	Metacarpals, five phalanges, one	37	left hind foot (calcaneus, astragalus, four tarsals,
	sesamoid		Five metatarsals, nine phalanges, two sesamoids)
31	left scapula	38	right hind foot (four metatarsals, eight phalanges.
32	left humerus		One sesamoid)

were recovered. Several explanations may account for this patterning. Lyman (1984), Lyman et al. (1992) and Kreutzer (1992), for example, have extensively researched the diagenetic effects of density differential bone on bone preservation and recovery. In short, bones which exhibit low density values and tend to be flat or thin in cross section are more susceptible to natural destructive forces than are bones which exhibit higher density values and tend to be more robust in cross section. Skeletal elements missing at the Spring Creek site, such as the mandible, innominate, sacrum, and vertebrae, generally exhibit low density values (Kreutzer 1992:284-285). Other low density bones such as the proximal humerus, however, were not only recovered during the excavations but they were exquisitely preserved. This suggests that differential bone density may not have adversely effected bone preservation and recovery at the Spring Creek locality. Additionally, carnivore ravaging (Binford 1981; Havnes 1980, 1983a, 1983b) may affect the number and type of bones likely to remain on the landscape for possible long-term preservation. No mastodont bones from the Spring Creek site show clear signs of carnivore damage such as punctures, pitting, furrowing, and channel flaking, althought animal gnaw markings tend to be relatively rare in modern elephant dieoff localities (Haynes 1991:142).

The pattern of disarticulation of the Spring Creek site is reflective of an animal that became mired in soft sediments, and portions of the carcass probably were subsequently affected by fluvial transport, and by later erosion of the Tertiary sands that originally preserved the bones.

The preservation of intact leg joints and vertically articulated elements of the feet (see especially Figure 3-30) may be interpreted as resulting from an animal that became mired in sediments and subsequently starved to death (Haynes 1995:17). As Haynes (1995:18) succinctly noted:

In these cases, animal's body, neck, and head need not fossilize in anatomical position like the legs, since the unmired trunk bones and body parts may be disturbed by scavenging birds and mammals, as well as by trampling animals and gravity after soft tissue begins to disappear. On the other hand, the legs would be fully protected...

In fact, "if soft tissue decays while the carcass is still exposed on the ground surface, the lower leg bones such as carpals, tarsals, and phalanges are the first elements to be scattered" (Haynes 1995:19). As noted above, the lower leg bones were the most common elements recovered at the Spring Creek locality. Thus, the most tenable interpretation that accounts for the differential preservation of the legs is that the Spring Creek Mastodont became mired in loose sediments, and the animal probably starved to death.

The spatial relationships between the front and hind limb elements may indicate that the mired mastodont sunk deeper into the sediments with its front leas, and its back legs were stretched out behind the body. The nearly complete front foot (Figure 3-30) was upright and nearly vertical, yet the entire hind limb (Figures 3-34 through 3-37) was positioned posterior side up. as if the hind leg was stretched far behind the animal. Additionally, the front limb elements were recovered between 40 cm and 50 cm lower in the stratigraphic profile than the hind limb elements.

The recovery of a femur that was not attached to an innominate, and the recovery of several rib heads but few vertebrae reinforces the interpretation that total ligament deterioration of certain joints in the body occurred before and possibly during burial. The overall position of the bones in relation to one another (the bones were not jumbled and limb units were entire found in articulation), reinforces the interpretation that the excavated mastodont bones were recovered at the place of death. The similar orientation of the bones, however, indicate that some of the missing bones may have been carried away from the main carcass by fluvial transport. It may seem logical that bones such as the skull and pelvic girdle were carried further downstream from the main carcass, but research suggests that these elements are the least likely to be dispersed from an elephant death site, whether by fluvial transport or by carnivore scavenging

(Todd and Frison 1986:88).

Modern elephants are inquisitive about the bones of their own kind, and they sometimes will carry off or trample upon bones of deceased elephants (Haynes 1991:141, 157). Thus, it is possible that bones such as the skull and pelvic girdle were carried away or crushed by other mastodonts as the body elements of the mired animal became exposed.

Additionally, directly above the sandy stratum that buried the bones was a stratum consisting of mainly cobbles and sand. This event scoured away some of the earlier stream sands and in the process may have directly destroyed some of the bones, or as Nials noted it may have indirectly destroyed bones by exposing them to the surface. The distal left femur recovered from the excavations was angled upward in the stratigraphic profile, and its proximal end may have been destroyed by the higher energy event that deposited the cobbly stratum. This event may also account for the missing skull and pelvic girdle, and for the hundreds unidentifiable of bone fragments recovered in the screens. It may never be known, however, whether the skull, mandible, pelvic girdle, and vertebrae are lying intact in the area but beyond our excavation units.

Osteology

Two metatarsals of the left hind foot exhibit corrosive damage and new bone

growth around the corroded areas. These bones were shown to Dr. Patricia Wright, an orthopedic surgeon in Elko. She tentatively identified the damage as stemming from osteomyelitis, bone infec-Osteomyelitis results from the tion. introduction of bacteria into bone through traumatic wounds or directly from adjacent infected soft tissue (Ortner and Putschar 1981:105). Because one of the metatarsals was corroded almost beyond identification, these data indicate that the animal probably was limping before it died. Because healthy adult elephants rarely get mired in soft sediments (Haynes 1995:18), these data may also help explain why the Spring Creek Mastodont apparently became mired in the sandy sediment. All mammalian long bones such as the femur and humerus consist of three separate bones. These are the proximal epiphysis, distal epiphysis, and the diaphysis or shaft. Major centers of bone growth are located between the two epiphyses and the diaphysis. The epiphyses, therefore, are not fused to the diaphysis in young mammals, but in an adult mammal the two epiphyses are fused to the diaphysis and form a single bone. Because the epiphyses do not all fuse at the same time, epiphyseal fusion data may indicate the age of the animal at the time of death.

All of the epiphyses are fused in the Spring Creek Mastodont specimen except the distal radii. The scheduling of epiphyseal fusion in modern elephants is poorly known (Haynes 1991:170), and some epiphyses can remain unfused until the fifth decade of life Haynes (1991:147).

Recent data suggest, however, that the distal radius is one of the last ephiphyses to fuse in elephants (Havnes 1991:350, Thus, in both modern Table A14). elephants the Spring and Creek mastodont specimen, epiphyses of the elbow fused before those of the wrist were fully fused. Based on the preliminary data presented in (Haynes 1991), the Spring Creek Mastodont could have been 30 or 40 in age, and perhaps older, when it died.

Conclusion

Miocene-aged gomphotheres are not uncommon occurrences in Nevada (Macdonald 1956; Tuohy 1986; Mawby The American Mastodont. 1986). however, occurs from the Middle Pliocene through the Late Pleistocene (ca. 3.5 million years to 10,000 years ago) (Kurten and Anderson 1980:344; Anderson 1984:83; Gingerich 1993:98). The Spring Creek Mastodont Site may be the first documented occurrence of this animal in Nevada. It may also represent the first documented evidence of this animal in the Great Basin, although Miller (1987) reported a Late Pleistocene mastodont in Utah that was found along the divide of the Colorado Plateau and the Great Basin drainage systems. Additionally, although wide-spread throughout North America (Kurten and Anderson 1980:344; King and Saunders 1984:316), probable Late Pliocene or Early Pleistocene-aged mastodonts are relatively rare in North America. On-going research will attempt to determine a more precise age for the

Spring Creek locality and to determine the importance of the site in comparison to

other mastodont localities in North America.

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The Elusive Fremont of Eastern Nevada by Marc Kodack

U.S. Army Corps of Engineers, 1222 Spruce St., St. Louis, MO 63103

Over the last two decades. archaeologists have implicitly explored how the distribution and density of human exploitable resources varies across latitude when resources in different latitudes are compared on a global scale. The environmental structure that is present is then used to discuss regional hunter-gatherer organizational structure and mobility (Binford 1983; Kelly 1983). Latitudinal variability in resource distribution and density reflects a well known ecological principal first stated by Alfred Russell Wallace in 1878 (Schall and Pianka 1978:679), that is, species diversity decreases from the equator towards the poles. However, significant exceptions to this principal occur that have direct implications for human populations. Examples of these exceptions include marine and terrestrial species restricted to the Arctic and the world-wide distribution of conifers. Conifers have their highest species richness in higher latitudes outside of the tropics (Brown and Gibson 1983:493; Stevens 1989:248).

Specific variables that change when

viewed latitudinally include effective temperature, primary biomass, and net primary productivity. Effective temperature is a measure of how much solar radiation falls on a particular point on the earth's surface and how this radiation is distributed. Primary biomass is how much living matter is within an area. Net primary productivity is how much living matter is available to herbivores in an area (Kelly 1983:282-283).

While effective temperature, primary biomass, and net primary productivity explain certain aspects of environmental structure that varies across large changes in latitude, we can broaden Binford's and Kelly's discussions by looking for other variables that also affect the global distribution and density of resources. Other variables such as elevation and longitude, when viewed globally also have significant impacts to resource distribution and species density. Along with latitude, elevation and longitude form a troika that can serve as the starting point for examining hunter-gatherer organizational structure. However, these variables cannot be divorced from the underlying

environmental structure that directly affects biogeographical distributions of all living organisms.

Environmental structure consists of the many abiotic variables that affect, either alone or in combination, the presence and distribution of individuals and species at a particular point either on or below the earth's surface and adjacent bodies of water. Ecological and evolutionary forces also shape environ-mental structure through individual/species interactions that may vary from mutualistic, neutral, and/or competitive (Brown and Gibson 1983:16), predator-prey interactions, and island biogeo-graphic principals such as island area and distance to the nearest mainland (MacArthur and Wilson 1963, 1967). Abiotic variables, especially elevation, are emphasized here.

The recognition by scientists that the geographical distribution and composition of species vary across the earth is not new. Observations in the late 18th and early 19th century by Alexander von Humboldt highlighted the relationship between climate and the distribution of plants (Merriam 1894:229; Holdridge 1967:11). Humboldt also noted that latitude and elevation are complimentary (Merriam 1890:30). By the end of the 19th century numerous biologists (Holdridge 1967:11; Brown and Gibson 1983:13) presented models to explain species

distribution. One of the most comprehensive of these models was that presented by C. Hart Merriam, a zoologist. Based on work Merriam conducted in northern Arizona, he proposed a series of irregular shaped life zones around the San Francisco Peaks (Merriam 1890). Within each life zone a recurring association of plant species was consistently found. Refinements of the life zone concepts still appear (Holdridge 1967), although broad use has fallen out of favor as an explanation of biogeographical distributions.

Merriam highlighted the relationship between latitude and elevation. He suggested that "belts of similar vegetation occur both at low elevations in high latitudes and high elevations in lower latitudes" (Brown and Gibson 1983:13; Merriam 1894:229). Especially critical in the distribution of plants are temperature and moisture (Merriam 1890:26). These variables influence the location of broad continental vegetation or life zones (Merriam 1894:238).

Derived from Merriam's and others work, a corollary to the ecological principle that species richness decreases from the equator towards the poles, is that species richness decreases from low to high elevations (Brown and Gibson 1983:502). Exceptions exist especially when the lowest elevations are composed of desert environments like the Mojave Desert of southeastern California, southern Nevada, and northwestern Arizona (see Grayson 1993:22 for boundary map) and high species diversity occurs at intermediate elevations (Brown and Gibson 1983:502).

By incorporating elevation into global explanations of how resource distribution and densitv affect hunter-gatherer organizational variability, we increase the range of variability in models proposed to explain why individuals and groups expend time in one place and not another, and perform certain activities here and not there. The construction of multidimensional models can be pieced together by focusing on a different global variable and exploring its possible effects on human movement and use of a landscape.

we return to the tropics where lf effective temperature, primary biomass, and net primary productivity all have high values when compared to non-equatorial areas, we can illustrate what happens to the surrounding environmental structure along an elevational and not latitudinal gradient. An additional ecological principal with relevance for mountain masses is that as area increases species and richness diversity increases and (MacArthur Wilson 1967:8). Implications of this principle coupled with ascension to higher elevations are that higher and higher elevations are

contained in smaller and smaller areas, ultimately resulting in very low species diversity approaching zero near barren mountain summits. I use the distribution of bryophytes to illustrate how elevation affects their distribution.

Bryophytes include mosses, liverworts, and hornworts. They are common non-vascular plants of the humid tropical rain forests found in the Old and New World. Although numerous plants could be used to illustrate how changes in elevation affect that vegetation. excellent biological bryophytes are indicators of local temperature and humidity. They are easily observed and directly reflect the gradual lowering of temperature with increases in elevation (Frahm and Gradstein 1991:669).

In the lowest elevations, 0-500 m, bryophytes are limited in distribution because of the presence of acidic soils. Their mass does not exceed 10g/m² (Table 1). The number of understory species does not exceed 25 to 30 per hectare. On individual trees many more species, 68 in one study, and 154 on a total of two dozen trees in another study, were present. Species here are small in size. Moving up into the montane and subalpine forests, bryophytes greatly increase in number with a maximum dryweight reached at 3000 m. In the submontane forest, whose maximum elevation reaches 1000-1400 m, bryo-

Table 1. Dryophytes and Elevation			
	Elevation Range	Maximum Percent Ground Cover	Phytomass g/m ²
Subalpine	3000-3500 m	80+	120-400g/
Upper Montane	2000-3500m	70-80	80-200
Lower Montane	1400-2400m	25-50	30-50
Sub-montane	500-1400	<10	10-30
Lowland	0-500 m	<10	10

Table 1. Bryophytes and Elevation

phytes cover 10% of the area. In the lower tropical montane forest, bryophyte cover varies from 25-50% and mass is 30-50g/m². Fifty species per hectare can be present. The upper limit of this forest varies from 1800-2400 m, but can reach 3000 m. Approximately 70-80% of the upper tropical montane forest area is covered by bryophytes with a mass of from 80-200 g/m². The upper limit occurs at 2000-3500 m. The subalpine forest occurs above 3000-3500 m. Here the "percent cover, phytomass and number of species may reach peak values" (Frahm and Gradstein 1991:674). Bryophyte mass varies between 120-400 g/m² with up to 100 species per ha. Ground cover exceeds 80% (Frahm and Gradstein 1991:670-676).

The elevational gradient along which bryophytes occur can be monitored by human groups moving along that gradient. The increasing presence of bryophytes in higher elevations is one biological indicator of the impact elevation has on local environmental structure. Although I focus on elevation, numerous other abiotic variables including local temperature and humidity, soils, location on the windward or leeward sides of mountain masses, and amount of sunlight reaching the lower levels of the rain forest, all interact with elevation to determine the geographic distribution of bryophytes. Although it is unknown if any hunter-gatherer groups ever monitored bryophytes during resource acquisition forays, environmental information could be extracted from bryophytes and the surrounding vegetation on general geographic position. The information could be used to determine the suitability of the local area for obtaining specific species. However, the two ecological principles of higher elevation and smaller area act to decrease species richness, thus constraining the choices available to huntergatherers. The reduced availability would directly affect immobile plant resources. Mobile animal resources could move to other physical locations (see Janzen 1967 for plant movement in the tropics vs. temperate regions).

The effect that elevation has on a global scale to environmental structure is visible in the tropics when mountain masses occur near or at the equator, in middle latitudes such as the Great Basin, or in high latitudes such as the Brooks Range in Alaska. The Great Basin with its contrasting basin and range topography offers a large area where both the regional and local affects of elevation on environmental and hunter-gatherer organizational structure can be studied. One such area in the Great Basin is Great Basin National Park and sur-rounding environs during the period A.D. 500-1350 when the Fremont occupied the area.

Archaeology in Eastern Nevada

Archaeological investigations in eastern Nevada (James 1981; James and Zeier 1982. National Archeological Database-White Pine County) document a long history of occupation of the region (Table 2) beginning with the Paleoindian at 8700 period B.C. (Thompson 1985:117; but see Bryan 1979:243) and continuing through the Archaic, Fremont, Paiute\Shoshone, and Historic periods. The goal of the present study is to examine possible Fremont organizational variability in a portion of the southern Snake Range (Figures 1 and 2) during the period A.D. 500 to A.D. 1350 (Madsen 1989).

The Fremont are a cultural historical entity (Morss 1931) who once occupied the eastern Great Basin. Material items that are distinctive of the Fremont include one-rod-and-bundle basketry, moccasins made from deer or mountain goat hide, trapezoidal clay figurines, and pottery (Madsen 1989:9-11; R. Madsen 1977). Although evidence for a number of different, regional variants is proposed (Ambler 1966; Madsen and Lindsay 1977; Marwitt 1970, 1986; but see Hogan and Sebastian 1980), for the purposes of this research the Fremont are characterized by the aforementioned material items and variable organizational strategies that ranged from being full time hunters and gatherers to settled horticulturalists (Madsen 1989:24-25).

Previous research in the region surrounding the project area has identified portions of the Fremont settlement system on the valley floor and in the immediately adjacent uplands. Fremont ceramics (R. Madsen 1977) are the most common indicator used by identify Fremont archaeologists to occupation of a location. A number of different kinds of Fremont sites, in different physical settings, are known from the Snake Valley and surrounding Because major vegetational areas.

changes have not taken place naturally since well before the period of Fremont occupation (Thompson 1984, 1985), the modern vegetation zones are probably in very similar locations to those that existed during the period A.D. 500 to A.D. 1350.

The most archaeologically visible Fremont sites are multi-room, valley bottom sites such as the Baker (26Wp63) (Wilde and Soper 1993) and Garrison sites in Snake Valley (Taylor 1954; Wilde 1992; Zancanella 1989:25-28, 34; see also Lindsay and Sargent 1979). Both sites are located on old alluvial fans in the sagebrush/shadscale zone. On the same alluvial fan as the Garrison site were at least eight other Fremont sites, varying from small to large artifact scatters with one or two mounds, most of which are probably structures (Zancanella 1989:25-28, 34). To the east in Utah, Fremont ceramics are known from open sites on valley floors (Berge 1964: Rudy 1953; William Zukofsky, personal communication, 1994) or slopes above the valley floor, both of which are in the sagebrush zone (Berge 1974; Wells 1990). To the north near the Deep Creek Mountains, open sites and a possible village site were near present or former marsh areas (Lindsay and Sargent 1979:22-24). Slightly higher in elevation are open sites or cave/rockshelters in the pinyon-juniper zone elevation are in the transitional zone. (Berge 1974; Bunch 1985; Fowler 1976, 1977; Gruhn 1979; Lindsay and Sargent 1979; Tuohy 1979; Wells 1990).

Table 2.	Culture History of the eastern Great Basin (after Madsen 1982:213-221, 1989
	Thompson 1985:117; Tuohy 1979:74)

Period Name	Time Period
Historic	A.D. 1800 to present
Paiute/Shoshone	A.D. 1300 to A.D. 1800+
Fremont	A.D. 500 to A.D. 1350
Late Archaic	1500 B.C. to A.D. 500
Middle Archaic	3500 B.C. to 1500 B.C.
Early Archaic	7000 B.C. to 3500 B.C.
Paleoindian	8700 B.C. to 7000 B.C.

Sites at approximately 2280 m in between pinyon-juniper and montaine vegetation (Lindsay and Sargent 1979; Wells 1990). Fremont settlement diversity is less well known in Spring Valley because of limited survey and the absence of intensive excavation. Previously reported Fremont sites in Spring Valley consist of variable-sized artifact scatters in open areas in the sagebrush zone (James and Zeier 1981:30-34; Zancanella 1990).

Based on previous work in Snake and Spring Valley, adjacent to Great Basin National Park, at least four different physical settings for Fremont sites are known (Table 3). For two of these settings, a very limited amount of direct subsistence evidence has been recovered and includes maize, pinyon nut hulls in juniper bark lined caches, and faunal remains from bighorn sheep, antelope, rabbits, squirrels, deer, bison, and birds (Taylor 1954:60; Tuohy 1979:33,35). The importance or percentage of floral and faunal resources in the Fremont diet is unknown due to the paucity of basic element counts and quantitative analysis, lack of information concerning excavation strategies and recovery methods, and absence of a of natural discussion and cultural formation processes Madsen (see 1980:25; Sharp 1989:20, 24).

However, despite previous work in the Snake and Spring Valleys, the extent or intensity of Fremont use of upland environments is not well known. These higher elevational areas may have been integral to regional Fremont settlement and subsistence strategies.

Although the aforementioned research has documented Fremont use of the region surrounding the project area, a theoretical framework for understanding and explaining how the Fremont exploited the resources on this regional landscape has not been presented. We might expect different organizational strategies employing residential or logistical mobility to exploit different kinds of resources due to the abrupt vertical topography in eastern Nevada and the effect this topography has on environmental structure and resource distribution and composition.

In the past, the lack of a theoretical framework for understanding Fremont settlement variability has hindered attempts at explaining the variability that existed during the Fremont occupation of eastern Nevada. However, working to the east in Utah, Simms (1986) proposed a model for Fremont settlement and subsistence variability. Simms (1986:204-205) suggests that to understand the known archaeological variability in settle-

Kind of Site	Dominant Surrounding Vegetation	Direct Subsistence Evidence
Open, ceramic/lithic scatter	Sagebrush	N/A
Open, ceramic/lithic scatter	Pinyon-Juniper or Transition Between Pinyon-Juniper and Montane Vegetation	N/A
Cave/rockshelter, ceramics	Pinyon-Juniper or between the Sagebrush and Pinyon-Juniper Zone	Pinyon nut hulls in juniper bark lined cache pits, maize
Alluvial fan or terrace with architecture	Shadscale or Sagebrush	Maize, various faunal remains

Table 3. Known Fremont Settlement Types in Spring and Snake Valley

ment of previously recorded Fremont sites such as large villages, rock-shelters, lithic and ceramic scatters, we should consider at least two alternative strategies. have not included a third strategy suggested by Simms, a period when both horticulturalists and hunter-gatherers are co-resident in the same area, to heighten the contrast between periods when horticulture was common and periods when hunting and gathering was prevalent.

Strategy 1

Logistical groups leave the horticultural base, engage in one or more activities on the surrounding landscape, and then return to the horticultural base. While away from this base where considerable labor is invested in the construction and maintenance of pit and/or surface structures, "short term use or special-use sites" (Simms 1986:206) are created and then quickly abandoned.

One indicator of this strategy may be the presence of "morphologically identical ceramics at both the larger horticultural sites and sites thought to represent these short term camps" (Simms 1986:206). Temperature and moisture restrictions on maize (Hevly 1983:29), the dominant food plant most likely grown at horticultural sites (see Madsen 1980:25, 29-30), confine this strategy to elevations below 2100 m where maize is capable of being successfully produced under the then existing water supplies and number of frost free days. Small plots of maize may occur above 2100 m, but compared to lower elevations, these plots will provide a very small percentage of the total harvest.

Strategy 2

Strategy 2 is a variable strategy where different degrees of mobility were employed as a response to short term failures or reductions in horticultural yields. One response may have been to move to a new area where horticultural activities were more productive. New pit houses and surface structures could then be constructed. An alternative response, was to abandon horticulture as a subsistence option altogether and concentrate on hunting and gathering.

If this was the case, many smaller, short term and special-use sites would have resulted from the activities of Fremont (in terms of material culture) hunter-gatherers, who were not necessarily collecting resources for transport to a large habitation/horticultural base site (Simms 1986:206).

As with strategy 1, almost all horticultural activities will be restricted to elevations below 2100 m. Small maize plots may occur above 2100 m.

Although areas above 2100 m could be used in both strategies, we might expect more intensive usage during strategy 2 if all horticultural areas are temporarily abandoned. Upland elevations offer non-maize food resources such as pinyon nuts, wood for fuel and shelter, small mammals or birds, and bighorn sheep that are unaffected by the physiological constraints these same elevations place on maize horticulture. Areas above 2500 m present problems to populations using either strategy because these areas severely constrain the temporal and spatial distribution of mobile and sessile food sources (see below).

Verticality and Fremont Settlement Variability

The eastern Nevada landscape has an abrupt vertical component that undoubtedly affected Fremont behavior, particularly the kinds of mobility strategies employed to obtain resources. The effect of this landscape on Fremont organization may be even more pronounced in the absence of significant geologic structural upheavals and large scale vegetational shifts (Thompson 1979, 1984:5, 71-73, 1985). Three elevational areas that occur on this landscape have the greatest potential to impact organizational strategies because of their significant spatial and temporal limitations on resource composition and distribution. The first area occurs between 1800 and 2100 m in elevation, where rainfall horticulture may have been practiced, particularly in Snake Valley on the east side of the southern Snake Range. The second area is a "transitional" zone occurring between 2100 and 2500 m. The third area consists of elevations over 2500 m that overlook Spring and Snake Valley. The three elevational zones described here would have presented Fremont populations with the opportunity to harvest a different combination of potential resources, the exploitation of which would have affected Fremont organizational strategies and, in turn, mobility.

Areas Between 1800 and 2100 m

Areas between 1800 and 2100 m in elevation, where maize probably was grown, represent the first elevational zone that affected resource composition and distribution. Procurement strategies that include horticulture are affected by numerous local environmental factors especially elevation, soils, surface and ground water; and rainfall. The number of locations that satisfy minimum physical conditions for successful horticulture are limited. For example, physiological characteristics of maize limit the areas where it could have been grown. Maize

> is a summer annual requiring adequate moisture (usually more than 5 cm) of rain per month, warm temperature (usually above 65° F during the day and above 55° F during the night) and a long growing season usually longer than 110 days (Hevly 1983:29).

The constraints of minimum moisture and temperature imposed on maize greatly reduce the chances of successful returns above 2100 m (Hevly 1983:33). Higher locations may have permitted a small amount of maize to be grown in some years, but the extent of these areas is probably very limited and yields would always be restricted. Although some varieties of maize can be grown at very high elevations, up to 3500 m in the Andes (Brush 1977:73-82), these maize varieties were not grown prehistorically in the Great Basin (Winter 1973). Hevly (1983:33) suggests that:

> . . . until the adoption of water control technology it would be predicted that populations dependent

on horticulture would be concentrated near permanent water sources or at elevations between 1800 and 2100 m, assuming the current climatic conditions.

Thus, upland areas above Snake or Spring Valley where the moisture requirements for maize are supplied solely through rainfall may have been an integral part of overall horticultural production. Valley floor locations with potential access to more secure "semipermanent" water supplies were used by Fremont populations just east of the project area (i.e. the Baker Site near Baker, Nevada, excavated by Brigham Young University [Wilde and Soper 1993]).

Areas Between 2100 and 2500 m

This zone links areas below 2500 m and above 2100 m. In this zone more intensive occupation should occur when Fremont groups followed Strategy 2. Use of this "transitional" zone offered better positioning for access to higher and lower elevational food resources. Although this zone is too high for anything but small, sheltered maize plots, the extreme spatial and temporal restrictions that occur above 2500 m are lessened. We should expect to find base camps intermediate in size between the village sites on the valley

occupations higher in elevation.

Areas Above 2500 m

floor and the smaller, more temporary

The high seasonal contrasts that occur above 2500 m would have spatially and temporally restricted all exploitable resources including conifers, herbivores, and smaller animals. Use of this zone by the Fremont probably was restricted to the summer months because of the constant threat of frost for cultivated plants. We thus might expect very temporary use of this zone with a sparse and dispersed archaeological record.

Raw Material Acquisition

The range of activities that occur at a site, the location on the landscape of these different activities, and the distance and kind of resources that can be obtained will be directly affected by elevationally induced differences in resource composition and distribution. The greater the degree of mobility in a settlement system. the likelihood increases that more places on a landscape such as the highly variable physical setting of the southern Snake Range and vicinity, will contain artifacts deposited by a range of activities. Fremont groups employing Strategy 1 because of reduced residential mobility,

should have left behind fewer artifacts across the landscape than Fremont groups using Strategy 2. However, Fremont task groups (Strategy 1) could overcome the more limited movement of the whole group by sweeping across the landscape to acquire specific resources. We might expect that the kinds of toolstone reduction techniques used will vary with the organizational strategy employed. Thus, we should expect differences in tools and debitage between the horticulturally based Fremont (Strategy 1) and Fremont groups less dependent on, or who had abandoned, horticulture (Strategy 2).

Toolstone such as obsidian, chert, guartzite, and guartz were commonly used in artifact production at previously recorded Fremont sites in the southern Snake Range. The specific sources for cherts, quartzite, and quartz are not currently known (Bonnichsen and Birnie 1985; Gruhn 1979:116, 119; Rudy 1953:23, 103; Taylor 1954:45-47; Wells 1990:81-84). Local outcrops of cherty limestone and dolomite (Hose and Blake 1976) probably provided some of the raw material. Obsidian sources used by prehistoric people in the southern Snake Range occur to the east in Utah (Nelson and Holmes 1979), in northeastern Nevada, and southeastern Idaho as

reported here. Locally available quartz cobbles in the northern Snake Range and a quarry in Spring Valley provided some portion of the quartzite toolstone used (Carmichael and Weed 1981:22-23; Gruhn 1979:119). Overall, the southern Snake Range is poor in high quality toolstone, e.g. obsidian.

Influences on technological organization are many (see M. Nelson 1991 for review). As a starting place for understanding Fremont organizational variability, the focus of this research is on raw material acquisition, archaeologically visible by the surface materials collected.

Raw material availability will affect rates of curation and expediency (Bamforth 1986, 1990:97-98); the distance from a source of lithic material directly influences the kinds of stone artifacts produced at residential sites (Elston 1988). The following hypotheses are proposed to understand Fremont organizational variability. These hypotheses are tested by examining toolstone acquisition and use and their effect on settlement variability. I expect that the highly varied topography conditioned Fremont organizational strategies. These strategies should be visible in the archaeological record as differences in toolstone procurement, reduction, and use between Fremont site assemblages.

Hypotheses for Strategy 1

Fremont groups employing Strategy 1 leave the residential base for the specific purpose of acquiring raw material, or this material could be obtained secondarily by a task group searching for another resource(s), thus embedding toolstone procurement in other resource searches and acquisition. The use of task groups might allow frequent replenishment of higher quality non-local toolstone such as obsidian. Based on Strategy 1, we expect that if Fremont groups occupy an area for longer periods of time, then the residential base should contain evidence for the continued use of both high and low quality toolstone. Given a readily available supply of obsidian, lithic technology should be expedient (Parry and Kelly 1987:297) with evidence for reduction through percussion of both cores and utilized flakes. For lower quality local toolstone such as chert and quartzite, we expect a similar expedient technology. Debitage of both high and low quality toolstone should be present in roughly equal percentages.

Hypotheses for Strategy 2

More mobile Fremont groups (Strategy 2) may only have high quality toolstone on hand for a limited time because frequent movement of the residential base camp places the group further away from spatially restricted high quality toolstone sources (Goodyear 1979:3). We should expect an increase in the use of local toolstone sources as the hiah quality toolstone supply is exhausted. This would be a direct consequence of frequent residential movement. Based on Strategy 2, we should expect that as Fremont groups increase their mobility, residential sites will be occupied for shorter periods of time resulting in the rapid depletion of the initial supplies of high quality toolstone brought from outside the area (Elston 1988:159). People will then be forced to concentrate on local sources of toolstone. I suggest that conservation of high quality raw material is emphasized. Conservation efforts miaht include flake tools manufactured from biface thinning flakes and possibly a small number of broken, expended bifaces. Cores manufactured through percussion will probably not be composed of high quality toolstone, although a small number of used percussion flakes may be present. Tools with evidence of edge rejuvenation, or the use of a bipolar technique may occur and may reflect attempts at lengthening the availability of high quality toolstone (Elston 1988:160). Evidence of the final stages of biface reduction, maintenance, and recycling should also occur (Goodyear 1979). As depletion of high quality toolstone occurs, lower quality raw material should begin to predominate among tools and debitage. We might expect heat alteration of local toolstone materials to improve control over flaking.

Temporary Camps and Strategies 1 and 2.

The above hypotheses are directed at identifying differences in toolstone and the artifacts made from different toolstone at Fremont sites. The temporary camps of each strategy may parallel the raw material evidence from the residential bases characteristic of each strategy. Thus, temporary camps associated with Strategy 1, although functionally differentiated from the base camp, may still provide material evidence of the ability to acquire a mix of both high and lower guality toolstone. Determination of which toolstone to use may be opportunistic (Nelson 1991:96); situations arise that are planned and а response not is immediately required. Temporary camps generated as part of Strategy 2 may, due to decreasing supplies of high quality toolstone, force the occupants to use lower quality local materials while temporarily away from the residential camp. Reuse of these temporary camps, will as always blur the interpretation of the archaeological record. However, if separate clusters at the same location are used as a coarse indicator of reoccupation, we might expect that the ability to acquire non-local toolstone in Strategy 1 or the restrictions of Strategy 2 that force

people to use local toolstone will be reinforced in the respective assemblage at temporary camps.

Verticality, environmental structure, organizational strategies, and mobility are a tightly integrated set of variables and responses affecting all prehistoric Native American populations of eastern Nevada. Variability in the distribution and composition of food resources occurs as a direct result of the vertical physical environment. Fremont organizational variability should be a response to differential resource availability in this vertical environment. This resulted in Fremont populations adopting two strategies, one based on residential mobility, the other based on logistical mobility. These strategies attempted to overcome the spatial and temporal differences in resource availability brought on by verticality and climatic perturbations. Each of these mobility strategies is associated with different kinds of lithic assemblages. A strategy using logistical mobility will continue to consume both non-local high quality and lower quality local toolstone. A strategy using residential mobility will quickly deplete the introduced stocks of high guality toolstone and be forced to use lower guality local toolstones. The interplay between these variables and Fremont responses, and the material remains that resulted, are visible in the regional archaeological record of eastern Nevada.

Survey Results

Few of the 25 prehistoric sites or isolated finds recorded during the two field seasons of survey in and around Great Basin National Park (Figure 2; Table 4) contained any artifacts that could be assigned to the Fremont period. The only time sensitive artifacts, projectile points and sherds, were not common. The projectile points that could be identified included Gatecliff Contracting Stem, Elko Corner Notched, Desert Side Notched, Cottonwood Triangular, Rose Spring, and Bull Creek. The majority of projectile points, 26 of 51, were unidentifiable. However, some evidence is present that hints at the kinds of activities prehistoric populations, possibly including the Fremont, were doing.

Three elevation zones, 1800-2100 m, 2100-2500 m, and above 2500 m, have been discussed as being significant for Fremont settlement variability in a topographically diverse landscape. Archaeological materials were recorded in each of these zones (Table 4).

1800 m to 210	0 m	2100 m to 2500 m	>2500 m
26Wp2669 26Wp2674 26Wp2675 26Wp2676 26Wp2877 26Wp2878 26Wp2879 26Wp2880 26Wp2881 26Wp2883 26Wp2884 26Wp2885 26Wp2885 26Wp2886 26Wp2887 26Wp2888 26Wp2888	UCSB-92-IF1 UCSB-92-IF2 UCSB-92-IF3 UCSB-92-IF4 UCSB-92-IF16 UCSB-92-IF17 UCSB-92-IF18 UCSB-92-IF20 UCSB-92-IF20 UCSB-92-IF21A UCSB-92-IF21B UCSB-92-IF23 UCSB-92-IF23 UCSB-92-IF25 UCSB-92-IF26 UCSB-92-IF27	26Wp2670 26Wp2673 26Wp2882 26Wp2890 26Wp2891 26Wp2892 UCSB-92-IF10 UCSB-92-IF11 UCSB-92-IF15 UCSB-93-IF8	26Wp2672 UCSB-93-IF9 UCSB-93-IF10

Table 4. Prehistoric Sites and Isolated Finds by Elevation Zone

Zone (m)	Total Number	Number of Quadrats (Sites and Isolated Finds)	Average Artifacts per Quadrat
2500+	40	3.0	13
2100- 2500	642	4.4	146
1800- 2100	910	9.6	94

Table 5. Number of Artifacts Per Elevation Zone

With archaeological materials recorded in each zone, how many artifacts occurred in each zone? To make comparisons between zones valid. I standardized the area surveyed by number of artifacts observed, using a 500 x 500 m quadrat, the basic sampling unit in the fieldwork, as one standard unit. The highest average number of artifacts per 500 x 500 m quadrat, occurs in the intermediate elevational zone, 2100-2500 m. Decreases in the average number of artifacts occur below and above this zone (Table 5).

The elevational zones used here are "imposed" on the landscape using maize physiology to determine the boundary. If instead, we temporarily abandon these artificial boundaries and look at the dominant modern vegetation (Table 6) surrounding each of the sites and isolated finds, we find different archeological "members" of these vegetation zones. Modern vegetation boundaries are similar to those that existed in the southern Snake Range over the last 6,000 years (Thompson 1984) with some changes possible as a result of historic/modern mining and grazing. I suggest that we can combine the Lower Sagebrush-Juniper with the Pinyon–Juniper Zone because any zone with juniper is at the lower end of the first montane forest zones encountered in the southern Snake Range and elsewhere in the Great Basin (Cronquist et al. 1972). I discard the alternative then of assigning the Lower Sagebrush-Juniper to the upper elevational end of the Sagebrush Zone. With three vegetation-based zones, the overwhelming majority of artifacts, n=1516 or 96% of all observed artifacts, occur in the Pinyon–Juniper Zone (Table 7).

Lower Sagebrush	Lower Sagebrush/Juniper	Pinyon-Juniper	Upper Sagebrush
	eugeer der verniper		
26Wp2675	26Wp2881	26Wp2669	UCSB-93-IF9
26Wp2677	26Wp2882	26Wp2670	UCSB-93-IF10
UCSB-92-IF16	26Wp2884	26Wp2671	
UCSB-92-IF17	26Wp2886	26Wp2672	
UCSB-92-IF18	26Wp2888	26Wp2673	
UCSB-92-IF19	26Wp2892	26Wp2674	
UCSB-92-IF20		26Wp2676	
UCSB-92-IF23		26Wp2877	
UCSB-92-IF24		26Wp2878	
UCSB-92-IF25		26Wp2879	
UCSB-92-IF27		26Wp2880	
UCSB-93-IF5		26Wp2883	
		26Wp2885	
		26Wp2887	
		26Wp2889	
		26Wp2890	
		26Wp2891	
		UCSB-93-IF2	
		UCSB-92-IF3	
		UCSB-92-IF4	
		UCSB-92-IF10	
		UCSB-92-IF11	
		UCSB-92-IF15	
		UCSB-92-IF21	
		UCSB-92-IF26	
		UCSB-93-IF1	
		UCSB-93-IF2	
		UCSB-93-IF3	
		UCSB-93-IF4	
		UCSB-93-IF6	
		UCSB-93-IF7	
		UCSB-93-IF8	

Table 6. Sites and Isolated Finds by Modern Vegetation Zone

Dominant Modern Vegetation	Total Number of Artifacts Observed	
Upper Sagebrush	2	
Pinyon-Juniper	943	
Lower Sagebrush/Juniper	573	
Lower Sagebrush	74	

Table 7. Number of Artifacts Per Modern Vegetation Zone

I divided the 25 sites recorded into four categories: 1) those sites with more chert, 2) those with more obsidian, 3) "other" where "other" consists mostly of guartzite and limited quantities of chalcedony, basalt, welded tuff, and quartz, and 4) those sites with almost equal amounts of two or more of the other categories. One site, 26Wp2892, stands out from the rest. This "anomaly" occurs because 26Wp2892 had almost one-fourth, 170, of all the randomly selected artifacts, 721, and almost 30% by weight, 311.9 g out of 1048.49 g total, of all the artifacts collected during the two field seasons (Table 8).

Chert is the most common raw material by weight at 14 sites, followed by obsidian at seven sites. Almost equal amounts, within 0.5 g, of obsidian and chert or obsidian and "other", occur at 26Wp2877, 26Wp2880, 26Wp2884, and 26Wp2889. No sites had "other" as the dominant toolstone. If we combine chert and "other" to reflect a locally available toolstone category versus the non-local

obsidian, we reinforce the two-to-one dominance, by weight, of chert/"other" toolstones when compared to obsidian at sites.

Complimenting an increased use of local toolstone, should be the use of reduction strategies that seek to conserve higher quality, non-local, toolstone such as obsidian.

The median size of flakes when viewed by raw material across maximum length, maximum weight, maximum thickness, and weight indicates that flakes of obsidian are smaller in all these dimensions when compared to other raw materials (Table 9). The smaller size of the median obsidian flakes is a direct result of the intensity of reduction.

Additional suggestive evidence of mobility is available in the obsidian sourcing analysis. I expected that the obsidian encountered would be from one of the many sources in western Utah. The majority of the artifacts I submitted for

Site Number	Obsidian	Chert	Other
26Wp2669	0.57	0.00	0.00
26Wp2670	0.42	10.43	4.60
26Wp2671	11.01	7.05	1.80
26Wp2672	7.52	0.00	0.00
26Wp2673	1.58	6.41	0.00
26Wp2674	13.50	2.33	3.06
26Wp2675	26.74	3.82	1,11
26Wp2676	7.58	8.77	0.00
26Wp2677	0.18	124.50	0.00
26Wp2877	1.10	0.70	0.00
26Wp2878	7.60	1.30	4.30
26Wp2879	5.30	18.90	0.00
26Wp2880	5.7	5.60	0.00
26Wp2881	32.50	78.76	4.50
26Wp2882	5.90	0.20	0.00
26Wp2883	1.60	5.50	0.00
26Wp2884	5.00	5.00	0.00
26Wp2885	4.30	65.05	0.40
26Wp2886	10.30	32.15	15.80
26Wp2887	3.50	12.30	0.00
26Wp2888	2.65	66.40	15.80
26Wp2889	4.90	0.00	4.40
26Wp2890	1.85	39.50	0.00
26Wp2891	4.70	20.15	0.00
26Wp2892	81.95	209.55	20.40
Totals	247.95	724.37	76.17

Table 8. Total Weight (g) of Chipped Stone Raw Material at Sites

	Maximum Length	Maximum Width	Maximum Thickness	Weight
All Flakes	15.45	10.74	0.45	2.70
Chert/Other	16.52	11.35	0.51	2.74
Obsidian	14.26	9.80	0.37	2.53

Table 9. Median Measurements (mm or g) of Flakes

x-ray fluorescence analysis are indeed derived from western Utah sources including Topaz Mountain, the Mineral Mountains, Panaca Summit, and the Black Rock Desert. However, one artifact each comes from the diffuse Brown's Bench source in northeastern Nevada, and the Malad, Idaho area in the southeastern portion of that state. The Brown's Bench source area is 330 km to the northwest and the Malad source is 380 km to the northeast from the slopes of the southern Snake Range. Very high mobility or trading relationships could both explain the presence of obsidian from these distant sources. At present either one of these alternatives is possible, although other non-locally available artifacts such as turguoise and shell recovered in the excavations the Baker Site indicate that obsidian was not the only distant material that found its way to the southern Snake Range and vicinity.

Conclusion

The effect that elevation has on global, regional, and local environmental structure has been noted in biology for over 200 years. I suggested that the impact that this environmental structure has on hunter-gatherer organizational structure should parallel the global affect latitudinal variability has on hunter-gatherers. However, we might expect that the and availability variability of environments across an elevational gradient may reduce the regional procurement area because resources that would only be available with large changes in latitude might be available by moving up in elevation. Using one or more mountain masses might result in an equivalent resource diversity to large latitudinal changes, but the diversity is contained in a smaller regional procurement area. In conjunction with smaller procurement areas, diet breadth might

also be constrained by two ecological principles previously discussed. Decreasing area and ascent to higher elevations both reduce species diversity. By seeking out resources across the entire elevational gradient present within a range of mountain masses, resource choice is lowered. The reduced choice should affect the decision to leave a patch because of the underlying environmental structure, in this case, a reflection of elevation.

I suggested that Simms (1986) model of oscillating Fremont settlement could be viewed through environmental structure as manifested by elevation. Although I proposed two alternative strategies of raw material acquisition and use, neither of the strategies had conclusive archaeological support. Support does exist however, for acquisition of non-local obsidians either through trade or high mobility. A definitive test of Simms (1986) model of Fremont settlement oscillation model in eastern Nevada remains to be conducted.

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A SAURIAN EFFIGY FROM WASHOE COUNTY, NEVADA by Robert R. Kautz¹, Donald Tuohy² and James Hutchins¹

¹Kautz Environmental Consultants, Inc., Reno, and ²Nevada State Museum, Carson City

A survey in anticipation of the a residential construction of and recreational complex along Thomas Creek in southwestern Reno, Nevada, produced a most unusual artifact. The cultural resource survey, conducted during the summer of 1994, was in the process of redescribing a well-known prehistoric site (26Wa99) referred to locally as the "Lower Thomas Creek Site" (Aikens 1972:23), when the object, interpreted herein as a saurian head effigy, was located. This site was first described in field notes by the late amateur archaeologist, Gladys W. Smith, and has been revisited and further charaterized by a number of amateur and professional archaeologists alike, including Frank Parker and his sister of Fernley, Nevada, and Alvin McLane of the Desert Research Institute of the University of Nevada, Reno. The effigy was described by the rock art professional, McLane, in his field notes of March 28, 1994, as "an elliptical rounded basalt boulder . . . with cup shaped pits and grooves." Though his description is accurate, McLane apparently failed to discern the intentional fashioning that

resulted in the overall shape of this most interesting artifact.

The Effigy

The stone effigy is constructed of a compact vesicular basalt covered with cupules and grooves, possessing short eye protrusions and obvious mouth parts suggestive of a reptilian or an amphibian head (Figure 1). The effigy evidently began as a rounded, moderately boulder patinated with knobby protrusions suggestive of an incipient head. In size, the object measures 74 cm from "nose" to "nuchal area" (front to back) and 55 cm from side of head to side of head. The measurement from the center of one "eye" to the other is 34 cm, while each "eye" is approximately 15 cm in diameter.

Shaping of the boulder began with the creation of the extensive cupmarks (cupules) that cover the boulder's dorsal and ventral surfaces. These cupules are shallow pits produced by repeatedly pecking the boulder surface, creating shallow (0.5 - 5 cm) and small (2 - 8 cm

Figure1. 3/4 View of Saurian Effigy.

in diameter) depressions. Likewise, a shallow channel has been ground, extending from side to side and crossing the effigy's ventral surface (Figure 2). These features, the cupules and the furrow, appear similar to those commonly referred to in the literature of western North American as representing the early pit-and-groove style (Heizer and Baumhoff 1962:208; Heizer and Clewlow 1973; Hedges 1980, 1983).

Following an unknown period of time, further modifications of the boulder's surface were achieved. These include grinding shallow channels around the natural bulges representing the effigy's eyes, a technique known as "rock feature incorporation" (Smith 1987; Hedges 1992), thereby effecting a bas relief surface. This superimposed channeling round each of the effigy's eyes creates short eye stalks that cross and cut through several cupules (Figure 3). Invariably, the pecked surface of these cupules appears to be the older patination. The front of the effigy was further modified by grinding a groove into what may have been, at least partially, a natural crack and extending it around the entire anterior portion of the effigy's "face," continuing with small lateral breaks around the entire boulder. This anterior mouth feature was further elaborated by grinding roughly perpendicular grooves into the mouth,

Schematic of Groove Distribution

thereby creating the uncanny impression of a mouth with natural wrinkles, five on the upper lip and at least three on the lower. One of these upper lip creases continues as a groove beneath the effigy, ending just short of connecting again to the mouth on the other side of the head. Three other groove elements, one on the dorsal surface near the nuchal area, one on the ventral surface underneath the eyes, and a third pair on the lateral sides of the head, complete the effigy's grooving. This bas relief effect has been described for other concentric petroglyph forms in the American West (Foster 1983:51), but rarely has it proved as effective as in the present case. The overall impression left by this imposing piece of stone carving is of a lizard or frog head (a saurian symbol?).

Figure 3. Plan View Illustrating Relationship of the "eye stalks" to the Cupules.

The Site

The prehistoric site upon which the effigy was found is located on the first terrace above Thomas Creek in the southwestern portion of Reno, Nevada. The site extends for a distance of almost two thousand meters, paralleling the stream where it is deeply incised into the alluvial fan due to an array of local thrust faults.

The site has changed radically between the time it was first described by Mrs. Smith in the 1950s and today. Foremost in terms of impact has been the repeated visits by illegal artifact looters. For instance, the Artifact Record of Smith's collections from this site (Burrows 1964; 1967) lists a total of 41 artifacts (in 40 entries) collected by Smith from the site surface. Of these 41 artifacts, a total of 22 are described as projectile points (51%). During our recent work, the site surface yielded fewer than five projectile points, in spite of an intensive survey of the entire site surface by professional archaeologists spaced no more than four meters apart. In contrast, vigorous excavations at the site (over 40 m³ of hand excavated soil) prove that projectile points are common below the soil surface. Also, an assemblage of buried hearth and hearth-like features clustered in a single location (Locus 4), containing a large quartz crystal, a ground stone pipe (for sucking cures rather than smoking?, Figure 4),

and a concentration of flaked and ground stone artifacts, makes for an unusual cultural context. These factors, combined with the presence in the immediate vicinity (within a mile) of some fourteen other examples of rock art, suggest the site may have possessed a symbolic significance beyond that of a simple logistical camp.

Today, even after fifty or more years of looting, the site surface remains littered with hundreds of thousands of flakes and several hundreds of ground stone fragments. This latter assemblage is characterized by well-worn manos, some of which are fire-cracked, and the remains of fragmented slab metates, some of which have been intentionally shaped and fire-cracked. The other relatively common artifact class evident on the surface is a full range of biface elements from very crude to well-shaped preforms. It is likely that this site had recognizable surface features such as rock rings or house depressions, and it is even more likely that the distribution of artifacts across the site surface had a meaningful story to tell about the people who lived here prehistorically. However, the recent looting has obscured these relationships and hence has cloaked that important story. It is hoped that the intensive excavations currently underway at 26Wa99 will help to recoup a portion of that loss.

Figure 4. Metavolcanic Pipe, Drilled From One Side.

As the saurian effigy was found to have been undercut, and new piles of looted artifacts were observed next to the object during each site visit in 1994, it was evident that the artifact looters were aware of this distinctive artifact Bob Kautz notified the Therefore. landowners, the Washoe Tribe, and the Nevada State Museum of the impending danger of its loss (Tuohy 1995). Thanks to the good will of The Nell J. Redfield Foundation (the landowners). the Washoe Tribal representatives, and the anthropology staff at the Nevada State Museum, the effiqy has been removed from its in situ location and has been placed on temporary loan at the Nevada State Museum by its new owner, the Washoe Tribe of Nevada and California. Precise replicas of the effigy have been created by the Nevada State Museum staff, and plans are underway to display the replica at the Museum for the enjoyment and enlightenment of the public.

Discussion

Based upon the consistent superposition of elements and the obvious differential patination, it appears that the effigy was modified on at least two separate occasions. At the time of the earlier modification, the unadorned boulder was pitted by the application of over a hundred cupule elements, and its ventral surface was grooved. Using the differential patination as a guide, the pitted and grooved boulder was not further modified for a relatively long period of time. Then, following this hypothesized hiatus, the *bas relief* eye stalks were added and the anterior surface was grooved to produce the effect of a wrinkled mouth.

In contrast to the cupules and grooves through which they are worked, the grinding surfaces associated with these latter activities appear fresh. This temporal interpretation is not inconsistent with secondary sources (Burrows 1964, 1967; Aikens 1972) regarding the content of the G.W. Smith collection. given the description of a great many of the projectile points as "large points" (site record, 26Wa99). Excavation at Locus 4, the localized area within the site with a somewhat intact stratigraphic profile, also suggests the presence of two or more components corresponding to a Middle to Late Archaic human presence. Projectile points of Late Martis (2500-1500 years B.P.) to Early Kings Beach (1500-800 years B.P.) phases dominate the tool assemblage.

A preliminary run of eight obsidian samples was x-ray fluorescent sourced by Dr. Richard Hughes of the Geochemical Research Laboratory, resulting in the identification of a single local obsidian source from Sutro Spring (4 specimens including a Rosegate point) and three more-distant southern sources including Bodie (2 specimens) and Mt. Hicks and Queen (each with 1 specimen). These same specimens were then submitted to Tom Origer at Sonoma State University for obsidian hydration analysis. The results of the hydration analysis suggest the presence of at least two components. One cluster of rind thicknesses that includes a Rosegate point measures between 1.3 to 3.1μ (5 specimens) and a second component represented by two specimens measures between 5.3 and 6.4 μ (one specimen failed to provide a result).

Given the highly disturbed nature of the site, it is possible that the effigy will tell us more about the site than the site can inform regarding the effigy. However, the mere presence of such an unusual and work-intensive form at this site would argue that the site may have had special significance. Steinbring (1992:102), for example, maintains that,

> ... almost every rock art site [has] some special qualities which probably aided in its selection by aboriginal peoples. And, phenomenal attributes, while unquestionably conditioned by numerous cultural influences, exceed the merely pragmatic by stimulating visual, auditory, and aesthetic responses.

It is suggested that the location of this site above Thomas Creek, as it incises through the broad slope (the Mt. Rose fan, a pediment) descending from the Carson Range below a spectacular Mt. provides а dramatic Rose. and panoramic view of the entire Truckee Meadows below. Further, the site lies midway between the environmental enticements at the Steamboat Hot Springs below and the canopy of the evergreen forests on the mountain slopes above. The region itself is crowded with other rock art, including zoomorphs and large boulders with associated cupules; both varieties of rock art have been found within the area surveyed for the present development. This style of petroglyph was referred to as "pit-and-groove" first by Baumhoff, Heizer, and Elsasser (1958) but is best known through the work of Heizer and Baumhoff (1962) from six Nevada sites. In the Owens Valley of California, von Werlhof (1965) adds a further eight sites to the total. This style is also common in southern California where Hedges (1973:21) suggested the name "cupule," a more descriptive term, be applied to this style of petroglyph.

This cupule style of petroglyph is present throughout California (Nissen and Ritter 1986; Smith and Lerch 1984; Minor 1975), and it is now known from at least fifty sites in Nevada (Tuohy 1973; Alvin McLane, personal communication).

It is also found along the Gulf Coast near Mulejé, Baja California Sur, Mexico, ranging across the Columbia Plateau and the Northwest Coast (Steinbring 1987). McGuckian et al. (1993:1), in fact, argue that,

> global occurrence of cupules, until recently their incidence in the Great Basin has been considered to be extremely rare.

They also offer the following generalizations: cupule art in Nevada is far more common than had been suggested, cupules exhibit a patterned distribution, "particularly as regards to proximity to reliable water sources, especially canyon derived streams," and that, as cupule art requires a minimal amount of modification, it is probably the earliest of Nevada styles.

A recent publication on these cupule or "rain rocks" as they are sometimes addresses called. similar issues (Parkman 1993). Parkman believes that these petroglyphs were used by Native American communities as ". . . ritual means making and stopping rain." He thinks the Indians may have drummed the cupules as an imitation of thunder, thus creating one or more aspects of a storm. Parkman (1993:101) also notes that cupules represent "... humankind's earliest known symbolic expression,

dating to at least 40,000 B.P. in France, and perhaps even earlier in India." Parkman (1993:101) takes into account the work of Dorn and Whitley (1983) and Whitley and Dorn (1987, 1988), who suggest a date of Heizer and Baumhoff's "pit-and-groove style" at 7,000 to 5,000 B.P. in the Great Basin.

The entire region that includes the south Truckee Meadows and the Mt. Rose pediment is currently included in a larger archaeological district based upon the relationship between the categories of sites occurring within it and the distribution of seasonal humans corresponding to the availability of plant and animal resources within it (Elston et al. 1995). There is no question that the life of the mind as reflected in the ritual and religious life of the prehistoric peoples of this region has been partially archived in stone by means of the rich rock art that still survives. The effigy we have described herein is one of the most unusual of this surviving record.

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