UTAH ARCHAEOLOGY 2001

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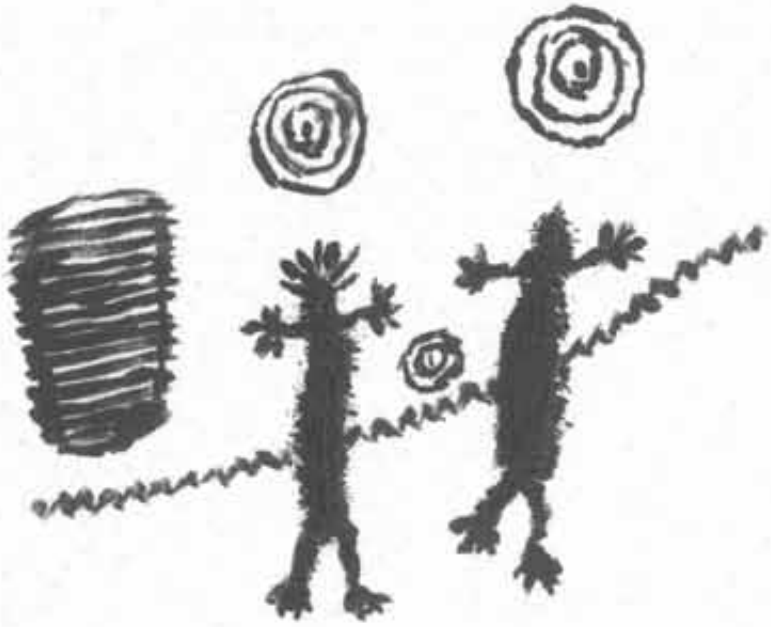

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UTAH ARCHAEOLOGY 2001

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Editors: Steven R. Simms, Utah Professional Archaeological Council
David Jabusch, Utah Statewide Archaeological Society
Editorial Assistant: Lara S. Petersen

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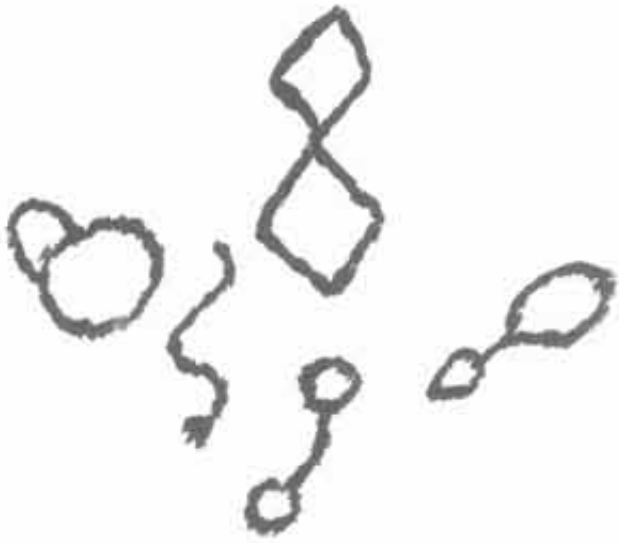
Front Cover: Illustrations throughout this issue were done by Shaun Petersen and feature entoptic patterns found in Great Basin rock art.



Messages from the Editors

We have a new editor representing the Utah Statewide Archaeological Society (USAS). David Jabusch assumed the post in summer 2001 and has tackled the job with capable enthusiasm. Dave is an active, long-time member of USAS, and a retired professor of Communications (University of Utah). He will surely bring perspectives and skills valuable to the journal. In his first year Dave has helped to shepard manuscripts through the system, solicited manuscripts, encouraged authors, and has generally "talked up" the potential of the journal to further contribute to the archaeology of Utah. He is planning a workshop for potential authors at the USAS Summer Convention at Antelope Island in June 2002. Welcome Dave and thank you!

This issue features the first-ever Photo Essay in *Utah Archaeology*. The Avocationist's Corner continues, as do the traditional sections. Once again, the most thanks goes to those archaeologists who make the effort to report their work in a published format; and do so in a style accessible to the profession and the public that supports archaeology. *Utah Archaeology* continues to be subscribed by libraries and professionals in the western U.S. and we will be starting a marketing campaign later this year to expand circulation. I encourage professional and avocational archaeologists to support your journal by preparing high-quality manuscripts on your work. The journal lives or dies by the hand of the archaeological community.

Once again, I want to extend heartfelt thanks to Kate Toomey and Lara Petersen for all their assistance in producing *Utah Archaeology*.

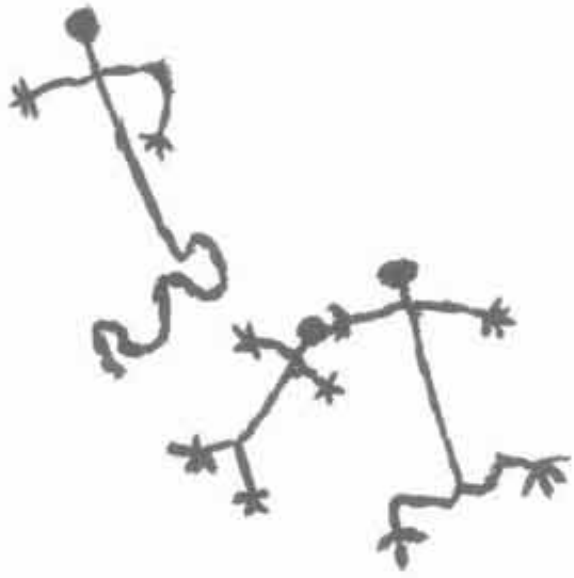
Steven Simms, editor for UPAC

I am pleased and flattered to be asked to work with Steve on *Utah Archaeology*. His wise decision to separate articles from professionals and avocationals will maintain the professional integrity of the journal, while making room for avocationals.

Avocationals interested in submitting articles to the journal might consider the following: Write about substantive material that others have not yet considered. This might begin with a book review. A description of sites, rock art or other data that you have encountered during years in the field would be welcome. Application to archaeological data or issues of your expertise in a relevant field would be interesting. Ceramics, textiles, geography, diet, herbs, art, and construction come to mind.

In the workshop at the USAS convention, we plan to answer any questions you have. In addition we will give you a brief view of the goals and point of view of the journal. We will discuss the organization and writing of an article. Finally, we will cover the mechanics of submitting an article to the journal. Come join us, we are ready to help.

David Jabusch, editor for USAS



CULTURALLY MODIFIED PONDEROSA TREES ON THE ASHLEY NATIONAL FOREST

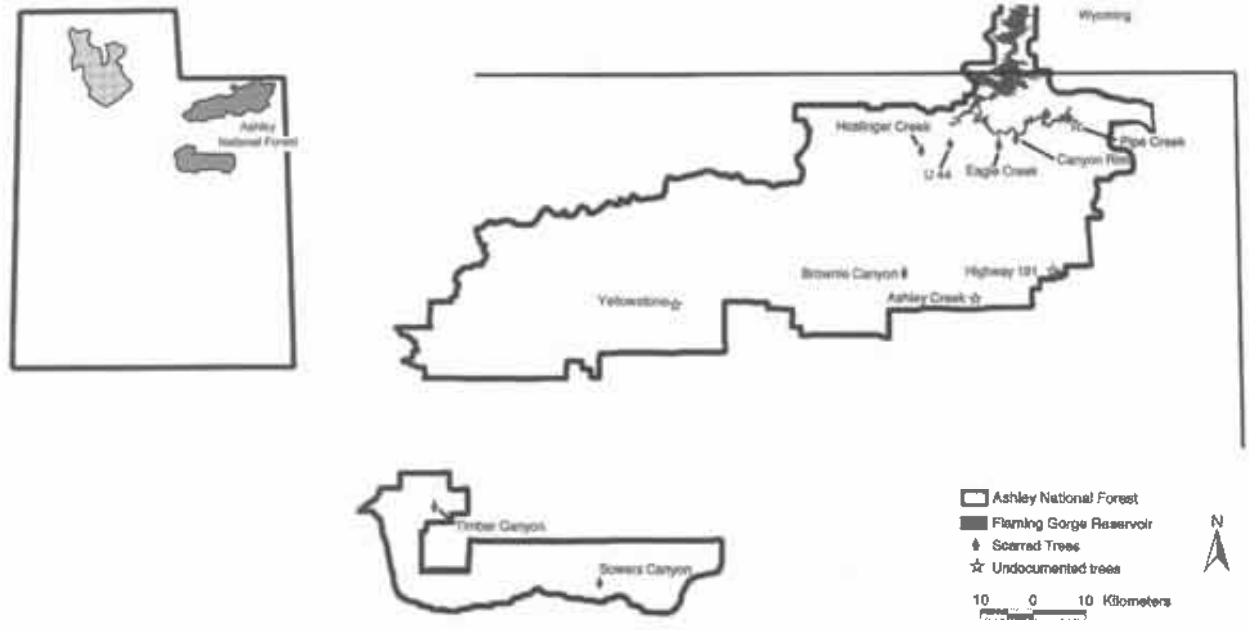
Lawrence DeVed, Uinta Basin Chapter, Utah Statewide Archaeological Society.
Byron Loosle, Ashley National Forest, 355 N. Vernal St., Vernal, UT 84078

For the last few years, members of the Uinta Basin Chapter of the Utah Statewide Archaeological Society have been recording an unusual site type that will soon be gone from the landscape. This article provides a description of culturally peeled trees on the Ashley National Forest that are probably the work of Native American people (Figure 1). These trees are an important link to the past, but are a disappearing resource. These ancient inhabitants will eventually die a natural death if they are not removed through logging, or damaged and killed by fire first. Club members Tim Sweeney, Leon Chamberlain, Lawrence DeVed, and Darlene Koerner have been studying these graceful giants. In a country where the evidence of former inhabitants rests lightly on the land, the culturally modified trees remind us that others passed this way before.

SCARRED TREES

We thought we had stumbled onto a relatively unexplored aspect of Native American culture with identification of culturally modified trees in the Uinta Basin. Literature on this phenomenon is relatively sparse for

Figure 1. Location of culturally modified trees surveyed in the Ashley National Forest.



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the Rocky Mountains and Great Basin areas. But a recent search on the internet revealed that the Pacific Northwest has a plethora of information on culturally modified trees (CMTs). Articles appear in environmental and government periodicals; archaeologists, Native Americans, and volunteer groups have conducted research projects; and numerous tours advertise these trees on their itineraries (Stryd 1998; Neary 2000; North Island Kayak 1999; Walz 1998). These trees are considered so important that the British Columbia Ministry of Forests has written a 127 page handbook for identifying and recording CMTs (Stryd 1998) and offers a formal eight-day Resource Inventory Standards course to learn to identify and record them. In the Pacific Northwest, red and yellow cedar were vital to life, wood planks were used for buildings, containers, and canoes, while bark and roots were used for basketry, clothing, medicines, ceremonial headgear, and art. In Utah, much less is known about aboriginal tree use. There are fewer trees here, and tree products appear to have been less important. Trees in the Great Basin were used for fewer products than in the Northwest. The Uinta Basin does not have huge cedar trees, but ponderosa was selectively stripped of bark to obtain cambium. Ponderosa pine was also scarred in Montana and Colorado in similar ways so comparisons can be made with these areas.

Scarred trees can result from natural processes such as lightning strikes, fire, and damage caused by animals. When lightning hits a tree it can literally blow the bark off the trunk. Lightning struck trees generally have a narrow scar that spirals most of the length of the tree. Many trees exhibit lightning strikes, but few show signs of the bark exploding. When the bark does explode, the scar outline is irregular and occurs at varying heights.

Scars also result from fire. Ponderosa is a fire- tolerant species and most trees have survived numerous fires. Ponderosa or yellow pine usually lives from 300 to 600 years (Fowells 1965:423). Before Forest Service fire suppression efforts, ponderosa groves experienced a fire every 10 to 20 years (Sherel Goodrich, personal communication 2000). These fires were usually low intensity, just burning the underbrush. Fires rarely burn hot or high enough to jump into tree limbs and create crown fires.

Fire suppression efforts over the last 100 years caused the brushy undergrowth to build to dangerous levels. The chances of a catastrophic fire killing these giants is now much greater. For this reason, the Forest Service has been more aggressive the last five to ten years in conducting prescribed burns in an attempt to mimic natural fire patterns and return the ecosystem to a more natural balance.

Fire scars, sometimes called "cat faces," tend to be triangular-shaped. The scar begins at ground level and rises to a sharp point two to three feet above the ground, although some scars are considerably larger. There is often some sign of blackening or charring of the interior wood. These scars tend to be on the upslope side of the tree, usually as a result of burning debris rolling downhill and becoming trapped against the uphill side of the tree.

Animals such as elk, bear, and porcupine scrape bark off with claws or teeth to obtain nutrients or insects from inside the bark. Deer and elk also rub their antlers on trees to remove spring velvet. Bark removal by animals tends to be irregular in depth and shape. Teeth, claw, or antler marks tend to be visible. Courtesy Tami Merkley, photographer.

Trail blazes and survey trees are human-created scars. Trail blazes are associated with a trail or road and have a consistent pattern, usually small strips or patches, often on both sides of the tree or trail. Survey trees or witness trees usually have a date, number, or other information carved into a scarred area (Martorano 1989:10).

CULTURALLY MODIFIED TREES

"A CMT is a tree that has been altered by native people as part of their traditional use of the forest" (Stryd 1998:1). Trees that have been peeled for cultural use of the bark may have been struck by lightning and burned, but they also have characteristics that show removal of their bark in another way. Note evidence of burning in scar of tree.

Unlike the Pacific Northwest where a variety of scar types have been documented (e.g., Hollenbeck et al. 1984, Styrd 1998), in the Uinta Basin scars tend to be fairly uniform, indicating cambium use. The scar usually begins at least one to two feet above the ground. The bottom of the scar is often flat but the top tends to have at least one or more points, occasionally eight or more feet above the ground. Cultural scars on trees in the Uintah Basin tend to be rectangular or oval.

WHY PEEL THE BARK?

Native American groups from Montana and Oregon to Arizona and New Mexico consumed the inner bark of ponderosa pine trees (Alldredge 1995:20-21). The inner bark is very nutritious. "During the spring the three tissues that make up the cambium contain large amounts of carbohydrates and proteins" (Alldredge 1995:24).

Martorano (1989:11-12) indicates that the Ute of southern Colorado stripped the bark of pine trees, usually to use the sap-laden inner bark for food. When peeled from the tree in the spring, it is fluid and sweet. Scraped from the outer bark and rolled into balls, it was chewed as a sweet treat. Mixed with corn and meat, it gave a pitch flavor to stew. It could also be used medicinally as a tonic to "clean them out." Smith (1974:65) noted, "small strips of the inner bark of the pine were tied into bundles and later eaten with salt" by the Northern Ute.

Martorano (1989:9) notes, "the inner bark consists of the phloem (flo-um) a layer of cells just beneath the outer bark that transports the food reserves manufactured by the tree." One pound of phloem has as much calcium as nine glasses of milk. It also contains iron, magnesium, zinc, and other nutritional substances. Considerable sap seeped out of the scar of this recently scarred lodgepole pine.

Leo Thorne (the father-in-law of Lawrence DeVed) owned a photographic studio in Vernal and asked members of the Ute tribe about the peeled trees. He was told trees were peeled to get the inner bark and pine gum for healing purposes. As a result, his family referred to the trees as "medicine trees," and the term is still often heard in Vernal. In some areas, a medicine man placed the person needing help against the scarred portion of a tree as part of a healing or exorcism ritual (Clifford Duncan, personal communication 2000).

Bertha Cuch (personal communication to Rhoda DeVed) remembers that her grandmother peeled trees and rolled the inner bark into balls that she gave the children as treats. This is similar to an account from a woman who remembers her grandmother collecting sap to use as a sweetener (Clifford Duncan, personal communication, 1998). Jonas Grant (personal communication, 1997) says the sap was used to waterproof moccasins. Other possiblities include using the sap as a glue to repair moccasin soles, as a waterproof basket lining (although we think piñon was the preferred "pine" for this use), and in healing. Clifford Duncan (personal communication 2001) recently suggested another possible use. In this rocky, mountainous area, unprotected horse hooves could easily be injured. When a person was going to a steep rocky spot, they took a piece of rawhide and glued it to the bottom of the horse's hoof with pine sap. Then they wrapped the edges of the rawhide around the horse's foot and tied it off with another strip of rawhide. This helped protect the horse in rocky terrain.

THE DATA

We located 26 trees that meet the descriptions of trees peeled by Native Americans. They range from

south of Duchesne to north of Vernal in the Flaming Gorge National Recreation Area. Since the conclusion of this project, additional trees have been noted on Pipe Creek, Ashley Creek, the North Fork of the Duchesne River, and in the Yellowstone drainage. We measured each tree and scar, and recorded on a form the measurements, a photograph, and a short description. If we had use of a Forest Service coring tool, cores were taken and tree rings counted. Table 1 summarizes the information gathered. All of the reported scars were on ponderosa pine (*Pinus ponderosa*), similar to what is observed in the Kootenai National Forest in Montana where 76 percent were ponderosa and the Wallowa-Whitman Forest in Oregon where 98 percent were ponderosa (Alldredge 1995:60). Other species such as black cottonwood (*Populus trichocarpa*), quaking aspen (*Populus tremuloides*), englemann spruce (*Picea englemannii*), and douglas fir (*Pseudotsuga menzesii*) were also peeled for cambium (Alldredge 1995:31), but no examples of these species with cultural scarring have been noted in the Ashley National Forest.

Table 1. Data from Culturally Modified Trees in the Ashley National Forest.

Tree	Direction (degrees)	Age when Peeled	Date of Scar	Scar Width in cm	Scar Height in cm
Brownie Canyon #1	190	120	1914	91	152
Brownie Canyon #2	170	–	–	137	175
Brownie Canyon #3	320	–	–	25	91
Timber Canyon #1	10	218	1947	30	138
Timber Canyon #2	350	121	1928	51	122
Timber Canyon #3	–	247	1911	41	89
Timber Canyon #4	76	–	–	58	129
Sowers Canyon #1	230	268	1900	46	140
Sowers Canyon #2	0	177	1919	25	89
Sowers Canyon #3	10	76	1943	26	104
Sowers Canyon #4	–	112	1913	–	–
Sowers Canyon #5	270	269	1931	86	160
Sowers Canyon #6	35	136	1961	53	150
Sowers Canyon #7	50	151	1932	56	137
U 44	80	–	–	46	122
Canyon Rim	270	–	–	28	90
Honslinger Creek #1	110	–	–	71	224
Honslinger Creek #2	220	–	–	59	178
Honslinger Creek #3	60	–	–	49	107
Eagle Creek #1	335	86	1954	33	97
Eagle Creek #2	120	118	1982	33	170
Eagle Creek #3	240	136	1948	30	149
Eagle Creek #4	220	115	1953	38	220
Eagle Creek #5	330	–	–	25	104
Eagle Creek #6	355	–	–	28	130
Eagle Creek #7	345	137	1861	46	160

Scar widths on trees we studied were between 25 cm and 138 cm with an average of 48 cm, while those from Colorado ranged from 1.3 cm to 152 cm (Martorano 1989:10). The length of the scar was between 10 cm and 274 cm in Colorado, but between 89cm and 224 cm (approximately 1 to 2 meters) on trees in the Ashley National Forest, with an average of 137 cm (1.4 meters). The Ashley National Forest tree scars tend to be slightly more uniform in size, and although they are apt to be about as large as those documented in Colorado, small scars are lacking in the Ashley National Forest examples.

White (1954) summarized the methods used to gather bark by Kutenai Indians who remember how the inner bark was harvested. According to his informants, tree-peeling took place as follows: 1) a tree was selected for peeling; 2) bark from a vertical notch six to eight inches (15 to 20 cm) long was removed from the tree and the inner bark sampled; 3) if the sample was considered "good," an area was selected for removing a larger section of bark; 4) a horizontal cut was made through the outer bark with an ax; 5) a sharpened branch or pole called a "debarking stick" was inserted under the cut and used to loosen and pry the outer bark from the tree with an upward motion. At times the strips of outer bark were pulled downward from the trunk as well as upward.

Martorano (1989:11) reported finding cut marks along the bottom scars from trees in southern Colorado. No similar cuts were found on the Utah trees. At least three Ashley National Forest trees had saw or ax cuts, but they appear to have been made long after the original bark peeling. These ax cuts were probably made by recent campers or hunters. Martorano also noted smaller, possible test scars on several trees in Colorado, but none were noted during this study. We also did not see more than one scar on any tree.

"The peeling process was undertaken primarily by women and usually done near a campsite. The trees were peeled in the spring usually in May, when the sap in the tree was running and the bark was easiest to remove" (Martorano 1989:10). Clifford Duncan (personal communication 1998) was told that Uinta Basin residents collected sap in May or early June. Turner (1978:60) states the best cambium from ponderosa trees is "obtained from young trees, before they began to bear cones. It could also be taken from the twigs and branches of older trees."

DATING WHEN THE TREES WERE SCARRED

For this project scarring dates were established by taking two cores from each tree, one from the area of the scar and another from an area with intact bark. Tree rings were counted for each core and the difference between the two ring counts was considered the age of the tree at which the scar was created. Randy Kaufman, a Forest Service employee with extensive tree ring counting experience, counted several of the cores. USAS chapter members counted the others. The Eagle Creek cores were the most difficult to recover and count, and accordingly should be considered estimates.

Alldredge (1995:57) noted a majority of the scars on the Kootenai National Forest were from the nineteenth century. Martorano (1989:11) states the "analysis of 40 culturally peeled trees in three parts of Colorado indicates that the majority of the trees were peeled between 1815 and 1875. One scar dated to 1793 and a few dated to post-1890." Ferris (1940:269) observed Utes near the Great Salt Lake collecting the inner bark of pine in the latter half of the nineteenth century.

In contrast to all of the just-mentioned examples, none of the trees from the Ashley National Forest were scarred before 1900 (Table 1). This date roughly coincides with the removal of Colorado Utes to the Ouray Reservation in the Uinta Basin. We suspect the best explanation for this is that the Ute in southern Colorado commonly stripped bark from ponderosa trees. When the Ute were forced from Colorado in 1882 the practice ceased there, but began on trees near the reservation in Utah.

Martorano (1989:11) noted 84 culturally scarred trees in her study area. She feels the trees were an important starvation food, although admitting they were probably part of routine subsistence and their use may have varied geographically. Alldredge (1995:22) notes considerable differences among ethnographers, so "whether cambium was used as a steady source of food or whether it was used solely during times of dietary stress has yet to be determined." We noted a more limited number of trees (approximately 35) on the Ashley National Forest, over a much larger area. Most areas contain only one or two scarred trees. Only on Eagle Creek and in Sowers Canyon were small clusters of seven trees found.

Martorano's assertion that ponderosa was a starvation food does not seem valid in Utah. We would expect many more trees with larger haphazard scars if peeling was done for survival. Instead, the peeling seems more consistent with occasional use as a sweetener, sealant, glue, or for medicinal purposes, as local informants have reported.

SUMMARY

The Uinta Basin has numerous culturally modified trees scarred between 1900 and 1960. The bark was peeled from these trees by local Utes probably to obtain a sweetener, sealant, or medicine. If you know the story behind the trees they become another recreational experience on the forest. As new trees are added to our database we hope to gain a clearer understanding of how important this resource was to local groups. If this report causes someone to look closer at that "burned tree," we are pleased.

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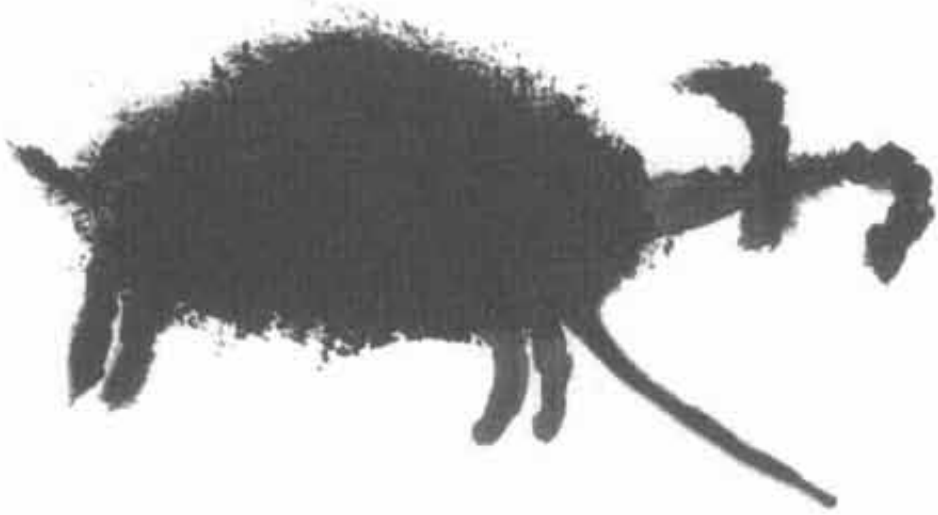

LATE PALEOINDIAN ARTIFACTS FROM UTAH VALLEY

Joel C. Janetski, Department of Anthropology, Brigham Young University, Provo, UT 84602

Late Paleoindian artifacts in the High Plains tradition are rare in the Great Basin. This paper reports Paleoindian style stone tools from Utah Valley in west-central Utah. These finds hold implications for: 1) the timing of human occupation in Utah Valley, and 2) Plains/Great Basin interaction during the terminal Pleistocene, early Holocene period (~9,000 B.P.). Interaction does not imply an intrusion of people nor do these artifacts necessarily equal the existence of a big-game hunting strategy in Utah Valley or the eastern Great Basin during this period.

Late Pleistocene/early Holocene assemblages from the Great Basin consist primarily of fluted and stemmed projectile points along with distinctive crescents (see Beck and Jones 1997; Willig et al. 1988 for reviews). Eastern Great Basin assemblages are no exception to this pattern. Fluted points and Great Basin Stemmed styles are present in good numbers from the Sevier Desert and Great Salt Lake region (Arkush and Pitblado 2000; Copeland and Fike 1988; Davis et al. 1996; Janetski and Nelson 1999; Simms and Lindsay 1989); however, Late Paleoindian artifacts in the High Plains tradition are rare to non-existent. In this paper I report one extensive collection and two isolated specimens that begin to build an argument for Late Paleoindian presence in Utah Valley, and, by extension, the eastern Great Basin.

MARTIN SITE COLLECTION

The Martin collection was gathered by an amateur on the south shore of Utah Lake in the early 1990s during low water years. Recognizing its importance, the collector subsequently made the assemblage available to me for study. He also took me to the site where he made the collection. I was for some time, however, unable to confirm the presence of any of the diagnostic tools or even the toolstone from the site—a fact that made me cautious about reporting the material. Further, the distinctive toolstone that dominates the assemblage contrasts starkly with that recovered from the Goshen Island site (dated to 2,000 B.P. and later) less than half a mile away. During much of the 1990s lake waters covered the site; however, in 2000 Utah Lake dropped, once again exposing the site area, which I monitored with a graduate student and found several flakes and an additional diagnostic tool. The toolstone of these most recently recovered artifacts matches closely that which dominates the amateur collection. These factors combined to confirm that the collection could be attributed to the same locale.

The site (42UT934) lies along the east shore of Utah Lake in an area referred to as Goshen Bay (Figure 1). Site elevation is 1,368 meters (4,488 feet) above sea level. Several flowing springs lie just north and a spring-fed pond/marsh area lies east of the site. The onshore landform here consists of a gravel bar deposited in recent times by lateral currents of Utah Lake (Donald

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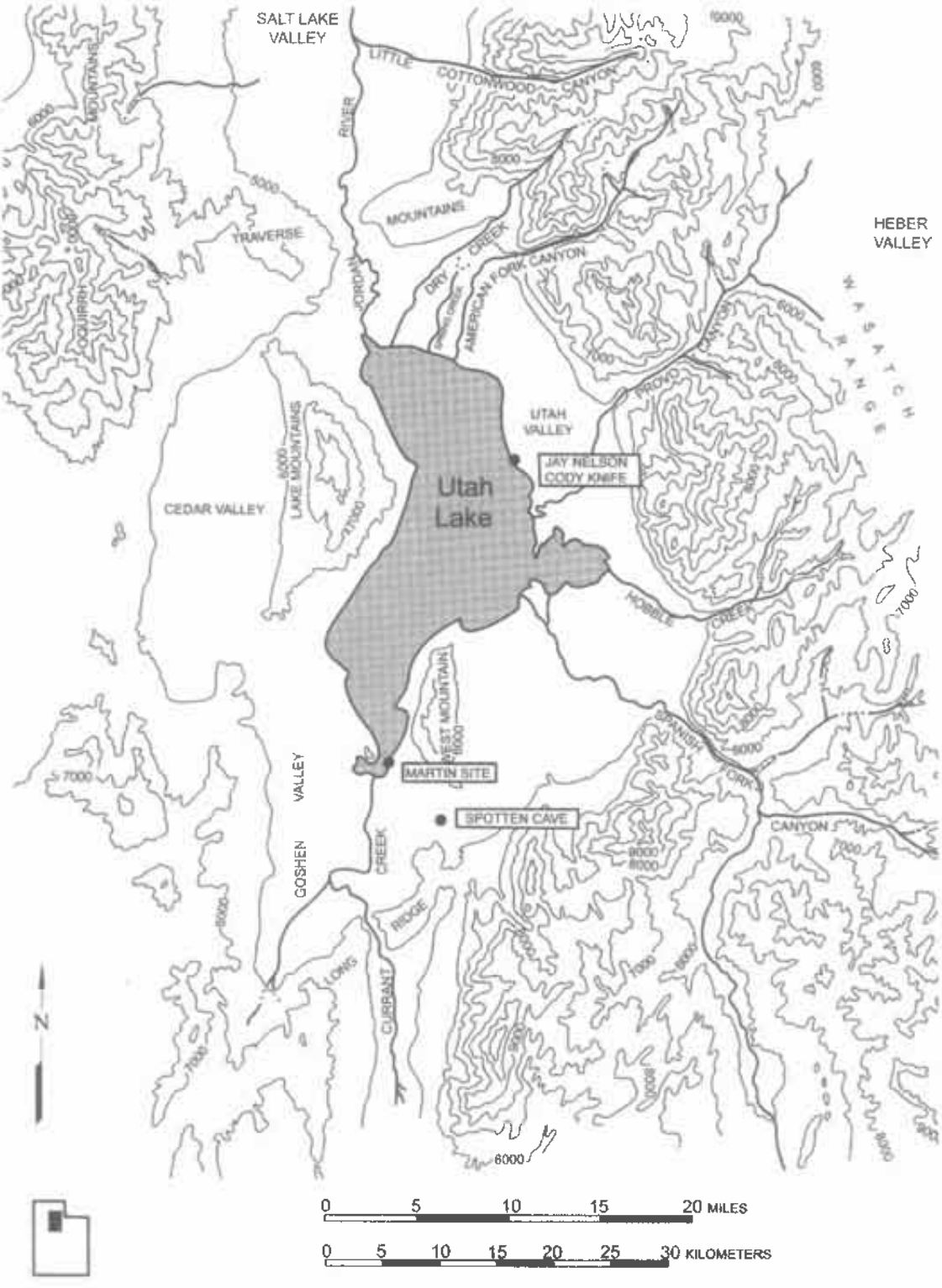

Figure 1. Approximate locations in Utah Valley of artifacts discussed in the text.

Table 1. Dimensions in milimeters of Select Late Paleoindian Tools from Utah Valley.

Specimen	Total Length	Max. Blade Width	Max. Blade Thickness	Stem Length	Max. Stem Width	Max. Stem Thickness
Scottsbluff II projectile point (FS 9.1)	57	33	5	12.5	21.8	5.2
Obsidian stemmed (FS 5.1)	54.4	24.2	9.9	15.4	19.6	6.6
Fishtailed projectile point (FS 5.9)	80	42.4	7.0	—	—	—
Hafted biface (FS 7.1)	145.5	61.1	9.7	—	—	—
Cody Knives: UT934						
No. 1 (FS 8.1)	76.4	30.7	6.4	17.0	20.9	5.4
No. 2 (FS 19.1 collection)	74	27.5	7.0	14.0	18.7	5.4
No. 3 (FS 7.2)	63.8	43.1	6	14.5	25.1	4.3
No. 4 (FS 7.4)	65.5	28.9	7.9	14.6	21.7	5.1
J. Nelson Knife	62.5	25.5	5.9	10.1	15.4	5.0

Curry, personal communication 1999). These gravels appear to have originated from the western slope of West Mountain that rises immediately east of the site. The bar slopes into the lake, merging with lake silts and sands. Artifacts tend to appear at the margin of the silt and the gravel bar. Lake edge vegetation is native bulrush (*Scirpus* sp.) and arrow cane (*Phragmites* sp.) along with non-native tamarisk. Cultural material seems concentrated in a relatively small area just south of the springs in what is now a minor bay.

Assemblage Description

The Martin Site assemblage includes tools and some debitage, with diagnostics limited to projectile points and specialized bifaces. The diagnostics range in style (and presumably age) from Cody complex to late Archaic. Clearly this assemblage represents a broad time period, a fact that has implications for the inclusion of non-diagnostic material described below. The obvious question is: Are *all* these artifacts Paleoindian in age? My decision to include gravers, cores, and a single biface is based on two assumptions: 1) gravers are often recovered from Paleoindian contexts (see for example Frison and Todd 1987: 249-50, Figure 7.12) and could be considered diagnostic; and 2) the dark toolstone from which both diagnostics and non-diagnostic artifacts were made seems typical of Late Paleoindian assemblages in the Great Basin (see Beck and Jones 1997: 201). Despite these justifications for including items of questionable age in the following discussion, I recognize that not all may be Paleoindian. Evidence to support or refute these assumptions would have to come from controlled excavations of the site.

The collection from the Martin Site currently consists of 140 items: 85 tools and 55 pieces of debitage. Most of the objects are large with the mean tool weight being 44.3 g and the debitage nearly 10 g. The dominant toolstone is a siliceous material ranging in color from very dark, almost black to a greenish gray. This material has been described by David Tingey of the Brigham Young University (BYU) Geology Department as a silicified volcanic rock containing small, lighter colored inclusions of amphibole and plagioclase, minerals common to rock from a volcanic terrain. This material made up nearly 70 percent of the assemblage. Quartzites made up another 14 percent, obsidian 8 percent,

Figure 2. Scottsbluff Type II projectile point, Martin Site.

and other cherts 8 percent.

Projectile Points. The projectile points attributed to the site are diverse: Scottsbluff Type II (n = 1), Rocker Side-notched (n = 2), Sudden Side-notched (n = 1), Humboldt (n = 1), Northern Side-notched (n = 1), Elko series points (n = 3), Gypsum (n = 1), unknown fish-tailed (n = 1), and stemmed (n = 2; one obsidian, one fine-grained dark gray quartzite). Metric measurements for all diagnostic artifacts are provided in Table 1.

The Scottsbluff II point (Figure 2) has a broad, somewhat convex blade and a slightly expanding stem (21.1 to 21.7 mm) with a convex base. It is strongly shouldered at ~90 degrees and has a slight hook at the shoulder. It is lightly edge-ground on the lateral margins of the stem and exhibits abrupt marginal retouch along almost the entire blade. It is made of a very fine-grained, black toolstone. It is thin with a width to thickness ratio of 6.6:1. A single small potlid on the stem suggests moderate heat treatment. Although not so clearly diagnostic, the stemmed point of obsidian is heavily edge-ground and that, along with its general morphology, suggests a Paleoindian age (Figure 3b). It is quite thick, 9.9 mm, and shows evidence of reworking. The base of the "fish-tailed" point (Figure 3a) is similar to a Larson Cache specimen (Ingbar and Frison 1987: Figure A6.1h). The shallow notches are ground. The toolstone is very dark brown to black, but it appears the black color may be on the surface only, as one of the ears is slightly broken and the interior color is brown. The tool exhibits fine grinding in the shallow notches.

Cody Knives (n = 4). Three bifaces are classified as Cody knives and an additional biface tentatively so classified (Figure 4a-d). All three specimens are made of dark to greenish volcanic material with small gray speckles. The best example of a typical Cody knife (No. 1 in Table 1, Figure 4c) exhibits fine retouch on both margins of the blade. The leading or convex edge is thickened from the retouch, resulting in a high edge angle. The stem is also retouched and edge-ground on the base lateral margins. The second typical Cody knife (No. 2, Table 1, Figure 4b) is less well made but similar to the first and is the specimen found by BYU. It is reworked with both percussion and pressure retouch. The convex edge is again thickened because of the reworking, and also characterized by a high edge angle. The third biface typed as a Cody knife (No. 3, Table 1, Figure 4a) strongly resembles a biface from the Larsen Cache in southwestern Wyoming (Ingbar and Frison 1987:472, Figure A6.1c). The fourth biface (No. 4,

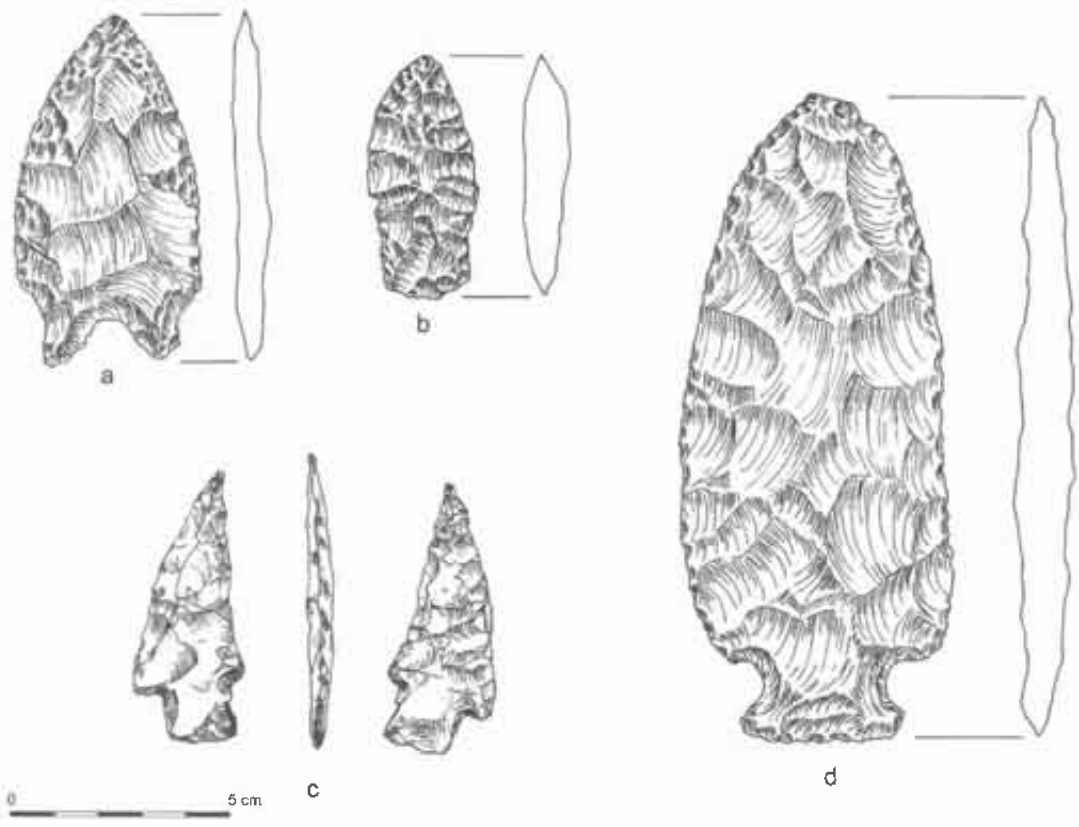

Figure 3. Artifacts discussed in the text: (*a*) fish-tailed point, Martin Site; (*b*) obsidian stemmed point, Martin Site; (*c*) Jay Nelson Cody knife, east shore of Utah Lake; (*d*) large biface, Martin Site.

Table 1, Figure 4d) is tentatively identified as a Cody knife because the blade appears purposefully curved. But, there are also clear morphological (shallow notched base, no grinding evident) and technological (convex edge lightly retouched, but not thickened) differences from the other specimens.

Bifaces (n = 25). Twenty-five bifaces are present in the Martin collection in addition to the points and Cody knives. Only one is described here because of its large size and the color of the toolstone, which is similar to the Cody knives. As noted, this specimen is large (FS 7.1 see Table 1 for specifications) and made of greenish-gray volcanic material, and is quite well-thinned (Figure 3d). The maximum width to central thickness ratio is 7.3:1. The notches are shallow and rounded. No basal grinding is present.

Gravers (n = 8). Eight gravers are noted in the collection. These were made unifacially on the lateral margins of large- to medium-sized flakes (Figure 5). The graver tool most often, but not always, occurs in a shallow concavity. Several are composite with side scrapers and unifacial retouch in addition to the gravers.

Cores (n = 11). All but one of the cores were of dark volcanic material, and all but two were nearly exhausted (Figures 6 and 7). The core of a different color is a greenish toolstone grading to black with gray inclusions and resembles that seen in Cody knife No. 2 and the large biface described above.

Debitage (n = 55). Debitage from the Martin Site included internal flakes with and without cortex and many were of the same dark toolstone used to make the finished tools. Although of limited use given that the sample is from the surface and is the product of a nonrandom collection strategy, the presence of both cores and flakes with cortex suggests that the source of the toolstone is local.

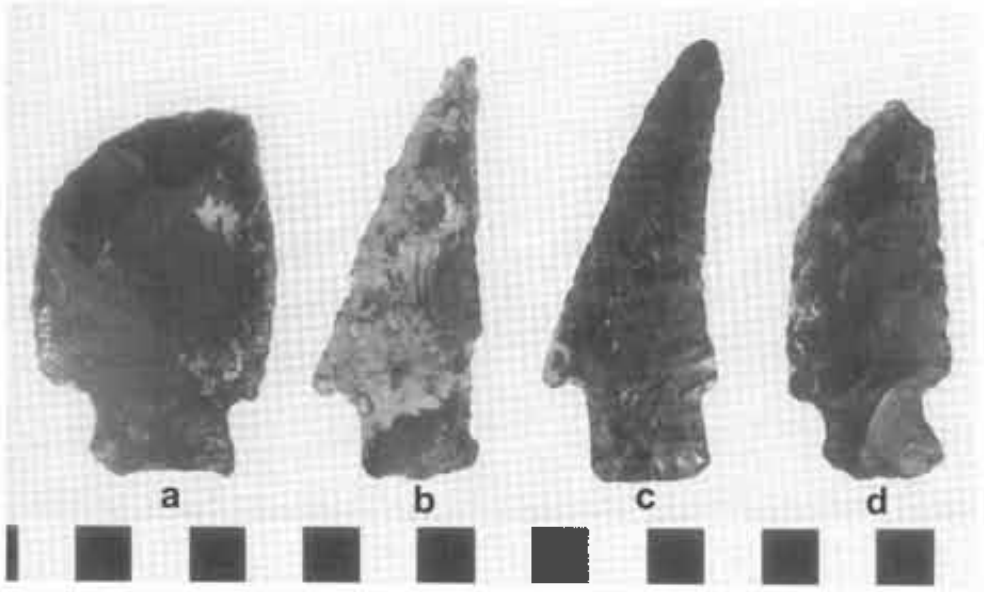

Figure 4. Cody knives, Martin site.

OTHER COLLECTIONS FROM UTAH VALLEY

Jay Nelson Cody Knife

Jay Nelson, an amateur collector from American Fork, Utah, found an isolated Cody knife on the east shore of Utah Lake near Geneva Steel (Figure 3c). This point is morphologically similar to those from the Martin Site but is made of a fine-grained basalt, not a siliceous material. The specimen appears water worn, which makes determination of edge grinding difficult.

Spotten Cave Projectile Point

A projectile point fragment from Spotten Cave (Mock 1971) is also reminiscent of Late Paleoindian styles. Spotten Cave, located at the south end of Utah Valley (Figure 1) was excavated in the 1960s by James Mock, a student at BYU working under the direction of Ray T. Matheny. The cave was dry and produced large quantities of cultural debris, including many projectile points. A re-examination of those points and of Mock's thesis suggests at least one of these points may be Late Paleoindian in age. The specimen (MPC Accession No. 81.55.64.1) is a long, distal, point fragment made of black chert not unlike that from the Martin Site (Figure 8a). The point has suffered heat damage as evidenced by pot-lidding on one face. It was finished by removing evenly spaced, parallel flakes using a pressure technique followed by very light retouch. The flakes tend to run obliquely up to the midline, with a few crossing the midline. If held with the distal end up, the flakes on one face run diagonally up from left to right and, on the obverse, run diagonally down from left to right. The point size is 77. 8 mm long by 20.1 mm wide at the widest point and 4.5 mm thick. No portion of the base is present nor is edge-grinding present. The point is elliptical in cross section.

The Paleoindian flavor of this artifact was not missed by Mock (1971:112), who compared it to Angostura points on the Plains. But, the Angostura flaking pattern consists of flakes consistently running obliquely across the midline from upper left to lower right (see Wheeler 1995; Wormington 1957). In fact, Mock (1971:112, Figure 28) depicts this specimen as though the flakes extend from one side of the point to the other (Figure 8b); however, the drawing is an abstraction of the artifact, not a realistic rendering (compare with Figure 8a). In addition, Mock states that the toolstone

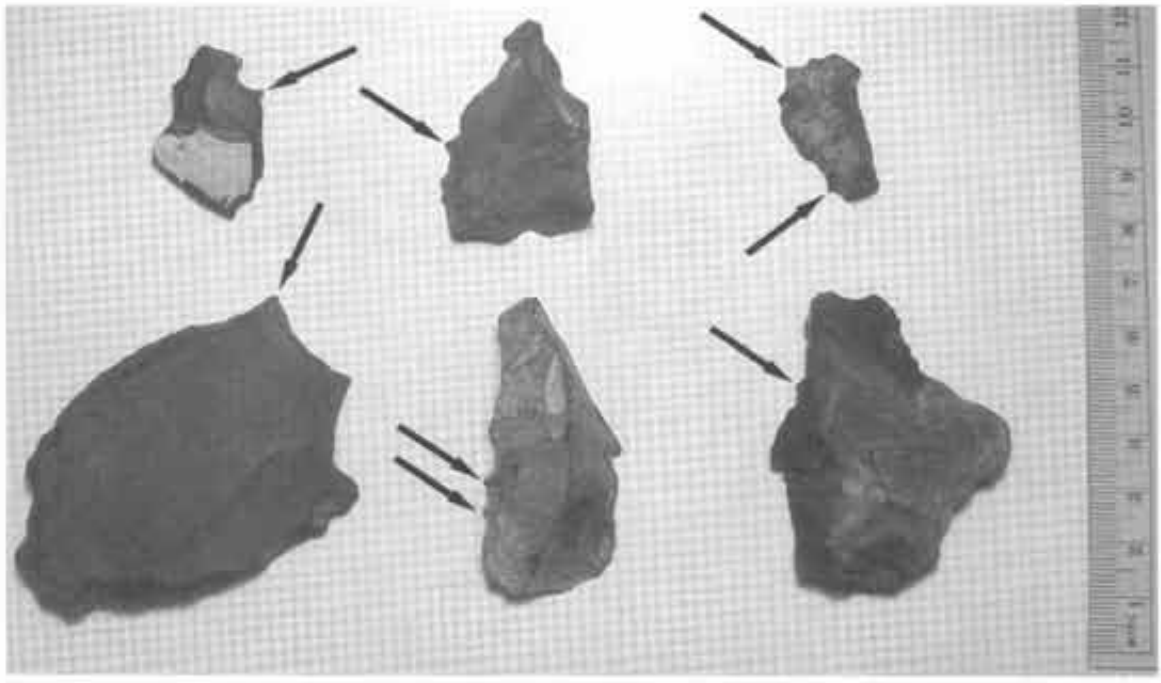

Figure 5. Gravers, Martin Site. Arrows indicate tool locations.

from which the point is made is "black obsidian," which is also inaccurate. In outline, the point strongly resembles Agate Basin distal fragments, but the Agate Basin specimens' flake scars are not diagonal (Frison 1978:158, 160). Without the base of the point, typological classification is speculative.

The point came from Level III in the cave, which is dated to 1,310 ± 90 B.P. and 730 ± 90 B.P. (uncalibrated) (Mock 1971:64, Fig. 11). If this association is accurate and the Late Paleoindian affiliation is correct, then the point was curated (i.e., collected and deposited in the cave at a much later date, but still in prehistory). Two lines of evidence argue that the point is Paleoindian in age: the distinct technological style and the material. As noted, the latter is similar to the tool stone of the Cody style artifacts from the Martin site.

DISCUSSION AND COMPARISONS

As noted at the outset, Late Paleoindian diagnostics are rare in the eastern Great Basin.[1] Syntheses of Great Basin late Pleistocene/early Holocene occupations by Beck and Jones (1997) and closer to home by Arkush and Pitblado (2000) report no such material for this region. Lindsay and Sargent (1979:22) mention finding a possible Cody knife fragment at 42JB163 along the lower reaches of Trout Creek in Snake Valley of western Utah. Simms (personal communication 2001) observed a Cody knife from a site along the Little Bear River near Young Ward, Cache Valley, Utah. Madsen (2000) reported a Cody knife and a Scottsbluff point from Huntington Canyon on the Colorado Plateau. Madsen (personal communication, 2000) is aware of other late Paleoindian style artifacts mentioned in the IMACS site files as well as some square based points from his work along the Old River Bed in western Utah. But, Wallman and Amick (1991) and Amick (1997) report a number of square based, lanceolate projectile points from the Black Rock Desert in northeastern Nevada and describe these tools as an Alberta/Cody assemblage showing strong morphological similarities to the Horner Site and like assemblages from the Plains (however, see Beck and Jones 1997). The Black Rock specimens are unlike those reported here.

The Martin Site material more closely resembles

Figure 6. Viable cores, Martin Site.

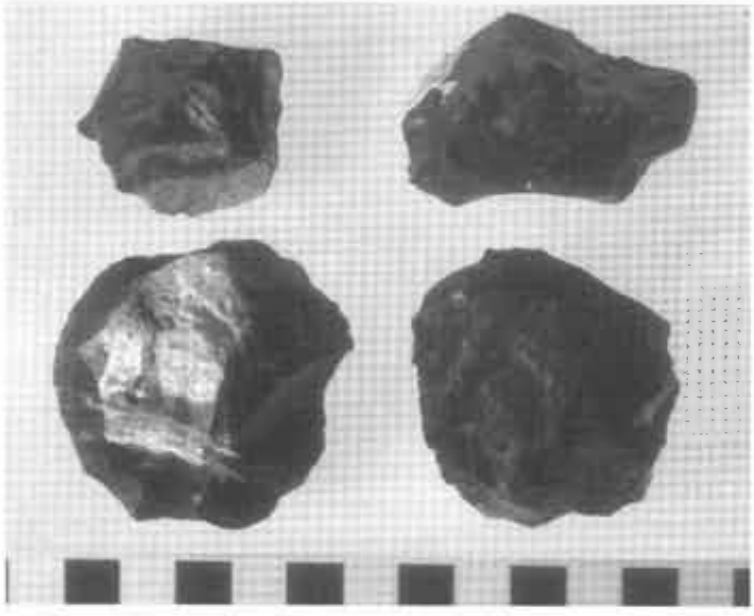

Figure 7. Exhausted cores, Martin Site.

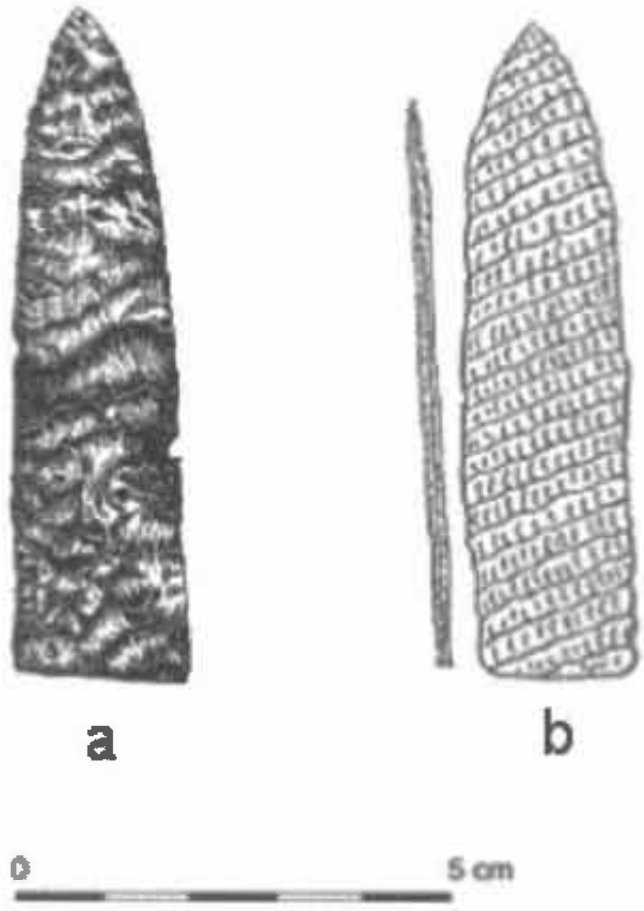

Figure 8. Projectile point from Spotten Cave (42UT104): (*a*) recent drawing, (*b*) drawing from Mock 1971.

Late Paleoindian material from sites to the east. The stemmed point is similar to the bifaces from the Larsen Cache (Ingbar and Frison 1987) and Scottsbluff Type II points from Pine Springs (Sharrock 1966:55), both of which are in southwestern Wyoming. Ingbar and Frison (1987) call these stemmed points specialized bifaces, five of which were also found at the Horner Site where they are lumped with Cody knives. The blade on the Martin Site point is slightly more ovate than the Larson Cache bifaces but otherwise compares favorably in shape and size with the well-thinned Larsen Cache specimens where the width to thinness ratio ranges from about 5:1 up to 9:1.

The Cody knives from the Martin Site as well as the Nelson specimen are similar to each other and to those recovered from the Horner site (Bradley and Frison 1987: Figure 6.15, especially c). The resemblance of the wider Cody knife (No. 3, FS 7.2) to the Larson Cache is also strong. It is thin relative to its width (width to thickness ratio of 7:1). It is made on a large flake and shows minimal retouch on the ventral side. The base differs from the Larson Cache specimen in that it appears shallowly notched rather than stemmed. The very thin nature of this tool suggests use for cutting meat into thin strips, perhaps for drying or for filleting fish.

The presence of late Paleoindian style artifacts in Utah Valley holds important implications for the culture history of the region. Most fundamentally, these points and bifaces argue for human presence in the valley at about the same time similar materials appeared on

the Wyoming plains. With the exception of the Spotten Cave point (see discussion above), no direct dating is possible for the Utah Valley material. If one accepts that these Cody knives and the Scottsbuff II point are typologically equivalent to the Horner Site and Larsen Cache, ages from those sites could be used to estimate the age for the Utah Valley collections. No dates are available for the Larsen Cache, but investigators have obtained several radiocarbon dates from the Horner Site that suggest an occupation between 9,000 and 10,000 years ago (see Frison and Todd 1987:98, Table 4.1 for all dates and p.105 for a discussion of the dates).

Finally, the source of the dark brown-black to greenish gray toolstone in the Martin collection and Spotten Cave projectile point is a primary issue. The presence of cores and some decortication flakes at the Martin Site could argue for a local source such as the nearby Tintic Mountains. At present the source is unknown.

SUMMARY

A couple of points can be made in summary. In nearly all cases in which location is known for Late Paleoindian materials in the eastern Great Basin, they come from valley bottom locales adjacent to riverine or lacustral contexts. This pattern is consistent with Beck and Jones's (1997) conclusion that the majority of Paleoindian diagnostic occurrences in the Basin are in lowland settings. Grayson, for example, stated that evidence for early human occupation should be found adjacent to valley wetlands where resource productivity was high compared to upland woodlands (Grayson 1993:242). The data from Utah Valley support that position. Additionally, the preference for dark toolstone is consistent with Beck and Jones's (1997) characterization of stemmed points from the Great Basin generally.

The implication of this growing body of data is that during the terminal Pleistocene, early Holocene period (~9,000 B.P.) there was Plains/Great Basin interaction, although the amount remains unknown. Wallman and Amick (1991) have suggested that the appearance of Late Paleoindian diagnostics represents an intrusion of bison and bison hunters in the northern Basin.

Bison hunting may have been an important activity in Utah and Salt Lake valleys during this early period as bison were here in good numbers during the late Holocene and one might expect their presence earlier as well (see Lupo and Schmitt 1997 for a review of eastern Basin bison populations during the late Holocene and Grayson 1988:15-18 for evidence of bison at Danger Cave during the early Holocene). But, the documentation of bison hunting does not equal evidence for an intrusion of people. We know people were here during the late Pleistocene (various references, but see Aikens and Madsen 1986:154), and it seems reasonable to assume they would have hunted bison if bison were available. As suggested above, stylistic similarities argue for some level of interaction perhaps resulting in a diffusion of ideas or even an exchange of material goods. A strong intrusion argument, however, would have to include the presence of nearly stylistically identical goods from the presumed area of origin and toolstone exotic to the region where the finds were made (in this case Utah Valley), but local to the area of origin. The importance of determining the source of the dark toolstone evident at the Martin site and in the Spotten Cave point is therefore heightened. If local toolstone were being exploited, it suggests a relatively long term occupation of the region because it implies knowledge of the local resource landscape and therefore would argue against an intrusion of people.

Finally, although the artifacts discussed here are intriguing, given that they could suggest late Paleoindian patterns, the mere presence of these diagnostics should not be taken to assume big game hunting (see for example, Dixon 1999).

NOTE

[1]Mark Stuart and Dann Russell are aware of a number of Paleoindian artifacts (including Cody knives) from north of Utah Valley (Mark Stuart, personal communication 2001). I have yet to see those specimens,

but their report suggests that Paleoindian presence in the eastern Great Basin may be stronger than previously thought.

Acknowledgments. A version of this paper was presented at the 1999 Great Basin Anthropological Conference. I have added the Jay Nelson artifact and the discussion of the Spotten Cave point. I thank Jason Bright and Brook Arkush for their useful comments and suggestions to improve the paper. Thanks to Dann Russell and Mark Stuart for sharing their knowledge of Paleoindian material. Finally, I thank Ron Martin for bringing the Martin Site to my attention and to Jay Nelson for recognizing his Cody knife as an important artifact and making it available for this report. The contributions of these two members of the Utah Statewide Archaeological Society, Utah Valley Chapter made this paper possible.

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CULTURAL AFFILIATION OF KACHINA BRIDGE RUIN

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Kachina Bridge Ruin, a storage site in southeastern Utah, has been called a San Rafael Fremont site based on the presence of adobe turtleback structures and triangular anthropomorphs painted on the inside wall of one of the turtleback structures. Based on new radiocarbon dates, the construction of the adobe structures at the site and the painting of the triangular anthropomorphs are now known to have occurred on or after A.D. 600-655, a time when upper White Canyon was occupied by Mesa Verde Anasazi, not Fremont. A literature review of turtleback structures and triangular anthropomorphs indicates that these traits cannot be considered diagnostic of the Fremont, and that Kachina Bridge Ruin is a typical Anasazi site for the region.

Kachina Bridge Ruin, also known as 42SA6801 or V:8:27, is in upper White Canyon, on the edge of the Red Rock Plateau archaeological district defined by Lipe (1970) for southeastern Utah. The archeology of the Red Rock Plateau, the area north of the San Juan River, east of the Colorado River, and south of Dark Canyon and the Abajo Mountains, is well known (Hobler and Hobler 1978; Lipe 1970; Matson, et al. 1988; Matson 1991; McVickar 2000) with one of its claims to fame being a long tree-ring chronology. This chronology (Ahlstrom 1985; Berry 1982) documents the intermittent presence of small horticultural-based households and communities in the area from about A.D. 200 through A.D. 1270. These Formative period sites are assigned to one or another archaeological culture or tradition based primarily on the relative percentages of ceramic wares and types that are present and secondarily on other material culture traits (cf., Geib 1996:98; Sharrock et al. 1961:14). Changes in ceramic assemblages across the Red Rock Plateau reflect variable and shifting interaction with areas to the east and south, or between the Mesa Verde (northern San Juan) Anasazi and Kayenta Anasazi traditions.

Two sites in the Red Rock Plateau district, Horsecollar Ruin and Kachina Bridge Ruin, have been assigned Fremont cultural affiliation rather than Anasazi, based not on ceramics, but on other traits. Horsecollar Ruin and Kachina Bridge Ruin are both structural sites located in upper White Canyon. These two sites were first recorded in the early part of the twentieth century. Marie Wormington (1955) suggested these sites might be Fremont because of their adobe architecture, but Hobler and Hobler (1978) effectively dismissed the notion that Horsecollar Ruin was Fremont when they noted that despite its architecture being "Fremont-like," the site lacked any other evidence for a Fremont occupation. Neither ceramics, portable artifacts such as figurines, rock art, textiles, nor other Fremont material culture diagnostic traits were present in Horsecollar Ruin. Today, archaeologists generally agree that Horsecollar Ruin is an Anasazi site, leaving Kachina Bridge Ruin a classificatory anomaly.

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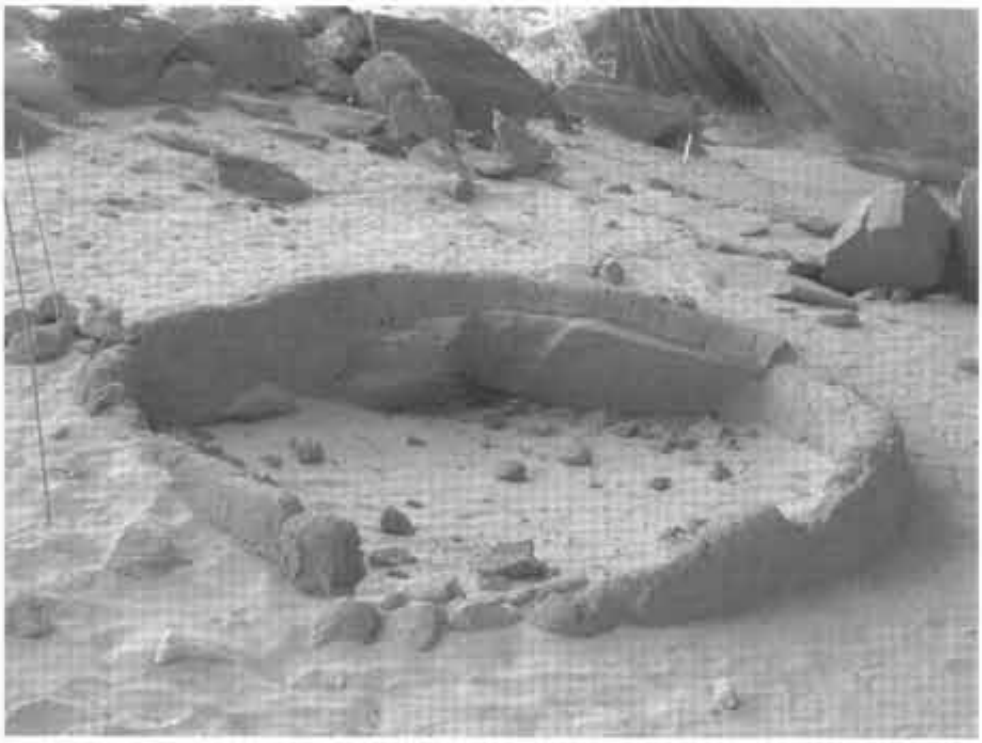

Figure 1. The large, low walls of Feature 1, looking south over broken turtleback structures.

Because Kachina Bridge Ruin had two putatively Fremont diagnostic traits, adobe turtleback architecture and Fremont pictographs, the Hoblers did not dismiss the possible Fremont classification. Phillip Hobler and Audrey Hobler (1978) summarized the adobe architecture and "Fremont" images in Kachina Bridge Ruin as follows:

> "One style of storage structure, possibly a survival from Basketmaker III-Pueblo I times, is made up of mud walls based on thick vertical slabs. The mud is built up in coils. Each coil contains small river cobbles or pieces of angular rock enclosed within it in such a way that they are not visible on the exposed surfaces of the wall. Sometimes the mud is also reinforced with grass or shredded juniper bark. This construction technique is a little like that adobe turtle-back technique used at some Fremont sites."

Wormington mentioned the mud and boulder structures at 42SA6819 (V:8:45) (Horsecollar Ruin) in reviewing evidence for Fremont-like architecture in southeastern Utah (1955). In this context it is interesting to note the presence of six white-painted Fremont figurines on the interior wall of the mud and boulder structure at site 42SA6801 (V:8:27). [Hobler and Hobler 1978:21-22].

With all the evidence that the Red Rock Plateau was part of the Anasazi culture area, how did Kachina Bridge Ruin become identified as a site whose Anasazi occupants borrowed Fremont design motifs or whose occupants were Fremont in an area otherwise occupied by Anasazi? This question is answered here in conjunction with reporting four new radiocarbon dates from Kachina Bridge Ruin.

THE SITE

Surveyor Earl Douglas first described Kachina Bridge Ruin in 1908. Since then it has been mapped and recorded several times. Kramer's (1987) feature designations are used here as a basis for further description and discussion of the site.

Figure 2. The high walls of Feature 2 are painted with six white triangular anthropomorphs.

Feature 1

Based on diameter, Feature 1 (Figure 1) is the largest adobe turtleback structure in Kachina Bridge Ruin. It is roughly circular in plan view and its maximum interior diameter measures 2.4 m. It incorporates a large boulder into its wall. The wall is made of one to two courses of adobe turtlebacks reaching a maximum height of 30 cm. The width of the turtleback's wall is 25 cm.

Feature 2

Feature 2 (Figure 2) is the highest adobe structure at the site. The topmost turtleback is currently 90 cm high from the interior ground surface, but when Douglas first described the feature in 1908 it was almost completely covered by sand. Looters have dug around the structure since Douglas's visit. Feature 2 is circular in plan view and its interior diameter is 2.3 m. As described by Hobler and Hobler in the quotation above, the walls are built up of concentric rings of adobe turtlebacks, plastered over with a smooth mud coating on both inside and outside surfaces.

Six white triangular anthropomorphs are painted on the inside plastered wall of Feature 2. Schaafsma (1978:69) called them "Fremont ghost figures" because they resembled triangular anthropomorphs in her southern San Rafael Fremont rock art zone. With Schaafsma's classification of the anthropomorphs as Fremont and Wormington's (1955) listing of adobe turtlebacks as a trait shared by Fremont and Anasazi, Kachina Bridge Ruin became known as a Fremont site located within an Anasazi culture area.

Other Features and Rock Art

Feature 3 of Kachina Bridge Ruin is described by Hobler and Hobler (1978:21) as a typical Basketmaker bell- or beehive-shaped cist (Figure 3). It is an above

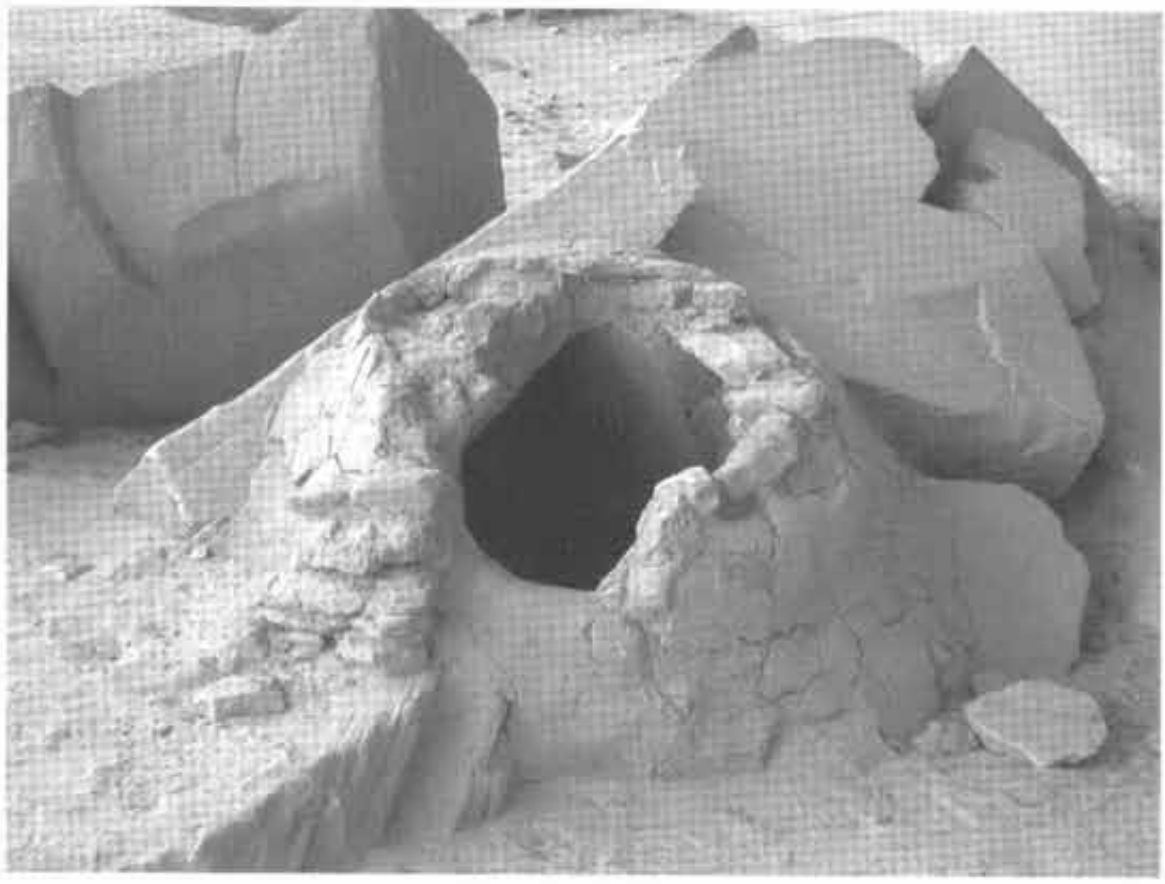

Figure 3. Feature 3, a bell-shaped cist.

ground storage structure built with adobe and sealed with a coating of mud plaster. It is located between Features 1 and 2.

Feature 4 is an arc of adobe clinging to the cliff wall at the south end of the site. The arc undoubtedly represents the presence of a former bell-shaped cist (cf., Guernsey and Kidder 1921:Plate 9e) that was dismantled prehistorically.

In addition to the six white anthropomorphs already described inside Feature 2, the cliff wall and boulders at Kachina Bridge Ruin are covered by hundreds of rock art elements, including mud daubs, handprints, anthropomorphs, zoomorphs, and geometric designs (Castleton 1987:206). Notable rock art elements include several greenish-white figures in San Juan Anthropomorphic Style, stylized handprints typical of Pueblo II-III Mesa Verde Anasazi (cf., Tipps and Hewitt 1989), spirals representative of Puebloan clan migration symbols, and red and white butterflies (Figure 4).

Rock art elements classified as Glen Canyon Style 4 are also found on the cliff walls and boulders in the site. While Glen Canyon Style 4 is highly variable (Turner 1963:6-7), it is associated with Pueblo II-III pottery in both the Kayenta and Mesa Verde Anasazi traditions. Glen Canyon Style 4 motifs at Kachina Bridge Ruin include geometric designs, lizards, snakes, and watchspring scrolls. Triangular anthropomorphs are also diagnostic of Glen Canyon Style 4 and anthropomorphs that Turner depicted as representative of Style 4 fall within the range of variation of the six triangular anthropomorphs painted inside the wall of Feature 2 in Kachina Bridge Ruin. Of course, the solid triangular figures in Kachina Bridge Ruin also resemble anthropomorphs found on Basketmaker III sites such

Figure 4. Solid and stylized handprints typical of Pueblo II-III Anasazi, and two butterfly motifs possibly representing a Puebloan clan symbol.

as those illustrated by Guernsey and Kidder (1921:Plate 13 c, d).

Ceramics

The Hoblers collected 20 sherds from Kachina Bridge Ruin including 16 Basketmaker gray ware sherds, 3 Pueblo II-III corrugated sherds, and 1 Basketmaker white ware sherd. Hurst (1989) reexamined these and other sherds collected from Natural Bridges National Monument and concluded that the Basketmaker III ceramic assemblage consisted almost entirely of imported Chapin Black-on-white manufactured with typical Mesa Verde andesite porphyry temper along with a generic sand tempered Lino-style gray ware. The sand tempered sherds might represent Kayenta Anasazi potters or they might reflect local production by potters who otherwise followed the Mesa Verde ceramic tradition. The latter seems to be the most reasonable explanation for the sand tempered gray wares in light of current understanding of local ceramic production processes (cf., Geib 1996:98-113).

While the gray wares from Kachina Bridge Ruin and other sites on the Red Rock Plateau reflect local production, imported white, red, and orange wares coupled with other material culture traits document intermittent, alternating occupations by northern San Juan Anasazi and Kayenta Anasazi; at no time in prehistory does the ceramic evidence from Kachina Bridge Ruin or any other Red Rock Plateau site indicate a Fremont occupation.

RADIOCARBON RESULTS

While working for the National Park Service, I had the opportunity to radiocarbon date four organic samples from Kachina Bridge Ruin. Table 1 and the following discussion present the dates in chronological order beginning with the most recent.

Table 1. Radiocarbon Results from Kachina Bridge Ruin.

Sample Number	Material	^{14}C Age	$^{13}C/^{12}C$ ratio	Calibrated 2 Sigma Range	Calibrated 1 Sigma Range
Beta-71960	yucca sandal	1,030±70	-25.0	A.D. 880-1170	A.D. 970–1040
Beta 81036	juniper berry	1,440±50	-23.5	A.D. 550-675	A.D. 600 655
Beta 81035	deer bone collagen	1,450±40	-19.8	A.D. 555–665	A.D. 600–650
Beta-75860	grass	1,630±60	-9.7	A.D. 265-575	A.D. 390 530

Beta-71960

Few artifacts remain at Kachina Bridge Ruin, but occasionally corncobs, yucca knots, cordage, sherds, and chipped stone artifacts rise through the sand to the surface. Several years ago, a patrolling park ranger collected a six by nine cm fragment of a twined cord sandal from the surface of the sand near Feature 1. The edge of the sandal was made of three-ply yucca fiber in an *S*-twist cord. Sixteen wefts were made of two-ply yucca in *S*-twist cordage. The sandal resembled one cataloged as No. 740 by Kankainen and Casjens (1995:124). It was completely destroyed during standard radiocarbon dating. The resulting one-sigma tree-ring calibrated date was A.D. 970-1040 (Beta-71960). This date falls within the A.D. 900-1100 time span traditionally assigned to Pueblo II.

Beta-81036

Broken turtlebacks from Feature 2 (Figure 2) lie around the high-walled circular structure. Comparison of Figure 2 here with Figure 13 in Hobler and Hobler (1978:22) shows that turtlebacks have fallen out of the wall of the adobe structure over the last 20 years. Two adobe turtlebacks lying between the structure and the cliff were broken open and searched for datable organic material. A single juniper berry was picked out of one and AMS radiocarbon dated. The resulting tree-ring calibrated one-sigma date was A.D. 600-655 (Beta-81036), a period that Geib (1996:117) calls the Early Formative.

Archaeologists traditionally date Basketmaker III to A.D. 500-700 (cf. Reed 2000:7), although Berry (1982) favors a more restricted time range of A.D. 600 to 700, and Matson, Lipe and Haase (1988) split the Basketmaker III occupation of the Red Rock Plateau into early and late periods with the dividing line at A.D. 650. Hurt's (2001:99) cross-dating of the ceramic assemblage from Natural Bridges National Monument led her to place the dividing line between early and late Basketmaker III at A.D. 600. Whatever temporal correlation of the Pecos stage classification is used, A.D. 600-655 falls within the Basketmaker III period/stage, but whether we call it early or late Basketmaker III depends on whose chronology is used.

Beta-81035

Adobe turtlebacks have also fallen from the north side of Feature 1 (Figure 1). Examination of a fresh break in a newly fallen turtleback revealed a protruding fragment of an artiodactyl hoof. The hoof fragment was pulled out of the mortar and submitted for a standard radiocarbon date. The resulting one sigma tree-ring calibrated date was A.D. 600-650 (Beta-81035). This date range falls within the traditional Basketmaker III time period or within Matson, Lipe, and Haase's (1988) early Basketmaker III, or Hurt's (2001:99) late Basketmaker III for Natural Bridges National Monument.

Beta-75860

A second fallen turtleback from the high walled structure with the white ghost figures (Feature 2, Figure 2) was broken open to reveal pine needles, grass

stems, charcoal flecks, and juniper bark mixed into the adobe. Several of the grass stems were extracted and radiocarbon dated. The resulting one sigma tree-ring calibrated date was AD 390-530 (Beta-75860), a date range classified as Basketmaker II.

Evaluating the Adobe Turtleback Dates

Three radiocarbon dates were obtained from organic matter inside three adobe turtlebacks from two structures at Kachina Bridge Ruin. The earliest date of A.D. 390-530 (Table 1) came from grass inside Feature 2. Radiocarbon results are statistical estimates so this date means there is a 68 percent chance the grasses died sometime between A.D. 390 and A.D. 530, or Basketmaker II. A juniper berry from inside another turtleback from the same structure, Feature 2, dated to A.D. 600-655. The hoof inside Feature 1 returned the same date as the juniper berry in Feature 2: A.D. 600-650, a time span classified as Basketmaker III.

The Basketmaker II date in Feature 2 may represent a phenomenon rarely discussed in the archaeological literature: old grass. There are seemingly endless discussions about old wood and how charcoal dates must be interpreted cautiously because people pick up and use wood that has been lying around for hundreds of years. Archaeologists are cautioned to only date annuals or short-lived organic matter to increase the quality of their radiocarbon results. But the grass date from Kachina Bridge Ruin indicates that grass, like wood, may be available for human use or reuse hundreds of years after the death of the organism. Given evidence for the dismantling of the Feature 4 adobe structure in the site, it is possible that Basketmaker III masons reused an earlier Basketmaker II turtleback from this dismantled feature. The Basketmaker II date could also reflect old grass present on the surface of the site or in the deposits used to mix the adobe during Basketmaker III times. Thus, the grass date does not provide a date for construction of the adobe structure, but it does provide a *terminus post quem* date.

Stratigraphers often apply the principle of *terminus post quem*, meaning that objects in a stratigraphic sequence provide dates on or after which the stratum containing them were deposited. Application of this principle to the grass date from Kachina Bridge Ruin establishes that this turtleback was made sometime on or after A.D. 390-530 (Table 1). If we only had this date available, we would conclude the structure was built during the Basketmaker II period. The availability of two more recent Basketmaker III dates of A.D. 600-655 demonstrate that construction of both structures and the painting of the white triangular anthropomorphs in Feature 2 occurred on or after these dates.

Evaluating the Sandal Date

The A.D. 970-1040 radiocarbon date on the twined cord sandal falls within the Pueblo II period. This might help date some of the rock art elements in the site such as the butterfly motifs or handprints, or it could merely represent when someone passed through White Canyon and lost a sandal. The archaeological record for the Red Rock Plateau indicates an occupational hiatus from A.D. 890-1029, but the Anasazi occupation of the area increased from A.D. 1030-1109 (Ahlstrom 1985).

CULTURAL CLASSIFICATION OF KACHINA BRIDGE RUIN

Some archaeologists classified Kachina Bridge Ruin as Fremont because of its adobe turtleback architecture and because six of the hundreds of rock art motifs in the site resembled Fremont ghost figures. In the following sections, I show that this classification is erroneous because neither adobe turtleback construction nor triangular anthropomorphs are diagnostic of the Fremont. This necessitates a brief review of some archaeological history.

Turtlebacks Are Not Culturally Diagnostic

Not long after Douglas (1908) documented Kachina Bridge Ruin, Judd (1919) described adobe turtleback structures at Paragonah in southwestern Utah, an area eventually designated as Fremont. Kidder and Guernsey (1919) described adobe turtleback structures in Fluteplayer House near Kayenta, Arizona, well within the Anasazi culture area. Kidder and Guernsey (1919:45) concluded that the adobe turtleback structures were used, partly filled with rubbish, and aban-

Table 2. Measurements of Six White Anthropomorphs, Feature 2, Kachina Bridge Ruin (in cm).

Figure No. (South to North)	Shoulder width	Torso length	Head length	Comment
1	22	24	6	—
2	17	23	7	—
3	14.5	22	—	Head eroded
4	—	—	—	Too eroded
5	18	22	5	—
6	—	—	—	Too eroded

doned before the erection of masonry-built rooms by the Puebloan people who made Kayenta (Tusayan) pottery. By 1921 enough stratigraphic work had been done in northern Arizona that adobe cists and granaries became diagnostic traits of the Basketmaker (Guernsey and Kidder 1921).

In 1931, Noel Morss described an adobe turtleback granary in Site 3 on Little Tantalus Creek in the Fremont River drainage (Morss 1931:4, 34) in south-central Utah. He pointed out that this Fremont adobe structure bore a closer resemblance to some of the adobe turtleback structures described by Judd than to the Puebloan wattle-and-daub construction of the Kayenta Anasazi. By including this one adobe turtleback granary in his type descriptions of Fremont sites, Morss was the first to associate adobe turtleback construction with the Fremont.

In 1948, Burgh and Scoggin (1948:34, 82-83) reported that while adobe turtleback structures were found in Basketmaker sites described by Kidder and Guernsey in the Kayenta area, they were also present in Big Bin Cave in Yampa Canyon. Although they could not directly date these structures, ceramic cross-dating led them to suggest a date of A.D. 650 (Burgh and Scoggin 1948:35). By 1955, the presence of an adobe wall appended to a masonry structure at the Turner-Look site in east-central Utah led Wormington (1955:178) to list construction with adobe turtlebacks as one of the traits shared by Anasazi and Fremont.

This brief history shows that although adobe turtleback construction might be temporally diagnostic, it is not a culturally diagnostic trait. Burgh, Scoggin, and Wormington recognized this, but with the post-1950s emphasis on defining regional variants of the Fremont (e.g., Lohse 1980), some Utah archaeologists have treated adobe turtleback construction as a Fremont diagnostic trait and ignored its presence in Anasazi sites.

Triangular Anthropomorphs May Be Culturally Diagnostic

Castleton and Madsen (1981) argued that triangular anthropomorphs are nondiagnostic traits because they are widely distributed in both Fremont and Anasazi culture areas. Obviously triangular anthropomorphs are found virtually everywhere. Even a cursory review demonstrates that triangular-bodied anthropomorphs are depicted in Basketmaker caves (Kidder and Guernsey 1921:Plate 13), in Glen Canyon Style 4 rock art panels (Turner 1963), in Chinle Representational Style, and in Fremont rock art. In refuting the argument for a Fremont presence in Canyonlands, however, Sharrock (1966:66-67) depicted the typical Fremont ghost figure as having a triangular body with pointed shoulders and a square or trapezoidal-shaped head. The shoulders and heads of the figures in Kachina Bridge Ruin are rounded, leading to the conclusion that the triangular anthropomorphs present in Kachina Bridge Ruin are not Fremont ghost figures.

I propose that if detailed morphometric analyses were made of the full range of triangular anthropomorphs found throughout the Southwest, styles with chronological, regional, and possible sociocultural significance could be statistically identified (cf., Geib 1996:109-111). To encourage rock art researchers to statistically assess stylistic variability, Table 2 provides measurements of the relative shoulder width, torso length, and head length of the six anthropomorphs inside Feature 2 of Kachina Bridge Ruin (only some of the figures could be measured because the pigment is too deteriorated to provide accurate measurements for all).

In providing these measurements, I hypothesize that the ratio of the shoulders to the torsos of these figures, coupled with their rounded heads and shoulders, falls within the statistical range of Mesa Verde Anasazi triangular anthropomorphs dating to the seventh to eighth centuries A.D. Furthermore, I hypothesize that if measurements were made of the heads and shoulders of rock art figures located west of the Colorado River in areas unequivocally classified as Fremont, these would fall outside the range of Anasazi figures such as those at Kachina Bridge Ruin.

I suspect that morphometrics have simply not been compiled to enable statistical differentiation of regional rock art styles within Southwestern archaeological culture units. But, even without metrics, the rounded heads and shoulders of the anthropomorphs in Kachina Bridge Ruin are apparently outside the range of the square or bucket-headed anthropomorphs with sharply pointed shoulders that seem to occur on ghost figures in the Fremont area.

CONCLUSIONS

This paper began by posing the question that if the Red Rock Plateau was part of the Anasazi culture area, how did Kachina Bridge Ruin become identified as a Fremont site? The site was called Fremont because of the presence of triangular anthropomorphs in an adobe turtleback structure. Comparison of the Kachina Bridge anthropomorphs with Fremont ghost figures (e.g. Sharrock 1966:66-67) demonstrates that the heads and shoulders of the Kachina Bridge figures are too rounded to meet the definition of a Fremont ghost figure. Even if we ignored the details of head and shoulder shape and only look at the torsos, however, the figures would still not be Fremont diagnostics because triangular torsos are found in both Fremont and Anasazi rock art (Castleton and Madsen 1981). Triangular torsos in and of themselves are nondiagnostic.

The other trait that led to the identification of the site as Fremont was adobe architecture. Although adobe turtlebacks are found in Fremont sites, they are also found in Anasazi sites, and in fact, throughout the Southwest. Like triangular anthropomorphs, adobe turtleback construction is not a culturally diagnostic trait, although it might be a temporal marker. Radiocarbon dates on organic matter within turtlebacks from Kachina Bridge Ruin document that these structures were built no earlier than A.D. 600-655. Before radiocarbon dates were available, Kidder, Burgh, Scoggin, and other Southwestern archaeologists hypothesized that adobe turtleback construction might serve as a temporal marker for the early Formative or Basketmaker periods/stages. The availability of these new radiocarbon dates confirms the Hoblers' assignment of the site to Basketmaker III, when horticultural populations expanded across the Red Rock Plateau coincident with increased annual precipitation, increased summer rainfall, and above-average temperatures. Most archaeologists attribute this population to actual migration of northern San Juan Anasazi from the Mesa Verde district, or at least migration of Mesa Verde women (Lipe 1970). Evidence for this migration comes from a low population density in previous periods and the presence of artifact types such as Chapin Black-on-white and Abajo Red-on-orange pottery, Style A arrow points, and two-rod-and-bundle basketry.

Under a paradigm of culture history, Southwestern archaeologists used artifact types such as these, along with architecture and settlement patterns, to divide and classify the continuums of space and time into the Anasazi, Fremont, Mogollon, or Hohokam archaeological cultures or traditions. Under newer paradigms, different research interests have led some archaeologists

to question the utility, validity, or distinctiveness of these classificatory units (cf., Madsen 1982; Speth 1988; Tainter and Plog 1994; Dongoske et al. 1997; Madsen and Simms 1998). Obviously, this paper was written to correct what I perceive as a minor classificatory error in southern Utah culture history; namely, Kachina Bridge Ruin is a Basketmaker III Anasazi site, not Fremont. Until we refine the basics of space-time systematics, we cannot begin to work on the larger, more interesting problems of Utah archaeology.

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THE OGDEN HIGH GRAFFITI ROCK

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To declare that rock art in the state of Utah is abundant is an understatement. One need only visit the many state and national parks throughout Utah or browse the literature sold at their visitor centers. One book documenting the best known of this art is the multi-volume set *Petroglyphs and Pictographs of Utah* by Kenneth B. Castleton M.D. Most rock art in the state can be attributed to prehistoric Native Americans, but not all. Dr. Castleton's book documents three panels that appear to be historic (Castleton 1987:64, 91). Another panel not documented by Castleton, similar in appearance, is located near Ogden and referred to by some residents as the "Ogden High Graffiti Rock" (Sawatzki 1996:5). This article will document the panel, compare it to similar panels described by Castleton as well as other rock art in Utah, and explore the questions of how, when, and why they were produced.

DESCRIPTION

The Ogden High Graffiti Rock (42WB266) is on the east bench of Ogden, Utah between Ogden Canyon and Taylor's Canyon (Figure 1). It faces south to southeast and is inscribed on a large boulder in the talus debris of the west-facing Tintic Quartzite cliffs. It is at an altitude of 1,530 m (5,020 feet) in section 26 of Township 6 North, Range 1 West on the USGS Ogden, Utah 7.5 minute quadrangle.

Another less common name for the Ogden rock is "The Moroni Rock," a name based on a Nephite prophet who holds an important role in the beliefs of the Church of Jesus Christ of Latter-day Saints.

Interviews with long-time Ogden residents suggest that the site could be less than 150 years old (Sawatzki 1996:5). Coloration of the individual symbols also suggests it is recent. The patina on the surrounding rock is dark and the exposed underlying rock is light. This contrasts with the patina observed on prehistoric petroglyphs on nearby Stansbury Island at the south end of Great Salt Lake and those at the Connor's Spring site at the north end of the lake. Other factors that point to the petroglyph's recent creation are the symbols' depth and sharpness. They appear to have been produced with a very hard and sharp fine-edged or pointed implement.

A similar panel is said to be located near Malad, Idaho (Mark Stuart, personal communication 2000), but no other information on that reputed panel could be found.

COMPARISONS

The three panels described by Castleton (1987) have characteristics that led him to identify them as historic. The Ogden High Graffiti Rock has the same characteristics. Castleton (1987:64, 91) also suggested that the panels might be the work of the same individual, a possibility that could also apply to the Ogden High Graffiti Rock.

To facilitate comparison between the Ogden High Graffiti Rock (Figure 1) and the three described by

Figure 1. Ogden High Graffiti Rock located near Ogden, UT.

Figure 2. Castleton's (1987:65) Figure 3.47 Fillmore, site # 3 (reprinted with permission of the UMNH).

Castleton, Castleton's photographs (Figures 2–4) are reprinted here with the permission of the Utah Museum of Natural History (UMNH). Figure 2 here is the same as Castleton's (1987:65) Figure 3.47 Fillmore, site # 3. Figure 3 is Castleton's (1987:91) Figure 4.36 Nephi. Figure 4 is Castleton's (1987:115) Figure 5.32 Cedar City, site # 3.

The similarities among the panels (Figures 1 – 4) include:

1. All four contain at least one set of two vertical parallel lines.

2. All four contain a "t" sign, with or without one line ending in an arrow shape.

3. All four contain one or more circles, each enclosing one or more "dots" with or without some form of a "t" inscribed inside the circle. Figures 1 and 4 contain a "W" inside a circle.

4. Figures 1, 2, and 4 contain a profile of almost identical human heads, each of which has a nose, eye, mouth, chin, two to three strands of hair, and an ear covered by one of the hair strands.

5. Figures 1 and 4 contain identical symbols that resemble either an inverted and/or reversed capital "G".

6. Figures 2 and 4 contain symbols that may represent "greater than" (>) and "less than" (<).

Figure 3. Castleton's (1987:91) Figure 4.36 Nephi (reprinted with permission of the UMNH).

7. Figures 1 and 2 contain identical symbols that may represent a sock with two diagonal parallel lines.

All four panels are in a row and column format, which suggests that some kind of written message is being presented and that is meant to be read left to right, top to bottom, or vice versa. The symbols are relatively light in contrast to the darker patina of the surrounding rock and appear to have been made with the same type of implement. Some of the symbols found on more than one panel are almost identical in execution and appearance. Most are not characteristic of those used in Na-

Figure 4. Castleton's (1987:115) Figure 5.32 Cedar City, site # 3 (reprinted with permission of the UMNH).

tive American rock art. Some of the symbols resemble Spanish mining symbols (Sawatzki 1996:5) and at least one is similar to a Proto-Sinaitic symbol (Harris and Hone 2002 para. IV-B, fig. 61), suggesting possible West Semitic influence. It is believed that "Sinaitic signs were created by reforming Egyptian Hieroglyphic signs based upon their acrophonic value" (Harris and Hone 2002 para. I-B).

DISCUSSION

Historic period rock art can be any number of things from doodling to maps. Occasionally it has a decipherable message. Certainly all writing systems use symbols, as do mathematical and musical notation systems. Some of the symbols in the rock art panels discussed here have meanings in known cultures. These convey a sense of the influences on the individual(s) who created these panels. For example:

1. Two of the "+" signs resemble crosses similar to those associated with Christianity, specifically, a "malta" in Figure 2 and an "egipcia" in Figure 3 (Rhoades 1982:30, 31).

2. The "W" seen in Figures 1 and 4 is also the Greek symbol for the letter "omega."

3. The inverted/reversed capitol "G" seen in Figures 1 and 4 is similar to a Proto-Sinaitic symbol (Harris and Hone 2002 para. IV-B, fig. 61).

4. Figure 3 and 4 each contain a "3" similar to an Apothecaries "scruple" (Webster's Ninth New Collegiate Dictionary 1985:1536).

5. Figure 4 has a symbol that resembles the Chinese "yin yang"sun chart (Kurint and Pena 2002 para. 6).

6. The facial features of the human heads in Figures 1, 2, and 4 are consistent with representation used on some Mesoamerican figures.

These examples tempt one to numerous interpretations of the four apparently historic rock art panels. They could be Spanish in origin: a Spanish presence in Utah was established by the late 1700s. They could be the work of gold miners or other early settlers on their way to California in the mid 1800s. Chinese railroad workers associated with building the transcontinental railroad in 1869 could be responsible for them. Also, they could be the work of historic Native Americans after making contact with settlers. Finally, one cannot rule out the Mormons who settled the region beginning in 1847, who may represent the best candidates responsible for making these panels.

The first leader of The Church of Jesus Christ of Latter-Day Saints claimed that ancient documents he translated were written in a symbolic language he called "Reformed Egyptian" (*Ogden Standard Examiner* 29 April 1980:11A). An interest in ancient writings is thus basic to Church beliefs and history.

Several years after arriving in the Great Salt Lake Valley, then-church president Brigham Young introduced the Deseret Alphabet as a phonetic representation of the English language. This suggests a continuing interest in ancient symbolism and its modification.

It was also acceptable to modify symbols and use them in an eclectic fashion as found in the Deseret Alphabet. This is consistent with the diverse combination of symbols found on the rock art panels.

Mormon scripture associates activities in the pre-Columbian Old and New Worlds, setting a backdrop for the creation of local symbolism by a Mormon settler or settlers, who were perhaps attempting to duplicate a form of writing reportedly used by earlier cultures. The fact that the panels prompt names such as "The Moroni Rock" signals some recognition by those familiar with the history of The Church of Jesus Christ of Latter-Day Saints. As the Mormon settlements expanded north and south of Salt Lake City beginning in the 1850s, the opportunity for the panels' creation by one or more individuals also expanded. We can only guess at their meaning.

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A TIP ON STABILIZING CERAMIC VESSELS

Barb Jolly and Roy Jolly, Dixie–Jennifer Jack Chapter Utah Statewide Archaeological Society, 508 Old Mill Rd., Mesquite, NV 89027

Jim Starr (Dixie–Jennifer Jack Chapter USAS) knows that patience and ingenuity are the prerequisites for ancient pot reconstruction. The St. George octogenarian has drawn attention throughout Utah with his innovative method using coat hangers to stabilize pots, instead of plaster of Paris.

Starr retired in 1977 and began his career as an avocational archaeologist in 1990 by taking classes taught by Diana Hawks, BLM archaeologist. While working on the South Gate excavation, BLM archaeologist Gardner Dalley asked Starr if he would be interested in reconstructing pots. Since then, he has reconstructed approximately 40 pots, and each pot requires 40 to 50 hours to complete.

Figure 1. Jim Starr demonstrates the use of coat hanger wire in reconstructing pots.

Figure 2. Coat hanger wire used to support reconstructed pots.

Through many hours of trial and error, Starr devised the following steps for reconstructing pots:

1. Wash sherds with warm water and asoft brush.

2. Sort by rim pieces, thickness, color, and bottom pieces if discernable. Rim pieces often indicate the vessel type.

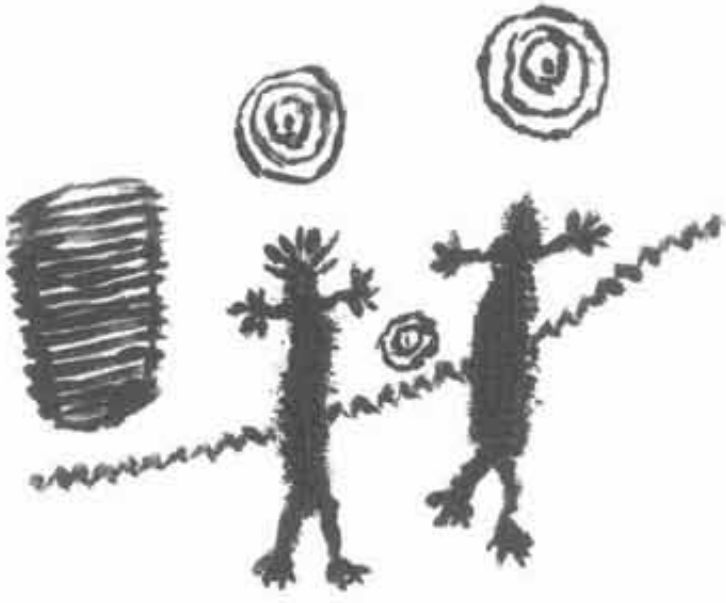
3. If the pot is small, start with the rim and work down. For large vessels, start with the rim and the bottom and work toward the center.

4. When finding two sherds that mate, apply a thin coat of Duco cement to each surface, hold in place a minute or two, then place in sand to maintain the contour while the glue dries.

5. When the glue is almost dry, check to be sure the fit is correct. If running a fingernail across a seam causes the nail to catch, the alignment is off and needs adjustment. Maintaining the contour is critical so that the top and bottom portions of the vessel match.

Coat hangers come in handy as the vessel is reconstructed because more often than not pieces are missing, leaving gaps in the pot. Plaster of Paris is often recommended for use in filling the gaps, but it can be messy. The plaster can also appear intrusive, detracting from the display of the original vessel. Coat hanger wire can be shaped to provide tension to support gaps in the pot as shown in Figures 1 and 2. The wire often can be shaped to fit inside the pot without additional support or attachment by carefully adjusting the wire tension. For pots with a large area left unsupported, use a system of bracing with coat hanger wire, along with glue and duct tape to help hold the wire in place. Starr encourages using ingenuity. Notice the various sizes, shapes, and arrangements of wire in the Figure 2.

With a minimum of alteration, the finished product accurately portrays the vessel, provides information about prehistoric life, and offers a striking reminder that pottery is one of Utah's most ancient arts.



Book Reviews

A History of Dogs in the Early Americas, by Marion Schwartz. Yale University Press, New Haven. 1997. 233 pages, 88 figures, 8 color plates. $32.50 *cloth*, $15.00 *paper*

Reviewed by: **Mark E. Stuart.** Promontory–Tübadüka Chapter, Utah Statewide Archaeological Society.

During my work with archaeological excavations I have had several unusual experiences with dog burials. My first was at the Orbit Inn Site (42BO120) near the Brigham City airport where we partially uncovered a human burial that was accompanied by a dog. There were no apparent burial goods with the human burial but the dog was buried with a string of beads. At the time I asked myself, "Why did the dog get the burial goods?" My second experience was at 42DV2 in North Salt Lake. Here I observed a dog burial containing skeletal elements from the front and hindquarters, but none of the bones in between. Once again I wondered why. In the case of the second oldest human burial discovered in Utah, the burial recovered from the shores of Utah Lake was accompanied by a dog burial. Last, during my work in the early 1990s at 42WB43 in the Great Salt Lake marshes, we recorded so many dog remains that we named the site "The Dog Site." While attempting to research these cases I was frustrated by a dearth of published material (but see Lupo and Janetski 1994). At last I have found a book that answers some of my questions.

A History of Dogs in the Early Americas by Marion Schwartz brings a large amount of interesting data about New World dogs into one highly useful volume. This was an excellent review of dogs from their origins to extinction. Although much material is not covered, including more would have resulted in a volume of unmanageable size. Schwartz identifies his purpose: "I began to understand that the word dog had many meanings. Dogs were as different as the people they served. What I wanted to understand was how different, and how one species - one nonhuman species at that - could be so many things to so many people" (pg. x). The resulting book does just that.

It begins with a review of where the pre-Columbian dog came from, covering the paleontological record, and at times the archaeological record of the family Canidae from its emergence until the development of the domestic dog in the Americas. As I found out, this has much to do with the peopling of the New World. When we finally know the answers to when and where people came to the Americas we will know how and where domesticated dogs also appeared.

The book continues with chapters on how prehistoric people of the New World used dogs for hunting, hauling, and herding, and for food. These chapters provide intensive coverage of these topics, using ethnographic references, prehistoric and historic art, and archaeological data. Schwartz's ability to draw upon all these resources is one of the book's strengths.

The most interesting chapter of this book is titled "Dogs in the Land of the Dead." Here the author provides a wealth of information on the spiritual nature of dogs in Native American cultures. Canid burials are discussed in terms of what we know about the cultural systems of which they were a part. These burials were not isolated instances of someone's favorite dog being ceremonially buried and remembered by the family, but rather a major event ritualized by the entire cultural system. Dogs were much more important to Native American cultures than most archaeologists are aware, and we should begin to look at these types of burial features and what they really mean.

The final chapter in this book covers canids in the prehistoric art of the New World. Schwartz discusses the many examples of ceramic figurines and hieroglyphic art found throughout Mesoamerica and South America. These pieces are further examples of how the domestic dog figured in the ceremonial and religious aspects of life.

The book's epilogue is a discussion of what happened to indigenous New World dogs after Europeans and their dogs arrived in the sixteenth century. The effects of European conquerors on New World natives and their cultures are well known. I did not know, however, that this invasion also had a drastic effect on the native New World dog. The European invasion drove the New World dog to extinction in some areas. We have learned something about the decimation of native cultural systems through archaeology and limited ethnographic accounts prepared by a few early Europeans. For the most part, however, these accounts provide only minor details about native dogs. Much of what we know has been developed by inference from these accounts and from limited archaeological studies.

I thoroughly enjoyed reading this interesting book. The comprehensive bibliography alone is worth its price and I highly recommend it to anyone interested in how dog remains in New World sites relate to cultural systems of which they were a part.

Lupo, K. D. and J. C. Janetski
1994 Evidence of Domesticated Dogs and Some Related Canids in the Eastern Great Basin. *Journal of California and Great Basin Anthropology* 16:199-220.

Kachinas in the Pueblo World, edited by Polly Schaafsma. University of Utah Press, Salt Lake City, 2000. 200 pages, line drawings, 40 color plates. $19.95 *paper*

Reviewed by: **Jon R. Moris,** Department of Sociology, Social Work and Anthropology, Utah State University, Logan, UT 84322-0730

This is a beautifully produced book, which incorporates papers from a 1991 seminar in honor of the late Fred Eggan. Eggan was the authority on the social organization of the western Pueblo peoples (in contrast to the eastern or Rio Grande Pueblos). His paper, completed shortly before his death, starts this collection after the editor's own, valuable introduction. To balance Eggan's and Hieb's papers on Hopi cosmology and religion, we have Edmund Ladd's on the Zuni ceremonial system (Ladd is himself a Zuni) and Dennis Tedlock's on how the Zuni "tell" Kachina stories through their dances (the final chapter). These four look at the Kachinas ethnographically. They bracket two other perspectives: the interpretation of Kachina symbolism captured in archaeological remains (either sites or petroglyphs), and the changing uses of Kachinas documented historically.

The archaeological papers (chapters 5-10) include a review of western Pueblo sites (Adams), pottery depictions (Hays), various petroglyphs (Polly Schaafsma), symbolism found in the magnificent Pottery Mound murals (Vivian), the meaning of Mimbres iconography (Thompson), and possible connections to Mesoamerica (Young). It is welcome that this one source contains a review of so many types of evidence contributed by leading scholars in their fields, who generally look for interconnections between traditions and the deeper meanings of Kachina symbolism. This makes for exciting but frustrating reading, because the comparatively short papers must be highly selective both in presenting evidence and in addressing common issues.

The historical papers (chapters 11-13) are by Curt Schaafsma on the early Spanish documentations, Wright on changing representations of Kachinas over time, and Brody on the transformation of Kachinas into contemporary American collectibles. Wright in particular warns against using one or two shared symbolic features in Kachina representations as evidence of shared meanings or of past historic connections.

It is clear from the collection as a whole that Kachina cults were fundamental features of most Pueblo societies; and, furthermore, they drew upon a common stock of overlapping symbols conveyed both

in art and in dance. While this collection gives us a valuable sampling of data and viewpoints, it lacks the depth to resolve disputed interpretations. A further constraint is the long delay since the original seminar in 1991; current arguments among professionals have gone far beyond the points raised here (see for example, the controversy over Mesoamerican connections). For a full review, we must await another conference. Meanwhile, this collection is exemplary in relating different types of evidence to its overall theme. Archaeologists and ethnographers didn't always communicate to each other this readily. Anyone interested in Kachinas, either as an avocation or professionally, will want to own this book.

The Art of the Shaman: Rock Art of California

The Art of the Shaman: Rock Art of California, by David S. Whitley. University of Utah Press, Salt Lake City. 2000. 138 pages, 90 color plates, 8 black and white plates, 7 illustrations, 8 maps. $45.00 *cloth*

Reviewed by: **Steven R. Simms,** Department of Sociology, Social Work and Anthropology, Utah State University, Logan, UT 84322-0730

Upon first encounter with this book I expected a light treatise that would play a supporting role to the beautiful color photography and full page, color maps in what was surely a coffee-table trophy. On the contrary, David Whitley's *The Art of the Shaman* is rich in detailed descriptions of rock art styles across the California and the Great Basin regions. Whitley traces rock art motif, style, variation and distribution in combination with a host of ethnographic description to propose relationships between rock art, ritual, rites of passage, symbolism, and shamanism. Whitley also seeks more than description and classification. The book is a sequentially structured argument that concludes, among other things: 1) rock art styles vary in time and much of the rock art of the last 1,000 years is directly related to historically known cultures; 2) rock art exhibits regional differences, but also interactive dynamism across cultural boundaries; 3) variation in the use of motifs is related more to function than to chronology; and 4) rock art is related in myriad ways to the shamanistic ideological systems of the indigenous cultures.

This book is a lavishly illustrated summation of Whitley's lengthy research into the relationship between rock art and shamanism (e.g., Whitley 1982, 1988, 1994, 1996, 1998). The argument that rock art has some connection to shamanism is not new; early twentieth century scholars such as A.L. Kroeber speculated on the possibility. The proposition that shamanism provides a context to account for much rock art finds support in cognitive neuroscience research. Many rock art graphics are found worldwide, suggesting there are underlying psychobiological processes at work regardless of the cross-cultural variations. Geometric graphics typical of rock art are called *entoptic* figures. They occur in different stylized scales ranging from simple hatching, squiggly lines and such, to patterned body humans, and fantastic animals. The brain can produce entoptic figures during a state of trance or "altered states of consciousness" (ASC). ASCs can be drug-induced, but are more commonly induced by fasting, physical exertion, and dreaming. Any or all of these activities can be related to shamanism. Whitley illustrates some entoptic figures (page 107), but in the meantime try pressing firmly on your closed eyelids long enough to "see stars." This gives you some idea of what entoptic figures are and how they are related to neurobiology.

David Lewis-Williams (e.g., 1986) and Thomas Dowson (e.g., Lewis-Williams and Dowson 1988, 1989) are the best-known proponents of the psychobiological research strategy, having applied it to European Upper Paleolithic and South African rock art cases. What Whitley brings to this area of study is increased attention to ethnographic and ethnohistorical lines of evidence to evaluate whether the graphic representations found in California and Great Basin rock art are tied to shamanism, how the context of rock art execution varies, and how it helps trace historically-known Native American groups into antiquity.

Central to Whitley's arguments is that much rock art interpretation denies a voice to the Native Americans who produced it. By connecting rock art to ethnographic accounts and the cultural context in which the art was made, Whitley hopes to bring to life elements of consciousness and meaning that are so easily missed in studies about the past where no person remains to challenge our interpretations or beliefs. Whitley criticizes interpretations of rock art such as the ever-popular astronomical and hunting magic explanations. He does not deny that indigenous cultures had deep knowledge of astronomy or that such knowledge made its way into rock art on occasion. Instead, his critique examines the tendency toward unwitting ethnocentrism in so much rock art interpretation. I must agree with Whitley that rock art studies suffer from this problem, having encountered many far-fetched and belief-based tales about what rock art means, including trans-oceanic contacts, treasure maps, New Age vision questing, or the last resort and hopelessly ethnocentric conclusion that rock art is just "graffiti."

Whitley's conclusions and the neuroscience approach in general are understandably controversial. Critiques of Whitley's California application, the Upper Paleolithic and South African work of Lewis-Williams and Dowson (1988, 1989) and of the neuroscience approach in general suggest that some scholars remain unconvinced (e.g., Bahn 1997, Quinlan 2000, see comments on Lewis-Williams and Dowson 1988). On the other hand, serious rock art scholars have for some time been looking toward resolving some of the long-standing problems that have plagued the field. There is an effort to move beyond stylistic description without lapsing into ad hoc correlations and gratuitous interpretation by requiring more rigorous methods, as well as higher standards of test and verification (e.g., Lorblanchet and Bahn 1993, Tacon and Chippendale 1998). How does *The Art of the Shaman* stack up?

Whitley begins with a description of the natural and cultural landscape, but with an eye toward giving the reader insight into how native Californians viewed their world. He divides the region into sections including Central, Southwestern, and Northwestern California, the Modoc Plateau, the Colorado River, and the Great Basin.

He then describes the nature of shamanism and the many symbolic and behavioral contexts that can be associated with shamanism. He carefully distinguishes the various behavioral complexes underlying shamanism such as the "Spirit Helper Complex" and the "Mythic Complex." This section shows how different the world view of hunter-gatherer societies was from European perceptions and shows that shamanism is at once a general, cross cultural concept, but one that can be expressed in many ritual and symbolic contexts.

In the next chapter Whitley reports the geographic variations in rock art and the means of dating it using AMS C-14, rock varnish, and a clever use of weathering patterns, exposure, and rock art style to argue for which types are likely to represent the last 1,000 years. He follows this with a detailed chapter describing each geographic tradition. Even if one were to ignore the central theses of the book, there is an abundance of fascinating information about the rock art.

Whitley moves into the meat of his argument in the chapter titled "Ethnography and California Rock Art." He discusses the meaning and use of knowledge in the indigenous forager societies of California and draws contrasts with modern cultures. He then explores the ethnographic and ethnohistorical record for associations between rock art and the various layers or contexts of shamanism such as "Vision Questing," "The Shaman's Vision," "The Shaman's Cache," rites of passage such as puberty ceremonies, fertility, sexuality, and dreaming rituals that recount mythical creation stories. This fascinating chapter shows Whitley is not offering a single explanation for all rock art. Shamanism is too complex and multifaceted, and the relationship between "shamanism" and rock art is a general one that enables myriad contexts and expressions. Shamanism itself so pervades the cultures of band societies that it is impossible for any expression of meaning, ideology, or art to escape its confines.

Whitley argues that his explanation applies best to the rock art of the last 500 years, and possibly 1,000 years. He is aware of regional variations, but also aware

that the relationship between types and locations of rock art and the particular cultural contexts of shamanism also vary. He observes that the specifics of rock art change over time, but never loses sight of the "widespread unity of the ethnographic pattern (that) speaks of a tradition of considerable time depth" (pg. 101).

The entire book, and especially the ethnographic descriptions, is heavily footnoted, but the reader will in most instances only find references to sources in their entirety, not the specific page citations permitting a rigorous evaluation of the asserted evidence. Perhaps omitted from this treatise for a broader audience, the need for specific page citations is one of those issues about rigorous ethnographic research methods important for the acceptance of Whitley's research. Nevertheless, in this general treatise, I appreciate Whitley's attempt to overcome the perception that shamanism amounts only to lone men vision-questing and hallucinating in the desert a la Don Juan of Carlos Casteneda's famous fictional works. Anthropology has long shown there is much more to it than this.

Whitley concludes with a chapter titled "Altered States of Consciousness and Metaphors of the Supernatural" in which he ties everything together. Here he presents the research on neuroscience and entoptics, and returns to the metaphors and behaviors found in various expressions or aspects of the shamanism complex. It is in this chapter that he devotes the most criticism to alternative models proposing to account for California and Great Basin rock art such as hunting magic and solstice sites. Whitley concludes: 1) his interpretation is the one best linked to ethnographic and ethnohistorical lines of evidence and thus to the cultural context of the rock art makers; 2) his interpretation is superior to competing models given the evidence at hand; 3) his model is sensitive to the variation in rock art expression while also accounting for the underlying similarities, not only in rock art, but also in the ideological systems of which rock art was a part.

Through all the specifics and the model building, Whitley sticks to his thesis found throughout the book but perhaps best expressed:

> "We can appreciate that native California rock art was simply one expression of a cognitive system of beliefs, relationships, and concepts that was as complex and rich as our own and that the indigenous Californians were not simply 'primitives' living on the edge of starvation, but individuals who lived complex lives much like ours" (pg. 101).

I was pleasantly surprised that this was not just another pretty book about Indian rock art, or one where a modern person attempts to "read" the rock art. Two of the most basic dilemmas of anthropology reside in this book: that the study of other cultures often tells us more about ourselves than it does about "them"; and that a holistic anthropology is found in the balance between seeing the forest for the trees, while attentive to the fact that there are individual trees. Thus, one can not only learn about rock art by reading this book, but one can glimpse some of the most thorny problems of understanding cultures other than our own.

This recommendation does not come with an agreement to all aspects of Whitley's position. I continue to be suspicious that rock art can be anything we want it to be. Despite Whitley's accomplished ethnographic and ethnohistoric research, test and veracity remain circumstantial. He does, however, present a systematic theory that gives force to his specific claims. His is not just a slew of correlations or "finger matching" with no anchor to an internally consistent theoretical structure—a shortcoming all too common to rock art research and archaeology in general.

The Art of the Shaman is an informative and thoughtful book that teaches a lot about rock art, sensitizes the interested reader to the difficulty of the interpretive task, and offers a glimpse of some of the most fundamental problems of studying humans—and the reason anthropology is called a "mirror for man."

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Prehistory of the Carson Desert and Stillwater Mountains: Environment, Mobility, and Subsistence in a Great Basin Wetland,

by Robert L. Kelly, with contributions by Virginia L. Butler, Linda Scott Cummings, Steven D. Grantham, Richard E. Hughes, Keith K. Katzer, Stephanie Livingston, David Rhode, Nancy D. Sharp, and Peter Wigand. University of Utah Anthropological Papers Number 123. University of Utah Press, Salt Lake City, 2001. 325 pages, 147 figures, 106 tables. $45.00 *paper*

Reviewed by: **David W. Zeanah,** Department of Anthropology, California State University, Sacramento, 6000 J Street, Sacramento, California 95819-6106.

Archaeologists are at their best when they grapple with thorny research issues. Confronting evidence that obstinately conflicts with theoretical expectations demands a reconsideration of the archaeological signatures of behavior, incorporation of new constraints into models, and testing predictions against new sets of data. Robert L. Kelly's investigation of Carson Desert prehistory is an excellent example of how such a research program can yield insights about the past that otherwise may never have been gained.

Kelly's goal was to evaluate the presumption that hunter-gatherers become sedentary whenever resources are sufficiently plentiful. He argued that foragers should remain mobile, even amidst a Garden of Eden of nearby foods, if scarce foods are energetically more profitable to procure than abundant foods. In the Carson Desert of western Nevada, he suspected that hard-to-come-by upland resources offered higher foraging returns than

prolific wetland foods, and predicted that prehistoric hunter-gatherers should have remained mobile unless forced to settle near marshes by population or climatic pressure. Kelly tested his hypothesis by surveying a sample of the Carson Desert in 1980 and 1981. Interpreting his findings based on an impressive arsenal of theoretical models about hunter-gatherer mobility and lithic technological organization, Kelly (1985:293) saw little evidence for sedentism despite the abundance of marsh resources.

The shoe fell between 1982 and 1986 when catastrophic floods in Stillwater Marsh washed away the mantle of sand that had hidden large, complex archaeological sites from Kelly's survey team. These sites bore evidence of prolonged residential occupation (middens, structures, storage pits, burials, and diverse artifact assemblages) and intensive exploitation of wetland resources. Faced with unexpected evidence, Kelly candidly acknowledged that his earlier conclusions were wrong, but rather than abandoning his research program, he refined his theoretical models and returned to the field. Supplementing an earlier bioarchaeological analysis of human skeletal remains from Stillwater Marsh (Larsen and Kelly 1995), the volume reviewed here reconsiders the 1980/1981 survey findings, and reports results of the 1987 excavation of site 26CH1062 in Stillwater Marsh. A forthcoming monograph will summarize excavations of Mustang Rockshelter in the Stillwater Mountains.

Chapters 1, 2, and 3 provide the archaeological, ethnographic, and environmental background for the study. The Carson Desert is well suited for investigating hunter-gatherer sedentism because some archaeologists have proposed that prehistoric occupants of the region followed a "limnosedentary" adaptive strategy allowed by the bounty of lacustrine resources (Heizer and Napton 1970). Although a case for limnosedentism can be made from the large occupation sites exposed by flooding, much of the evidence for the original argument was drawn from excavations of Hidden, Lovelock, and Humboldt Caves, which appear to have been used primarily for caching wetland foods and foraging gear. Kelly points out the inherent contradiction of this interpretation with the limnosedentary model by asking why sedentary foragers living in marsh-edge villages would need to stash essential food and equipment in inaccessible caves; caching implies that they periodically moved away from local wetlands. Ethnohistoric accounts of the nineteenth century Toedokado Paiute suggest that Carson Desert hunter-gatherers intensively used wetland resources, but were not particularly sedentary.

The environmental description discusses the short-term volatility of marsh productivity: annual variability in precipitation, runoff, and temperature affect water depth, salinity, and emergent vegetation that, in turn, cause dramatic fluctuations in fish, mammal, and avian populations. Paleoenvironmental evidence reveals longer-term climatic trends; an arid period between 7,000 and 4,500 years ago, effectively wetter climate from 4,500 to 2,000 years ago, greater aridity from about 2,000 to 600 B.P., and a return to wetter conditions punctuated by drought between 600 and 50 B.P. Projecting how these trends affected the foraging ecology of the Carson Desert is complicated by the uncertain histories of the Walker River, which may have flown into the Carson Desert between 2,700 and 2,000 years ago, and the Holocene expansion of piñon into the Great Basin, which may not have reached the Stillwater Mountains until after 1,250 B.P.

Kelly's theoretical approach, as laid out in Chapters 1 and 3, is grounded in behavioral ecology, and relies on the assumption that hunter-gatherers maximize foraging efficiency over time. Developing a simple model that tracks how searching for food from a base camp depletes nearby resources and forces longer distance forays from home, Kelly shows that local foraging returns may diminish sufficiently to make it worthwhile for hunter-gatherers to move to a new foraging territory even in a rich environment. Thus, the key to predicting whether foragers settle down or pull up stakes lies in understanding the energetic tradeoffs between logistic and residential mobility.

Kelly models four such tradeoffs pertaining specifically to the Carson Desert: foraging in Stillwater Marsh from a nearby base, moving from the marsh to forage in the Stillwater Mountains, collecting in the

mountains from a marsh residence, and collecting in the marsh from a mountain camp. Each scenario compares the effective return rates for procuring various resources in good and bad years, considering sexual division of labor and appropriate search, transport, and moving costs. The simulations assess wetland foraging to have been most efficient for women, even after the arrival of piñon in nearby mountains. Men would often have found hunting bighorn their most profitable option, but the returns offered by fishing and trapping were usually too high to make moving camp to the mountains worth the effort. Therefore, Kelly predicts that Carson Desert hunter-gatherers normally resided in wetlands while hunting logistically in the uplands. Wetland habitation may have intensified during the warm/dry period between 2,000 and 600 B.P. because the productivity of upland resources would have diminished relative to wetland alternatives. In contrast, cool/ moist episodes, such as those between 4,500 and 2,000 B.P., would have enhanced the attractiveness of foraging in the uplands and neighboring wetlands, and drawn Carson Desert hunter-gatherers away from Stillwater Marsh more often.

Chapter 4 models the effects of mobility strategy on lithic technological organization so that the foraging predictions may be tested against Carson Desert chipped stone assemblages. Kelly contrasts bifacial reduction strategies, which he associates with relatively high logistic and residential mobility, with bipolar and core reduction strategies associated with infrequent residential moves under circumstances of raw material shortage and abundance, respectively. Noting that toolstone sources accessible from the Carson Desert lowlands are rare and poor quality, Kelly expects that transient hunter-gatherers who briefly visited the valley floor would have left lithic assemblages dominated by bifaces and flake cores of imported toolstones. In contrast, foragers who resided on the valley floor for prolonged periods would have practiced bipolar and flake core reduction strategies, and made greater use of nearby sources.

Chapters 5 and 6 describe the results of the 1980/ 1981 survey, and reconsider findings in light of the updated theoretical context. The 1,600 km^2 study area was devised to sample piñon-juniper woodland and upper sagebrush communities in the Stillwater Mountains, Stillwater Marsh, an area of unstabilized sand dunes west of the marsh, and the valley floor south of the marsh. The sample drawn from portions of the Stillwater Mountains above 1,341 m (4400 feet) in elevation was inventoried as 57 500 m by 500 m quadrats, and circular catchments extending 500 m from ten springs. Lower elevations were sampled by 15 100 m wide transects extending across the valley floor. Together the survey inventoried 2.7 percent of the study area, discovering 106 sites on the valley floor and 54 sites in the Stillwater Mountains.

Diachronic inferences drawn from projectile points retrieved from the survey are limited by small sample size, and potentially biasing effects of amateur point collection. Nevertheless, there are some statistically supportable trends associating Rosegate points with the marsh, Desert series points with the dune region, and Elko series points with the upper sagebrush community and south valley region. Obsidian projectile points originate from various remote sources north (predominately Majuba Mountains) and south (mostly Mt. Hicks and Bodie Hills) of the Carson Desert.

Evidence of biface reduction is statistically prevalent in the mountains, whereas valley and marsh sites are characterized by core reduction, and dune sites by bipolar knapping. Both imported obsidians and local toolstone are common in the marsh. Groundstone tools are most prevalent on the valley floor and isolated projectile points most common in unwooded portions of the mountains.

Chapters 7, 8, and 9 report the 1987 excavation of 26CH1062, and include technical analysis sections by Steven D. Grantham, Richard E. Hughes, Linda Scott Cummings, Pete Wigand, David Rhode, Nancy D. Sharp, Virginia L. Butler, and Stephanie Livingston. The site lies on a lunette dune adjacent to a fluctuating marsh. Recent flooding removed at least 10cm of sediment from the site surface, exposing numerous pit features and a possible secondary trash dump. Kelly's team excavated sixty-two pits, focusing their effort on three large feature complexes.

Kelly interprets two of the complexes as households associated with living floors (Features 4 and 7), but Rhode suggests that the floors may in fact be seed roasting surfaces based on the quantities of charred cattail seeds they contain. If they are houses, then they probably represent unroofed windbreaks rather than pithouses, because both are shallow and lack substantial posts or hearths. Smaller adjacent pits may have served for caching equipment, whereas larger pits are probably food storage facilities. All the pits are relatively shallow and lack conclusive evidence of prepared caps or linings, suggesting that they held stores for only short periods.

Small flakes, biface fragmentation, tool to debitage ratios, and bipolar core reduction show that the residents of 26CH1062 intensively utilized their inventory of chipped stone tools, as would be expected of long-term, marsh residents. But comparison with other sites from the western Great Basin suggests that the 26CH1062 assemblage is not so exhausted as the assemblages of other long-duration residential camps. Poor quality nearby toolstones are not as well represented as imported chert and obsidian in the assemblage of site 26CH1062, suggesting that occupants were sufficiently mobile to replenish non-local materials, making exhaustive tool reduction unnecessary.

Subsistence residues from site 26CH1062 were mostly obtained from marshes, and nearby alkali flats. Predominant plant macrofossils are cattail and seepweed seeds, and the taxa best represented in the faunal assemblage are tui chub, muskrat, jackrabbit and waterfowl. Conclusive evidence of upland resource use is limited to a handful of artiodactyl bones; notably no evidence of piñon use was found. Plant macrofossils point to a late summer to early winter occupation, tui chub bones and avian egg shell suggest spring and early summer use, but the lack of investment in substantial hearths and structures argues against winter residence. Kelly interprets site 26CH1062 as a long-term, but not sedentary, residential base.

There are intriguing differences between the assemblages of the two living floors. Three radiocarbon dates indicate that they represent two discrete components dating between 830 and 1,100 B.P. (Feature 4) and around 1,390 B.P. (Feature 7). The Feature 7 cluster contains higher percentages of aquatic macrobotanical remains, whereas the Feature 4 cluster contains more taxa from the fringe of the marsh and adjacent alkali flats. This implies that the older feature complex was associated with a deeper, wetter marsh than the younger cluster; the greater representation of muskrat bones in the Feature 7 complex, and small rodents in the Feature 4 complex support this inference. The Feature 7 assemblage contains more chert, obsidian, and bifaces, whereas more local toolstones and evidence of core reduction are found in the Feature 4 cluster. The Feature 4 complex includes two of the more substantial food storage pits, whereas no comparable facilities occur near the Feature 7 complex. Kelly cautiously proposes that these divergences are consistent with his expectations about sedentism; the component associated with drier ecological context bears more evidence of prolonged residence than the occupation that occurred under wetter circumstances.

In Chapter 10, Kelly integrates his findings with the regional archaeological database and evaluates his theoretical expectations. The cache caves suggest that although prehistoric foragers were committed to using wetland resources, they periodically abandoned local marshes. Notably, most of the cave deposits seem to predate the dry climatic period between 2,000 and 600 B.P. The open habitation sites tend to date within the xeric interval, and may represent a different land-use pattern of intensive, prolonged, although not sedentary, occupation of wetland environments. The survey data are consistent with the predicted patterns of prolonged (although not sedentary) residence on the valley floor, logistic usage of the mountains, and intensified occupation of wetlands during the xeric 2,000 to 600 B.P. period. Bioarchaeological analysis of the osteological sample shows that prehistoric populations lived a healthy but physically demanding, mobile lifestyle that emphasized wetland resource procurement. Notably, incidences of osteoarthritis and femur cross-sectional geometry suggest greater mobility for men than women. Kelly finds these data consistent with his theoretical expectations,

concluding that resource abundance is a necessary but insufficient requirement for sedentism.

Kelly goes on to consider the traveler-processor model of the Numic Spread (Bettinger and Baumhoff 1982) as an alternative explanation for the temporal shift in land-use patterns observed in the Carson Desert. Evaluating whether independent lines of evidence support the arrival of Numic speakers at the time that intensive occupation of Stillwater Marsh began, Kelly concludes that linguistic, material culture, and genetic evidence can neither support nor falsify the traveler-processor alternative. He suggests several directions whereby future research will help resolve the issue.

I have a few minor quibbles with Kelly's assessment of how well his theoretical approach accounts for the archaeological record. First, Kelly acknowledges that his evidence for a settlement pattern change after 2,000 B.P. may be biased by site formation and preservation factors. At this point we simply cannot be sure that earlier and later long-term habitation sites, comparable to 26CH1062, do not remain undiscovered in other ancient marsh locations in the Carson Desert. Kelly recommends a strong program of geoarchaeological investigations within the region to assess this possibility.

Second, I am bothered by the rarity of upland resources recovered from the Stillwater sites given the osteological evidence of mobility among men, and the theoretical predictions of Kelly (and myself!) that Carson Desert men should have been logistically mobile to access bighorn. Yet only a smattering of artiodactyl bone has been recovered from the lowland sites. Perhaps the rarity of upland faunal remains merely reflects the effects of field processing on the transport of residues that preserve in the archaeological record; the forthcoming Mustang Rockshelter monograph may reassure us that this is so.

Kelly rightly interprets the absence of piñon macrofossils from lowland sites, the rarity of groundstone in piñon groves, and the lack of carbon and nitrogen isotope signatures of piñon consumption in bioarchaeological samples to be consistent with his prediction that piñon had little influence on subsistence-settlement systems in the Carson Desert. But it is important to point out that his foraging simulations rank logistic procurement of piñon from marsh camps as more profitable than foraging for nearby seeds and waterfowl, particularly during bad years. Since evidence for use of both wetland seeds and waterfowl are ubiquitous on the Stillwater Marsh sites, the absence of piñon from those contexts seems inconsistent with expectations. As Kelly recognizes, piñon simply may not have been available in sufficient quantity in the nearby Stillwater Mountains to make the effort worthwhile. He proposes additional work to pin down the history of piñon in the Stillwaters.

Finally, I suspect that Kelly's foraging models under-emphasize the effects that boom and bust cycles of wetland productivity on prehistoric mobility strategies. Kelly acknowledges that resource abundance in wetlands varies, and that occasional droughts, floods, and epidemics may cause marsh ecosystems to collapse altogether, but his foraging simulations suggest that wetland resources would tend to have been more productive than upland resources in most bad years. This plays out in his expectations about how long-term climatic variability affected land-use patterns. During wet periods, enhanced hunting and fishing (in non-local fisheries) opportunities were often productive enough to draw bands out of Stillwater Marsh. During dry periods, such foraging bonanzas were harder to come by, and Carson Desert foragers intensified their occupation of Stillwater Marsh. They residentially moved from Stillwater Marsh only during rare occasions when catastrophic collapses caused them to abandon the wetland for long periods of time.

This scenario seems inconsistent with cases of dental hypoplasia and cortical bone loss in the Stillwater osteological sample that indicate occasional periods of food shortages and nutritional stress (Larsen and Kelly 1992:133). This suggests to me that collapses of marsh productivity may have been more than rare events, and played a larger role in shaping Carson Desert prehistory than Kelly recognizes. It is interesting in this regard to consider the survey findings of Intermountain Research in nearby Fairview Valley (Zeanah 1996), the basin 30 km southeast of Stillwater Marsh.

Fairview Valley lies within the annual foraging ter-

ritory of the Toedokado Paiute, so there seems no reason to doubt that the prehistoric occupants of Stillwater Marsh also visited Fairview Valley. The arid basin floods too sporadically and briefly to have fostered a wetland community, and is notable only for the richness of its Indian ricegrass stands. But under normal circumstances Stillwater Marsh offered far more profitable springtime foraging opportunities than such xeric seed stands (in fact, Indian ricegrass seeds are rarely retrieved from archaeological contexts in Stillwater Marsh). Harvesting ricegrass in Fairview Valley should only have been profitable when wetland resources were unavailable in Stillwater Marsh, causing brief spring moves to Fairview Valley.

Large occupation sites with abundant ground stone tools and fire-cracked rock, but lacking exposed pit features, fringe the playa in Fairview Valley. Figure 1 compares the number of groundstone tools and projectile points found in Fairview Valley, with Kelly's survey findings in Stillwater Marsh and the Stillwater Mountains. Points and groundstone are equally well represented in Stillwater Marsh; points dominate in the Stillwater Mountains whereas groundstone tools are more common in Fairview Valley. The representation of groundstone in Fairview Valley suggests the presence of women and residential base camps. If so, failures of marsh resources must have drawn Carson Desert foragers into neighboring valleys for relatively short periods. Since Fairview Valley would have offered few foraging opportunities for men, it may have been during these stressful events that men practiced their most extreme logistic mobility, accounting for the signatures of both sexually dimorphic mobility and nutritional stress in the skeletal sample.

Minor issues aside, this book is an outstanding example of the use of behavioral ecology models as a strategy for investigating stubborn research issues. Kelly's tenacity in investigating the causes of sedentism in the Carson Desert has paid-off handsomely. He has developed robust models that track the cost-benefits of various mobility options in the Carson Desert, and the archaeological signatures of mobility behavior. He has marshaled an impressive body of data that speak directly to predictions of the models. He builds a persuasive case that he has accurately pegged the causes of mobility and sedentism in the Carson Desert.

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