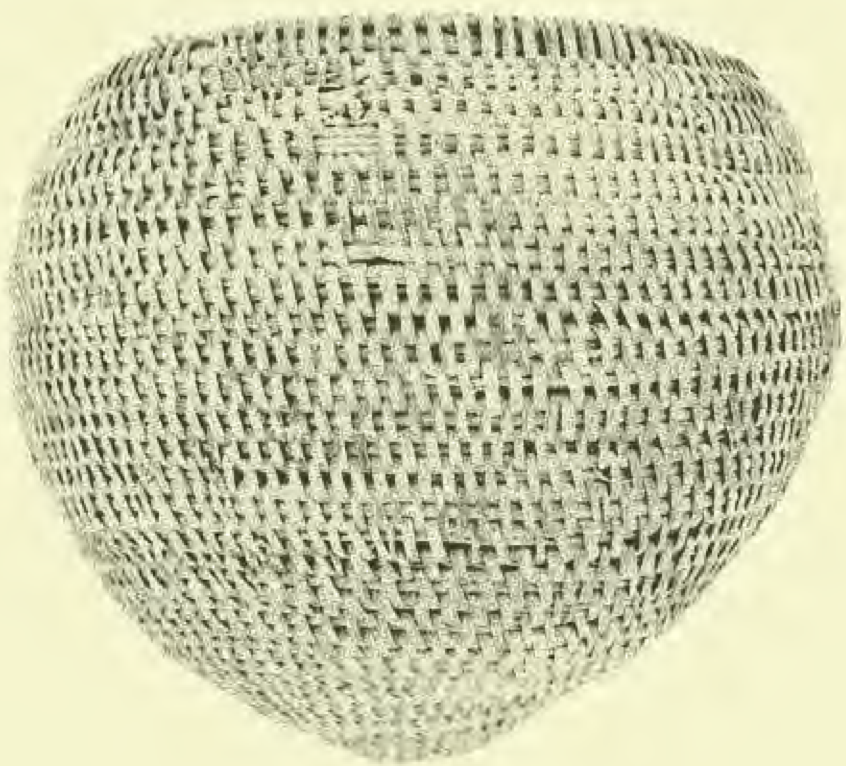
2009

UTAH ARCHAEOLOGY

Utah's Journal of Archaeological Research



No. 1

22

2009

UTAH ARCHAEOLOGY

Volume 22, No. 1

2009

UTAH ARCHAEOLOGY

Volume 22, No. 1

A publication of the

Utah Statewide Archaeological Society
Utah Professional Archaeological Council
Utah Division of State History

Cover: Basket with a wide mouth, excurvate sides, and pointed base. Original photo provided by Leeflang et al. (see page 54 this volume). Cover image generated from orginal photo by Scott Ure.

Utah Archaeology is an annual publication of USAS, UPAC, and the Utah Division of State History. The journal focuses on prehistoric and historic archaeological research relevant to Utah. It is provided as a benefit for individual membership in either USAS or UPAC. Membership information for UPAC is found at www.upaconline.org/membership.htm and USAS at www.utaharchaeology.org/membership.html. Journal submissions, questions, comments, or information requests can be sent to the editors at the following address:

Utah Archaeology Editor
256 ALLN-BYU
Provo, Utah 84602

E-mail: utaharch@gmail.com

Printed and bound at the University Press Building, Brigham Young University, Provo, Utah.
United States of America.

ISSN 1040-6449

♾ The paper for this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

2009

UTAH ARCHAEOLOGY

Volume 22, No. 1

Message from the Editors

For more than 20 years, Utah Archaeology has been committed to publishing research from the diverse group of stakeholders that are committed to Utah's past. Our community has greatly benefited from hearing the different perspectives brought to the journal by academic, avocational, contract, and government archaeologists. In this issue, we look to the future of the journal and the archaeology of Utah by dedicating an entire issue to student contributions.

The papers cover a diverse range of topics, time periods, and theoretical orientations. Culturally Modified Trees are the subject of Richard Allen and Jacob Skousen's study. The authors combine dendrochronological analysis and ethnohistoric data to characterize several peeled trees in central Utah. Shannon Arnold Boomgarden uses GIS to look at the visibility of Fremont granaries in Range Creek Canyon asking whether the stored food was hidden, or placed in a highly visible locations for longer-distance monitoring. Rachelle Greene Handley discusses the balance between preservation of archaeological sites and our responsibility to providing learning opportunities to the public in our management of cultural resources. In a study of Fremont gaming pieces from the Parowan Valley, Molly Hall presents a new typology for these oft-encountered objects and argues that the Parowan Valley was a focus of large festival-like gatherings. Arie Leeflang and several co-authors, including junior high school student Jonathan Bailey, report on a Late Prehistoric ceramic vessel and woven basket cache discovered in Emery County. Scott Ure focuses on the life of a Fremont individual who lived at Seamons Mound in Utah Valley and interprets that life through the lens of practice theory.

It is clear that the future of Utah Archaeology is in good hands. We wish these authors the best as they move forward in their careers and continued educational pursuits, and look forward to future submissions from students working in the state.

The Editors

Chris N. Watkins
David T. Yoder

Culturally Modified Trees from Joe's Valley: Dating and Cultural Affiliation

Richard Allen and B. Jacob Skousen
Department of Anthropology, Brigham Young University

Culturally Modified Trees are recognized as important archaeological features in many areas of the world. This feature class has received much less research attention in the state of Utah. Several Culturally Modified Trees from central Utah were analyzed during the current study. Using chronological, historical, and ethnographic data, we argue that these trees were modified during a 100 year period spanning the Late Prehistoric and Early Historic periods by Native American groups.

Culturally modified trees (CMTs) are a well documented part of the archaeological record in many areas of the world including the United States (see Martorano 1981; Swetnam 1984; White 1954). However, little research has been done on CMTs in Utah including a study by Lawrence DeVed and Byron Loosle (2001; see also Loosle 2003). In this paper, we describe 40 CMTs from Joe's Valley, Utah and address several questions in a cursory attempt to fill the void of CMT research in Utah.

We begin by reviewing previous studies on CMTs, with a focus on those performed in Utah. This is followed by a description of Joe's Valley, the 40 CMTs recorded in this area in 2008, and the methods used. Next, two basic questions are addressed about these trees: (1) when were the trees modified and, more specifically, were they modified within a short or long period of time? and (2) who was modifying the trees? In other words, was modifying trees a Utah Native American practice, the result of relocated "tree-peeling" Ute groups from other parts of the west (see Loosle 2003), or the product of European traders, settlers, or some other group.

Previous Research on CMTs

Previous research on CMTs has focused on four topics. The first is the identification of CMTs. Different kinds of CMTs are recognized in the northwestern United States and Canada (Stryd and Feddema 1998), Montana (White 1954), Arizona (Swetnam 1984), New Mexico (Swetnam 1984), Colorado (Martorano 1981), and Utah (DeVed and Loosle 2001). Most of Utah's CMTs are Ponderosa Pine trees with "peel scars," or areas where the bark was removed and the inner wood of the tree is exposed (also known as "peeled trees;" see Figure 1). In contrast to scars produced by forest fires or animal activity, peel scars are usually rectangular or oval shaped and are several feet from the ground surface, with the lower end usually above ground surface (DeVed and Loosle 2001). The bottom of the scar is often horizontal and the top usually tapers to one or more points (see Martorano 1981, 1989). Martorano (1981; 1989) and DeVed and Loosle (2001) provide the best descriptions of CMTs that would be relevant to CMTs in Utah and how to identify them.

The second line of research infers the function of CMTs from oral traditions, ethnographic and historical records, interviews with native informants, and the archaeological record. Studies suggest that CMTs from different geographical regions had different functions. In British Columbia and the northwestern United States, for example, the outer bark of cedar trees were used for canoes, paddles, house-building materials,

Figure 1. Photo of Rich Allen standing next to a tree with a peel scar.

boxes, bows, masks, and dishes, while the inner bark was used for clothing, mats, nets, twine, baskets, and rope (Stryd and Feddema 1998). In contrast, hemlock, fir, pine, and spruce were used for medicine, wood, fuel, and food (Stryd and Feddema 1998:5). Martorano (1981:4) claims that ethnographic and historic records reveal that CMTs in Colorado had four basic functions: (1) as raw material for constructing various objects; (2) as building material; (3) as a food source; and (4) for medicinal purposes. More specifically, she argues that the inner bark, or cambium, of many of the peeled trees in Colorado was used as a starvation food (Martorano 1989). As for the function of CMTs in Utah, DeVed and Loosle (2001:12) believe that Uinta Mountains CMTs were probably used as an occasional food source or as a sweetener, sealant, or medicine;

other possible functions include an adhesive, waterproofing resin, or kindling to light fires (Emery County Historical Society 1981; Loosle 2003).

Determining the dates CMTs were modified is the third line of research and one that we take up in this paper. Aside from a few studies in the central and northern Rocky Mountains, we found no studies on this topic. Peeled trees from Colorado have yielded dates that range from the mid-eighteenth to mid-twentieth century (Martorano 1981). Cores obtained from peeled trees in the Uinta Mountains (DeVed and Loosle 2001) reveal that the trees were peeled after A.D. 1900.

Finally, a few studies have discussed who was responsible for peeling the trees, which is the second topic we explore in this study. This issue also seems to be restricted to the CMTs from the Southwest and northern Rocky Mountains. Martorano (1981, 1989), for example, suggests that indigenous Ute groups were perhaps one of several groups responsible for the peeled trees she encountered throughout Colorado. Loosle (2003) claims that CMTs in Utah's Uinta Mountains were peeled by Colorado Ute groups relocated to the Uinta Basin sometime after A.D. 1900.

Data Set Description

The CMT data presented in this paper came from Joe's Valley, Utah, from an approximately 20 square mile area. Joe's Valley is located in Emery County, about 10 miles west of Orangeville, Utah. Geographically Joe's Valley lies at approximately 7,100 ft above sea level within the Wasatch Plateau. The valley is a long, relatively narrow graben; a landform which develops when faults cause a portion of the earth's crust to slump lower than the surrounding land. The vegetation in the valley is diverse, ranging from pinyon-juniper forest, sagebrush, grassy meadows, and ponderosa pine (*Pinus ponderosa*) forest. Several permanent water courses crosscut the valley, along which many ponderosa pine trees (some CMTs) are situated. These and most of the minor drainages in the area run into Joe's Valley Reservoir, built in 1966 (Emery County Historical Society 1981:316).

When CMTs were encountered during a 2008 survey, each tree or group of trees (multiple trees within 20 m of each other) were given an arbitrary isolated find (IF) number; any trees associated with sites were included in the respective sites. The trees were described using a standard set of measurements which included the height, diameter, and circumference of each tree (see Table 1). The Scars on each tree were recorded using a standard set of measurements including the height, width, depth, aspect, and distance above the ground surface (see Table 2). The general shape of the scar was also noted. Any other descriptive information about the scar was given, including the presence of ax or cut marks, bullet holes, and carvings. In addition, the geographical and topographical features surrounding the tree or group of trees was described, and UTM coordinates of the CMTs were recorded. Finally, at least one photograph was taken of each scar.

A total of 40 CMTs were recorded in 2008. Three trees exhibited two scars, making 43 scars total. All of these trees were Ponderosa Pine and generally fit the description of CMTs given by Martorano (1981) and DeVed and Loosle (2001). As stated earlier, many of the trees were located along Lowry Water and tributaries of Swasey Creek, the two major drainages on opposite ends of Joe's Valley. A few trees measured about 35 meters tall (IF 48, Tree 1; IF 50, Trees 1 and 2; IF 54, Tree 2; IF 56; IF 57; ML-4686). Two trees (IF 122, Tree 1; IF 129, Tree 1) were dead and partially collapsed when we encountered them, making their height before they died unknown. The diameter of the trees was taken from the trunk at four feet, six inches; the diameters varied from 115 cm to 40 cm. The circumference was measured from the same height. The average circumference was 238 cm. The largest was 415 cm while the smallest was 162 cm.

Table 1. Peeled Tree Data

	Height (meters)		Diameter (cm)		Circumference (cm)	
IF or Site Number	Tree 1	Tree 2	Tree 1	Tree 2	Tree 1	Tree 2
40	25	–	110	–	300	–
41	30	30	85	90	260	280
42	20	20	70	60	210	180
43	25	25	80	95	250	330
45	30	–	65	–	205	–
46	35	–	70	–	240	–
47	25	15	70	80	220	240
49	20	–	80	–	230	–
50	40	35	75	60	270	208
52	40	–	75	–	260	–
53	35	–	65	–	210	–
54	35	40	60	90	205	300
55	25	–	45	–	170	–
57	40	–	80	–	260	–
116	20	–	65	–	198	–
119	30	–	75	–	281	–
120	30	35	45	75	165	248
121	25	25	50	55	162	180
122	dead	30	75	60	244	208
123	30	–	76	–	255	–
125	30	35	58	63	234	206
126	30	35	58	90	230	313
127	30	–	75	–	291	–
129	dead	–	dead	–	dead	–
132	25	–	45	–	186	–
136	30	–	75	–	265	–
ML-4686	40	–	115	–	415	–
ML-4687	30	–	70	–	215	–
ML-4692	20	–	55	–	175	–

The height, width, and depth of each scar were taken at the longest, widest, and deepest points of the scar. While peel scars never completely heal, the edge bark does grow back over the scar edge to some degree (Stryd 1997). As a result, each scar in this data set appears to have partially healed, but the amount of healing is unknown. In other words, the measurements presented here are of the partially healed scar, not the scar immediately after it was peeled. The median height of the scars was 131 cm, while the largest height was 224 cm and the smallest was 27 cm. The median width was 51 cm, but the largest was 150 cm and the smallest was 10 cm. The depth of the scars varied from 20 cm to five cm, with an average of 13 cm. Some of the scars were so wide that they nearly spanned the entire circumference of the tree (IF 122, Tree 1).

Table 2: Scar Data

	Height				Width				Depth				Shape				Aspect				Distance AGS			
	Tree 1		Tree 2		Tree 1		Tree 2		Tree 1		Tree 2		Tree 1		Tree 2		Tree 1		Tree 2		Tree 1		Tree 2	
IF or Site Number	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2	Scar 1	Scar 2
40	180	–	–	–	60	–	–	–	8	–	–	–	RC	–	–	–	60	–	–	–	25	–	–	–
41	140	–	135	–	80	–	35	–	12	–	15	–	RC	–	OV	–	10	–	90	–	50	–	25	–
42	110	–	45	–	25	–	20	–	10	–	10	–	RC	–	RC	–	40	–	320	–	40	–	120	–
43	160	–	95	–	60	–	40	–	15	–	15	–	RC	–	TD	–	350	–	270	–	40	–	40	–
45	130	–	–	–	40	–	–	–	8	–	–	–	RC	–	–	–	275	–	–	–	70	–	–	–
46	110	–	–	–	20	–	–	–	?	–	–	–	RC	–	–	–	100	–	–	–	180	–	–	–
47	115	–	115	–	20	–	40	–	10	–	10	–	RC	–	?	–	240	–	165	–	40	–	30	–
49	100	–	–	–	80	–	–	–	15	–	–	–	RC	–	–	–	210	–	–	–	70	–	–	–
50	95	–	60	–	33	–	30	–	10	–	8	–	OV	–	RC	–	40	–	90	–	80	–	80	–
52	140	–	–	–	110	–	–	–	15	–	–	–	RC	–	–	–	280	–	–	–	60	–	–	–
53	150	–	–	–	40	–	–	–	12	–	–	–	OV	–	–	–	120	–	–	–	55	–	–	–
54	180	–	90	–	80	–	20	–	12	–	15	–	RC	–	RC	–	80	–	70	–	40	–	20	–
55	45	–	–	–	25	–	–	–	5	–	–	–	TR	–	–	–	250	–	–	–	35	–	–	–
57	160	–	–	–	80	–	–	–	20	–	–	–	RC	–	–	–	150	–	–	–	0	–	–	–
116	76	–	–	–	19	–	–	–	5	–	–	–	TD	–	–	–	60	–	–	–	48	–	–	–
119	190	–	–	–	55	–	–	–	8	–	–	–	RC	–	–	–	25	–	–	–	20	–	–	–
120	40	–	27	–	10	–	14	–	5	–	5	–	TD	–	TD	–	310	–	300	–	90	–	90	–
121	180	–	121	–	105	–	64	–	7	–	7	–	RC	–	OV	–	140	–	80	–	0	–	57	–
122	180	–	52	–	150	–	19	–	7	–	5	–	OV	–	TD	–	90	–	265	–	66	–	52	–
123	178	–	–	–	75	–	–	–	12	–	–	–	RC	–	–	–	110	–	–	–	0	–	–	–
125	145	–	202	–	29	–	110	–	8	–	10	–	TD	–	RC	–	220	–	100	–	0	–	0	–
126	110	116	160	158	47	20	74	47	8	12	10	10	RC	TD	RC	RC	85	225	25	260	28	32	0	45
127	95	–	–	–	48	–	–	–	7	–	–	–	OV	–	–	–	25	–	–	–	35	–	–	–
129	98	–	–	–	83	–	–	–	5	–	–	–	RC	–	–	–	180	–	–	–	25	–	–	–
132	46	–	–	–	20	–	–	–	12	–	–	–	OV	–	–	–	250	–	–	–	77	–	–	–
136	140	–	–	–	54	–	–	–	12	–	–	–	OV	–	–	–	20	–	–	–	45	–	–	–
ML-4686	185	110	–	–	60	40	–	–	20	20	–	–	RC	OV	–	–	200	340	–	–	30	80	–	–
ML-4687	145	–	–	–	35	–	–	–	10	–	–	–	OV	–	–	–	320	–	–	–	55	–	–	–
ML-4692	150	–	–	–	20	–	–	–	10	–	–	–	RC	–	–	–	30	–	–	–	35	–	–	–

OV= Oval; RC= Rectangle; TD= Teardrop; TR= Triangle;

These large scars represent intense or large-scale peelings episodes. On the other hand, some scars were so small that they were probably only "test scars" (IF 120, Trees 1 and 2).

In addition to these dimensions, each scar was given a general shape designation: rectangle, triangle, oval, or teardrop. Twenty-four)of the scars (57 percent) were rectangular-shaped, one (2 percent) was triangular, 10 (24 percent) were oval, and seven (17 percent) were teardrop-shaped. The distance of the scars above the ground surface ranged from zero (at the ground surface) to 185 cm, the average being 102 cm. Interestingly, nearly half of the trees (17 or 39 percent) had scars with an aspect between 1 and 90 degrees. Eight trees (19 percent) had scars with an aspect between 91 and 180 degrees, nine trees (21 percent) had scars with an aspect of between 181 and 270 degrees, and nine trees (21 percent) exhibited scars with an aspect of between 271 and 360 degrees. We have no explanation for why nearly half of the scars were oriented between 1 and 90 degrees; this could be an avenue for future research.

Coring Methods

To address the two questions of this paper, we had to know the approximate year the trees were peeled. These dates were determined through cores obtained from a number of the CMTs recorded in 2008 and a few previously recorded CMTs. Coring is usually done at about breast height. or approximately 4 ft, 6 in (1.37 m). A core from both the bark and the scar/s were taken (the reason for this is explained below). If the borer missed the center of the tree, or if the core was broken or inadequate in any way, a new core was attempted in a different place on the tree. If a viable core from either the bark or scar was not obtained within three attempts, the tree was ignored.

Cores were taken using an increment borer (Figure 2). The length of the borer used depended on the diameter of the tree, but most of the trees were cored with a 22 in (~56 cm) borer. Attaining a successful core required a sharp, undamaged borer bit; thus preventing the core from corkscrewing inside the borer, breaking, or making the end of the core jam in the borer tip. We also found that obtaining a viable core required cleaning and lubricating the inside of the borers with a small wad of paper towel saturated with WD-40 which kept the core from sticking to the inside of the shaft. Despite an undamaged bit and lubricated borer, however, some trees still did not core well. Some trees contained sections of dead wood within the them which often became compressed inside the bore causing it to jam. In addition, some trees were very sappy. A sappy tree caused the core to stick inside even a clean, well-lubricated bore shaft, and breaking the core was the only way to unclog the borer.

When an adequate core was obtained it was placed into a paper straw. The straw was labeled with the IF or site number and whether the core came from the bark or scar of the tree. The cores were taken to Brigham Young University where they were removed from the paper straws and glued on pieces of notched wood (Figure 3). The provenience information for each core was written on each mount. After the glue had dried for several days, the cores were sanded down almost parallel to the surface of the notched wood mount. Rough sandpaper was used for sanding the core flat; finer sandpaper was later used to make the rings more visible and easier to count. Initially we attempted to count the rings using a low-powered microscope. After the rings were counted, the number of rings from both the bark and scar cores were entered into an electronic spreadsheet (see Table 3). However, this method proved to unsatisfactory, as we learned, many rings are often missing. Not having any idea how many of the rings might be missing, we submitted cores to the University of Arizona Dendrochronology Lab in order to gain greater accuracy. The inadequacy of counting rings was proven when we received dates back from the lab and compared them to the dates from counting the rings.

Figure 2. Photo of Rich Allen and Jake Skousen coring tree.

Question 1: When were the trees peeled?

The first question asked in this paper was related to when the trees were peeled. When attempting to obtain the calendar date by counting rings, the number of rings in the scar core is subtracted from the number of rings from the bark core (which we had hoped represented the age of the tree). The differences are then subtracted from the year the trees were cored (in this case 2008). We also made an attempt to take account of some the rings that might be missing from the cores by adding the average number of rings from saplings in the project area that were 4 ft 6 in (1.37 m) tall (the rings from the early growth of a tree will not be present when the core is bored at breast height). Despite the effort expended using the above method we came to realize that critiques of the method of age calculation described above are valid (Swetnam 1984). We believe the ring counting method produces dates that are not reliably accurate, and in some cases could be off by dozens of years. Simply counting rings from cores will not produce reliable dates, as we learned. The only substitute that is recommended is that one use a coring strategy that will allow for date clustering (Towner and Galassini 2010). This entails collecting four cores from a tree, one from the scar, one from the bark surface, and two that penetrate the area where the bark is growing over the edges of the peel scar; known as the “curl.” Dates from the peel scar represent maximum potential dates since an unknown number of rings are missing from the cambium that was peeled off (Dean 1996). These dates are therefore close approximations; we do not know for sure how close. Furthermore, dates from the bark taken from the curl area may penetrate the scar and can therefore be compared to the dates taken from scar cores. Because our coring strategy from the

Table 3. Peeling Dates

Location	Tree No.	Scar No.	Maximal Date from outside of the scar	Interior Scar Date	Comments
ML 3665	1	1	–	–	Undatable
ML 3665	1	2	–	–	Undatable
ML 3665	2	–	–	–	Complacent
ML 3665	3	–	1882 + vv	–	–
ML 3666	2	1	1790 + vv	–	–
ML 4692	1	"Bark"	–	1841 ±	Complacent
IF 40	1	1	1857 + vv	–	–
IF 43	1	1	1839 + vv	–	–
IF 45	1	1	–	–	undatable
IF 47	1	1	1842 + vv	–	–
IF 54	1	1	1867 + vv	–	–
IF 57	1	1	1844 + vv	Post 1851	–
IF 121	1	1	1840 + vv	–	–
IF 123	1	1	1824 + vv	Post 1829	–
IF 125	1	1	1849, 1848 + vv	1849	–
IF 126	1	1	1842 + vv	–	–
IF 126	1	2	1883 + vv	–	–

bark end did not take cores from the curl area of the trees, we have dates from them that may represent post-injury responses to a peeling event the same as that of the scar or perhaps some other post-injury response or peeling event. In our sample the maximum dates from the scars may not be too far off if IF-57 is an indication. It was missing just seven rings from the cambium. Therefore, we argue that these dates give us a good approximation of when these trees were peeled and can aid in inferring who peeled them.

From the CMTs cored in 2008, 17 cores were intact enough that we submitted them to the Dendrochronology Lab at the University of Arizona. Using the cross-dating from their collections, a total of 13 cores have tentative maximum dates for the peeling events (Table 3). The cores show that trees in Joe's Valley were being peeled perhaps as early as A.D. 1790 to as late as post-A.D. 1883. Furthermore, many peelings occurred between these two dates. Overall, just one was peeled prior to 1800 (likely the sample may include more if dates were obtained for all the trees recorded), and the other 12 (92 percent) trees were peeled between 1800 and 1900. Therefore, according to this limited sample, tree peeling in Joe's Valley occurred for approximately one century. Interestingly, the maximal dates for the peeling events range from 1839 to the late 1850s, precisely the period of intense contact with Europeans, and the period when indigenous tribes were pushed off their traditional land-use areas.

Question 2: Who peeled the trees?

To answer the second question, we combine the dates obtained from the cores and what we know about the culture history of Joe's Valley. Archaeological investigations indicate that the Joe's Valley area was visited by Native Americans for thousands of years (Montgomery and Montgomery 2000); however, the dates recovered from the CMT cores span from A.D. 1790 to A.D. 1883, which correspond to the end

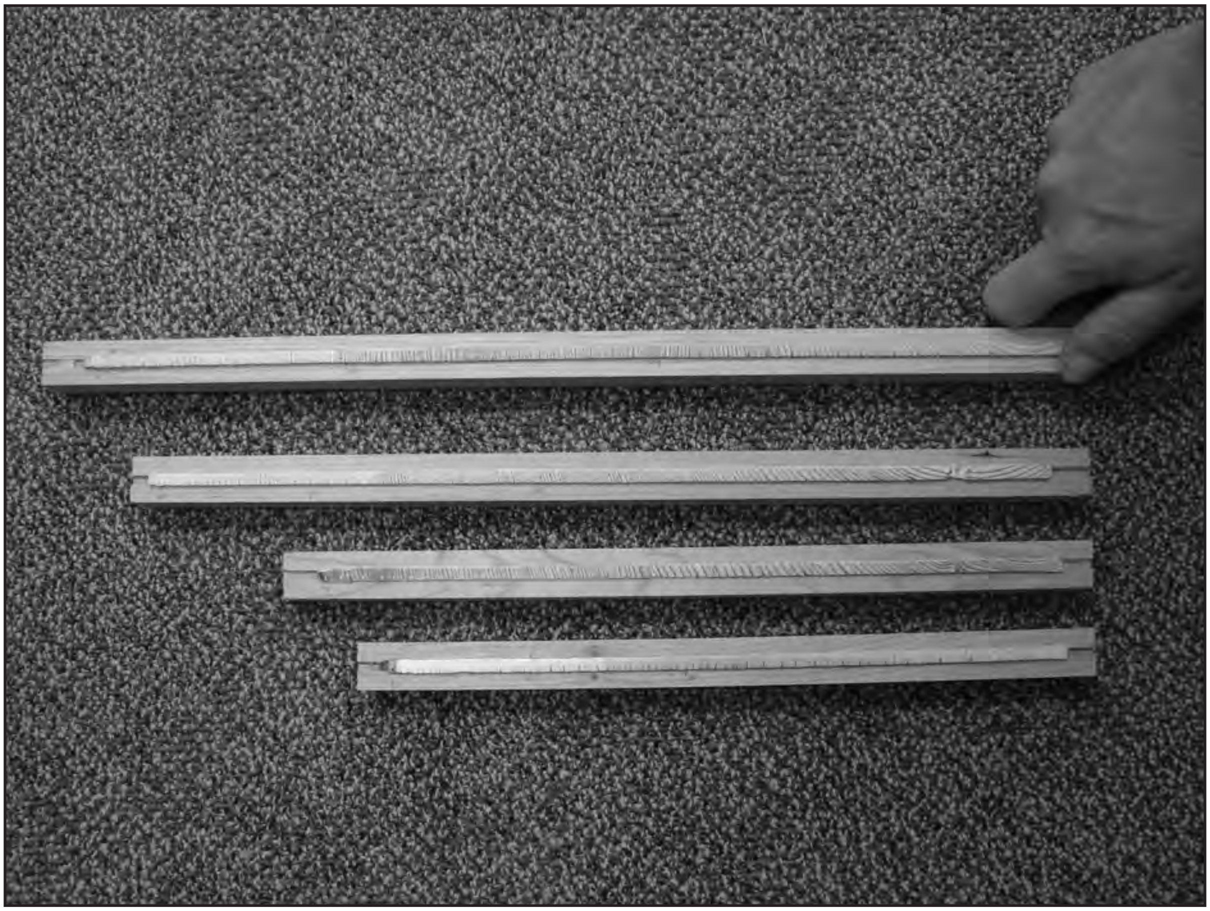


Figure 3. Photo of mounted tree cores.

of the Late Prehistoric and the beginning of the Historic period. Therefore, we will discuss the culture history of the Wasatch Plateau during these two periods; focusing specifically on the Native American, European, and Euro-American groups that may have lived in or visited Joe's Valley during this time.

In general, historic accounts from European explorers indicate that central Utah was sparsely populated but well within Ute Indian territory (Duncan 2000; Geary 1996). Little is known about the territories of the various Ute bands that frequented this area, particularly before European contact. Territorial boundaries were usually vague, although major geographic features (such as mountain ranges) probably separated different bands (Duncan 2000).

The Sanpitch and Sheberetch—both small, desert-dwelling Ute bands—were the two Native American groups that most likely visited the Wasatch Plateau during the periods in question. The Sanpitch band, which came from the Sanpete Valley, were said to have had an intimate knowledge of the plateau (Geary 1996). They crossed the plateau on their way to Castle Valley, which they used as a hideaway for horses stolen during the Walker War in the 1850s and Blackhawk War in the 1860s (Geary 1992, 1996; Powell 1979; Taniguchi 2004). Whether Sanpitch visits to the plateau became popular before or after Chief Walker began his raids is unknown, as is the extent of their knowledge of the plateau. Numerous Indian trails were noted on the plateau (Geary 1992, 1996; Powell 1979), but it is unclear whether the Sanpitch band was responsible for them.

The Sheberetch band probably visited the Wasatch Plateau as well. John R. Swanton (1974:373) includes the Sheberetch band in his subdivision of Ute groups in Utah and places them in the vicinity of Joe's Valley. According to Duncan (2000), the area east of the Wasatch Range and south of the San Rafael River was inhabited by the Sheberetch. Furthermore, historical documents allude to the location of the Sheberetch band. A U.S. Army detachment met several "Sivareechee Utah Indians" (probably the same as the Sheberetch band) on Cottonwood Creek (Geary 1996:38). However, the extent to which the Sheberetch visited the Wasatch Plateau is unknown because their encounters with settlers were rare.

European incursions into Ute territory began with Spanish and Mexican traders in the early 1800s. They established the Old Spanish Trail which wound its way to the east and south of the Wasatch Plateau. Most of the interaction between the traders and Ute Indians at this time was the result of the Indian slave trade (see Duncan 2000; Taniguchi 2004). Furthermore, trappers began traversing Utah in the 1830s and had some contact with the Ute groups. When traveling through Sanpete Valley in 1834, W. A. Ferris and his trapping party encountered a group of "*Sann-Pitch*" Utes (Ferris 1983). Ferris mentioned that this group brought back "the inner bark of the pine, which has a sweet acid taste, not unlike lemon syrup" from the mountains (Ferris 1983:345).

Over time, contact with European and American groups had a profound impact on many Ute bands in this part of Utah. Ute hunting grounds, for example, were depleted by Mormon settlements established in the 1850s (Duncan 2000). In fact, the Sheberetch were probably abandoning Castle Valley by the onset of Mormon settlement because Indian encounters are only documented during this period of time. Shortly thereafter, there were no more encounters mentioned in historical records (Jensen et al. 1949). One of the most obvious impacts was the relocation of many Ute bands by U.S. government. During the late 1860s, the Sanpitch band was gradually relocated to the Uintah Reservation. The last summer they stayed in Sanpete Valley was in 1872 (Duncan 2000). The fate of the Sheberetch is less certain, but it is believed that they were absorbed in to the Uintah Band and relocated to the Uintah Reservation as well (Duncan 2000).

This brief history reveals that a number of different groups were near Joe's Valley during the time of the peeling episodes and therefore could have been responsible for the peelings. However, two of the peeling episodes (ML-3666, Tree 2; IF 123) clearly took place before European contact; therefore, native Ute groups were most likely responsible for these peelings. We also know that Ute bands (i.e., the Sanpitch band) continued peeling trees during the historic period, so peelings in the historic period may have been performed by these same bands. It is possible that the later peeling episodes (after 1872) were performed by cattle and sheep ranchers, lumberjacks, or both. In other words, it is possible that other groups peeled the trees after this time.

Summary and Conclusion

In the first part of this paper, we discussed previous research on CMTs and described 48 CMTs from Joe's Valley, Utah. After discussing coring methods, we also discussed the dates of the peeling episodes. Cores taken from thirteen of the 40 CMTs yielded tentative peel dates from A.D. 1790 to A.D. 1883, or during the Late Prehistoric and Historic periods. Finally, we proposed that native populations were responsible for most of the peelings that date prior to the expulsion of Ute bands from the area. While other populations may have been responsible for peeling episodes in the historic period, the historical accounts show that native Ute groups, particularly the Sanpitch band, were still peeling trees during European contact and settlement. We also know that the

Sheberetch band was located in the area and may have peeled trees as well. In short, it is possible that native populations during the historic period were peeling trees in Joe's Valley. However, two peeling episodes likely correspond to the time after indigenous Ute groups were relocated to other parts of Utah, which may imply that other groups were peeling trees. On the other hand, it is feasible that these same Ute groups periodically visited their homeland to hunt and gather traditional resources, including the bark of Ponderosa Pine trees.

If nothing else, this study is useful because it provides data on Utah CMTs; a unique data set that has received little attention. It also outlines methods for coring CMTs, which is crucial for future research on the dates of CMTs. However, we believe this study has important implications for Utah prehistory as well. First, it shows that tree peeling was a widespread phenomenon. The only other area that we know contains a significant amount of CMTs is the Uinta Mountains (DeVed and Loosle 2001; Loosle 2003). In addition, this study suggests that the practice of peeling trees in Utah may be older than previously thought and continued for a long time. In the few papers that discuss the age of Utah CMTs, DeVed and Loosle (2001) and Loosle (2003) suggest that tree peeling in the Uinta Mountains was the result of relocated Ute groups from Colorado. In other words, peeling trees was a Colorado Ute phenomenon, not a practice of Ute groups near the Uinta Mountains. However, our study strongly suggests that tree peeling was indeed practiced by some Utah Native Americans. Evidence for this includes nine trees in our data that may have been peeled before any Native American relocation took place. In fact, the greatest concentration of peeling events appears to have taken place just prior to the removal of the Ute from their traditional lands. Additionally, few of these trees were peeled in the early to mid 1800s when historical accounts document native Ute groups peeling trees. Finally, it is worth noting the continuity of this practice from the wide chronological spread (approximately 100 years) of peeling activity. The persistence of this practice from the Late Prehistoric period into the late nineteenth century indicates that tree peeling was a significant Native American tradition in Joe's Valley. ■

Acknowledgements: *We thank Charmaine Thompson and the Manti-LaSal National Forest for their support and encouragement with this project. Elaine Alexander graciously donated time to help us get started on coring trees. Stan Kitchen from the USDA Forest Service provided the borers and other supplies needed for this project as well as many insights into coring procedure. Finally, we thank Dr. Matthew Becker of Brigham Young University for allowing us to use his tree ring lab, providing materials for mounting the cores, and imparting valuable suggestions regarding tree coring.*

Richard Allen
Department of Anthropology
Brigham Young University
Provo, UT 84602
E-mail: ilamatepeque@yahoo.com

B. Jacob Skousen
Department of Anthropology
Brigham Young University
Provo, UT 84602
E-mail: jake_skousen@yahoo.com

References

Dean, Jeffery S.
1996 Dendrochronology and the Study of Human Behavior. In *Tree-Rings, Environment, and Humanity*, edited by J.S. Dean, D.M. Meko, and T.W. Sweetnam, pp. 461–471. University of Arizona, Tucson.

DeVed, Lawrence, and Byron Loosle
2001 Culturally Modified Ponderosa Trees on the Ashley National Forest. *Utah Archaeology* 14:1–13.

Duncan, Clifford
2000 The Northern Utes of Utah. In *A History of Utah's American Indians,* edited by Forrest S. Cuch, pp. 167–224. Utah State University Press, Logan.

Emery County Historical Society
1981 *Emery County, 1880–1980*. Emery County, Utah.

Ferris, Warren A.
1983 *Life in the Rocky Mountains: A Diary of Wanderings on the Sources of the Rivers Missouri, Columbia, and Colorado, 1830–1835*, edited by Leroy R. Hafen. Old West Publishing Company, Denver, Colorado.

Geary, Edward A.
1992 *The Proper Edge of the Sky: The High Plateau Country of Utah*. University of Utah Press, Salt Lake City.
1996 *A History of Emery County*. Utah State Historical Society, Emery County Commission, Salt Lake City.

Jensen, Naomi, M. Keller, B. Winters, S. Larsen, and M. Seely
1949 *Castle Dale*. In Castle Valley: A History of Emery County. Edited by Stella McElprang. Emery County Company of the Daughters of Utah Pioneers.

Loosle, Byron
2003 So Delicious They Ate the Bark Off the Trees. Electronic document, http://www.fs.fed.us/r4/ashley/heritage/ethnography/, accessed November 7, 2008

Martorano, Marilyn A.
1981 *Scarred Ponderosa Pine Trees Reflecting Cultural Utilization of Bark.* Unpublished Master's Thesis, Department of Anthropology, Colorado State University, Fort Collins.
1989 So Hungry They Ate the Bark Off a Tree. *Canyon Legacy* 9–12.

Montgomery, Keith R. and Jacki A. Montgomery
2000 *Cultural Resource Inventory of the Miller Flat Road Improvement Project in Lower Joe's Valley, Emery County, Utah, MOAC Report 00–49*. Montgomery Archaeological Consultants, Moab.

Powell, Allan K.
1979 *Emery County: Reflections on its Past and Future*. Utah State Historical Society, Salt Lake City.

Stryd, Arnoud H.
1997 *Culturally Modified Trees of British Columbia: A Handbook for the Identification and Recording of Culturally Modified Trees*. British Columbia Ministry of Forests.

Stryd, Arnoud H. and V. Feddema
1998 Sacred Cedar: The Cultural and Archaeological Significance of Culturally Modified Trees. Electronic document, http://www.davidsuzuki.org/files/SacredCedar_sm.pdf, accessed October 20, 2008.

Swanton, John R.
1952 *The Indian Tribes of North America*. U.S Government Printing Office, Washington, D.C.

Swetnam, Thomas W.
1984 Peeled Ponderosa Pine Trees: A Record of Inner Bark Utilization by Native Americans. *Journal of Ethnology* 4(2):177–190

Taniguchi, Nancy J.
2004 *Castle Valley America: Hard Land, Hard-Won Home*. Utah State University Press, Logan.

Towner, Ronald and Stacy Galassini
2010 Cambium-Peeled Trees in the Zuni Mountains, New Mexico. Paper presented at the 2010 meeting of the Society for American Archaeology, St. Louis.

White, Thain
1954 *Scarred Trees in Western Montana*. Montana State University Anthropology and Sociology Papers, No. 17, Bozeman, Montana.

An Application of ArcGIS Viewshed Analysis in Range Creek Canyon, Utah

Shannon Arnold Boomgarden
Department of Anthropology, University of Utah

This paper examines the visibility of numerous remote granaries located in Range Creek Canyon of central Utah. Of the more than 400 sites recorded in the canyon, approximately twenty-five percent are storage facilities. These include granaries, (above ground storage) cists, (subterranean or semi-subterranean storage) and caches of tools or raw materials. Many of these are located in highly visible but difficult to access locations (remote granaries), while others are easily accessible but well-hidden. This pattern may represent two strategies for protecting stored resources: one in which the storage facility is plainly visible and can be easily monitored and another in which resource stores are hidden and left unattended. Using viewshed analysis, the visibility of granaries from the valley floor and from prehistoric residential sites is assessed and quantified. Recent high resolution Digital Elevation Models and georeferenced aerial photographs allow an accurate reconstruction of what is visible from each granary, i.e. archaeological sites, the valley floor and defensive vantage points. This paper will test the hypothesis that granaries are visible from the valley floor and positioned in view of residential sites. If correct, the function of this defensive positioning may be to monitor access to granaries from a distance.

Range Creek Canyon is located in the West Tavaputs Plateau of east central Utah (Figure 1). Range Creek itself is a perennial stream and a tributary to the Green River. The canyon ranges in elevation from 10,000 feet at Bruin Point to about 4,000 ft at its terminus, 30 miles to the south. It is extremely rugged and isolated, bounded by Nine Mile Canyon to the north and the Book Cliffs to the east and south. In 2002, the University of Utah became involved in archaeological research in lower Range Creek Canyon. The University of Utah and Utah Museum of Natural History have since held field schools in Range Creek Canyon each summer. Over 400 sites have been recorded including, residential locations (defined by circular surface rock alignments and charcoal stained soil), artifact scatters, rock art panels, and storage facilities.

Approximately twenty-five percent of the sites recorded in Range Creek Canyon are identified storage facilities, including granaries and cists. The construction materials, sizes, and shapes of granaries vary, but of particular interest are the locations of these features. For the purpose of this study, the granaries are grouped into two categories based on location and difficulty of access. The first includes “remote” granaries. These are located away from residential sites, on difficult-to-access cliff faces and ledges (Figure 2). They appear to be highly visible from many points on the valley floor and adjacent ridgelines. The second category includes cists and granaries located closer to the valley floor, thus more accessible from nearby residential sites, but well hidden in their natural surroundings (i.e., boulder fields, alcoves and crevices) (Figure 3). These two categories may represent two storage strategies: (1) one in which stored goods are put on display in difficult to access locations where they can be monitored to prevent theft; and (2) one in which goods are hidden in easily accessed locations close to home. These strategies are similar to examples of hoarding reported in the animal behavior literature but differ in interesting ways worthy of investigation (Vander Wall 1990).

Hoarding Theory

The practice of hoarding food has evolved independently among many animal species. Vander Wall (1990:43) explains the term “food

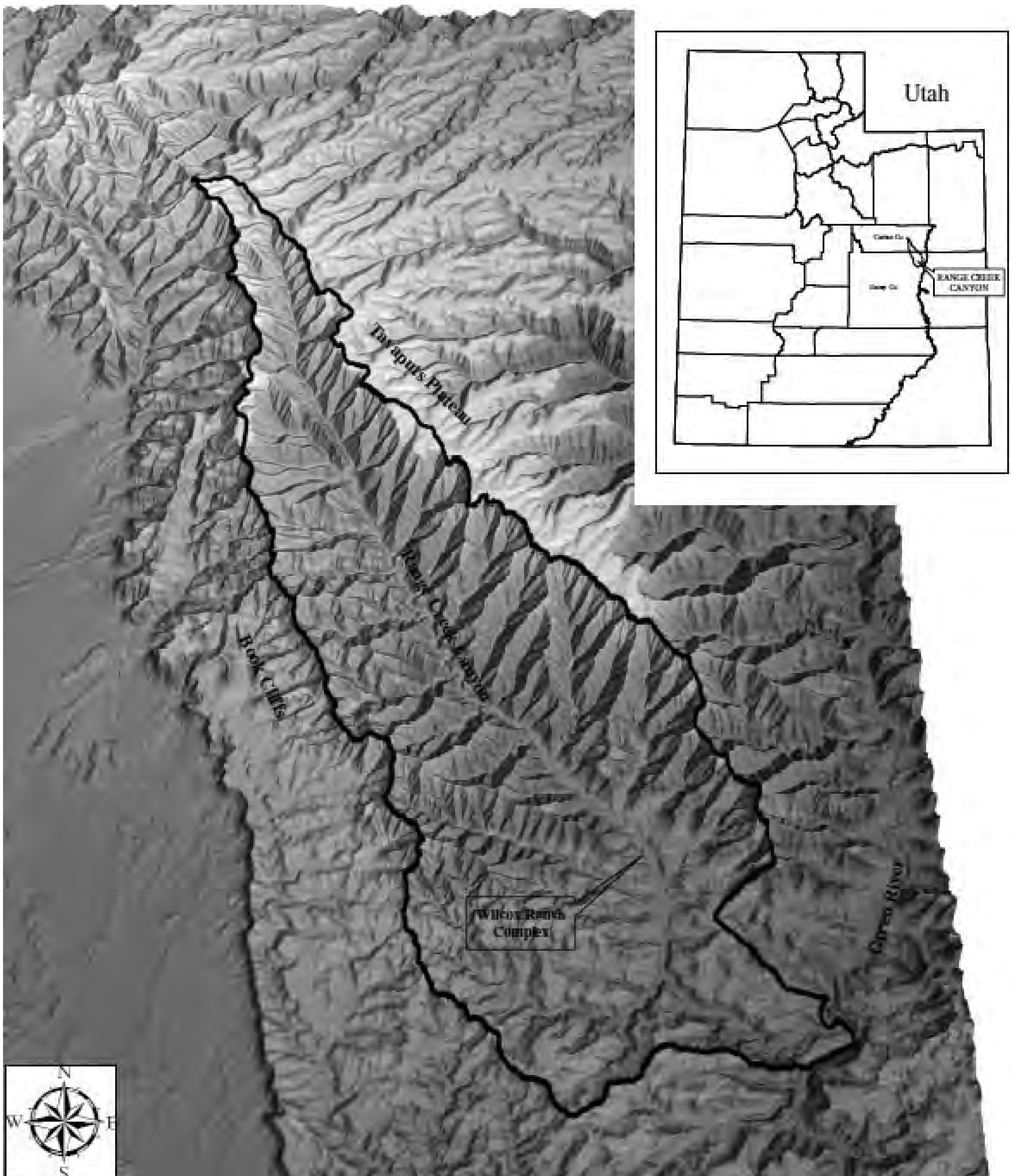


Figure 1. Relief map of Range Creek Canyon showing the surrounding land forms. Inset shows location of Range Creek Canyon in Utah. Boundary line indicates drainage limits.

hoarding" as covering "a variety of behaviors that are united by two common criteria: postponement of food consumption and food conservation through special handling." These special handling activities include hiding small amounts of food to be eaten daily and

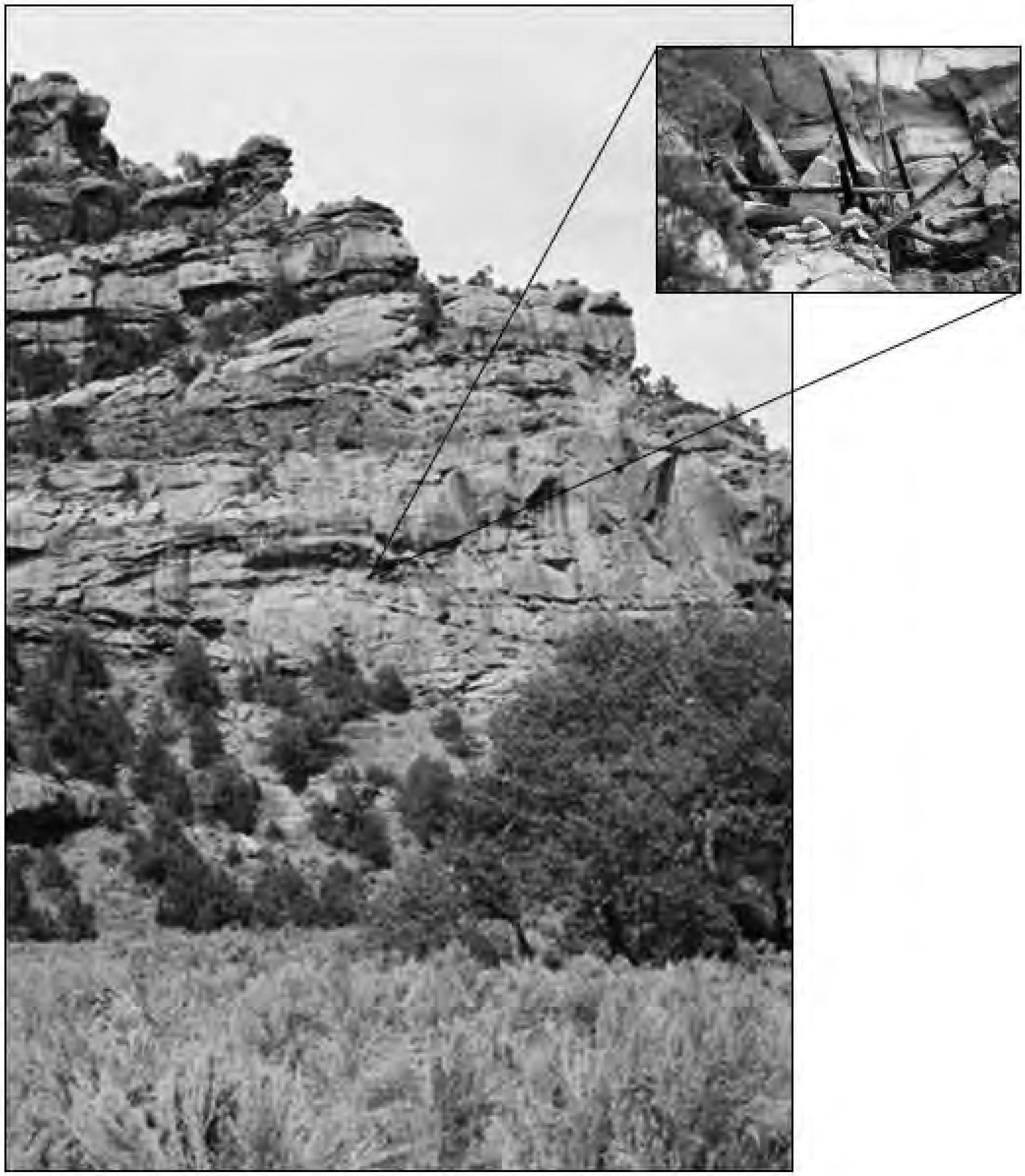


Figure 2. Photograph of remote granary. Inset shows a close up of granary built on man-made platform perched on cliff face.

sequestering larger quantities to be recovered during times of food scarcity. Methods of storage range between larder hoarding (storing a large amount of food in one location) and scatter hoarding (distributing food items at more than one location across a home range). Vander Wall's review of the diverse number of animals that store food suggests that "the environmental conditions that promote hoarding are widespread and the behavioral precursors to hoarding are not uncommon" (1990: 43).

The adaptive value of hoarding food has been expressed in a mathematical model by Andersson and Krebs (1978). The authors demonstrate that if an animal recovers a significant amount of stored food the fitness gain will exceed the costs

Figure 3. Photograph of hidden but easily accessible cist.

associated with hoarding and the behavior will be selected for and should continue in a population. If stored food is not recovered in a sufficiently high proportion, then the cost of hoarding may be too great and the practice will either fail to develop or disappear.

In Range Creek Canyon remote granaries appear to share a combination of the scatter hoarding and larder hoarding characteristics discussed by Vander Wall (1990). Three factors determine the distinction: (1) the amount of food stored at a single location; (2) the distance of the cache from the hoarder's residence; and (3) whether the cache is actively guarded. Scatter hoards are typically hidden and left unattended. They are usually numerous and contain only small amounts of a resource so that if one is pilfered, the contents rot, or the location itself is somehow forgotten, the hoarder does not lose everything (Figure 4). Animals practicing scatter hoarding behavior typically do not return to their caches until food is retrieved. Larder hoards are usually fewer in number, contain a larger amount of the resource, and are situated closer to the hoarder's residence, making them easy to access and actively defend (Vander Wall 1990).

Thus, in Range Creek Canyon, it appears that the small cists and granaries hidden in easily accessible locations (i.e., boulder fields and alcoves) are much like the scatter hoarding strategy. On the other hand, the "remote" granaries are more like larder hoards in size but they are scattered across the landscape in difficult-to-access but highly visible and easy to monitor locations. Thus, while they are not actively guarded they are protected from pilferage by their difficulty to access and high visibility. In this situation the cost of guarding is reduced. Placing a granary on public display increases the number of witnesses and spreads the cost of guarding among all participants. This

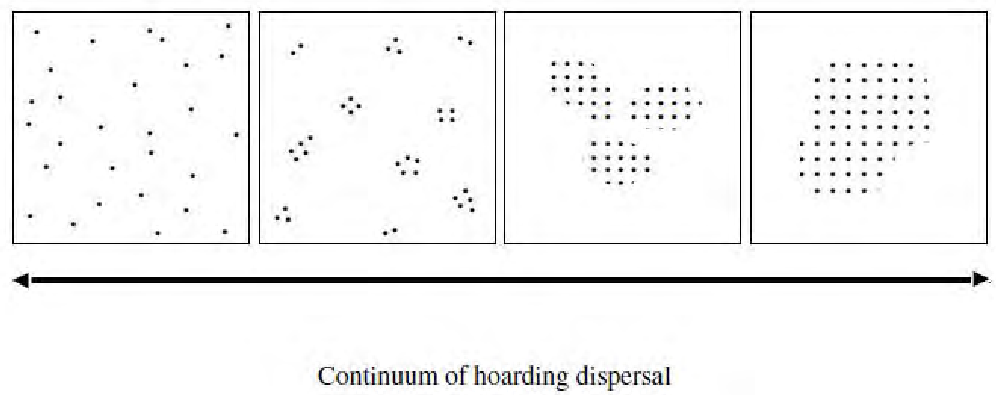


Figure 4. Scale of hoarding behavior with scatter on the left and larder on the right, modified from Vander Wall 1990.

increases the benefits of locating granaries in such seemingly costly locations.

This ability to monitor remote granaries from a distance might be the key to what is going on in the storage strategies in Range Creek Canyon. Foragers used a mixed strategy that combines characteristics of both scatter hoarding and larder hoarding. Granary location enables the forager to monitor and defend from a distance. To investigate this strategy further, it is necessary to quantify the visibility of remote granaries.

Visibility and Viewshed Analysis

This study uses viewshed analysis to quantify the visibility of the remote granaries in Range Creek Canyon. Ideas about visibility and intervisibility have always been important in archaeological research. Much of the archaeological interest in visibility studies has focused on the placement of monuments and settlements across the landscape (Wheatley 1995; Fisher et al. 1997; Woodman 2000; Llobera 2001; Jones 2006) and has applications for cultural resource management and planning (Batchelor 1999). Modern visibility analyses today calculate a line-of-sight map (or viewshed) for a location using digital models of surface topography. Viewshed calculations determine what areas can be seen from a given viewing location and determine whether a direct line-of-sight exists (intervisibility) between a set of features (Wheatley and Gillings 2002). Viewsheds calculated for each granary in this study, demonstrate whether the granary can be seen from areas along the valley floor and residential sites.

Every calculation in a viewshed analysis takes place using a continuous grid that represents the surface typology of the project area. Each cell of the grid has a built in elevation. This grid is called a Digital Elevation Model (DEM). In viewshed analysis, the visibility between each grid cell (or numerous grid cells) and each surrounding cell can be computed. Visibility is calculated by measuring the tangent from an observation point placed within a cell to each surrounding cell starting from cells closest to the observation point (in this case each granary). As long as the tangent increases in line-of-sight from the observation point, the cell is considered visible. If the tangent decreases, the cell is not considered visible. O'Sullivan and Unwin (2003) compare this function to an imaginary profile drawn from a single view point on the landscape to every other point on the DEM (Figure 5). Successive heights along each profile are listed, where they cross a grid line, and are used to determine whether or not the point is visible (O'Sullivan and Unwin 2003: 241–242). Once a viewshed is calculated, each cell in the DEM receives a value, "one" for visible and "zero" for not visible. The final output can be displayed with only the visible areas indicated (Figure 6).

The methods used in this analysis focus on field-of-view concepts. Wheatley and Gillings (2002) define field-of-view as the total area visible from a given point on the landscape. The viewsheds calculated in this way produce a field-of-view for a point assigned to each granary site. Each granary was set as the 'observer point' and a viewshed was calculated. It is assumed that all cells falling within its field-of-view have an unobstructed view of the granary.

Granaries with a wide field-of-view should be more common in Range Creek Canyon if monitoring them from below was advantageous to the foragers. Granaries visible from a wide area are more easily defendable both when foragers are in the immediate area and able to actively watch and defend stored goods, as well as when foragers are conducting other activities within the viewshed of a granary (i.e., the larger the viewshed) the greater the number of potential witnesses. Remote granaries with the widest field-of-view will be those located well above the valley floor and perched on cliff walls with nothing blocking visibility. As well as being highly visible, the precarious positioning makes remote granaries extremely difficult to access, but only visibility will be investigated here.

Methods

To generate the viewsheds for each granary several data layers were needed as input into ArcGIS 9.2. First was the 2 m resolution DEM for Range Creek Canyon. This is a continuous grid of 2 x 2 m cells with an elevation for every cell. The second layer of input was an observer point for each granary site. These were acquired from the IMACS site forms and GPS receivers from the University of Utah's Range Creek Canyon database. A third input layer was an estimate of locations on the valley floor from which the granary could be monitored (as opposed to cliffs, ledges, ravines, etc.). This was generated by buffering 50 m on either side of a line representing the creek, thus creating a 100 m corridor that represents a conservative estimate of the valley floor (Figure 6). While this is not the most accurate measure of the entire "valley floor," it allows viewsheds generated for granaries located in narrow parts of the canyon to be compared to viewsheds generated for granaries located in wide parts of the canyon while keeping the width of the valley floor corridor constant. The final input layer was a point layer indicating the location of every prehistoric residential site from the Range Creek Canyon spatial database.

Using the 3D Analyst extension in ArcGIS 9.2, individual viewsheds were generated for seventy-two granary sites, fifty-five in the main canyon and seventeen in side drainages. Figure 6 shows one example of a viewshed output overlapping the valley floor corridor layer. The area where each viewshed overlapped the valley floor corridor was calculated for each of the fifty-five granaries located in the main canyon. The distance along the valley floor corridor (usually north to south) where the viewshed overlapped was estimated in ArcGIS using the ruler tool. In order to increase the reliability of the estimates, I took all distance measures at the same resolution and took each measurement several times then calculated the average. Figure 7 demonstrates how measurements were consistently taken along the valley floor corridor from along the center (the creek) of the area where the viewshed overlapped the corridor.

Viewsheds were also used to estimate the intervisibility between granaries and residential sites; those with surface rock alignments and charcoal staining. The residential sites were displayed and counted if they fell within the viewshed of a granary.

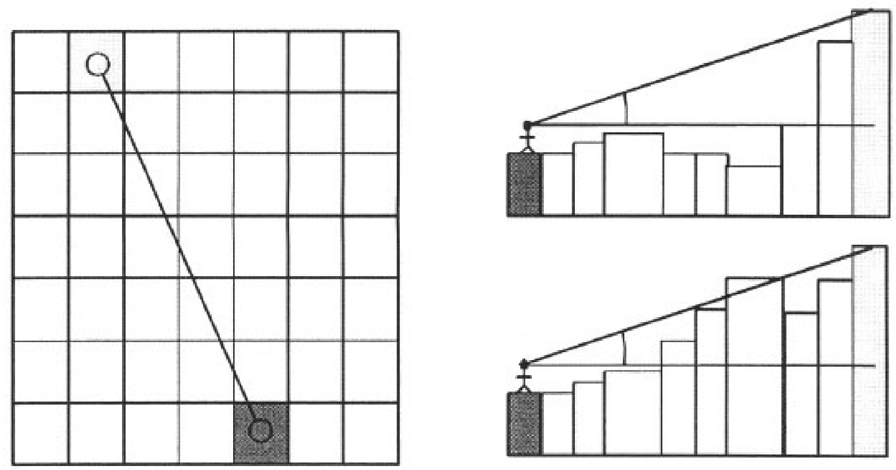


Figure 5. Illustration of how line-of-sight is calculated on a grid, modified from O'Sullivan and Unwin (2003).

The next step was to obtain direct measures of visibility. First, Larry Coats (Department of Geography, University of Utah) used technical climbing gear to access several remote granaries where he took photographs of the area of the valley floor with an unobstructed view from the granary (Figure 8). Second, ground crews with GPS receivers, documented the extent to which they could view Coats and the granary. When the human derived and ground truthed viewsheds were compared to computer generated viewsheds, the results varied. Generally, the computer generated viewsheds tend to be greater than the area actually visible by the human eye (Figure 9). This occurs because computer analysis considers only topography and visibility is equal to the line-of-sight between two grid cells. What is clearly visible to the human eye is subjective and differs from a computer simulation but the ground truthing strategy showed all of the granaries sampled to be highly visible from the valley floor corridor. As the viewer neared the furthest extent of the viewsheds on either end of the corridor, the exact location of the granary sometimes became difficult to make out but the access routes to the granary were still quite visible.

Results

All of the granaries in the main canyon had a viewshed of at least 100 m overlapping the valley floor corridor and many viewsheds covered much greater distances (Figure 10). This demonstrates that the granaries are indeed not hidden.

Of the seventy-two granaries sampled, twenty-seven had one or two residential sites within their viewsheds, whereas twenty-three had between three and eight (Figure 11). This means that people conducting daily activities could have looked up and monitored the remote granaries on the cliffs around them. A field check confirmed these findings. While standing on site 42Em3066, the locations of twenty-nine sites were clearly visible, nine were remote granaries. This area is not the norm for Range Creek Canyon because it is a particularly wide open area of the canyon with a high density of sites. Field checks from additional sites will provide a more representative sample of this phenomenon.

The accuracy of computer generated viewsheds is conditioned by the accuracy with which granaries can be located on the DEM. Locations of granaries in the Range Creek Canyon database were assigned using GPS

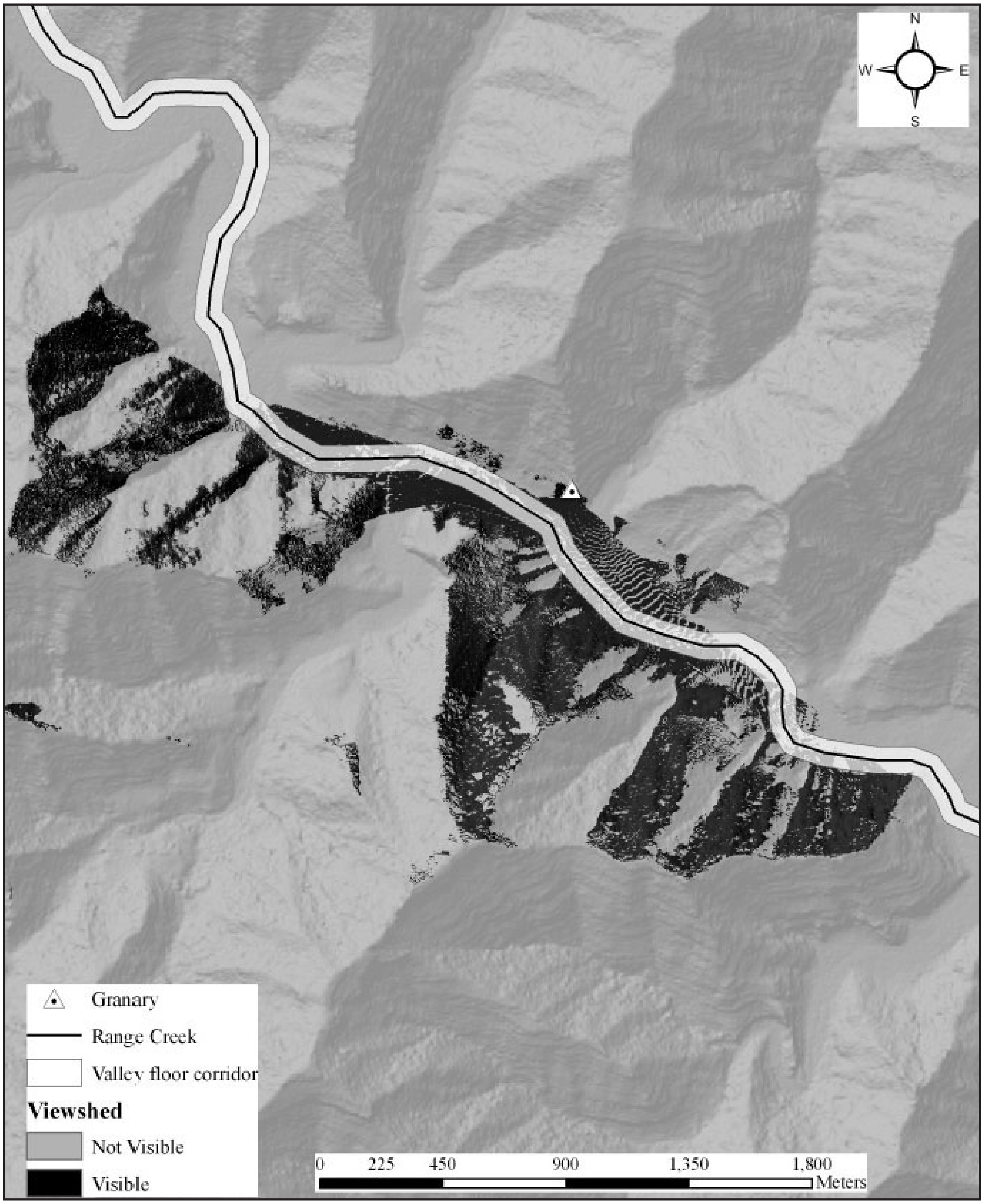


Figure 6. Hillshade map showing example of a computer generated viewshed output overlapping the valley floor corridor (corridor measures 50 meters on either side of Range Creek). Areas visible from the granary are shown in black.

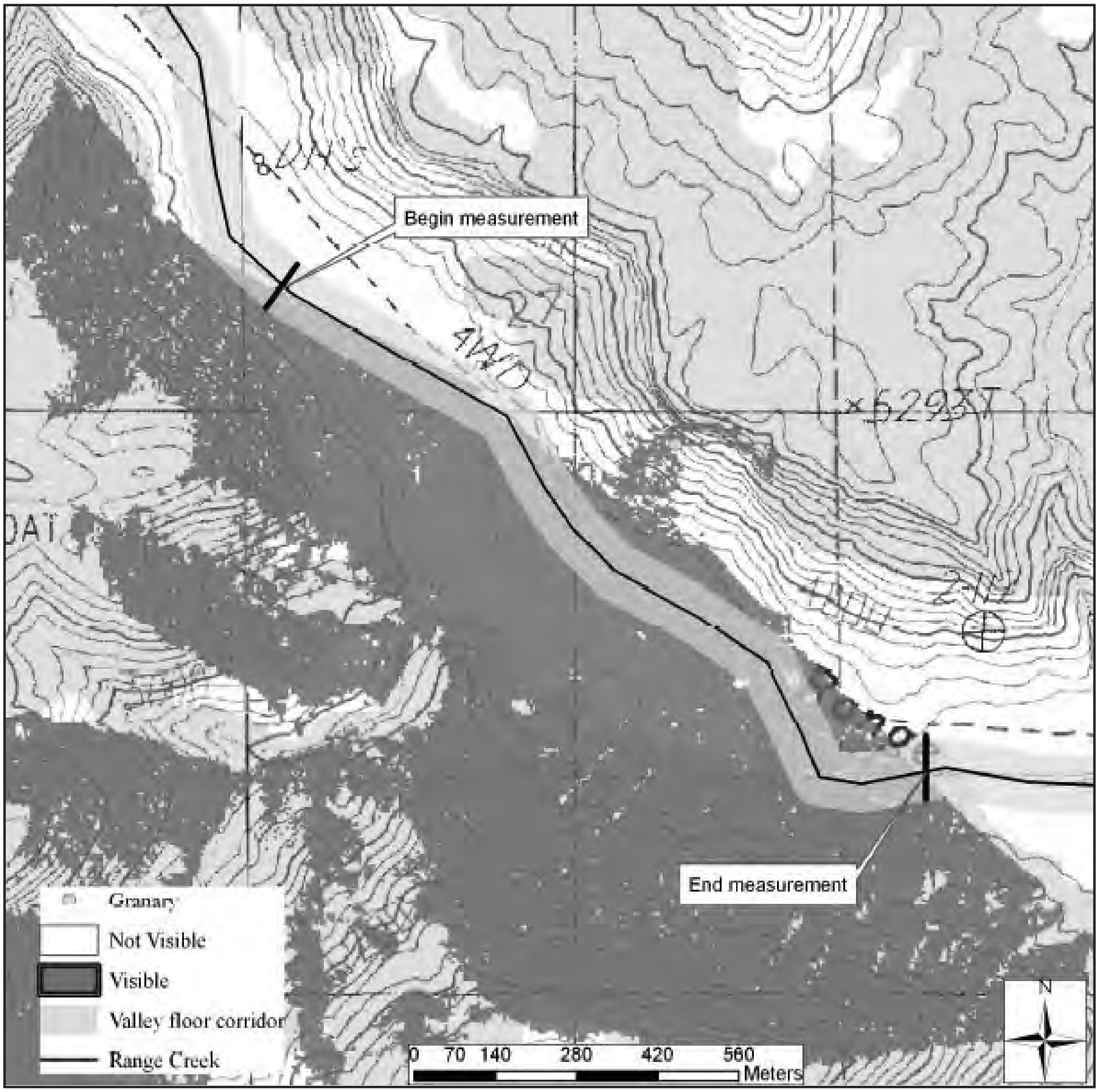


Figure 7. Topographic map showing the overlapping viewshed and valley floor corridor. The distance visible along the corridor was measured as a line down the center (Range Creek) of the overlapping area using the ArcGIS measuring tool.

derived UTMs or by crews hand plotting sites on topographic maps. Unfortunately, due to the inaccessibility of many of the remote granaries, taking a GPS recording adjacent to the granary itself is very difficult.

Many remote granary locations were recorded away from the actual granary and their true location was estimated. How, then, does the lack of accuracy in placement affect our estimates of visibility? To address this question, the locations of a sample of granary points were recalculated using a reflector-less total station. The total station was set up on the valley floor below each granary and the UTM location of the machine was recorded. The distance of the granary above the total station was recorded and added to the

Figure 8. Photograph taken by Larry Coats from a remote granary showing the visible area along the valley floor.

total station elevation to get the vertical location of the granary (Figure 12).

Viewsheds were regenerated based on the new locations of thirteen granaries. Viewsheds generated from locations recorded with GPS and topographic map estimates were compared to those refined with the total station (Figure 13). The expectation was that if the refined location was at a higher elevation then the original, viewshed would increase and the visibility would be greater along the valley floor corridor. If the refined location was lower in elevation then it would be expected that the viewshed would decrease and the visible distance along the valley floor corridor would be smaller. We were interested in whether the results changed systematically from the originally recorded location and the locations refined by the total station. We found that half of the refined viewsheds were smaller and half were larger than those previously generated (Figure 14). Increasing the accuracy of the remote granary location did not systematically change the estimates of visibility in either direction. Even with the refined locations, all of the granaries were still visible from significant distances along the valley floor corridor.

Conclusion

Despite its limitations, viewshed analysis demonstrates that remote granaries in Range Creek Canyon are visible from the valley floor. This conclusion is supported by computer generated estimates and visual assessment. Measurements reported here probably underestimate the visibility of granaries because they only examine site visibility from a conservatively defined valley floor corridor 50 m on either side of the creek. The actual valley floor is significantly wider in many areas. These estimates do not take into consideration the visibility of numerous routes by which granaries might be accessed by thieves

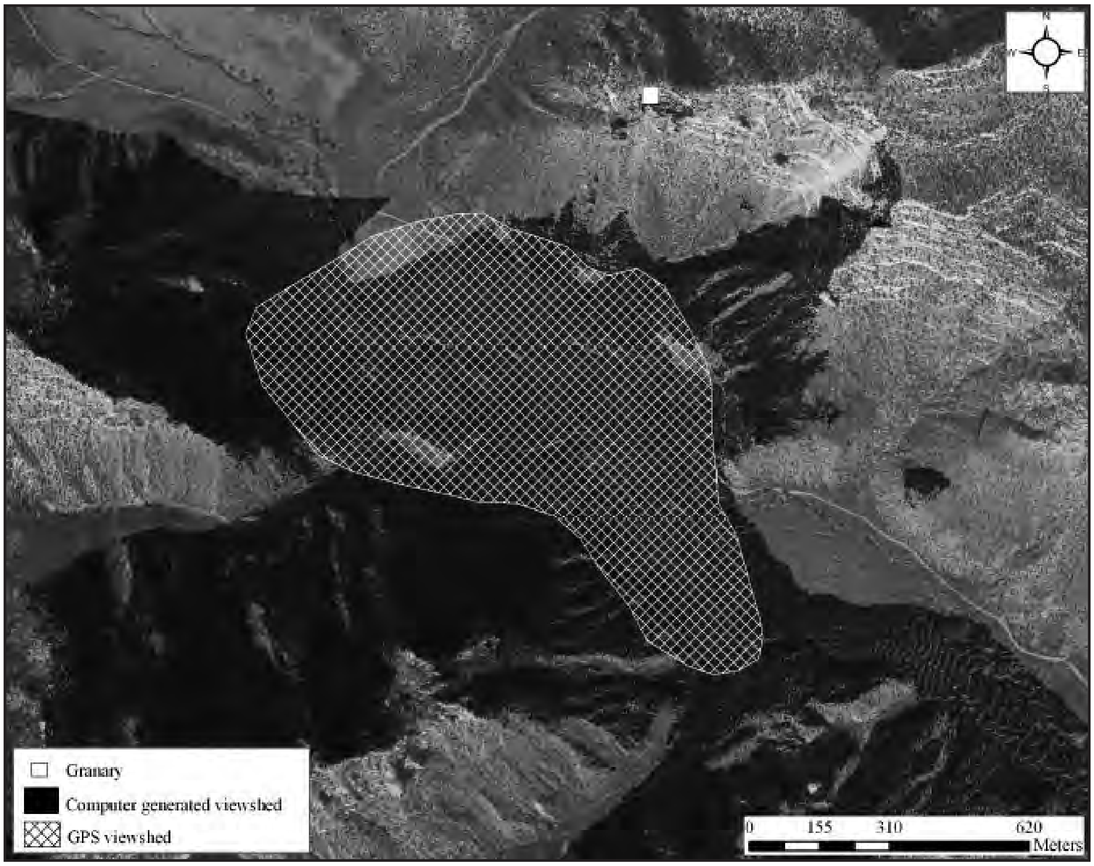


Figure 9. Aerial photograph showing the overlap of a computer generated viewshed and viewshed recorded by a GPS receiver estimating the area visible to the human eye.

as well, which may be a major consideration for a forager when choosing a granary location.

However, ArcGIS does not produce a very robust estimate of visibility. This is especially true in areas like Range Creek Canyon that have such varied topography but may be less true in areas lacking the extreme relief of this canyon allowing more precise measurements. Thus, analyzing differences between viewsheds calculated for each granary is likely to be misleading because the visible distance is only an estimate, providing more of a range of visibility rather than an exact measure. Nonetheless, the majority of granaries are visible from one or more structural sites considered residential in nature and some granaries are visible from six or more residential sites.

Nothing in this analysis contradicts the original proposition that placing granaries in visible locations is a storage strategy designed to deter theft. The odds of identifying a pilferer approaching or entering a granary is a function of how many potential witnesses are present. A larger viewshed means more potential witnesses. Given the difficulty of accessing these granaries, a pilferer would be forced to move carefully and commit to the action early on in its execution.

Having a line-of-sight view to multiple granaries from the valley floor would allow these facilities to be guarded by a relatively small number of individuals who could participate in other activities while monitoring access routes to remote granaries. This might be especially important if a significant number of Fremont

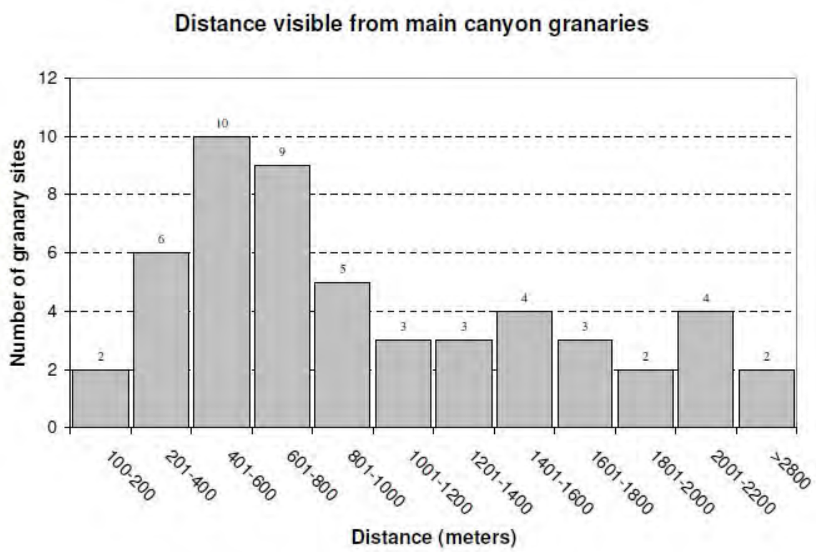


Figure 10. Histogram showing the distance visible along the valley floor corridor calculated for fifty-five granaries in the main canyon.

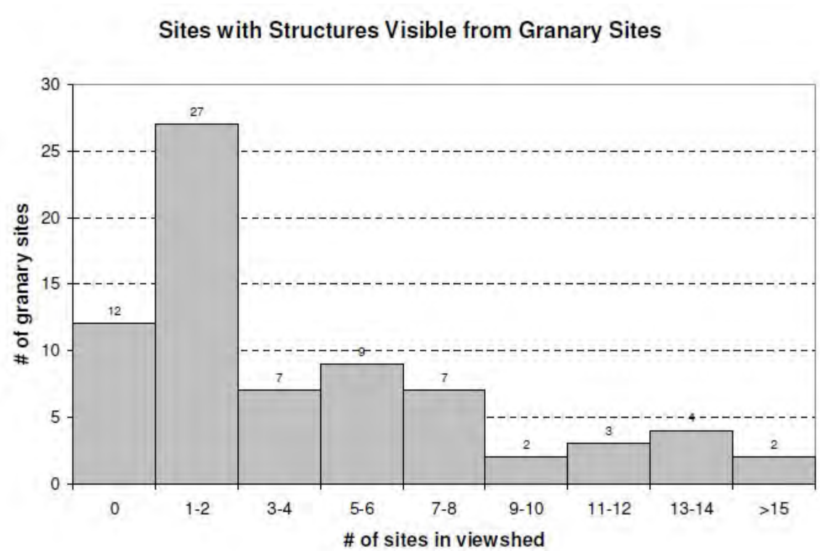


Figure 11. Histogram showing number of residential structures visible within each viewshed for seventy-two granaries in Range Creek Canyon and associated side canyons.

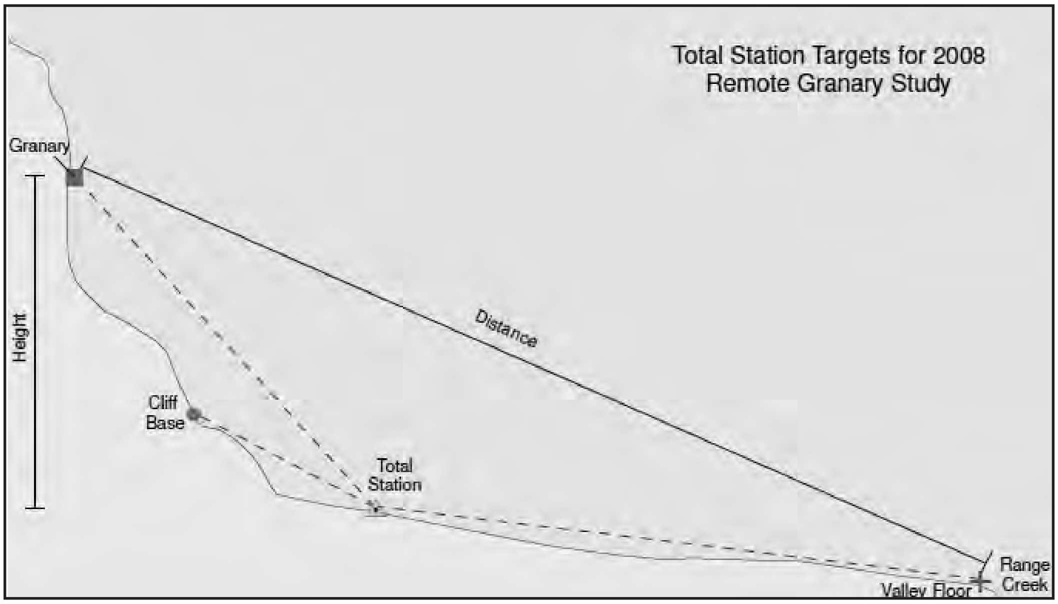


Figure 12. Schematic showing the targets for refining vertical locations of granaries using the reflector-less total station. The total station was set up below each granary and the UTM location recorded. The distance of the granary above the total station was recorded and added to the total station elevation to get the vertical location of the granary.

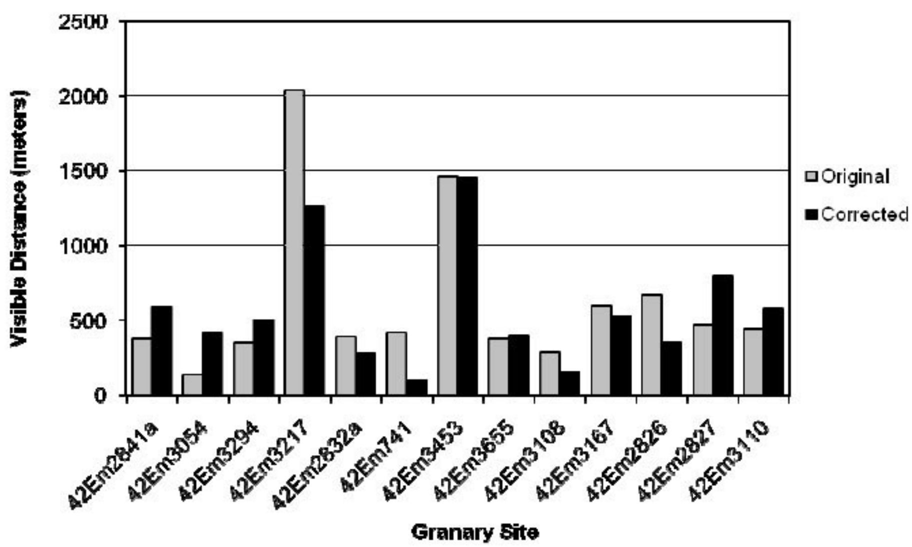


Figure 13. Histogram showing the change in visibility along the valley floor corridor for viewsheds generated from original plotted locations and locations refined by the total station for thirteen sample sites.

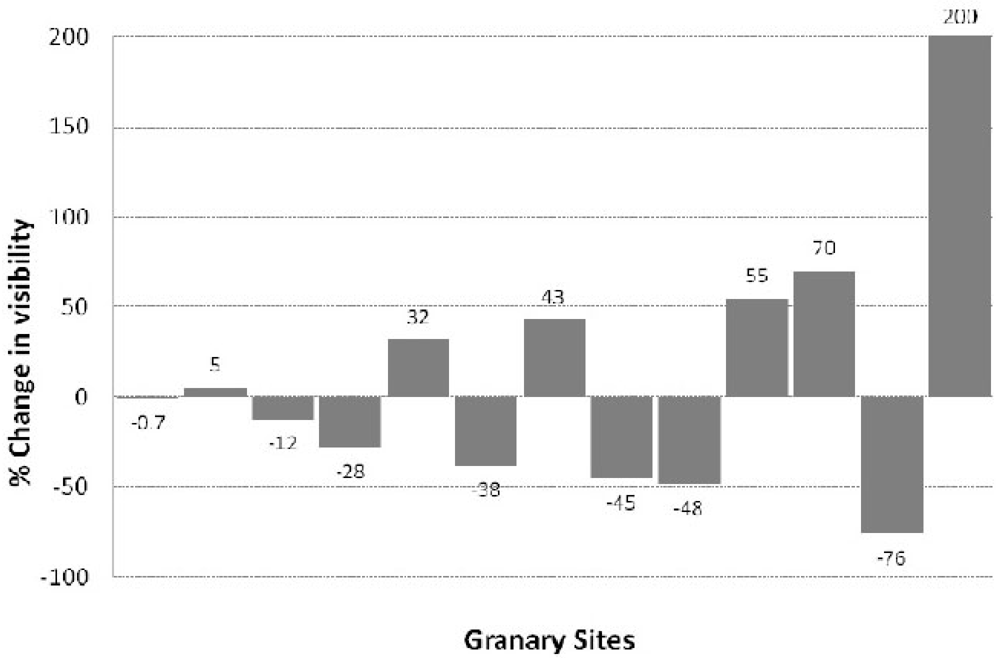


Figure 14. Histogram showing the percentage of change in visibility along the valley floor corridor, positive and negative, between viewsheds calculated from refined total station locations and earlier estimates.

foragers left the area seasonally to hunt and gather wild resources elsewhere. Fewer people would be necessary to remain in the canyon to guard stored resources. ■

Acknowledgements: I would like to thank Duncan Metcalfe for his support and guidance and Larry Coats for his help in accessing remote granaries. Thanks to Joel Boomgarden, Jamie Clark, Joan Coltrain, Rachelle Green, James O'Connell, Chris Parker, and Corinne Springer for comments and suggestions and to the field school students for their help and patience.

Shannon Arnold Boomgarden
Department of Anthropology, University of Utah
270 South 1400 East, Stewart Building
Salt Lake City, Utah 84112

References

Andersson, Malte and John Krebs
1978 On the Evolution of Hoarding Behaviour. *Animal Behaviour* 26:707–711.

Batchelor, Dave
1999 The Use of GIS for Archaeological Sensitivity and Visibility Analysis at Stonehenge, Avebury and associated sites, World Heritage Site, United Kingdom. In *GIS and Cultural Resource Management: A Manual for Heritage Managers*, edited by P Box, UNESCO, Bangkok.

Fisher, Peter, Chris Farrelly, Adrian Maddocks, and Clive Ruggles
1997 Spatial Analysis of Visible Areas from the Bronze Age Cairns of Mull. *Journal of Archaeological Science* 24(7):581–592.

Jones, Eric E.
2006 Using Viewshed Analysis to Explore Settlement Choice: A Case Study of the Onondaga Iroquois. *American Antiquity* 71(3):523–538.

Llobera, Marcos
1996 Exploring the Topography of Mind: GIS, Social Space, and Archaeology. *Antiquity* 70:612–622.

O'Sullivan, David, and David Unwin
2003 *Geographic Information Analysis*. John Wiley and Sons, Hoboken, New Jersey.

Vander Wall, Stephen B.
1990 *Food Hoarding in Animals*. University of Chicago Press, Chicago.

Wheatley, David
1995 Cumulative Viewshed Analysis: A GIS based method for investigating intervisibility, and its archaeological application. In *Archaeology and Geographic Information Systems: a European Perspective*, edited by Gary R. lock and Zoran Stancic, Taylor & Francis: London.

Wheatley, David and Mark Gillings
2000 Vision, perception and GIS: developing enriched approaches to the study of archaeological visibility. In *Beyond the Map: Archaeology and Spatial Technologies*, edited by Gary R. Lock, NATO Science Series A: Life Sciences, IOS Press, Amsterdam.
2001 *Spatial Technology and Archaeology: The Archaeological Applications of GIS*. Taylor & Francis, London.

Woodman, Peter
2000 Beyond Significant Patterning, Towards Past Intentions: the Location of Orcadian Chambered Tombs. In *Proceedings of the UK Chapter of Computer Applications and Quantitative Methods in Archaeology 1999*, edited by Caitlin Buck, Vicky Cummings, Cole Henley, Steve Mills and Steve Trick, Archeopress, Oxford.

The Distribution of Gaming Pieces Across the Fremont Culture Area with a Focus on the Parowan Valley

Molly A. Hall
Department of Anthropology. Brigham Young University

Fremont gaming pieces, though common in archaeological sites, have been largely ignored as a useful data set in understanding the Fremont way of life. Classification systems used in previous analyses of gaming pieces were inadequate for comparing data between sites, so a new system has been devised based on the presence and absence of decorative elements. The gaming pieces from Parowan Valley sites tend to differ in decorative style from the sites located outside of the Parowan Valley, especially those on the Colorado Plateau and in the northern Great Basin. The high quantity of gaming pieces within the Parowan Valley suggests that the locality was the focus of large aggregations of Fremont people in regular, festival-like circumstances.

For over 100 years, archaeologists have routinely classified small, rectangular pieces of worked bone from Fremont artifact assemblages as gaming pieces. This function was imposed upon this class of worked bone artifacts based on limited ethnographic data (see Gunnerson 1969; Judd 1926; Talbot et al. 2000; Wormington 1955). A recent examination of ethnographic literature reveals that the key characteristics of gaming pieces used in hand and dice games of Native North American groups are also the prominent features of Fremont gaming pieces (Hall 2008:68–74).

Stewart Culin (1992 [1907]:36–43) reports that a majority of Native American groups (128 out of 223 in his study) participated specifically in some form of "dice game". In the ethnographic records, gaming pieces are generally rectangular or sub-rectangular in shape, must have two rapidly distinguishable sides (since games are usually played at a very fast pace), and must be of a size that can easily fit into one's hand. Though the particulars varied from group to group, hand games incorporated the hiding of a gaming piece in one of several teammates' hands and the subsequent attempt by the opposing team to discover its location. The equally popular dice games were played by tossing numerous gaming pieces from baskets, ceramic bowls, or one's hands onto a surface and tallying points according to the combination of sides which land "face up" (Brunton 1998; Culin 1992 [1907]; MacFarlan 1958)

Additionally, among ethnographic groups gaming activities are highly associated with large aggregations of people. The two most common games (the dice and hand games) played by the Eastern Shoshone during times of aggregation both involved bone gaming pieces (Shimkin 1986:322–323). It is therefore not unreasonable to speculate that large aggregations and festivals, including gaming activities, were regular events in the lives of the Fremont people of the Great Basin (for a more detailed discussion of ethnographic games and gaming paraphernalia and their relationship to Fremont gaming pieces (see Hall 2008:29–39, 68–75).

Though some details vary, Fremont gaming pieces are generally rectangular pieces of worked bone which have been flattened on the ventral side by grinding and retain a slight curve on the dorsal side. Moreover, the dorsal side is commonly adorned with partially drilled dots, incised lines, or both. The combination of these two characteristics yields a piece with one flat, undecorated side and one curved, decorated side, making the two broad sides easily distinguishable. The pieces tend to range from 4–6 cm in length, certainly a size which fits comfortably in one's hand (see Figure 1).

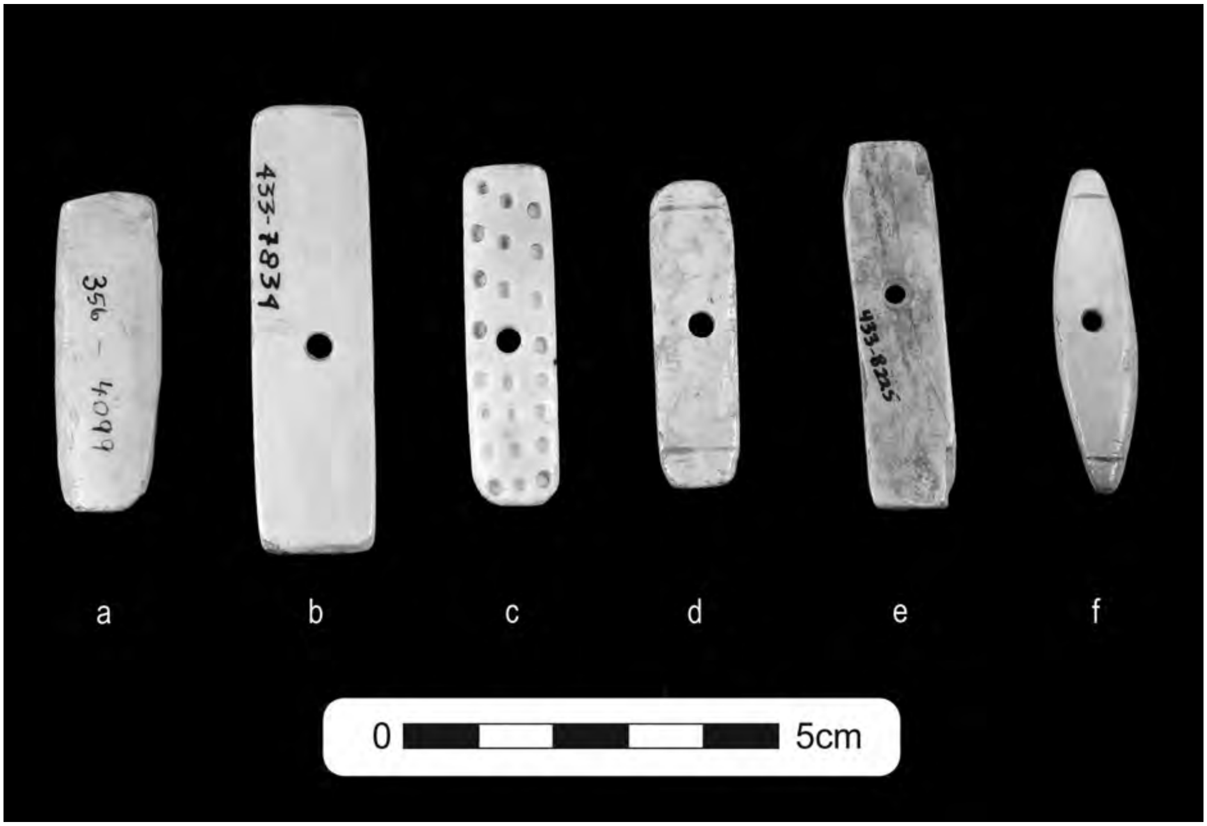


Figure 1. Gaming pieces from the PVAP collection.

These gaming pieces are common in Fremont archaeological assemblages, but have long been ignored as a source of valuable information about Fremont culture and are rarely discussed in more that descriptive terms (for exceptions, see Gunnerson 1969; Talbot et al. 2000; Wormington 1955).

Fremont Gaming Pieces and Typologies

The Fremont, an archaeological culture, inhabited the northern Colorado Plateau and eastern Great Basin from approximately A.D. 1 to 1350 (Talbot 2000). Worked bone artifacts, specifically those frequently called "gaming pieces," are consistently present across the Fremont culture area but are abundant within the Parowan Valley and a few other sites (see Figure 2). Gaming pieces have been recognized as a characteristic of Fremont assemblages since as early as Judd's excavations in the 1910s (Judd 1926). These pieces of worked bone are abundant in Fremont assemblages, appearing as the second most frequent worked bone artifact class in Fremont sites (Gunnerson 1969:141; Janetski 2002:361; Wormington 1955) and appearing in sites throughout the Fremont culture area, ranging from the Bear River #2 Site in the north to Circle Terrace in the south; Baker Village in the west to Turner-Look in the east. Intriguingly, bone gaming pieces, though abundant in the time of the Fremont, do not appear in the archaeological record within the Great Basin during the preceding Archaic or subsequent late Prehistoric time periods. Nor are they found in surrounding regions during the time of the Fremont, with the exception of a few pieces found in Anasazi sites (Dalley 1970; Judd 1926; Shutler 1984).

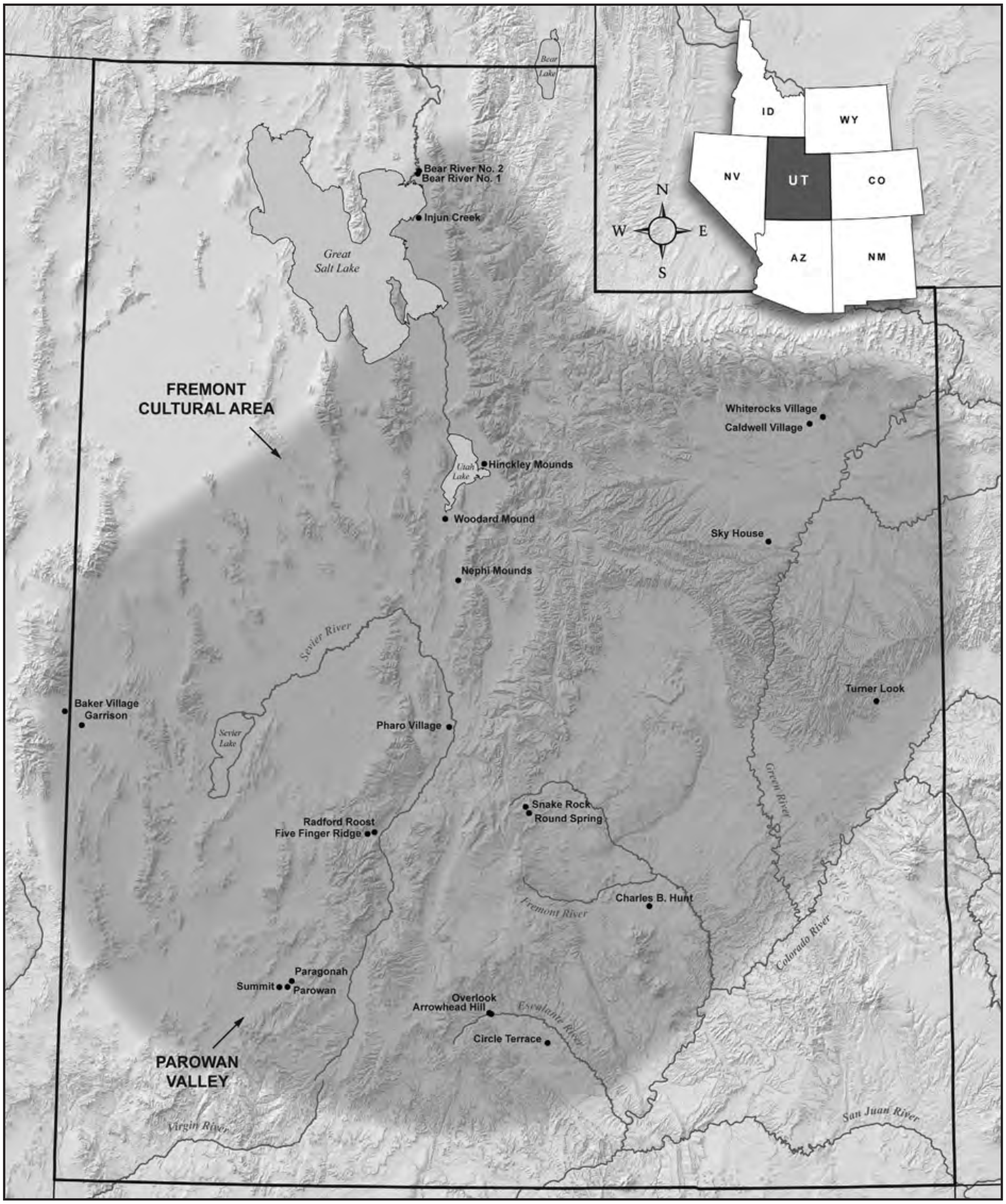


Figure 2. Map of Fremont culture area, Parowan Valley, and Fremont sites with gaming pieces.

In past technical reports on Fremont artifact assemblages three loose typologies have been presented and subsequently used in the analysis of gaming pieces. The first typology for analyzing and reporting gaming pieces was devised by Gardiner Dalley (1970:101) in his report on the worked bone from Median Village. He established three classes for gaming pieces: Type A consisted of centrally-drilled pieces, Type B was made up of pieces which had been broken and then reworked, and the Type C category was a catch-all group for everything else. Twelve years later, Duncan Metcalf divided the gaming pieces from the University of Utah excavations at Summit into the following categories: Class I, "characterized by a general lack of finish"; Class II, pieces with a high degree of finish; and Class III, centrally-drilled pieces (Metcalf 1982:84). Finally, in the report on excavations at Five Finger Ridge, Talbot et al. (2000) slightly altered Dalley's 1970 classification system. This typology retained a separate class for centrally drilled pieces (Type A), akin to Dalley's Type A and Metcalf's Class III. Additionally, this typology contained a newly named class, "preforms" (Type B), which mirrored Metcalf's Class I. Lastly, the classification reflected back once again to the earlier typologies by using a "catchall" category (Dalley's Type C and Metcalf's Class II) to accommodate the diverse group of complete pieces which are neither centrally drilled nor unfinished. Numerous other site reports, dating from as early as 1938, contain descriptions of worked bone gaming pieces, but they lack an innovative classification and later reports generally reference Dalley (1970) or Talbot et al. (2000) when classifying gaming pieces.

The Parowan Valley Archaeological Project Collections

The gaming pieces newly analyzed for this study come from excavations in the Parowan Valley of southwestern Utah which took place in the 1950s and 1960s and were conducted by the University of California, Los Angeles (UCLA) and the College of Southern Utah (CSU, presently Southern Utah University, or SUU).

The Parowan Valley is located approximately 20 miles northeast of Cedar City in southwestern Utah, on the eastern edge of the hydrographic Great Basin (see Figures 2 and 3). The mountains to the east are drained by creeks which periodically likely flowed into the Little Salt Lake in the valley bottom. It is on three of these perennial drainages—Red, Summit, and Parowan Creeks—that the three largest sites in the Parowan Valley—Paragonah (42IN43), Summit/Evans Mound/Median Village (42IN40/44/124), and Parowan (42IN100)—are situated. These large sites are found in close proximity to one another, with a maximum distance of 15 km separating any two sites (see Figure 3).

As of 1973, "the Parowan Valley [had] probably been the scene of more [Fremont] archaeological activity of varying quality than any other part of Utah" (Marwitt 1970:5). After being described in early historical accounts and explored by United States Geological Survey parties, the archaeology in the Parowan Valley became a focus of crews collecting artifacts for museums and even the 1893 World's Columbian Exhibition (Janetski 1997). In 1915, Neil Judd conducted the first professional work in the valley at the site named Paragonah (42IN43).

Ten field seasons were spent excavating in the Parowan Valley by UCLA between 1954 and 1964. These excavations focused on the sites of Paragonah (42IN43), Parowan (42IN100), and Summit (42IN40). The only publications resulting from this work are a summary of the 1954 excavations (Meighan et al. 1956) and a preliminary report on the 1962 excavations (Alexander and Ruby 1963). These excavations have gone largely unpublished and practically ignored for almost fifty years, until the start of the Parowan Valley Archaeological Project (PVAP), discussed in more detail below.

At some point in the early 1960s, archaeologists and students from CSU excavated at Summit for an unknown length of time. Unfortunately, all of the notes from these excavations have been lost (Barbara Frank, personal communication 2007), but the artifact catalog which assigns artifacts to

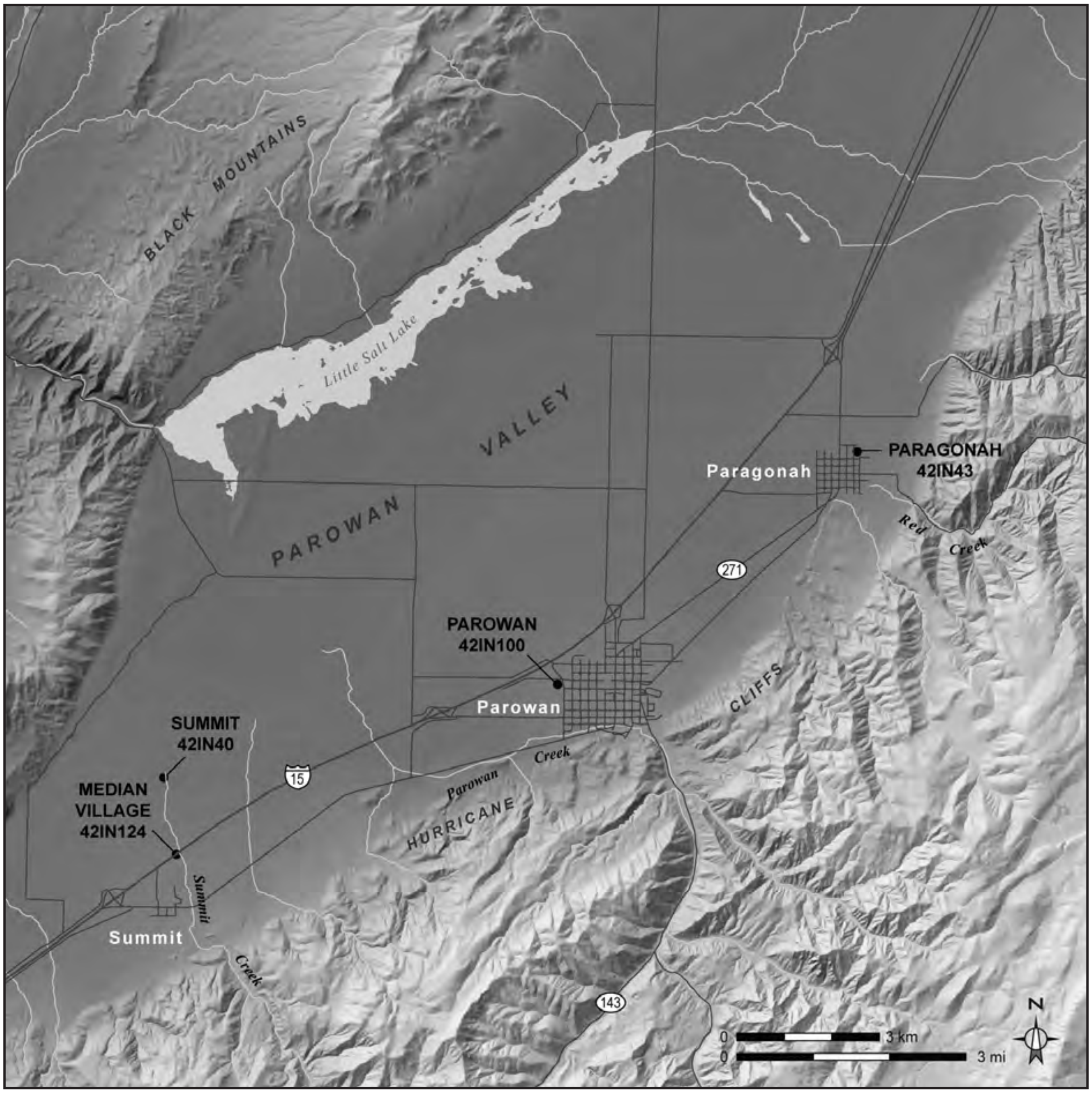


Figure 3. Map of the Parowan Valley and major sites.

various excavation grids, features, and structures is still available and from it a relative site map has been constructed (SUU Excavations Site Map, Parowan Valley Archaeological Project notes, Museum of Peoples and Cultures, Provo, UT). In addition to UCLA's and CSU's work, the University of Utah spent four seasons at Summit from 1970 to 1973. These excavations are well reported in the literature, so they will not be addressed here (Berry 1974, 1972a, 1972b; Dodd 1982).

The Parowan Valley Archaeological Project

In 1999, Joel C. Janetski and Richard K. Talbot of the Department of Anthropology and Office of Public Archaeology (OPA) at Brigham Young University (BYU) began a reexamination of the archaeological investigations done by UCLA in the Parowan Valley. Shortly thereafter, BYU acquired the extensive collection of artifacts and field notes from UCLA's willing and supportive Fowler Museum. PVAP is a collective effort involving professionals and students from BYU, the Fowler Museum of Cultural History at UCLA, and the Archaeology Repository at SUU. Its goals are to address sociopolitical and other research questions regarding the Fremont through the examination of existing collections (Janetski et al. 2001). With some notable exceptions, such as the University of Utah reports mentioned above, most of the data languish unpublished and the limited synthesis work, while crucial, is grossly inadequate. Therefore, the project also seeks to fill this gaping hole in the literature pertaining to this much-excavated region. The ultimate goal of the project is to publish the results of all of the previously described work so that the data from these archaeologically rich sites can be easily accessed by researchers.

As part of the research associated with PVAP, BYU and OPA sent numerous UCLA wood and charcoal samples to various laboratories for dating analysis, and conducted a literature search of dates obtained by the University of Utah. They acquired a total of 36 radiocarbon dates and seven tree-ring dates, most of which fall into Talbot et al.'s (2000) late Fremont era, A.D. 900–1350 (Dates, Parowan Valley Archaeological Project notes, Museum of Peoples and Cultures, Provo, UT). Additionally, portions of the UCLA collections have been analyzed and reported as M. A. theses (Hall 2008; Jardine 2007; Watkins 2006; Woods 2009) and future monographs are planned in the BYU Museum of Peoples and Cultures Occasional Papers series.

As part of the PVAP artifact collections there are over 5,200 worked bone artifacts including 1,224 gaming pieces and gaming piece fragments from the three sites. Most Fremont artifact assemblages currently reported contain fewer than 25 gaming pieces per site. Round Spring, Five Finger Ridge, and Turner-Look stand out, having 56, 58, and 171 pieces respectively. Notable within the Parowan Valley assortment of gaming pieces are many probable "preforms," previously recognized as unfinished gaming pieces (Dalley 1970; Metcalf 1982; Talbot et al. 2000).

Analysis Methods Including a New Classification System for Fremont Bone Gaming Pieces

It was clear from cursory investigations of the PVAP artifacts that there were extremely high raw quantities of bone gaming pieces in the collections from Paragonah, Parowan, and Summit. Initial analysis began with a simple sort of the assemblages by artifact type. As the analysis of worked bone began, it was clear that previous analysis methods used for bone gaming pieces were not sufficient to record and analyze all of the possibly significant characteristics of said pieces. Therefore, a new, slightly more detailed analysis system which is heavily reliant on Dalley (1972), Metcalf (1980), and Talbot et al. (2000) was created.

Once a worked bone piece was identified as a gaming piece using the characteristics described above, the next step was to identify whether or not it was a preform by carefully examining all the surfaces of the artifact for remnants of flake scars and grinding striations. Preforms are unfinished pieces which retain some flake scars around the edges from early stages of production and have no decorative features (see Figure 4). Gaming pieces were made by first roughly shaping a mammal long bone by flaking the edges (this may or may not have been preceded by cutting the bone down to a manageable size). Then, the bone pieces were more finely shaped by grinding the edges and surfaces to make them smooth (Dalley 1970). In Figure 4, pieces *a–c* represent early stage preforms, long bones which have been split, and cut or broken to the desired length for making gaming pieces and may have one or two flake scars along the edges. Pieces *d–h* are mid-stage preforms, which are characterized as having many large flake scars from initial shaping. Finally, pieces

Figure 4. Preform gaming pieces from the PVAP collection: early- (a–c), mid- (d–h), and late-stages (i–l).

i–l are late stage preforms, which exhibit smaller, more precise flake scars as well as evidence of the beginning stages of grinding along the flaked edges. These pieces should be compared to Figure 1 to see the distinct differences between preforms and finished gaming pieces.

The presence/absence of burn marks, centrally drilled holes, hematite, and surface decorations were also recorded. Surface decorations could consist of incisions, partially drilled holes that create a dotted affect on the surface, or a combination of the two. Other descriptive and quantitative details such as completeness, faunal element and taxonomical information, and dimensions (the maximum length, width, and thickness) were recorded for each piece.

Though the classification systems and types described previously are convenient for displaying data in a report, they are not conducive for use in analysis. This is because the categories do not regularly reflect decoration. Additionally, the broad "catch-all" or "leftover" categories do not describe all the possible combinations of characteristics. Therefore, a new classification system, one which entails recording the presence and absence of various decorative characteristics, was needed for Fremont gaming piece analysis.

This new typology, originally presented by Hall (2008), was based on the combinations of the characteristics listed above and was strongly influenced by those of Metcalf (1982) and Talbot et al. (2000). This system consists of three types and four sub-types. Type 1 gaming pieces are those defined above as preforms. Type 2 pieces are finished pieces which are not centrally drilled (see Figure 5*a–c*), and Type 3 pieces are finished pieces which are centrally drilled (see Figure 5 *d–g*). In addition to the three types, Type 2 has three sub types (A, B, and C) and Type 3 has four subtypes (A, B, C, and D). Subtypes A, B, and C are the same for both Types 2 and 3. Subtype A are not decorated (see Figure 5*a* and *d*), subtype B are decorated with partially drilled dots (see Figure 5*b* and *e*; also see Figure 6 for a variety of dot designs), subtype C are decorated with incisions, which may be arranged in a variety of ways, but most commonly consist of one line on each end of the pieces (see Figure 5*c* and *f*; also see Figure 7 for variety of incised designs); and subtype D are decorated with both dots and incisions (see Figure 5 *g*; also see Figure 8 for variety of dot and incised designs). Please note that the decorative pattern of dots and incisions only appears on pieces with a centrally drilled hole. I also noted hematite, as either present or absent during the analysis of each piece.

Results and Discussions

The recent analysis of gaming pieces from the UCLA and SUU collections added 1,225 specimens (161 from Paragonah, 418 from Parowan, and 646 from Summit) to the previously available data. Previous to these recent analyses, approximately 495 pieces had been recorded in all Fremont assemblages outside of the Parowan Valley. In the discussions below for the distribution within sites, only the PVAP data is considered, since it is the only data for which there is also provenience information. However, in the following considerations of the entire Fremont cultural area, the data from PVAP collections has been combined with data from previous reports on excavations in the Parowan Valley (Berry 1972; Dodd 1982; Marwitt 1970) as well as cursory analyses of Neil Judd's collections housed at the University of Utah and Smithsonian Institution. There are some interesting patterns in the distribution of these pieces across each individual site, and when comparing those within the Parowan Valley with those in the rest of the Fremont culture area.

Individual Sites in the Parowan Valley

Due to the varying methods of excavation and the paucity of notes for UCLA's excavations, it is difficult to identify the original locations of many of the gaming pieces. Of Paragonah's 161 gaming pieces only 95 pieces could be plotted on the site map; at Parowan, 390 of the total 418 pieces had accurate proveniences; and of the 646 pieces from Summit, only 340 were able to be plotted (see Figures 3.7, 3.10, and 3.18 in Hall 2008).

Despite difficulties in locating exact proveniences of gaming pieces, a clear pattern appeared in the provenience of gaming pieces at each of the sites in the Parowan Valley: numerous gaming pieces were recovered from the features

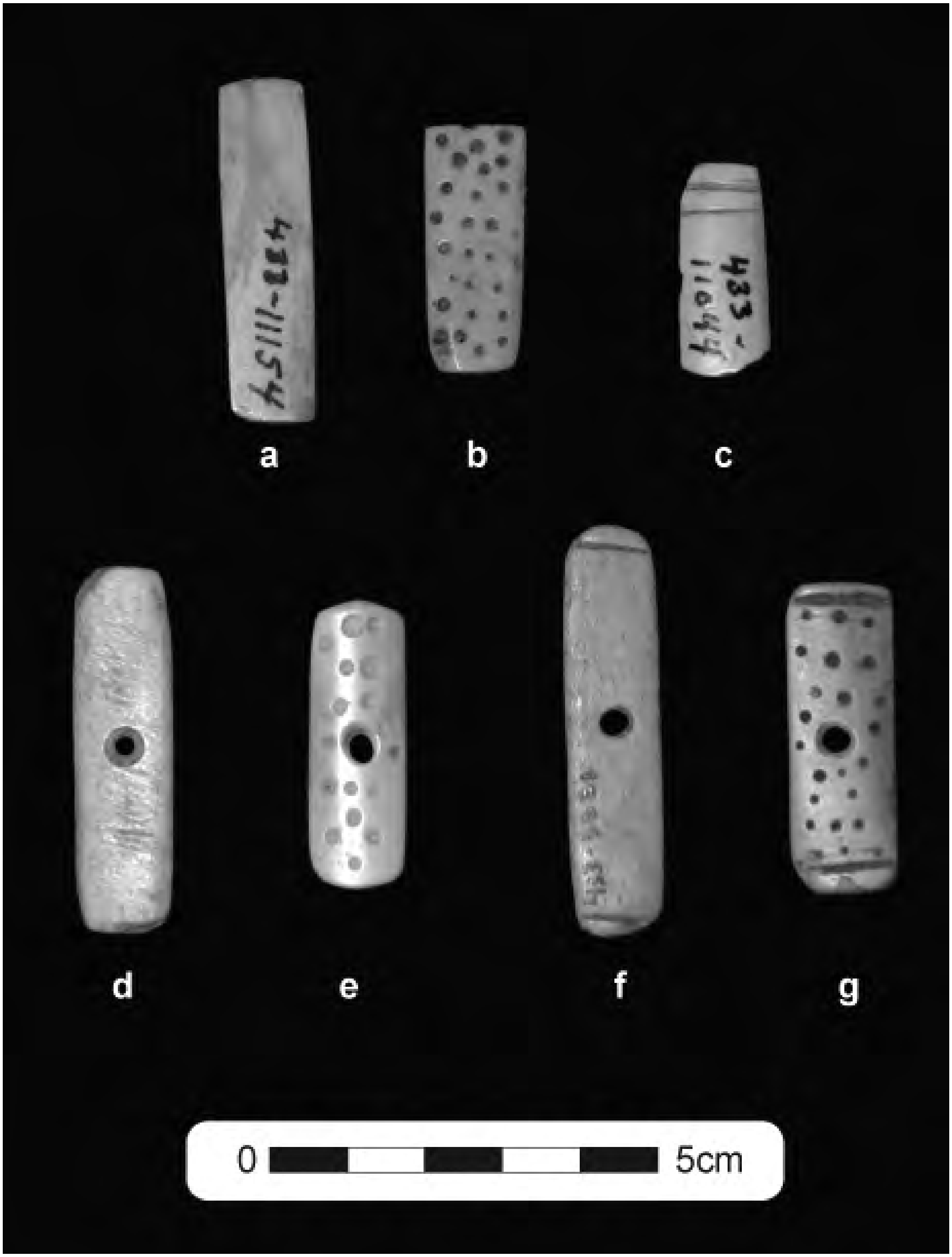


Figure 5. Gaming piece types: Type 2A (a), Type 2B (b), Type 2C (c), Type 3A (d), Type 3B (e), Type 3C (f), Type 3D (g).

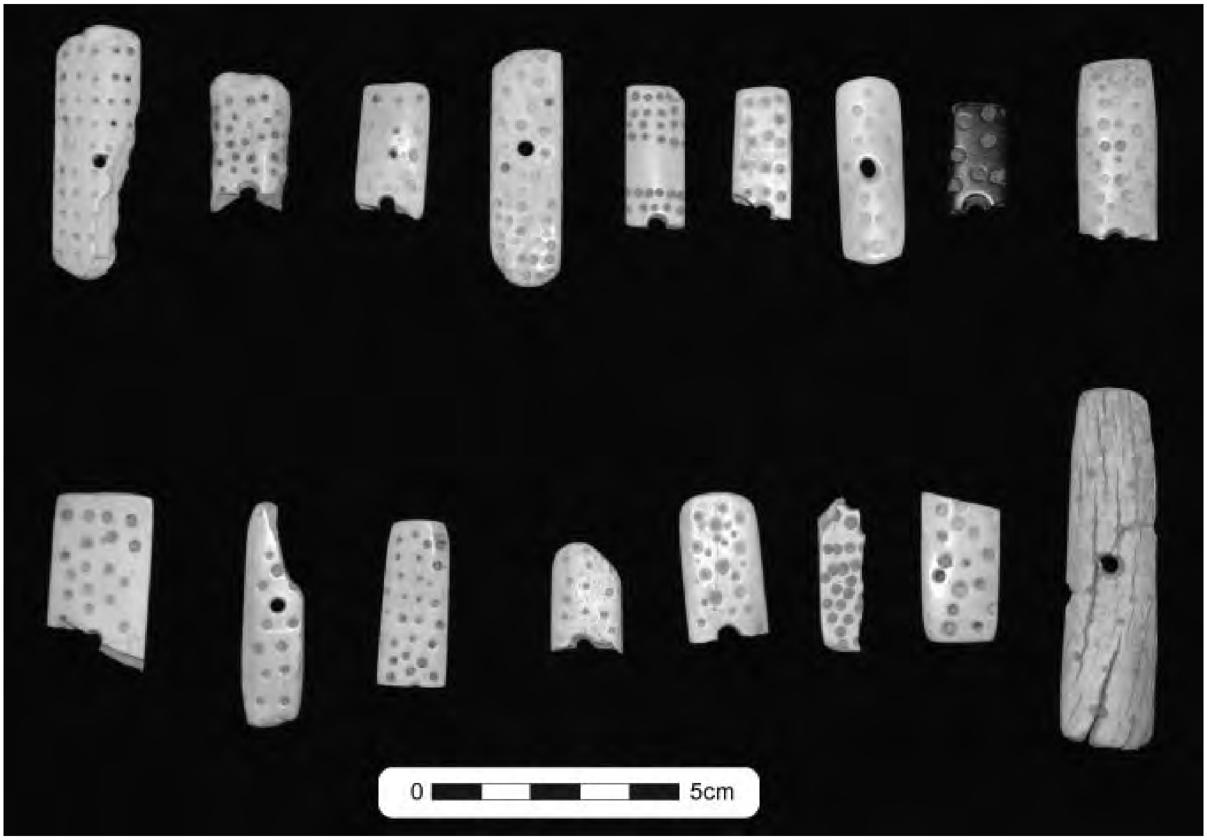


Figure 6. Variety of dot designs on gaming pieces.

and fill of residential structures while very few were recovered from within storage structures. At Paragonah only one of the 95 pieces which had clear provenience was located in a storage feature while the other 94 came from pithouses. The distribution of gaming pieces at Parowan is less conclusive because artifacts could only be provenienced to excavation unit, rather than structure, but a clear majority of pieces come from the eastern and central areas of the site (where many residential structures are located), while few pieces come from the western side of the site, (where many storage structures are located). Of the 68 gaming pieces that could be directly associated with a structure at Summit, 61 were found in residential structures while seven were located in storage structures. This pattern is also reflected in the distribution of artifacts made from exotic materials (specifically, *Olivella* shell and turquoise) across all three sites (Jardine 2007).

The Fremont Culture Area

In addition to the data gleaned from new analyses of the PVAP collections, data was also collected on Fremont gaming pieces found in published sources and readily available reports for sites inside and outside of the Parowan Valley (see above). Twenty-four Fremont sites reported a total of 2,124 gaming pieces (see Table 1). Due to the varying numbers of gaming pieces per site (1–898), the data was normalized by the number of residential structures in the site (see Figure 9), in an attempt to standardize the data by population over time as has been done in previous analyses of PVAP data (Jardine 2007; Watkins 2006). Therefore, two sites (Bear River No. 1, and Bear River No. 2) which had no residential structures

Table 1. Distribution of Characteristics of Gaming Pieces in the Fremont Culture Area

Site	Gaming Pieces	Possible Preforms	Centrally Drilled	Hematite Present	Decoration Present	"Sets"	Residential Structures	Ratio (Gaming Pieces per Residential Structure)
Parowan Valley	1,629	277	691	1,289	169			
Paragonah	313	44	122	278	34	–	32	9.78
Parowan	418	53	192	362	48	–	14	29.86
Summit	898	180	377	649	87	see Marwitt 1970:101 and Hall 2008:56–57	64	14.03
Outside the Parowan Valley	495	71	40	214	61			
Arrowhead Hill	1	–	–	–	1	–	2	0.50
Baker Village	1	–	–	1	–	–	8	0.13
Bear River No. 1	4	–	–	–	–	–	–	–
Bear River No. 2	8	–	–	–	5	–	–	–
Caldwell Village	13	4	–	13	8	see Ambler 1966:59	16	0.81
Charles B. Hunt	3	–	–	–	–	–	1	3.00
Circle Terrace	11	–	–	2	1	–	2	5.50
Five Finger Ridge	58	17	21	"Several"	"Several"	–	38	1.53
Garrison Site	12	–	12	12	2	–	8	1.50
Hinckley Mounds	25	–	–	2	1	–	3	8.33
Injun Creek	3	–	–	–	–	–	1	3.00
Nephi Mounds	42	7	3	34	4	see Sharrock and Marwitt 1967:38	10	4.20
Overlook	3	–	1	–	–	–	1	3.00
Pharo Village	16	1	1	12	2	–	3	5.33
Radford Roost	2	–	–	2	–	–	1	2.00
Round Spring	56	"Several"	–	35	"Minimal"	–	13	4.31
Sky House	4	–	–	1	1	–	1	4.00
Snake Rock Village	47	–	–	–	3	–	13	3.62
Turner-Look	171	37	1	91	27	see Worming ton 1955:58–59	5	34.20
Whiterocks Village	5	–	–	–	5	–	4	1.25
Woodard Mound	10	5	1	9	1	–	1	10.00

were excluded from this analysis (Aikens 1966, 1967).

It is obvious from the raw data that there are many more gaming pieces in the Parowan Valley than in the rest of the Fremont culture area combined. Also, most sites located outside of the Parowan Valley, have very few total gaming pieces. Therefore, the data from the three Parowan Valley sites were combined and compared as a group to the combined sites from outside of the Parowan Valley. Specifically, there were 14.8 gaming pieces per excavated structure within the Parowan Valley and 3.7 pieces per structure outside of the Parowan Valley in the Fremont area, indicating that there were more gaming pieces relative to the population at the Parowan Valley sites than in the rest of the Fremont area. When the data are displayed with each site individually represented (see Figure 9), the site with the most gaming pieces per residential structure is the Turner-Look site, located outside of the Parowan Valley, with 34.2 pieces per structure. Many of the gaming pieces from the Turner-Look site came from one large structure which probably served a communal purpose (Talbot et al 2000; Wormington 1955). This correlates with the ethnographic reports which state that gaming activities were highly associated with communal gatherings and large group activities.

The first characteristic examined was that of a centrally drilled hole. Of the 1,629 gaming pieces from the Parowan Valley, 42.5 percent had centrally drilled holes, contrasted with outside the Parowan Valley where a mere 7.8 percent had centrally drilled holes (see Table 1). Clearly, this is a significant difference ($\chi^2 = 203.584$, df = 1, $p < 0.001$). Moreover, the only two sites from outside the valley that had more than three gaming pieces with centrally drilled holes, the Garrison Site (12 of 12) and Five Finger Ridge (21 of 58), were also located in the southwestern portion of the Fremont culture area. In contrast, the sites with no centrally-drilled pieces were located in the north and east portions of the Fremont culture area (see Table 1 and Figure 2).

The presence of hematite on gaming pieces appears across the entire Fremont area, but in varying degrees. From the Parowan Valley 79.1 percent of the gaming pieces had hematite or hematite residue on them, while only 43.0 percent of the pieces from outside of the Parowan Valley had hematite on them (see Table 1). Like the centrally-drilled hole, this characteristic appears in significantly different quantities within and outside of the Parowan Valley ($\chi^2 = 240.517$, df = 1, $p < 0.001$). It is unclear why these characteristics were so ubiquitous in the southeastern part but not in the rest of the Fremont culture area.

Third, the presence of decorations on gaming pieces was examined. It seems to have been a characteristic of gaming pieces that shows up consistently throughout the Fremont area (10.4 percent of the pieces from within the Parowan Valley versus 11.9 percent of the pieces from outside). But, once the decorative types were separated into dotted, incised, and both, significant patterns appeared. First, of the 169 decorated pieces in the Parowan Valley, 85 (50.3 percent) had a dotted design; while 13 (22 percent) of the 59 decorated pieces from outside of the Parowan Valley exhibited dotted designs (see Table 2), which is also a statistically significant ($\chi^2 = 14.253$, df = 1, $p < 0.001$). The sites outside of the Parowan Valley with large quantities of dotted gaming pieces were the Garrison Site, Pharo Village, and Woodard Mound, each of which is located in the Great Basin portion of the Fremont culture area (see Figure 2).

Next, the percentages of decorated gaming pieces which had incised styles of decorations were compared. Within the Parowan Valley, 40.8 percent (n = 69) of the decorated pieces were incised compared to 80.0 percent (n = 46) outside of it. This difference also proved to be statistically significant ($\chi^2 = 24.128$, df = 1, $p < 0.001$). In fact, every site outside of the Parowan Valley which had incised gaming pieces had a higher percentage of incised pieces then any site within the Parowan Valley. This correlates with the distribution of incised pottery which is

Table 2. Types of Decoration on Gaming Pieces Inside and Outside of the Parowan Valley

Location	Dotted	Incised	Both	Neither	Total
Parowan Valley	85	69	15	1,460	1,629
Outside Parowan Valley	13	47	0	436	496
Total	98	116	15	1,896	2,125

also more common outside the Parowan Valley, especially in the northern portion of the Fremont area where pots were less frequently painted (Watkins 2009). Another geographical pattern was clear within this set of data as well; the sites outside of the Parowan Valley which had the highest quantities of incised gaming pieces (Turner-Look, Caldwell Village, Whiterocks Village, and the Bear River No. 2 site) were all located on the Colorado Plateau or in the very northern portion of the Great Basin. The final decorative pattern is the combination of dots and incisions. This combination is only found within the Parowan Valley (15 total pieces).

The Significance of Large Quantities of Gaming Pieces in the Parowan Valley

Large quantities of gaming pieces at a particular site (or in a relatively small region, such as the Parowan Valley) are the result of intensive gaming activities. These activities are highly associated with festival-like circumstances among ethnographic groups (Brunton 1998a; Culin 1992 [1907]; MacFarlan 1958; Shimkin 1986). Indications of frequent gaming would signify that the Fremont people were regularly aggregating under similar circumstances in the Parowan Valley and at the Turner-Look site, where gaming pieces are abundant in the archaeological record. It would be advantageous to look for evidence of feasting as well as large communal architecture as additional evidences for large gatherings and communal activities at these sites. At the Turner-Look site, fourteen of the bone gaming pieces, along with a pottery disc, were found in a large structure which probably served communal purposes.

The faunal and ceramic analyses is still underway for the PVAP collections, but there are approximately 75,000 faunal bones and 325,000 ceramic pieces listed in the artifact catalogs. The analysis of these artifact classes should provide insight into any feasting activities that may have taken place in the Parowan Valley. Additionally, it was likely that trade was a prominent activity at these gatherings (Janetski 2002), which is supported by the distributions of *Olivella* shell and turquoise which are similar to the distributions of gaming pieces across all three sites in the Parowan Valley (Jardine 2007).

A high frequency of preforms of various stages, such as is found in the Parowan Valley, indicates that gaming pieces may have been produced there. Because the gaming pieces are made from material readily available across the Fremont area (large mammal long bones), it does not seem like the pieces were being made exclusively in the Parowan Valley with the purpose of trading or distributing outside of the valley, though this hypothesis has not yet been tested. Instead, it is probable that there were more and larger gaming activities taking place in that locality than in the rest of the Fremont world. As stated previously, among Native North Americans, gaming is highly associated with large gatherings. Sites and/or areas with more evidence of gaming, which can be seen in the archaeological record as higher quantities of gaming paraphernalia per household, can, therefore, be assumed to have been the locations of large social gatherings.

The significances of high frequencies of hematite stained and centrally drilled pieces are harder to determine. The functional aspects of

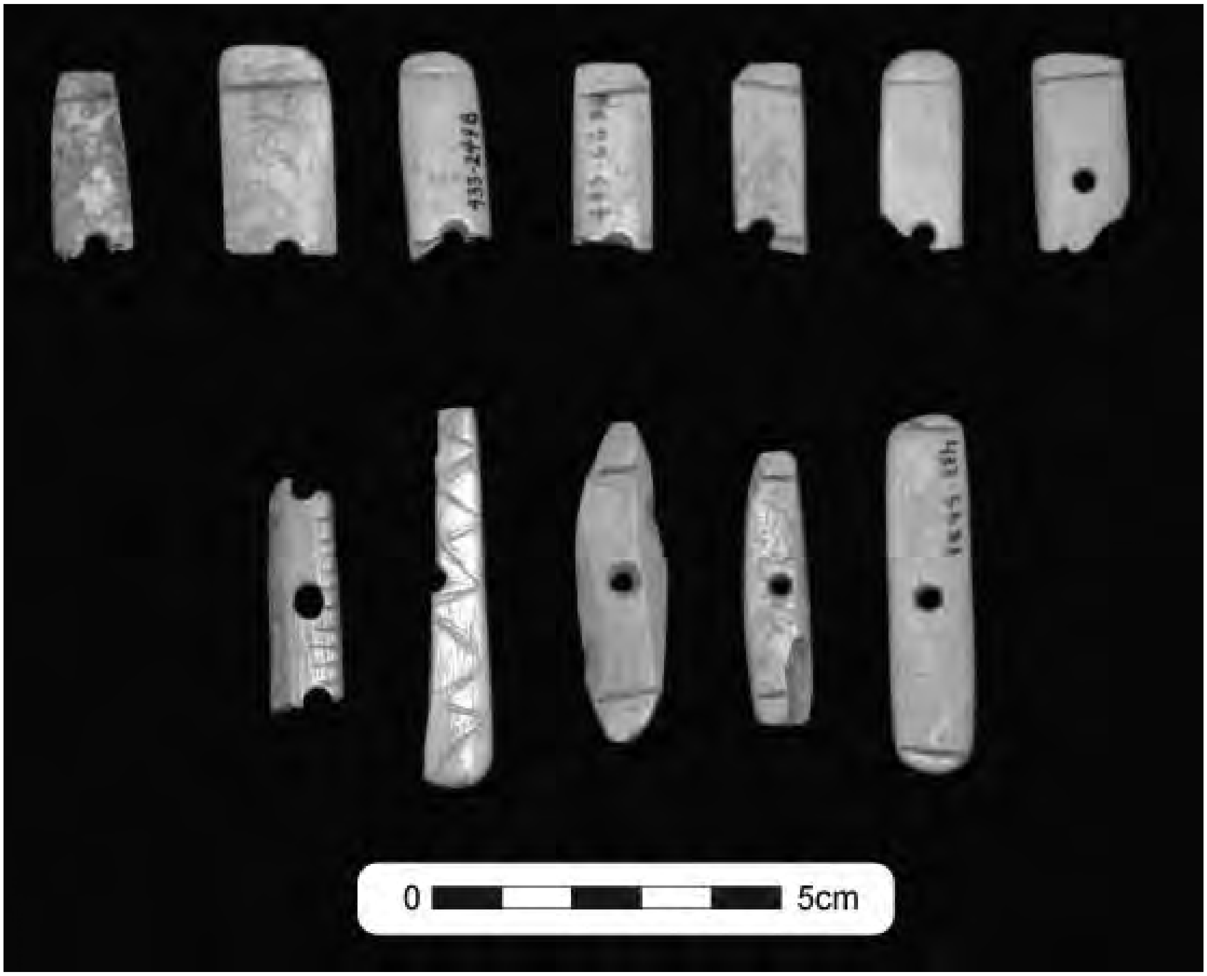


Figure 7. Variety of incised designs on gaming pieces.

these characteristics are not clear, but they may be tied to intensive gaming activities of the Parowan Valley. The centrally drilled holes in some pieces could provide a way to more easily transport collections of gaming pieces. Hematite, unlike the other decorative characteristics, appears on gaming pieces in all stages of production (80.9 percent of preforms and 85.1 percent of finished pieces), and likely had to do with the production process itself (whether practical or ritual), rather than existing purely for the sake of decoration. Additionally, these characteristic may have been part of the regional style, seen so frequently among other Fremont artifact types (Jennings 1978; Marwitt 1970).

Conclusions

In conclusion, the worked bone pieces found in Fremont archaeological assemblages described previously closely resemble in size, shape, and decoration bone gaming pieces used by Native Americans, as recorded in several ethnographic records (Brunton 1998; Culin 1992 [1907]; MacFarlan 1958; Shimkin 1986). Therefore, these artifacts were most likely used as gaming pieces in some sort of Fremont game, presumably similar to the hand and dice games played by Native Americans in recent times.

With the addition of 1,225 gaming pieces from the UCLA and CSU excavations in the 1950s and 1960s, it was necessary to devise a more detailed classification system for the analysis of these worked bone pieces. This new classification system allows for the examination of one characteristic of the pieces in a collection regardless of any other characteristic of the same pieces.

Within Fremont ceramics, architecture, rock art, clay figurines, and other artifacts, there is a distinct regional variation (Jennings 1978). Now, it is apparent that gaming pieces follow this trend as well. Most notable, is the geographic variation in decorative types. Those pieces decorated with dots tend to appear more in the south and Great Basin portions of the Fremont culture area, while incisions appear more in the north and Colorado Plateau areas. Hematite covered pieces and those with centrally drilled holes appear more in the Parowan Valley than outside of it, but in general, both of those characteristics can be found across the Fremont culture area. It is apparent that the dotted and incised decorative styles are each specific to a different region within the Fremont culture area. It appears that these geographical patterns of decoration types are simply another example of regional variation that is found so prevalently in the Fremont material culture (Marwitt 1970).

In addition to these broad characteristics, there is evidence in the form of extremely high quantities of gaming pieces in the Parowan Valley that the Fremont were aggregating there regularly in large groups. These aggregations would have played a significant role in the Fremont culture on multiple levels. Primarily, the purpose for the gatherings would have been formal, such as a ritual or periodic subsistence-related activities (e.g. harvests), but the secondary purposes such as trading, feasting, gaming, and/or gambling would have been just as important to the continuance of the Fremont culture.

Currently, the three completely analyzed data sets from the PVAP collection (exotic ornaments, worked bone gaming pieces, and projectile points) support the hypothesis that the Fremont were gathering regularly under festival-like circumstances in the Parowan Valley and that this location was of importance during the late Fremont period. However, these are only a small portion of the artifacts at our disposal from the Parowan Valley, and other data sets, especially the faunal remains and architectural information, must be examined for evidence of large aggregations and feasts. This will allow for deeper understanding of the Fremont social structure, a topic which, until recently, has been underrepresented in Fremont literature. ■

Acknowledgements. Thank you to Barbara Frank at Southern Utah University, Wendy Teeter at UCLA's Fowler Museum, Michelle Knoll from the Utah Museum of Natural History at the University of Utah, Jeff Bartlett from the Prehistoric Museum at the College of Eastern Utah, and the Smithsonian Institution for the generosity with their collections. Also thanks to the many students, past and present, who contributed to the slow-but-steady progress of the Parowan Valley Archaeological Project. Finally, I am especially grateful for the help of Dr. Joel Janetski who provided invaluable guidance throughout this project.

Molly Hall
Project Archaeologist
AR Consultants, Inc.
805 Business Parkway
Richardson, TX 75081
Email: molly.hall@hotmail.com

References

Aikens, C. Melvin

1966 *Fremont-Promontory-Plains Relationships*. Anthropological Papers No. 82. University of Utah Press, Salt Lake City, Utah.

1967 *Excavations at Snake Rock Village and the Bear River No. 2 Site*. Anthropological Papers No. 87. University of Utah Press, Salt Lake City, Utah.

Alexander, W. and J. W. Ruby

1963 *1962 Excavations at Summit, Utah: A Progress Report*. Nevada State Museum Anthropological Papers, No. 9. Carson City, Nevada.

Ambler, J. Richard

1966 *Caldwell Village*. Anthropological Papers No. 84. University of Utah Press, Salt Lake City, Utah.

Baer, Sarah, and Jacob Sauer

2002 *The BYU Escalante Drainage Project: Little Desert, Main Canyon, and Escalante Desert Areas 2002*. Museum of Peoples and Cultures Technical Series No. 02–08. Brigham Young University, Provo, Utah.

Berry, Michael S.

1972a *Excavations at Evans Mound 1970–1971: An Interim Report*. Departments of Anthropology, University of Utah, Salt Lake City, Utah.

1972b *The Evans Site*. Special Report (limited distribution), Department of Anthropology, University of Utah, Salt Lake City, Utah.

1974 *The Evan's Mound: Cultural Adaptation in Southwestern Utah*. Unpublished Master's thesis, Department of Anthropology, University of Utah, Salt Lake City, Utah.

Brunton, Bill B.

1998 The Stick Game. In *Plateau*, edited by Deward E. Walker, Jr., pp. 573–583. Handbook of North American Indians, vol. 12, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Christensen, Ross T.

1946 *A Preliminary Report of Archaeological Investigations near Utah Lake, Utah 1946*. Unpublished Master's thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Culin, Stewart.

1992 *Games of the North American Indian, Vol. 1: Games of Chance*. Reprinted University of Nebraska Press, Lincoln. Originally published 1907, Bulletin No. 24, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Dalley, Gardiner F.
1970 Worked Bone and Antler. In, *Median Village and Fremont Culture Regional Variation*. Anthropological Papers, No. 95, John P. Marwitt, editor, pp.96–127. University of Utah Press, Salt Lake City, Utah.

Dodd, Walter A.
1982 *Final Year Excavations at the Evans Mound Site*. Anthropological Papers, No. 106. University of Utah Press, Salt Lake City, Utah.

Fowler, Don D.
1963 *1961 Excavations: Harris Wash, Utah*. Anthropological Papers No. 64. University of Utah Press, Salt Lake City, Utah.

Gillin, John
1936 *Archaeological Investigations in Nine Mile Canyon, Utah*. Bulletin of the University of Utah, Vol. 28, No.11. University of Utah, Salt Lake City., Utah

Green, Dee F.
1961 *Archaeological Investigations at the G. M. Hinckley Farm Site, Utah County, Utah, 1956–1960*. Brigham Young University Press, Provo, Utah.

Gunnerson, James H.
1969 *Fremont Culture: A Study in Culture Dynamics on the Northern Anasazi Frontier*. Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University Vol. 59, No. 2. Peabody Museum, Cambridge, Massachusetts.

Hall, Molly A.
2008 *Parowan Valley Gaming Pieces and Insights into Fremont Social Organization*. Unpublished Master's thesis, Department of Anthropology, Brigham Young University, Provo, Utah. http://contentdm.lib.byu.edu/cgi-bin/showfile.exe?CISOROOT=/ETD&CISOPTR=1552&filename=etd2595.pdf

Janetski, Joel C.
1997 150 years of Utah Archaeology. *Utah Historical Quarterly* 65:100–133.
2002 Trade in Fremont Society: Contexts and Contrasts. *Journal of Anthropological Archaeology* 21:344–370.

Jardine, Cady B.
2007 *Fremont Finery: Exchange and Distribution of Turquoise and* Olivella *Ornaments in the Parowan Valley and Beyond*. Unpublished Master's thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Jennings, Jesse D.
1978 *Prehistory of Utah and the Eastern Great Basin*. Anthropological Papers No. 98. University of Utah Press, Salt Lake City, Utah.

Jennings, Jesse D., and Dorothy Sammons-Lohse
1981 *Bull Creek*. Anthropological Papers No. 105. University of Utah Press, Salt Lake City, Utah.

Judd, Neil M.
1919 *Archaeological Investigations at Paragonah, Utah*. Smithsonian Institution, Washington, D.C.
1926 *Archaeological Observations North of the Rio Colorado*. Government Printing Office, Washington, D.C.

MacFarlan, Allan A.
1958 *Book of American Indian Games*. Associated Press, New York.

Madsen, David B., and La Mar W. Lindsay
1977 *Backhoe Village*. Antiquities Section Selected Papers No. 12. Division of State History, State of Utah.

Marwitt, John P.
1968 *Pharo Village*. Anthropological Papers No. 91. University of Utah Press, Salt Lake City.
1970 *Median Village and Fremont Culture Regional Variation*. Anthropological Papers, No. 95. University of Utah Press, Salt Lake City, Utah.

Meighan, Clement C., Norman E. Coles, Frank D. Davis, Geraldine M. Greenwood, William M. Harrison, and E. Heath MacBain
1956 *Archaeological Excavations in Iron County, Utah*. Anthropological Papers No. 25. University of Utah Press, Salt Lake City, Utah.

Metcalf, Duncan W.
1982 Worked and Unworked Faunal Remains. In *Final Year Excavations at the Evans Mound Site*, edited by Walter A. Dodd Jr., pp. 79–92. Anthropological Papers, No. 106. University of Utah Press, Salt Lake City, Utah.

Richens, Lane D.
1983 *Woodard Mound: Excavations at a Fremont Site in Goshen Valley, Utah County, Utah 1980–1981*. Unpublished Master's Thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Rood, Ronald J., and Kae MacDonald
1993 Round Spring Modified Bone, Antler, and Shell. In *The Round Spring Site, 42SV23*, pp.77–96. Hogan Pass Final Report on Archaeological Investigations along Forest Highway 10 (State Highway 72), Sevier County, Utah, vol. 3, edited by Michael D. Metcalf, Kelly J. Pool, Kae McDonald, and Anne McKibbin. Metcalf Archaeological Consultants, Eagle, Colorado.

Sharrock, Floyd W., and John P. Marwitt
1967 *Excavations at Nephi, Utah, 1965–1966*. Anthropological Papers No. 88. University of Utah Press, Salt Lake City, Utah.

Shields, Wayne F.
1967 Excavations: Uinta Basin. In *Miscellaneous Collected Papers 15–18*, pp. 1–30. Anthropological Papers No. 89. University of Utah Press, Salt Lake City, Utah.

Shimkin, Demitri B.
1986 Eastern Shoshone. In *Great Basin*, edited by Warren L. D'Azevedo, pp. 308–335. Handbook of North American Indians, vol. 11, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Shutler, Richard
1984 *Lost City: Pueblo Grande De Nevada*. Anthropological Papers, No. 5. Nevada State Museum, Carson City, Nevada.

Steward, Julian H.
1936 *Pueblo Material Culture in Western Utah*. Anthropological Series Vol. 1, No. 3. University of New Mexico, Albuquerque, New Mexico.

Talbot, Richard K.
2000 Fremont Farmers: The Search for Context. In *The Archaeology of Regional Interaction: Religion, Warfare, and Exchange Across the American Southwest and Beyond*, edited by Michelle Hegmon, pp. 275–293. University of Colorado Press, Boulder, Colorado.

Talbot, Richard K., Lane D. Richens, James D. Wilde, Joel C. Janetski, and Deborah E. Newman
1999 *Excavations of Icicle Bench, Radford Roost, and Lott's Farm, Clear Creek Canyon, Central Utah*. Museum of Peoples and Cultures Occasional Papers No. 4. Brigham Young University, Provo, Utah.
2000 *Excavations at Five Finger Ridge, Clear Creek Canyon, Central Utah*. Museum of Peoples and Cultures Occasional Papers No. 5. Brigham Young University, Provo, Utah.

Taylor, Dee C.
1954 *The Garrison Site*. Anthropological Papers No. 16. University of Utah Press, Salt Lake City, Utah.

Watkins, Christopher N.
2006 *Parowan Valley and Fremont Complexity: Late Formative Ceramic Production and Exchange*. Unpublished Master's thesis, Department of Anthropology, Brigham Young University, Provo, Utah.
2009 Type, Series, and Ware: Characterizing Variability in Fremont Ceramic Temper. *Journal of California and Great Basin Anthropology* 29:145–161.

Wilde, James D., and Reed A. Soper (editors)
1999 *Baker Village: Report of Excavations, 1990–1994*. Museum of Peoples and Cultures Technical Series No. 99–12. Brigham Young University, Provo, Utah.

Woods, Aaron R.
2009 *Distribution, Function, and Value of Parowan Valley Projectile Points.* Unpublished Master's thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Wormington, H. Marie
1955 A Reappraisal of the Fremont Culture. *Proceedings of the Denver Museum of Natural History No. 1*. Denver, Colorado.

Yoder, David T.
2006 Miscellaneous Objects and Ornaments from Arrowhead Hill. Manuscript on file, Office of Public Archaeology, Brigham Young University. Provo, Utah.

The Bailey Basket (42Em4090): An Unusual Late Prehistoric Artifact Cache in Emery County, Utah

Arie W. Leeflang[*†], Kevin T. Jones[†], Andrew T. Yentsch[†], James M. Adavasio[**], and Jonathon Bailey[‡]

[*]*Department of Anthropology, University of Utah;* [†]*Antiquities Section: Utah Division of State History;* [**]*Mercyhurst Archaeological Institute;* [‡]*San Rafael Junior High School*

The Antiquities Section of the Utah Division of State History recovered an intact Late Prehistoric ceramic vessel and woven basket from a small cache in Emery County in January 2009. The basket and pot date to the historic period and were probably cached and never retrieved by a Numic speaker some 170 years ago.

On January 20, 2009 a small, tightly-woven basket and a ceramic brownware vessel were recovered in Emery County, Utah by a crew from the Antiquities Section of the Utah Division of State History. Both were well preserved when found; the vessel resting within the basket in a bed of shredded juniper bark. The basket is small with a wide mouth, pointed-bottom, and constructed of willow in a coil method. The ceramic vessel is also wide-mouthed, with a pointed bottom, and appears to be a brownware cooking vessel.

The basket and associated ceramic vessel were discovered by a local Emery County family exploring an area south of the town of Emery, Utah. In early January 2009, while hiking with his parents (Scott and Sherrie Bailey), Jonathan (Jon) Bailey, a seventh grade student from Ferron, made the discovery. In a craggy area, Jon spotted what he thought might be a "geocache" under a small overhang in an area of broken sandstone ledges. Noticing stones he thought were deliberately placed, he and his father investigated. Removing the sandstone slabs revealed an intact, ancient basket sitting upside-down on the floor of the ledge. Excited, they photographed the basket and were surprised as they carefully rolled it over to find it contained a gray colored ceramic pot. The Baileys limited any further investigation to photos, placed the basket back in its original position, and finally replaced the stones that obscured the artifacts.

Returning home, delighted by their discovery, they posted the photos of the find in the gallery of their personal website, but were careful not to disclose the site location. Recognizing the significance of their find, the Baileys sought to report the discovery to the proper authorities. On January 13, 2009, Scott phoned Kevin Jones, State Archaeologist, and arrangements were made for a crew from the Antiquities Section to meet Scott in the town of Emery and to travel together to the discovery site to collect the find.

Site Description

The basket and ceramic vessel were recovered from a small, sheltered ledge, which is located at the bottom level of a short sandstone outcrop, roughly 1.8 m above a loosely compacted sand and gravel colluvial slope (Figure 1). The ledge itself is about 4 m wide, extending out from the rock face 1.35 m. The basket and pot were situated in a shallow overhang that is 53 cm from the ledge floor to the ceiling (Figure 2). This area is well protected, being 60 cm in from the drip line of the outcrop/cliff face. Four unmodified sandstone slabs were arranged around the artifacts to conceal them. This arrangement created a box-like, above-ground cist. This feature was found against the back of the sheltered area, approximately one meter from the east edge of the ledge. The discovery was recorded on an IMACS form and assigned the state trinomial site number 42EM4090.

Figure 1. The ledge where the artifacts were found. A scale bar and the slabs hiding the artifacts can be seen in the shadows in the lower right portion of the photograph.

The Basket

The basket is a relatively small, wide-mouthed bowl with excurvate sides and a pointed base (Figure 3). It is virtually complete with the notable exceptions of the final rim circuit and a tear on one margin (see below). The foundation consists of three stacked willow (Salix sp.) rods, the great majority of which are peeled or decorticated. The stitches are also peeled, bilaterally split willow and are non-interlocking. The foundation is regularly exposed by the intentionally wide spacing of the stitches. The work surface is concave as is typical for bowls and the work direction is left-to-right. Accidental splitting of the stitches on the work surface is minimal (~5

Figure 2. The basket with the vessel hidden beneath in-situ after removing the concealing slabs.

percent) while accidental splitting on the non-work surface is common (~50 percent). The method of starting is an unreinforced continuous coil with a central aperture (Figure 4). The rim is missing. Splices have fag ends bound under and moving ends are clipped short and concealed under stitches.

As noted above, on one margin there is a split or tear (Figure 5) which runs from the rim ~145 mm toward the base. Approximately 50 mm from the rim, the split or tear has been partially mended via a ~41 mm long, 2.4 mm wide length of untwisted rawhide (genus/species unknown) which was apparently secured by a larks head

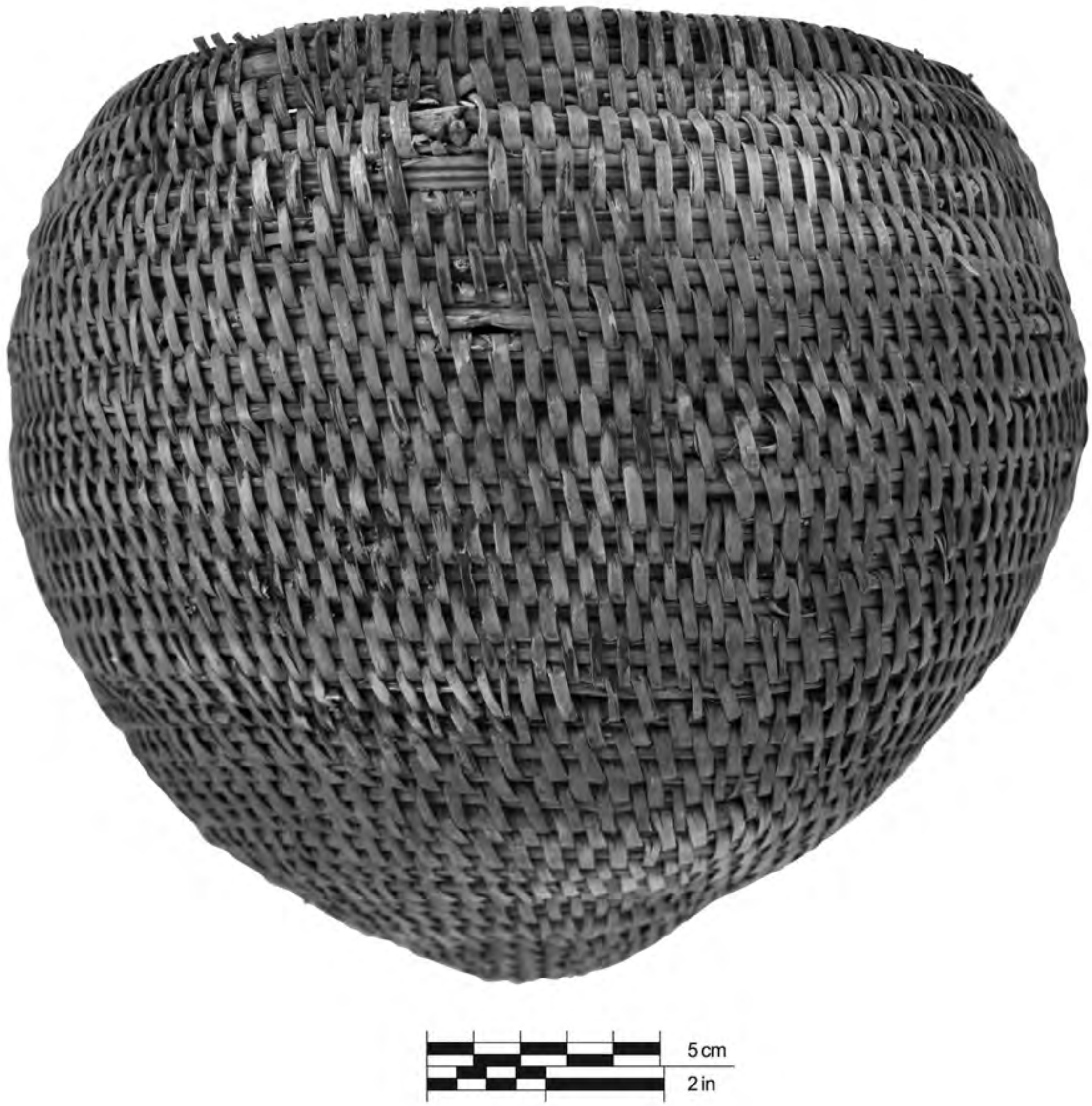


Figure 3. The basket with its wide mouth, excurvate sides, and pointed base.

knot, part of which has now decayed or been gnawed away.

The interior of the basket is partially filled with shredded juniper (*Juniperus* sp.) bark, some of which is very loosely Z-twisted (Figure 6). No actual cordage is present in the bundled contents which presumably served as padding for the enclosed ceramic vessel. A sample of this material was extracted for radiometric analysis. The sample returned a conventional radiocarbon age of 170±40 B.P. which places the basket firmly in the Late Prehistoric (Beta-260536; Table 1).

The padding and the vessel were apparently secured by a composite strap bundle. This strap is affixed to the basket in four locations. The point of affixation closest to the tear (located in the first

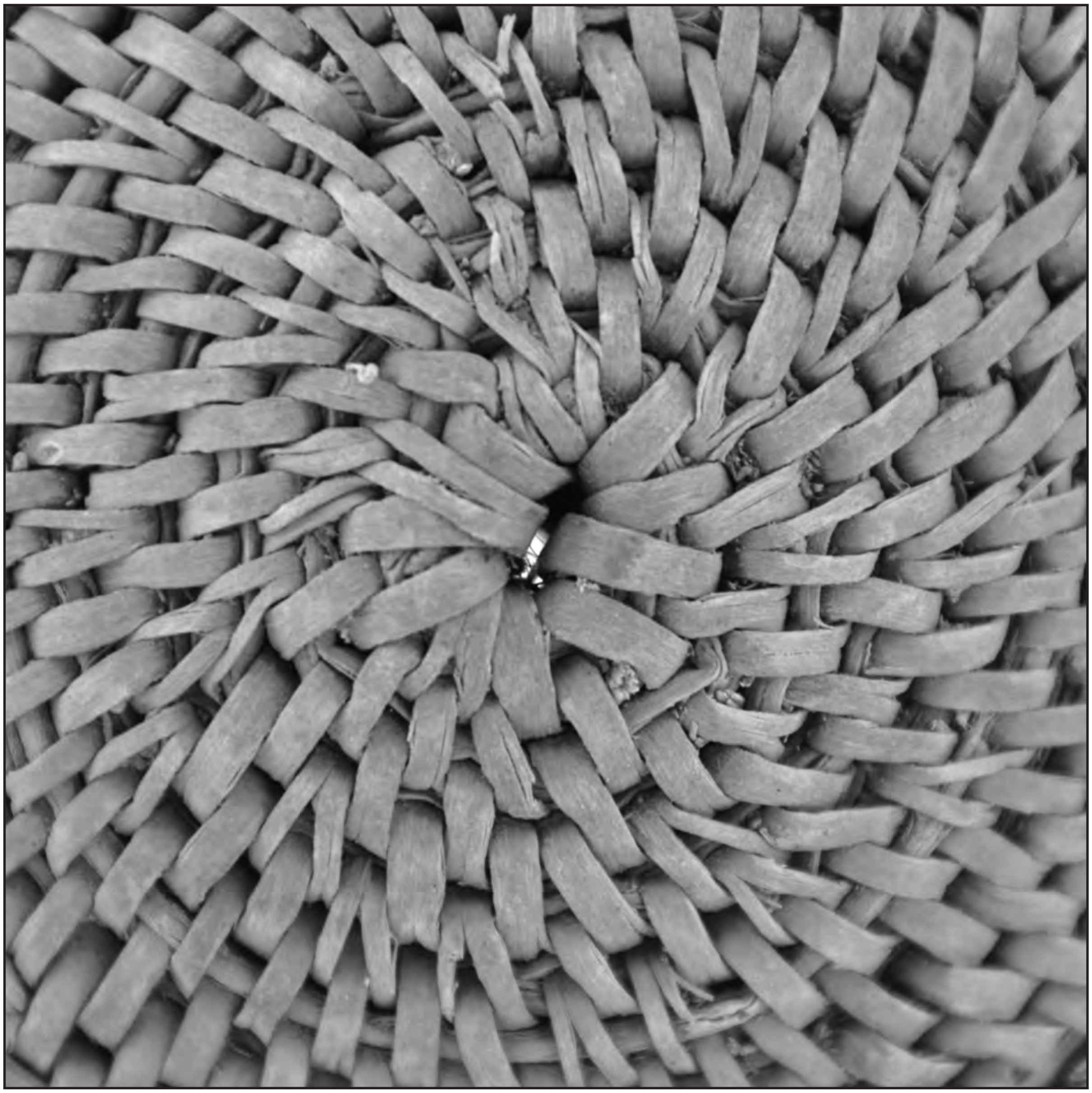


Figure 4. The basket's central aperture and unreinforced continuous coil starting method.

coiling row from the top and ~12 mm to the right of the tear) appears to be a single looped strand secured on itself with an overhand knot. The loop section on the outside of the basket appears to have been gnawed away by rodents. On the inside of the basket, one end is cut or broken at the knot and the other end extends 20.5 mm to an apparent wear-induced break. This strip averages 6.8 mm in width and 1.1 mm in thickness. Due to the damage to the basket at the tear, determining the direction of insertion is problematic.

The second point of affixation is ~187 mm to the right. This locus consists of either two failed piercing points and two successful points or four piercing points, of which the hide at two points has decayed or been somehow removed.

Figure 5. The basket's split or tear running from the rim toward the base. The partial rawhide mend can be seen in the lower left portion of the photograph.

The lowest of these points is nine coils from the top and pierces into the basket and has no extant hide. The second lowest is seven coils from the top, appears to pierce from the inside and still has hide present. The two remaining points are in the third row from the top. The left-most point pierces into the basket and is without hide while the right-most pierces from the inside of the basket and still has leather present. The extant strap on the inside is secured with a square knot, the two free ends of which extend 28 mm and 37 mm before ending in apparent wear-induced breaks. This hide strip averages 2.9 mm in thickness and 7.1 mm in width.

The third affixation point is ~135 mm to the right of the second and is nearly opposite the

Figure 6. The interior of the basket partially filled with shredded *Juniperis* sp. bark, some of which is very loosely Z-twisted.

basket wall tear. This point consists of two wall piercings, the lowest of which is seven coils from the top and pierces into the basket while the upper is three coils from the top and pierces from the inside. Only the upper point has extant hide. The knot on the interior consists of either three stacked overhand knots or one granny knot stacked with one overhand. The two free ends dangle approximately 40 mm and 75 mm before ending in wear-induced breaks. This hide strip averages 1.5 mm thick and 12.5 mm wide.

The final attachment point is ~180 mm to the right of the third and 113 mm to the left of the basket wall tear (Figure 7). This point consists of a single loop round the top-most coil. This leather loop is secured to itself with a granny knot. To this loop is affixed, via overhand knot, a strip of leather approximately 56 mm long. The other end of this strip is square knotted to a third strip of hide. This third strip extends ~26 mm before it is square knotted to a fourth piece of hide which results in one dangling loop and five dangling strips of hide, all of which average 65 mm in length. Each of these dangling ends could have been part of, or affixed to, the other loops, but this cannot be confirmed. The first three pieces

Table 1. Radiocarbon data from juniper bark lining inside the basket

Sample Number	C14 Age Conventional	2 Sigma Range (Cal) B.P.	Material
Beta-260536	170± 40 B.P.	300 to 60	Juniper Bark

of hide in this knotted series are equivalent in size and average 6.8 mm in width and 1.1 mm in thickness while the fourth piece averages 2.7 mm in width and 1.5 mm in thickness.

The basket exhibits moderate attrition wear on both surfaces and the juniper padding is encrusted with organic material. The vessel configuration and construction technique is fully consistent with a Numic ascription and the specimen may have served as a berry or seed container (Adovasio 1975, 1980, 1986a; Adovasio et al. 1982; Adovasio and Pedler 1994; Adovasio et al. 2002; Janetski 1991). Conversely, and not surprisingly, the vessel form and method of manufacture is not encountered within the Fremont or even earlier Archaic basketry industries in the greater study area (Adovasio 1970, 1971, 1975, 1980, 1986a, 1986b; Adovasio and Pedler 1994; Adovasio et al. 2002).

Critical measurements of the specimen include: maximum diameter at mouth 175 mm; maximum diameter on wall 275 mm; maximum height (depth) 210 mm; range in diameter of coil 3.50–7.09 mm; mean diameter of coil 6.18 mm; range in width of stitches 2.15–2.91 mm (work) and 2.49–3.49 mm (non-work); mean width of stitches 2.87 mm (work) and 3.01 mm (non-work); range in gap between stitches 2.51–3.99 mm (work) and 2.21–3.31 mm (non-work); mean gap between stitches 2.97 mm (work) and 2.78 mm (non-work); range and mean coils per centimeter is two.

The Ceramic Vessel

One brownware ceramic vessel about the size of a cantaloupe was recovered from within the basket (Figure 8). It measures 160 mm in height, 161 mm at the widest point, and has a mouth diameter of 146 mm. The vessel is a wide-mouthed, pointed bottom, globular specimen with a fairly rough surface. Fingernail impressions may be present on the exterior surface but are not clearly discernible. The rim of the vessel is only slightly outcurving. This vessel appears to be a brownware cooking vessel that is blackened around the rim and in the interior. The bottom of the vessel has a grayish-white, ashy appearance, likely the result of being used for cooking in an open fire. The exterior surface of the vessel grades from a whitish ash-smudged base, (Munsell 7.5 YR 6.1/1) to a brown-colored (Munsell 10 YR 4/2) mid-section, to a dark gray rim (Munsell 10 YR 2/1). Surface characteristics and overall morphology of this vessel are consistent with other descriptions of Shoshone Brownware vessels from the region (see Janetski 1994 and references therein).

Associated Plant Remains and Analysis

Upon removal of the objects from the ledge, three pinyon (*Pinus* sp.) nut hulls were observed in the small sandy area in which the artifacts had been placed. This wind-blown fill was removed for further analysis. Based on the upside down storage of the vessel and basket it is likely that these hulls were originally carried within the vessel.

Macrofloral, pollen, phytolith, and Fourier Transform Infrared Spectroscopy (FTIR) analyses of the ceramic vessel were completed by Paleo Research Institute of Golden, Colorado (Cummings et al. 2009). The local vegetation was clearly represented in their findings, including sagebrush, pinyon and juniper, Cheno-ams and various members of the sunflower family. Maize (*Zea mays*) rondels were noted in the phytolith wash pointing to the presence of maize in the vessel. Food processing evidence

Figure 7. Basket rim and one attachment point for rawhide handle or securing strap.

included animals, native plants, and cultivated plants. Animals likely included deer, bison, duck, rabbit, and fish. Locally procured seeds, berries, nut meats, squash, yucca root, and bean signatures were all exhibited in the FTIR record. Overall, the analysis points to the ceramic vessel being used to cook a variety of meat and plant resources.

Discussion

Despite the many archaeological sites recorded in the vicinity, this particular site had resisted discovery. Much of the immediate discovery area is characterized by a low density lithic scatter. Nearby previously recorded sites span the Early Archaic through the historic era, and range from simple lithic scatters to structural remains (both

Figure 8. The ceramic vessel with its wide mouth and pointed-bottom.

prehistoric and historic) to expansive trash dump locations associated with Euro-American mining and ranching operations.

Both the basket and the vessel have pointed bases. This morphology would indicate a possible Numic or Late Prehistoric origin. At the present time no clearly Late Prehistoric archaeological sites have been documented in the vicinity of the discovery. However, the abundant lithic scatters in the area without diagnostic artifacts may be attributable to that time period. ■

Arie W. Leeflang
Department of Anthropology
University of Utah
Salt Lake City, UT, 84112;

Antiquities Section
Utah Division of State History
300 S. Rio Grande Street
Salt Lake City, UT, 84101
E-mail: aleeflang@utah.gov

Kevin T. Jones
Antiquities Section
Utah Division of State History
300 S. Rio Grande Street
Salt Lake City, UT, 84101
E-mail: ktjones@utah.gov

Andrew T. Yentsch
Antiquities Section
Utah Division of State History
300 S. Rio Grande Street
Salt Lake City, UT., 84101
E-mail: a.yentsch@yahoo.com

James M. Adavasio
Mercyhurst Archaeological Institute
Mercyhurst College, Erie, PA 16546

Jonathan Bailey
San Rafael Junior High School, Ferron, UT

References

Adavasio, J.M.

1970 The Origin, Development, and Distribution of Western Archaic Textiles and Basketry. *Tebiwa: Miscellaneous Papers of the Idaho State University Museum of Natural History* 13(2):1–40.

1971 Some Comments on the Relationship of Great Basin Textiles to Textiles from the Southwest. *University of Oregon Anthropological Papers* 1:103–108.

1975 Fremont Basketry. *Tebiwa: Miscellaneous Papers of the Idaho State University Museum of Natural History* 17(2):67–76

1980 The Evolution of Basketry Manufacture in Northeastern Mexico, Lower and Trans-Pecos Texas. In *Papers on the Prehistory of Northeastern Mexico and Adjacent Texas*, edited by J. F. Epstein, T. R. Hester, and C. Graves, pp. 93–102. The University of Texas at San Antonio Publications of the Center for Archaeological Research, San Antonio, Texas.

1986a Artifacts and Ethnicity: Basketry as an Indicator of Territoriality and Population Movements in the Prehistoric Great Basin (with Rhonda L. Andrews). In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings*, edited by C. J. Condie and D. D. Fowler, pp. 43–89. University of Utah Press, Salt Lake City, Utah.

1986b Prehistoric Basketry. In *Handbook, of North American Indians*, vol 11, Great Basin, edited by W. L. d'Azevedo, pp. 194–205. Smithsonian Institution, Washington, D.C.

Adovasio, J. M., R. L. Andrews, C. S. Fowler

1982 Some Observations on the Putative Fremont "Presence" in Southern Idaho. *Plains Anthropologist* 27(95):19–27.

Adovasio, J. M., and D. R. Pedler

1994 A Tisket, a Tasket: Looking at the Numic Speakers through the "Lens" of a Basket. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by D. B. Madsen and D. Rhode, pp. 114–123. University of Utah Press, Salt Lake City, Utah.

Adovasio, J. M., D. R. Pedler, and J. S. Illingworth

2002 Fremont Basketry. *Utah Archaeology* 15(1):5–25.

Cummings, L.S., K. Puseman, C.Yost, and M.K. Logan, and R. A. Varney

2009 *Pollen, Starch, Phytolith, Organic Residue (FTIR), and Macrofloral Analyses of a Ceramic Vessel from the Bailey Basket Site (42EM4094), Emery County, Utah*. Paleo Research Institute Technical Report 09–34. Paleo Research Institute, Golden, Colorado.

Janetski, Joel C.

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

1994 Recent Transitions in Eastern Great Basin Prehistory: The Archaeological Record. In *Across the West: Human Population Movement and the Expansion of the Numa*, edited by David B. Madsen and David Rhode, pp. 157–178. University of Utah Press, Salt Lake City, Utah.

A Review of Archaeological Resource Management Techiques

Rachelle Green Handley
Uinta-Wasatch-Cache National Forest

An archaeological management plan developed for public lands in the United States should be guided by two principal themes. First, archaeological sites are often of great interest to the public and they should have the opportunity to learn about prehistory and history from the unique perspective that visiting such sites offers them. Second, archaeological sites are non-renewable resources making their preservation crucial. These two fundamental principals are often—perhaps inevitably—at odds with one another; however, a management plan using formal and replicated techniques will allow land managers to achieve the fine balance between these two goals.

Heritage tourism is growing at an accelerating rate in the United States and worldwide (Pinter 2005:9). As a result, archaeological sites on public lands are often adversely impacted; especially in areas lacking visitation management practices. Archaeological sites offer a glimpse into past human activity and are the only means by which we can come to understand how these peoples lived. Archaeologists are concerned with gaining an accurate understanding about the activities that occurred at sites, which can only be achieved when site formation and context is preserved. Additionally, site preservation is important so future generations can learn from both the experience of visiting sites as well the scientific knowledge that can be obtained from them. Unfortunately, many public visitors to archaeological sites are uneducated about proper site etiquette and the importance of preservation. This often results in non-malicious visitor activity such as touching rock art, leaning against or climbing over architectural structures, and collecting artifacts as mementos of their trip. Properly standardized and implemented management techniques can largely reduce these behaviors, facilitating long-term sustainability of archaeological resources.

IMPACTS OF VISITATION

Research conducted on ancestral Puebloan archaeological sites in the Four Corners area demonstrates the direct correlation between public access and vandalism to archaeological sites (Ahlstrom et al. 1992; Fetterman and Honeycutt 1987; Hartley and Wolley Vawser 2004; Nickens et al. 1981; Simms 1986; Sullivan et al. 2002; Uphus et al. 2006). Researchers found that factors such as site visibility, size, density, distribution, attractiveness, accessibility, and proximity to recreational activities correlated with increased vandalism. Additionally, increased public awareness about site locations, lack of public knowledge regarding legal protection for sites, and lack of on-site law enforcement increased site susceptibility to vandalism.

Many archaeological sites have fallen victim to overt, or malicious vandalism but more often, archaeological site visitation results in casual, or non-malicious vandalism. Casual vandalism or “depreciative behavior” differs from overt “vandalism” because it lacks intent to cause harm (Knopf and Dustin 1992:211). Casual vandalism resulting from visitation to archaeological sites occurs in two general forms: (1) the movement and removal of surface artifacts resulting from a lack of education on the importance of provenience; and (2) the degradation of sites simply as a function of being visited. The latter includes increased surface erosion due to foot traffic, deterioration of structures due to visitors climbing on or over them, and damage to rock art from visitors touching, chalking and inscribing (on or near) panels. A more recent threat is the practice of geocaching, where geocaches are being place on or near sites resulting in increased visitation and subsurface disturbance if caches are buried.

The cumulative effects of both overt and casual vandalism associated with unrestrained visitation are clearly evident today at some of the most important archaeological sites worldwide. Stonehenge, in Wessex, England, is a classic example of users visiting a site until near destruction, and has led to aggressive management of the resource to control user access and movement (Malone and Bernard 2002:37–38). Locally, research conducted in Range Creek Canyon, Utah has shown the contrast in archaeological site preservation between controlled and uncontrolled access (Spangler et al. 2006). Unrestrained visitation outside of the controlled access points of the Range Creek Ranch gates showed a dramatic increase in the degree of site degradation (Spangler et al. 2006:15, 95).

There has been a range of responses by land management agencies in the United States to reduce the impact of public visitation. Responses have varied as a function of site visibility, expected visitation, assessment of the scientific and educational value of the archaeological sites, and available funding (Williams 1978). It has been customary for land managers to simply post signs informing visitors that collecting artifacts and disturbing archaeological features is illegal, however a wide variety of signage has been implemented with varying opinions of their success (Nickens 1993:48–77). Conversely, in those cases where sites are visited in high volume, such as the archaeological districts managed by the National Park Service, sites are thoroughly mapped and all the surface artifacts are collected and analyzed. Additionally, certain guidelines are used to stabilize architecture using preservatives, concrete, and hidden reinforcement, thus hardening a site from the impacts of visitation (Richert and Vivian 1974).

MANAGEMENT TECHNIQUES

There are four basic categories for the management techniques available to resource managers to mitigate the largely unintentional, casual impacts of visitation to archaeological sites. First, is controlling visitor access to and activities near sites. These techniques include nondisclosure policies, control of vehicular access, limitation on the number of visitors, camping restrictions, and trails. Second, there are ways to control visitor behavior when they are visiting sites. These methods include signage, interpretive education materials, barricades, and official presence. Third, is protecting sites from high volume visitor traffic through methods of site stabilization. Fourth, is to educate the public about the value of archaeological resources and proper site etiquette prior to site visitation through a variety of public outreach programs.

It should be noted that many of the existing studies on management techniques summarized here are qualitative rather than quantitative analyses and some are focused on protecting natural rather than cultural resources. However, human behavioral response to management techniques in a natural resource setting should directly apply to similar circumstances in a cultural resource setting.

Controlling Visitors Access and Activities Near Sites

Non-Disclosure Policy

Often archaeological site locations may be revealed to or discovered by staff, contractors, or tour guides who work on public lands. In order to protect these sites, agencies can issue a written policy prohibiting staff from revealing such locations to the public. When working with archeological consultants, contractors, and permittees (such as tour guides), agencies can include contract and permit stipulations restricting the release of sensitive site location information and the release of archaeological reports. Although not foolproof in preventing disclosure of site locations, these tools can serve to reinforce their protection.

Control of Vehicle Access

Controlling access by closing roads designated for motorized traffic that are near sites has shown to provide protection especially from overt vandalism (Spangler et al. 2006:13–25). With gates in place, overt vandalism decreases with increasing distance from a gate (Spangler et al. 2006:15).

Incidental impacts of off-road all terrain vehicle (ORV/ATV) on or near archaeological sites have the potential to be detrimental to surface deposits (Hartley and Wolley Vawser 2004:3, 9; Spangler 2007:24–25; Uphus et al. 2006:340). Although it is difficult to control these vehicles use on public lands, designated roads should be clearly marked and signs appealing the ORV/ATV user to stay on roads may be beneficial. In the case of foot trails, signs with an explanation of the importance and legal implications of staying on designated trails help to enforce proper behavior (Johnson and Swearingen 1992).

One way archaeologists managing sites on public land can discourage off-road use is by getting involved with the user groups through voluntary organizations such as the Tread Lightly organization (www.treadlightly.org). In situations where sites continue to be impacted by disobedient ORV/ATV users, the land managing agency may want to consider closing routes near susceptible sites.

Limitation on Number of Visitors

Limiting the number of visitors by use of a permitting system can reduce visitor traffic and its resulting impacts. This management practice has been effectively implemented at Stonehenge and at Range Creek Canyon in Utah; however, the nature of these sites allows for controlled access through massive financial resources and rugged terrain, respectively. In addition, the use of a permitting system for sites located in remote and controlled access areas has been recommended to land management agencies as a means to reduce improper behavior, because an official record makes the visitor more conscientious about their site etiquette (Spangler 2007:47). Limiting public access to public lands is a contentious issue and nearly impossible to successfully achieve; however, in lieu of an official record, a voluntary register that can be placed at trailheads can provide the same result (Swadley 2008; Sullivan 1984:43–53).

Camping Restriction

Camping activities create a number of impacts to archaeological sites. The more serious impacts include: the introduction of modern trash (Hartley and Wolley Vawser 2004:3, 9); introduction of modern hearths at sites, including the removal of rocks and timbers from prehistoric and historic structures for hearth construction and use (Hartley and Wolley Vawser 2004:3, 9; Sullivan et al. 2002:42–43; Uphus et al. 2006:334–335); feature disturbance when firewood is obtained from cutting down trees growing within site structures (Sullivan et al. 2002:43; Uphus et al. 2006:337); and the introduction of slash and trash from those woodcutting activities (Sullivan et al. 2002:43; Uphus et al. 2006:334–335, 337).

Camping activities are difficult to control. A suggestion is to fence campground perimeters when they are located near high site density areas, with the intent of discouraging campers from engaging in activities beyond the campground (Sullivan et al. 2002:44; Uphus et al. 2006:340). A suggestion to control the impacts associated with wood-cutting is to only allow this activity within gated areas that are free of archaeological sites (Sullivan et al. 2002:44; Uphus et al. 2006:340–341).

Trails

The creation of formal and officially designed pedestrian paths serves to control use and prevents visitors from creating social trails. Creation of formal trails achieves three goals that dovetail with other resource needs, these include: 1) protection of the environment, 2) cultural resource preservation, and 3) visitor safety. In general, visitors prefer the quickest yet simplest site route, but environmental factors that contribute to trail deterioration must be considered prior to trail construction. Leung and Marion (1996) conducted an extensive literature review concerning factors that contribute to trail degradation and how trail construction can minimize these effects; they summarize four main factors which require consideration prior to trail design. First, the climate of an area and more specifically how the precipitation will influence the degree of erosion a trail will receive. Second, surrounding vegetation plays a key role in the degree of soil loss and trail widening. Third, soil and surface characteristics will determine the degree of trail tread incision and drainage. Improper tread incision and drainage will encourage visitors to walk off trail to avoid muddy areas, resulting in trail widening. Fourth, incorrect trail design can promote trail widening and erosion. Trail design should not run parallel to the landscape's slope, but rather, should run perpendicular following the contours of the slope resulting in a "switchback". A switchback trail is beneficial for several reasons: it may not provide the quickest access but it provides an easier route for visitors; it minimizes the slope of the trail and thus minimizes erosion; it facilitates trail drainage in wet conditions; and its steeper adjacent side slopes will keep visitors on the trail preventing trail widening.

When these environmental factors are considered, several undesired human tendencies can be prevented, although trailside signs explaining the need to stay on trails will further enforce the desired behavior (Johnson and Swearingen 1992; Swearingen and Johnson 1988). With trails in place, proper maintenance of those trails will need to be conducted on a regular basis in order to maintain their effectiveness, this in turn will encouraging proper trail use as well as site etiquette (Swadley 2008).

Controlling Visitor Behavior at Sites

Signage

Signage is a protection technique commonly used by land managers to communicate with the public about archaeological or other sensitive resource areas (Nickens 1993:22; Williams 1978:81). Preservation signs remind visitors about the delicate nature of the area they are visiting and that it is necessary to protect natural and/or cultural resources. Signs use two appeal techniques, interpretation and sanction, which differ in language and intent. An interpretation message requests visitors to refrain from performing undesired acts (burning wood, picking up artifacts, disposing of trash, etc.), explains why the actions have a deleterious impact on the resource, and solicits their assistance in site protection. A sanction message is a warning which explicitly states the law and the personal consequences for breaking it, such as a monetary fine and/or imprisonment. Compared to the complete absence of signage at a site, researchers found that the presence of signs resulted in an increase in desirable visitor behavior (Duncan and Martin 2002:23; Gale and Jacobs 1987:81–85; Gale 1985:115; Gale 1984:36, 39; Jameson and Kodack 1991:246; Johnson and Swearingen 1992:116; Martin 1992:126; Nickens 1993:50; Swearingen and Johnson 1988:38, 41; Widner and Roggenbuck 2000:10–11). Although a variety of strategies have been researched, sanction messages either by themselves or in conjunction with interpretation messages tend to have the most success on influencing visitor behavior (Johnson and Swearingen 1992:115; Martin 1992:127; Nickens 1993:54–57; Swearingen and Johnson 1988:38, 42); however, one study showed no difference between sanction and interpretive signs (Duncan and Martin 2002:23). When a preservation message of any kind is in place, visitors are more conscientious about their behavior especially in the presence of other visitors (Gale 1984:36–37). Unfortunately, the problem persists that visitors do not always read preservation signs, though a simple appeal for visitor attention, such as the wording "please take the time to read this message," will increase the number of visitors who read the sign and almost doubles the reading time by visitors (Cole 1998). Another useful technique is use of images of eyes on signs, which has been found to foster a feeling of being watched, that in turn promotes desired behavior (Ernest-Jones et al. in press).

Interpretive Education

Educational messages provide the visitor with notable information about the resource, and have shown to positively influence behavior (Gale and Jacobs 1987:84, 91–94; Gale 1984:36, 39; Martin 1992:127; Nickens 1993:55, 57; Swadley 2008). Tour guides are often used in places such as National Parks to deliver this type of message to visitors. More often land managers cannot facilitate the logistics or costs required to have on site tour guides. In these cases, a sign with an educational message can be used. Educational messages are often incorporated with a preservation message (Nickens 1993) or it may be provided on a separate sign or brochure. Interpretive education, through printed or digital media, is a good management solution when land managing agencies do not provide tour guides.

An educational interpretation message should achieve the following goals: (1) relate to an audience; (2) allow personal revelation based on information; (3) use a combination of techniques (text and pictures) to present information; (4) do not instruct but provoke an interest in the topic; and, lastly (5) address the subject as a whole rather than any phase (Tilden 2007:34–35). Often messages are executed in a way that fail to attract or hold a visitors attention (Gale and Jacobs 1987:91–92); therefore, mangers must take into account how the textual length and meaning conveyance will affect the visitor's retention of the message. Educational messages that hold visitors attention will positively correlate to retention (Cole et al. 1997:66). Longer messages will increase visitor reading time but retention of information decreases linearly with increase in information provided (Cole et al. 1997:67). Therefore, a land manager must select the most pertinent information and effectively execute a message easily read in a short time span.

Barricades

Barricades are often deemed necessary when a message of site preservation alone does not provide adequate protection (Higgins 1992:228–229; Hogue 1992:7, 10, 23; Swadley 2008). Managers commonly use barricades for caves and rockshelters with archaeological deposits and features, historic mines, and other vulnerable archaeological features, such as rock art, in order to provide protection when visitors continue to engage in damaging behaviors. A barricade can provide the necessary means to keep visitors just out of arms reach of the resource. There are several barrier methods, some of which are more aesthetically pleasing than others. The most effective but the least visually appealing is chain-link fencing, often with a viewing gap at average height (5'10") and barbed wire along the top (Gale and Jacobs 1987:74). Although chain link fencing may provide significant protection, it obstructs visitors view and is considered visually displeasing, resulting in a less enjoyable experience (Lorblanchet 1975:119–120; Gale and Jacobs 1987:74). Therefore, this technique should only be used in the extreme cases of visitor disobedience (Gale and Jacobs 1987:74). The more common and visually pleasing techniques are waist high (or shorter) barriers composed of wood posts strung with rope, or an all wood fence. Compared to a control of no barrier, these techniques dramatically reduce detrimental visitor behavior (Gale and Jacobs 1987:77–80; Gale 1985:114; Gale 1984:33, 36–37; Swearingen and Johnson 1988:52–58). Although both techniques are effective, in one case an all wood fence was better at deterring visitors than a post and rope barrier (Gale 1984:37), but in another case the opposite was found (Swearingen and Johnson 1988:52–58). A natural barrier technique such as using boulders or vegetation may help to deter visitors but is largely unsuccessful at preventing access because visitors associate them with the natural environment (Gale and Jacobs 1987:77; Gale 1985:117; Gale 1984:37–38).

Official Presence

The presence of a uniformed employee, regardless of legal enforcement ability, has shown to be a "discriminative stimulus" (Geller 1994; Vande Kamp et al. 1994; Widner and Roggenbuck 2000:11). A uniformed land manager on location dramatically increases visitor responsiveness in conjunction with a message of expected etiquette (Swearingen and Johnson 1988:47, 49; Widner and Roggenbuck 2000:11). Tour guides often facilitate this presence when providing information to visitors about the resource. Their own behavior has show to influence how visitors behave (Gale and Jacobs 1987:94–97). Formal presence of any kind, from site stewards to law enforcement will discourage poor visitor etiquette at archaeological sites, though the costs and personnel time may be prohibitive for this type of site protection.

Site Stabilization

General Stabilization Techniques

Site stabilization is often used by land managers for those sites they are expecting a high volume of visitation, such as Ancestral Puebloan sites in Mesa Verde and Chaco Canyon. There are a wide variety of techniques used to "harden" sites against the impacts of visitation, which option is best should be determined on a case by case basis, taking into account specific site needs, and the costs and benefits. Land managers considering site stabilization can refer to the National Park Service (NPS) publication "Site Stabilization Information Sources" (Thorne 1991) which summarizes the available literature on site stabilization from federal and state agencies as well as academic institutions.

Alternative Stabilization Techniques

There are alternative methods of site stabilization which can serve to protect those sites that land managers wish to divert visitation. One technique is to promote revegetation on site through re-seeding and other non-ground disturbing activities. Revegetation is often needed when on-site vegetation is diminished as a result of high visitation but may also be the result of natural processes. Revegetation is primarily used to protect sites from natural erosion but may also serve to disguise vulnerable sites from visitors. The NPS publication "Revegetation: The Soft Approach to Archaeological Site Stabilization" (Thorne 1990) summarizes the cost and benefits of this "soft" approach and provides references concerning plant data and guidelines for conducting such a project. All sites have been naturally impacted by the physical and chemical processes of vegetation; however, when a plan to promote vegetative growth is developed, those impacts must be weighed against the benefits of preventing continued erosion as a result of visitation.

A second technique used to protect sites from natural or mechanical loss that may also serve to protect vulnerable sites from visitation is intentional site burial. Archaeological sites are often buried as a result of natural deposition and are somewhat protected from natural erosion processes as a result. The NPS publication "Intentional Site Burial: A Technique to Protect Against Natural or Mechanical Loss" (Thorn 1989) provides land managers interested in using this technique with a thorough overview on how to evaluate sites, consider impacts, and assess the benefits of using this technique.

Public Outreach

Educational Programs

A way to promote an appreciation for archaeological sites and an understanding of proper etiquette when visiting sites is to educate children on and off the site. Project Archaeology, a partnership of the Bureau of Land Management and Montana State University, aims at promoting a sense of stewardship for children in grades K-12 and also serves to educate teachers and the general public. The program's website (www.projectarchaeology.org) contains all curriculum, past newsletters, and state coordinator contact information. Another avenue is through local state historical and archaeological programs, like Utah's Prehistory Week, which engage the public through interpretive programs, experiential learning, and volunteer involvement. These programs provide an opportunity for professional archaeologists to get involved with stakeholder groups who have aim at educating the local community not only about, but also how to protect the archaeological resources in their area.

Volunteer Programs

Involvement of the public in archaeological pursuits through the guidance of professional archaeologists contributes to public understanding and sense of stewardship for these resources. There are several ways land managers can involve the public in both the management and protection of archaeological resources, one such volunteer program is Passport In Time, originally started by the United States Forest Service in 1991. The program facilitates public participation in survey, excavation, and processing of artifacts, along with direct involvement in historic preservation through historic building repairs and site stabilization efforts. The program was so successful that it is now used by other federal agencies such as the Bureau of Land Management and the National Park Service. For more information on Passport In Time visit www.passportintime.com.

Stewardship Programs

Another avenue to recruit public participation in the preservation of archaeological resources is stewardship programs. Several states including Arizona, California, Colorado, and Nevada have successful site stewardship programs. The Nevada Archaeological Site Stewardship Program (NASSP) headed by the Nevada State Historic Preservation Office, was modeled from the successful Arizona Site Stewardship Program, but modified for the needs of Nevada. NASSP coordinates with federal and state land managers who sponsor and support trained volunteers to visit archaeological sites that agencies do not have the time or resources to sufficiently protect or monitor. This program has been successful at increasing public awareness about, and appreciation for, archaeological sites. Site stewards provide a physical presence, which alone can aid in abating deleterious behavior by visitors. Although this is a Nevada-based program, the NASSP coordinators often work with agencies in other states to facilitate growth of similar programs in the United States. For more information on the NASSP please refer to their link at www.nvshpo.org.

CONCLUSION

There are several techniques available to land managers that are useful in controlling visitor impacts to both natural and cultural resources. If an agency is only capable of implementing one management technique, sanction warning signs should be used as they are generally less expensive and more easily employed than other methods. If an agency has the ability to implement a more extensive management plan, a combination of the presented techniques should serve to increase archaeological site sustainability. An archaeological site management plan should engage visitors, elicit a sense of pride in their cultural heritage, and foster a personal responsibility in the protection of sites for the benefit of future generations. Archaeological site management on public lands can achieve these goals through providing visitors an education about the cultural heritage of the area while also explaining why cultural resource preservation is so important. ■

Acknowledgments. I would like to give special thanks to the family and friends of David C. Williams who made my research possible through funding from the David C. Williams Memorial Graduate Fellowship. Their support to the graduate students of the University of Utah's, Department of Anthropology has had a great influence on research aimed at understanding how to manage and preserve Utah's cultural resources for generations to come. Their help in this endeavor is appreciated not only by myself and the other students funded, but also by the archaeological community of Utah.

Rachelle Green Handley
Supervisor's Office
88 West 100 North, Provo, UT 84601
E-mail: rlgreen@fs.fed.us

References

Ahlstrom, Richard V. N., Malcolm H. Adair, R. Thomas Euler and Robert C. Euler
1992 *Pothunting in Central Arizona: The Perry Mesa Archeological Site Vandalism Study.* Cultural Resource Management Report No. 13. United States Forest Service Southwestern Region and Bureau of Land Management, Arizona.

Cole, David N.
1998 Written Appeals for Attention to Low-Impact Messages on Wilderness Trailside Bulletin Boards: Experimental Evaluations of Effectiveness. *Journal of Park and Recreation Administration* 1(1):65–79.

Cole, David N., Timothy P. Hammond and Stephen F. McCool
1997 Information Quantity and Communication Effectiveness: Low-Impact Messages on Wilderness Trailside Bulletin Boards. *Leisure Sciences* 19:59–72.

Duncan, Garrett S. and Steven R. Martin
2002 Comparing the Effectiveness of Interpretive and Sanction Messages for Influencing Wilderness Visitors' Intended Behavior. *International Journal of Wilderness* 8(2):20–25.

Ernest-Jones, Max, Daniel Nettle and Melissa Bateson
2011 Effects of Eye Images on Everyday Cooperative Behavior: A Field Experiment. *Evolution and Human Behavior* 32:172–178.

Fetterman, Jerry and Linda Honeycutt
1987 *Mockingbird Mesa Survey, Southwestern Colorado*. Colorado Cultural Resources Series No. 22. Bureau of Land Management, Colorado.

Gale, Fay and Jane M. Jacobs
1987 *Tourists and the National Estate. Procedures to Protect Australia's Heritage.* Special Australian Heritage Publication Series Number 6. Australian Heritage Commission, Australian Government Publishing Service.

Gale, Fay
1984 The Protection of Aboriginal Rock Art from Tourists at Ubirr, Kakadu National Park. In *Visitors to Aboriginal Sites: Access Control and Management, Proceedings of the 1983 Kakadu Workshop*, edited by Hilary Sullivan, pp. 32–40. Australian National Parks and Wildlife Services, Canberra.
1985 Monitoring Visitor Behavior at Rock Art Sites. *Rock Art Research* 2(2):112–117.

Geller, E. Scott
1994 The Human Element in Integrated Environmental Management. In *Implementation Integrated Environmental Management*, edited by J. Cairns, Jr., T. V. Crawford and M. H. Brooks, pp. 5–26. Virginia Polytechnic Institute and State University, Blacksburg.

Hartley, Ralph J. and Anne M. Wolley Vawser
2004 *Assessing Contemporary Human Activity at Sites in the Anasazi Archaeological District, San Juan National Forest: A Quantitative Approach*. Midwest Archaeological Center. National Parks Service. Electronic document, http://www.nps.gov/history/mwac/publications/misc_pdf/mcphee.pdf, accessed September 5, 2007.

Higgins, Howard C.
1992 Rock Art Vandalism: Causes and Prevention. In *Vandalism: Research, Prevention and Social Policy*, technical coordinators Harriet H. Christensen, Darryll R. Johnson and Martha H. Brookes, pp. 221–232. General Technical Report PNW-QTR-293. United States Forest Service Pacific Northwest Research Station, Portland, Oregon.

Hogue, Kathleen
1992 *Conservation and Management Strategies for Three Rock Art Sites in Arches National Park*. Rock Art Conservator Evaluation Provided to Southeast Utah Group of Parks.

Jameson, John H. and Kodack, Marc
1991 Signing as a Means of Protecting Archaeological Sites. In *Protecting the Past*. CRC Press, edited by George S. Smith and John E. Ehrenhard, pp. 235–246. Online edition by SEAC. Electronic document, http://www.nps.gov/history/seac/protectg.htm, accessed October 3, 2007.

Johnson, Darryll R. and Swearingen, Thomas C.
1992 The Effectiveness of Selected Trailside Sign Texts in Deterring Off-Trail Hiking at Paradise Meadow, Mount Rainier National Park. In *Vandalism: Research, Prevention and Social Policy*, technical coordinators Harriet H. Christensen, Darryll R. Johnson and Martha H. Brookes, pp. 103–119. General Technical Report PNW-QTR-293. United States Forest Service Pacific Northwest Research Station, Portland, Oregon.

Knopf, Richard C. and Daniel L. Dustin
1992 A Multidisciplinary Model for Managing Vandalism and Depreciative Behavior in Recreation Settings. In *Influencing Human Behavior: Theory and Application in Recreation, Tourism, and Natural Resource Management*, edited by Michael J. Manfredo, pp. 209–262. Sagamore Publishing Company, Champaign, Illinois.

Leung, Yu-Fai and Jeffery L. Marion
1996 Trail Degradation as Influenced by Environmental Factors: A State-of-the-Knowledge Review. *Journal of Soil and Water Conservation* 51(2):130–136.

Lorblanchet, M.
1975 *Rock Art Erosion in the Grampians Mountains*. Unpublished Report to the Australian Institute of Aboriginal Studies, Canberra, Australia.

Martin, David C.
1992 The Effect of Three Signs and a Brochure on Visitors' Removal of Pumice at Mount St. Helens. In *Vandalism: Research, Prevention and Social Policy*, technical coordinators Harriet H. Christensen, Darryll R. Johnson and Martha H. Brookes, pp. 121–131. General Technical Report PNW-QTR-293. United States Forest Service Pacific Northwest Research Station, Portland, Oregon.

Malone, Caroline and Nancy Stone Bernard
2002 *Stonehenge*. Oxford University Press, Oxford.

Nickens, Paul R.
1993 *Use of Signs as a Protective Measure for Cultural Resource Sites.* Technical Report EL-93-6. U. S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.

Nickens, Paul R., Signa L. Larralde, and Gordon C. Tucker
1981 *A Survey of Vandalism to Archaeological Resources in Southwestern Colorado*. Colorado Cultural Resources Series No. 11. Bureau of Land Management, Colorado.

Pinter, Teresa L.
2005 Heritage Tourism and Archaeology: Critical Issues. *The SAA Archaeological Record* 5(3):9–11.

Richert, Roland V. S. and Richard G. Vivian
1974 *Ruins Stabilization in the Southwestern United States*. Publications in Archaeology No. 10. National Parks Service, Washington, D. C. Electronic document, http://www.nps.gov/history/history/online_books/archeology/10/index.htm, accessed September 28, 2007.

Simms, Steven R.
1986 *Cultural Resource Investigations in Southeastern Utah to Aid in the Assessment of Archaeological Vandalism.* Archaeological Technician Program, Weber State College, Logan, Utah. Submitted to United States Forest Service, Salt Lake City, Utah.

Spangler, Jerry D.
2007 *Site Condition and Vandalism Assessment of Archaeological Sites, Lower and Middle Arch Canyon, San Juan County, Utah*. Southern Utah Wilderness Alliance. Case 1:06-cv-01502-AWI-DLB Document 10. Electronic document, http://www.suwa.org/site/DocServer/SpanglerReport_ArchCanyon.pdf?docID=862, accessed September 15, 2007.

Spangler, Jerry D., Shannon Arnold and Joel Boomgarden
2006 *Chasing Ghost's: An Analysis of Vandalism and Site Degradation in Range Creek Canyon, Utah*. Colorado Plateau Archaeological Alliance. Electronic document, http://www.cparch.org/docs/Research_Library/Range_Creek_Vandalism_redacted.pdf, accessed September 18, 2007.

Sullivan III, Alan. P., Patrick M. Uphus, Christopher I. Roos and Philip B. Mink II
2002 Inadvertent Vandalism: The Hidden Challenge for Heritage Resource Management. *CRM* 2:42–45.

Sullivan, K.M.
1984 Monitoring Visitor Use and Site Management at Three Art Sites, An Experiment with Visitors' Books. In *Visitors to Aboriginal Sites: Access, Control and Management, Proceedings of the 1983 Kakadu Workshop,* edited by Hilary Sulivan, pp. 43–53. Australian National Parks & Wildlife Services, Canberra, Australia.

Swadley, Ben
2008 *Actively Managing Rock Art Sites.* Rock Art in Arkansas. Electronic document, http://arkarcheology.uark.edu/rockart/index.html?pageName=Actively%20Managing%20Rock%20Art%20Sites, accessed February 3, 2011.

Swearingen, Thomas C. and Darryll R., Johnson
1988 *An Analysis of Off-Trail Hiking in Response to Selected Social Control Techniques at Paradise Meadows, Mount Rainier National Park.* Seattle: National Parks Service Cooperative Park Studies Unit, College of Forest Resources, University of Washington, Seattle, Washington.

Throne, Robert M.
1991 *Site Stabilization Information Sources.* NPS Archaeology Program Technical Briefs. Electronic document, http://www.nps.gov/archeology/PUBS/TECHBR/tch12A.htm, accessed January 27, 2011.
1990 *Revegetation: The Soft Approach to Archaeological Site Stabilization.* Electronic document, http://www.nps.gov/archeology/PUBS/TECHBR/tch8.htm, accessed January 27, 2011.
1989 *Intentional Site Burial: A Technique to Protect Against Natural or Mechanical Loss.* Electronic document, http://www.nps.gov/archeology/PUBS/TECHBR/tch5.htm, accessed January 27, 2011.

Tilden, Freeman
2007 *Interpreting Our Heritage, fourth edition, expanded & updated*. The University of North Carolina Press, Chapel Hill, North Carolina.

Uphus, Patrick M., Alan P. Sullivan III and Philip B. Mink II
2006 Identifying at-risk Heritage Resources with GIS: Modeling the Impact of Recreational Activities on the Archaeological Record. *International Journal of Risk Assessment and Management* 6(4/5/6):330–343.

Vande Kamp, Mark, Darryll R. Johnson and Thomas C. Swearingen
1994 *Deterring Minor Acts of Noncompliance: A Literature Review*. Technical Report NPS/PNRUN/NRTR-92/08. Cooperative Park Studies Unit, College of Forest Resources, University of Washington, Seattle, Washington.

Widner, Carolyn J. and Joseph Roggenbuck
2000 Reducing Theft of Petrified Wood at Petrified Forest National Park. *Journal of Interpretation Research* 5(1):1–18.

Williams, Lance R.
1978 *Vandalism to Cultural Resources of the Rocky Mountain West*. Cultural Resources Report No. 21. United States Forest Service Southwestern Region, Albuquerque, New Mexico.

The Social Side of Subsistence: Examining Food Choice at the Seamons Mound Site (42UT271) using Sociocultural Perspectives

Scott M. Ure
Department of Anthropology, Brigham Young University

Seamons Mound (42UT271) is located in Utah Valley, just east of Utah Lake in the curving neck of Little Dry Creek on the Provo River delta. The mound is among hundreds of Fremont sites dotting the area and was excavated between 1968 and 1970 by Brigham Young University. This paper examines human remains found during the excavations at Seamons Mound that date to heart of the Fremont era. They exhibit intriguing physiological and pathological characteristics including possible head trauma and a debilitating handicap. Recent stable isotope analyses, metric studies, and sociocultural interpretations offer additional perspectives into the cultural implications of food choice for one young individual living along the shores of Utah Lake.

For decades Great Basin archaeologists have studied Fremont farmers using theoretical models developed mainly to examine hunters and gatherers (Allison 2008:57). Recent discussions by several Fremont scholars, however, suggest Fremont studies need to combine these behavioral and ecological studies with more sociocultural perspectives—a pattern used successfully in American Southwestern archaeology (Talbot 2000:275–276). As James Allison (2008:77) writes, "by combining ecological and social perspectives, Southwestern archaeologists have been highly successful at documenting and explaining dynamic patterns of social change." Examining Fremont sociocultural issues is not entirely foreign. One of the more successful examples was provided by Joan Coltrain and Steven Leavitt's (2002) analysis of burials recovered from the Great Salt Lake wetlands. Their conclusions recognize the influence of gender, age, and social status in Fremont food choice and ultimately subsistence patterns.

Following Coltrain and Leavitt (2002), I argue that Fremont diet studies must continue to broaden and examine how sociocultural influences affected Fremont food choice. Hodder and Hutson (2003:188) explain that, "one of the main and immediate impacts [of recognizing numerous viewpoints] is that it is no longer possible to study one arbitrarily defined aspect of the data on its own." In this light, I argue that Fremont research needs to examine how sociocultural factors influenced Fremont food choices. In this paper, I interpret osteological and dietary information from the skeletal remains found at Seamons Mound using practice theory to examine how social factors may have influenced this person's food choice.

To address these research goals I first outline the basic concepts of practice theory and explain how applying it provides a more thorough interpretation of Fremont dietary practices. Following my outline of practice theory, I discuss the results from Coltrain and Leavitt's analysis of the Great Salt Lake wetlands to establish a framework for interpreting results from my analysis of the Seamons Mound burial. I then provide a basic overview of the Seamons Mound site, followed by a discussion of my osteological and dental examinations, as well as the isotopic and radiocarbon analyses performed on the Seamons Mound burial. Finally, I interpret my analytical results using practice theory to explore how social factors may have influenced the dietary practices of this individual.

Practice Theory

Current practice theory is based on concepts associated mainly with sociologists Anthony

Giddens (1979; 1984) and Pierre Bourdieu (1990; 1998). Hodder and Hutson (2003:92) describe Bourdieu's theory of practice as an "implicit invitation to archaeologists to come to an understanding of the principles lying behind other cultural practices through an examination of and involvement in objects arranged in space and in contexts of use." In short, practice theory examines the recursive relationship between social structures and the agency of individuals. Practice theorists argue that individuals are actively engaged in defining and reinventing their world. For example, Timothy Pauketat (2003:82) argues that, "gender, ethnicity, cosmology, and political allegiances are routinely negotiated in the contexts of pottery production, use, and discard." Artifacts can be therefore be considered the result of actions by knowledgeable and active individuals interacting and changing their world. Allison (2008:60) explains that "practice theorists attempt to explain how the actions of knowledgeable human agents are influenced by the structural properties of their societies, while the same actions reproduce and modify the structures." Additionally, practice theory focuses on how human agents are influenced by their social structure, but not necessarily in a deterministic way (Cowgill 2000). We must, however, also recognize that individuals often repeat actions based on enculturation (Ortner 1984).

Structure

Giddens (1984:377) defines structure as, "rules and resources, recursively implicated in the reproduction of social systems. Structures exist only as memory traces, the organic basis of human knowledgeability, and as instantiated in action." Sewell (2008:131) clarifies that Giddens "rules" are comprised of "conventions, recipes, scenarios, principles of action, and habits of speech and gesture." Rules can also be unspoken, informal, and unconscious assumptions and presuppositions.

In his definition of structure, Giddens states that in addition to rules, structures are also comprised of resources which are the conduits for social power and change as individuals interact at varying social scales (Giddens 1979). Resources can be both individuals and products or goods that provide the means whereby an individuals, as well as groups, can influence or control others. Individual resources are the less tangible personal characteristics including, physical strength, agility, creativity, ingenuity, skill, etc. (Sewell 2008). Products and goods are resources that include natural or produced items often used to establish or maintain sociopolitical control (Sewell 2008). Non-human resources are especially important to archaeologists because they constitute the material record from which we derive our interpretations of the past.

Re-examining Giddens' (1984:377) definition, he states that structures, "exist only as memory traces" and are therefore considered "virtual." He argues that they do not exist in tangible form except as ideas in the human mind that are "instantiated in action" or put into practice by human agents (Sewell 2008:129). Tangible, real-world objects are resources that partially constitute structure; however, they are clearly not virtual, as described by Giddens. Tangible human bodies are, for example, not virtual, nor are material objects considered intangible (Sewell 2008). Sewell argues that structures are therefore dual in nature, comprised of virtual schemas—intangible ideas that exist only in the mind but are put into practice through human action—and tangible resources such as materials and goods. The relationship between the two is also recursive: schemas are the result of resources, and resources are the product of schemas. Tangible resources (material culture) can theoretically be read hermeneutically to uncover the social schemas they reflect (Sewell 2008).

Agency

Varien and Potter (2008:7) define agency as, "the choices made by people as they take action, often as they attempt to realize specific goals." In addition, people often identify themselves by the choices they make, thus signaling "who they are, and who they are not" (Varien and Potter 2008:15). Human beings have an intrinsic capacity for agency, but the form it takes fluctuates due to its recursive relationship with structure. Individuals are therefore both empowered as well as constrained by social structures.

Choices and actions can be active and passive, conscious or unconscious. The unconscious choices made through *habitus* represent "durable dispositions—ways of being, tendencies, propensities, inclinations" (Bordieu 1977:72). These non-reflexive actions are heavily defined by structure and are often referred to as practice (Bordieu 1990:80–97). This does not mean, however, that actions are rigidly determined by habitus, rendering the individual unable to act differently. Breaking from habitus is always an option, although the consequences for doing so are often unforseen.

Agency can therefore be considered the intentional and conscious choices that influence actions, whereas practice or habitus refers to the unintended, unconscious, and routine actions. Agency, however, can relate to more than single individuals acting by themselves. Agency can also be expressed collectively. Varien and Potter (2008:8) write that, "agency is fundamentally relational, and it can entail acting in concert with others, including acting with others [or] against others."

Great Salt Lake Wetland Burials

Practice theory offers a useful way for interpreting data from a social perspective, but is it useful for formulating useful conclusions about Fremont food choice? Sewell (2008) argues that the material record can be read hermeneutically to uncover the results of agency and the social schemas of those that produced and consumed these items. Coltrain and Leavitt's analysis of burials found in the Great Salt Lake (GSL) wetlands provides an excellent example of how examining sociocultural influences can provide insightful results. Although they did not explicitly use practice theory, many of their conclusions examine the relationship between individuals and their social structures.

In the early 1990s Great Salt Lake water levels dropped significantly, exposing the skeletal remains of eighty-six individuals south of Willard Bay (Figure 1) (Fawcett and Simms 1993; Simms 1993; Simms et al. 1991). Evidence of eroded campsites containing middens, hearths, ash stains, post holes, storage pits, and activity areas were noted during surveys in the area. The majority of the burials were recovered from shallow pits associated with these campsites, and very few grave goods were found associated with these remains. Coltrain and Leavitt (2002:459), however, note one exception at site 42WB324 where 11 individuals were recovered along with numerous grave goods. Of note among these goods were a bison horn, fish hooks, gaming pieces, and one partial projectile point. No formal architectural features were noted (Simms et al. 1991:44–52).

The osteological examination of the skeletal remains noted various pathologies including degenerative joint disease, a variety of mastoid infections, heavy dental wear, *cribra orbitalia*, and enamel hypoplasia. Coltrain and Leavitt (2002:457) also noted that 33 percent of the skeletal population had one or more symptoms of nutritional stress. In addition to the osteological examinations, 50 of the 86 skeletal remains were subjected to AMS radiocarbon dating and stable isotope biochemistry to calculate the age, C_4, and C_{13} levels in the bone collagen (Coltrain 1997, 2002; Coltrain and Stafford 1999). Twenty-six of the 86 individuals were sexed, and among this subset, males exhibited a much higher mean $\delta^{13}C$ value than females—more than three times the standard deviation of females, while $\delta^{15}N$ values were relatively equal (Coltrain and Leavitt 2002:465). This suggests that some males in the Great Salt Lake wetlands dataset consumed more C_4 resources (most likely dominated by maize) than females, but both sexes consumed approximately the same amount of protein. Coltrain and Leavitt (2002) note, however, that

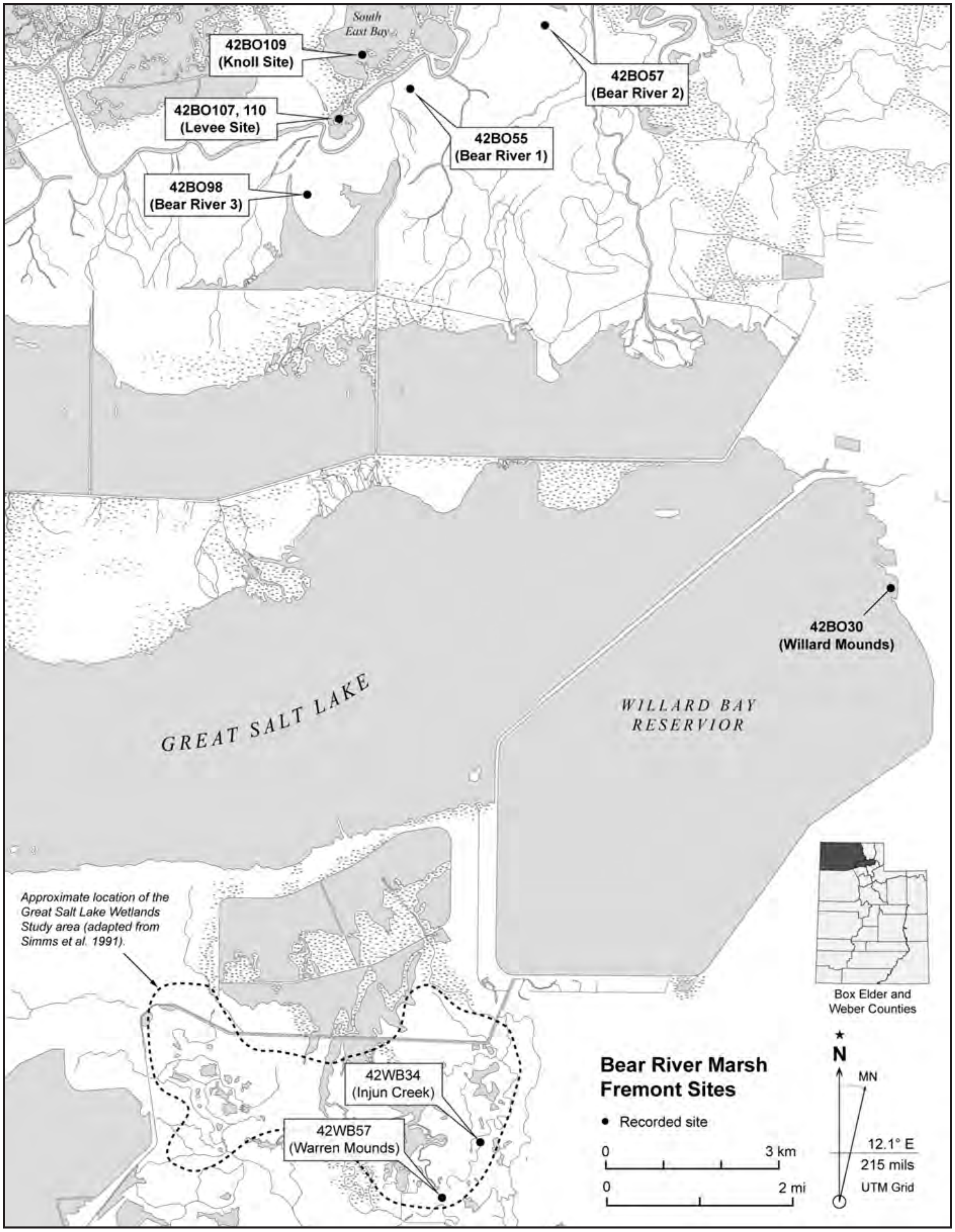


Figure 1. Map showing the location of prominent Fremont sites in the Bear River Marsh area, as well as the location of the Great Salt Lake Wetlands study area (map adapted from Simms et al. 1991).

these results are somewhat skewed by male remains recovered from site 42WB324. The 11 male burials shared a "high degree of C_4 intake, increased nutritional stress, reduced skeletal robusticity, and a relatively elaborate burial context" (Coltrain and Leavitt 2002:474). In addition, these 11 males all consumed more animal protein than typically found among Fremont villagers with diets comprised mostly of maize. Results from the GSL Wetland burials study led to important conclusions regarding the relationship between isotope levels and specific characteristics tracked during the analysis. Coltrain and Leavitt (2002:484) explain that "wetlands carbon and nitrogen isotope ratios are inversely correlated and covary with five monitored variables: radiocarbon age, sex, age-at-death, skeletal robusticity, and skeletal pathology."

Coltrain and Leavitt (2002:474) also conclude that "if maize had both a ritual and dietary function, it would have had a corresponding social as well as economic currency enhancing its value relative to wild resources, bestowing prestige on males who dispensed it in exchange for labor, animal protein, or political support." Coltrain (2002) also suggests that these males may have consumed maize as a food staple, as well as a ritual beverage. Coltrain and Leavitt (2002:474) write, for example, that both ethnographic and iconographic information suggest that maize beer was an important pre-Inkan ritual drink consumed during feasts that was prepared, but never consumed by women (Hastorf 1991; Hastorf and Johannessen 1993; Moore 1989).

Age-at-Death and Diet

Forty-nine GSL burials were assigned an age-at-death among the Great Salt Lake wetland burials (Fawcett and Simms 1993; Owsley et al. 1996; Simms et al. 1991). Within this dataset Coltrain and Leavitt (2002) noted little variation in diet among adults, children, and adolescents containing moderate $\delta^{13}C$ levels (referred to as "mixed" diets by Coltrain and Leavitt). Among those with high $\delta^{13}C$ values (likely attributed to increased maize consumption), however, were adolescents and adults over the age of 45. According to Coltrain and Leavitt (2002:466), the amount of C_4 consumption among GSL Wetland burials seems to "roughly correlate with age."

Seamons Mound (42UT271)

During 1968 and 1970, Brigham Young University (BYU) students excavated a prehistoric site near Utah Lake designated as Seamons Mound (42UT271). During the course of their excavation they recovered pottery, stone tools, faunal bone, figurines, and three sets of human skeletal remains which were removed and stored at the BYU Museum of Peoples and Cultures. Although three individuals are represented in the skeletal human remains, only one was fully analyzed using osteometrics, radiocarbon dating, and stable isotope biochemsitry. The skeletal remains for this individual (identified as Individual 1) were relatively intact and had excellent bone preservation. The skeletal remains for Individual 1 also had the highest potential for testable collagen necessary for successful radiocarbon and stable isotopic analyses. Individuals 2 and 3 were also examined, although only using osteometrics to evaluate sex, age, and pathology.

Site Description

Seamons Mound is located in the heart of the Fremont residential area of the Provo River Delta in Utah Valley, Utah. It is located east of Utah Lake in the curving neck of the now extinct Little Dry Creek (Figure 2). Other Fremont mound sites nearby include the Hinckley Mounds (42UT110–113), Benson Mound (42UT3), Marrott Mound (42UT116), Rollins Mound (42UT4), Carter Mound (42UT115), and the Smoking Pipe Site (42UT150), as well as many others. Goshen Valley (Figure 3), located just south of Utah Lake, also contains several excavated Fremont residential sites: Woodard

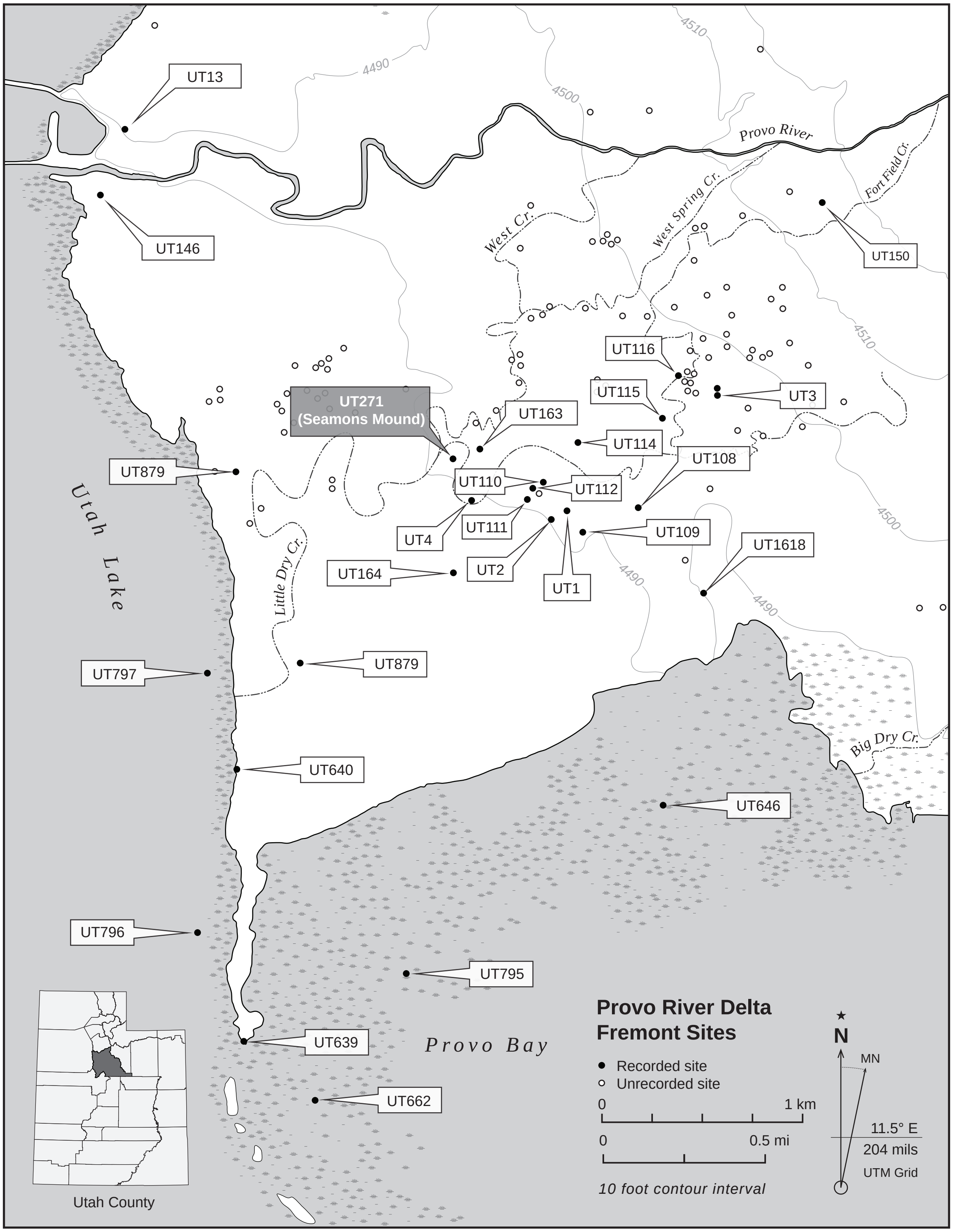


Figure 2. Location of Seamons Mound (42UT271), as well as nearby Fremont sites in the Provo River Delta.

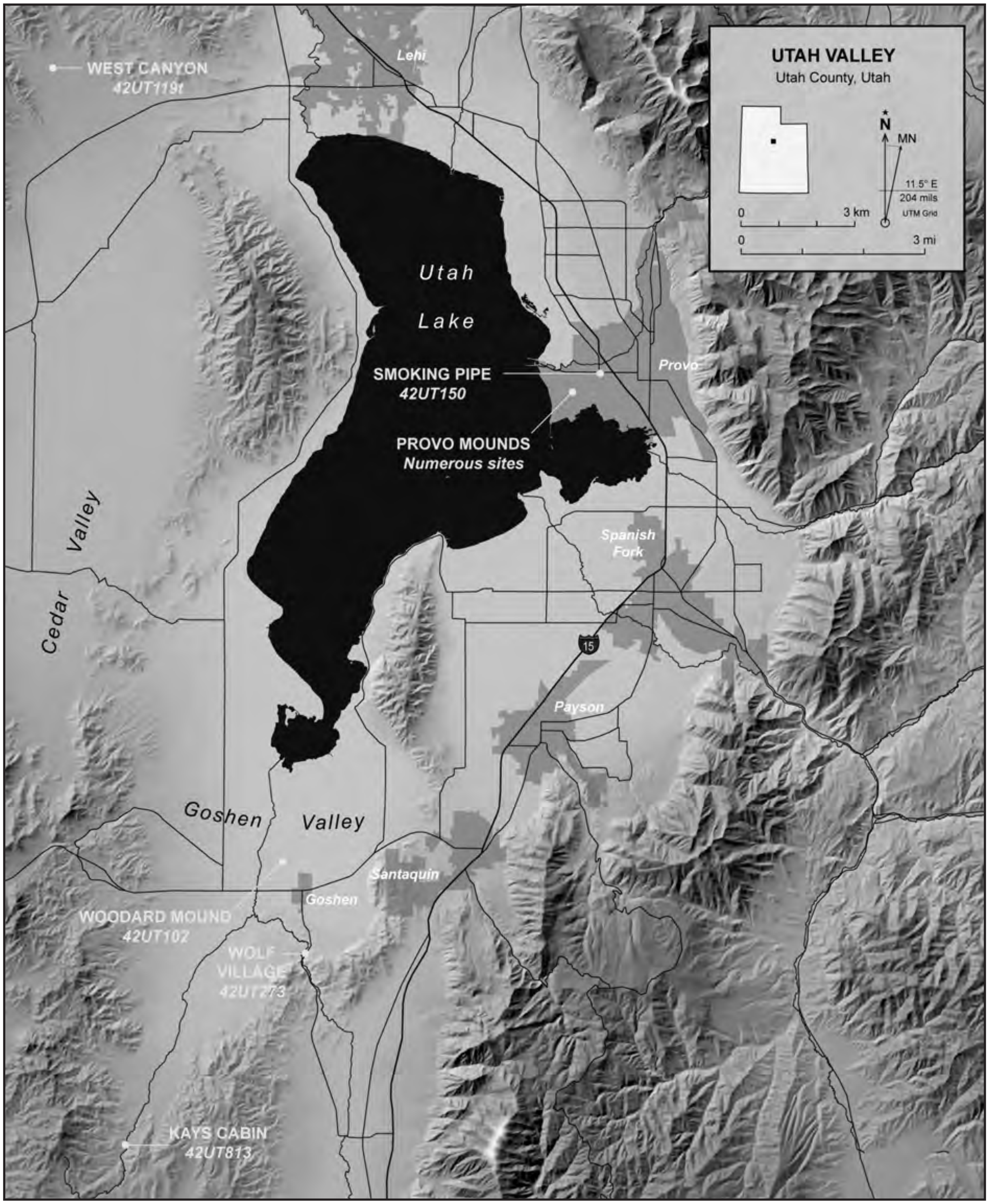


Figure 3. Map showing selected Fremont sites located in Utah Valley.

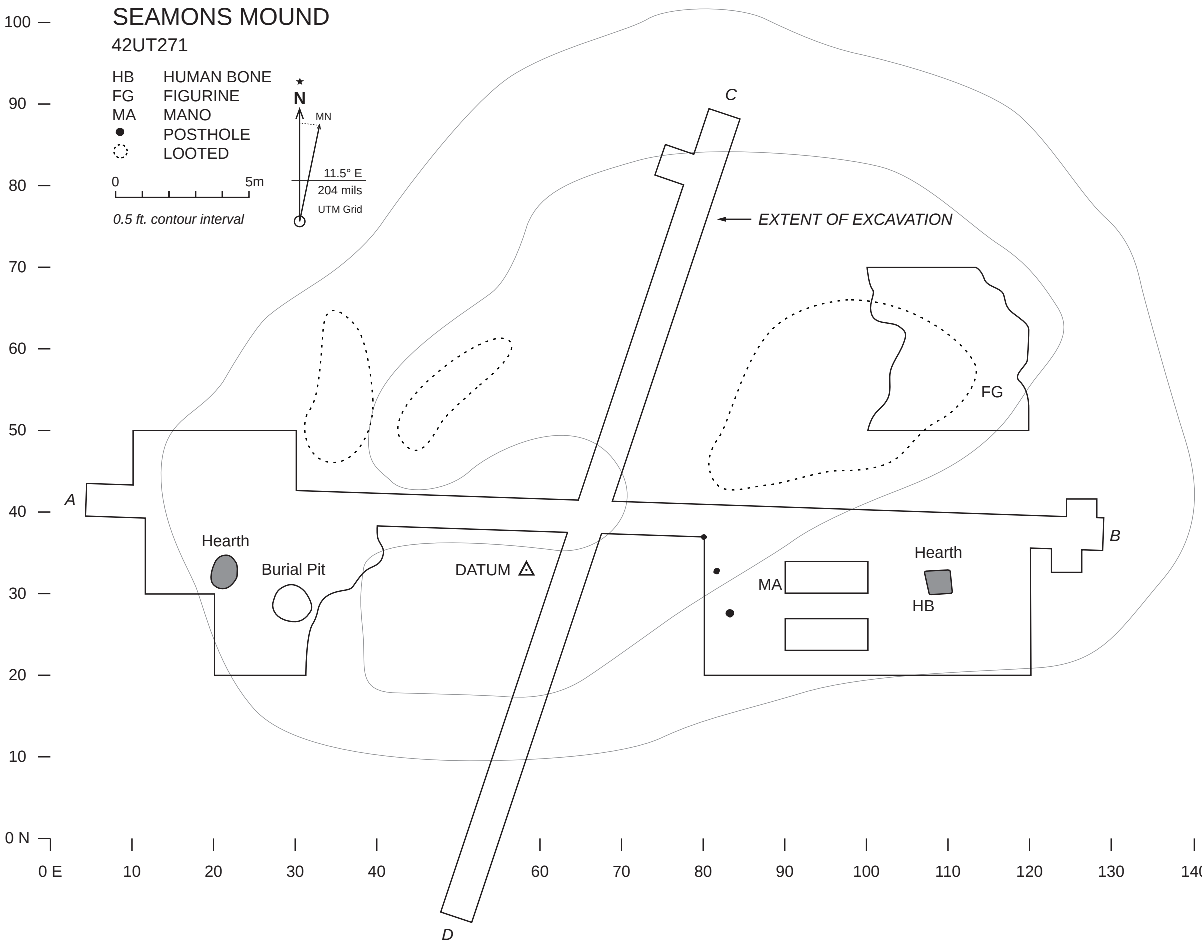


Figure 4. Plan map of the 1969 Seamons Mound excavations compiled from student notes.

Mound (42UT102), Wolf Village (42UT273), and Kay's Cabin (42UT813). There are 20 recorded mounds in the Provo River Delta, but maps and descriptions from amateur archaeologists Robert and James Bee note over 100 other mounds in the area (see Figure 2) (Janetski 1990; Bee and Bee 1934–1966). Rex Madsen (1969), a student who helped excavate Seamons Mound, wrote in his field notes that the site had been extensively looted when they began excavation there in late 1968. He noted, however, that the mound still rose approximately two feet above the ground (Madsen 1969:17). In addition, he observed that the mound was likely complete in the past, but had recently been cut in two by a bulldozer (Figure 4).

Architectural features at Seamons Mound were sparse, but included two clay-rimmed hearths, two cache pits, concentrations of adobe and clay, and a burial pit. The burial pit was found below adobe debris and a thin charcoal lens. Photographs from the excavation (Figure 5) show some surface alteration (adobe plastering?) to the pit walls. Whether the pit was intentionally prepared for internment, or was simply a convenient place to bury a body remains unclear from Madsen's (1969) site report. The presence of adobe fragments, combined with

Figure 5. Seamons Mound burial and the associated burial pit.

scattered refuse, trash pits, extramural hearths, and a burial suggests that Seamons Mound likely contained habitation and/or storage structures. If structures did exist at one time, they have fallen victim to plowing that began in the Provo River Delta after the arrival of Euroamerican settlers. When placed in a larger geographical context of the Provo River Delta and the numerous village sites nearby, Seamons Mound was likely part of a larger Fremont style community along the Provo River.

Material Culture

Artifacts recovered from Seamons Mound included stone tools, work bone tools, and ceramics. Stone tools recovered included projectile points, drills, gravers, scrapers, bifaces, and choppers. In addition, two rectangular slate "palettes," an elongated stone pendant, and one stone bead were noted during excavation (Madsen 1969:33). Bone and antler artifacts recovered included awls, antler scrapers, a bone harpoon point, a saw-toothed scapula tool, a "possible bone weaving tool," bone tube beads, and a bone gaming piece (Madsen 1969:41). Regarding the bone harpoon, Madsen (1969:42) described this tool as made from a large mammal bone with serrations or barbs on one side that extend three-fourths of the length of the tool. Ceramic sherds recovered were described as "Provo, Salt Lake, Sevier, and Uinta types" (Madsen 1969:42). It is unclear what Madsen (1969) meant by the Provo type, but he describes it as having Black-on-gray varieties, as well as the Sevier type having Black-on-gray and Black-on-white examples. These painted wares are most likely Fremont Snake Valley black-on-gray and Ivie Creek black-on-white pottery. In addition to the plain gray and painted wares, surface manipulated (corrugated, incised, punctuated, and "coffee-bean" appliqué) sherds were also noted in the assemblage. Vessel shapes represented in the assemblage from rim sherd analysis included bowls, pitchers, ollas, and jars. Numerous Promontory style sherds were also recovered at Seamons Mound.

Faunal remains from Seamons Mound contained a variety of mammals, fish, and birds (Green 1961). Species identified by Madsen (1969:60) include duck, deer, elk, bison, beaver, gopher, sucker, and horse (found in the plow zone). Cook (1980:56) later examined the Seamons Mound faunal remains and concluded that wetland fauna were clearly favored. Interestingly, fish remains are not nearly as abundant in the faunal dataset compared to other Fremont wetland sites near Utah Lake. This may be due in part to collection techniques. Water screening at other Utah Valley wetland sites (e.g. Woodard Mound and the Smoking Pipe Site) had much higher recovery rates of fish bone, which may explain the lower numbers at Seamons Mound where water screening was likely not used.

Regarding floral remains, Madsen (1969:60) explains that aside from charcoal and beam impressions in adobe, no other macro- or microfloral remains were recovered. Floral remains from other contemporary sites around Utah Lake, however, provide a more complete picture of plant species exploited by the Fremont living in Utah Valley. A storage pit in the Fremont level of Spotten Cave (42UT104) contained corn cobs, corn husks and stalks tied together, black beans with pods, squash rind fragments, and cane. In addition, Mock (1971:80) noted hackberry, beeweed, buckwheat, yucca, sunflower, and pinyon pine seed shells. At Woodard Mound (42UT104), Richens (1983) noted an abundance of Cheno-ams, but other species included Indian Rice Grass, reed, maize, bulrush, cryptantha, knotweed, juniper, and elderberry. The Smoking Pipe site (42UT150) which is located a little over a mile to the northeast (see Figure 2), and essentially contemporaneous with Seamons Mound (Forsyth 1991), contained maize kernals, cobs, corn stalks, and five beans of an unknown variety (Billat 1985:91–93). Pollen recovered included Cheno-ams, beeweed, species from the sunflower family, the mustard family, buckwheat, the tomato or potato family, and maize. Floral remains recovered from these sites which are temporally and spatially similar to Seamons Mound, suggest that those living there probably had access to a variety of similar cultivated crops including maize, beans, and squash. It also seems safe to assume that the Seamons Mound inhabitants consumed a wide variety of wild plants similar to those noted at these same Fremont sites located in Utah Valley.

Human Remains

The human remains recovered from Seamons Mound during the 1968–69 excavations represent three different individuals, all found in varying contexts within the site boundaries. All remains were associated with Fremont features and artifacts, and were located within the larger context of the Fremont Provo Mound site. For the purpose of this analysis, each individual was numbered for general reference. Individual 1's skeletal remains were well preserved and mostly intact, but the remains from Individuals 2 and 3 have ubiquitous root etching, fragmentation, and deterioration. All of the carpals, metacarpals, and hand phalanges, the tarsals, metatarsals, and foot phalanges, and cranium, sternum, and left scapula for Individual 1 could not be found in the museum collections but were noted in 1968 excavation photos. A significant number of bones for Individuals 2 and 3 were also missing and not described in the original archaeological documentation. It is likely that these remains were not preserved, or possibly not recovered during the 1968 excavation.

Analytical Methods

Human remains from Seamons Mound were analyzed to determine sex, age, stature, cultural affiliation, diet, dental inventory, dental wear, long bone growth, and pathology. Sex was assessed using the mastoid process shape, mental eminence, and sciatic notch scoring suggested by White (2000) and chin shape characteristics per Bass (1995). Age was calculated using dentition and epiphyseal closure following White (2000), while stature was estimated using an equation developed for Great Basin populations by Auerbach and Ruff (2009). General cultural affiliation was determined from AMS radiocarbon dating, and conclusions about diet were drawn from stable carbon isotope biochemistry. Dental inventory and wear, and long bone growth were estimated following calculations from White (2000) and Bass (1995). Cranial metrics and race estimation were not included because crania for all three individuals at the Seamons Mound burial, aside from occipital sections for Individuals 1 and 3, either could not be found in the museum collections, or were not preserved and therefore not collected during excavations.

Individual 1

Dick Miller (1969) performed the initial osteometric analysis and concluded that Individual 1 was a female ranging from 16–22 years of age. He based these conclusions on the general gracility of the skeletal remains and morphological characteristics of the pelvis. My analyses, however, suggests that Individual 1 was likely a subadult male ranging in age from 12–15 years.

Individual 1 was interred in an oval pit, in the prone position, head pointed southwest. The internment seems haphazard, with the head and legs awkwardly bent, extending over the edges of the burial pit. In addition, the tibiae and fibulae were angled approximately ninety degrees from the femora, extending up the edge of the pit; the left arm was extended slightly outward from the body. The head rested at an acute angle against the steep burial pit wall and was turned nearly ninety degrees from the spinal alignment to the southeast (see Figure 5).

Dentition and Mandible

I initially examined the mandibular dentition, which was later examined by Dr. Darrell Thomas, DDS (2009). These examinations noted the presence all permanent teeth, except for the third molars (RM_3 and LM_3) or "wisdom teeth" which calcify between the ages of 14–16 (Thomas 2009) and erupt by approximately 18 years of age (White 2000:344). X-rays confirmed this observation and revealed no calcification for third molars (Figure 6). Third molar crypts, however, are visible in the x-ray, suggesting the very early stages of third molar growth (Thomas 2009). Second molars ($RM_{2,}$ LM_2) are fully erupted with slight but uniquely even wear on the Protoconid and Hypoconid cusps. The two central incisors (RI_1, LI_1) exhibit significant wear and chipping with nearly all occlusal enamel missing. This may suggest frequent teeth grinding or using the incisors as tools in a biting, clenched, position. Additionally, the first molars (RP_3, LP_3) and canines ($RC_{1,}$ LC_1) show heavy wear which also indicates teeth grinding or a diet containing heavy grit. The tooth-wear pattern for some of the teeth analyzed matches attrition typical of 24–30 year olds (White 2000), while others are not nearly as worn. Thomas (2009) concluded that the grinding patterns on the teeth likely stemmed from neurological habits. He based this conclusion on the visible wear of the mandibular condyle typical of someone with Temporomandibular Joint Disorder (TMJ);a condition often attributed to habitual teeth grinding and clenching.

Individual 1's second right incisor (RI_2) exhibits a minor shovel-shape typical of Native American incisors (White 2000:377), and aside from significant tooth wear, the teeth are in excellent condition showing little or no caries

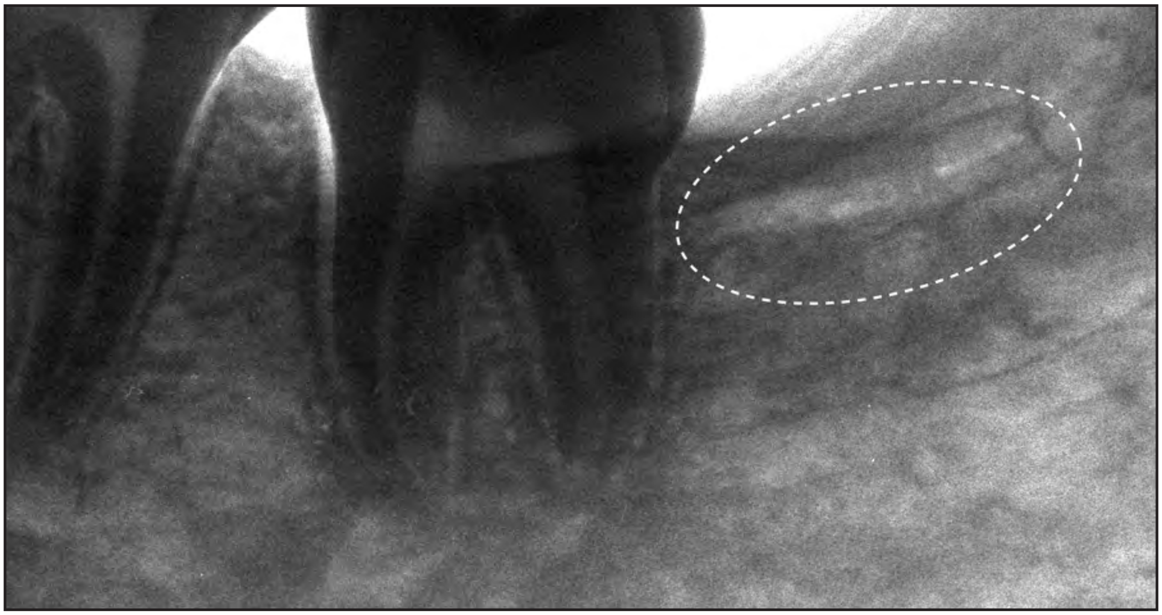


Figure 6. X-ray showing a lack of calsification for Individual 1's third molar.

or abscesses which are typical among those consuming high quantities of maize and/or gritty food. Thomas (2009) noted that "only one molar had some pitting and no ectodermal dysplasia on either cuspid . . . and no other signs of pitting or dysplasia." The dentition also suggests Individual 1 did not experience significant dietary stress.

Occipital Bone

Portions of the occipital bone provided further insight into the sex and pathology for Individual 1. The left mastoid process was missing, but the right was still visible with only a portion of the tip absent. The mastoid process is wide, pronounced, and moderately robust, suggesting masculinity. The presence of a large ovate hole, measuring 4.5 cm wide in the lower right half of the occipital bone and approximately 6–8 cm wide in the upper portion of the occipital, offers insight into a possible cause of death. Analysis of the broken edges revealed micro crushing that tilts inward toward the cranial vault with subtle bone chipping on the interior sections of the hole. The Lambodial suture also appears separated, starting at the fractured area and extending laterally toward the right half of the skull. The edge color and characteristics suggest an ancient break (White 2000:409). Making a temporal determination for this fracture is problematic, but the general shape and extent of the fracture suggests a traumatic event as evinced by the noted bone chipping and suture separation usually attributed to extreme head trauma. If this fracture was ante- or perimortem, it would have been fatal. Photographs from the original excavation show the fracture extending into the right Temporal and Parietal portions of the skull and exhibit what appears to be soil from the inhumation filling the cranial vault. Original observations made by Miller (1969:55) state that, "the apparent violent death of the individual [is] evidenced by a large cranial collapse of the right temporal area with resultant skull fragmentation inward."

Axial Skeleton

Nearly all of the vertebrae are present for Individual 1, except for the atlas (C-1) and seventh cervical vertebrae (C-7). Most of the epiphyses, except for half of the C-3 cervical vertebrae are unfused, suggesting an age of no more than 17 years old (Bass 1995) (Figure 7). The sternum is missing from the skeletal remains and was therefore not analyzed, but the ribs were nearly complete, except for rib number 11 on the right, and 10 and 11 on the left. The proximal epiphyses and the articular and nonarticular parts of the tubercle on the ribs remain unfused, suggesting an age of 17 years or younger. The innominate bone, ilium, ischium, and the pubis, along with the iliac crest are entirely unfused. According to Bass (1995:194), these three bones normally fuse around 12 years of age. In addition, the Sciatic notch angle for Individual 1 is acute, matching the angle typical for males (White 2000:369). Both innominate blades are quite thin, 4.7 mm at the thinnest point, and are worn completely through in the upper portions.

The sacrum provides interesting insight into the health of Individual 1. All but sections four and five are unfused, suggesting an age of 18 or younger (Bass 1995). Interestingly, the median crest at the neural arch is entirely unfused, a trait indicative of the most severe form of spina bifida known as *Myelomeningocele*. The first epiphyseal ring at the median arch also exhibits a boney protuberance where the normal fusion should occur. This is likely a portion of the unfused spine that often protrudes through the skin on the back of individuals with spina bifida (Figure 8).

According to the Center for Disease Control and Prevention (CDC) (2008), spina bifida can significantly reduce mobility and cause frequent hip dislocation, decrease bowel and bladder control, cause learning disabilities and/or mental retardation, and contribute to hydrocephalus. The CDC (2008) describes spina bifida as a life-long disability that often requires multiple corrective surgeries and constant care by others. Causes of Spina bifida include genetics, nutritional, and environmental sources. Preliminary studies have recently found a correlation between the consumption of products made with locally grown, unprocessed maize and an increased risk in neural tube defects (NTD) in Mexican-American women born in Mexico (Voss et al. 2009; Hendricks 1999). Mycotoxins produced from the *Fusarium verticillioides* fungus commonly found in maize and maize products such as tortillas, have been shown in some cases to increase the risk of spina bifida and other NTDs. The implications for these continuing studies are significant for understanding the possible cause of these birth defects in prehistoric maize farming populations.

Appendicular Skeleton

The clavicles for Individual 1 are both present, although the medial epiphyses remain unfused—these normally fuse around the 17th or 18th year (Bass 1995). Only one scapula was available for analysis, and all of the epiphyses are unfused, including the coracoid process, glenoid cavity, acromion, inferior angle, and the medial border (Bass 1995). The coracoid process is the first scapular epiphysis to fuse at age 15, but remains unfused with Individual 1, suggesting an approximate age of 15 or younger. Also, the right scapular blade, like the innominate blade, is considerably thin and fragile, possibly suggesting weak musculature or left-handedness. In addition, both humeri (24.9 cm in length), radii (19.2 cm in length), and ulnae (21.2 cm in length) are present and unfused at all proximal and distal ends. The humeri are also missing epiphyses at the medial epicondial, which normally fuse between 11 and 16 years of age (Bass 1995). The long bones in the arms for Individual 1 are generally quite gracile and thin, also suggesting a weak muscular structure. The femora (34.3 cm in length), tibiae (29.3 cm in length), and fibulae (27.9 cm in length), like the long bones in the arms, are all unfused at the proximal and distal epiphyses, including the femoral heads and the greater and lesser trochanter, which usually join between 14 and 19 years of age (Bass 1995). In sum, the appendicular skeleton adds additional information about Individual 1's age, which is lowered to approximately 11–12 years old, based specifically on the age sensitive unfused epiphyses in the humeri.

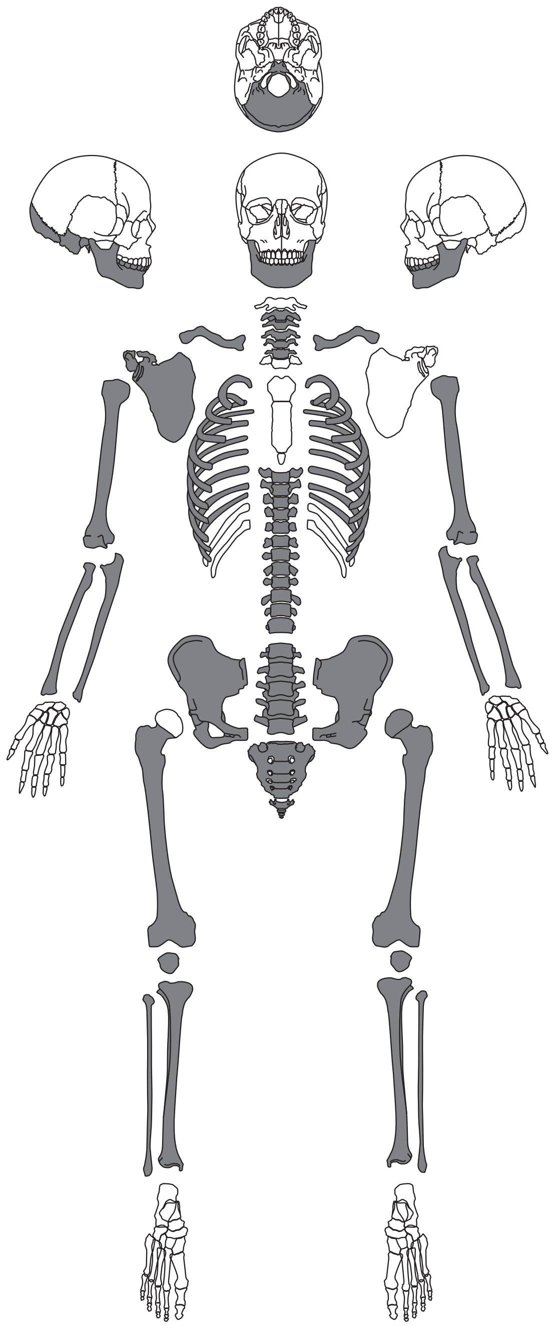


Figure 7. Diagram showing the presence and abscence of bones post-excavation for Individual 1.

Conclusions for Individual 1

Sex and Age

Based solely on epiphyseal fusion, Individual 1 was probably between 11–17 years of age. The lack of epiphysal fusion in the humeri suggests the earlier age range between 11 and 12 is the most likely (Table 1). Dentition offers a very precise age which corroborates the evidence from the epiphyseal fusion. Root closure of the second molars typically finishes by age 14–16 (Thomas 2009) and second year molars usually erupt between 10–12 years of age (White 2002:342). Individual 1's second molars are fully erupted, but x-rays (see Figure 6) show that the root closure is incomplete, placing this person at 12 years of age, ±6 months (Thomas 2009). Considering the chin shape, sciatic notch angle, and mastoid process shape, the sex for Individual 1 is likely male.

Living Stature

Determining stature for a person this young is challenging due to missing epiphyses which alter the overall length for long bones. In addition, stature is further complicated by racial differences among the various populations (Bass 1995:26). The maximum stature was estimated using a stature equation provided by Auerbach and Ruff (2009) for the Great Basin and American Southwest Native American males: 0.160 × Femoral bicondylar length (mm) + 0.126 × Tibial maximum length (mm) + 47.11. Based on this equation, Individual 1 was approximately 55 inches tall (4 ft. 6 in. ± 1). From a gross perspective, this height fits a smaller-sized adolescent around the age of 11 or 12 years old.

Cultural Affiliation

The right first rib from Individual 1 was sent to Lawrence Livermore National Laboratory, Livermore, California for AMS radiocarbon dating. The analysis returned two possible 2 sigma calibrated age ranges of cal A.D. 994–1058 (p = 0.52) and cal A.D. 1076–1154 (p = 0.48). The probable median calibrated age is A.D. 1074. Based on these results, Individual 1 is affiliated with the Fremont culture, which is substantiated by Fremont artifacts found at Seamons Mound. This date range shows that Individual 1 lived during the height of the Fremont culture—a time

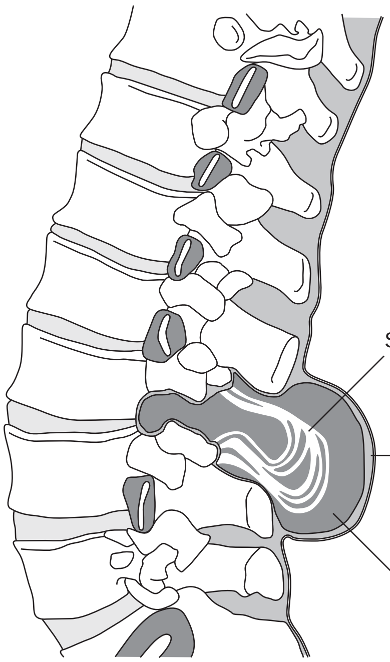


Figure 8. Diagram showing the effects of a severe form of spina bifida known as *Myelomeningocele*.

of substantial, flourishing village communities such as those found in the Parowan Valley, Utah Valley, and along the Bear River near the Great Salt Lake. In most cases, these villages cultivated maize as evinced by the high C_4 concentrations found in isotopic analyses from human remains found at these sites (Coltrain and Leavitt 2002).

Diet

The same rib submitted for radiocarbon dating was also analyzed using stable carbon isotope biochemistry to determine the lifelong dietary pattern for Individual 1. The analysis uses "isotope ratio mass spectrometry to monitor relative abundances of the stable isotopes of carbon (^{13}C / ^{12}C) in human bone collagen or apatite" (Coltrain and Stafford 1999:60). In addition, the same method is used to measure the ratio of stable isotopes of nitrogen $^{15}N/^{14}N$. The results show the level of C_4 and protein intake over an individual's lifespan (Coltrain and Leavitt 2002). In general, lower $\delta^{13}C$ values equal less C_4 resource consumption; lower $\delta^{15}N$ values indicate less protein consumption.

Bone collagen preservation for the Seamons Mound burial was evaluated based on methods used by Coltrain and Leavitt (2002) in their analysis of Fremont burials in the Great Salt Lake wetlands, which include whole-bone percent nitrogen, atomic carbon to nitrogen ratios, and collagen yields. The atomic carbon to nitrogen ratio for this analysis was 17 percent, with a carbon to nitrogen ratio of 3.2, indicating a very well-preserved bone collagen (Ambrose 1990). The carbon and nitrogen isotopic analysis performed on the right first rib of Individual 1 returned a $\delta^{13}C$‰ value of -14.3 and a $\delta^{15}N$‰ value of 11.2.

According to Coltrain and Leavitt (2002:470), an individual's diet with $\delta^{13}C$ values equal to or less than -14.0 per mil are representative of people who "subsisted on diets relatively high in C_4 foods." They also conclude that "Maize intake is the most parsimonious explanation for

Table 1. List of Bones and their stage of Fusion for Individual 1

Bone	Epiphyses	Fused / Unfused	Age of Fusion	Notes	Length
Axial Skeleton					
Cervicle vertebre	Vertebral ring	Unfused	17	C-3 fused	
Ribs	Proximal	Unfused	17		
	Articular	Unfused			
	Nonarticular	Unfused			
Innominates	Illium	Unfused	12		
	Ischium	Unfused			
	Pubis	Unfused			
	Iliac crest	Unfused			
Appendicular Skeleton					
Clavicles	Medial	Unfused	17 - 18		
Scapula	Coracoid process	Unfused	15	Thin blade, fragile	
	Glenoid cavity	Unfused			
	Acromion	Unfused			
	Inferior angle	Unfused			
	Medial border	Unfused			
Humeri	Proximal	Unfused		Gracile	24.9 cm
	Distal	Unfused			
	Medial epicondial	Unfused	11 to 16		
Radii	Proximal	Unfused			19.2 cm
	Distal	Unfused			
Ulnae	Proximal	Unfused			21.2 cm
	Distal	Unfused			
Femora	Femoral head	Unfused			34.3 cm
	Greater trochanter	Unfused	14 to 19		
	Lesser trochanter	Unfused	14 to 19		
Tibiae	Proximal	Unfused			29.3 cm
	Distal	Unfused			
Fibulae	Proximal	Unfused			27.9 cm
	Distal	Unfused			

elevated $\delta^{13}C$ values." Coltrain and Stafford (1999:73) write, "Individuals from the Great Salt Lake wetlands with isotope ratios at or more positive than ca. -13‰ consumed diets high in C_4 plant resources and/or isotopically enriched animal protein." Burials from the Willard and Woodard mounds, both of which are Fremont village sites where maize was cultivated, had mean $\delta^{13}C$ values at approximately -13.00 per mil on average, with mean $\delta^{15}N$ values around 10.8 per mil (Coltrain and Leavitt 2002). Burials at Fremont village sites included in Coltrain and Stafford's (1999) original wetland research averaged $\delta^{13}C$ levels of between -11.00 per mil and -7.4 per mil, which they suggest represents a diet comprised of 70 to 85 percent C_4 resources. They write that these results from Fremont village sites suggest "maize, perhaps supplemented by a small suite of native C_4 plants, was on average the most abundant food in the Fremont 'village' diets . . . the role of wetland resources appears minimal by comparison" (1999:72). Coltrain and Stafford (1999:73) note that Backhoe Village and the Smoking Pipe site (the latter temporally and spatial near Seamons Mound), though both very close to riparian wetlands, exhibit carbon isotope readings indicative of high maize consumption. Individual 1's $\delta^{13}C‰$ value of -14.3 could suggest a moderate to high level of C_4 consumption. If -11.0 per mil to -7.4 per mil represent 70–80 percent C_4 consumption, as suggested by Coltrain and Stafford, then Individual 1's diet was conservatively comprised of 50–60 percent C_4 resources likely dominated by maize.

Pathology

Cranial trauma seems to be one likely cause of death for Individual 1. Excavation photos show this hole extending further into the temporal and parietal sections of the skull. The break itself is clean, ovate, and narrow. The shape and condition of this fracture match head trauma patterns caused by fatal blows visible in crania of soliders in Neolithic Europe (Schulting 2008). A large amount of concentrated force was likely required to cause the visible suture separation and clean breaks around the interior hole surfaces. This seems to eliminate any postmortem scenarios such as roughly placing the body in the burial pit or dropping the body head-first onto a hard object. Neither explanation would provide enough force to create the cranial trauma evident, nor explain the narrow, ovate hole found in the skull. The more likely scenario involves an oval shaped object, roughly 5 cm at the widest point, and 6–8 cm long, impacting Individual 1's skull either ante- or perimortem. Without analyzing the full cranium, however, this explanation for the cause of death remains tenuous.

Regarding the malformed sacrum, the completely open and unfused neural arch is a clear indicator of spina bifida, which certainly affected this individual's overall health and likely caused significant daily discomfort. Although issues with mobility and mental retardation typically seen among those with spina bifida may not have directly caused death, these problems could have contributed heavily to an overall decline in health and a decreased life span.

Individual 2

The skeletal remains from Individual 2 are considerably less complete than Individual 1, but also exhibit subadult characteristics. During excavation, these remains were found disarticulated and possibly intermingled among those of Individual 1, although the actual provenience from the 1968–1969 excavations is unclear. No cranial bones were recovered for this individual. Skeletal remains include two cervical vertebrae, eight thoracic vertebrae, two lumbar vertebrae, the right humerus and radius, the left ulna, the right clavicle, the upper portions of the right and left innominates, the left femoral head, the left humerus head, and the first through fourth unfused sacral rings. In addition, 11 rib fragments are present, although most are partially fractured making rib identification difficult. Similar to Individual 1, this person has unfused long bone epiphyses in the humerus, radius, and ulna. The innominates are likewise not fused, and the sacral notch angle is acute and narrow. Without more information, determining sex and age is difficult.

Individual 3

The mandible, along with several poorly preserved rib fragments of Individual 3, were found several meters north and east of the Individual 1 burial. This small mandible has mostly developed first molars (RM_1/LM_1), and unerupted second molars ($RM_{2/}LM_2$) are visible in open tooth sockets of the mandible. Both

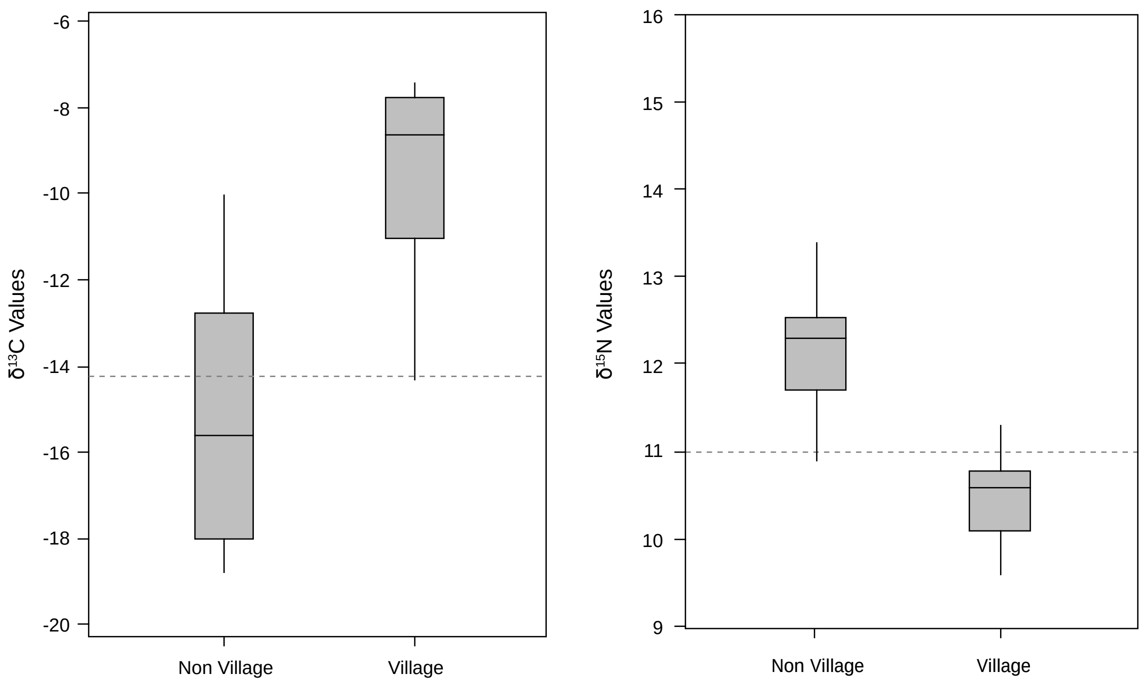


Figure 9. Graph comparing δ13C and δ15N values betwen Fremont non-village and village sites. Dashed line represents Individual 1's values.

first premolars (RP_3/LP_3) are missing, and bone growth over the tooth sockets suggests long term tooth decay. Caries are extensive and especially pronounced in the second premolars (RP_4/LP_4) and first molars (RM_1/LM_1). Abscesses are visible in the mandible below the two central incisors (RI_1/RI_1). The chin is moderately flat and slightly indented. Due to the young age of this person (estimated at between 9 and 12, based on dentition [White 2000]), and the lack of any other remains to provide more information, establishing sex was not possible.

Human Remains Discussion

Examining the skeletal remains from Seamons Mound offers useful insight into the lives of these three individuals, but especially Individual 1. Unfortunately, little can be concluded about Individuals 2 and 3 other than that they were children, and had poor dental health. Much more, however, can be concluded about Individual 1. My studies show that this person was male, 11–12 years old, and stood approximately 4 feet, 6 inches tall. He lived during the height of Fremont maize cultivation in Utah Valley and consumed moderate amounts of maize as seen in his $\delta^{13}C$ value. He did not, however, eat as much as typical Fremont male adolescents living in farming communities (Coltrain and Leavitt 2002:475). Individual 1 had very healthy teeth, quite uncommon amongst agriculturalists (White 2000), but he was also severely handicapped.

Individual 1's isotopic results show a diet comprised of moderate C_4 resources and a slightly above average protein intake. This ratio does not fit the typical pattern indicative of people living in well-established Fremont farming villages (Coltrain and Leavitt 2002). The mean $\delta^{13}C$ value for Fremont village burials is -9.4. The $\delta^{13}C$ value for Individual 1 is -14.3, two standard deviations below the mean for Fremont village sites (Figure 9). The mean $\delta^{15}N$ value for these same Fremont village burials is 10.5, while the $\delta^{15}N$ value for

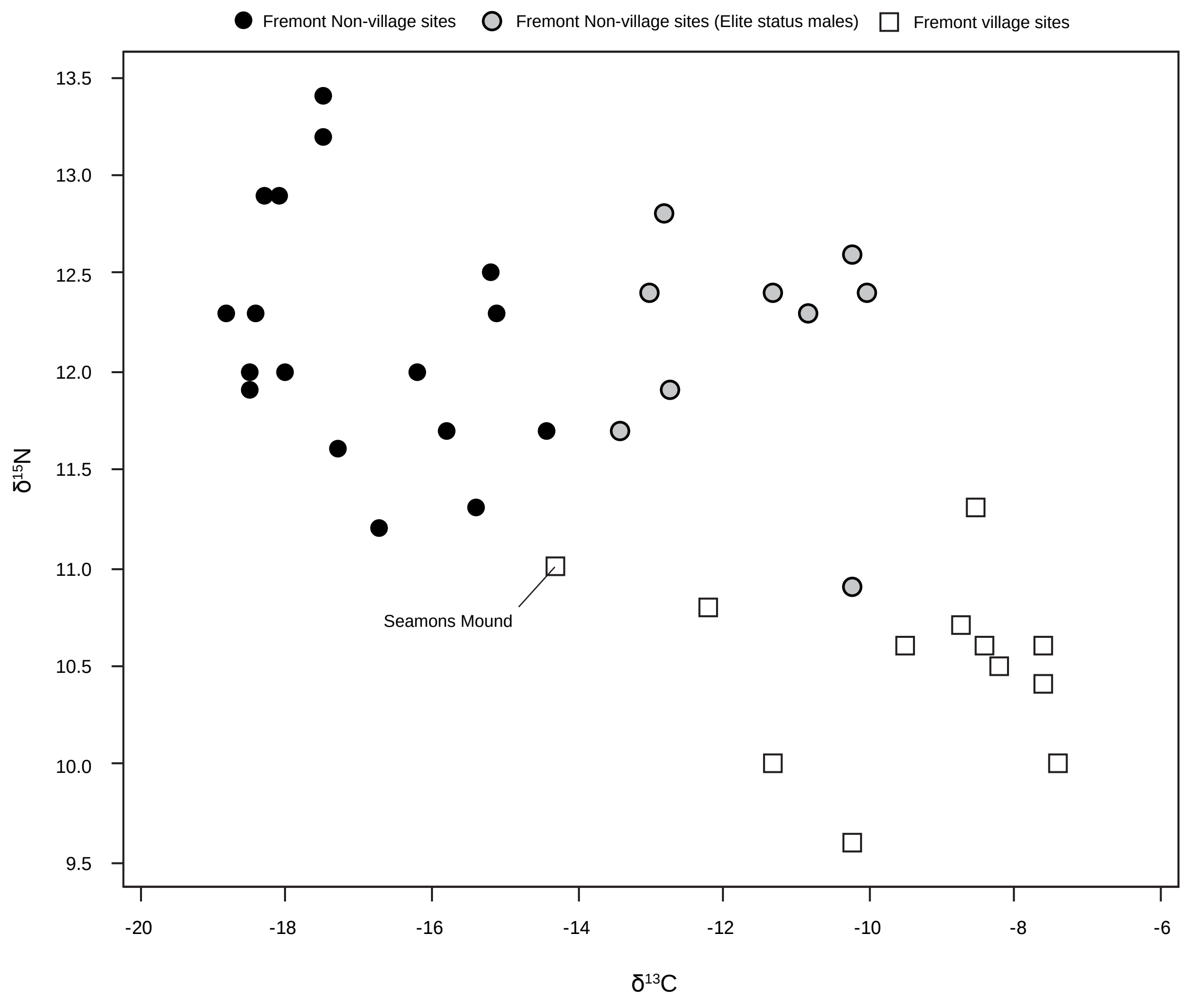


Figure 10. Graph showing the plot of Individual 1's ratio of δ15N to δ13C values which trends toward results from individuals living in non-village sites.

Individual 1 is well within the median range at 11.0. Comparing the $\delta^{13}C$ isotopic results from Individual 1 with non-village burials in the Great Salt Lake wetlands shows a better fit with non-village Fremont burials with high $\delta^{13}C$ levels (Figure 10). Non-village Fremont burials have a mean $\delta^{13}C$ value of -15.4, and a mean $\delta^{15}N$ of 12.2 (Coltrain and Leavitt 2002), much closer to the isotopic results from Individual 1.

Individual 1's skeletal remains also show that he had severe spina bifidia. He almost certainly suffered from numerous side-effects associated with spina bifida, including mental retardation and immobility. He also had a gracile physique, weak musculature, and was likely unable to participate in hunting, farming, or significant physical labor. His daily life was likely marked with pain from a boney protuberance in his lower back, and he probably relied on others for his daily needs. He may have died from a blow to the head or from complications with spina bifida. His body was buried face-down in a shallow pit too small to contain his entire body—his legs and arms were unflexed and bent awkwardly, and his neck was twisted with his head pushed up against the pit wall.

Interpreting the Seamons Mound Burial using Practice Theory

Although Individual 1 lived in a village at the height of Fremont agricultural practices, why was his $\delta^{13}C$ value similar to the non-village GSL wetland diets (Coltrain and Leavitt 2002)? Examining this question using behavioral and ecological perspectives might conclude that Individual 1 was part of a subsistence system that switched between full-time foraging and full-time farming as evinced by his “mixed diet” (Madsen and Simms 1998). Interpreting the data using practice theory to take into account the social side of food selection, however, offers several alternative scenarios.

Scenario 1

Coltrain and Leavitt (2002) argue that adolescent males and older men in the GSL wetland burials generally had the highest $\delta^{13}C$ values, suggesting that gender and age may have influenced access to maize. One plausible aspect of Fremont social structure derived from Coltrain and Leavitt’s (2002) work suggests that male socialization and maturation practices were associated with increased maize consumption. Hypothetically, when adolescent boys reached a certain age, they advanced to manhood and were given access to more maize. Placed in terms of practice theory, the maize represents tangible resources used to maintain and define the social structure of Fremont males (Giddens 1979). This example shows how Fremont agents and structure may have interacted reciprocally to solidify and perpetuate social patterns. In this case, the men and boys are the active agents making choices that signal their positions in society, practice customs, and realize goals. The structure in this example is recognized as consisting of resources; both human (the men and boys) and non-human (maize) manipulated by these acting agents—likely the older males—to maintain social patterns.

Applying this example to the young man from Seamons Mound, it seems that he participated in the larger community successfully as a child—having reached the age of twelve—but his handicap may have prohibited his transition to an adult male. Individual 1’s birth defects also likely restricted his ability to contribute to daily chores, hunting, planting, harvesting, repairs, etc. This may have led to Individual 1 experiencing some type of extended childhood where he stayed with his mother longer than normal and was not socialized with the rest of his male cohort. Segregating the handicapped has some precedent in the archaeological record. Several individuals buried at an archaic site in the central Mississippi River drainage were likely segregated due to their deformities. These disabled individuals had incapacitating handicaps that likely kept them from contributing to daily tasks. They were not buried in formal mounds with the rest of the community on a nearby bluff (Charles and Buikstra 1983).

Similar to those segregated handicapped persons in the Mississippi River drainage, it is plausible that Individual 1 was excluded from adult male groups given his physical and mental handicaps. This may have prevented his social transition to manhood (defined by my hypothesized Fremont structure), and consequently his access to controlled resources (maize) which identified his position in society. He may have become a burden for his family which might provide a motive for his apparent head trauma if he became too much of a liability for his care-givers. There is no question that violence was a part of the Fremont world (Novak and Kollman 2000), and his handicaps may have made him an easy target.

Scenario 1, however, is based on the assumption that adult and adolescent males had more access to maize. This is based on data from the GSL wetland burials. There is some thought that the individuals found in the GSL burials were likely foragers and not Fremont farmers (Talbot 2010). Excluding the GSL burials and examining only burials from well-established Fremont village sites, reduces the sample size considerably, making this scenarios tenuous at best. Thus, associations made in this reduce sample between maize consumption and gender (but especially the handicapped) among the Fremont living in a village context is sparse and likely biased. It is possible that males, females, and the handicapped had equal access to maize which may have been simply a food staple for everyone.

Scenario 2

A contrasting scenario argues that those living at Seamons Mound may have respected and honored the handicapped—an idea that is not without precedent. Greek, African, Chinese, and Sumerian mythologies, for example, all revered disabled or deformed individuals; some were even deified (Drake 2011). Among the Adena (a Native American culture in the mid-west) for example, there is evidence that one person with dwarfism was highly revered by his community (Snow and Baby 1973).

Perhaps Individual 1 from Seamons Mound was also considered unique and given preferential treatment. As mentioned previously, the fact that this young man reached the age of twelve with an extremely debilitating condition, suggests that at least one, if not many, provided constant care for him. This may have included feeding, washing, and even carrying him from one place to another; an interpretation that could have merit based on his overall gracile skeletal structure. His teeth were also in excellent condition when compared to most other maize eating individuals who are typically plagued by caries, abscesses, and a host of other dental problems. In addition, he was well fed. His teeth exhibited only minor signs of nutritional stress, and stable isotopic evidence suggests that he consumed a slightly above average amount of protein and fat rich meats.

There is considerable ethnographic evidence among Native American groups that animal meats rich in fat content were consumed to help with ailments, pregnancies, fertility, as well as eaten during communal feasts. Beverly Hungry Wolf (1980:184) wrote that meat that ran along the backbone of a cow was roasted and mixed with berries to make “really good pemmican” that was “used by the Horns Society for their sacred meal of communion.” Wolf (1980:187) also writes that, “boiled tongue was an ancient delicacy served . . . at the Sun Dance.” She noted that women were often given specific portions of the intestines during pregnancy to give the baby a round head; only men ate the male organs, as well as the first several ribs near the shoulders (Wolf 1980). These were considered a delicacy for men. Among the Chippewa, bear fat was consumed by the men who felt it made them stronger and more resistant to disease. These men stated that, “We eat it sometimes now and everybody feels better” (Hilger 1992:96–97). Consuming bear meat was also considered good for reproduction. If a woman was unable to bear a child, the husband would begin consuming large quantities of bear meat over several weeks to increase the chance for pregnancy (Fallon and Enig 2011).

In the ethnographic examples above, practice theory enhances our understanding of how the actions of individuals reciprocally influence social structures through the use and control of resources. In these examples, protein and fat rich meats were a resource whose value was reinforced through its consumption during rituals, as well as for medicinal and mythological purposes. Individuals who controlled these valued resources reinforced current belief systems, elevate people and groups, and in some cases could have redefined certain aspects of social systems.

Applying practice theory in conjunction with these ethnographic records offers a possible framework to explain why Individual 1 had a diet somewhat similar to hunter-gatherers while living in a farming community. The structure in this example consists of both resources and social rules. The resources included the hunters, and the meat they procured; caring for invalids who may have been revered could constitute an aspect of Fremont social norms or rules (structure). Agency is then recognized in the acts, as well as the motives of those procuring and providing meat for Individual 1. These people would have included his family, friends, relatives, and neighbors who shared or gifted resources. They may have provided meats in an attempt to increase status or prominence, and/or potentially redefine social structures. They may have, however, simply been attempting to honor and/or help the young man by providing him a valued resource, thus reinforcing the structure accepted in the community. There is little question that he was given meat by others; he was clearly physically unable to hunt game himself. From this interpretation, it is very possible that his lower $\delta^{13}C$ values may have actually been a result of increased meat consumption, instead of a mixed diet representative of switching subsistence strategies.

Conclusions

The analysis of the internment at Seamons Mound offers a detailed glimpse into the life of a young man who lived during a time when farming was prevalent among Fremont villages dotting the shores of Utah Lake. This research attempted to apply practice theory in a holistic, yet informative way, to clean possible insight about Fremont food choice. Specifically, I explored how the social structure within the Seamons Mound community, and the agency of individuals residing there, influenced the actions of those who interacted with Individual 1. I conclude that although the surrounding ecological environment influenced what this young man ate, examining sociocultural factors helps formulate new ideas about how cultural factors influence food choice. Additionally, this study raises new questions about how prehistoric peoples viewed handicapped members in their families and communities. These are important questions that pertain to Fremont social and cultural beliefs that require further study. ■

Acknowledgements. I would like to thank Dr. Joel Janetski for providing the guidance to start this research, as well as his financial support to help fund much of the analysis. I would also like to thanks Dr. Darrell Thomas for performing the dental exam and personally funding analysis for the dental calculus studies. I am also grateful to Rich Talbot, Lane Richens, and Mike Searcy for their valuable input, as well as the Museum of Peoples and Cultures at BYU for accomodating my requests during this research.

Scott M. Ure
Graduate student, Department of Anthropology
Brigham Young University
244 ALLN
Provo, Utah 84602
scott_ure@byu.edu

References Cited

Ambrose, Stanley H.
1990 Preparation and Characterization of Bone and Tooth Collagen for Isotopic Analysis, *Journal of Archaeological Science* 17:431–451.

Auerbach, Benjamin M. and Christopher B. Ruff
2010 Stature Estimation Formulae for Indigenous North American Populations. *American Journal of Physical Anthropology* 141:190–207.

Bass, William M.
1995 *Human Osteology: A Laboratory and Field Manual*. Special Publication No. 2, Missouri Archaeological Society, Columbia, Missouri.

Bee, James W. and Robert G. Bee
1934–1966 Archaeological Collections, Utah County, Utah. Notes and Ms. on file, Museum of Peoples and Cultures, Brigham Young University, Provo, Utah.

Bourdieu, Pierre F.
1990 *The Logic of Practice*. Stanford University Press, Stanford, California.
1998 *Practical Reason: On the Theory of Action*. Stanford University Press, Stanford, California.

Billat, Scott E.
1985 *A Study of Fremont Subsistence at the Smoking Pipe Site*. Unpublished MA thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Centers for Disease Control and Prevention
2008 The Basics About Spinal Bifida. Electronic document, http://www.cdc.gov/ncbddd/spinabifida/facts.html. Accessed April 10, 2008.

Charles, Douglas K. and Jane E. Buikstra
1983 Archaic Mortuary Sites in the Central Mississippi Drainage: Distribution, Structure, and Behavioral Implications. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 117–145. Academic Press, New York, New York.

Coltrain, Joan B.
1997 Fremont Economic Diversity: A Stable Carbon Isotope Study of Formative Subsistence Practices in the Eastern Great Basin. Unpublished P h.D. dissertation. Department of Anthropology, University of Utah, Salt Lake City, Utah.
2002 Maize Beer and Bison: Towards an Understanding of Gender Differences in Diet among the Great Salt Lake Fremont. In *Invisible No More: Gender Roles and Relations in the Archaeological Record of the Great Basin*, edited by K. Lupo and M. Leach. University of Utah Press, Salt Lake City, Utah.

Coltrain, Joan B. and Steven W. Leavitt
2002 Climate and Diet in Fremont Prehistory: Economic Variability and Abandonment of Maize Agriculture in the Great Salt Lake Basin. *American Antiquity* 67(3):453–485.

Coltrain, Joan B. and Thomas W. Stafford Jr.
1999 Stable Carbon Isotopes and Great Salt Lake Wetlands Diet: Toward an Understanding of the Great Basin Formative. In *Prehistoric Lifeways in the Great Basin Wetlands*. Edited by Brian E. Hemphill and Clark S. Larsen. University of Utah Press, Salt Lake City, Utah.

Drake, Julia
2011 Crippled Bodies in Mythology. Electronic document, http://www.ehow.com/info_8535213_crippled-bodies-mythology.html. Accessed December 15, 2011.

Fallon, Sally and Mary G. Enig
2011 Guts and Grease: The Diet of Native Americans. Electronic Document. http://www.manataka.org/page1852.html. Access January 3, 2012.

Fawcett, William B. and Steven R. Simms
1993 *Archeological Test Excavations in the Great Salt Lake Wetlands and Associated Analyses*. Contributions to Anthropology No. 14. Utah State University, Logan, Utah.

Forsyth, Donald
1991 Some Calibrated Radiocarbon Dates from Utah County, Utah. *Utah Archaeology* 4(1):83–88.

Giddens, Anthony B.
1979 *Central Problems in Social Theory: Action, Structure, and Contradiction in Social Analysis*. MacMillan Press, London.
1984 *The Constitution of Society: Outline of the Theory of Structuration*. Polity Press, Cambridge.

Green, Dee F.
1961 *Archaeological Excavations at the G.M. Hinckley Farm Site, Utah County, Utah, 1956–1960*. Unpublished MA thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Hastorf, Christine A.
1991 Gender, Space, and Food in Prehistory. In *Engineering Archaeology*, edited by J. M. Gero and M. W. Conkey, pp. 132–159. Blackwell, Cambridge.

Hastorf, Christine A. and Sissel Johannessen
1993 Pre-Hispanic Political Change and the Role of Maize in the Central Andes of Peru. *American Anthropologist* 95(1):115–138.

Hendricks, Kate
1999 Fumonisins and Neural Tube Defects in South Texas. *Epidemiology* 10(2):198–200.

Hilger, Sister Mary Inez
1992 *Chippewa Child Life and its Cultural Background*. Minnesota Historical Society Press, St. Paul, Minnesota.

Hodder, Ian and Scott Hutson
2003 *Reading the Past: Current Approaches to Interpretation in Archaeology*. Cambridge University Press, Cambridge.

Hungry Wolf, Beverly
1980 *The Ways of My Grandmothers*. Morrow Press, New York.

Janetski, Joel C.
1990 Wetlands in Utah Valley Prehistory. In *Wetland Adaptations in the Great Basin.* Museum of Peoples and Cultures Occasional Paper No. 1, Brigham Young University, Provo.

Janetski, Joel C. and Richard K. Talbot
1995 Social and Community Organziation. In *Clear Creek Canyon Archaeological Project, vol. 5: Results and Synthesis* by Richard K. Talbot, Joel C. Janetski, Deborah E. Newman, Lane D. Richens, and James D. Wilde, pp. 363–382. Museum of Peoples and Cultures Technical Series No. 95-9. Brigham Young University, Provo, Utah.

Madsen, David B. and Steven R. Simms
1998 The Fremont Complex: A Behavioral Perspective. *Journal of World Prehistory* 12(3):255 – 336.

Madsen, Rex
1969 *The Seamons Mound: A Fremont Site in Utah Valley*. Student field report submitted to Dr. Ray T. Matheny, Brigham Young University, Provo, Utah.

Miller, Dick
1969 *Field Report of Excavations at Mound 42UT271, Seamons Farm, Provo, Utah*. Student field report submitted to Dr. Ray T. Matheny, Brigham Young University, Provo, Utah.

Moore, Jerry D.
1989 Pre-Hispanic Beer in Coastal Peru: Technology and Social Context of Prehistoric Production. *American Anthropologist* 91(3):682–695.

Novak, Shannon A. and Dana D. Kollmann
2000 Perimortem Processing of Human Remains Among the Great Basin Fremont. *International Journal of Osteoarchaeology* 10:65–75.

Owsley, Doug, Shannon Novak, and P. Hamzavi
1996 *Examination of Burials from Around the Great Salt Lake, Utah*. Manuscript on File, Department of Anthropology, University of Utah, Salt Lake City, Utah.

Richens, Lane D.
1983 *Woodard Mound: Excavations at a Fremont Site in Goshen Valley, Utah County, Utah 1980–1981*. Unpublished MA thesis, Department of Anthropology, Brigham Young University, Provo, Utah.

Schulting, Rick
2008 Skeletal Evidence for Interpersonal violence in the Neolithic of Northwest Europe. http://www.arch.ox.ac.uk/research/research_projects/neolithic_violence. Accessed September 30, 2008.

Simms, Steven R.
1993 The Past As Commodity: Consultation and the Great Salt Lake Skeleton. *Utah Archaeology* 6:1–6.

Simms, Steven R., Carol J. Loveland, and Mark E. Stuart
1991 *Prehistoric Human Skeletal Remains and the Prehistory of the Great Salt Lake Wetlands*. Utah State University, Logan, Utah.

Snow, Charles E. and Raymond S. Baby
1973 Adena Portraiture. In *The Adena People, No. 2* by William S. Webb and Raymond S. Baby, pp. 47–60. Ohio Historical Society, Columbus, Ohio.

Talbot, Richard K.
2000 Fremont Farmers: The Search for Context. In *The Archaeology of Regional Interaction: Religion, Warfare, and Exchange Across the American Southwest and Beyond*, edited by Michelle Hegmon, pp.275–293. University Press of Colorado, Boulder, Colorado.
2010 Peopling the Promontory: A Model of Great Salt Lake and Utah Lake Wetland Adaptations ca. A.D. 900–1400. Paper presented at the 32nd Great Basin Anthropological Conference, Layton, Utah.

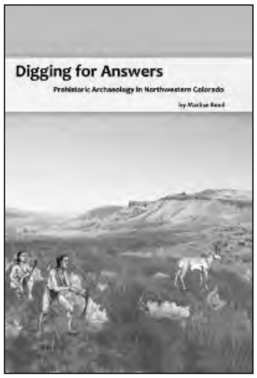
Thomas, Darrell
2009 Dental Examination of a mandibular teeth (99.22.1.2) from the burial at Seamons Mound (42UT271). Report on file, Museum of Peoples and Cultures, Brigham Young University, Provo, Utah.

Varien, Mark and James M. Potter
2008 The Social Production of Communities: Structure, Agency, and Identity. In *The Social Construction of Communities: Agency, Structure, and Identity in the Prehistoric Southwest*, edited by Mark D. Varien and James M. Potter, pp. 1–20. Altamira Press, Lanham, Maryland.

Voss, Kenneth A., Ronald T. Riley, Maurice E. Snook, and Janee Gelineau-van Waes
2009 Reproductive and Sphingolipid Metabolic Effects of Fumonisin B1 and its Alkaline Hydrolysis Product in LM/Bc Mice: Hydrolyzed Fumonisin B1 Did Not Cause Neural Tube Defects. *Toxicology Sciences* 112(2):459–467.

White, Tim D.
2000 *Human Osteology*. Academic Press, San Diego, California.

Book Reviews



"Digging for Answers: Prehistoric Archaeology in Northwestern Colorado" by Marlise Reed, Alpine Archaeological Consultants, Inc. and Metcalf Archaeological Consultants, Inc. Published by Alpine Archaeological Consultants, Inc., Montrose, Colorado, 2009. ISBN 0–9743137–2–6

Review by Ronald J. Rood, Utah Assistant State Archaeologist, Antiquties Section, Utah Division of State History. rrood@utah.gov

I often have the opportunity to visit 4th grade classrooms and talk to students about the archaeology of Utah. *Digging for Answers* gives us all another tool to use in taking the message of science and archaeology to young people. Based on excavations conducted by Alpine and Metcalf for major pipeline projects in northwestern Colorado, Marlise Reed takes archaeology to her audience in the form questions kids might ask an archaeologist and then providing clearly written and succinct answers accompanied by rich illustrations and photographs.

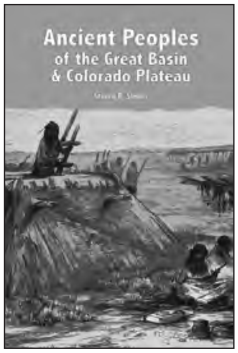
I love the simplicity of this book and I love the message. Her selection of topics to cover is extensive and includes discussions about prehistoric tools, clothing, firepits, storage and many others. For example, in one section, Marlise Reed poses the simple question "What can prehistoric fire pits tell us about the past?" With photographs of fire pit features, she discusses dating, identified charcoal for insight on trees and thus environment, the use of residue analysis from the unglamorous fire-cracked rock, bones, and plant remains to learn about food resources, stone boiling, length of occupation, and function. She does all of this in just over 200 words in a manner that leads to additional questions and comments from the readers.

I recently took copies of *Digging for Answers* to a 4th grade classroom in Salt Lake City. I had the students read several sections and then we had a question, answer, and comment period. The section on fire pits generated questions like "What kinds of roots did people eat?" "How does stone boiling work?" "How do they get the starch from the rocks?" "How would you know what kind of animal they ate if all you had were bones?" All good questions and all evidence the passage got the kids thinking. That is the way it worked for every section. The questions and the associated passages worked to get the kids thinking beyond the pages of the book and prompted excellent and insightful inquiries.

Reed provides a brief time line, a list of additional resources and a short statement about why it is important to leave artifacts in place and why context is so crucial. Just the right amount of ethics for the intended audience.

Marlise Reed is not an archaeologist per se but she grew up literally surrounded by archaeologists. Her talents as a writer and illustrator along with her embedded archaeological experience makes *Digging for Answers* a fine example of how Archaeology as a profession needs to continue to reach out to the public and young people and how archaeology, just by its very nature, tends to prompt people, especially young people, to start thinking. We need more of these types of books generated from consumer funded CRM projects to keep archaeology alive and important. *Digging for Answers* is one great example on how this can be meaningfully done.

Alpine Archaeological Consultants provided me with quite a few copies of *Digging for Answers* and I've handed them out to students from Ibapah, Utah to Provo. One 4th grade boy from Salt Lake City wrote this in a letter in a letter to me after I visited their classroom; "Thank you for the book about the archaeology in Colorado. It is very cool and I like the cool drawings. I read the whole book." ■



Ancient Peoples of the Great Basin & Colorado Plateau, by Steven R. Simms. Left Coast Press, Walnut Creek, CA. 2008. $26.95 (paperback).

Reviewed by Kevin T. Jones, Antiquities Section, Utah Division of State History

When I was deciding where to go to graduate school, I happened to attend a meeting of the Wyoming Archaeological Society in Rock Springs, and Jesse D. Jennings of the University of Utah was the keynote speaker. I had applied to Utah, and considered it to be a good school, having read many of the Utah site reports and particularly the University of Utah Anthropological Papers. Most of what I had read was workman-like but rather unspectacular. Jennings, however, changed my opinion of the place. His sharp wit and deep insight into the archaeological record, and especially his careful consideration of archaeological site formation processes excited and intrigued me. He was not just blandly reporting counts of artifacts and describing structures, he was asking questions and seeking answers. When I returned home I took a closer look at Jennings' Danger Cave report and was dazzled by the crisp thinking and the lucid writing. I decided then to attend the University of Utah.

Jennings was, as were most scholars of his era, a polished writer. His prose is clear and concise, but it also exhibits a flair that is uncommon among scientists. His descriptions of artifacts and archaeological features are accurate and clean, but also rich and evocative. His reference to quids as "unlovely specimens" in his Danger Cave report has always been one of my favorites. Jennings' beautifully-written autobiography is as easy to read as it is illuminating, and his several textbooks are clear and unstilted. His skill as a writer and great knowledge of the archaeology of the region would make one think that his "Prehistory of Utah and the Eastern Great Basin" (University of Utah Anthropological Papers 98, 1978) would be a masterpiece.

It is, unfortunately, not. It is, with a few exceptions, rather bland, dreary and uninspired. The descriptions are drab, the excursions into thoughtful consideration of the meaning or possibilities of the archaeological record few, and the utility of the work, other than as a quick reference or to check a photo or table is limited. With the exception of the last two chapters, which are thoughtful and somewhat forward-thinking, it reads almost as if it was done to fulfill an assignment.

For thirty years, this unlovely work has stood alone as a compendium of archaeological knowledge for the region, until the publication of Simms's Ancient Peoples of the Great Basin & Colorado Plateau. And this new publication does not only replace Jennings' outdated tome, it surpasses it in nearly every respect.

This is a very readable and informative book. The prose is not flashy, but it is also far from stodgy— the writing is solid, and full of rich imagery. Not many scientists can write this way or this well. The fluid style reads easily, and the extensive documentation (over 100 pages of notes and references) is available for those who wish to check it, but the use of endnotes keeps the text free of obtrusions.

Jennings felt compelled in his summary chapter to admit that the book's narrative is presented "as if no questions, doubts, or uncertainties existed about the evidence and the "truth" of the account." He used the chapter to then point out some of the things that were not well-understood, and to identify areas toward which he thought additional work should be directed. Simms seems to have learned from this approach, as he presents information throughout with thorough discussion of data weaknesses, and alternative interpretations. This strategy accomplishes a couple of things—it makes clear to the reader that learning about the past is an ongoing process-- that we don't know everything,-- and perhaps even more importantly, it invites the reader to take part in the thought processes of the scientist—as though the reader was participating in a seminar with the author. Sidebars used throughout the text are particularly effective in focusing the reader's attention on a particular subject for more in-depth treatment and discussion.

Simms offers a solid treatment of the span of human occupation of the region, as well as informative discussions of the tools of our trade, touching on everything from radiocarbon dating to linguistics. His cultural-historical musings weave a compelling picture, although not all will be in agreement with some of his offerings. No matter. His thoughts on issues such as the language of the Fremont or their kinship systems are provocative and grounded, and will help push present and future archaeologists to immerse themselves deeply into the anthropological and biological richness of our subjects.

Ancient Peoples of the Great Basin & Colorado Plateau will be a standard in classrooms and libraries for years to come, and it serves our profession well—the archaeology is presented with a depth and passion that captures the spirit of a complex and often uneven field. This is the book I will give people whom I want to favorably dispose toward archaeology.

I have heard from many people, including scientists, avocational archaeologists, and interested citizens, about how they have enjoyed and benefited from reading Simms' book. Roy MacPherson, retired rocket scientist, longtime Utah Statewide Archaeological Society member, and recipient of the Dorman Award for contributions to the archaeology of Utah recently remarked to me "This is a great book. I wish it had been available to me 25 years ago when I was first getting started—I would have progressed much more quickly and understood things much more completely."

Archaeology is a subject many people find fascinating, yet it is often difficult for archaeologists to avoid the dry, mummified prose of CRM, or to write without speaking down to audiences. Jennings was a gifted writer who inspired many of us, and some, including the late Christopher Raven, seemed ready to carry the pen forward, but fell short. Steve Simms has risen to the challenge of presenting scientific information in a way that draws readers in, rather than stultifying them with endless sentences of arcane jargon. This book is a gem. If you haven't read it, do so. You will be rewarded with fresh insight into the past, and will be exposed to the workings of a very creative scientific mind. Great job Dr. Simms.

Errata: The lovely photograph on p. 16 of a boy and his dog is from an unnamed cave on the west side of the Silver Island Mountains. Pilot Peak is in the distance. Floating Island Cave is on Floating Island, on the east side of the Silver Island Range. It was first occupied approximately 7,000 years ago.

UTAH ARCHAEOLOGY 2009 vol. 22(1)

ARTICLES

BOOK REVIEWS

♾ The paper for this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).