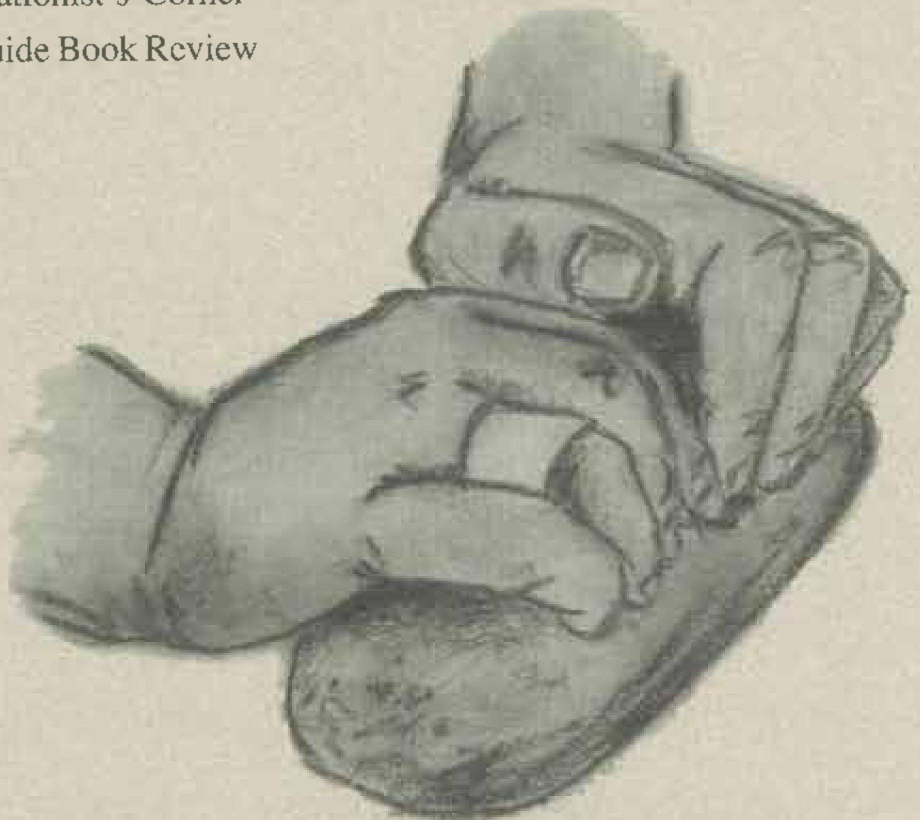
UTAH ARCHAEOLOGY 2000

New in This Issue:

The Avocationist's Corner

Hiking Guide Book Review



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UTAH ARCHAEOLOGY 2000

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Front Cover: Illustrations throughout this issue were done by Shaun Petersen based on photographs found in *Survival Arts of the Primitive Paiutes* by Margret M. Wheat.

Message from the Editors

This second issue of the journal under our editorship shows some signs of the direction we hope to take *Utah Archaeology* to reflect the fact that it is a joint publication by avocational *and* professional archaeologists.

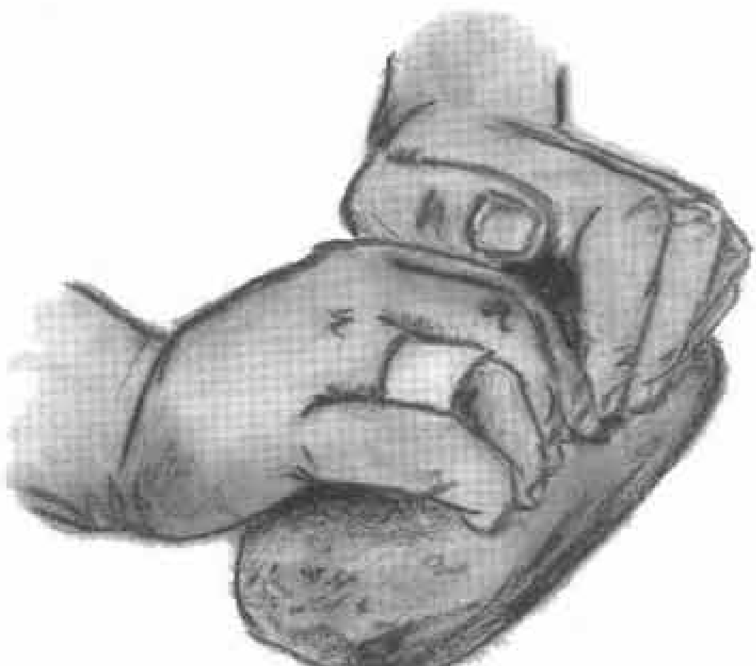
This issue inaugurates a section titled, "The Avocationist's Corner." The authors are long-time avocational archaeologists and members of the Utah Statewide Archaeological Society. Authorship in the "Corner" however, is not restricted in any way. On the contrary, we encourage professionals to prepare articles that may be of interest to and written for, an educated, but non-professional archaeological public.

We also present an array of book reviews this time that range from general anthropological reading (*Ants for Breakfast*), to the history of archaeology (*Time, Trees, and Prehistory*), to a collected work of interest to specialists, professional and amateur alike (*Intermountain Archaeology*). We also include the first review of a hiking guide in *Utah Archaeology* (*Canyoneering: The San Rafael Swell*). Guidebooks increasingly contain sections about archaeology. The quality of research found in these guides, their accuracy, and their efforts to convey the ethics of cultural resource preservation to an increasing population of backcountry users is uneven at best. By virtue of review, we send signals to our readers and perhaps to publishers that cultural resources matter. Perhaps authors can be stimulated to increase the attention they pay to the archaeological and historical resources of Utah's backcountry. We also include in this issue for the first time, a "rejoinder" to a book review—a reminder that debate is central to learning.

Kate Toomey and Lara Petersen are crucial to the production and quality of the journal. Kate is on the journal's Editorial Advisory Board, and carefully copy-edits the journal. Despite the fact that the manuscripts have been through several editorial cycles at that point, Kate greatly improves "the read," and the final appearance of the journal. We thank her for donating her time to this effort. Lara Petersen is a student at Utah State University and is the Editorial Assistant. She designed the look of the journal and formatted the text in Pagemaker for submission to our printer, Square One Printing, Logan, UT. Thank you Lara.

We were about to go to press when Lara gave birth to Benjamin on March 4. Congratulations Lara! We carefully planned for this event, but Benjamin was apparently not on the same page as us; he arrived two weeks early. Hence, the journal is a little later this year.

Steven Simms, editor for UPAC
Randy Jones, editor for USAS



OSTEOARTHRITIS, MOBILITY AND ADAPTIVE DIVERSITY AMONG THE GREAT SALT LAKE FREMONT

Emily Brunson, Department of Sociology, Social Work and Anthropology, Utah State University, Logan, UT 84322-0730

This study examines adaptive diversity in a prehistoric Fremont population from the Great Salt Lake wetlands, using the prevalence, severity, and patterning of osteoarthritis as a key to understanding mobility in this population. Findings suggest that a pattern of low residential mobility, supplemented by logistical activities of males existed across the sample. In relation to other groups from the Great Basin, the Great Salt Lake sample expresses slightly lower levels of osteoarthritis, although the difference is more apparent among the females. It is likely that they were slightly more tethered to residential bases than their Great Basin counterparts.

Mobility in the Great Basin has primarily been defined by two alternative models—limnosedentism and limnomobility. While both of these have contributed to our understanding of foraging in the Great Basin, anthropologists realize that mobility, as implied by subsistence strategy, was never as simple as predicted by these models. In addition to the ethnographic record, which implies differences in mobility along gender lines (Kelly 1983; Fowler 1982), archaeological and bioarchaeological evidence suggest that subsistence strategies, and thus mobility, in the Great Basin varied through time and space, depending on the resources and technologies available (Hemphill 1999; Kelly 1999; Madsen and Simms 1998; Ruff 1999; Simms 1986; Upham 1994). Such variation is especially apparent during the Fremont period in the eastern Great Basin, where corn horticulture was practiced in addition to foraging.

A model of adaptive diversity proposes to explain this variation in the eastern Great Basin (Madsen and Simms 1998; Simms 1986, 1999). Consistent with previous models, this one acknowledges variability in subsistence strategies. In addition to the option of being full-time foragers, farmers, or something in between, individuals could change which of these strategies they practiced during the course of their lives, in response to changing circumstances. As Madsen (1989: 27-28) so eloquently explained, "a single individual may well have lived the entire range of variation, from full-time farmer in a settled village to a full-time mobile forager in the space of a few years."

In light of mobility, the adaptive diversity model predicts that while variation will occur between individuals, a general trend, representing a single pattern of life in the region, will exist across the sample (Madsen and Simms 1998; Simms 1999). A biomechanical study of long bones from the Great Salt Lake wetlands found that males tended to be more mobile than females (Ruff 1999). According to Simms (1999: 45), "these findings are consistent with an archaeological record of residential stability in the wetlands, of moves between base camps, with men being the primary participants in a logistic system that moved resources from around the wetlands as well as outside them, while women were more tethered to the wetlands."

Adaptive diversity is supported by several lines of evidence from the eastern Great Basin and northern Colorado Plateau including archaeology (Madsen and Simms 1998; Simms et al. 1997; Upham 1994), DNA

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analysis (O'Rourke et al. 1999), carbon isotope analysis (Coltrain and Stafford 1999), biomechanical analysis (Ruff 1999) and examination of skeletal pathologies that relate to diet breadth and risk reduction (Bright and Loveland 1999). This study provides yet another line of evidence to evaluate the concept of adaptive diversity, by using osteoarthritis to examine mobility in a Fremont skeletal collection from the Great Salt Lake wetlands.

OSTEOARTHRITIS AS AN INDICATOR OF MOBILITY

Because mobility results in mechanical stress that contributes to measurable osteoarthritic changes, it is possible to make inferences about a group's level of mobility by analyzing the prevalence, distribution, and severity of osteoarthritis from skeletal remains of individuals who comprise that group (Jurmain 1977). While the presence of osteoarthritis correlates with a variety of factors, including age, sex, weight, hormones, and infection, the primary cause is mechanical stress (Larsen 1997). This stress may be continuously applied to the joints over long periods of time, or it may consist of intensive but infrequent activities, such as occasional hunting expeditions (Bridges 1991, 1992).

Osteoarthritis appears on joint surfaces in two main forms: resorption of bone on articular surfaces (pitting) and proliferation of bone that occurs along articular margins (lipping) or vertebral centrum margins (osteophytes). In some cases, degeneration of cartilage can result in polishing on bone surfaces, where bones come into direct contact. This severe manifestation of the disorder is called eburnation. Schmorl's nodes, herniations of vertebral disks due to extreme mechanical loading of the back, are not osteoarthritic in the strict sense of the term, but because they also result from mechanical stress, their presence offers added insights about mobility (Jurmain 1977; Larsen et al. 1995; Larsen 1997).

The Great Salt Lake Sample

The skeletal collection recovered from the Great Salt Lake wetlands is especially applicable to an evaluation of population-level mobility. A minimum number of 85 individuals were recovered from a 64 km^2 area that was exposed through natural processes. It is likely this collection represents a random sample of Fremont lifeways, including full and part-time foragers in addition to full-time farmers, and is thus a more accurate representation of adaptive diversity than is normally available (Simms 1999).

If the model for adaptive diversity is accurate, a pattern of osteoarthritis should exist in the Great Salt Lake sample. In a previous biomechanical analysis of the skeletal series, Ruff (1999) determined that males were more mobile than females. However, only 20 of the burials were applicable to his study because the biomechanical analysis requires long bones (primarily femora were studied). Because mobility increases mechanical stress, which in turn increases the prevalence and severity of osteoarthritis, Great Salt Lake males should also have a higher prevalence and severity of osteoarthritis than their female counterparts, especially in the spine and lower limb joints which are most affected by mobility. This combination of data will effectively enlarge the small sample sizes applicable to both of these studies and thus strengthen the evaluation of mobility in the Great Salt Lake population.

MATERIALS AND METHODS

During the late 1980s, fluctuating levels of the Great Salt Lake, combined with erosion from wind and rain, exposed hundreds of archaeological sites along the eastern shore (Simms 1999). These wetland sites were excavated between 1990 and 1992 to prevent vandalism and further erosion from destroying the 85 skeletons exposed in this area (Fawcett and Simms 1993; Simms et al. 1991). AMS radiocarbon dating of extracted collagen from 50 of the skeletons dates the series from A.D. 400–1450, with most burials (87.7 percent) dating between A.D. 700–1300 (Simms 1999).

Of the 85 individuals recovered, 28 (15 males and 13 females) were suitable for this study. Other skeletons were either too young (< 18 years) at the time of death

Table 1. Osteoarthritis Scoring Protocol.

Anomaly	Score
Lipping	0 = no evidence of lipping 1 = slight, lipping is discontinuous (<50% affected) and is not pronounced (< 2mm in height) 2 = moderate, lipping is discontinuous (>50% affected) and/or it exceeds 3 mm in height 3 = severe, lipping is continuous and/or it exceeds 4mm in height in a single area
Pitting	0 = no evidence of pitting 1 = slight, less than 30% of the joint surface affected 2 = moderate, between 30% and 60% of the joint surface affected 3 = severe, more than 60% of the joint surface affected
Eburnation	3 = presence of polishing on joint surfaces

(n = 21) or too fragmentary (n = 36). In most cases, age and sex data on individuals were obtained from Loveland 1991. The remaining skeletons were aged and sexed by the author and Patricia Lambert, Utah State University, using standard osteological criteria (Bass 1987; White 1991). In the case of adult burials 42WB269.24, 42WB318.37, and 42WB032.81, it was not possible to determine the specific age at death; therefore the mean age at death for the sample (34.8 years) was assigned to these individuals.

All macroscopic evidence of skeletal modifications to the joints were scored, following DeRousseau's (1988) definition of osteoarthritis as including all degenerative articular joint changes. These changes included lipping, pitting, and eburnation. To reduce bias due to differences in preservation, osteoarthritis scores were only recorded for joint surfaces that were at least 50 percent complete. Lipping and pitting were scored separately, according to the degree of severity on a scale of 0 to 3 (Table 1 and Figure 1). This scoring method allowed the assignment of values between these numbers (e.g., 1.5 and 2.25) if the severity was between the criteria for those points. Joints with evidence of eburnation were scored as 3. The score assigned to each articular surface was the highest value obtained for any of these three observations. For example, if an articular region had a lipping score of 1, a pitting score of 0 and no evidence of eburnation, the score for that bone would be 1. In addition to this, evidence for Schmorl's nodes was also recorded, though its presence did not affect any of the scores for osteoarthritis.

This scoring scale was applied to all the major articular regions, including the spine, shoulder, elbow, wrist, hand, hip, knee, ankle, and foot (Table 2). The score for a joint complex was obtained by taking the highest value of osteoarthritis severity among all surfaces comprising that joint. Thus, scores were recorded for all joint complexes represented by at least one joint surface.

To provide a broader context for understanding osteoarthritis in the Great Salt Lake skeletal series, these data were compared with data collected on skeletal samples from Stillwater Marsh, Nevada (Larsen et al. 1995) and Malheur Lake, Oregon (Hemphill 1999). The Stillwater and Malheur samples represent foragers from the western and northern areas of the Great Basin, respectively. Data from both series were reported by researchers based on the presence/absence of osteoarthritis in the form of lipping, pitting, and eburnation. In order to compare these two samples with the Great Salt Lake series, it was necessary to modify the Great Salt Lake scores according to this presence/absence scheme. In a personal communication with Clark Larsen, one of the osteologists working with the

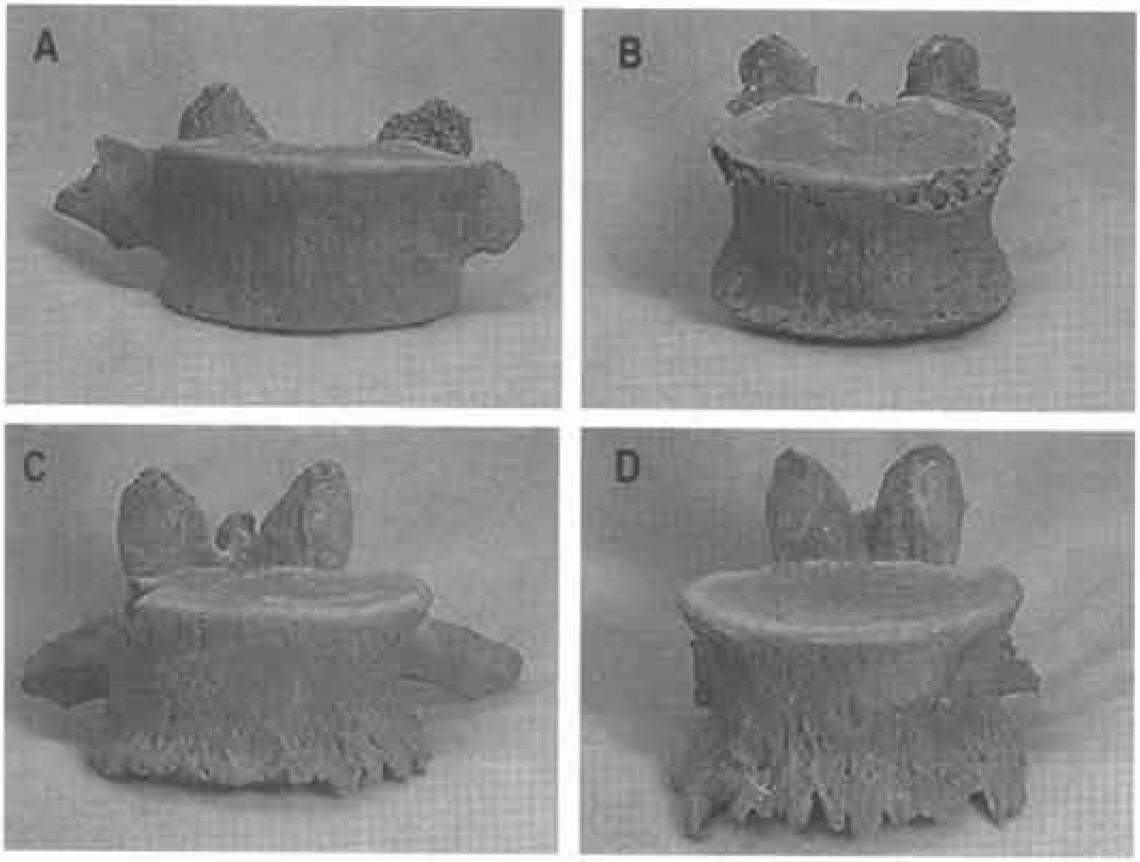

Figure 1. Pathological skeletal modifications associated with osteoarthritis in lumbar vertebrae from individual 14. These bones represent the scoring scale used in this study, with A = 0, B = 1, C = 2, and D = 3.

western Great Basin skeletal collections, it was agreed that including all joints with a score of 1.5 or above as having osteoarthritis (present) and excluding those with a score below 1.5 would produce the most comparable sample for our purposes. Age comparisons indicate very little mean difference between the Great Salt Lake (x = 34.8 years) and Stillwater (x = 33.4 years) samples, while the Malheur sample is slightly older (x = 37.2 years). None of these differences are statistically significant (two-tailed t-test, $p > .05$).

A Note on Scoring Osteoarthritis

This study and many others rely on osteoarthritis data to examine issues of mobility, occupation, mechanical demand, and gender-based work activities, among others. However, in nearly every case different methods and criteria are used. While some researchers prefer to record data based on severity, others record whether osteoarthritis is present or absent. Differences also exist in the scoring criteria for the degree of severity and even in the evaluation of whether osteoarthritis is present or absent on an articular surface. Thus, it is possible for two researchers looking at the same bone to have different opinions about the presence of osteoarthritis and how severe it is.

I chose to score osteoarthritis according to severity because this type of measurement provides valuable information on the degree to which individuals were affected by this disorder. In order to make comparisons with the other Great Basin samples, it was necessary to convert my severity data to reflect the presence/absence scheme used by Larsen, Ruff and

Table 2. Articular Surfaces and Margins of Major Adult Joints Observed for Severity of Osteoarthritis (adapted from Larsen, Ruff, and Kelly [1995]).

Articular Joint	Skeletal Component
cervical	intervertebral body, superior and inferior articular facets
thoracic	intervertebral body, superior and inferior articular facets
lumbar	intervertebral body, superior and inferior articular facets
scapula	superior intervertebral body of first sacral vertebra
shoulder	proximal humerus (head), scapula (glenoid)
elbow	distal humerus (trochlea, capitulum), proximal radius (head, radial tuberosity), proximal ulna (semi-lunar notch, radial notch, coronoid process)
wrist	distal ulna (head, styloid process), distal radius (lunate-scaphoid articular surface), carpals, metacarpals (proximal)
hand	metacarpals (heads); proximal, intermediate and distal phalanges
hip	femur (head), innominate (illium auricular and acetabulum)
knee	femur (lateral and medial condyles), patella (condylar surface), tibia (lateral and medial condyles)
ankle	tibia (talar articular surfaces), tarsals, metatarsals (proximal)
foot	metatarsals (heads); proximal, intermediate and distal phalanges

Kelly (1995) and Hemphill (1999). This process involved deciding how the scoring methods used in this study could best reflect those used by these other researchers. In the end, it was decided to use values at 1.5 and above as having osteoarthritis "present." Despite the likelihood of disagreement among osteologists, comparison of the results is facilitated by the fact that the analysts working with the Great Salt Lake, Stillwater, and Malheur collections are explicit in identifying their methods. Perhaps the proliferation of cases will enable standards for scoring and interpreting osteoarthritis to be developed and used in future studies. Such standards will likely make data from different studies more comparable and reduce researcher bias.

RESULTS

The most common manifestation of osteoarthritis in the Great Salt Lake series is lipping; 85.7 percent of the individuals in the sample (24/28) are affected with this disorder in one or more joints. Pitting is the second most common form of osteoarthritis, with 57.1 percent of the population (16/28) affected. Eburnation is rare in the Great Salt Lake series, affecting only one older male, or 3.6 percent of the sample. On the other hand, Schmorl's nodes are quite common, affecting 29.6 percent of skeletons with vertebrae present (6/21).

Eight bilateral joint complexes (e.g., shoulder, elbow, and hip) were assessed to determine if osteoarthritis severity was symmetrical in the Great Salt

Table 3. Scores of Osteoarthritis Severity among Great Salt Lake Individuals.

			Joint*											
Site/Burial Number	Sex	Age	C	T	L	S	Sho	Elb	Wri	Han	Hip	Kne	Ank	Foot
42WB48.3	F	30–35	**	—	—	—	1.25	1.5	1.5	1.5	—	0	1	1
42WB185.14	M	45+	1	2	3	0	1.5	2	2	1	1	1	1.5	—
42WB185.16	M	45	3	2	—	—	—	—	—	—	—	—	—	—
42WB185.17	M	25–30	1	—	—	—	—	—	—	—	—	—	—	—
42WB269.20	M	30+	2	—	—	—	0	1	1	0	1	—	1	—
42WB269.21	M	25	1	—	—	—	—	1	.5	0	1	.5	1.5	0
42WB269.23	M	20–30	—	0	1	—	0	0	—	—	1.5	—	—	—
42WB269.24	M	unk.	—	—	—	—	—	—	—	—	0	—	—	—
42WB269.27	F	17–25	0	—	—	—	—	0	—	—	0	—	—	—
42WB269.28	F	35+	3	1	1	—	1.5	1.5	1	1	1	1	1	1
42WB286.32	F	35–40	0	.5	0	0	1	1	2	1	.5	.5	.5	.5
42WB318.37	F	unk.	—	—	—	—	—	—	—	1	1	—	—	1
42WB324.47	M	45+	2	2	3	—	1	3	2	3	1	2	1	3
42WB324.49	M	25–30	—	—	—	—	—	—	—	0	—	—	–	0
42WB324.53	M	35–40	1	1	1	—	1	2	1	1.5	1	2	.5	—
42WB324.55	M	19–24	1	0	0	—	1	1	0	—	0	0	0	0
42WB324.56	M	17–22	.5	1	0	0	0	0	0	0	0	0	0	—
42WB324.58	M	25–30	1	.5	—	—	2	1	1.5	.5	.5	1.25	1	1.5
42BO73.61	F	40+	2	1	2	0	1	1	1	.5	1	3	1	.5
42BO579.64	F	18–23	1	0	0	—	0	0	0	0	0	0	—	—
42BO580.65	F	45+	—	—	—	—	1.5	2	1	1	—	1	—	—
42BO599.68	F	45+	0	0	1	—	2	2	1	1	2	1	1	0
42BO185.76	F	25–30	1	0	1	0	1	1	1	0	1	0	.5	0
42BO700.77	M	45+	2	2	3	—	2.5	2	2	2	2	2.5	1.5	1
42WB32.78	F	40+	—	—	—	—	—	1	—	—	1	1	1	—
42WB32.81	F	unk.	—	—	—	—	—	—	—	0	—	—	0	0
42WB32.83	M	40	2	1	—	—	1	1	—	—	—	1	—	—
42WB32.84	F	50+	2	1	2	1	2.5	2.5	3	0	1.5	1	—	1

* C = cervical, T = thoracic, L = lumbar, S = sacrum, Sho = shoulder, Elb = elbow, Wri = wrist, Han = hand, Hip = hip, Kne = knee, Ank = ankle, Foot = foot

** = missing data

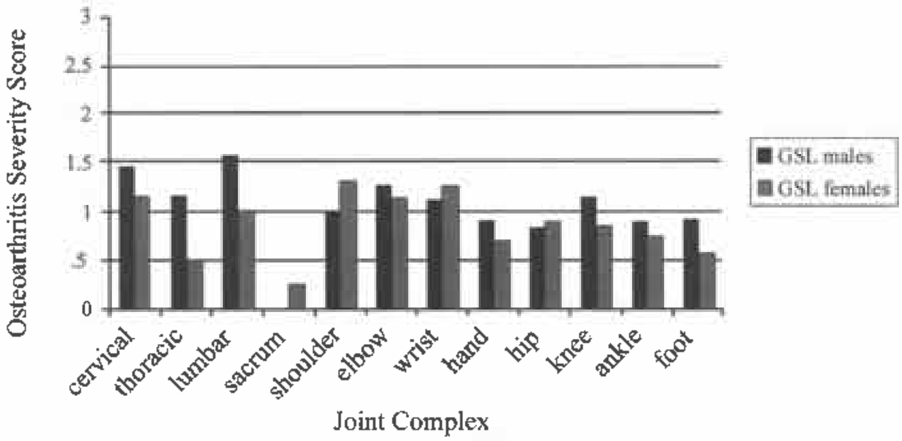

Figure 2. Sex differences in the Great Salt Lake sample by joint complex.

Lake series. With the exception of one individual, a 45 year-old male with eburnation and severe lipping on his right elbow and only moderate joint modification on his left elbow, there is no evidence of asymmetry in osteoarthritis severity in the Great Salt Lake sample. Because there were few disparities between bilateral joints, scores for right and left sides were combined for this study.

While osteoarthritis is widespread in the Great Salt Lake series, its severity varies greatly between joints. Among males, severity is highest for the lumbar vertebrae (average score = 1.57) and lowest at the sacrum (average score = 0). However, this low score for the sacrum may be due to the small sample size (n = 2). The second lowest score for males is at the hip (.82). Among females, osteoarthritis severity scores range from 1.31 for the shoulder to .25 for the sacrum. The distribution of osteoarthritis in the Great Salt Lake skeletal series is provided in Table 3.

In eight of the twelve joint complexes, males exhibit more severe osteoarthritis than females (Figure 2). This trend is especially apparent in the vertebral column and lower limb joints, specifically the cervical, thoracic and lumbar vertebrae, the knees and the feet. In the sacrum, shoulder, wrist, and hip, females exhibit higher levels of severity than males, but none of these differences were statistically significant (Independent Samples *t*-test, $p > .05$).

In relation to the Stillwater and Malheur series, the Great Salt Lake group shows slightly lower osteoarthritis prevalence in most of the joints. However, only the difference between the thoracic vertebrae of Great Salt Lake and Malheur females was significant using a Chi-square test ($p > .05$), including Yates' correction for small sample sizes where appropriate, ($X^2=4.857$, $p = .028$; Tables 4 and 5). The similarity in osteoarthritis prevalence is more readily observed among the males, where 66.7 percent of Great Salt Lake males are affected by this disorder, while 78.6 and 61.5 percent of Stillwater and Malheur samples are affected respectively (Figure 3). Greater differences exist between the Great Salt Lake females, where only 53.8 percent of the population is affected, and females from Stillwater Marsh and Malheur Lake, where 72.2 and 68.2 percent are affected (Figure 4).

DISCUSSION AND CONCLUSIONS

Adaptive diversity implies variation, not between two separate cultures—one of full-time, mobile foragers, the other of full-time, sedentary farmers—but within a single culture, in which alternative subsistence strategies were utilized by individuals over the course of their lives. Instead of relying completely on one method of subsistence, most, if not all individuals would have engaged in a combination of strategies, depending on

Table 4. Comparison of Osteoathritis Prevalence by Sex among Great Basin Samples.

	Great Salt Lake		Stillwater Marsh*		Malheur Lake*	
Joint	No.**	%**	No.	%	No.	%
Males						
Cervical	12	41.7	13	61.5	8	62.5
Thoracic	10	40.0	13	46.2	8	75.0
Lumbar	7	42.9	11	54.5	9	77.8
Sacrum	2	0	11	45.5	6	50.0
Shoulder	10	30.0	13	61.5	10	40.0
Elbow	11	36.4	13	61.5	9	66.7
Wrist	9	44.4	12	41.7	8	50.0
Hand	9	33.3	11	18.2	7	28.6
Hip	11	22.2	10	40.0	13	23.1
Knee	9	33.3	12	33.3	13	15.4
Ankle	9	33.3	11	45.5	12	33.3
Foot	6	33.3	10	20.0	30	100.0
Females						
Cervical	8	37.5	10	40.0	13	53.9
Thoracic	7	0	13	23.1	11	63.6
Lumbar	7	28.6	12	75.0	14	78.6
Sacrum	4	0	10	40.0	14	35.7
Shoulder	9	44.4	13	23.1	18	22.2
Elbow	12	41.7	15	40.0	19	26.3
Wrist	9	33.3	13	23.1	15	33.3
Hand	10	10.0	11	9.1	11	45.5
Hip	10	20.0	16	6.3	20	30.0
Knee	10	10.0	15	26.7	21	28.6
Ankle	8	0	14	0	18	16.7
Foot	9	0	8	12.5	7	14.3

* Stillwater Marsh data from Larsen, Ruff and Kelly 1995; Malheur Lake data from Hemphill 1999.

** No. = Number of articular joints observed for the presence or absence of osteoarthritis.
% = Percentage of articular joints affected by osteoarthritis.

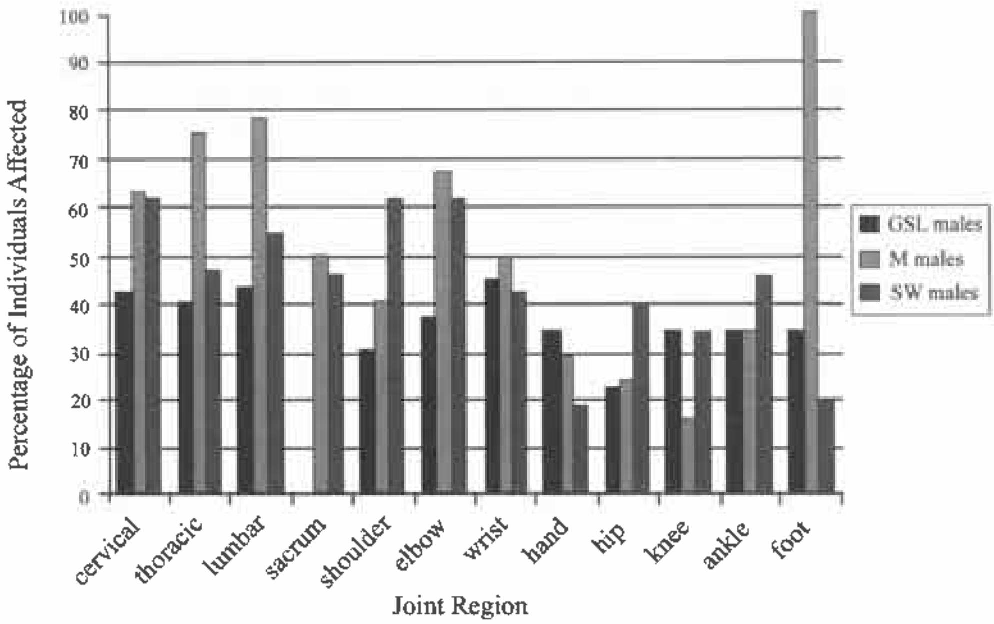

Figure 3. Differences in osteoarthritis prevalence among the Great Salt Lake (GSL), Stillwater Marsh (SW), and Malheur Lake (M) males.

the environmental and social factors acting at the time. Each of these strategies in turn would involve different levels of mobility, varying from highly mobile to highly sedentary. When viewed over the lifetimes of individuals however, the effects of these different activities would accumulate, causing a general pattern of mobility—representative of variability, not the lack of it—to exist for the population.

Osteoarthritis evidence from the Great Salt Lake wetlands supports such a pattern of mobility in this region. The presence and severity of osteoarthritis suggest that males were more mobile than females, similar to the findings of Ruff (1999) in his biomechanical study of long bones from the same sample (Ruff 1999). Based on ethnographic (Kelly 1983; Fowler 1982) and archaeological evidence (Kelly 1995; Madsen and Simms 1998; Simms et al. 1997; Upham 1994; Zeanah 1996), this difference between the sexes likely represents females being more tethered to base camps or farming sites, while males engaged in logistic activities around and outside the wetlands.

Additional evidence for male involvement in logistic activities lies in the high prevalence of Schmorl's nodes on their thoracic and lumbar vertebrae. Thirty-eight percent of males in the Great Salt Lake sample with vertebrae present (5/13) are affected by this disorder, including one young adult (17–22 years). When correlated to diet, based on stable carbon isotope values obtained by Coltrain and Stafford (1999), Schmorl's nodes are only found in individuals with mixed or high C4 diets (range = -14.8 to -10.8). This could mean that Schmorl's nodes are associated primarily with farming activities. It is also possible that these males were more heavily involved in trading activities that increased their access to corn, or hunting forays that gave them greater access to bison or other large game. Such activities would be consistent for the model of mobility in the Great Salt Lake wetlands and with knowledge of subsistence and trade, but it is not possible to conclusively determine if this was the case.

The change in life history patterns and the residential cycling characteristic of adaptive diversity may reduce risks related to diet and health in a difficult and often variable environment. In a previous study of skeletal remains from the Great Salt Lake wetlands, Bright and Loveland (1999) found low levels of disease and

Table 5. Chi-Square Analysis of Osteoarthritis Prevalence by Sex among Great Basin Samples.

	GSL-Still*		GSL-Mal*		Still-Mal*	
Joint	χ^2	p	χ^2	p	χ^2	p
Males						
Cervical	.987	.320	.208	.648	.000	1.000
Thoracic	.087	.768	1.015	.314	.711	.399
Lumbar	.000	1.000	.830	.362	.375	.540
Sacrum	.181	.671	.178	.673	.000	1.000
Shoulder	2.253	.133	.000	1.000	.365	.546
Elbow	1.510	.219	1.818	.178	.000	1.000
Wrist	.016	.899	.000	1.000	.000	1.000
Hand	.067	.795	.000	1.000	.000	1.000
Hip	.387	.534	.000	1.000	.174	.676
Knee	.000	1.000	.317	.573	.338	.561
Ankle	.008	.927	.000	1.000	.028	.867
Foot	.000	1.000	1.406	.236	3.318	.069
Females						
Cervical	.000	1.000	.078	.781	.057	.812
Thoracic	.521	.470	4.857	.028	2.537	.111
Lumbar	2.237	.135	3.054	.081	.000	1.000
Sacrum	.709	.400	.598	.439	.000	1.000
Shoulder	.351	.554	1.421	.233	.000	1.000
Elbow	.008	.930	.793	.373	.717	.397
Wrist	.002	.965	.000	1.000	.032	.857
Hand	.000	1.000	1.723	.189	2.063	.151
Hip	.191	.662	.440	.507	1.864	.172
Knee	.260	.610	.582	.445	.000	1.000
Ankle	.000	1.000	.368	.544	.987	.321
Foot	.004	.952	.017	.896	.000	1.000

*GSL = Great Salt Lake; Still = Stillwater Marsh; Mal = Malheur Lake

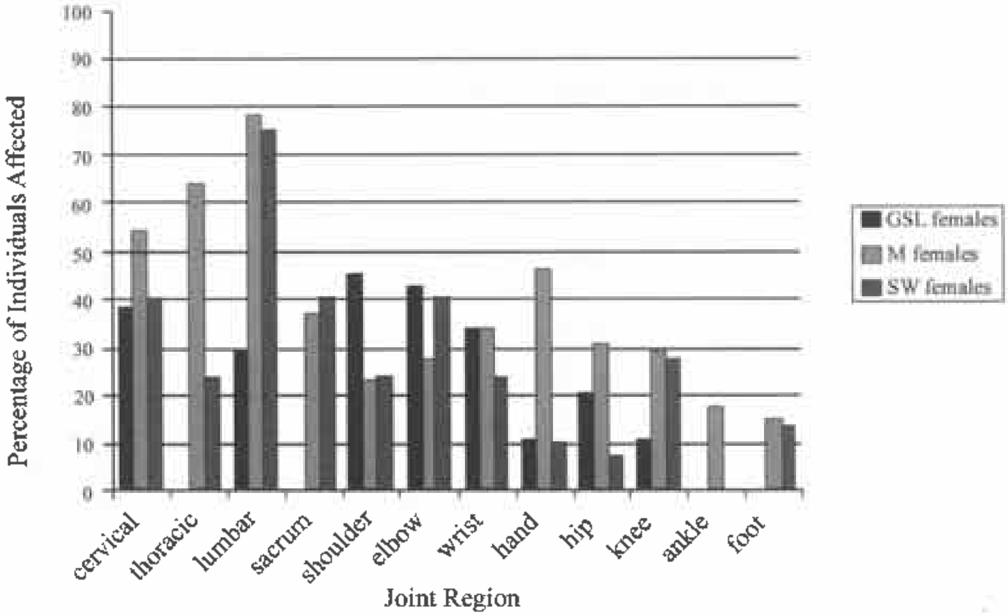

Figure 4. Differences in osteoarthritis prevalence among the Great Salt Lake (GSL), Stillwater Marsh (SW), and Malheur Lake (M) females.

malnutrition, as indicated by low frequencies of enamel hypoplasia, periosteal lesions and porotic hyperostosis. Levels of these were much lower than in remains from Stillwater Marsh and Malheur Lake, indicating the Great Salt Lake Fremont experienced lower risks of food shortage and disease. This raises the question of how the activities of the Great Salt Lake population differed from those of other groups in the Great Basin.

Generally, a lower prevalence of osteoarthritis was observed in the Great Salt Lake sample, in comparison to samples from Stillwater Marsh (Larsen et al. 1995) and Malheur Lake (Hemphill 1999). However, this pattern was more apparent among the females. By joint region, Great Salt Lake females are very comparable to their Great Basin counterparts in the joints of the upper limbs, but are quite different in the spine and lower limbs. This patterning suggests that while Great Basin females engaged in similar activities that affected their upper limbs—most likely food processing activities—they participated in different activities that affected their lower limbs and backs. A possible explanation for this is that Great Salt Lake females were slightly more sedentary than their Great Basin counterparts, a condition made possible because of the range of adaptive diversity in the Great Salt Lake population—a range extended by the inclusion of farming in the mix. Such a situation would be consistent with Bettinger's statement (1999: 329) that "mobility is inversely related to quality of life."

Osteoarthritis among Great Salt Lake males is also generally less prevalent than osteoarthritis in males from Stillwater Marsh and Malheur Lake, but statistically there is little difference between them. Patterning suggests all three groups led vigorous lives, characterized by high levels of mobility (Hemphill 1999; Larsen et al. 1995). These findings lend additional credence to the hypothesis that males were the primary participants in logistic activities in the Great Basin.

Osteoarthritis analyses of skeletal remains recovered from the Great Salt Lake wetlands supports a model of adaptive diversity where farming or foraging subsistence patterns reflect changes in lifeways rather than distinct cultures. While individuals from this area engaged in diverse subsistence activities, a general pattern of mobility exists for the sample. This pattern involves low residential mobility among many of the people much of the time, combined with higher rates of logistical mobility, especially among males. These findings are supported by biomechanical evidence (Ruff 1999), examination of skeletal pathologies that relate to diet breadth and risk reduction (Bright and Loveland 1999), and various archaeological measures in the Great Salt Lake area and the region (Madsen and Simms 1998; Simms 1999; Simms et al. 1997; Upham 1994).

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THE ARROYO SITE, 42KA3976: ARCHAIC LEVEL INVESTIGATIONS

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A recent flood episode in a minor tributary of Kitchen Corral Wash in central Kane County exposed extensive buried Virgin Anasazi deposits and features dating to the late Pueblo II/early Pueblo III period. Located stratigraphically beneath the Anasazi horizon were a series of charcoal lenses and surfaces that were investigated in profile only. Two of these surfaces yielded radiocarbon dates circa 3,800 B.P. Evidence is presented that suggest these underlying features represent a shallow Late Archaic pithouse that preceded later Formative developments.

In the spring of 1994 emergency excavations were conducted by the Kanab Field Office, Bureau of Land Management, at 42KA3976, a late Pueblo II / Pueblo III residential site located along Kitchen Corral Wash, a major tributary of the Paria River. The site had been severely damaged by a recent wash cut that exposed a number of buried architectural features. 42KA3976 was one of six Anasazi (Basketmaker III–Late Pueblo II) residential sites recorded during a clearance inventory of the Kitchen Corral Wash bottomlands. No Archaic period sites were recorded. At an elevation of 5,560 feet, the vegetation of the broad valley floor is dominated by big sage (*Artemesia tridendata)*. The old growth sage brush was scheduled to be burned and drill-seeded as part of a rangeland revegetation project. With the exception of 42KA3976, all of the sites occur on the pinyon-juniper covered ridges above the valley floor; 42KA3976 is situated on alluvial outwash at the base of a colluvium-covered slope.

The varied terrain and geology of this portion of the Grand Staircase physiographic section (Stokes 1977) insured that a variety of floral, faunal and geological resources were locally available to its prehistoric inhabitants. Several springs occur in the canyon, the closest to 42KA3976 is less than one kilometer away. The narrow floodplain of the wash itself is located 600 meters to the east of the site and was probably used for agriculture by the Anasazi. The intervening expanse of alluvium offered opportunities for both dry farming and akchin field systems that took advantage of the lateral outwash fans. Although the practice of agriculture structured Anasazi settlement, subsistence was not restricted to agriculture: in addition to native vegetation, Anasazi midden deposits at the Arroyo site held quantities of bone including mountain sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), and pronghorn (*Antilocaprus americanus*) (Nauta 1995).

In the absence of agriculture, Archaic subsistence practices could have relied on locally available native species. Native floral resources, including Cheno-ams (goosefoot family and pigweed) and various seed-producing grasses, were available on the valley floor. The modern Paunsagunt mule deer herd migrates down Kitchen Corral Wash from the high plateaus to their winter range, and probably did so in the past. Open range near the site was likely suitable for pronghorn, and sheep habitat occurs in the rugged cliffs above the site. Taking into account resources such as pinyon (*Pinus edulis*) and other upland species available from the surrounding slopes, the Arroyo site could have

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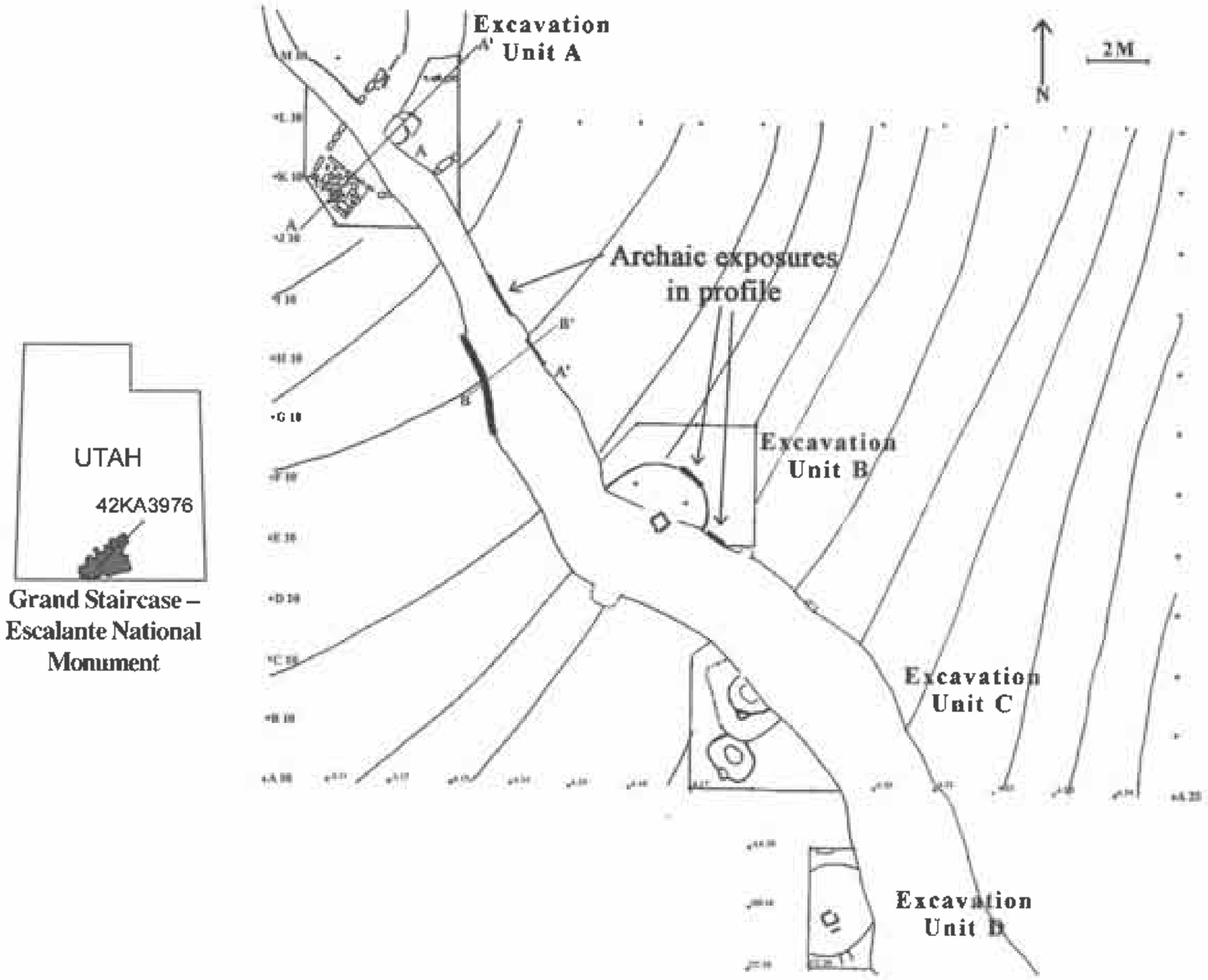

Figure 1. Arroyo site plan map showing Anasazi and Archaic features.

provided Archaic inhabitants a relatively sedentary base for year-round foraging, or a temporary camp used to exploit seasonally available resources.

SITE DEPOSITIONAL HISTORY

The Anasazi horizon of the Arroyo site was buried by over one meter of alluvial outwash that had accumulated within the past 800 years. Flood episodes sealed the cultural deposits and features and protected them from additional weathering and looters. A recent, very intense flood episode created a deep, straight-sided arroyo cut through the center of the site. The 2.5 m deep cut exposed a 40 m long Anasazi horizon that included a masonry roomblock, two fully subterranean pithouses, two "miniature pitstructures," and numerous small features and use surfaces (Figure 1). Excavation units were opened to expose the Anasazi features in plan and they were subsequently excavated (the excavation report is in preparation; see McFadden 1999 for a brief review).

This report describes evidence for a deeper, apparently extensive, Archaic level and an apparent shallow "pithouse" in the stratum that underlies the Anasazi level. The lower stratum is a dense consolidated alluvium that corresponds with a soil unit described by Kulp (1995) as " Pre-Anasazi Alluvium." Kulp places

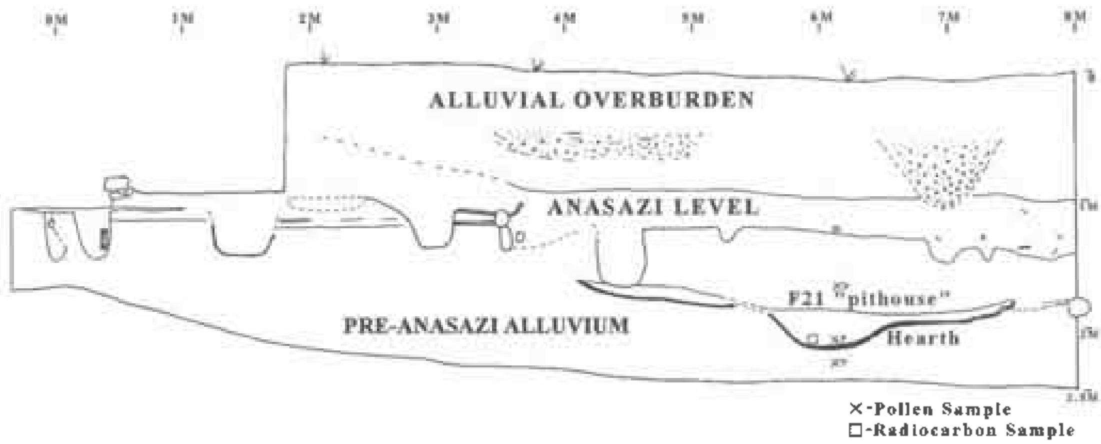

Figure 2. Profile A-A', east side of arroyo.

the upper date for the deposition of this unit at 2910 B.P. He goes on to say "While no absolute age data or detailed sedimentology is currently available for these floodplain deposits, it seems likely that they may represent the floodplain environment of the channel system. . . ." (Kulp 1995:21). Excavation undertaken in Unit B indicated that the pre-Anasazi alluvium lies directly on the Petrified Forest Member of the Chinle Formation.

Because the Anasazi horizon was continuous over the site and only discrete structural features were excavated, areal excavation of the underlying Archaic level was not possible. Thus, investigations were limited to the exposed profiles in the arroyo cut and the excavation units.[1]

EXCAVATION METHODS

The initial recording of the Anasazi features at the Arroyo site involved drawing a profile of the east wall of the wash. This continuous vertical face offered excellent control for examining the buried Anasazi features as well as the deposits above and below them (Figure 2). Numerous sherds and artifacts in the ash-stained sands of the upper level, as well as the features that originated from it, indicated that the horizon was obviously Anasazi. A distinct lens of charcoal located on both walls of the wash and beneath the Anasazi stratum was noted and drawn. This lens is referred to as Feature 21 (F21) on the east wall and Feature 34 (F34) on the west wall of the arroyo which, at this point, was about two meters wide (Figure 3). Another lens of charcoal, at about the same elevation, was noted in the arroyo cut eight m to the south. While the lens may have been continuous at one time, it appeared to have been truncated by the prehistoric excavation of the pithouse in Excavation Unit B. Subsequent excavation of the mostly unlined pit structure revealed charcoal in its east wall offering evidence that, while the lens was not necessarily continuous, a surface occurred at the same elevation in the deposits. In all, exposed profiles of the lower charcoal lenses could be identified over an area measuring 8 by 2 m. No soil horizon or occupation surface could be identified beyond the charcoal lenses.

Evidence for the "Pithouse"

The excavation of F34 was limited to a 10 cm deep by 20 cm high cut above a distinct soil contact formed by a lens of charcoal-impregnated clay resting on the pre-Anasazi alluvium (Figure 4). The only artifact in the feature was a portable slab milling stone that lay directly on the surface near the south end of this 1.5 m long excavation unit (Figure 5). No occupation surface or level of origin for the F34 surface was discernible in the

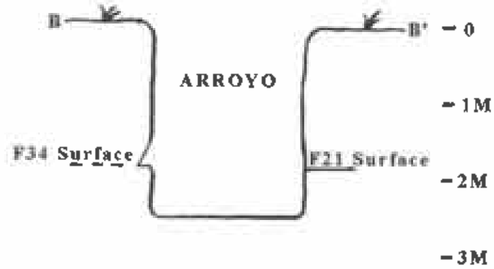

Figure 3. Section B.

profile. A composite sample of small charcoal fragments was collected from the lens for radiocarbon dating, a bulk macrofossil sample was obtained, and a pollen sample was taken from beneath the milling slab.

F21, exposed in the opposite bank, was a dish-shaped soil contact nearly four meters long, originating 60 cm below the Anasazi stratum and nearly two m below the modern surface (Figure 2). Fill above the contact with the pre-Anasazi alluvium was a charcoal/ash and ash-impregnated sandy clay similar to that of F34. In the center of the feature was a basin shaped depression 85 cm in diameter and 30 cm deep. Pollen samples were collected from the surface in the depression and from the alluvium both above and below the feature. A bulk macrofossil sample was collected from the depression. F21 and F34 are thought to be occupational surfaces.

Radiocarbon dates from composite samples of small charcoal indicate that Features 21 and 34 are roughly contemporary (Figure 6). Additional traits held in common that suggest they belong to the same feature include their origination at the same elevation in the pre-Anasazi alluvium (Figure 3), the similarity of the F21 and F34 occupation surfaces, and the nearly identical fill above them. Evidence that these are part of a pithouse includes the basin-shaped depression that appears to be a hearth, and a single fragment of fired clay daub that suggests a lightly constructed superstructure of brush and clay.

MACROFLORAL AND POLLEN ANALYSIS

Macrofloral Analysis

Martin (1995) analyzed the remains of carbonized plant materials from F21 and F34. A volume of 4.5 liters from F34 yielded a single *Helianthus* sp. seed. A volume of 6.9 liters from F34 (which included the putative "hearth") yielded a total count of 30 charred seeds, including: Asteraceae (n = 1), Cheno-Ams (n = 10), *Chenopodium* sp. (n = 6), and unidentifiable (n = 13) specimens. Also noted in each feature was a small quantity of *Pinus* sp. bark and needles. No local comparative data exist to assess the significance of these counts. It is noted, however, that these taxa continue to be used during the succeeding Formative period (Martin 1996, 1997).

Pollen Analysis

Cummings (1995) analyzed pollen from four locations associated with the Archaic level. Pollen samples were collected from beneath the milling slab on the F34 surface, from the "hearth" depression surface in F21, and from sterile contexts both above and below F21 in the pre-Anasazi alluvium (Figure 2).

The pollen samples collected and examined from the Archaic level exhibited a pollen record different from all of the Anasazi samples. The "pithouse" samples were dominated by *Artemisia* pollen; *Pinus* and *Juniperus* pollen counts were generally smaller than those noted in the Anasazi samples. Other species present included Asteraceae, Cheno-ams, *Sarcobatus*,

Figure 4. Collecting charcoal from F34. Note milling slab at left.

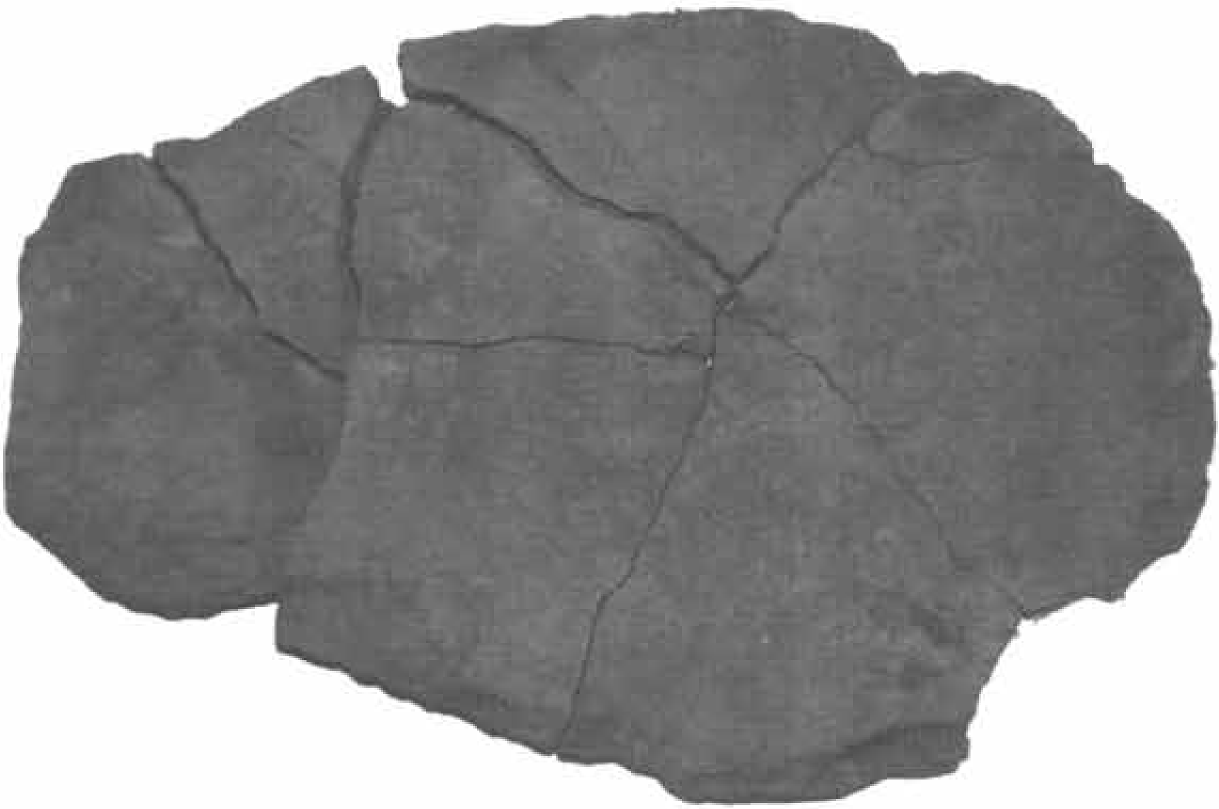

Figure 5. Milling slab from Archaic surface (49 x 32 x 3.5 cm).

Table 1. Radiocarbon Dates from the Archaic Level at 42KA3976.

Site Number	Laboratory Number	Material	Context/Control	B.P. Age	2 Sigma Range	Cal. Curve
42KA3976	Beta 77109	Charcoal	F34 Surface West Side	3370 ± 80	1880–1450 B.C.	1660 B.C.
42KA3976	Beta 77118	Charcoal	F21 Hearth East Side	3420 ± 90	1935–1505 B.C.	1705 B.C.

Ephedra, and Poaceae. Small quantities of hollow starch granules, and starch granules with hila that are typical of grass seeds, were also recovered. The pollen sample taken beneath the milling slab yielded sagebrush seeds, Cheno-am seeds, grass seeds, and a member of the Solanaceae (potato/tomato) family, holding open the possibility that any of these may have been processed using the milling stone (Cummings 1995).

DATING AND CHRONOLOGY

The two radiocarbon dates from F21 and F34 (Table 1) place the putative pithouse within the Late Archaic period, 3300–1500 B.C. (Tipps 1995).

Although no projectile points were found in the Archaic level of the Arroyo site, Gypsum dart points, a key diagnostic of the Late Archaic period, are relatively common on the Grand Staircase (Keller 1987), Kaiparowits Plateau (Geib et al. 1999), and Arizona Strip (Fairley 1989). Keller's (1987) inventory on the Skutumpah Terrace, located about 20 km northwest of the Arroyo site, recorded 10 Late Archaic sites and a total of 34 Gypsum points. A collection of Gypsum points, reported to have been found on the terrace between the Skutumpah and the Arroyo site, are made of Petrified Forest Member chert (Figure 7). The source of this distinctive agatized wood is the Chinle Formation, which is exposed at the base of the Vermilion Cliffs.

Dates for Gypsum points are generally cited as 2500 B.C. to A.D. 500 (Holmer 1986). Based on a reanalysis of dated points from Sudden Shelter, Tipps (1995:52) cites their range as 3500 and 1500–1000 B.C. for the northern Colorado Plateau. On the Grand Staircase section of the southern Colorado Plateau, Gypsum points seem to have persisted into the Formative period. Eccles and Walling-Frank (1998) describe Gypsum points from securely dated Basketmaker II (circa A.D. 200) contexts at the Reservoir Site on the Utah–Arizona border at Colorado City (Nielson et al. 1996).

In addition to diagnostic projectile points, the Barrier Canyon rock art style, dated between 2000 B.C. and A.D. 300 in the Canyonlands region (Tipps 1995:168), occurs locally on the Grand Staircase (Judd 1926:122) and supports the impression of a widespread Late Archaic occupation on the southern Colorado Plateau. To date, however, recorded Late Archaic site types on the Grand Staircase are restricted to lithic scatters (Brown 1982), lithic and groundstone scatters (Keller 1987), and rockshelters (Janetski and Wilde 1989). Few open camps and no residential structures have been attributed to the Late Archaic period on the southern Colorado Plateau.

CONCLUSIONS

Although only tentative conclusions can be drawn from the limited investigations of the Archaic level at the Arroyo site, the findings can help formulate a model of settlement and subsistence for the Late Archaic on the Grand Staircase section of the Colorado Plateau. If, in fact, the preferred location for semi-permanent Late Archaic camps was in alluviated bottom lands, such sites are likely to be under-represented by

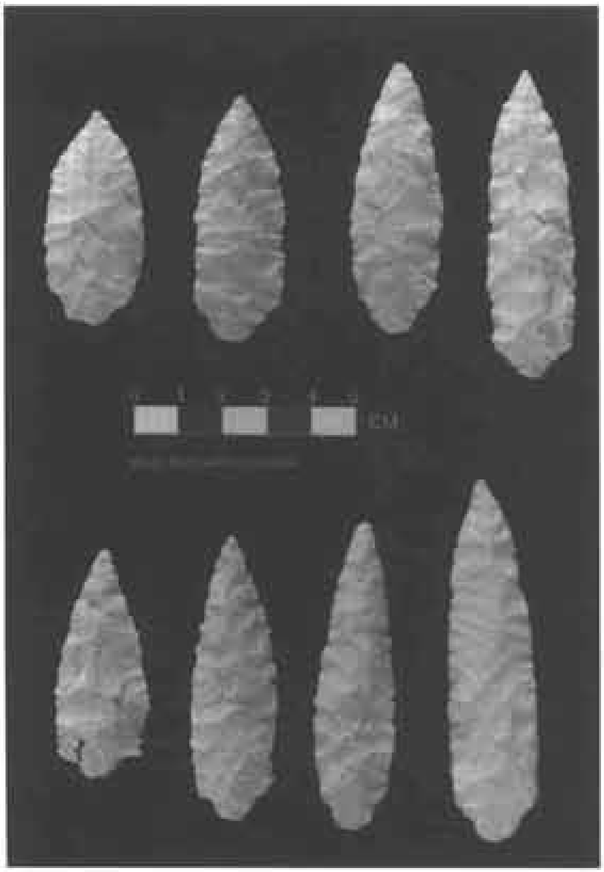

Figure 7. Gypsum projectile points from the Grand Staircase.

surface inventories. Ultimately, their identification may require geomorphological studies of sediments and buried soil horizons exposed in wash profiles of the numerous alluvial filled valleys on the Grand Staircase.

The identification of a Late Archaic population on the Grand Staircase has important implications for understanding the origins of Virgin Anasazi agriculture. Was the local adoption of agriculture a process of diffusion to existing bands of hunter-gatherers, or was the spread of maize the result of a migration of agriculturalists from the south (Berry and Berry 1986)?

In support of the migration hypothesis, Geib and Davidson point out that there appears to be an occupational hiatus of rockshelters in the Four Corners area between 3,500 to 2,500 years ago, just prior to the Basketmaker II period (Geib and Davidson 1994:201). On the Grand Staircase the continuity of occupation is unclear—only a few sites have been dated to the period immediately preceding the relatively well known Basketmaker II era (Figure 8). The handful that have been reported only hint at the presence of a large enough population to adopt the Formative lifeway. Further, all of the available dates are the result of limited excavations that lack the context to flesh in details of local settlement pattern and adaptive strategy.

Nevertheless, the diffusion of agriculture to an existing population on the Grand Staircase remains a viable hypothesis. Both the wide distribution of Late Archaic rock art styles, and particularly the temporal continuity of Gypsum projectile points, suggests that there was no occupational hiatus on the Grand Staircase immediately prior to the introduction of agriculture. If an *in situ* population of Archaic foragers is eventually described then local adaptation, rather than population migration may best account for the distinctiveness of the emerging Virgin Basketmaker II culture.

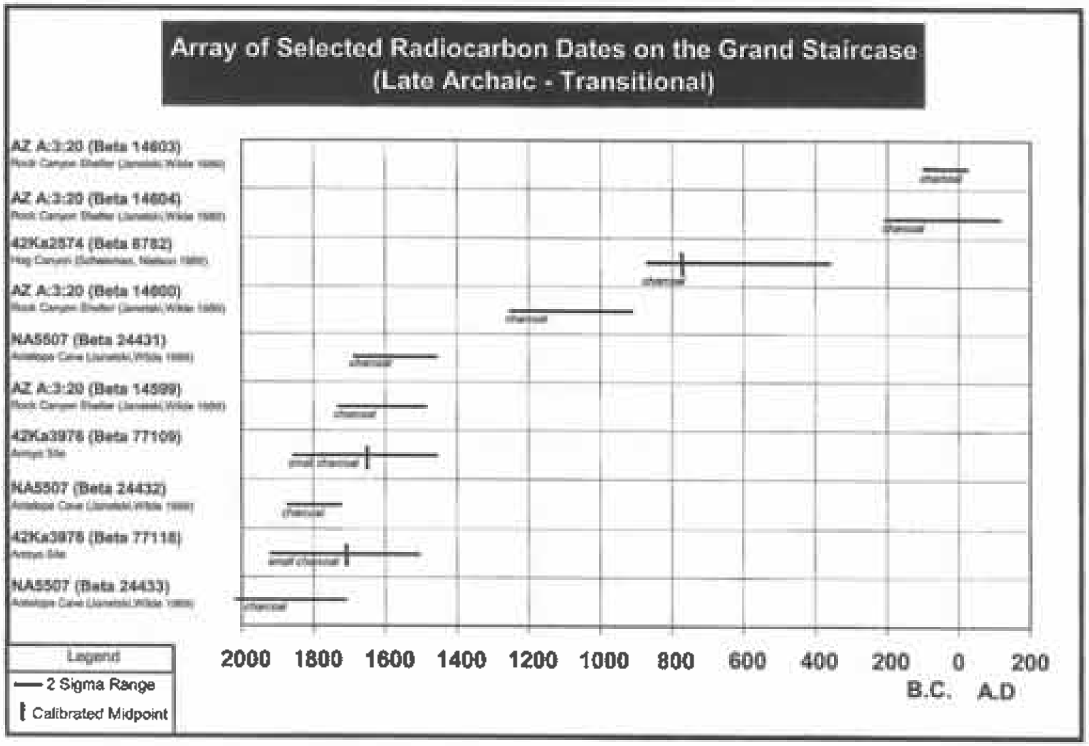

Figure 8. Some late Archaic radiocarbon dates from the area.

Acknowledgments. The excavations at the Arroyo site involved many people. Those directly involved in the investigation of the Archaic level include: Gardiner Dalley, Diana Hawkes (Christensen), Geralyn McEwen, and Laird Naylor of the Bureau of Land Management (BLM). I am indebted to them for their skilled observations and hard work. I am especially pleased to have worked with Steve Martin, U.C.L.A., who collected and analyzed the macrobotanical data as part of his Ph.D. dissertation. Thanks also goes to Verlin Smith, BLM, Kanab Field Office Manager, for his support of the project and Garth Portillo, BLM, Utah State Office Archaeologist, who provided funds for analysis. I thank Gardiner Dalley, Bill Davis, and an anonymous reviewer for their editorial comments and advice.

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NOTE

[1]The initial excavations at the Arroyo site were conducted as emergency data recovery directed at the remnants of obvious Anasazi structures. Our knowledge of Virgin Anasazi site layouts suggested that the site was extensive and that the initial investigations would recover only a sample of the features present. In anticipation of future investigations at the site, permanent datums were placed that would facilitate re-establishing the grid system.

The definition of an underlying Archaic level significantly expands the research opportunities at the site. Potential future investigations at the Arroyo site will be carried out under the supervision of the USDI, BLM, Grand Staircase–Escalante National Monument.

This is a new section in *Utah Archaeology*. We think there is room in the journal for articles on non-traditional subjects and articles of general interest. The two articles in this inaugural issue are by avocational archaeologists, but anyone can contribute. We seek either nontraditional subject matter, such as the articles in this issue, or photo-essays of artifact collections that feature the photos with a minimum of text, or educational pieces on general topics; for instance a synthesis about "Paleoindians in Utah," or a guide on "What you can learn from human skeletal remains." The possibilities are many. If you have an idea for an article, please contact one of the editors. —*S.S., R.J.*

OSBORNE RUSSELL ENCOUNTERS A WOLVERINE

Dann J. Russell, Promontory/Tübadüka Chapter, Utah Statewide Archaeological Society, 2581 W. 5000 S., Roy, UT 84067

As a student doing post-graduate studies at Weber State University in the mid 1970s, I remember looking at an oil painting in the Student Union Building by Farrell R. Collet of a mountain man having an encounter with a wolverine. I didn't give it much thought until several years later. Then, because of my interest in mountain men and current day reenactments of their rendezvous, I obtained a copy of a *Journal of a Trapper*, edited by Aubrey L. Haines, University of Nebraska Press. This book contained the journal of Osborne Russell, a trapper in the Rocky Mountains and eastern Great Basin during the early to mid 1800s. In my reading, I came across an encounter that Mr. Russell had with a wolverine on February 4, 1841. This event was apparently so significant to him that he devoted several pages to it. I later learned that Mr. Collet's painting was depicting this event documented in Osborne's journal. The painting is now on loan to the Weber County Commissioner's Office in downtown Ogden. Figure 1 is a photograph of this painting and is presented here by permission of Weber State University and the Collet family.

Having been born and raised in Ogden within walking distance of the mouth of Ogden Canyon, and having spent many summers in the surrounding foothills, Osborne's description of the area caused me to reflect on my wanderings there. Since then a question has echoed through my mind. Where was Osborne Russell camped on February 3, 1841, the day before he faced the wolverine? To attempt to determine where he was on this day, his travels and activities just prior to this time will be examined from his writings. Russell often described his travels and surroundings in great detail. In so doing, not only will the examination point out possible locations where he had his encounter with the wolverine, it will point out that he was in the vicinity of locations known today in the Ogden Valley. Even more important archaeologically, it will point out some of the wildlife and Native Americans that made the Ogden Valley their home in the early 1800s, and even climatic conditions that existed at this time.

BACKGROUND

Osborne Russell was born June 12, 1814 in Bowdoinham, Maine. He was one of nine children of

Figure 1. ***Osborne Russell Encounters a Wolverine*** **by Farrell R. Collet.**

George C. and Eleanor (Power) Russell. Not much is known of him until he joined Nathaniel J. Wyeth's expedition to the Rocky Mountains in 1834. From there on he had many adventures trapping and hunting until 1843 when he left for the west coast, never to return to his old ways again. He was one of the very few mountain men who had enough education to read and write, and because of this, kept a journal of his adventures hunting, trapping, and dealing with the Native Americans in the Rocky Mountains and eastern Great Basin. Osborne died August 26, 1892 and is buried in an unmarked grave in Placerville, California. His death notice in the Placerville Mountain Democrat, September 4, 1892 reads, "Russell—at the County Hospital, August 26, 1892, Osborne Russell (Judge), a native of Maine, aged 78 years" (Haines 1986:xviii).

JOURNEY INTO THE OGDEN VALLEY

On December 15, 1840 Osborne was in Cache Valley. Quoting from his journal and preserving his grammar, he writes,

> "The next day we travelled across the Valley in a SW direction Then took into a narrow defile which led us thro. The mountain in to the valley on the East borders of the lake" (Haines 1986:113).

Key words from this part of Osborne's journal are "SW direction" and "narrow defile." It is most probable that he traveled along the Bear River through the Bear River Narrows, where present day Cutler Reservoir exists, and made camp somewhere along the river below the mouth of the narrows. If this is not correct, the only other alternative would have been for him to travel south in Cache Valley, over the mountains and down Brigham

City Canyon. However, this direction of travel is contrary to his writings and many times he documents in his journal traveling along streams and rivers (Haines 1986:93), and since travel along a stream was to his liking, the Bear River should be no exception. His travels of the next few days also lend credence that the Bear River Narrows is the "narrow defile" of which he speaks. On December 16, 1840 he writes,

> "The day following we moved along the Valley in a South direction and encamped on a small branch close by the foot of the mountain" (Haines 1986:113).

It's very likely that the small branch referred to is present day Willard Creek and not the creek from Brigham City Canyon. Traveling through "the Valley in a South direction" and camping along this creek would not put him "by the foot of the mountain." However, both creeks are approximately 25 to 27 miles south of the mouth of the Bear River Narrows and it was not uncommon for Osborne to travel 20 to 25 miles a day (Haines 1986:96). Osborne next writes,

> "20th Decr. We moved along the borders of the Lake about 10 Mls. And encamped on a considerable stream running into it called 'Weavers's river' At this place the Valley is about 10 Mls wide intersected with numerous Springs of salt and fresh hot and cold water which rise at the foot of the Mountain and run thro. The Valley into the river and Lake" (Haines 1986:114).

The present day Weber River runs farthest north through an area known as West Weber and is approximately 9.5 miles from Willard Creek at this point, which adds further credence that Willard Creek was where he was camped just prior to this latest move. Two present-day springs, Cold Springs and Utah Hot Springs, lie directly at the base of the mountains. Two of the creeks that run through the valley originate from these springs, Cold Springs Creek and Warm Springs Creek. Figure 2 shows the approximate location of these springs as well as a proposed path of Osborne's journey into the Ogden Valley. For detailed information, the USGS topographic map, 1955, Plain City, Utah, should be consulted. Other creeks that run through this area are First and Second Salt Creeks, Dix Creek, and Fourmile Creek. All of these springs and creeks lie between Willard Creek and the Weber River at West Weber. He further writes,

> "Weavers river is well timbered along its banks principally with Cottonwood and box elder . . ." (Haines 1986:114).

There are cottonwood and box elder trees along the river at this point that are in excess of 6 feet in diameter (from personal observation). From these entries in his journal, it should be apparent that Osborne Russell was very observant and attempted, although not always successfully, to be precise about describing his surroundings and giving directions and distances. This will help in determining his location on February 3, 1841.

CHRISTMAS DAY IN 1840

Osborne writes,

> "Decr. 25th It was agreed on by the party to prepare a Christmas dinner but I shall endeavor to describe the party and then the dinner. I have already said the man who was the proprietor of the lodge in which I staid was a French man with a flat head wife and one child The inmates of the next lodge was a half breed Iowa a Nez percy wife and two children his wifes brother a Nex percy 2 children and a Snake Indian The inmates of the 3d lodge was a half breed Snake his wife (a Nez percy and two children). The remainder was 15 lodges of Snake Indians¼ (Haines 1986:114).

He goes on to describe the dinner that was from stewed elk meat, boiled deer, boiled flour pudding with dried fruit and sauce made from the juice of sour berries and sugar, followed by strong coffee. Prehistoric campsites have been located along the Weber River in the West Weber and Slaterville area by Mark Stuart (personal communication) of the Utah Statewide Archaeological Society (USAS). Mark also stated that local farmers have reportedly plowed up gunflints and flintlock parts in this same area. For detailed information about this area the USGS topographic map, 1992, Plain City, Utah, should be consulted.

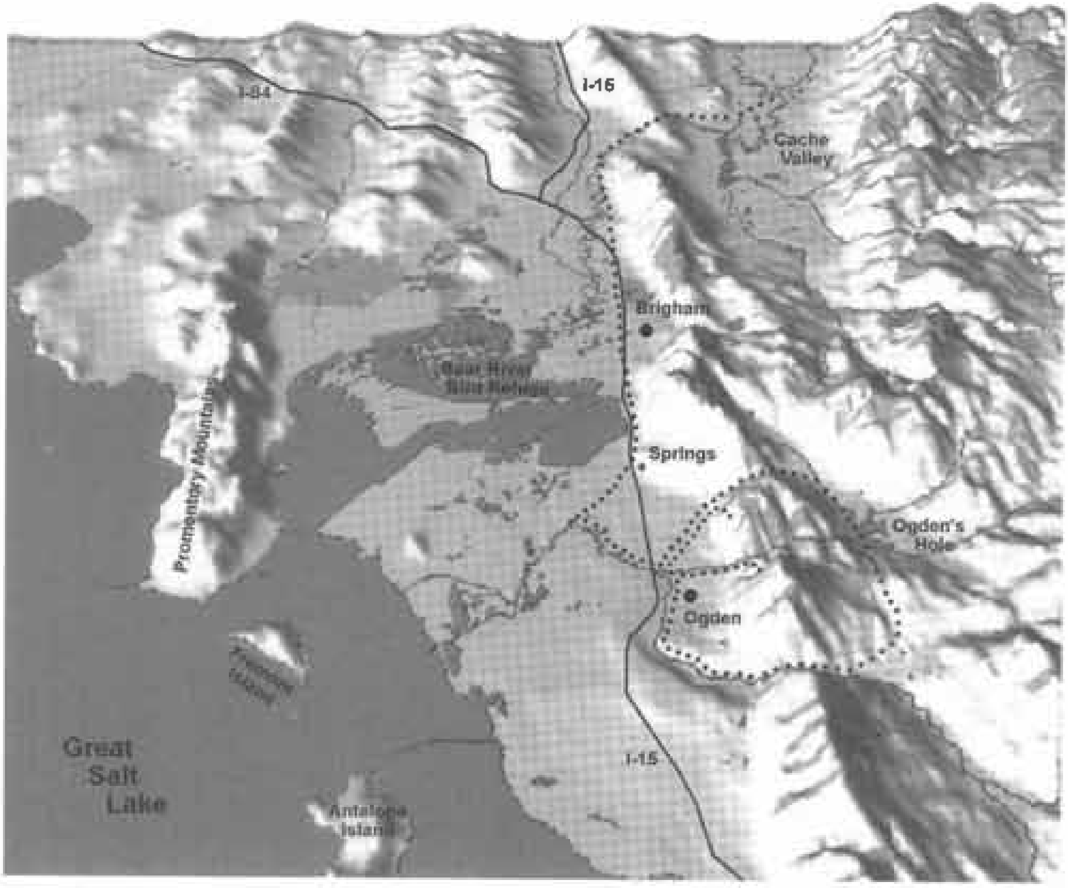

Figure 2. The Northern Wasatch Front.

1841 AT THE RIVER'S FORK AND BEYOND

After the first of the year the party moved up the Weber River. He writes,

> "On the 3d we moved Camp up the stream to the foot of the mountain where the stream forks The right is called Weavers fork and the left Ogden's both coming thro. The mountain in a deep narrow cut . . . On the 10th I started to hunt Elk by myself intending to stop out 2 or 3 nights I travelled up Weavers fork in a SE direction thro the mountains . . . in about 10 Mls I came into a smooth plain 5 or 6 Mls in circumference just as the Sun was setting here I stopped for the night the snow being about 5 inches deep and the weather cold I made a large fire—" (Haines, 1986:116).

From his description it would appear that he camped in the area between Mt. Green and Peterson, Utah. Osborne continues to write,

> "At daylight it was still snowing very fast and had about 8 inches during the night—I saddled my horse and started in a North direction over high rolling hills covered with Scrubby oaks quaking asp and maples for about 10 Mls where I came into a smooth valley about 20 Mls in circumference called 'Ogdens hole' with the fork of the same name running thro. it. Here the snow was about 15 inches deep on a level." (Haines 1986:116,117).

Here, Osborne has traveled over what is known as Trappers' Loop and into the Huntsville, Utah area. Trappers' Loop is locally known as an area that was frequented by trappers and explorers in the early to mid 1800s, thus giving it its name. Several trade bead caches have reportedly been found in this area by local residents.

Having killed an Elk in Ogden's Hole, he bedded down for the night. In the morning on the 12th of January he writes,

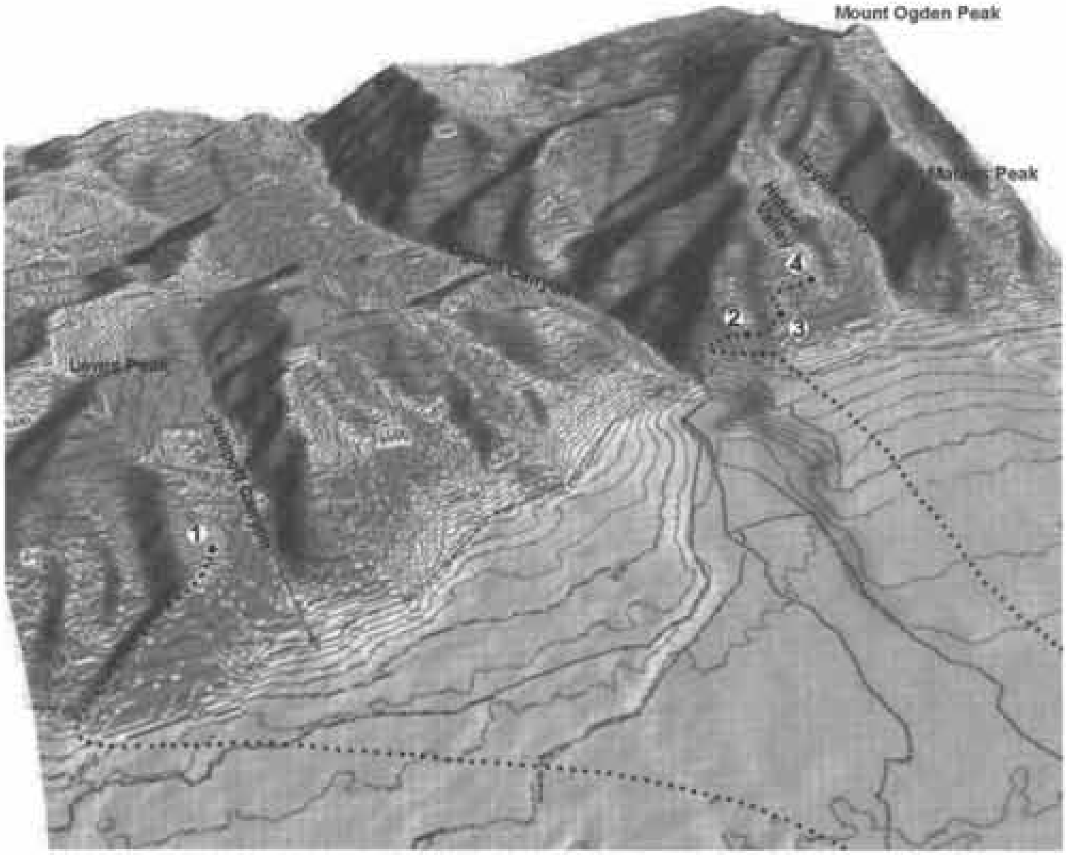

Figure 3. Mountain Range East of Ogden.

> "In the morning when I awoke it was still snowing and after eating breakfast I packed the Meat on my horse and started on foot leading him by the bridle Knowing it was impossible to follow down this Stream with a horse to the plains I kept along the foot of the Mountain in a Nth. Direction for about 3 Mls then turning to the left into a steep ravine began to ascend winding my way up thro. the snow which grew deeper as I ascended I reached the Summit in about 3 hours in many places I was obliged to break a trail for my horse to walk in I decended the mountain West to the plains with comparative ease and reached the Camp about dark" (Haines 1986:117).

Osborne has described very clearly the fact that travel down Ogden Canyon was impossible with his horse, so he traveled along the western edge of Ogden's Hole, which is the west edge of Huntsville, and then ascended up present day North Ogden Divide. In his description he stated that the snow was very deep at the summit, which is at 6180 feet, and that he had to break a trail for his horse. This was the 12th of January, just 22 days before his wolverine encounter.

FEBRUARY 3, 1841

Osborne again writes,

> "The 3d day of Feby. I took a trip up the mountain to hunt Sheep I ascended a spur ... until near the top where I found a level bench where the wind had blown the snow off. I ... took along the side of the mountain among the broken crags to see what the chance was for supper ... I had not rambled far before I discovered 3 rams about 300 ft perpendicular below me I shot and killed one ... I returned to my horse and built a large fire with fragments of dry sugar maple which I found scattered about on the Mountain having for a shelter from the wind a huge piece of Coarse Sandstone of which the mountain was composed ... after sleeping till about midnight I arose and renewed the fire ... I was upwards of 6,000 ft above the level of the lake, below me was a dark abyss silent as the night of Death I ... laid down and slept until near daylight—" (Haines 1986:117,118).

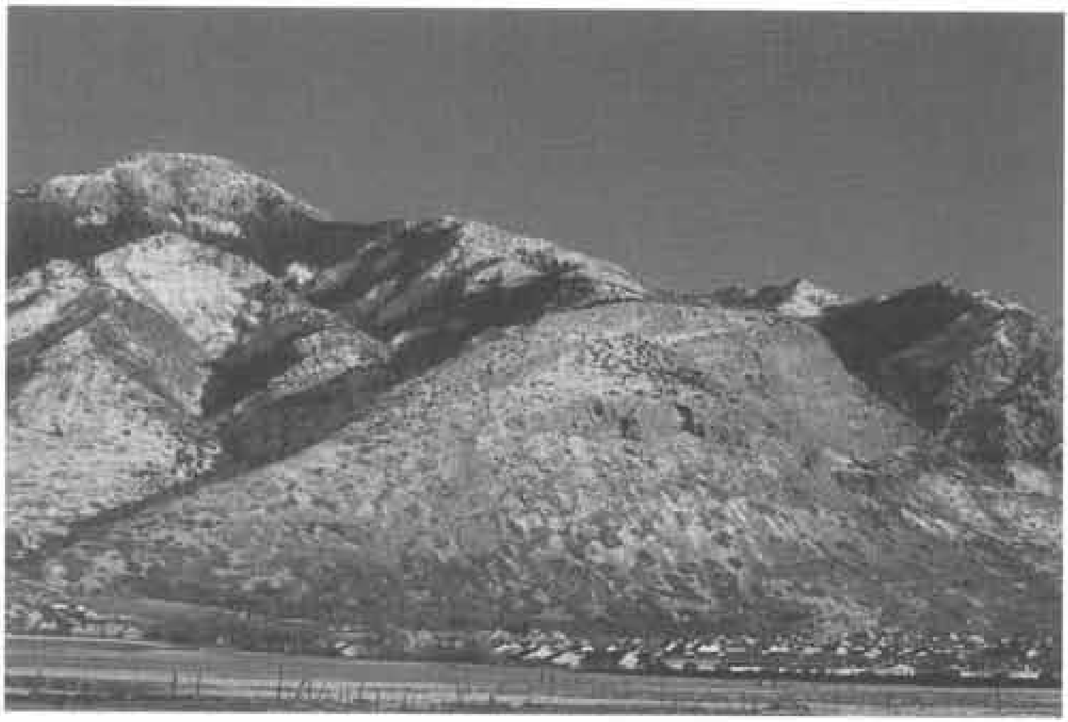

Figure 4. Photograph of Jumpoff Canyon Site 1.

This part of his journal is very descriptive and enables an attempt to locate where he was. He was camped at the foot of the mountains where the Ogden and Weber rivers meet. He traveled in an eastward direction either on the northern or southern side of the Ogden River and ascended a ridge of lesser elevation that ran parallel to the mountains. He did not camp on the mountaintop, but near the top, on a flat bench around 6,000 feet above the lake where there was no snow. He was near a rocky formation with a deep abyss and mountain sheep below.

Running nearly north to south from North Ogden Divide to the south end of Ogden is a mountain range east of Ogden that is marked on the west facing slopes by a large cliff of Tintic Quartzite. There are two areas here that lend themselves to Osborne's description of his mountain ascent. The first, which could have easily been observed on his return from North Ogden Divide, is north of the Ogden River and begins at the mouth of Garner Canyon in the vicinity of the corporate boundaries between Ogden and North Ogden cities. This spur heads in a south by southeast direction along the top of the cliffs and ends in a flat plain at approximately 6,120 feet. Figure 3 shows this area as Site 1. More detailed information can be obtained from the USGS topographic map, 1992, North Ogden, Utah. This flat plain overlooks Jumpoff Canyon below Lewis Peak. Jumpoff Canyon is appropriately named because of the sheer drop from the cliffs above and would most certainly look like a dark abyss at midnight. Figure 4 is a photograph of this area taken in mid-January of 2001 and could possibly show the same surface conditions that faced Osborne in 1841.

The other area east of the fork of the Ogden and Weber rivers is known as Hidden Valley and is accessible by one of two trails. The first trail is known as Indians' Trail which leads up the south side of Ogden Canyon. The second trail branches off from Indians' Trail and is known as the Hidden Valley Trail. This trail travels along and above the cliffs and leads directly into Hidden Valley itself. Ascent up the mountain using this system of trails, which is believed to have been established long before Euro-American settlers entered the Ogden Valley, would have been much easier than

Figure 5. Photograph of Hidden Valley Site 2.

the Jumpoff Canyon route, which is very rocky. There are three possible locations in this area that Osborne could have used for his overnight stay. Figure 3 shows these locations as Sites 2, 3, and 4. More detailed information can be obtained from the USGS topographic map, 1992, Ogden, Utah.

Site 2, just under 5,200 feet, is the very flat Bonneville terrace of ancient Lake Bonneville. It is directly above Indians Trail and at the beginning of the Hidden Valley trail head. It is very flat and is close to the mouth of Ogden Canyon, which could be Osborne's dark abyss. The wind blows most of the time from the mouth of the canyon and many times during the winter months blows the snow from this spot. Located in the middle western edge is also a large outcropping of the Tintic Quartzite which could have been used as the shelter. Figure 5 pictures this area and clearly shows Indians' Trail and the quartzite outcropping in the middle of the terrace.

Site 3, pictured in Figure 6, is at an altitude of 5,600 feet, protrudes from the mountain, and is open to winds coming off the mountain top. It is still relatively close to and above the mouth of Ogden Canyon and yet overlooks the valley floor below. Much of what one would see below would also appear as a dark abyss.

Site 4, at 5,720 feet and pictured in Figure 7, is near the top yet far enough below that it is situated among the "broken crags" of the cliff. It also lies at the mouth of Hidden Valley and is in the path of winds coming off the mountaintop and through this valley. The view from here is of the valley floor below and an extension of Hidden Valley down and through the cliff, also giving the impression of a dark abyss.

All four sites are in the vicinity of 6,000 feet above sea level, but not the level of the lake. The Great Salt Lake has an average level of 4,200 feet and 6,000 feet above the lake would put him higher than Mt. Ogden Peak at 9,570 feet. Perhaps Osborne was not as high as he thought, and not as good at estimating altitude as he was at distance traveled.

LAKE OBSERVATIONS

Osborne next records some extremely interesting observations about the Great Salt Lake and the Ogden

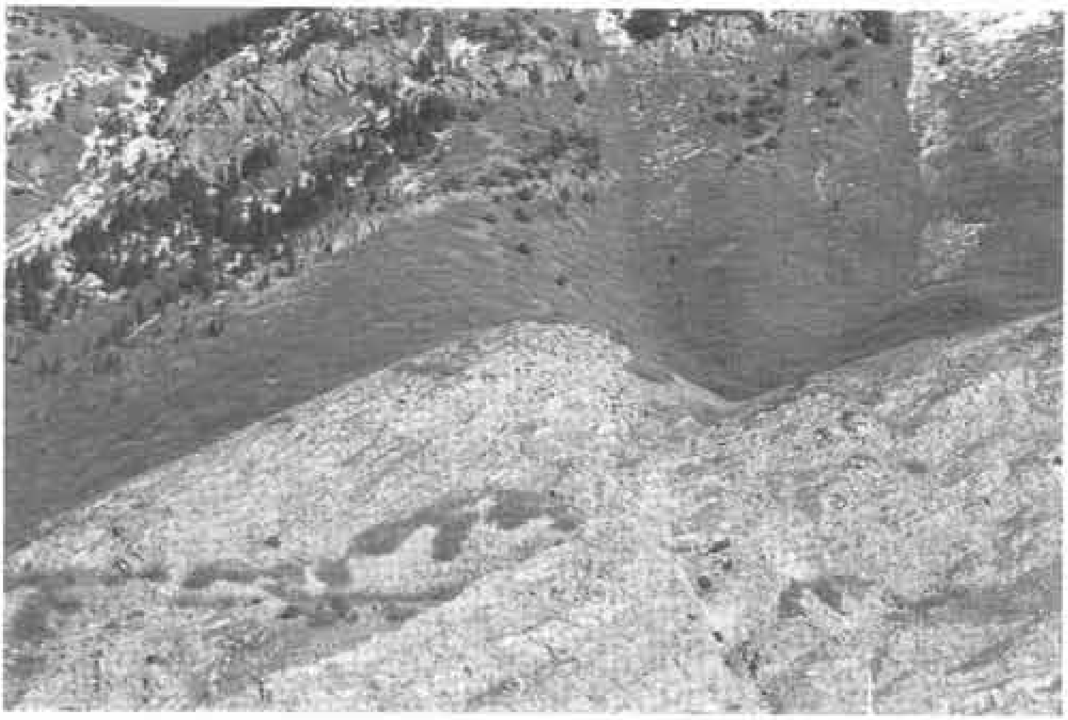

Figure 6. Photograph of Hidden Valley Site 3.

Valley. He writes,

> "My Chief object in Sleeping at this place was to take a view of the lake when the Sun arose in the Morning. This range of mountains lies nearly Nth & South and approaches the Lake irregularly within from 3 to 10 Mls. About 8 Mls from the SE shore stands an Island about 25 Mls long and six wide having the appearance of a low Mountain extending Nth & South and rising 3 or 400 ft Above the water To the Nth [W] of this about 8 Mls. Rises another Island apparently half the size of the first. Nth of these about six Mls. In circumference which appears to be a mass of basaltic rock with a few scrubby Cedars Standing about in the Cliffs the others appear to be clothed with grass and wild Sage but no wood except a few bushes near to the western horizon arose a small white peak just appearing above the water. Which I supposed to be the mountain near the west Shore. On the Nth. Side a high Promontory about Six Mls wide and 10 long projects into the lake covered with grass and scattering Cedars On the South Shore rises a vast pile of huge rough mountains; which I could faintly discern thro. the dense blue atmosphere" (Haines 1986:118).

Osborne has just described Antelope Island, Fremont Island, Stansbury Island, Pilot Peak, Promontory Point, and the Oquirrh Mountains, respectively. Probably his most important observation is the dense blue atmosphere. This could be the first known account documenting an inversion in the Ogden Valley. Inversions happen almost annually during the winter months over Ogden, with modern pollution intensifying their severity. Local folklore has it that the Native Americans called the Ogden Valley the "Valley of Smoke," and so it would appear that inversions were common in the valley long before the Mormons settled it.

A WOLVERINE FOOLS A YANKEE

On February 4, 1841 Osborne writes,

> "About sun an hour high I commenced hunting among the rocks in search of Sheep but did not get a chance to shoot at any till middle of the afternoon when crawling cautiously over some shelving cliffs I discovered 10 or 12 Ewes feeding some distance below me I shot and wounded one reloaded my rifle and crept down to the place where I last saw her when I discovered two standing on the side of a precipice Shot one thro the head and she fell dead on the cliff ... went round the rock down to where she fell butcherd her hung the meat on a tree then pursued and killed the

Figure 7. Photograph of Hidden Valley Site 4.

other After butchering the last I took some of the [meat] for my supper and started up the mountain and arrive at the place where I had slept about an hour after dark I soon had a fire blazing and a side of ribs roasting ... by the time supper was over it was late in the night And I lay down and slept till morning At sun rise I started on foot to get my meat and left my rifle about half way down the Mountain when I came to where the first sheep had been hung in a tree I discovered a large Wolverine sitting at the foot of it I then regretted leaving my rifle but it was too late he saw me and took to his heels as well he might for he had left nothing behind worth stopping for All the traces I could find of the sheep were some tufts of hair scattered about on the snow. I hunted around for sometime but to no purpose. In the meantime the cautious thief was sitting on the snow at some distance watching my movements as if he was confident I had no gun and could not find his meat. and wished to agravate me by his antic gestures he had made roads in every direction from the root of the tree dug holes in a 100 places in the snow apparently to decieve me but I soon got over my ill humour and gave it up that a Wolverine had fooled a Yankee." (Haines 1986:119,120).

Figure 1, presented earlier, depicts this event.

DISCUSSION

It may never be known exactly where Osborne Russell was on February 3rd and 4th of 1841 and maybe it's not very important. Perhaps someday more evidence than has been presented here will shed more light onto the nature and locations of his encampments. However, the passages presented here allow one to follow Osborne Russell's footsteps into the Ogden Valley and surrounding countryside before settlement by the Morman pioneers in 1847. They show that there was an abundance of big game, especially elk and mountain sheep in the valley in the early 1840s. During this time, wolverines were making the mountains east of Ogden their home, although they are gone today according to the Utah Division of Wildlife Resources. The winter of 1840 in Ogden appears to have been a normal winter with an inversion. Long before there were oil refineries, Kennecott Copper, and automobiles to intensify the effects of inversions in the valley, they still hindered one's visibility. Ogden Canyon was virtually impassible and perhaps this is the reason for Indian's Trail up the canyon. Finally, in the 1840s Native Americans of diverse identities including Flathead, Nez Perce, Cree, and Snake

(Shoshone), all accompanied by both English and French trappers, used the Ogden Valley for their wintering grounds.

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POTTERY RECONSTRUCTION

David Jabusch and Susan Jabusch, Salt Lake City Chapter, Utah Statewide Archaeological Society.

Avocational archaeologists seem fascinated by pottery reconstruction, but professionals are less so. This may reflect the contrast between non-professionals' interest in artifacts and professionals' focus on the information they represent. Published works on archaeological ceramics include detailed discussions on construction, curation and analyses, but no treatment of reconstruction (e.g. Olin and Franklin 1982; Shepard 1956). In any case, we have been privileged to gain experience with the reconstruction of pottery vessels while working at Petra, Jordan and in various Utah laboratories. This paper identifies some of the reasons for and against reconstruction, and describes some of the techniques we've learned over the years.

DECIDING WHETHER TO RECONSTRUCT

Deciding whether to reconstruct a pot isn't easy. To the casual observer, the question is obvious: why not? The primary issue is information. Will reconstruction increase or decrease the yield of information from the pot? Reconstruction may possibly add information about a vessel's form and function. In the process however, there is real potential for destroying information and hastening the artifact's deterioration. Improper glues or careless handling can cause the deterioration or loss of the artifact. Unnecessary washing, taping, and handling may destroy minute accumulations of pollen and other residues of the vessel's contents. The preservation of these residues is important because future researchers will surely bring new analytical techniques and questions to bear on previously discovered artifacts.

On the other hand, most repositories (usually museums) have ceramics that were collected long before modern archaeological techniques were developed. Hence, objects often lack proper documentation of provenance and other information. In these cases, reconstruction is justified to display the vessel or to use it for some other educational purpose. Even the increased space needed to store such artifacts in an already-crowded museum may be an overriding argument against reconstruction.

Finally, economic and political considerations may have a bearing on the decision. A museum may be able to trade or loan a reconstructed vessel to another institution, making good use of the artifact and benefiting all parties. At Petra for instance, the Jordanian government requires preservation and reconstruction of every artifact that is more than 50 percent complete as a condition of renewing the excavation permit. In these situations, the benefits of reconstruction outweigh its advantages.

TECHNIQUES FOR RECONSTRUCTION

Given the decision to reconstruct a particular vessel, you must assemble the proper tools. It is optimum to have an assigned work area with a sandbox approximately two to three feet square in which to safely place the round or irregular pieces (Figure 1). It is also useful to have a few soft brushes, masking tape, glue, and cleaning solvent.

The glue is particularly important. The main considerations are avoiding deterioration of the artifact and reversibility of the gluing. That is, if someone finds it necessary to deconstruct the vessel, can the glue be dissolved with the minimum damage to the artifact? The Utah Museum of Natural History (1989) recommends that the choice of glue be made "after prior consultation" with the museum that will ultimately store the artifact.

At Petra, we used a mixture of acetone and clear plastic (acetate) chips, which produced a solution much like airplane glue. Duco cement is a similar solution and is readily available. The best glue we have found is polyvinyl acetate (PVA), available from Light Impressions.[1]

Begin by sorting the sherds into groups that seem to go together. Surprisingly, sections of the same vessel can differ significantly in thickness, shape, and color. The pot pictured in Figure 1 varied not only in thickness, but its color ranged from pale brown to black. It is not uncommon to have sherds from other vessels mixed in with those from the vessel under construction. The most challenging scenario arises when there are sherds from two or three vessels mixed together.

In attempting to match specific sherds, it is often necessary to look for more subtle signs. At Petra, where potters used a wheel, fine lines made by the potter's fingers as the pot turned could be used to match two sherds. Further, firing the pot produced differential coloring of the clay that was visible in the broken edges of the sherds. Well-fired clay turned from a dark gray to a bright orange throughout. Poorly fired clay produced a "sandwich" of gray clay between layers of orange on the inside and outside of the sherds. We used these variations to sort and match the sherds, as well as to exclude sherds from other pots.

Figure 1. Fremont Grayware vessel under reconstruction.

Reconstruction isn't as simple as finding two sherds and gluing them together until the pot is completed. Any two sherds can be glued so that they appear to fit perfectly. Unfortunately, minute discrepancies in the angle of the joint, accumulated around the perimeter of a two-foot diameter pot can cause the last joints to be so misaligned that they don't even touch. The trick is to keep the joints aligned so the last ones glued are as tight as the first. As a rule, it's better to postpone gluing until you are sure the alignment is correct. One technique is to fit three or more sherds into a larger piece and then glue the joints at the same time. Try to avoid crooked edges so the next joint will fit tightly. By assembling three or four sherds into a larger sherd, you can maintain the proper alignment of the joints and hence reconstruct the curvature of the pot both vertically and horizontally.

Begin assembling the pot at the bottom and proceed up the sides. This makes it easier to keep the sides aligned as you proceed. The Fremont pot pictured in Figure 1 was so symmetrical we had difficulty finding

Figure 2. Reconstructed Fremont Grayware vessel.

the base. We started with an assemblage of similar tan sherds. As we progressed, it became clear that the section we began with was the lower part of one side, and we could work from there through the bottom and up the vertical circumference to the rim.

One technique we developed to postpone the finality of gluing is to tape the unglued joints inside and out with small pieces of masking tape, producing a remarkably strong temporary joint. The down side is that the tape probably removes microscopic residues that could be used in later research, so we recommend avoiding or at least minimizing this technique on unwashed sherds that have potential for further research.

To achieve a tight joint at the all-important proper angle, first brush all of the dust and dirt from the joint, then clean and moisten it with a glue solvent on a cotton swab. Apply glue along the entire length of the joint where the sherds will attach. As the edges fit together you can feel them "click". Holding the sherds tight, tape both sides of the joint to hold it until the glue dries. Taping the joints gives added strength, making it possible to glue more of the pot at each session. If possible, glue a group of sherds that comprise the pot's entire circumference, because this achieves a better fit and angle while there is still some "give" to the glue. As an alternative to tape, you can hold the newly glued section in place with large rubber bands that can extend around the pot. Have an assortment of large sizes and tensions available so you can select just the right rubber band for the particular job. Continue this process until you reach the rim.

We found it convenient to remove the tape from the previous day's gluing before moving up the pot. Left too long, masking tape becomes increasingly difficult to remove. Rubber bands can remain until the pot is completed as insurance against it giving way under the pressure of the reconstruction work.

For large, heavy pots, glue only one section at a time. We used at least six sessions to glue the pot in Figure 1, allowing a day in between each session for the glue to dry.

One pitfall is gluing past what is thought to be a missing sherd, leaving a hole, and finding the missing sherd later. The irregular edges of sherds often make it difficult to fit the missing sherd into the hole. Taping the entire pot before gluing avoids this problem. If you end up with a missing sherd, you can fill the cavity with material such as plaster of Paris, sheetrock Spackle, or some similar substance. This filler can be left white or colored to resemble the vessel. However, we prefer to leave the space empty because it is less obtrusive than white filler and more natural than a colored one. This approach also minimizes the contact between the sherds and foreign substances that may contribute to the pot's deterioration.

When you complete the restoration, remove the remaining tape and rubber bands, stand back, and appreciate the results of your labor.

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Washington D.C.

Utah Museum of Natural History
1989 *Guidelines Governing Disposition of Archaeological Collections at the Utah Museum of Natural History.* Booklet, UMNH, Salt Lake City.

NOTE

[1] Light Impressions is a museum supply company, 439 Monroe Ave., Rochester, NY 14607-3717 (800) 828-6216.

A FINAL TABULATION OF SITES RECORDED IN THE GREATER GLEN CANYON AREA BY THE UNIVERSITY OF UTAH DURING THE GLEN CANYON PROJECT

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P-III Associates, Inc., 2759 S. 300 W. Salt Lake City, UT 84115-2932

The Glen Canyon Project was, and still is, the largest cultural resource management project ever completed in Utah. Jennings's (1966) summary of the Glen Canyon Project indicates that more than 2000 sites in southern Utah and northern Arizona were recorded by the University of Utah as part of the project between 1956 and 1963. A literature review, archival research, and a file search completed as part of a database compilation project demonstrate that fewer than 1700 archaeological and historical sites were actually recorded by the University of Utah between 1956 and 1963. More recent inventory data suggest that there were biases in the field recording procedures during the Glen Canyon Project.

In the 1950s and 1960s, the University of Utah (UU), the Museum of Northern Arizona (MNA), the University of New Mexico (UNM), and the University of Colorado (UC), in cooperation with the National Park Service (NPS), performed archaeological and historical investigations in the Upper Colorado River Basin region in response to the threat of cultural resource losses posed by the construction of several dams in the region. This project was collectively and officially called the Upper Colorado River Basin Archeological Salvage Program (UCRBASP). The UC worked at Curecanti Reservoir, the UNM at Navajo Reservoir, MNA in Glen Canyon, and the UU in western and southern Utah, eastern Colorado, southwestern Wyoming, and northeastern Arizona. Most of the UU investigations were conducted in southern Utah in response to the plans for the construction of Glen Canyon Dam. The portion of the UCRBASP project conducted by the UU and MNA in southern Utah and northern Arizona became known colloquially as the Glen Canyon Project (GCP).

In his final summary of the Glen Canyon Project, Jennings (1966:43) reports "the precise location of over 2000 [archaeological] sites is now known." However, a complete tabulation of sites recorded by the UU and MNA was never prepared during the GCP. In 1998, P-III Associates, Inc., compiled management data on all the archaeological and historical sites investigated by the UU on the GCP. MNA is currently compiling a similar database for sites originally investigated by its teams on the GCP.

METHODS

The identification of cultural properties recorded during the GCP by the UU was initiated with a review of the University of Utah Anthropological Papers (UUAP), the principal publication medium used by the university to disseminate data on the GCP. The review of the university's anthropological series revealed 31 salient publications (Table 1). Next, P-III Associates compiled a Microsoft Access database of the sites identified in the UUAP. The database includes 27 fields: Smithsonian site number and other site designations, site locational data and legal descriptions, the general types of cul-

Table 1. List of References in the UUAP that Contain Information on Sites Identified and Documented by the University of Utah in the Greater Glen Canyon Area During the UCRBASP.

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1963b Appendix II: Kaiparowits Survey, 1961. In *1961 Excavations, Kaiparowits Plateau, Utah*, pp. 70-100. Anthropological Papers No. 66, Glen Canyon Series No. 20. University of Utah Press, Salt Lake City.

1965 *Excavations in Southwest Utah*. Anthropological Papers No. 76, Glen Canyon Series No. 27. University of Utah Press, Salt Lake City.

Crampton, C. G.

1959 *Outline History of the Glen Canyon Region, 1776-1922*. Anthropological Papers No. 42, Glen Canyon Series No. 9. University of Utah Press, Salt Lake City.

1960 *Historical Sites in Glen Canyon, Mouth of San Juan River to Lees Ferry*. Anthropological Papers No. 46, Glen Canyon Series No. 12. University of Utah Press, Salt Lake City.

1962 *Historical Sites in Glen Canyon, Mouth of Hansen Creek to Mouth of San Juan River*. Anthropological Papers No. 61, Glen Canyon Series No. 17. University of Utah Press, Salt Lake City.

1964a *Historical Sites in Cataract and Narrow Canyons and in Glen Canyon to California Bar*. Anthropological Papers No. 72, Glen Canyon Series No. 24. University of Utah Press, Salt Lake City.

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Day, K. C.

1963 Appendix II: Moqui Canyon and Castle Wash Survey. In *1961 Excavations, Glen Canyon Area*, pp. 237-305. Anthropological Papers No. 63, Glen Canyon Series No. 18. University of Utah Press, Salt Lake City.

1964 Appendix II: Survey and Tested Sites. In *1962 Excavations, Glen Canyon Area*, pp. 139-156. Anthropological Papers No. 73, Glen Canyon Series No. 25. University of Utah Press, Salt Lake City.

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1961 Appendix II: Lake Canyon Survey. In *1960 Excavations, Glen Canyon Area*. Anthropological Papers No. 52, Glen Canyon Series No. 14. University of Utah Press, Salt Lake City.

1963 *1961 Excavations, Harris Wash, Utah*. Anthropological Papers No. 64, Glen Canyon Series No. 19. University of Utah Press, Salt Lake City.

Fowler, D. D., and C. M. Aikens

1963 *1961 Excavations, Kaiparowits Plateau, Utah*. Anthropological Papers No. 66, Glen Canyon Series No. 20. University of Utah Press, Salt Lake City.

Gunnerson, J. H.

1959a Archeological Survey of the Kaiparowits Plateau. In *The Glen Canyon Archeological Survey, Part II*, pp. 319-469. Anthropological Papers No. 39, Glen Canyon Series No. 6. University of Utah Press, Salt Lake City.

1959b *1957 Excavations, Glen Canyon Area*. Anthropological Papers No. 43, Glen Canyon Series No. 10. University of Utah Press, Salt Lake City.

Lipe, W. D.

1960 *1958 Excavations, Glen Canyon Area*. Anthropological Papers No. 44, Glen Canyon Series No. 11. University of Utah Press, Salt Lake City.

Table 1. (Continued) List of References in the UUAP that Contain Information on Sites Identified and Documented by the University of Utah in the Greater Glen Canyon Area During the UCRBASP.

Lipe, W. D., F. W. Sharrock, D. S. Dibble, and K. M. Anderson
1960 *1959 Excavations, Glen Canyon Area.* Anthropological Papers No. 49, Glen Canyon Series No. 13. University of Utah Press, Salt Lake City.

Lister, R. H.
1958 *The Glen Canyon Survey in 1957.* Anthropological Papers No. 30, Glen Canyon Series No. 1. University of Utah Press, Salt Lake City.
1959a The Glen Canyon Right Bank Survey. In *The Glen Canyon Archeological Survey, Part I*, pp. 27-162. Anthropological Papers No. 39, Glen Canyon Series No. 6. University of Utah Press, Salt Lake City.
1959b The Waterpocket Fold: A Distributional Problem. In *The Glen Canyon Archeological Survey, Part I*, pp. 285-317. Anthropological Papers No. 39, Glen Canyon Series No. 6. University of Utah Press, Salt Lake City.
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tural remains noted at each property, the collection status of each property (i.e., whether the site was surface collected, tested, or excavated), the land owner, the Memorandum of Agreement (MOA) number(s) under which the site was investigated, the respective report citation, and comments. In addition to developing the database of the sites, accurate site plots, when available, were marked on a set of U.S.G.S. 7.5' maps covering the GCP area.

Whenever possible, information presented in the UUAP was used to complete the database fields. In many instances, however, the UUAP did not provide site-specific locational information. In an attempt to obtain the requisite data, both the original UU field maps and base maps and site forms at Utah State Historic Preservation Office (SHPO) were examined. To insure that all sites recorded by the UU on the GCP were included in the database, a complete search of SHPO site records for all counties in southern Utah was conducted. All available site records that were recorded prior to 1963 were inspected. This effort located another 72 sites that were investigated during the GCP, but not documented in any of the UUAP publications.

RESULTS

A total of 1563 sites were listed in the 31 UUAP publications for the Glen Canyon area. As noted above, an additional 72 sites not included in any UUAP publications, were subsequently discovered in the SHPO files and added to the database. Many of these 72 sites are historic Paiute sites that were recorded by Catherine Sweeney (Fowler) (cf. Sweeney and Euler 1963). The remaining sites are small prehistoric sites located near Boulder City, Utah.

Thus, the total number of cultural properties recorded by the UU as part of the GCP is 1635 (Figure 1). Of these, 286 are in Garfield County, Utah; 3 are in Grand County, Utah; 648 are located in Kane County, Utah; 622 are in San Juan County, Utah; 29 are in Washington County, Utah; 16 are located in Wayne County, Utah; and the remaining 31 properties are in Coconino County, Arizona. A total of 1354[1] of the properties are prehistoric and the remaining 281 are historic sites or landforms and topographic features. Prehistoric artifacts were collected from 1173 of the properties.

The 1635 sites include all 281 historic sites reported in the UUAP. Only a few of these historic sites have been assigned Smithsonian site numbers and recorded on site forms in the SHPO files. The UUAP publications provide the information necessary to create site forms for the remainder of these sites. Many of these historic sites are actually landforms or topographic features rather than cultural manifestations. For example, the historical researchers recorded buttes, mouths of canyons, sand bars, river rapids, and other natural features as historic sites because they were places where historic events occurred, or were place names referenced in historical documents. We have included these landforms and topographic features in the database to assist the SHPO in updating its records.

Every effort was made to record accurate locational information for each site. Specific location data could not be obtained for 134 of the sites because the sources used to compile the database either contained information that was so generic that the sites could not be plotted with any degree of confidence, or they lacked locational information altogether. Furthermore, although specific location data were compiled for the remaining 1501 sites, much of it is also rather dubious.

Only 51 sites have locational information considered to be precise, as these sites have been field checked within the last few years. Location data for another 558 of the sites were compiled from site plots on the original University of Utah field maps. These data are assumed to be relatively accurate because these are original plots not subject to transposition errors. Location data for 543 of the sites were compiled from the SHPO base maps which contain secondary plots. The location data for many of these sites are suspect because of possible transposition errors. Finally, location data for the remaining 349 properties is based only on general locational information provided in the UUAP. The accuracy of these plots is questionable and efforts should be made to field check these site locations in the future.

SUMMARY AND DISCUSSION

More than 30 years after the end of the GCP, a final tabulation of sites recorded and investigated by the UU is now available. A total of 1635 archaeological and historical sites, including some landforms and topographic features, were investigated during the GCP by the UU. A computer database of information about these sites was prepared and submitted to the Bureau of Reclamation, the NPS, and the Utah SHPO.

A comparison of the database of sites recorded by the UU on the GCP with subsequent inventories in the Glen Canyon region enables us to make some observations about the quality and utility of the site inventory data from the GCP. In 1976, Schroedl (1976) reassessed more than 150 sites recorded by the UU in Lake and Moqui canyons during the GCP. This area of Glen Canyon was heavily occupied prehistorically and about 10 percent of all the sites recorded by the UU during the GCP were situated in Lake and Moqui canyons. Schroedl discovered a number of site recording problems by the UU inventory teams in these two canyons.

First, three recorded "sites" were not sites because they did not exhibit any cultural remains. Also, five of the sites recorded in Moqui Canyon by the GCP teams were recorded twice and assigned a second set of site numbers. But most importantly, Schroedl (1976, 1981a, 1981b) demonstrated that certain site types and categories were systematically missed and not recorded by the UU.

Several of the sites that were missed in these two canyons were small, open Anasazi structural sites located on small prominences within the canyon. These sites were missed by the GCP inventory teams because the crews were focused on searching for Anasazi sites in alcoves and overhangs along the canyon walls. A similar site recording bias by the UU teams occurred in Canyonlands National Park (Tipps et al. 1996:196-197) in the early 1960s where the GCP inventory procedures were also used (cf. Sharrock 1966). In Upper Salt Creek and Big Pocket of Canyonlands National Park, the UU inventory teams focused their efforts along the canyon walls and within alcoves and overhangs. Small- and medium-sized open Anasazi sites not located along the canyon walls but situated within the wide canyon bottom environments were consistently overlooked and not recorded.

Not only were certain Anasazi site types often missed by the UU during the GCP, but the Archaic occupation of the benchlands and uplands surrounding Glen Canyon also went unrecognized. As Tipps (1987:3) and later Geib (1996:195) note, the GCP focused on the Anasazi occupations in the canyon environment ignoring the uplands because they were considered dry and unsuitable for human habitation. Jennings (1966:66) states "The Glen Canyon Area cannot certainly be shown to have been much utilized by man prior to the Christian era." According to Tipps (1987:3), most researchers believed that the area was uninhabited prior to Basketmaker II except for a small enclave of Archaic people in the highland plateaus surrounding Navajo Mountain.

Schroedl (1981b) and Tipps (1983) were among the first to point out that the GCP failed to identify Archaic occupation in the area. In the late 1980s during investigations by Northern Arizona University, Geib (1996) recorded numerous open lithic scatters of Archaic age in outlying areas in Glen Canyon. Geib's research culminated in the publication of an extensive discussion of Archaic occupation in the area (Geib 1996) with the recognition that Archaic sites are one of the most abundant site types in the region.

In summary, the database of sites recorded by the UU during the GCP is biased and incomplete. It is not suitable for rigorous hypothesis testing about the prehistory of the region and is largely of historical interest only. The true achievement of the UU on the GCP is not the number of sites recorded, but the massive quantity of high quality data recovered from more than 100 tested and excavated sites, mostly Anasazi sites, reported on in the UUAP. This is the lasting legacy of the GCP.

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Tipps, B. L., A. D. La Fond, and R. I. Birnie
1996 *Cultural Resource Investigations Near White Crack, Island-in-the-Sky District, Canyonlands National Park, Utah.* Cultural Resources Report 411-02-9617. Cultural Resource Selections No. 11. National Park Service, Intermountain Region, Denver.

NOTE

[1] A total of 120 prehistoric sites in the UU GCP database have associated MNA site numbers. Gene Foster of MNA may have initially recorded a few of these sites in the early 1950s prior to the start of the GCP (Adams et al. 1961). The final tabulation of GCP sites recorded by MNA should clarify which sites were actually recorded by MNA. The Glen Canyon series reports published by MNA indicate that more than 600 sites were recorded during the GCP by MNA.

SITE 42DC823: EVIDENCE FOR HIGH ELEVATION FORAGING IN THE UINTA MOUNTAINS

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High elevation archaeological research in the Southern Rocky Mountains focuses on the evidence of game drives and hunting blinds (J. Benedict 1975; Cassels 1995; Hutchinson 1990). The occurrence of ground stone tools in the mountains, although noted (Black

1982:104-105; Buckles 1978: 247; Metcalf and Black 1985:22) has not generated much research. Ground stone use is documented for prehistoric plant processing in lowland areas, but some archaeologists argue that ground stone was not used for plant processing in upland areas (J. Benedict 1991).

In order to test if plants were being processed on high elevation ground stone, plant remains (pollens/phytolith/macrofloral) need to be found in association with the ground stone. Ashley National Forest archaeologists have recorded eleven sites with ground stone above 3,080 m (10,000 ft) during limited surveys. This report describes the evidence for high altitude plant utilization from test excavations done in 1999 at site 42DC823, located in the Uinta Mountains in northeastern Utah (Figure 1). Located at an elevation of 3,182 m (10,440 ft) in the Chepeta Lake drainage (Figure 2), the site is a large lithic scatter with ground stone and firepit/hearth features.

Originally, I hypothesized that plant remains from high elevation plants such as *Lewisia pygmae* and *Polygonum bistotoides* would be identified. Neither plant was identified, however, pollen analysis of a buried piece of ground stone and several features reveal interesting possibilities about the prehistoric use of the Uinta Mountains.

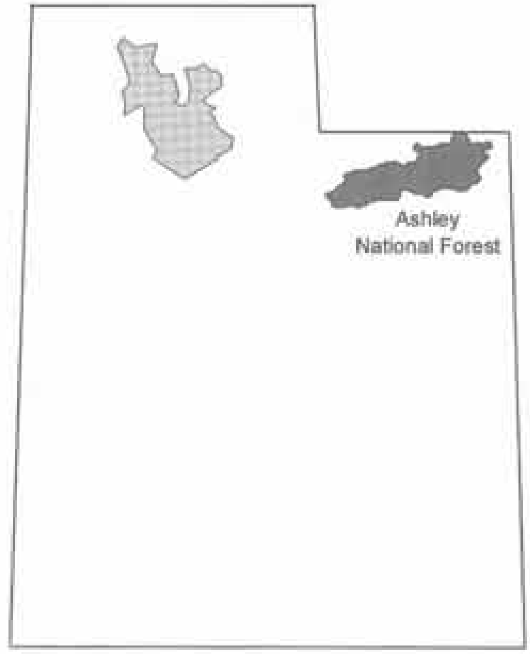

Figure 1. The project area is in the west-central section of Ashley National Forest, northeastern Utah.

TAXONOMIC POSSIBILITIES

The High Uintas at first glance do not appear to have a large number of edible plant species. The pinyon pine nuts found in the Uintas (*Pinus edulis*) are smaller than those harvested from species found in the Great Basin (Goodrich and Neese 1986). Limber pine and white bark pine are practically non-existent in the Uintas. J. Benedict (1991:3) notes for the Colorado Front range, "the usable portions [at high elevations] of most plants are small, and the patchiness of their distribution would have discouraged large-scale harvesting."

Smith (1974:269) cross-references the scientific names of plants used by the Northern Ute with their Ute names and occasionally the common names in English. Smith lists several berries that grow today in the subalpine zone between 2,750 m (9,000 ft) and timberline: blueberries (*Vaccinium ovalifolium*), buffalo berries (*Shepherdia canadensis*) which grow in the Uintas between 2,500–3,230 m (8,200–10,600 ft.) and ripen in July and August (Goodrich and Neese 1986:136), currants (*Ribes aureum*), wintergreen berries (*Orthilia secunda*), and juniper berries (*Juniperus communis*) which grow between 2,133–3,352 m (7,000– 11,000 ft) (A. Benedict 1991; Goodrich and Neese 1986:120; Smith 1974:269-270). Smith (1974:271) also reports the use of garlic and wild onion. Clifford Duncan, a Ute elder, describes the traditional harvesting of spring beauty (*Claytonia lanceolata*) or what he calls Indian Potato (personal communication 1999). He remembers going up into the mountains with his mother as a little boy to collect the plant. He notes the roots are the edible part of the plant.

Other potentially edible plants not mentioned by Smith or Duncan include bitterroot (*Lewisia pygmae*) and American bistort (*Polygonum bistotoides*). The bitterroot plant (*Lewisia redivia*) is well-known for its traditional use (Harrington 1967). The species of bitter-

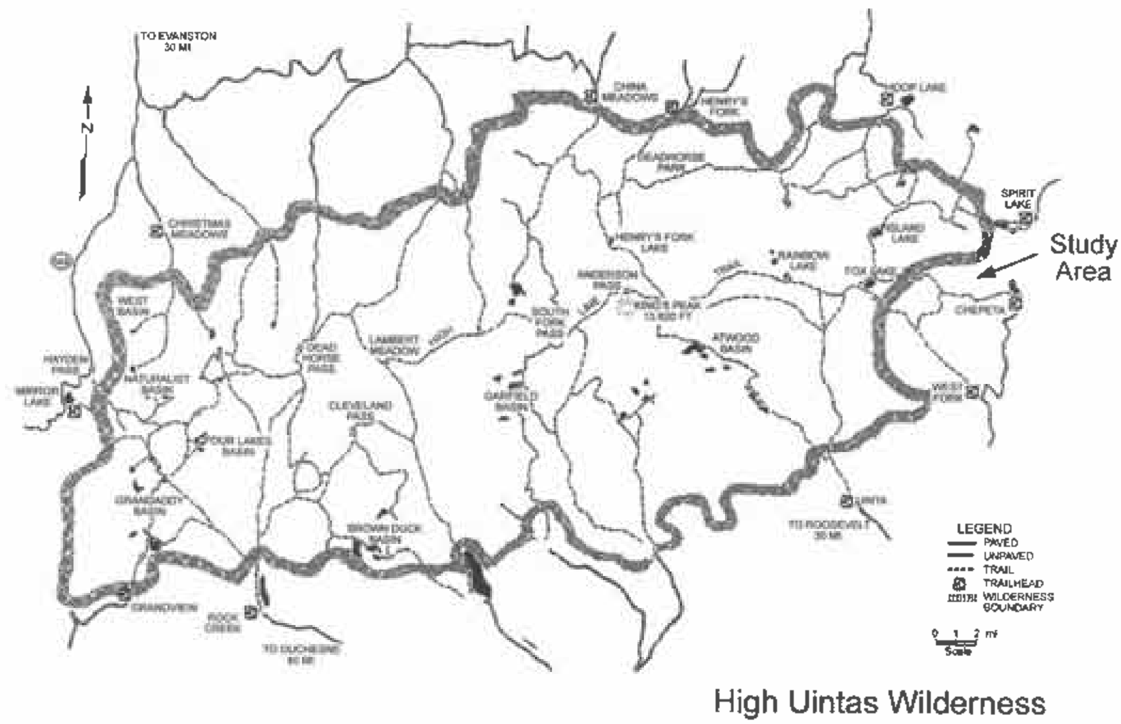

Figure 2. High Uintas wilderness map. The project area is located just east of the High Uintas boundary near the Chepeta trailhead.

root found at high elevations in the Uintas is *Lewisia pygmae* and may or may not have the edible properties of *Lewisia redivia*. Bistort (*Polygonum bistotoides*) is well-known for its use in other countries as well as in North America (Harrington 1967). In the Uintas, bistort is fairly common between elevations of 2,133–3,352 m, (7,000–11,000 ft), has a thumb-sized root (Goodrich and Neese 1986), and when roasted tastes somewhat like a chestnut.

This line of research presents possibilities, but vegetation has changed significantly since prehistoric times, and the first step in determining if specific plants were used in the past is to identify remains in the archaeological record. To complicate the issue, the presence of edible plants in the archaeological record does not necessarily mean people were eating or using those plants. The plant remains, whether they be pollen, starch, phytoliths, or seeds, need to be present on ground stone, or in a context such that cultural rather than natural occurance is indicated.

42DC823: ENVIRONMENTAL SETTING AND DESCRIPTION

The Uinta Mountains, located in northeastern Utah, exhibit glaciated topography with cirques, hummocky moraines, u-shaped valleys, and large boulder fields (Malmstrom 1997). Glacial deposits include "both lateral and recessional moraines and glaciofluvial materials" (Hansen 1977:5). Most of the area above 2,745 m (9,000 ft) can be classified as alpine tundra, spruce-fir, or lodgepole pine ecozones (A. Benedict 1991). Treeline differs on the north and south slopes of the Uintas, with the southern slope's treeline occurring slightly higher (Madsen et al. 2000:17).

An archaeological survey crew with the "Passports in Time" public archaeology program of the U.S. Forest Service identified site 42DC823 in 1994. They recorded 500 flakes and a metate. The site is situated on a bench alongside the Whiterocks River flowing through a high meadow surrounded by a spruce-fir forest (Figure 3).

Figure 3. Photo of 42DC823 facing southeast with the Whiterocks River in the background and an excavation unit in the foreground.

TEST EXCAVATIONS

Test excavations were conducted in 1999 under the direction of the author with assistance from Byron Loosle, Ashley National Forest. All notes, forms, maps, artifacts, soil samples, and photographs are on file and in storage at the Ashley National Forest office in Vernal, Utah. The excavation yielded seven charcoal features, a projectile point, three bifaces, and three additional metates. Radiocarbon, soil, and obsidian samples were also obtained.

Auger testing in north and south transects about 20 m apart revealed charcoal flecks and charcoal concentrations. We began 1 by 1 m excavations where auger holes produced the most charcoal, but only excavated half of the unit unless we found cultural remains. Units were numbered as opened and excavated in 10 cm arbitrary levels. Most of the testing was concentrated in three areas: Area A is the southern most part of the site, Area B is in the middle portion of the site on a little bench adjacent to the forest edge with a view of the southern portion of the meadow, and Area C is in the eastern part of the site.

Once features were identified, a plan map was drawn and the feature divided in half. Half the feature was excavated and the profile of the remaining wall was drawn. The remainder of the feature was then excavated. We bagged whole features for analysis of pollen and macrobotanical remains, to recover samples for radiocarbon dating.

RESULTS

Of the nineteen units excavated, three were in sterile sediment consisting of pinkish red sands. We found seven charcoal stains within this sterile sediment, five of which were discrete and excavated as features. Feature descriptions and pollen study results are shown in Table 1. Dates from the features range from 700 B.P. to 3740 B.P. (Table 2).

Pollen analysis of one buried metate fragment (Figure 4) revealed "elevated Brassicaceae and Poaceae

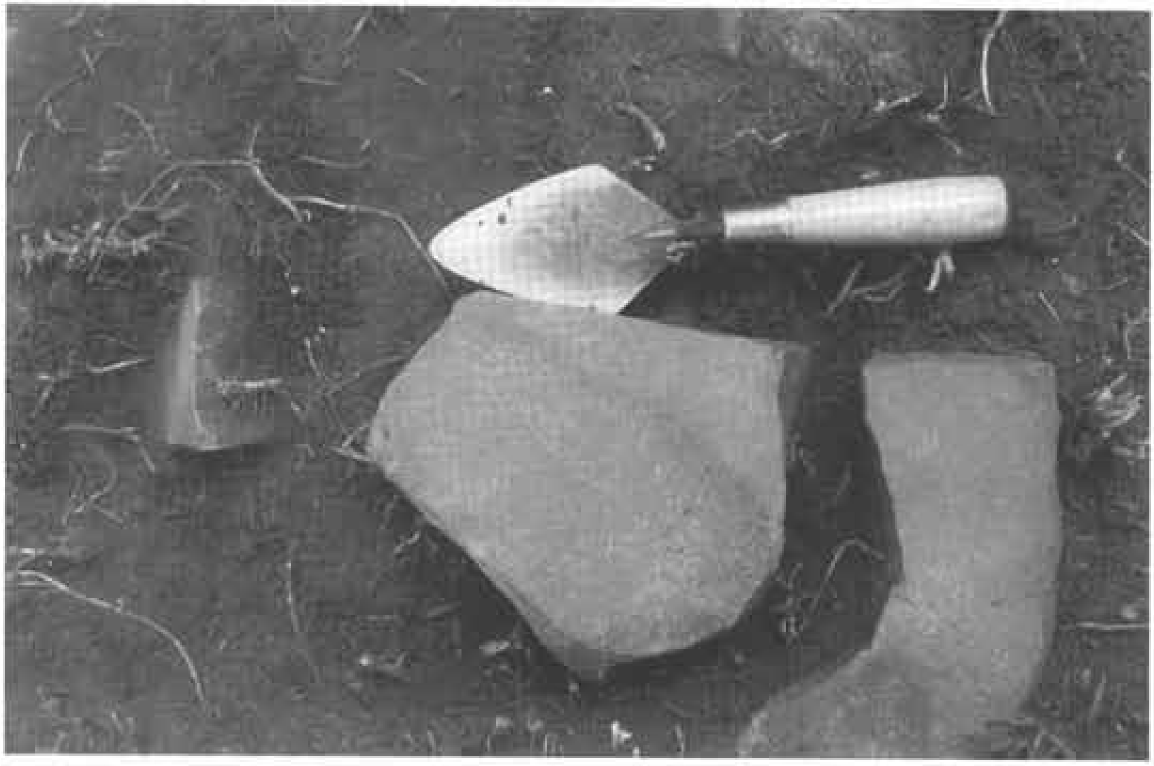

Figure 4. Metate found at 42DC823 in buried context and submitted for residue analysis (courtesy of Clay Johnson).

pollen frequencies [which] are consistent with grinding seeds from the mustard and grass families with this metate. Recovery of Rosaceae pollen. . . might reflect grinding fruits or seeds from members of the rose family" (Puseman and Cummings 2000:7). One starch granule that was identified on the metate is consistent with members of the grass family and some *Frageria*-type (strawberry) pollen (Puseman and Cummings 2000:7). A member of the Poaceae family is Indian rice grass (*Oryzopsis hymenoides*), which is found up to 3,080 m above sea level (Goodrich and Neese 1986). Shimkin (1947) notes that the Shoshone used a member of the Brassicacea: tansy mustard (*Descurainia californica, D. richardonii*).

Macrofloral remains from Feature 8 include a charred Poaceae seed and seed fragment, charred *Picea* and *Pinus* needle fragments, and a charred pine cone scale fragment (Puseman and Cummings 2000:8). These may represent limber pine (*Pinus flexis*) seed processing activities or a forest fire. Some unusual pollen remains included *Typhus* (cattail) and *Quercus* (oak), each of which grow at lower elevations. Oak acorns (*Quercus macrocarpa*) were used by the Cheyenne (Hart 1981:26) and cattail pollen (*Typha latifolia*) was a high ranking resource used by the Paiute (Simms 1987:133; Wheat 1967:11).

DISCUSSION

The plant remains, charcoal filled features, and ground stone tentatively support the hypothesis that plant processing occurred at this site. These are preliminary results, as little of the site area has been tested.

What does evidence of plant processing at high elevations mean for understanding people living in the mountains? This particular site demonstrates that people were carrying the food up from lower elevations where

Table 1. Feature Descriptions and Associated Macrofloral/Pollen Results.

Feature Number	Feature Description	Pollen/Macrofloral Analysis Results (Puseman and Cummings 2000)
1	Cello-shaped stain measuring 140 cm x 80 cm in area B. Excavation revealed two discrete portions with the northern discrete portion labeled Feature 4.	Slightly elevated Poaceae pollen count; large pollen concentration reflecting recent deposition.
2	Round bottomed hearth in area A measuring 70 cm x 75 cm.	No sample analyzed.
3	Irregular shaped charcoal stain in association with metate 3. Measured 25 cm in diameter x 6 cm in depth.	No sample analyzed.
4	Thin charcoal lens measured 45 cm x 20 cm.	Similar to Feature 1 with additional *Quercus* (Oak) and *Typha* (cattail) pollen.
5	Irregular shaped stain measuring 30 cm x 32 cm.	No sample analyzed.
6	Possible posthole measuring 20 cm in diameter.	Abundance of *Pinus* charcoal.
7	Irregular shaped stain measuring 30 cm x 40 cm.	No sample analyzed.
8	Circular stain measuring 38 cm x 41 cm.	Charred Poaceae seed and seed fragment, charred *Picea* and *Pinus* fragments, and charred pine cone scale fragment.

berries, oak, and cattail grow, and that the original hypothesis for procurement of locally available bistort, springbeauty, and bitterroot is unsupported.

Examining plant remains on high altitude ground stone may help answer one reccurring question in intermountain archaeological studies: was there a culturally distinct people during the Archaic period occupying the mountain areas? Clifford Duncan, a Ute elder, refers to a people called the *kivenuche*, a mountain people who occupied the Uinta mountains (personal communication 1999). If these people were indeed culturally distinct, perhaps further studies can emulate Bonnie Pitblado's (1999) study on Paleoindian projectile points and the toolstones used. She looks at all the Paleoindian points in the Rocky Mountains and tries to determine if there was a stylistic type and toolstone specific to the Rocky Mountains. Hauer (2000) performs statistical analysis of ground stone in association with elevation, bifaces, ceramics, and other archaeological debris in southwestern Idaho. Pursuant to studies like these, perhaps certain projectile point styles and raw material types may be associated with sites with ground stone, and those without. This holds open the possibility of reconstructing foraging ranges.

CONCLUSION

The testing of 42DC823 provides evidence that plant processing occurred at this high altitude site in the eastern Uinta Mountains. The tested features dated from 3740 B.P.–700 B.P. Residue found on one ground stone fragment contained pollen from plants typical of

Table 2. Radiocarbon Dates from 42DC823.

Feature Number	Laboratory Number	Analysis	Measured Radiocarbon Age	Conventional Radiocarbon Age
1	Beta 133755	Standard-AMS	700 ± 40 B.P.	710 ± 40 B.P.
2	Beta 133756	Radiometric Standard	3740 ± 60 B.P.	3740 ± 60 B.P.
4	Beta 133757	Radiometric Standard	840 ± 70 B.P.	840 ± 70 B.P.
6	Beta 133758	Standard-AMS	3140 ± 50 B.P.	3170 ± 50 B.P.
8	Beta 133759	Radiometric Standard	1770 ± 60 B.P.	1770 ± 60 B.P.

Note: Conventional ^{14}C age is the result after applying $^{13}C/^{12}C$ corrections to the measured age, and is the most appropriate radiocarbon age.

lower elevations, suggesting that people brought plant foods to the higher elevations. Other high altitude sites should be tested to determine if a pattern of ground stone and plant use occurs in other areas.

Acknowledgments. I would like to thank my financial sponsors, University of Wyoming Arts and Sciences Independent Research grant, American Alpine Club Research grant, and Ashley National Forest. Paleo Research Laboratory performed the soil/metate analysis. Clifford Duncan provided a great deal of insight into plant and ground stone use in the Uinta Mountains. Dr. Byron Loosle provided every opportunity that the U.S. Forest Service would allow so that this research could be performed. This project could not have been successful without the help of Dr. Mary Lou Larson, Dr. Robert Kelly, and my crew: Daniel Pugh, Clay Johnson, Val Stock, Sheila Keogh, Gabe Keogh, Judy Breen, Nate Horton, Karen Clouse, and Julie Meyer. Dr. Byron Loosle, Dr. Mark Miller, H. Blaine Phillips III, Kevin Morris, and Clay Johnson reviewed early drafts of this paper.

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EARLY ARCHAIC SQUARE-STEM DART POINTS FROM SOUTHEASTERN UTAH

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The third and final season of excavations at Old Man Cave in southeastern Utah (Geib and Davidson 1994) resulted in the unanticipated recovery of square-stem dart points in association with open-twined sandals from early Archaic deposits. These points are reminiscent of Gypsum or Gatecliff Contracting Stem points, which are securely dated to the late Archaic for both the Colorado Plateau and Great Basin, sometime after about 3000 cal. B.C. (see Holmer 1978, 1986; Tipps [1995:52] proposes a beginning date of about 3500 cal. B.C.). The points from Old Man Cave lack the tapered stem of Gypsum points and are thus morphologically distinctive. Nevertheless, had they been found in other circumstances, I likely would have assumed that they were late Archaic in age, characterizing them as some sort of Gypsum variant. Indeed, the Old Man Cave specimens are virtually indistinguishable from some of the Gatecliff Contracting Stem points from Hidden Cave (see comparisons below). Most significantly, the stemmed specimens from Old Man Cave retain evidence of hafting pitch identical to pitch remnants seen on the stems of Gypsum/Gatecliff points from cave sites (e.g., Holmer 1980a:Fig. 17i, m, n). The traces of mastic indicate that the Old Man Cave specimens, like Gypsum/Gatecliff points, were "glued" to dart foreshafts instead of being tied on with sinew.

The square-stem points from Old Man Cave are associated with open-twined sandals, which are early Archaic diagnostics (see discussion of sandal dating in Geib 2000). To be certain of their temporal placement, two samples were radiocarbon dated: grass stems from around one of the points, and pitch on the base of another point. Radiocarbon dates on the grass stems of 7300 ± 100 B.P. and 7340 ± 60B.P. on the pitch confirm their stratigraphic assignment to the early Archaic. These points demonstrate that the practice of gluing dart points to foreshafts instead of tying them on with sinew began thousands of years earlier than previously thought for a portion of the Colorado Plateau. Given that several millennia separate the points reported here from Gypsum/Gatecliff points, the technological shift to adhesive hafting seen in the late Archaic may still lack local precedent. This report describes and illustrates the points, presents the results of radiocarbon dating, and discusses some implications of the findings.

THE SITE

Old Man Cave is a small shelter (15 by 10 m) formed in Cedar Mesa Sandstone within a tributary of Comb Wash that drains the northeastern edge of Cedar Mesa (Figure 1). Looters had extensively disturbed much of the shelter, but excavation revealed that portions of an early Archaic component remained intact. During three short seasons of work at the site we managed to sample both the strata and features of this early occupation and unravel the history and processes of deposit formation. A preliminary report on the first two seasons of work at the site is available (Geib and Davidson 1994), as well as a master's thesis on the analysis of plant remains from early Archaic feces (Hansen 1994). A final site report is in preparation and anticipated to be finished by the end of 2001.

The ashy and organic-rich early Archaic deposits at the site, designated as depositional unit III, varied in thickness from a minimum of about 10 cm to a maximum of 80 cm. The area of thickest accumulation was the north-central portion of the cave, where up to nine layers of varying content and thickness were identified; unfortunately ground moisture had rotted much of the uncarbonized organic remains in this area. Early Archaic deposits across much of the rest of the site were thinner, with three layers generally identifiable. Preservation was excellent, however, especially where the deposits had accumulated upon massive roof spalls in the central portion of the shelter. The dry layers yielded abundant grass chaff and other nonartifactual organics, as well as occasional human feces, open-twined sandals, and cordage.

Chronological control for the early Archaic occupation of Old Man Cave is provided by nine radiocarbon dates that range in age from ca. 6600 to 4800 cal. B.C. The most intensive period of use was during the earliest part of this range, up to about 5800 cal. B.C., during which the bulk of the unit III deposits accumulated.

PROVENIENCE

Excavations at Old Man Cave recovered three square-stem dart points (Figures 2 and 3). One of these was in looter backdirt (Point 0.1.1), but the other two came from intact early Archaic layers. Point 575.7.1 was found in situ within a tightly packed, 10–15 cm thick layer of grass stems and chaff (mainly *Sporobolus* sp.) and other organics. Found along with the point were netting fragments of Dogbane (*Apocynum* sp.) and cordage, portions of open-twined sandals, and a one-hand mano. With no sign of rodent or other intrusion, the point was clearly associated with the matted grass stems

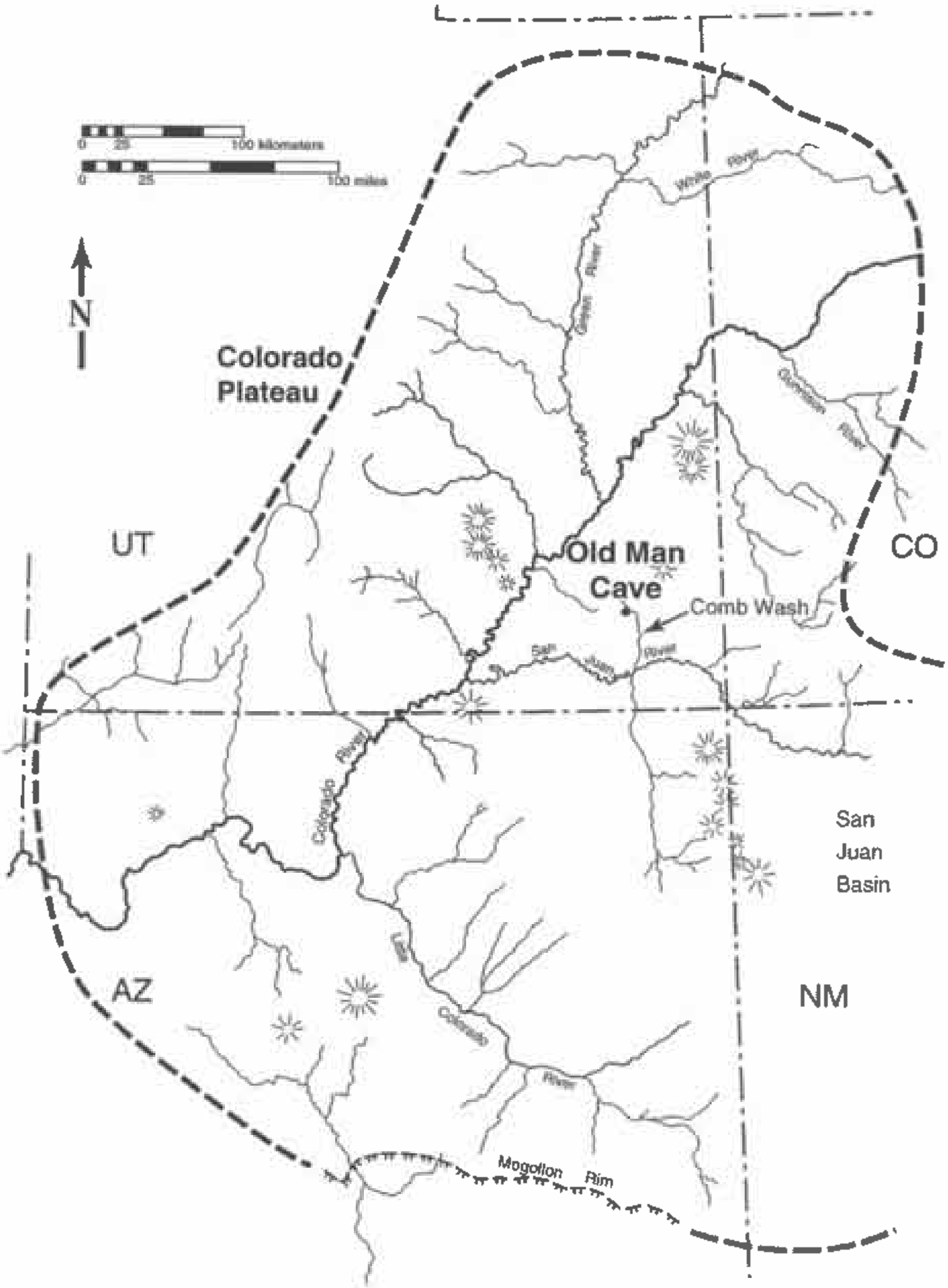

Figure 1. Location of Old Man Cave.

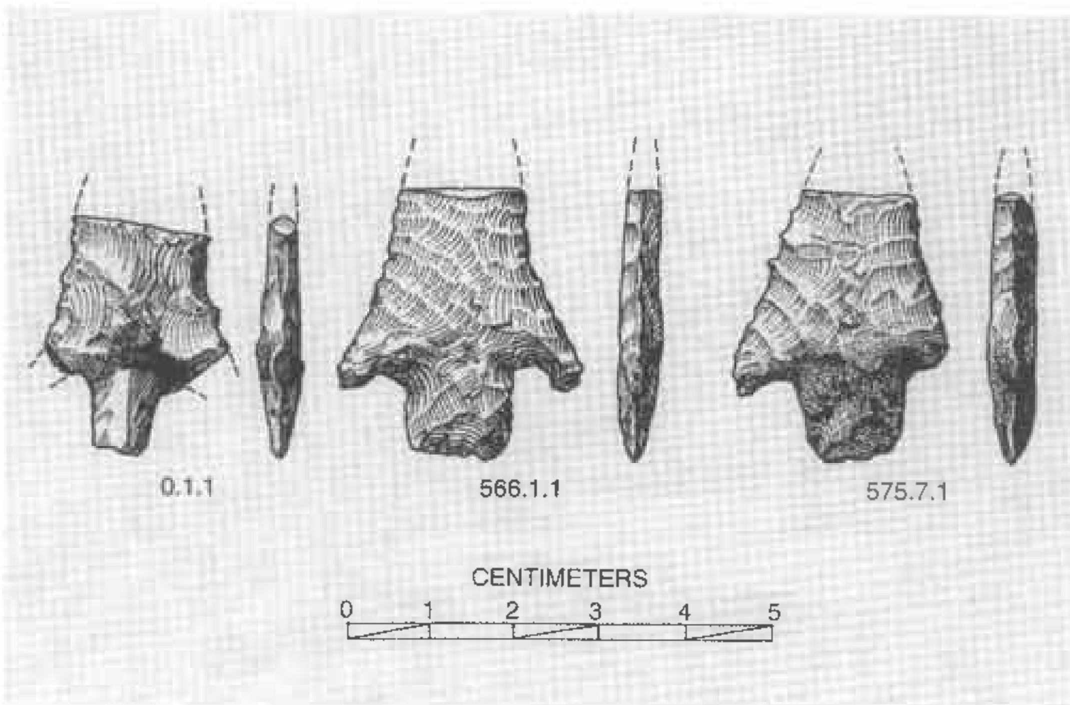

Figure 2. Illustration of the square stem points from Old Man Cave.

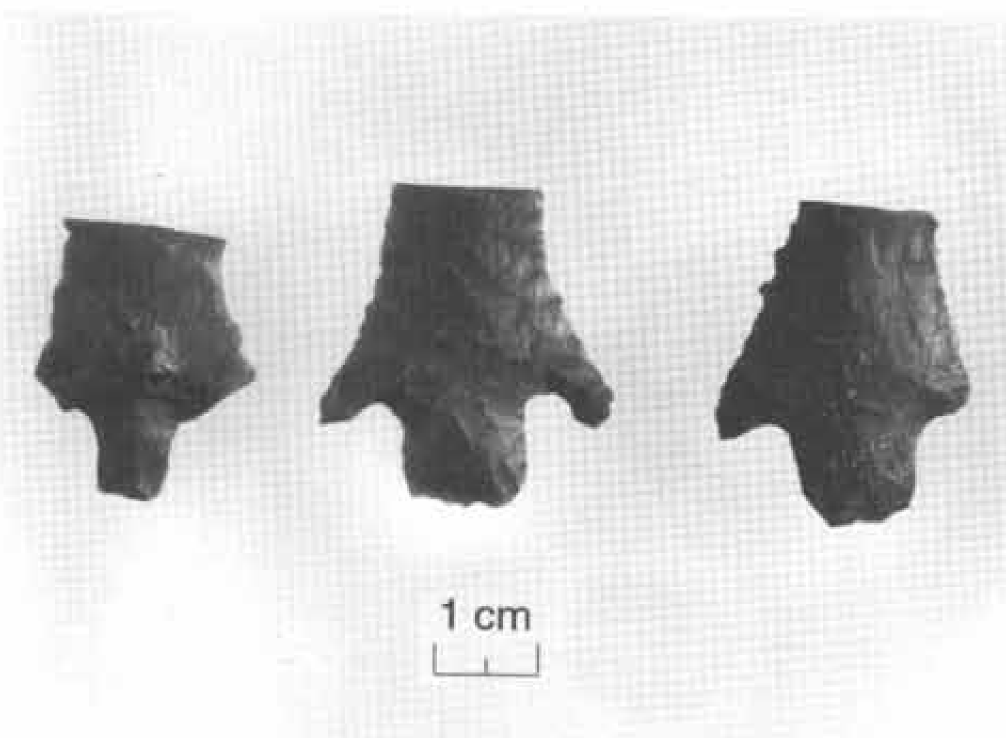

Figure 3. Photograph of the same points illustrated in Figure 2.

Table 1. Dimensions (in millimeters) of the Square Stem Points from Old Man Cave.

Dimensions	Point 0.1.1	Point 566.1.1	Point 575.7.1
Length	27 (45–50)	31 (45–55)	32 (45–50)
Width	21 (25–27)	28	25 (27–28)
Thickness	5	5	5
Stem Length	8	11	10
Stem Width	7	12	12

Note: Numbers in parentheses represent estimates of original size prior to breakage.

and other organics. Point 566.1.1 was recovered from the screen while sifting an ashy deposit from underneath the organic layer; it came from a test unit 1 m away from where point 575.7.1 was retrieved.

THE POINTS

Condition and Dimensions

All three points are fragmentary, with their tips broken by bending fractures, likely the result of impact. Two of these also exhibit breaks of one (point 575.7.1) or both (point 0.1.1) barbs, and one corner has been snapped from the stem of the 575.7.1 specimen. An interesting feature is the occurrence of a red pigment stain over the bending break of the 0.1.1 point. This specimen also has what superficially appears to be a slight burination of the blade margin; the origin of detachment however is not the flat surface created by the bending break but the opposite margin of the point. This fracture resulted from an overshot during pressure flaking.

Table 1 presents the measurements for the points. Because none of the points are whole, the length measurements are estimates. Because their barbs are broken, estimates are also given for the original widths of points 0.1.1 and 575.7.1.

Material

All of the points are made of chert. Points 566.1.1 and 0.1.1 are of gray chert identical to that available from the Honaker Trail Formation, the closest exposures of which occur along the San Juan River just down from the mouth of Comb Wash. Point 575.7.1 is of a dark brownish red chert that is commonly available from limestone beds within the local Cedar Mesa sandstone. These cherts indicate a localized selection of raw materials, a pattern that was equally apparent in the debitage from the Archaic deposits of the cave.

Production Technology

The blades are incurvate in plan and section, a shape that does not seem to be the result of resharpening. Both long and transverse sections of the points are slightly convex and moderately symmetrical, with the edges centered on the midlines for the most part.

The three points exhibit a range of production characteristics. The best-made is 566.1.1, which was finished by a series of narrow (ca. three mm wide), semi-parallel, diagonal pressure flakes removed in a systematic fashion to produce a very sharp edge. The flaking pattern for both faces is generally down to the right, with most flakes from the left side extending past the midline; those from the right are shorter and more-or-less collateral, but still parallel. The flakes on the blade have partially obliterated the notching (stem-forming) flakes, which are expansive and lunate shaped.

Point 575.7.1 is similar to the previous example in that one face was partially finished by a series of nar-

Table. 2 Radiocarbon Determinations for the Square Stem Points from Old Man Cave.

Sample Number	Material	PN	^{14}C Age	$^{13}C/^{12}C$ Ratio	Calibrated 1 Sigma Range	Calibrated 2 Sigma Range
Beta-77870	pitch	566.3	7340 ± 60	-24.1%	6170–6050 B.C.	6345–6010 B.C.
Beta-77871	grass	575.4.1	7300 ± 100	-12.1%	6190–6000 B.C.	6365–5955 B.C.

Note: Calibration based on Stuiver and Reimer's (1993) program CALIB, Version 3.0.3A, 20-year data set, Method A.

row, semi-parallel, diagonal pressure flakes. In this case they are also mainly down to the right from the left side whereas those from the right are collateral and parallel; from both sides they meet at the midline. On the reverse side, which was the original ventral surface of the flake blank, the flaking pattern is not as finely done, but this seems to be the result of a depressed surface topography along one side that would not allow flakes to extend to the midline. The producer only removed short, non-invasive flakes from the left margin; had the artisan tried to remove longer flakes they would have terminated in a step or hinge.

The flaking pattern of point 0.1.1 is unpatterned, consisting of collateral expanding flakes. Some of the flakes are relatively wide, six to seven mm, and extend past the midline, resulting in a well-thinned point. The stem of this point on the side shown in Figure 2 appears somewhat odd because the flake scars are those of the original flake blank; they parallel the direction of detachment from the core. Most shaping of the stem occurs on the opposite side, which is the ventral surface of the flake blank.

As a final note about production technology, it is worth mentioning that none of the points exhibit abrasion of the stem as do most early Archaic stemmed points such as Pinto or Bajada. Basal grinding is certainly not necessary for glue-on points and indeed it is absent from Gypsum points.

Pitch

The stems of all three points retain pitch adhesions, some up to about 1 mm thick. Prior to dating, point 566.1.1 retained the most pitch, enabling the removal of 0.01 g of this material for radiocarbon dating. In an attempt to identify the likely source for the mastic, the remaining residue (ca. five mg) on this point was removed for pollen analysis. Slides were prepared by dissolving the scrapings in isopropyl alcohol, then mixing the residue with glycerol and mounting it on glass slides. The sample was nearly devoid of pollen; after scanning three slides, Susan Smith of the Paleoecology Laboratory at Northern Arizona University observed just four pollen grains. It is perhaps significant that three of the pollen grains were pinyon-type (the fourth was a grass pollen grain). If the mastic was pinyon pitch this would come as no surprise—pinyon grew in the vicinity of Old Man Cave by at least 6600 cal. B.C. as evidenced by the recovery of bark, twigs, cone parts and needles of this plant from the earliest cultural deposits at the site (Coulam and Sharp 1993).

RADIOCARBON DATING

The two samples submitted for radiocarbon analysis were 42.2 g of grass stems (*Sporobolus* sp.) and 0.01 g of pitch. The pitch (PN566.3) was removed from the base of point 566.1.1, whereas the sample of grass (PN575.4.1) was collected during excavation from around point 575.7.1. The samples were submitted to Beta Analytic, where both received standard pretreatment. The grass sample was analyzed by the beta-decay method but the pitch sample was forwarded to the Lawrence Livermore National Laboratory for AMS dating. The results, corrected for isotopic fractionation, are presented in Table 2.

Because the dates are statistically contemporane-

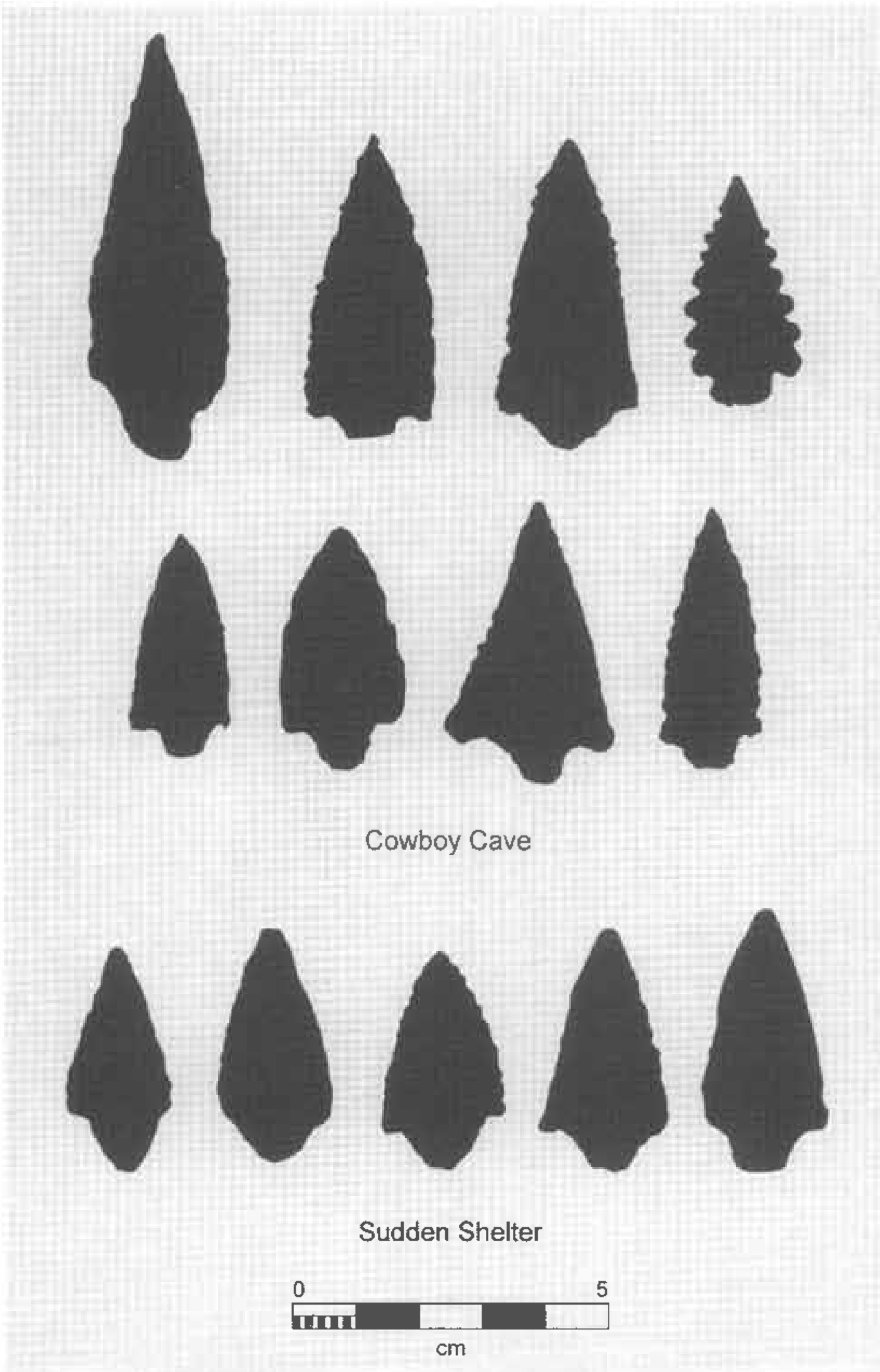

Figure 4. Examples of Gypsum/Gatecliff points from the Colorado Plateau; from Holmer 1980a: Fig. 17 g-n, 1980b: Fig. 36 j-n.

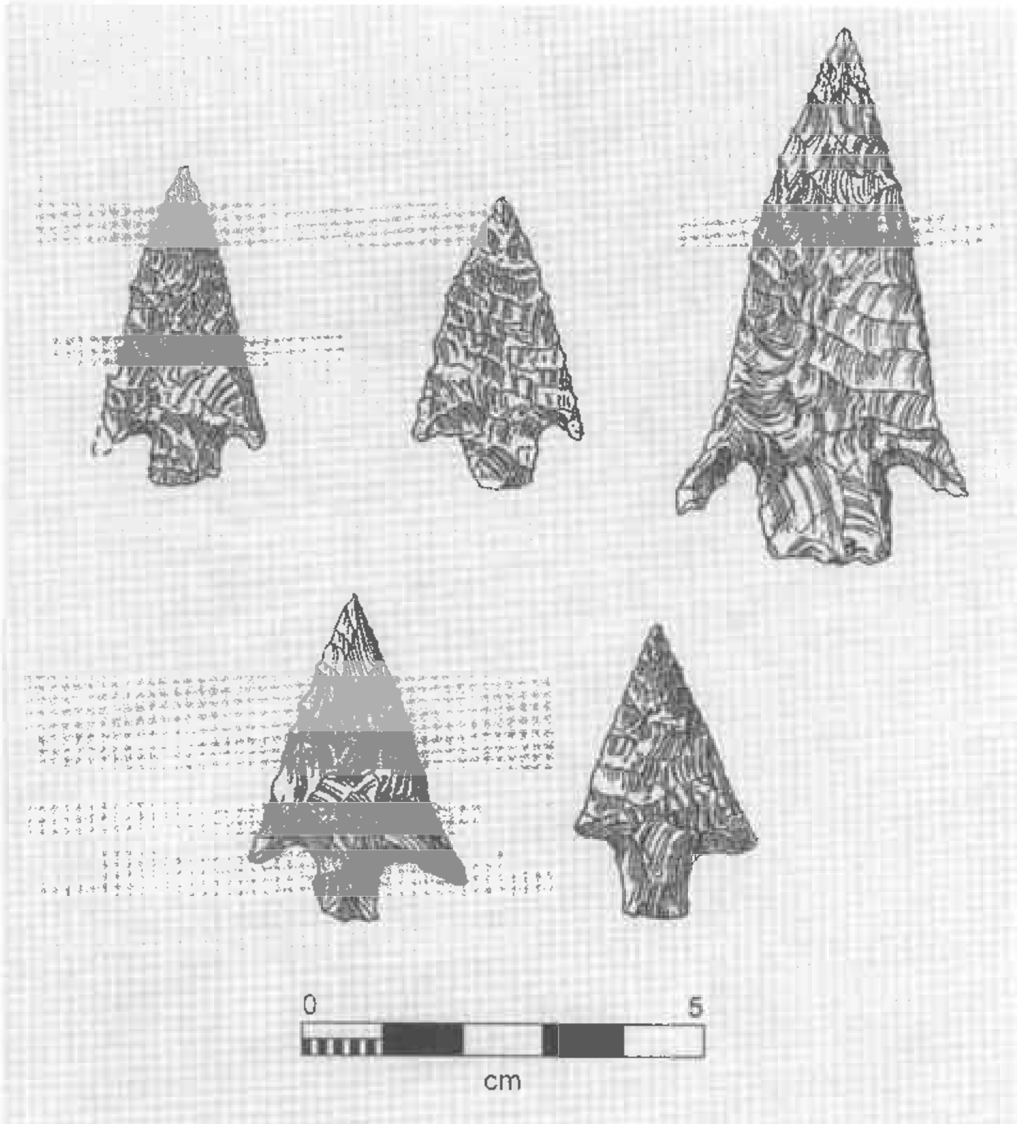

Figure 5. Examples of Gatecliff points from Hidden Cave and Gatecliff Shelter that are similar to the points reported here; from Pendleton 1985: Fig. 55 w, Fig. 56 e, h, and Fig 57. f; Thomas and Bierwirth 1983: Fig. 81 c, g.

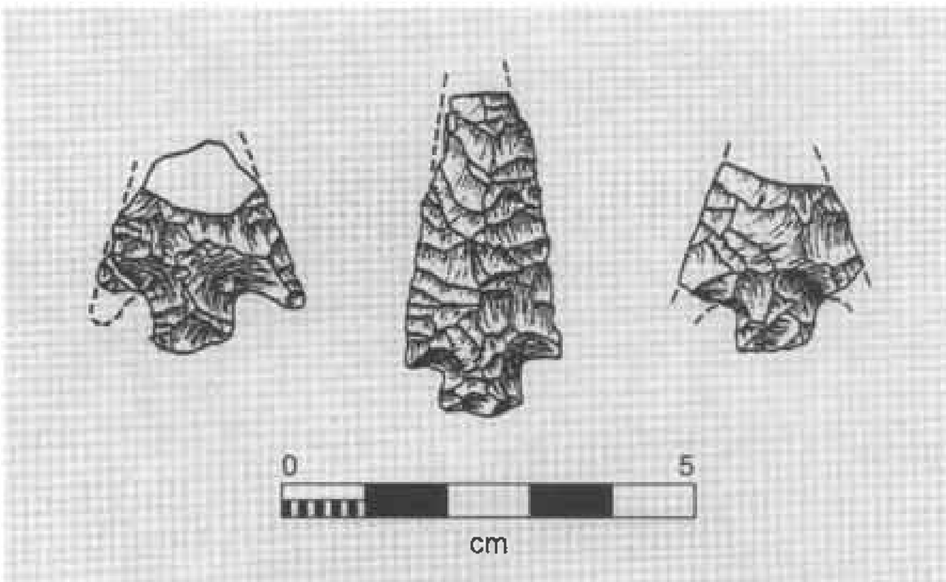

Figure 6. Stemmed points from 5GN289, Taylor Park, Colorado; from Black 1986: Figures 32b, 33 and 35.

ous ($T' = .11$; $Xi^2 = 3.84$) and the points apparently represent almost identical depositional intervals, the dates were averaged (7329 ± 54 B.P.). The calibrated 1 sigma range for the average is 6185 to 6050 cal. B.C., while the 2 sigma range is 6225 to 6010 cal. B.C. The radiocarbon dates support the early Archaic temporal assignment based on stratigraphy and sandal associations.

COMPARISONS

The three square-stem points from Old Man Cave are clearly similar to Gypsum or Gatecliff points (Figure 4). The chief differences are with the stem and blade shape. With few exceptions Gypsum/Gatecliff points on the Colorado Plateau have a constricting stem in contrast to the square stem of the points reported here. The blades of Gypsum/Gatecliff points also tend to be excurvate rather than the incurvate form on the Old Man Cave specimens. Nonetheless, if the point sample is large enough it is conceivable that the range of variability for Gypsum/Gatecliff points might include the points considered here. This indeed seems to be the case for Hidden Cave where, as I mentioned at the start of this paper, a few Gatecliff Contracting Stem points are quite similar to the Old Man Cave square stem points. These are shown in Figure 5. It is interesting to note that sandals produced by open-twining were also recovered from Hidden Cave (Goodman 1985:265–266, Fig. 91b), although this likely has nothing to do with the potential age of the square stem points from that site.

Tipps (1988:85–86) tentatively defined the type San Rafael Stemmed to accommodate a group of dart points from the northern Colorado Plateau that have wide, slightly expanding stems with square bases. The points described here can be distinguished from this proposed type by having shorter, straight-sided stems.

Other comparisons can be made with the stemmed points described as Type 10 by Black (1986:141-143) from 5GN289 of Taylor Park within the Gunnison Basin of Colorado. The points that he illustrates, which are shown in Figure 6, resemble the square-stemmed points from Old Man Cave. The association of the four 5GN289 specimens with a hearth dated 2650 ± 180 B.P. supports a late Archaic age (Black 1986:55). Black (1986:143) speculates that his stemmed points from Taylor Park might be part of a morphological continuum that began during the fifth millennium B.P. with Summit Stemmed, a type named by Gooding (1981).

CONCLUSION

I have described square-stem dart points recovered from the early Archaic deposits of Old Man Cave and verified their temporal placement by radiocarbon dating mastic from the base of one point and grass associated with another point. The potential age range based on the two dates is 6225 to 6010 cal. B.C. Because these points are morphologically distinctive from most Gypsum/Gatecliff points and date thousands of years earlier, a new type may be called for. The geographical distribution of this point style is currently unknown. The points are associated with open-twined sandals, a type of early Archaic footwear found across the entire Canyonlands section of the Colorado Plateau. Cowboy and Dust Devil caves are notable sites yielding open-twined sandals, but to my knowledge square-stem points similar to those reported here were not recovered from the early Archaic deposits of these caves. Thus the points and sandals likely have different distributions that just partially overlap.

The advent of Gypsum points during the late Archaic seems a major change in point technology because the type signals a change in hafting technique. Despite previous changes in point morphology, most of the changes did not constitute major departures from preceding types—a shift in notch angle or placement of the notch along the blade. Gypsum points (until now) appeared to mark the beginning of when hunter-gatherers started gluing their points to foreshafts rather than binding them on with sinew. As Holmer (1986:112) observes in his discussion of Gypsum points, "no example of earlier point styles can be found that bears any evidence of the use of pitch as a hafting element." The square-stem points reported here not only provide evidence for early Archaic use of pitch in hafting but reveal a hafting method that is essentially no different from that of the late Archaic.

Holmer (1986:112) presents a believable account for why gluing points to foreshafts with pitch would replace the prior technique of binding them on with sinew. His history of the spread of this technique, however, may require revision based on the Old Man Cave evidence. The practice of pitching stemmed points to foreshafts has a record of use on a portion of the Colorado Plateau thousands of years earlier than previously known. This technique might have been just a short-lived experiment that fell into disuse only to be reinvented a few millennia later, at which time it was quickly and widely adopted, spreading up the Colorado River and across the Intermountain region during late Archaic times, as Holmer (1986:113) suggests. Alternatively, the technique might have lingered as a minor component of the technological repertoire on the Colorado Plateau (or in the adjacent mountain basins of Colorado) until the late Archaic. If the latter is true, and the square-stem points reported here represent a predecessor to Gypsum points, then there is no need to look to the Mexican highlands for the source of the innovation.

As a final note, the finding of these points near the close of this century highlights that much remains to be learned about Archaic projectile point styles and culture history on the Colorado Plateau.

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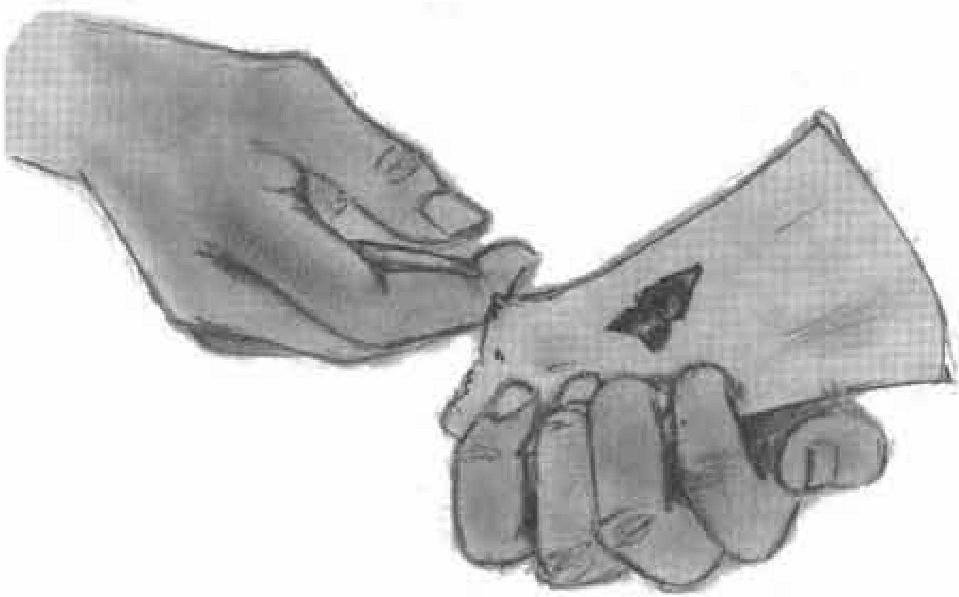

Book Reviews

Ants for Breakfast: Archaeological Adventures among the Kalinga, by James Skibo. University of Utah Press, Salt Lake City. 1999. 167 pages, 25 illustrations, $14.95 *paper*

Reviewed by: **Clay Johnson,** P. O. Box 31, Jensen, UT 84035

James Skibo, an associate professor of anthropology at Illinois State University, is best known as a behavioral archaeologist. Behavioral archaeologists believe that the investigation of specific human behaviors (using, making, or discarding things) is a more fruitful approach than investigation based on culture, the mind, or environmental interactions (Skibo, Walker and Nielsen 1995). Skibo's book, *Ants for Breakfast*, which conveys his experiences among the Kalinga people of the Philippines, was written while he was a graduate student fulfilling the time-honored tradition of doing anthropological fieldwork among the far-flung societies of our world. Skibo incorporates this with an overview of anthropological and archaeological theory and method by indulging his "passion for pottery." His graduate fieldwork was done under the guidance of Professor William Longacre of the University of Arizona, and is an ethnoarchaeological study of Kalinga ceramic cooking vessels and their use-wear. His fieldwork took place in a mountain village of 500 people located two hours from the nearest road.

Ants for Breakfast is easy reading with a light touch. Skibo spins a narrative from the details of his personal experiences, his fieldwork, Philippine history, and local geography. In this narrative Skibo weaves an overview of and anecdotes from the history of anthropology and archaeology. Through these chapters, Skibo deals nominally with his arrival in the Philippines, a Kalinga funeral, Kalinga history, foods, and conversations with his graduate advisor. He describes interactions with outlaws and the military (it was sometimes difficult to differentiate between them), and a debilitating bout of intestinal trouble. He also explores Kalinga legal devices and the impact of progress on the future of the Kalinga villagers.

One recurrent subject is medical treatment. An occasional part of the bargain in cross-cultural contacts of this type is that the visiting scholar serves as doctor and dispenser of modern miracle drugs. Since available drugs, tested treatments, and perceptions of what constitutes serious illness or injury vary from place to place; this process can be fraught with danger, frustration and uncertainty as well as satisfaction. In one case Skibo was asked to treat a teenage girl who had severed her fingertip with a machete, so that it was hanging by a flap of skin. Skibo put the fingertip in place and cleaned and wrapped the wound. He assumed the girl would be transported to a medical facility for stitches and further treatment. He even offered to pay the costs, but was told that further treatment was unnecessary for such minor cuts. The disparity of drugs and medical knowledge cuts both ways though. Six months after returning to the United States Skibo discovered that he had acquired intestinal worms. The common treatment in the Philippines, one small white pill with no side effects, was not available in the United States, where the cure consisted of three to five days of drug induced nausea and misery.

The book contains considerable discussion of Skibo-Kalinga daily interactions and village life, including sections dealing with differing cultural perceptions of what constitutes food, and a description of the latest in efficient porcine village sanitation systems. Skibo outlines his experience with Kalinga community justice, an intriguing approach centering on consensus, restitution, and accommodation rather than on incarceration. The narrative also illuminates the delicate personal diplomacy necessary for guests in an unfamiliar culture, especially where a strong oral tradition and community participation shape most decisions.

Skibo's writing style is clear, unemotional and instructive. Anthropology majors or armchair adrenalin junkies may find *Ants for Breakfast* titillating and a good primer on the details, mystery, loneliness, and sometimes gut-wrenching terror of fieldwork described in other ethnographies such as Napoleon Chagnon's work with the Yanomamo, Redmond O'Hanlon's travels in Borneo and the Amazon, or Mark Plotkin's South American ethnobotanical adventures.

I would have appreciated the inclusion of more detail on pottery use-wear and information developed during the study, especially since Skibo began writing this book six years after his fieldwork experience. An index would be helpful because the book is loosely organized and it is often difficult to relocate a particular idea or discussion. *Ants for Breakfast* is not for the reader seeking hard data, technical discussion of method and theory, or detailed observations. The book is however, an attractive vehicle for those with a new interest in anthropology or anthropological fieldwork because it is an accessible introduction to the processes, concepts, and problems encountered during ethnographic fieldwork.

Canyoneering: The San Rafael Swell, by Steve Allen. University of Utah Press, Salt Lake City. 1999. 167 pages, $16.95 *paper*

Reviewed by: **Mark E. Stuart**, Promontory/Tübadüka Chapter, Utah Statewide Archaeological Society, 2110 E. 6550 S., Uintah, UT 84405

It is not often I get a chance to review a book which I know something about. The San Rafael Swell is one of my favorite hideouts. I hesitate to tell others about this special place because I prefer to keep its grandeur, beauty, and solitude for myself. I'm afraid though, Steve Allen's book *Canyoneering: The San Rafael Swell* will let this cat out of the bag. It is the definitive hiking guide for the San Rafael Swell, and his passion and love for this land shows in every page.

Allen quit his full-time job and accomplished in less than a year the task of hiking every significant canyon and side canyon of the San Rafael Swell. He also climbed nearly every knob, pinnacle, and mesa in the millions of acres of this wonderland. His efforts resulted in a useful, interesting and at times humorous book which I found easy to read.

The purpose of the book is to guide hikers of all skill levels, from beginners to expert rock climbers. The book details 63 major hikes and numerous side excursions. As he explored the Swell, Steve kept careful notes and took scores of photographs so he could reproduce hikes in great detail (much like an archaeological excavation). He shows mileage on each road leading to a hike, noting fence posts, canyon mouths, and intersections. His hike descriptions point out overhangs, potholes, gullies, and caves the hiker needs to know to keep from getting lost. He evaluates the relative ease or danger of each trip and rates them according to the standard scale used in mountaineering (Class #1 easy to 5+ for experts only). He points out important twists, turns, directions for climbing up or scrambling down. He even estimates the time required to get from certain rock formations to that ancient Native American petroglyph panel that might be a point of interest on a particular hike. The book is sprinkled with valuable gems of knowledge about geology, history, folklore, and ancient Native American sites. An important contribution of the book are chapters about preservation and etiquette for walking gently on the land. In my opinion, these chapters should be required reading for anyone who ventures into the beautiful open spaces of Utah.

Although the stated purpose is to guide hikers, this book is also useful for auto touring and mountain biking, as it lists many of the important scenic overlooks and wonders that can be viewed by car or a short hike from the roads which criss-cross the Swell.

The chapter on archaeology is entitled "Man in the San Rafael Swell." It is a brief (only 8 pages) but comprehensive overview of human use of the Swell beginning with the Paleoindians of some 10,000 years ago. He traces the transition in land and lifeways from the late Pleistocene to the Archaic peoples of the Desert Culture. He elaborates on the enigmatic Barrier Canyon Style rock art found throughout the Swell and tentatively dated to the Archaic period. He then spends a couple of pages discussing the Fremont culture and mentions almost in passing the Numic peoples who occupied the area in Late Prehistoric times. He concludes by mentioning the Euro-Americans who now occupy the western and eastern fringes of the Swell and those who use its rugged open spaces today as a recreational playground.

I wished this chapter had more detail, but for the novice there is enough to gain knowledge and appreciation of the depth of the ancient and recent history of the area. For those wanting to know more, there is an excellent bibiliography at the book's end.

The only issue on which I disagree with the author is his statement that the Swell was only lightly used by ancient Native Americans. It has been my experience that archaeological sites in the Swell are common, especially in areas with water of any sort, and that although the ancient Swell was not crowded by modern standards, it was fully occupied for thousands of years. Most of these sites are, however, scatters of lithics and/or pottery, and rock art sites. This discrepancy may simply be that the author is a writer and a hiker who did not readily recognize the archaeological resources in the area. It may also be that he had preservation in mind and did not want to bring to public attention the fact that archaeological sites in the Swell are common. I did appreciate Allen's plea for the preservation and care of the cultural and rock art sites he describes, and his useful suggestions of how to treat these resources when visiting or discovering them.

During a recent visit to the Swell, I field checked one of his hikes, using the book as a guide. I found his mileage, landmark descriptions, and even the time allotted for the hike to be remarkably accurate. It was obvious that the author knew what he was writing about from experience. I even managed to find one of his petroglyph sites without too much trouble considering I am an old, out of shape explorer. I know one thing for sure. This book will occupy a place within my daypack and will be a ready reference for any visit I make to the San Rafael Swell.

Intermountain Archaeology, edited by David B. Madsen and Michael D. Metcalf. University of Utah Press, Salt Lake City. 2000. 368 pages, 98 illustrations. $45.00 *paper*

Reviewed by: **Kae McDonald,** 1522 Bennett Avenue, Glenwood Springs, CO 81601

Intermountain Archaeology is a useful collection of papers from the first three Rocky Mountain Anthropological Conferences. Although the editors freely admit that the volume appears to be an eclectic mix of articles focused on the southern one-third of the Intermountain region, a closer look reveals several themes pertinent to a broader area: transport costs associated with living at and/or using high altitudes, continuing struggles to define the spatio-temporal extent of the Fremont Culture, and resource use including plants, animals, and stone.

David Zeanah's article entitled "Transport Costs, Central-Place Foraging, and Hunter-Gatherer Alpine Land-Use Strategies" is a detailed analysis using a central-place foraging model, with the goals of comparing prehistoric Great Basin and Rocky Mountain alpine strategies, and describing the potential choices available to pre-village hunter-gatherers of the White Mountains in the western Great Basin. Zeanah provides a great deal of data on transport costs, and is explicit in describing his simulation of central-place foraging behavior in a portion of the Owens Valley. He concludes with a brief discussion of reasons for the alpine village pattern in the White Mountains, and what these may mean for similarities in the archaeological record of the Rocky Mountains. Although he determines that the patterning found in the Rocky Mountains is distinct from that of the White Mountains in the western Great Basin, I found his last paragraph to be quite cogent. Briefly, that we should not be seeking a single model of hunter-gatherer alpine land use, but rather that we should incorporate a theoretical perspective capable of modeling variability in the ways that hunter-gatherers might use high altitudes.

The second article, "Differential Transport Costs and High-Altitude Occupation Patterns in the Uinta Mountains, Northeastern Utah" by David B. Madsen, Thomas R. Scott and Byron Loosle discusses current research in the High Uintas Wilderness. As the title states, their investigations are focusing on the distinct site patterning of three basins observed during initial fieldwork. No prehistoric sites were found in the southern slope basin, while numerous sites, interpreted primarily as hunting-related, were found along the northern slope basins. Using several models to aid in defining the range of foraging and the transport choices available to prehistoric hunter-gatherers, the authors develop a hypothesis that it was cheaper and less risky to hunt on the northern side of the Uintas, and that a greater number of hunting-related sites would be found there. A second hypothesis, that the presence or absence of hunting sites is related to the presence of large alpine grassland areas, also remained intact through subsequent surveys. They also found that the Uintas and the Wasatch Plateau do not seem to act as a boundary between distinct prehistoric adaptive systems, and that simple economics could explain many of the decisions regarding residential versus logistical mobility. Notwithstanding the fact that groups along the southern edge of the Uintas probably did access the northern slope, the authors still feel strongly that much of the High Uintas were used primarily by people from the north.

The next three articles focus on the Fremont Culture, continue a focus on disentangling a wide range of adaptations lumped under this cultural moniker. Jerry D. Spangler's first article describes the results of several years of intensive survey in Nine Mile Canyon in east-central Utah. Nine Mile Canyon has for years been a popular destination for those interested in rock art, but archaeological studies have relied on fairly out-of-date descriptions from the first half of the twentieth century. Spangler focuses on storage facilities, ceramics, and two categories of residential sites—those that are situated on the stream terrace, and those found on bedrock surfaces of pinnacles, rock outcrops, and isolated mesas. The residential sites along the stream terrace are interpreted to be temporary occupations associated with horticultural pursuits, while those on pinnacles, rock outcrops, and isolated mesas provide expedient access to critical resources. Storage facilities range from large, energy-expensive structures to small cists less than 0.5 m in diameter. The small ceramic assemblage implied that pots were brought in, rather than being made locally. The range of observed tempers would seem to support this conclusion. Spangler concludes that much of the archaeological phenomena documented in Nine Mile Canyon reflect itinerant horticultural activities involving seasonal migrations of small groups to tend the crops and pursue other available resources.

Julie E. Francis and Danny N. Walker document a possible Fremont occupation of the Calpet Rockshelter (48SU354), which includes the northernmost known occurrence of Fremont rock art. Identifiable Fremont-associated images include trapezoidal anthropomorphic figures, which are uncommon for Wyoming Basin and Plains rock art motifs. Artifacts, including a heavy sandstone slab metate, a two-hand mano, a Uinta Side-notched projectile point, as well as a radiocarbon date of 950±70 BP and the rock art, are cited as evidence for a Fremont occupation of the rockshelter. A second, distinct, occupation lies above the "Fremont" level, and is probably just as significant for the quantities of obsidian among the chipped stone debitage assemblage. A number of the obsidian flakes have been sourced to the Fish Creek-Teton Pass, and Malad, Idaho, sources. Both levels are interpreted as representing a limited activity area by a logistically-oriented task group, and the authors suggest that the area surrounding the Calpet Rockshelter may have been part of a regular subsistence round for groups ranging out of either the Uinta Basin or the Great Salt Lake area.

A second paper by Spangler discusses radiocarbon dates from the Uinta Basin, with the goal of reviewing and updating past chronologies; of real benefit is an appendix of radiocarbon dates. Spangler extends the Late Archaic Period to A.D. 500, with the proviso that by as early as A.D. 1, and certainly by A.D. 200, distinct patterns are recognizable, one of which included maize horticulture. The Late Archaic is followed by the Fremont Period, which extends from ca. A.D. 500 to A.D. 1300. A variety of subsistence strategies describe this period of time, but Spangler focuses on two distinct adaptations: the Uinta adaptation (A.D. 550 to 1000), and the Tavaputs adaptation (A.D. 1000 to 1300). Much of this discussion can be related to results discussed in his previous paper in this volume. Spangler admits, however, that despite the abundance of chronometric data now available, significant gaps in the data base continue to complicate any comprehensive interpretation of the local chronology.

An important contribution to Paleoindian studies in the Rocky Mountains is David B. Madsen's article "A High-Elevation Allerød-Younger Dryas Megafauna from the West-Central Rocky Mountains," in which he discusses the excavation of a nearly complete skeleton of a *Mammuthus columbi*, and the partial skull and isolated rib of a short-faced bear. The mammoth and surrounding deposits were radiocarbon dated, returning results ranging from 8430 to 12,340 B.P., with the deaths of the mammoth and short-faced bear dating to ca. 11.2 and 10.8 thousand years ago, respectively. Cut marks on the mammoth's rib and metacarpal suggest human interaction, and bifacially worked stone tools were recovered from both lake deposits and a moraine surface below the lake. Diagnostic artifacts include a Pryor Stemmed projectile point, a Cody knife, and a Scottsbluff point basal fragment. Madsen concludes with a brief review of paleoclimatic models, and the implications for megafaunal extinctions.

The paper "Early Archaic Burials from the Southern Rocky Mountains: Yarmony and the Red Army Rockshelter" by Ann L. Magennis, Michael D. Metcalf, and Kelly J. Pool adds substantially to the very little information available about the populations that inhabited the mountains. Skeletal remains from Yarmony and Red Army Rockshelter are described: a 60+ year-old female, and a 55+ year-old female, respectively. These are then related to the available sample from the southern Rocky Mountains; a total of twelve bodies. Based on this very small sample, they found that most of the younger males were buried away from residential base camps, while older males and females were interred at the residential base camps. This pattern fits well with high mobility among younger males, something that could have occurred during both the Paleoindian and Archaic periods.

The final six articles address the use of mountain resources, including plants, animals, and lithic materials. Stan McDonald's paper entitled "Archaic Use of the Wasatch Plateau Uplands" reports on the survey efforts of avocational archaeologists from 1989 and 1993 in the Wasatch Plateau of central Utah. All of the discovered sites are lithic scatters, and include two Paleoindian sites, including the Huntington mammoth site reported on by Madsen, five Early Archaic sites, three Middle Archaic sites, two Late Archaic sites, five Fremont sites, and two Late Prehistoric sites. In general, McDonald found that most aboriginal populations used the upper plateau for hunting-related activities, and that this pattern does not change significantly through time.

Kevin D. Black's study of "Lithic Sources in the Rocky Mountains of Colorado" has the simple goal of documenting the number and diversity of toolstone sources in the mountains of Colorado. Using site forms on file at the Colorado Office of Archaeology and Historic Preservation, he succeeded admirably, categorizing over 237 sources of seven distinct lithic materials including crypto-microcrystalline silicates, petrified wood, quartzites, igneous rocks, siltstone, granite, and hematite. There is evidence for prehistoric quarrying activity at many of these sites, and a variety of other activities including food preparation and consumption also occurred at the quarries. Black cautions, however, that more extensive conclusions would be premature, given the lack of detail on many of the site forms. He concludes by encouraging all archaeologists to increase our awareness of the number and variety of toolstone sources that were available to the prehistoric populations of the southern Rocky Mountains.

Lis T. Nauta's article entitled "Utah Chub Size Utilization at Goshen Island" focused on developing a system for determining Utah chub sizes from archaeological remains, and subsequently applies that model to Utah chub remains excavated from two prehistoric components at Goshen Island (42UT636) in Utah Valley. She found that the Late Prehistoric component contained all sizes of fish, while the Late Archaic component contains primarily small fish. These results suggest that the Late Archaic groups inhabiting the island were selecting the smaller, more desirable fish, while at the same time focusing on higher-ranked large mammals. The lack of available higher-ranked large mammals during the Late Prehistoric period seems to have forced these groups to focus on the larger, more labor-intensive, Utah chub.

Anne McKibbin documents the discovery of fish remains and notched pebbles interpreted as fish net weights in "A Bad Day Fishing is Better than a Good Day Hunting and Gathering: The Pescadero Site." The discovery of these items, which have regional parallels throughout the Intermountain West, adds materially to the understanding of Uinta Phase (Fremont period) subsistence in the Green River Basin of southwestern Wyoming. Besides fish remains, which include cutthroat trout or mountain whitefish, Cypriniformes (minnows or suckers), and chubs, a range of mammal bone from ground squirrels to bison was excavated from this site, and shows clear evidence of utilization. Overall, fishing probably contributed to a broad subsistence base employed by the inhabitants of the Pescadero Site. Further, it may have been most utilized in late winter/early spring, when many other resource patches were unproductive, and when plant resources were first becoming available near the end of winter. Finally, McKibbin briefly discusses the Uinta Phase and the Fremont influence in the Green River Basin, concluding that while the responses to population pressures may be similar, southwestern Wyoming is just too cold to support horticulture.

The article "Root Procurement in the Upper Green River Basin: Archaeological Investigations at 48SU1002" by Julie E. Francis explores the potential contribution that root processing would add to the diet of prehistoric inhabitants along the Green River Valley. Excavation of a large cobble-filled feature dating to the Middle Archaic provides Francis with the findings necessary to discuss this topic. Macrobotanical remains consist primarily of charred wood, a few charred *Chenopodium* seeds, and several varieties of starches. Camas and biscuitroot may have been some of the numerous roots available for consumption by Middle Archaic groups, and would have yielded a significant part of the diet for a small family group. Roots in an unreduced state are not very transportable, and baking would have been required to extend their shelf life and transportability. Francis argues that although root processing and consumption retain a low archaeological visibility, they may have added an important component to the diet, not only in the upper Green River Valley, but elsewhere in the Rocky Mountains.

Patrick M. Lubinski's paper "Of Bison and Lesser Mammals: Prehistoric Hunting Patterns in the Wyoming Basin" discusses the contribution of bison and pronghorn to the prehistoric diet in the Green River Basin. Lubinski found that five genera primarily contributed to the prehistoric diet, including bison, pronghorn, ground squirrel, cottontail, and jackrabbit. Of these, bison and pronghorn exhibit the most interesting diachronic trends. Briefly, bison occur in at least half of all assemblages for all but the Early Archaic, and pronghorn occur in small quantities except at a few unusual sites. Importantly, however, jackrabbit, cottontail, and ground squirrel are the most common animals in Green River Basin archaeofaunas, and rank equal to bison and pronghorn during the Early Archaic period. He concludes that there is no one explanation for fluctuations in resource use over time, and that further work is required to fully understand dietary choices made by the prehistoric populations inhabiting the Green River Basin.

Robert L. Bettinger sums up the volume with observations of how high-altitude land use can be applied to archaeology in the Intermountain West in general. While Bettinger highlights the contributions of high altitude archaeology in the larger regional subsistence-settlement system, he also points out a tangible weakness to most of this work: that data supporting the understanding of that larger subsistence-settlement system are often lacking. He promotes stepping outside the "snapshot" perspective that is often the lot of many CRM projects (which comprise the bulk of the data for many of the articles included in this volume), and do something about connecting sites to make complete subsistence-settlement systems. Bettinger also comments on the "Fremont Problem," and the very real distinctions between CRM-generated research and that produced by academia. Overall, he supports the work of those Intermountain scholars who can "concentrate their efforts on a few key research problems that are broad enough to be of interest to those working elsewhere but uniquely well-suited for investigation in the Intermountain region."

Time, Trees, and Prehistory: Tree-Ring Dating and the Development of North American Archaeology, 1914 to 1950, by Stephen Edward Nash. University of Utah Press, Salt Lake City. 1999. 294 pp., 30 illustrations, 1 map. $35.00 *cloth*

Reviewed by: **Michael S. Berry**, Utah School and Institutional Trust Lands Administration, 675 E. 500 S., Suite 500, Salt Lake City, UT 84102-2818

This is undeniably a thoroughly researched book. Regrettably, it fails to deliver on the promise of its title. It is not about "Time, Trees, and Prehistory." Rather, it is fundamentally about the ethics, rationality and, in some cases, pettiness of the major players in the development of dendrochronology from Douglass's initial insights through the state of the art as of 1950. The year 1950 is, I agree, a convenient break point for this study. Radiocarbon dating was soon to become the predominant method of absolute dating in archaeology worldwide. Dendrochronology is, of course, capable of dating a prehistoric construction event to the exact year whereas the radiocarbon method can only provide a probability argument that the event occurred within a given range of years. The significant difference is that the scope of dendrochronology is geographically limited to the relatively few areas where master tree-ring chronologies can be developed for a tree species that happened to be used by the prehistoric inhabitants. Radiocarbon dating is universal in scope. Nash, by cutting off the argument at 1950, avoids any serious discussion of calibration of the two methods. I consider that to be the major chronometric issue for Southwestern archaeology. The tree-ring controlled southern Colorado Plateau Anasazi sequence is bounded on the south by the radiocarbon controlled Hohokam sequence and on the north by the radiocarbon controlled Fremont and Western Anasazi sequences. Any in-depth understanding of prehistoric cultural dynamics over this vast area will, of necessity, require creative approaches to chronometric resolution. But broad scale chronometry clearly is not what this book is about. So it would not be fair to criticize Nash for not dealing with that issue in any detail.

The book is organized into nine chapters, each of which appears to have been written as a stand-alone article. There is a great deal of inter-chapter redundancy and repetition that could have been repaired by a solid round of copy-editing. However, my objections to this highly detailed work run much deeper than editorial laxity. Nash's treatment of the correspondence among the principal players frequently devolves to the academic equivalent of tabloid journalism. Intellectual debate tends to be resolved into simplistic a posteriori characterization of "good guys" (e.g., Douglass, Clark Wissler, Emil Haury) versus "bad guys" (e.g., Harold Gladwin, Neil Judd). Nash has not, for all his rigor, provided us with an intellectual history of dendrochronology. He has given us a sometimes entertaining, sometimes regrettable, historical odyssey centered much more on the players than the plot. Perhaps that is because the plot is a simple one.

Douglass, whose interest was focused on the cyclicity of sunspot activity and the attendant effects upon global climatic patterns, sought a method to extend what he viewed as proxy data of these phenomena in living trees to the distant past through the employ of timbers preserved in Southwestern archaeological ruins. He developed the notion of crossdating timber sections, first, to link living tree-ring sequences to early historic timbers and, second, to extend that method of analysis to prehistoric timbers. Once this initial conceptual breakthrough was made, the painstaking effort of pattern matching continued, with little methodological modification, to the present, led by a host of Douglass's intellectual descendents. And for decades, publication of dates was not allowed until Douglass had verified them personally.

It may be the essential elegance of Douglass's discovery that led Nash to deal so heavily in personalities as opposed to chronicling the development of dendrochronology per se. Whatever the reason, I was not at all enlightened by, for instance, Neil Judd's alleged pettiness and academic irresponsibility in purportedly failing to acknowledge the work of his predecessors and peers. Nor do I think it was particularly useful to assert that,

> "Gladwin has a reputation of being a member of the lunatic 'fringe' of southwestern archaeology in general . . . and archaeological tree-ring dating in particular" (pg. 101).

Or to attribute Gladwin's alleged failure to comprehend Douglass's skeleton plot method to intellectual deficiency.

> "Gladwin's apparent revisionism therefore does not accurately reflect the facts of the situation, and it is clear that he missed at least three class periods that semester. . . Perhaps he simply did not have the ability or type of mind to attend class on a regular basis" (pg. 115).

Both Judd and Gladwin made major contributions to Southwestern archaeology (as Nash elsewhere acknowledges) and I see no reason to malign their reputations with these ad hominem asides. Similarly, the gossipy accusations by Florence Hawley's disgruntled coworkers that she wrote her husband's master's thesis and used departmental secretaries at the University of Chicago to type the manuscript, need not have been included in the present work. Nash does attempt to place this incident in the context of the times, but the publication of unsubstantiated accusatory notes and letters serves no useful purpose.

This book is not for everyone. Students looking for detailed information on the methods and techniques of tree-ring dating will be disappointed. Jeffery S. Dean's *Tree-Ring Dating in Archaeology* (Dean 1978) is a much better sourcebook for such purposes. Those thoroughly familiar with tree-ring dating and the history of Southwestern archaeology will appreciate some (but not all) of the information brought to light by Nash's thorough archival research.

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1978 *Tree-Ring Dating in Archaeology.* Miscellaneous Collected Papers 19-24, Anthropological Papers, No. 99.University of Utah Press, Salt Lake City.

Note from the Editor:

Upon submitting his review, Michael Berry suggested that I invite Stephen Nash to respond. I pursued this gracious offer and Dr. Nash was indeed happy to reply. Together they signal the importance of argument in intellectual discourse. —*S.S.*

Reply to Review by Michael S. Berry of **Time, Trees, and Prehistory: Tree-Ring Dating and the Development of North American Archaeology, 1914 to 1950**, by Stephen E. Nash.

Stephen E. Nash, The Field Museum, Roosevelt Rd. and Lake Shore Dr., Chicago, IL 60605

Michael Berry's selective review of *Time, Trees, and Prehistory* appears to be based on a cursory reading of the text and a rather surprising misunderstanding of the social nature of scientific research. It also contains a number of factual errors that I feel compelled to clarify. Before addressing these point-by-point, let me offer a few general statements.

During the course of my dissertation research (Nash 1997), I examined some 10,000 pieces of archived correspondence relating to the development of archaeological tree-ring dating. Frankly, I too was astonished by the "pettiness of the major players" involved. Undergraduates and graduate students alike are repeatedly taught that scientists are objective, unbiased, and impartial. If biases are present, the holy grail of the Scientific Method will lead to their identification and systematic elimination. This ideal does not hold true in the hard sciences, where experiments can actually be replicated, and certainly does not hold true in the social sciences, of which archaeology is a card-carrying member.

Our professional predecessors were not necessarily objective, unbiased, impartial observers engaged in an entirely noble search for The Truth. They were human beings affected, as we all are today, by complicated and often conflicting demands arising from employment, familial, personal, professional, scholarly, and social commitments. As a result, the book acknowledges a syllogism:

> Science is conducted by human beings.
> Human beings are political animals.
> Science is therefore political.

Readers can deny this at their own peril. I make no pretenses that I am unbiased, impartial, or apolitical. With respect to the development of archaeological tree-ring dating, however, I gathered a wealth of archived data. I welcome and invite scholars to examine the same archived documents and persuasively argue that science is apolitical.

Also during the course of my dissertation research, I examined more than 600 publications on North American archaeology and the development thereof. When considered in light of the archived correspondence, it quickly became clear that the two sets of texts communicated radically different understandings of what occurred in archaeological circles between 1914 and 1950 (more on this below). Because individual scholars will by definition interpret texts differently, I used the indefinite article rather than the definite article in the dissertation title: I offered "*a* history", not "*the* history", of archaeological tree-ring dating. Because I am partial and biased, and because science and our understanding thereof are iterative processes, I again welcome and invite alternative interpretations as long as they are based on the same data and not impressions.

To address some of the factual errors and misconceptions in Berry's review: He states, "[Douglass] developed the notion of crossdating timber sections, first, to link living-tree sequences to early historic timbers and, second, to extend that method of analysis to prehistoric timbers." Douglass *did* develop "the notion of crossdating timber sections"— his first publication on the matter appeared in 1909. He *did not*, however, develop the notion "to extend that method of analysis to prehistoric timbers." As I was careful to point out on page 23, Clark Wissler of the American Museum of Natural History developed this notion when he wrote to Douglass on 22 May 1914:

> "Your work suggests to me a possible help in the archaeological investigation of the Southwest. . . . We do not know how old these ruins are, but I should be glad to have an opinion from you as to whether it might be possible to connect up with your modern and dated series of tree specimens [with wood specimens] from these [prehistoric] ruins by correlating the curves of growth."

Douglass was not interested in archaeology in the 1910s and it would be surprising indeed if he made such a revolutionary inference regarding something that the record indicates had not crossed his mind until Wissler made this and other overtures.

Berry states, "for decades, publication of dates was not allowed until Douglass had verified them personally." This is simply not true. As I point out on page 158, after the Second Tree-Ring Conference in 1935, Haury, McGregor, Hawley, Stallings, and Getty were authorized to verify archaeological tree-ring dates for specimens from their respective areas. The fact is that the verification of tree-ring dates became more difficult to obtain during the 1940s because these individuals moved on to other jobs and scholarly pursuits.

Berry was not "at all enlightened by Neil Judd's alleged pettiness and academic irresponsibility in purportedly failing to acknowledge the work of his predecessors and peers." He should be. The fact is that from quite early on (e.g. 1930, see pages 32-35), Judd did not give credit where credit was due for the development of archaeological tree-ring dating. That he was taken to task for this *potential* oversight is well documented in primary documents (e.g., letters between Judd, Douglass, and Nels Nelson of the American Museum of Natural History) archived at the Smithsonian Institution and the University of Arizona, as well as secondary documents at other institutions. In retrospect, Judd's actions appear less of an oversight and more of an intentional act because he continued to promulgate and publish inaccuracies about his role in this drama more than three decades later (Judd 1964, 1968). As noted above, the construction of scientific knowledge is iterative and cumulative. Failure to cite one's predecessors and claiming someone else's ideas for one's own are second only to plagiarism and data fabrication as egregious ethical violations in scholastic activity. I invite scholars to analyze the archived documents recording this unfortunate episode, develop their own interpretations, and *then* enlighten me as to how I may be incorrect in my assessment of the situation.

With regard to the bombastic iconoclast Harold Sterling Gladwin, I took pains to give credit to Gladwin and Gila Pueblo where appropriate, particularly in their support of Haury's tree-ring work from 1930 to 1937 (see page 95-104 and page 123), and the Gladwin-induced re-examination of Flagstaff archaeology (see pages 165-183). However, the fact remains that, with respect to archaeological tree-ring dating, Gladwin lashed out at his colleagues repeatedly and often. He often did so on the basis of preconceived notions and emotion, not data. I have no quarrel, however, with Berry's assertion that both Gladwin and Judd made significant contributions to Southwestern archaeology.

Finally, my "gossipy" treatment of the decidedly subjective, unscientific, unethical, and arguably illegal, actions that affected Florence Hawley's attempts to establish tree-ring dating in the American Midwest was intended simply to document another unfortunate episode in the history of our discipline that had important ramifications for our archaeological understanding of the prehistoric past.

The fact remains that scholarly publications do not tell the truth, the whole truth, and nothing but the truth, and *Time, Trees, and Prehistory* is certainly no exception. It simply presents the results of my analysis of an exciting and exceedingly well-documented period in the history of North American archaeology. I fully expect other scholars to examine the same data and arrive at alternative conclusions. Until then, I find it ironic that Berry's impressionistic, selective, and error-prone review can accuse me of publishing "unsubstantiated accusatory notes."

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