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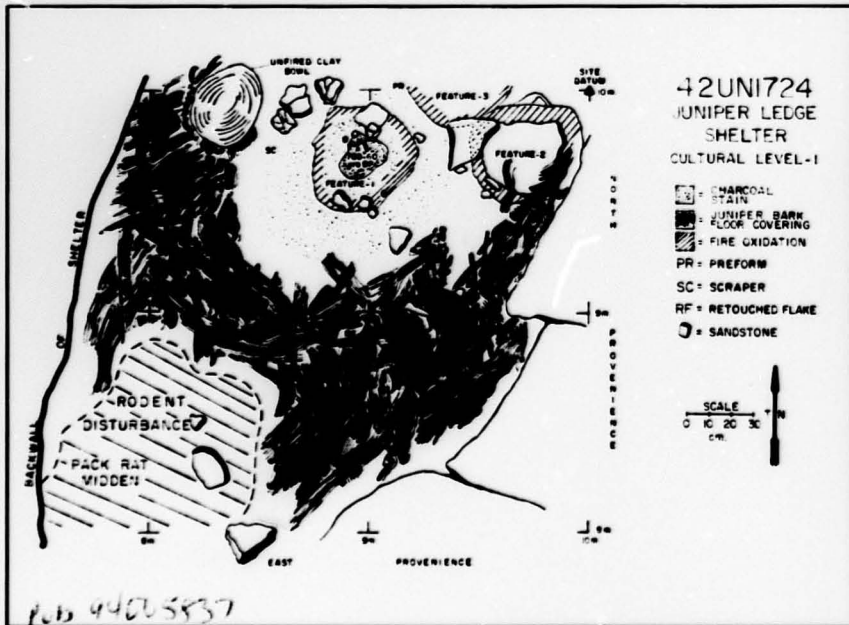
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Archeological Investigations at Two Sites in
Dinosaur National Monument:
42UN1724 and 5MF2645

139

By
James A. Truesdale

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16. Abstract (Limit: 200 words)

Archeological excavations in Dinosaur National Monument (DINO) were conducted at 5MF2645 (the Pool Creek Site) in 1988 and 42UN1724 (Juniper Ledge Shelter) in 1989. The information from these two sites, along with additional archeological data obtained between 1988 and 1992, have expanded our knowledge of the past 3700 years of human occupation in the DINO area.

Juniper Ledge Shelter (42UN1724) is a south-southeast facing rockshelter in the Jones Hole Ely Creek area of the monument. Excavation of a two meter square unit produced evidence of three occupational components and a Fremont burial of an adult female with associated artifacts. The upper two components at the site produced information on the Fremont/Numic transition, while the lowest component contained evidence of early corn horticulture.

The Pool Creek Site (5MF2645) is a Fremont open habitation site situated on a ridge northeast of Pool Creek, within the steep canyon system of the Green and Yampa Rivers. Excavations uncovered a Fremont pitthouse with associated features and artifacts and a Fremont burial with the remains of an adult female and an infant.

Data from 42UN1724 and 5MF2645 provide macro-floral, pollen, faunal, and radiocarbon data on Fremont settlement and subsistence patterns, mortuary practices, and the Fremont/Numic transition.

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**ARCHEOLOGICAL INVESTIGATIONS AT TWO SITES
IN DINOSAUR NATIONAL MONUMENT:
42UN1724 AND 5MF2645**

**DATA RECOVERY AT JUNIPER LEDGE SHELTER
(42UN1724)**

By
James A. Truesdale

With Contributions By

Linda Scott Cummings

and

Clay Johnson

**ARCHEOLOGICAL TESTING AT SITE 5MF2645 AND
DATA RECOVERY OF THE POOL CREEK BURIAL**

By
James A. Truesdale


U.S. Department of the Interior
National Park Service
Rocky Mountain Region
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1993

FOREWORD

As part of the National Park Service mission to protect and interpret its resources, it is important to make valuable, scientific information readily available. Therefore, I am pleased to present this volume in our occasional series of publications on the Rocky Mountain Region's past.

These two reports were prepared by James A. Truesdale, when he was the Dinosaur National Monument Archeologist, and present new data on Fremont occupation of the park. This work extends the known sequence of radiocarbon dates and documents a 3700-year record of prehistoric occupation in what is now Dinosaur National Monument.

In both studies, exposed human remains were excavated to prevent further loss through erosion and vandalism. Excavation, analysis, final reporting, and ultimate disposition of the human remains and associated funerary objects were carried out in consultation with the Uintah and Ouray Ute Tribe, including review of the final text and all figures. This project represents cooperation between the National Park Service and the Uintah and Ouray Ute Tribe to achieve the goal of sensitive and appropriate management of these very important remains while enabling scientific investigations to proceed.


Robert M. Baker
Regional Director
Rocky Mountain Region

Mission: As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration. NPS-D-89.

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JUNIPER LEDGE SHELTER

I would like to thank Dinosaur National Monument Superintendent (Dennis K. Huffman) for allowing Jerry Ballard (DINO Yampa District Ranger), Cindy Doktorski (Assistant Green River Naturalist), Fawn Curtis (DINO River Concessions Assistant), and Rita H. Clagett (Seasonal Green River District Interpreter) to take time away from their jobs to assist in the excavation. They tolerated those cold overcast November days. Michelle Riley cataloged and encoded the artifacts into the Automated National Curation System (ANCS). Additional thanks go to David Whitman (Chief of Interpretation - DINO) for his support and editorial comments, and the Dinosaur Nature Association for funding all of the supporting studies (radiocarbon dating, macrofloral, pollen, fiber and corn analyses). I would like to thank Linda Scott Cummings (PaleoResearch Laboratories) for the macrofloral, pollen, and fiber analyses. Thanks to the staff at Beta Analytic Inc. for numerous conversations concerning the radiocarbon dating of corn.

In addition, I would like to thank Charles A. Reher (University of Wyoming), Blaine Phillips (Utah Bureau of Land Management, Vernal District Archeologist), Mike Metcalf (Metcalf Archaeological Consultants), Adrienne Anderson, Ann Johnson, Betty LeFree, and Helen Fairley (National Park Service), David Madsen (Utah State Archaeologist), Kevin Jones (Assistant Utah State Archaeologist), Steven Creasman (Western Wyoming College), Clifford Duncan (Uintah and Ouray Ute Tribe), and Clay Johnson (Vernal, Utah) for valuable

conversations and professional consultations during the various phases of the Juniper Ledge Shelter project.

POOL CREEK BURIAL

The author would like to thank Dinosaur National Monument Superintendent Dennis K. Huffman and Chief of Interpretation David Whitman for their support. George W. Gill (University of Wyoming, Department of Anthropology) guided and assisted the author in the osteological analysis. Thanks to the staff of Beta Analytic, Inc. for their service and consultation. Thanks also to David A. Breternitz, Kevin Jones (Assistant Utah State Archaeologist), David B. Madsen (Utah State Archaeologist), and Charles A. Reher (University of Wyoming, Department of Anthropology) for numerous professional conversations and consultations. I especially appreciate the consultation and advice of Clifford Duncan (Uintah and Ouray Ute Tribe) who helped with various aspects of the project. Thanks to Adrienne Anderson and Ann Johnson (National Park Service, Rocky Mountain Region, Division of Cultural Resources Management) for their support and editorial comments. Also special thanks should go to the Dinosaur Nature Association for funding the supporting studies in this project.

James A. Truesdale
Archeologist
1993

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DATA RECOVERY AT JUNIPER LEDGE SHELTER (42UN1724)

By
James A. Truesdale
With Contributions By
Linda Scott Cummings
and
Clay Johnson

INTRODUCTION

The Juniper Ledge Shelter was discovered on September 29, 1989, during a pedestrian survey for archeological resources in the Jones Hole/Ely Creek area of Dinosaur National Monument (DINO) in northeastern Utah (Fig. 1). The site is located in Uintah County, Utah, at an elevation of approximately 1585 m (5200 feet) AMSL.

Due to the presence of human remains exposed on the site, an evaluation to consider management actions was conducted by the DINO Archeologist on September 29, 1989. A decision to salvage the interment was made based upon several criteria: (1) human bone was exposed on the surface and was continuing to erode, endangering the burial's existence; (2) the remains continued to be impacted by rodent activities; (3) there was potential for the remains to be destroyed by unauthorized collection and vandalism due to the close proximity and easy access from the Jones Hole/Island Park trail, and (4) this would be an opportunity to determine the nature, extent, and integrity of the site's buried cultural deposits for nomination of the site to the National Register of Historic Places.

The Jones Hole/Ely Creek area is one of the most heavily visited sections of DINO. Access can be gained by trails starting from the Jones Hole fish hatchery two miles to the north, three campgrounds located on the Green River two miles to the south, and from Island Park 4 miles to the west. The campgrounds located on the river are occupied continually for three months (mid-June through Mid-August) by boaters on raft trips. The Monument Green River District

Ranger indicated that 60 to 80 boaters frequent the Ely Creek area every day during these months. A conservative estimate on visitation per day for the Jones Hole/Ely Creek area between the heavy river use period and summer months alone is 1800 to 2400 individuals. The main attractions to this area are Deluge Shelter (42UN178), a stratified prehistoric rockshelter with its "Fremont" pictograph panels, fishing in Jones Creek, and a natural waterfall on Ely Creek.

In addition, the Jones Hole/Ely Creek area may have the highest density of archeological sites per square mile in the Monument. Past and present archeological investigations in the area indicate that 90 percent of the sites have evidence of unauthorized collection and/or vandalism.

A Data Recovery Plan was written for site 42UN1724 (Juniper Ledge Shelter) (Truesdale 1989) to outline field and laboratory methods and address specific research domains. In addition, the Data Recovery Plan addressed Native American concerns and the curation and ultimate disposition of human remains and associated artifacts. American Indian Consultation was initiated on October 2, 1989, with a letter to the Uintah and Ouray Indian Agency notifying them of the discovery of human remains and the management decision to salvage the interment. As a result, Clifford Duncan (Director of the Uintah and Ouray Ute Cultural Rights Protection Office) visited the site while excavation was in process. Duncan burned sweet grass and prayed at the site.

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Introduction

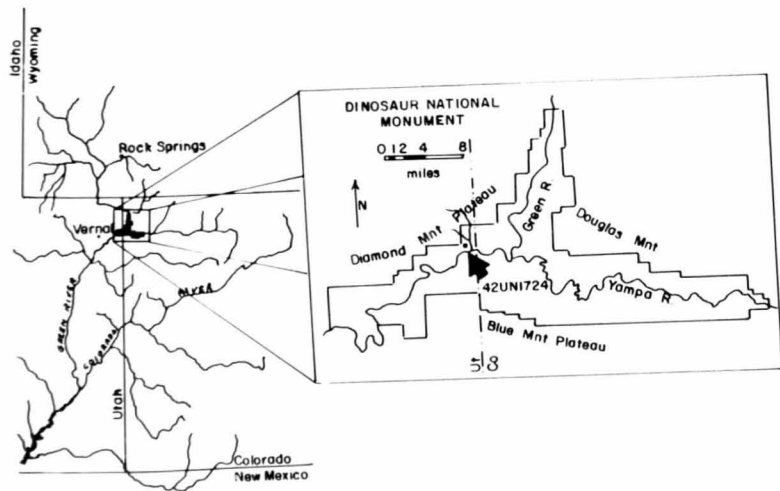


Figure 1. Location of the Juniper Ledge Shelter (42UN1724)

Site Description

The data recovery program was designed to insure that the information potential of the Juniper Ledge burial is not lessened through destruction, collection and/or vandalism, or through physical modifications to the site setting which would effectively make deposits inaccessible to investigations. In November of 1989 the DINO Archeologist and a crew of volunteers began test excavations of Juniper Ledge Shelter.

All materials and artifacts collected during the data recovery at Juniper Ledge Shelter have been curated under the Automated National Curation System (ANCS) and accession number DINO-220. All artifacts are curated at Dinosaur National Monument headquarters, Dinosaur, Colorado.

SITE DESCRIPTION

The Juniper Ledge Shelter (42UN1724) is situated on a long narrow ledge which trends southwest-northeast along the north side of a steep walled canyon (Fig. 2). The site is a wide open alcove which measures 11 m (NE-SW) across the front by 6 m (NW-SE) from the drip line to the back wall and 15 to 20 m in height (Fig. 3). In addition, an alcove approximately 50 meters to the northeast contained the remains of a storage structure (granary). The storage structure consisted of a slab of sandstone wedged vertically in a small alcove, one small piece of adobe, and a corn cob fragment.

Vegetation on the site is characteristic of a juniper shrub community with juniper dominating the landscape. Additional species observed on and surrounding the site

are sagebrush, mountain mahogany, prickly-pear cactus, rabbitbrush, several varieties of wheat grass, and Indian rice grass. A riparian vegetation community may be found 300 m to the northeast. The site is located in the Weber Sandstone Formation (Middle Pennsylvanian).

The site consists of low density chipped stone tools and debitage, fire cracked rock, and a concentration of pottery scattered in an area of 66 sq m. This scatter of artifacts is concentrated around two exposed firepit features which exhibit charcoal and charcoal stained soil eroding from the front slope of the shelter. The front of the shelter is eroding because of a small wash that runs south.

Ceramic sherds were recovered from the surface. The sherds exhibit a gray to black interior core, a gray interior and exterior surface, a finely sorted paste, and a poorly sorted crushed limestone temper, which is visible through the exterior surface. The temper may be exposed due to surface erosion of the sherds. The ceramics are similar in morphological attributes to Uinta grayware which is associated with the Fremont of the Uinta Basin. In addition, a hafted stone knife was recovered adjacent to the ceramic scatter at the site (Fig. 3). This knife was made from a tan to gray chert, exhibits wide-open side-notches, and measures 6.99 cm in length, has a blade width of 2.34 cm, is .61 cm in thickness, has a hafting element width of 1.22 cm, a hafting element height of 1.06 cm, and a base width of 1.57 cm.

Site Description



Figure 2. View to north at the location of Juniper Ledge Shelter

Site Description

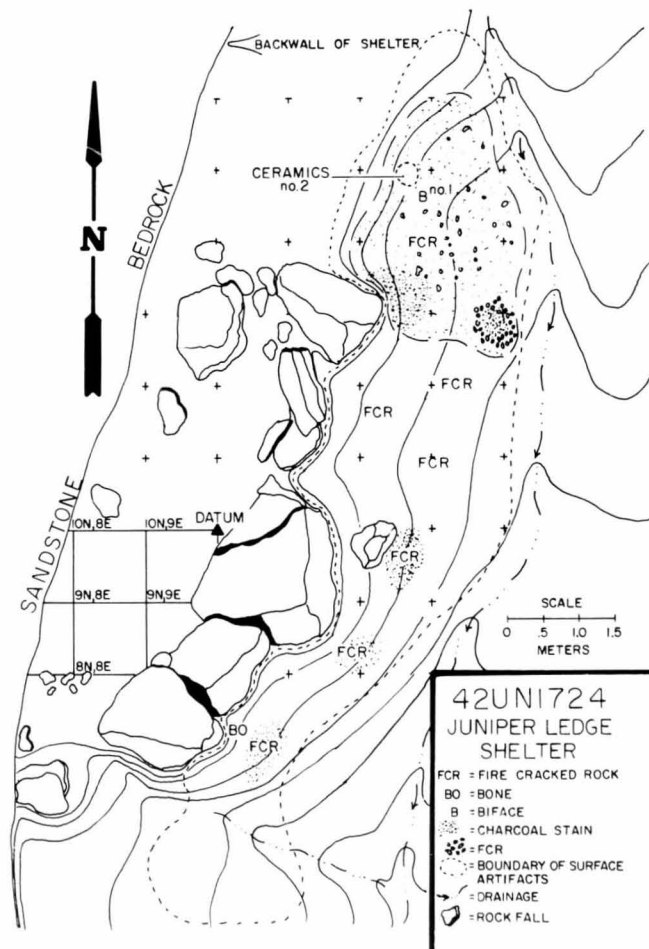


Figure 3. Site map of Juniper Ledge Shelter (42UN1724)

Method of Excavation

The burial is a primary inhumation of unknown biological and ethnic affinity, and age. The burial was thought to be situated between the back wall of the rockshelter and several large sandstone blocks, which have fallen from the roof or wall of the shelter (Fig. 3) (Truesdale 1989). A human 3rd cervical vertebra was located on the surface eroding from a rodent burrow which extends back into an opening between two sandstone blocks. The vertebra was exposed on the surface and shows signs of weathering (bleaching, dry bone breaks and splintering). In addition, juniper bark behind these sandstone blocks was exposed by rodent burrowing and subsequent erosion and the juniper bark is suspected to be part of the interment. Strips of juniper bark have been recorded covering human remains in southwestern Wyoming and northwest Colorado (Truesdale 1987, 1989; Truesdale and Gill 1987). Sediments on the site consist of a tan to light brown loosely compacted silty sand mixed with colluvial deposits, and exfoliated pieces of sandstone. In addition, juniper seeds and branches, cactus spines, and rodent scat are mixed in with the shelter's deposits. The depth of deposits in the shelter is approximately one meter.

METHOD OF EXCAVATION

The excavation consisted of a two meter square block orientated to true North and positioned over the strips of juniper bark suspected of being the human interment.

The provenience of the excavation block is 8-10 m N and 8-10 m E (Fig. 4). An arbitrary datum was established with an elevation of 100.00 m and all other elevations were measured relative to this elevation. The excavation consisted of two adjacent 1 x 2 sq m units, (8-9 N, 8-10 E) and (9-10 N, 8-10 E). The excavation represents an area of approximately 3.4 percent of the shelter sediments and cultural deposits. The first two levels (1 and 2) in each unit were 5 cm in depth and the remaining levels (3 through 7) were 10 cm. All sediments were screened through a 1/16 inch wire mesh. Macrofloral, pollen, and carbon samples were collected from firepit features. Macrofloral and pollen analyses were conducted by Linda Scott Cummings (PaleoResearch Laboratories) (Appendix A). Radiocarbon dating was conducted by Beta Analytic Inc. A recalibration program (Stuiver and Becker 1987) that converts radiocarbon dates to calendric age (cal age) was utilized and the results may be found in Appendix B.

The human remains recovered were handled with dignity and respect. The values inherent in the remains, by virtue of their very nature, required special handling. At all phases of the project, the human remains were carefully protected, not open to view or handling by individuals not involved in the determination of their disposition and evaluation, and were not treated as objects of curiosity.

EXCAVATION RESULTS

Data recovery at site 42UN1724 (Juniper Ledge Shelter) identified the remains of three cultural components. The cultural levels were primarily defined by radiocarbon dates (Table 1), frequency, and type of artifacts recovered in each excavation level (Fig. 4), superimposition of levels and features (Fig. 5), and the following data.

CULTURAL COMPONENT 1

Cultural Component 1 extends from the ground surface to approximately 10 to 15 cm (Surface to 99.90 cm) below the surface and was predominately contained within excavation levels 1 and 2. However, artifacts considered to be associated with this occupation level were found in all excavation levels due to two main reasons. These causes included (1) the slumping and

collapsing of excavation walls, and (2) displacement through previous rodent activity. The sediments consist of a loosely compacted sandy silt mixed with sticks, cactus spine, and scat from rodents, and small and medium sized mammals. The overall stratigraphic context of Cultural Component 1 was fairly uniform and flat, following a natural surface of the shelter.

Cultural Level 1 contained a floor covering of juniper bark strips laid down and incorporated in and around Features 1, 2, and 3 (Figs. 6, 7, and 8) with an unfired clay bowl. The juniper bark floor varied in thickness (2 to 5 cm) and exhibited strips of juniper bark covering the ground in the area between three large fallen sandstone blocks and the back wall of the shelter.

Table 1. Radiocarbon results for samples recovered from Juniper Ledge Shelter (42UN1724)

Cultural Level No.	Beta Analytic Lab No.	C14 Age Years B.P.	Comments
1	Beta-34324	700 ± 60	Charcoal from Feature 1
2	Beta-34325	1110 ± 50	Charcoal from Feature 4
3	Beta-36605	1650 ± 80*	Corn kernels
4	Beta-34326	2330 ± 80	Juniper bark burden basket

*Corrected for isotopic fractionation; $\delta^{13}C = -23.8$ 0/00

Excavation Results

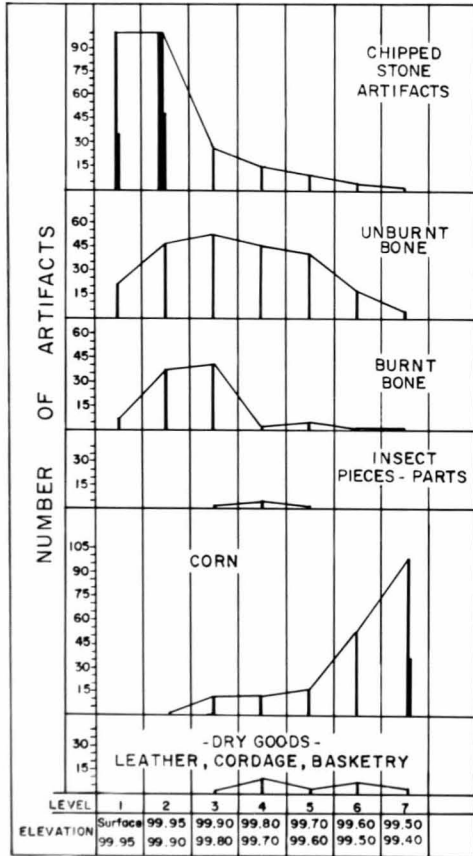


Figure 4. Frequency of artifacts by excavation level recovered during data recovery at Juniper Ledge Shelter

Excavation Results

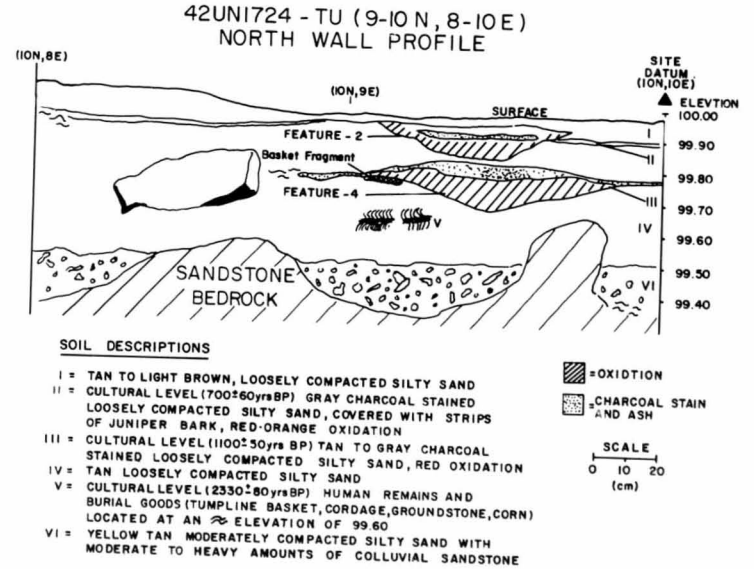


Figure 5. Soil profile of the north wall of Excavation Units 9-10N, 7.5-10E at Juniper Ledge Shelter

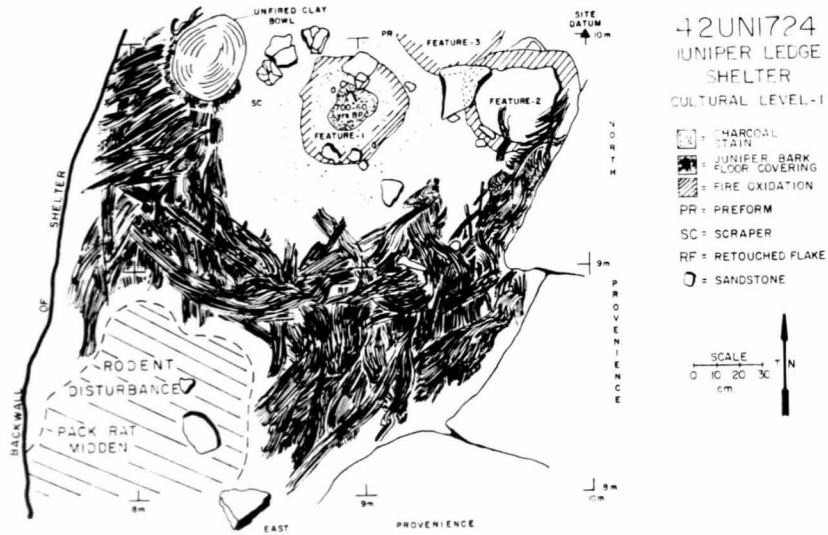


Figure 6. Plan View of map of Cultural Component 1 at Juniper Ledge Shelter (42UN1724)



Figure 7. Plan view of Cultural Component 1, (Excavation Units 8-9E, 7.5-10E), Juniper Ledge Shelter (42UN1724)

Excavation Results



Figure 8. Plan view of Cultural Component 1 after removal of the juniper bark floor covering, (Excavation Units 8-9N, 7.5-10E), at Juniper Ledge Shelter (42UN1724)

An unfired clay bowl or basin was uncovered near the back wall of the shelter (Fig. 9). The bowl had been placed on top of the juniper bark floor covering and formed in a wet/plastic state. The bowl is constructed of a grayish tan to light brown silty sandy clay and exhibits poorly sorted particles of sand and pebbles (temper) exposed on the interior and exterior surfaces (Fig. 9). The bowl is oblong in shape and measures 37 cm in length, 30 cm in width, 1-2 cm in thickness and a basin depth of 10 cm.

Artifacts recovered from this cultural level include 653 pieces of chipped stone debitage, three retouched flakes, two preforms, one bone knapping tool, one bone awl, a piece of cut wood, five pieces of fragmented cordage, and 261 complete or fragmented pieces of bone. The retouched flakes, preforms, bone awl and knapping tool are illustrated in Figure 10. A description of these artifacts may be found in Table 2. A breakdown of debitage by material type from levels 1 through 3 may be found in Table 3.

The high frequency of tertiary flakes (84.6 percent) and presence of a knapping tool suggests that tool manufacture and/or maintenance was a major activity associated with this occupation. Clear chert from the Cedar Mountain Formation represented 91.5 percent of the chipped stone artifact assemblage with the Morgan Formation brown (dendritic) cherts representing 6.75 percent. In addition, the presence of two preforms suggests that projectile points were being manufactured as well. A preform (Fig. 10, No. 12277) exhibits sharp squared corners at the base suggesting that the

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finished point would have had side-notches and possibly a basal-notch removed rather than corner-notches. The presence of various working edges represented on utilized and retouched flakes, and the bone awl suggests that hide and/or clothing preparation and/or maintenance was an activity associated with Cultural Component 1. Of the 261 pieces of complete or fragmented bone recovered from Cultural Component 1, 68 (25 percent) were burnt. Faunal analysis of the burnt and unburnt bone recovered in excavation levels 1 and 2 identified elements of mule deer (*Odocoileus hemionus*), desert cottontail (*Sylvilagus audubonni*), canyon mouse (*Promyscus crinitus*) and wood rat (*Neotoma* sp.). Included in the bone of Cultural Component 1 was a portion of a left maxillae and right mandible of a mule deer. The wear pattern exhibited on the tooth row of the deer maxillae suggests an age of 4.5 to 6.5 years of age for the animal. This estimation of age suggests a fall kill.

Feature 1 was a shallow basin firepit measuring 45 cm in diameter and varying from 5 to 10 cm in depth. The exterior edge of the firepit exhibited an orange to red band of oxidation varying from 2 to 6 cm in thickness. The fill of Feature 1 consisted of charcoal and charcoal stained earth. Macrofloral analysis of the firepit contents found that a large variety of both charred and uncharred remains were present. Most of the uncharred remains are also represented as charred remains in this feature. Evidence of both pine (*Pinus*) and juniper (*Juniperus*) is present, primarily in the form of seeds and stems. The presence of both *Pinus* and *Juniperus* seeds suggests that pine nuts and juniper berries may both

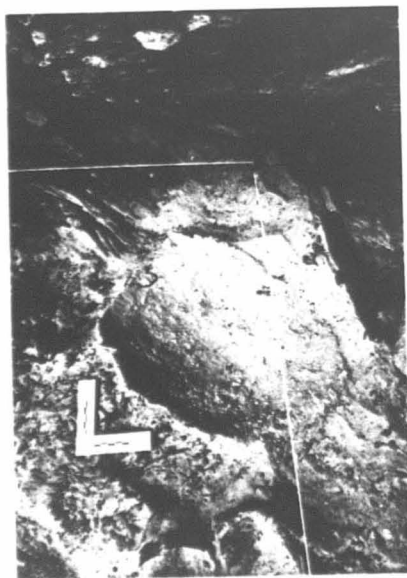


Figure 9. Unfired clay bowl uncovered in Cultural Component 1, (Excavation Units 9-10N, 8-9E), at Juniper Ledge Shelter 42UN1724

Table 2. Inventory and description of chipped stone, bone, and antler artifacts recovered from Cultural Component 1 at Juniper Ledge Shelter (42UN1724)

1. Gray quartzite retouched flake (single convex working edge), No. 12172.
2. Brown (dendritic) chert preform, No. 12173.
3. Black chert retouched tertiary flake (double convex working edge), No. 12174.
4. Brown (dendritic) chert retouched tertiary flake (typical end scraper and graver, double straight working edges), No. 12236.
5. Brown (translucent) chert utilized tertiary flake (double straight working edge).
6. Brown (dendritic) chert retouched tertiary flake (single concave/convex working edge).
7. Brown (dendritic) heat treated chert preform, No. 12277.
8. Dark gray chert preform base fragment.

Table 3. Breakdown of debitage by material type recovered from excavation levels 1 through 3 (surface to 99.85 cm), Excavation Units 8-10N, 8-10E, at site 42UN1724

MATERIAL TYPE	PRI	SEC	TER	SH	BTh	SPALL	TOTAL	%
CHERT:								
Clear	0	0	506	92	0	0	598	91.5
Brown (dendritic)	1	0	36	3	4	0	44	6.75
Gray	1	1	6	0	0	0	8	1.2
Milky White	0	1	1	0	0	0	2	.3
Maroon	0	1	0	0	0	0	1	.15
TOTAL	2	3	549	95	4	0	653	100.0
PERCENTAGES	.3	.45	84.15	14.5	.6	0		

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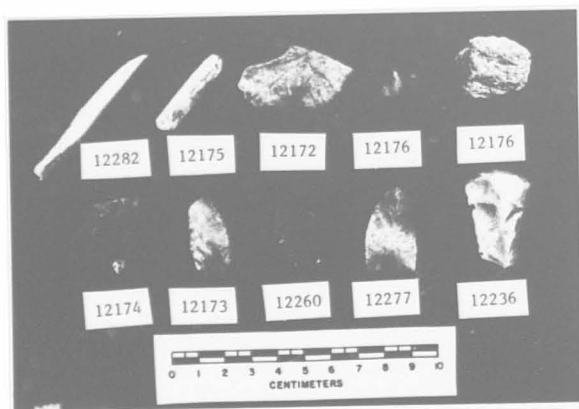


Figure 10. Cultural Component 1 artifacts recovered during excavation at Juniper Ledge Shelter 42UN1724, (Excavation Units 8-10N, 7.5-10E)

have been exploited as foods. Charred cactus (Cactaceae) spines were noted, suggesting that a cactus was processed in the feature. The composite seeds are also rare in the record and may be associated with either exploitation or accidental introduction. Recovery of Gramineae seeds as both charred and uncharred seeds may also suggest food processing activities. A single charred pea (Leguminosae) was also recovered, and may be present through food processing or accidental introduction. A single uncharred seed similar to members of both the four-o'clock (Nyctaginadeae) and evening primrose (Onagraceae) families was

recorded. Members of these families are common weeds, and its presence in the feature is most likely accidental.

The various species represented in the macrofloral remains recovered from Feature 1 would suggest a mid-summer to fall occupation for Cultural Component 1. All of the charcoal identified from this feature was *Juniperus*. A sample of charcoal from Feature 1 was sent to Beta Analytic Inc. to be radiocarbon dated. A radiocarbon date of 700±60 years B.P. (Beta-34324) was obtained. A radiocarbon recalibration age of A.D. 1280 resulted.

The pollen analysis from Feature 1 revealed a moderately large frequency of *Pinus* pollen (Appendix A, Tables 2 and 4) and indicated the proximity of pine to the rockshelter. Lesser quantities of fir (*Abies*), *Juniperus*, and *Pinus* pollen are noted. Betulaceae pollen is noted in Feature 1. The absence of Douglas fir (*Pseudotsuga*) pollen is not unusual, as *Pseudotsuga* is infrequently encountered in the pollen record even when it grows locally. Douglas fir is nearly absent from this area today.

Non-arboreal pollen noted in this record is dominated by sagebrush (*Artemisia*) in both features. Small quantities of Cheno-am, greasewood (*Sarcobatus*), low-spine and high-spine Compositae, Mormon tea (*Ephedra nevadensis*-type), grasses (Gramineae), Leguminosae, Onagraceae, *Opuntia*, beardtongue (*Penstemon*), Rosaceae, and nightshade or potato (Solanaceae) also indicate vegetation in the vicinity of this rockshelter. No pollen types were recovered in sufficient quantity to indicate subsistence activity. It is possible, however, that the *Opuntia* pollen recovered from Feature 1 might be present through exploitation of the prickly pear. No pollen from corn (*Zea mays*) or pumpkin (*Cucurbita pepo*) were identified. Additional information on macrofloral and pollen remains identified in Feature 1 at site 42UN1724 may be found in Appendix A.

Feature 2 was situated against the inside portion of a large sandstone rockfall block located in front of the shelter entrance (Fig. 6). Feature 2 consisted of a left maxillae and right mandible of a mule deer associated with charcoal and charcoal stained soil situated under a slab of sandstone. The

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feature was approximately 50 cm in diameter and 5 cm in depth and appears to be a rake off from a nearby firepit feature and/or a discard zone for the deer remains. The eastern portion of Feature 2 was covered by strips of juniper bark.

Feature 3 was only partially disturbed by the test excavation. Feature 3 was positioned between and to the north of Features 1 and 2 (Fig. 6). Feature 3 is a shallow basin firepit measuring, 60 cm (diameter) and 8 cm (99.96 to 99.88 cm) in thickness. Feature 3 exhibits a thin (3 cm) layer of ash and charcoal covering a thin (5 cm) layer of red oxidation (Figs. 5 and 11).

CULTURAL COMPONENT 2

Cultural Component 2 extends from 99.90 to 99.60 cm (elevation). Sediments consist of loosely to moderately compacted, tan to light brown sandy silt mixed with sticks, cactus spines, and rodent scat. The overall stratigraphic context of Cultural Component 2 was difficult to define horizontally and vertically. The cultural level appeared to have an undulating surface due to the presence of sandstone rockfall in two separate areas. In addition, rodent activity had disturbed the southern portion of the level, most likely causing much of the irregular cultural surface and dispersion of artifacts over 30 cm in depth.

The cultural level consisted of a firepit, Feature 4 (Figs. 6 and 11), and a concentration of cultigens (corn and pumpkin), Feature 5. Artifacts recovered include one preform, two retouched flakes, one piece of red ochre, 48 pieces of chipped stone debitage and 178 pieces of bone. The

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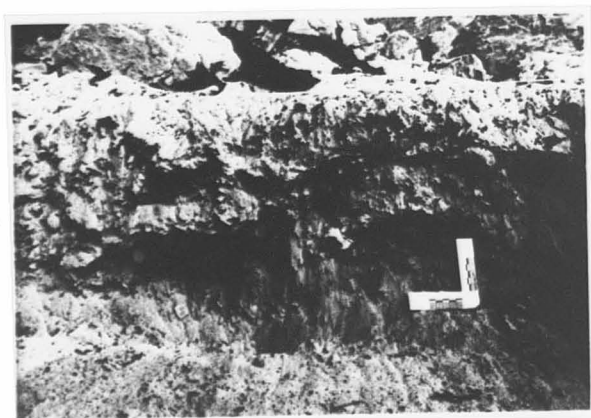


Figure 11. North wall profile, (Excavation Units 9-10N, 9-10E), view of Features 3 and 4 with juniper tump line strap visible below Feature 4

chipped stone debitage recovered during excavation of levels 3, 4, and 5 are similar in material type to the debitage recovered in excavation levels 1 and 2. The chipped stone tools, preform, debitage and red ochre recovered during the excavation of levels 3, 4, and 5 are considered to be associated with Cultural Component 1 because of three observations: 1) there was some mixing of materials due to the unit walls caving and slumping in, 2) rodent activity may have displaced much of the debitage, and 3) the frequency of chipped stone artifacts (Fig. 4) decreases from the surface to bedrock (99.40 cm).

Of the 178 complete or fragmented pieces of bone, 128 (80 percent) were unburnt and 50 (20 percent) were burnt. Faunal analysis of the burnt and unburnt bone identified elements of mule deer, desert cottontail, and mouse. The frequency and type of bone recovered from excavation levels 3, 4, and 5 are similar to the bone assemblage recovered from excavation levels 1 and 2. Due to this similarity and the concentrated frequency of burnt and unburnt bone in vertical context (Table 2), the bone from excavations levels 1 through 5 are suspected of being contemporaneous and associated with Cultural Component 1. The bone represented in excavation levels 3, 4, and 5 may have settled through the loosely compacted sediments in the shelter, and/or were displaced by rodent activity.

Also recovered was a fragment of a one rod and bundle stacked foundation coiled basket which measured 10.8 cm (l), 1.0 cm (w) and a .2 cm (th), (Fig. 12). The basket fragment was located adjacent to the western edge of Feature 4. Grasshopper pieces/parts

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and a burnt insect/larva (Fig. 13), fibers, and cordage made from rodent hair (Fig. 14), flax (*Linum* sp.) (Fig. 15), and one stalk fragment from a horse tail rush (*Equisetum* sp.) were recovered from excavation levels 3, 4, and 5, Units 8-10N by 8-10E at site 42UNI724. The threads and cordage recovered from Cultural Component 2 exhibit a single Z-twist and/or 2 or 3 ply, Z-twist and S-spun manufacture.

Feature 4 was only partially excavated. A little less than half of the feature still remains to the north of the excavation block. Feature 4 is a shallow basin measuring 80 cm in diameter and 15 cm (99.83 to 99.68 cm) in depth and was situated 3 to 5 cm directly under Feature 3 (Fig. 6). Feature 4 exhibits a thin (1 to 3 cm) band of ash overlying a small concentration of charcoal in the center of the feature. Underlying the ash and charcoal is a large thick (8-9 cm) band of red oxidized silty sand which constitutes 80 percent of the feature (Figs. 5 and 11). A charcoal sample was collected from the center of Feature 4 and sent to Beta Analytic, Inc. for radiocarbon dating. A date of 1110 ± 50 years B.P. (Beta-34325) was obtained. A radiocarbon recalibration age of A.D. 944 resulted. This places the occupation for Cultural Component 2 approximately 328 years before that of Cultural Component 1.

The macrofloral analysis of Feature 4 indicated that it contained evidence of both *Juniperus* and *Pinus* although no pine seed fragments were recovered. This record suggests that perhaps only juniper berries were processed. Both charred and uncharred cactaceae spines were observed suggesting that they may have been present



Figure 12. Tanned leather stained with red ochre (No. 12263) and fragment of basket (No. 12199) recovered adjacent to Feature 4 (Excavation Units 9-10N, 9-10E), at site 42UN1724

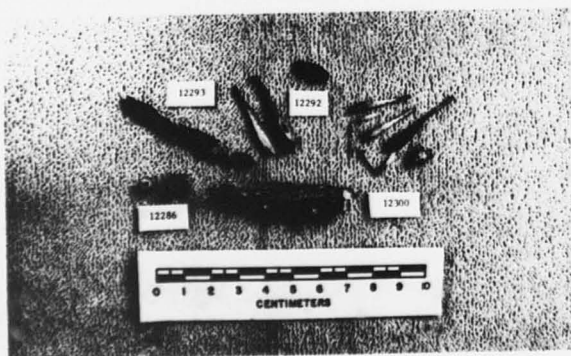


Figure 13. Grasshopper pieces/parts (Nos. 12286, 12293, 12300) and a burnt insect/larva (No. 12292) recovered from Feature 4 (Excavation Units 9-10N, 9-10E), Cultural Component 2 at site 42UN1724

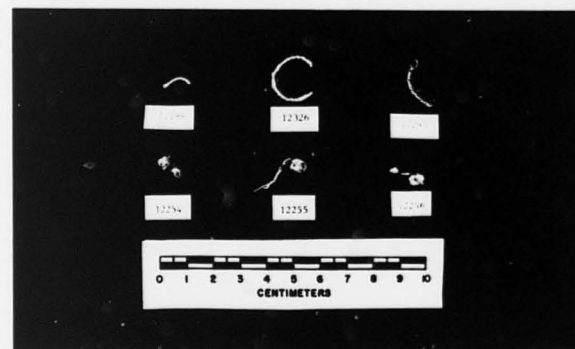


Figure 14. Thread and cordage made from unidentified rodent hair recovered from levels 3, 4, and 5 (99.90-99.60 cm), (Excavation Units 8-10N, 8-10E), Cultural Component 2 at site 42UN1724

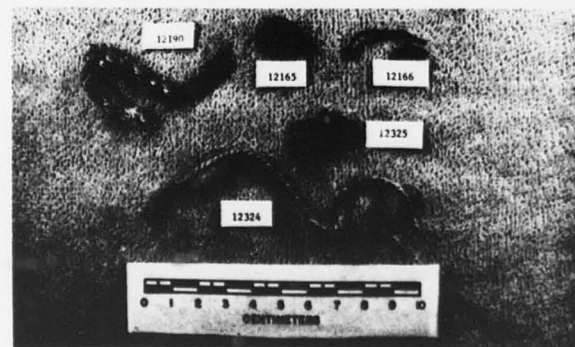


Figure 15. Thread and cordage made from Flax (*Linum* sp.) recovered from levels 3, 4, and 5 (99.90-99.60 cm), (Excavation Units 8-10N, 8-10E), Cultural Component 2 at site 42UN1724

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through food processing activities. The hedgehog cactus (*Echinocactus*) seeds and seed fragments were also recovered, suggesting that these seeds were processed. Mountain mahogany (*Cercocarpus*) seeds and leaves were present in Feature 4, as they were in Feature 1. Chenopod seeds, however, were much more abundant in Feature 4, and definitely suggest food processing activities. Compositae seeds are represented by only a few uncharred pappus fragments, which may be present either through food processing activities or accidentally. A small quantity of charred and uncharred mustard (Cruciferae) seed fragments suggests that mustard seeds may also have been processed in this feature. Charred, probably wild, buckwheat (*Eriogonum*) seed fragments may also represent food processing activities. Gramineae is represented by charred seeds, as well as uncharred seeds and other parts. The presence of the charred grass seeds in particular points to food processing activities. Charred Malvaceae seeds were also noted, and may be present through food processing activities. Prickly pear cactus (*Opuntia*) seed fragments and an embryo were recovered as uncharred remains and might be present through food processing activities. Alternatively they may have been introduced either at the time of occupation or later as a contaminant. The charred elderberry (*Sambucus*) seeds are probably present through food processing activities (Appendix A, Table 3).

Charcoal in Feature 4 was diverse. A diffuse porous charcoal similar to cottonwood and aspen (*Populus*) was the most common. *Pinus* was the subdominant type, and *Juniperus* was the least abundant

type of charcoal present. The charcoal indicates use of a variety of fuel types.

Feature 5 (Fig. 16) is a small discard/trash pile placed between two rocks, consisting of corn cobs and fragments, and remains of one pumpkin. There was no indication of whether the discarded cultigens were placed in a pit. Feature 5 measured approximately 25 cm in diameter and was situated between a large sandstone slab and the inside portion of one of the large sandstone rocks in front of the shelter. Due to erosion and rodent activity corn cobs were found scattered to the southwest along a sandstone rock to elevations of 99.50 cm.

All cobs recovered and associated with Cultural Component 2 are uncharred and contain no kernels. One of the cobs (Fig. 17, No. 12323) is impaled on a stick. Another cob (Fig. 17, No. 12322) has a hole in the base suggesting that it, too, may have been on a stick. Winter (1973) notes several of the Fremont cobs he examined were impaled on a stick. Three of the five cobs have variable numbers of rows. One cob has 14 rows, one has twelve, two have 10 rows, and the fourth is 8-rowed. All cobs except the 8-rowed cob are wider at the base and taper toward the tip, a characteristic of Fremont cobs. The 8-rowed cob is narrower at the base than the mid-section, which is typical of 8-rowed "Mais de Ocho" and Chapalote cobs pictured in Winter (1973:449). Eight-rowed cobs are noted to be more common in Anasazi sites, mixing with Fremont populations less often in northern Utah than in southern Utah (Winter 1977:106). Only one of the five recovered cobs was the typical 14-rowed Fremont dent type. As

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Figure 16. Feature 5 (Excavation Units 8-9N, 8-9.SE) and the concentration of corn cobs (*Zea mays*) and pumpkin (*Cucurbita pepo*)

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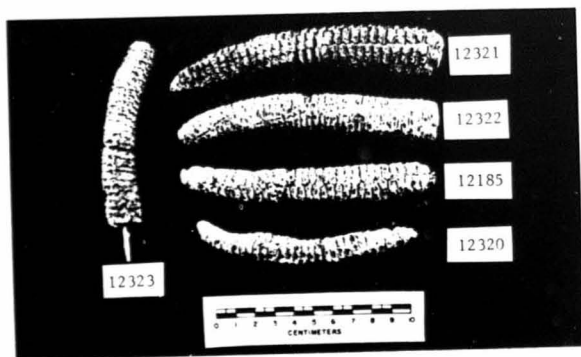


Figure 17. Corn Cobs (*Zea Mays*) recovered from Feature 5, (Excavation Units 8-9N, 8-9.5E), Cultural Component 2 at site 42UN1724

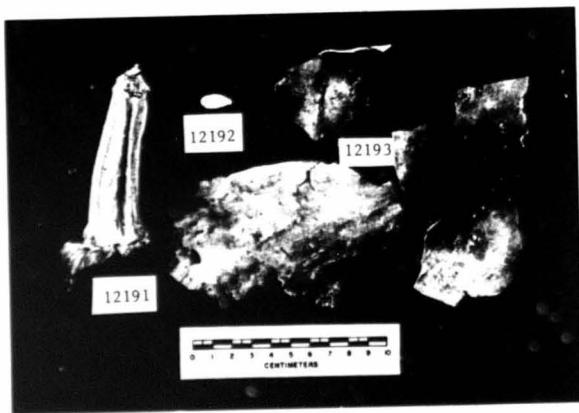


Figure 18. Pumpkin (*Cucurbita pepo*) recovered from Feature 5 (Excavation Units 8-9N, 8-9.5E), Cultural Component 2 at site 42UN1724

previously noted, two of the five cobs had been impaled on sticks, a trait common in the Fremont culture. The recovered corn is most similar to Fremont dent.

Feature 5 also contained a peduncle or stem of *Cucurbita pepo* and a seed identified to *Cucurbita pepo* (Figs. 16 and 18). The peduncle compares favorably with *C. pepo* peduncles reported by Gasser (1981). The stem, seed, and rind fragments represent a single pumpkin or squash. The cellular structure of the rind was examined and compares most favorably with *Cucurbita* sp. (Gasser 1981:63).

CULTURAL COMPONENT 3

Cultural Component 3 extends from 99.60 to 99.40 cm. Sediments consist of a loosely to moderately compacted, tan to light brown sandy silt mixed with sandstone rock, sticks, cactus spines, and rodent scat. The overall stratigraphic context of Cultural Component 3 was difficult to define vertically and horizontally. The cultural level appeared to have an undulating surface due to the presence of sandstone rock fall. In addition, rodent activity had disturbed the level causing much of the irregular dispersal of artifacts.

Cultural Component 3 consisted of a juniper tumpline and burden basket (Fig. 19), 187 kernels of corn, five corn cobs, two fragments of horse tail rush, two complete grasshoppers, four grasshopper legs, and two fragments of juniper bark cordage. Also recovered was a piece of a tanned leather strap stained with red ochre measuring 11.8 cm (l), 1.4 cm (w) and 0.12

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cm (th) (Fig. 12). Sixteen pieces of chipped stone debitage were also recovered from Cultural Component 3. However, it is most likely that the chipped stone debitage came from a higher component due to caving and slumping in of unit walls during excavation.

The remnants of a loosely woven juniper bark burden basket and tumpline were recovered from this level. The basket measured 58 cm in length, 39 cm in width and was orientated north-south. The basket exhibited a coarse elongated bag loosely woven with open simple and diagonal twining interlocking weave of long strips of bark vertically and horizontally with a Z-twist weft (Adovasio 1986). The tumpline strap was attached to the main basket body. The strap exhibited a Z-twist cordage interlocking stitch on either side of a 7 to 10 cm wide strap of horizontal strips of juniper bark (Figs. 20, 21, and 22). The upper portion or lip of the basket was lined with grass. The basket was in relatively poor condition, a portion of it having been removed and repositioned to the west by rodents. A piece of the juniper from the basket was sent to Beta Analytic Inc. for radiocarbon dating. A date of 2330 ± 80 years B.P. (Beta-34326) and a recalibrated age of 399 B.C. resulted.

In direct association, positioned in the bottom of the basket were 104 kernels of corn (*Zea mays*) (Appendix A). These corn kernels were submitted to PaleoResearch Laboratories for analysis and resulted in being identified as Fremont dent. All of the submitted kernels were measured (Appendix A, Table 5). A sample of the corn kernels was submitted to Beta Analytic Inc. for

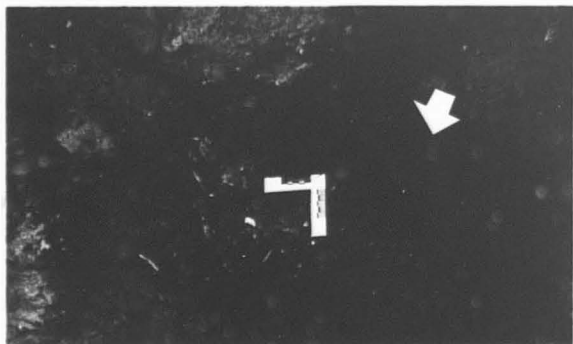


Figure 19. Loosely woven juniper bark burden basket in situ; basket straps at top of photo trending into north wall. The arrow points to location of corn kernels



Figure 20. Portion of juniper basket strap (No. 12250)



Figure 21. Portion of juniper basket strap (front view)

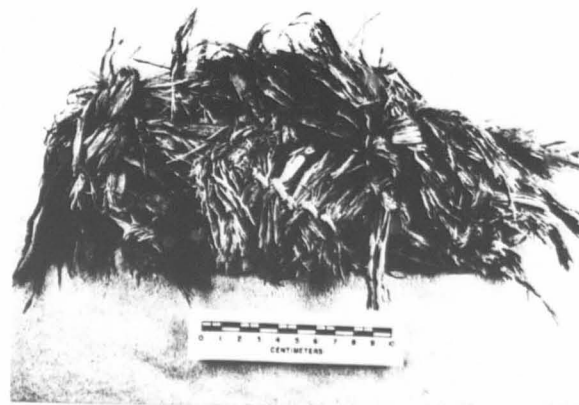


Figure 22. Portion of Juniper basket strap (back view)

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radiocarbon dating. An age of 1650 ± 80 years B.P. (corrected for isotopic fractionation) (Beta-36605) and a recalibration age of A.D. 408 resulted. The kernels of corn exhibited no modification through rodent gnawing and/or chewing, and no evidence of rodent burrowing activity was noticed in the area of concentration.

HUMAN REMAINS

The burial at site 42UN1724 is a prehistoric primary inhumation of an American Indian middle aged (30 - 40 years) female of unknown biological affinity. The burial is apparently situated between the back wall of the rockshelter and several large sandstone blocks, which have fallen from the roof or wall of the shelter (Fig. 23) (Truesdale 1989). A human 3rd cervical vertebra was located on the surface eroding from a rodent burrow which extends back into an opening between two sandstone blocks. The vertebra exposed on the surface shows signs of weathering (bleaching, dry bone breaks and splintering).

Only one additional human bone was recovered during the excavation. A complete right radius was located between 8.361 m N, 7.5 m E and 8.575 m N, 7.479 m E at an elevation of 99.77 cm. The distal end of the radius was pointing 175 degrees southeast and dipping slightly to the south at approximately 5 degrees. The radius was situated on its medial side. The radius exhibits weathering (bleaching, dry bone breaks), and is beginning to splinter.

Sex determination was made by examining and observing features on the radius (robusticity and length). One of the most

obvious sex differences in long bones is that typically male bones are longer and more "massive" than typically female bones. The radius recovered at Juniper Ledge Shelter is clearly a female as it is small and lacks robusticity. Using Krogman (1962), the maximum length (212.5 mm) of the radius falls into the range for females. Age is set between 30 and 40 years based upon arthritic lipping on the body of the cervicle vertebrae and lack of arthritic abrasions on the radius. Race is assigned to American Indian as the radius was located below Cultural Components 1 and 2.

A living stature of 5 feet 1 inch has been calculated from the maximum length (212.5 mm) of the radius, according to the most accurate Trotter formula for female Caucasoids (Krogman 1962; Trotter 1970). The particular formula used (Caucasoid) produces the greatest internal consistency for Northwestern Plains Indian females as demonstrated in an earlier, more complete, analysis of long bone proportions (Gill 1976). The formulae of Genoves (1967), developed from a skeletal series of Central American Indians, are frequently utilized by human osteologists working with North American Indian populations, but these produce especially unreliable results for specimens from the Rocky Mountain area. Therefore, the applicable Genoves formula was not applied in this case.

The two human skeletal elements appear to have been dislodged from their original position by rodent activity, and it is expected that the remainder of the burial is in the shelter. Since no burial feature was found, it is difficult to define its associated attributes. However, some attributes can be

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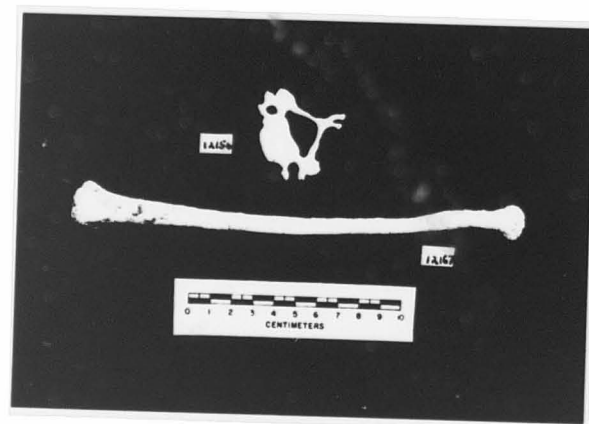


Figure 23. Human remains recovered from Juniper Ledge Shelter

deduced through reason. The primary landform and position is a canyon and an alcove. The vehicle of disposal is unknown, however, it is most likely that the burial is a simple primary interment of a female placed in a prepared area, possibly a pit, between the rockfall and the back wall of the shelter. There was no evidence of body preparation, degree of flex, position of arms, rotation of head, or deposition of the

individual (Truesdale 1987). In addition, there is no indication with which cultural component at Juniper Ledge Shelter the burial is associated. It is the author's opinion that the burial most likely dates earlier than Cultural Component 2 and may be associated with Cultural Component 3. However, the burial may represent a fourth component at the site.

DISCUSSION AND CONCLUSIONS

CULTURAL COMPONENT 3

Near the beginning of the Christian era, a number of technologies attributed to the Uinta Fremont lifestyle (horticulture with corn, beans, and squash, and the bow and arrow) were introduced to the Late Archaic cultures on the Northern Plateau (Creasman 1981; LaPoint et al. 1981; Weber et al. 1977) and inter-mountain basins of the Rocky Mountains (Armitage et al. 1982; Breternitz 1970; Leach 1970; Schroedl 1985; Sharrock 1966; Smith and Creasman 1988; Truesdale 1989, 1990). When the actual emergence of corn horticulture as far north as the Uinta Basin began is unknown. However, archeological data suggest a mixture of horticulture, hunting, and gathering appeared around A.D. 100-200 and inspired a very well planned and subsequent intensive strategy of seasonal (winter) sedentism and early summer to fall habitation of the steep canyons of the Green and Yampa Rivers of Dinosaur National Monument (Truesdale 1989, 1990).

Evidence has been accumulating for the presence of preceramic horticulture in the Southwest. Much of the discussion on the topic concerns the presence and antiquity of corn (Berry 1982; Ford 1981; Minnis 1985; Wide and Newman 1989), and the development and spread of specific varieties (Upham et al. 1987). Recently obtained radiocarbon dates on corn remains, as well as corn-associated dates from other sites in southern Arizona (Doelle 1985; Fish et al. 1986; Huckell 1984; Martin 1963), and northwestern Arizona (Janetski and Wilde

1989) suggest that horticulture was established in the region prior to the time of Christ. In addition, evidence from northwestern New Mexico (Simmons 1986), northeastern Arizona (Bentacourt and Davis 1984) and central Utah (Wilde and Newman 1989) indicate the practice was widespread in the northern Southwest during the Late Archaic period 2,000 to 3,000 years ago. Winter (1973) notes that dent corn may have been transported from Mexico through western Arizona into southwestern Utah, then diagonally up the Green River Valley. Alternatively, the Fremont dent may have evolved in place from a primitive form of pop or flint corn and maize with "relatively high amounts of Teosinte germ plasm" (Winter 1973:450).

The earliest cultural level (Cultural Component 3) at Juniper Ledge Shelter is represented by a tumpline and burden basket made from juniper bark which radiocarbon dated to 2330 ± 80 years B.P. (399 B.C.) (Beta-34326). Associated in the basket were 104 kernels of *Zea mays*. The results of the 2330 ± 80 years B.P. radiocarbon date initially suggested that the corn associated with the burden basket could be the oldest reported Fremont dent corn. The open simple and diagonal twining interlocking weave, and the Z-twist weft of the basket recovered at Juniper Ledge Shelter is similar in construction technique and material type to recorded Archaic baskets recovered in the Great Basin (Adovasio 1986).

The 2330 years B.P. (399 B.C.) age would be the oldest date for corn in Utah and would further support the presence of corn in the late Archaic. In addition, these data would suggest that horticulture was practiced as far north as the Utah/Wyoming border several centuries before the introduction of ceramic technology. The possible antiquity of the corn, situated as far north as the Jones Hole area of northeastern Utah, required a second radiocarbon sample, preferably from the corn kernels. A sample (15 grams) of the 104 corn kernels associated with the burden basket was sent to Beta Analytic Inc. for radiocarbon dating. A C12/C13 recalibration of the date resulted in an age of 1650 ± 80 years B.P. (A.D. 408) (Beta-36605).

The differences in radiocarbon ages in Cultural Component 3 initiated numerous long conversations with the staff at Beta Analytic Inc. Conclusions from these conversations and a search of the archeological literature were that both dates are reliable for each sample. It is unlikely that the basket was made earlier (399 B.C.) and then found and reused 800 years later (A.D. 408). In addition, no evidence of rodent gnawing on the corn kernels or burrowing around the basket suggested transportation of the corn to its discovered context.

Creel and Long (1986) discuss how corn has seen little use in radiocarbon dating, because it acquired a reputation for giving young dates. Creel and Long (1986) state the basic reasons for this reputation are twofold: (1) the extent of isotopic fractionation in corn, and (2) frequent lack of agreement among dates on corn and other materials from the

same archeological context. Researchers have found that much of the apparent age error in corn carbon-14 dates resulted from isotopic fractionation. Corn (*Zea mays*) is one of many grasses that select proportionally more radioactive carbon during photosynthesis than virtually all woody plants (Bender 1968; Browman 1979; Hall 1967a, 1967b; Lowdon 1969). This fractionation of C-14 is exactly predictable from measurements of the stable carbon isotope ratio, C-12/C-13, routine in most radiocarbon dating laboratories. The 1650 ± 80 years B.P. corn date in Cultural Component 3 at Juniper Ledge Shelter is a C-12/C-13 calibrated age. Creel and Long (1986) studied radiocarbon dating of corn and concluded that a potential sample should not be eliminated for dating merely because it is corn.

When there is a discrepancy in radiocarbon dates from samples in such direct association with each other, such as the burden basket and corn in Cultural Component 3, the researcher must reiterate to himself the often-made admonition of understanding the relationship between the event (when the corn was grown) vs. the feature (burden basket) being dated, and the sample intended for radiocarbon dating. In the terminology, Dean (1978) concludes that one should recognize the potential difference between the "dated event" and the "target event." The dated event is the event that is actually dated by chronometric technique while the "target event" is that to which the date is to be applied. Creel and Long (1986) conclude that a corn C-14 date not only gives an accurate approximation of the sample's true age, but also can indicate the time of the "target event" at least as confidently as other

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sample types. Therefore, a greater confidence and reliability upon the 1650±80 years B.P. (A.D. 408) corn date from Cultural Component 3 at site 42UN1724 is favored.

An age of A.D. 408 is an earlier date for corn in northeastern Utah and the Uinta Basin than previously recorded (Ambler 1966; 1969; Truesdale 1989, 1990). It has been proposed that by A.D. 400 to 500 limited numbers of ceramic vessels accompanied by maize began to appear in Utah (Aikens and Madsen 1986), and by A.D. 800 corn/beans/squash horticulture was widespread in the northern Colorado Plateau and the Uinta Basin (Marwitt 1970, 1986). Anderson (1948:92) states that corn samples from Mantle Cave appear to have grown in the area for a considerable period of time because of their mature, classic appearance. All ears are evenly tapered and have 16 or more rows and heavily dented kernels. If the Mantle Cave Specimens were less well-developed, the maize could be considered a recent introduction. Because most varieties of maize are closely adapted to the length of day in their own latitude, if they were moved north it would take a number of generations before they became fully adapted to their new habitat (Anderson 1948:92). Data from Juniper Ledge Shelter in Cultural Component 3 suggest that corn was introduced into the Uinta Basin and the Green and Yampa River canyons before A.D. 408 and very possibly during Late Archaic times.

CULTURAL COMPONENT 2

The Uintah Fremont culture developed in a geographically isolated area of considerable

environmental diversity from an Archaic base that had become regionally sedentary and specialized (Truesdale 1989, 1990). If agriculture developed out of non-agricultural Archaic people then it seems reasonable to suppose that it arose to solve an environmental and/or population problem that they were facing. Binford (1983) discusses "packing" a region with people and concludes, that as population continues to grow in an environment that offers no continual options, demand increases within a space that is now constrained, and some form of intensive production system such as agriculture becomes mandatory. It appears that the Archaic people in the Uinta Basin were fairly sedentary, possibly due to the plentiful faunal, floral, and tool stone resources available. Binford (1983:200) draws a conclusion from a similar type of lifestyle and terms this the "Garden of Eden Proposition" and the "Slug Principle." Truesdale (1990) suggests that the interior canyons of the Yampa and Green Rivers and surrounding environs were occupied throughout most of the year by Late Archaic peoples and later by the Fremont to acquire faunal, floral, and tool stone resources, and replenish supplies diminished in the villages during the winters. Binford (1983:202) suggests that a rich environment, much like the Uinta Basin and the interior environs of the Green and Yampa River canyons, encourages sedentism. Sedentism, in turn, is seen as encouraging production intensification or experimentation with ways of producing sufficient food in the limited space around a permanent settlement (hence, agriculture).

It is difficult to characterize a uniform set of attributes of a single cultural adaptation

pattern as broadly characteristic of Fremont, setting it off from both the Archaic hunting/gatherer foraging cultures and the similar Shoshonean cultures that followed. The Uintah Fremont never developed horticulture and sedentary villages as their neighbors in the prehistoric southwest (Marwitt 1986). However, strong evidence for year round sedentism has been suggested through rock art studies in Dinosaur National Monument (Appendix C). Fremont village sites have been recorded in the Uinta Basin (Ambler 1966; Marwitt 1970; Blaine Phillips 1990, personal communication) and in Dinosaur National Monument (Breternitz 1970; Leach 1966; Truesdale 1989, 1990).

Hunting and gathering appears to have remained an important economic activity of the Fremont groups during the entire span of their culture. Wood (1968) suggests that there is no reason why hunting parties would not originate in large permanent agricultural settlements miles away from the hunting grounds. This appears to have been especially true for the Fremont groups who occupied the steep canyons of the Green and Yampa Rivers of Dinosaur National Monument from A.D. 100 to 1250 (Leach 1970; Truesdale 1989, 1990) and adjacent areas (Truesdale 1986; McKibbin 1992). Cultural Component 2 at Juniper Ledge Shelter offers some insight to the environmental adaptation and subsistence economy of the Uintah Fremont through seasonal utilization of a secondary canyon of Ely Creek in the Green River canyon at A.D. 944.

Cultural Component 2 consisted of a shallow basin firepit (Feature 4) radiocarbon dated to an age of 1110±50 years B.P. or A.D.

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944 (Beta-34325). Feature 4 contained Juniper, *Pinus*, and *Populus* charcoal, and thirteen varieties of charred and uncharred wild plant species (Appendix A). In addition, Feature 4 contained dried grasshopper pieces/parts and one burnt insect larva. Cuitigens recovered from a discard pile (Feature 5) included a peduncle or stem of *Cucurbita pepo* and a seed identified to *Cucurbita pepo*. The peduncle and cellular structure compares favorably with *C. pepo* reported by Gasser (1981:63). In addition, five corn cobs were recovered from Feature 5. The corn cobs recovered are most similar to Fremont dent.

Binford (1983:210) indicates that mobility is restricted when a region is packed with people and resource exploitation becomes concentrated. In addition, mobility can be restricted voluntarily through the introduction of a new food stuff (Binford 1992, personal communication). Packing, in fact, is considered a hinderance upon the normal strategy of hunters and gatherers, and may have also hindered the adaptation strategy of the Uintah Fremont. A characteristic of "packing" is significant change in terms of the kinds of areas and/or resources utilized, and may be represented by data obtained from Cultural Component 2 and 1 at Juniper Ledge Shelter. Materials recovered in Cultural Component 2 indicate an adaptation utilizing secondary canyons of the Green River seasonally for growing corn and pumpkin, and gathering a variety of wild plants and insects. The Fremont who formerly killed deer and mountain sheep and put up the meat for storage may have been progressively forced to move to a heavier reliance on agriculture, maximizing all available suitable space to grow corn, beans,

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and squash, while continuing to forage and gather for wild plants and small faunal resources such as grasshoppers.

Grasshoppers are a quality food source with an energy value of 3,010 Cal/kg (Madsen and Kirkman 1988; Jones and Madsen 1989) and may have been utilized as a supplemental rather than a major food source while occupying the Ely Creek area.

Small garden plots are suspected of being placed in peripheral side canyons and in many of the small alcoves which contain continual water resources through seeps (Truesdale 1990). These small garden plots could be maintained while gathering rounds took place in the Ely Creek area. The presence of certain mature wild plant species and cultigens would suggest a specific seasonal occupation for Cultural Component 2 between early summer to mid-fall. During this season items were gathered for food, as well as, for the manufacture and maintenance of textiles (threads, cordage, basketry, clothing). Data suggest that corn and pumpkin were consumed during the occupation of Cultural Component 2 at site 42UN1724.

CULTURAL COMPONENT 1

The ultimate fate of the Fremont has been discussed and debated (Aikens 1966, 1972; Husted and Mallory 1967; Liestman 1985; Simms 1990; Wright 1978), but has not yet been resolved.

Hardesty (1977) contends that as "shifting farming" cultures search for soils containing materials built up by an "equilibrium community," they as domesticated

opportunists feed upon this supply until it is exhausted. The habitat is then allowed to experience succession, reestablishing materials cycles, so that it can be reused.

The Uintah Fremont appear to have had such a situation utilizing the moist mineral rich soils in seeps of the Ely Creek/Jones Hole canyon area. This type of strategy may have been an adaptation that occurred through "packing" of Fremont in the area. As the "equilibrium community" of the Ely Creek/Jones Hole area was depleted of minerals in the soils, the use of the area must have changed. This process may have occurred several times over the 1000+ years of Fremont occupation in the Uinta Basin.

In the Dolores Canyon region an extended series of droughts circa A.D. 900 to 1250 has been reported (Peterson 1986). These droughts may also have affected the Uinta Basin and the horticultural subsistence portion of the Fremont life style. Liestman (1985) states that climate in the Dinosaur area became drier at about A.D. 1000 and that by A.D. 1225 a full scale drought was in effect.

Thus, the Fremont may have had to abandon their sedentary lifeway and rely more on hunting and gathering as their Archaic ancestors once did. Due to a shorter growing season in this region, the cultural transition to hunting and gathering may not have been as traumatic for the Uinta Basin Fremont as it was for their southern and western Fremont neighbors who were almost totally dependent on maize agriculture. Archeological data from Juniper Ledge Shelter Cultural Components

Discussion and Conclusions

1 and 2 indicate the use of the Ely Creek/Jones Hole area at this time of significant environmental and climatic shift.

Cultural Component 1 at Juniper Ledge Shelter consisted of a series of firepit features surrounded by a prepared floor with strips of juniper bark and an unfired clay bowl. Artifacts associated with Cultural Component 1 include eight chipped stone and two bone tools, 697 pieces of chipped stone debitage, and two pieces of red ochre. A firepit (Feature 1) yielded a radiocarbon date of 700 ± 60 years B.P. (A.D. 1280). The macrofloral analysis from the fill of Feature 1 indicated the use of ten various wild plants species possibly consumed and/or processed during the occupation and the use of four different plant species for fuel. A discard pile (Feature 3) contained the remains of a mule deer. In addition, burnt and unburnt bone representing mouse, ground squirrel, rabbit, and deer were recovered from Cultural Component 1. Cultural Component 1 is considered to be associated with the Late Uintah Fremont who were beginning to feel the impact of climatic change and the cultural ecologic

behavioral split of horticulture and hunting/gathering in the area. Pollen analyses from Feature 1 (Cultural Component 1) and Feature 4 (Cultural Component 2) indicate that the floral environment of Ely Creek/Jones Hole area did not change over 400 years. However, the postulated droughts at this time and the depletion of mineral resources in the soil may have affected the cultigens grown by the Fremont. This may be evident at Juniper Ledge Shelter by the presence of cultigens in Cultural Component 2, and lack of cultigens and increase use of faunal resources in Cultural Component 1. The presence of certain mature wild plant species and the remains of a mature deer suggest a specific seasonal occupation for Cultural Component 1 between late spring to fall. The preparation of the juniper bark floor, the placement of the clay bowl on the juniper near the back of the shelter and the variety of chipped stone debitage suggests a rather lengthy occupation with several types of subsistence activities occurring. This type of intensive preparation of a site for long-term utilization was not new to the Fremont lifestyle.

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Appendix A

**Analysis of Fremont Paleobotanic Materials at
42UN1724
Dinosaur National Monument**

**By
Linda Scott Cummings**

45

INTRODUCTION

Individual remains of corn and squash were submitted for analysis from an Archaic/Fremont site (42UN1724) at Dinosaur National Monument. In addition, two pollen and two macrofloral samples were also examined. This analysis focused on identification and description of the cultigens, and the relation of the corn to previously reported Fremont corn populations in Utah. Examination of the pollen and macrofloral samples was aimed at identifying any other subsistence items from Features 1 and 4.

METHODS

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10 percent) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. Zinc bromide (density 2.0) was used for the flotation process. The samples were mixed with zinc bromide while still moist, immediately after centrifugation to remove the dilute hydrochloric acid and water. All samples received a short (10 minutes) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for three minutes to remove any extraneous organic matter. A

light microscope was used to count the pollen to a total of 100 to 200 pollen grains at a magnification of 430x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the actual introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. A "T" on the pollen diagram indicates that the pollen type was observed outside the regular count while scanning the remainder of the microscope slide.

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

The macrofloral samples were floated using a modification of the procedures outlined by Matthews (1979). One liter of sample was floated in approximately 3 gallons of water. The sample was stirred until a strong vortex formed, which was allowed to slow before

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pouring the light fraction through a 150 micron mesh sieve. Additional water was added and flotation process repeated until all visible macrofloral material was removed from the sample (a minimum of three times). The floated portion was then dried and passed through a series of graduated screens (US Standard Sieves with 4 mm, 2 mm, 1 mm, and 0.5 mm openings) to separate charcoal debris and to initially sort the seeds. The contents of each screen were then measured and examined. The material which remained in the 2 mm, 1 mm, and 0.5 mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, while a portion of the finest material, which passed through the 0.5 mm sieve, was examined under a magnification of 20x. Estimates of seed fragment frequencies were calculated from recovery of remains during the sort of a portion of the finest fraction and are represented in the macrofloral table by an asterisk (*). Macrofloral remains were identified using a binocular microscope at magnifications of up to 40x. The coarse fraction was water screened, dried, and examined for macrofloral remains. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules.

DISCUSSION

The Juniper Ledge Site (42UN1724) is located in Dinosaur National Monument. This rockshelter contained several occupational levels and several features. The occupational levels included a Late Archaic or early Fremont occupation, radiocarbon dated to 2330 B.P., overlain by a Fremont occupation radiocarbon dated to 1110 B.P., overlain by a later Fremont or

Numic occupation dating to 700 B.P.

Feature 1 was collected from the later Fremont occupation, dating to 700 B.P., which may be Numic and associated with the Shoshone migration. This feature contained a large quantity of bone. The level associated with this feature contained juniper bark on the floor. An unfired clay bowl and hundreds of chipped stone flakes were also recovered.

A review of ethnobotanical literature describing uses for plants represented in the macrofloral and pollen samples provides evidence of exploitation, in historic times, both by broad categories, such as greens, seeds, roots, and tubers, and by specific example, i.e., seeds parched and ground into meal which was formed into cakes and fired in grease. Repetitive evidence of the exploitation of resources indicates a widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. The ethnobotanic literature serves only as a guide indicating that the potential for utilization existed in prehistoric times--not as conclusive evidence that the resources were used. Pollen and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, become indicators of use. Plants that are reviewed include Juniperus, Pinus, Cheno-ams, Compositae, Cruciferae, Eriogonum, Gramineae, Malvaceae, Cactaceae including Opuntia, and Sambucus.

Juniperus berries were exploited ethnohistorically as a source of both food and medicine, while the wood was used as fuel and a construction material. Juniper

berries are an abundant crop and available into the winter. Gallagher (1977:28-29, 122) notes that juniper berries were an important food for the Apache. The berries were eaten fresh, boiled, pounded to form a kind of bread, or soaked and pounded to make a liquid drink. Goodwin (1935:62) also notes that juniper berries were a staple for the Apache. Smith (1974) reports that the northern Utes rubbed juniper berries with a mano to separate the seeds from the pulp. The pulp was then either eaten fresh or dried and ground on a metate. Harrington (1967:242-244) and Rogers (1980:18) note that the Rocky Mountain and high plains juniper berries were collected in the late summer or fall and may have been eaten raw or cooked (boiled or roasted). Dried berries were stored for winter use, when they may have been ground into meal and used to make mush, cakes, or a beverage. The berries may also have been used to flavor meat (Angell 1981:96; Harrington 1967:242). Juniper berries are also used to make a concoction for use as a medicine (Densmore 1974; Gilmore 1977). The Gosiute used juniper both as firewood and as a construction material. Smaller juniper branches, as well as grass, were used as a covering on the floor, while juniper bark was used as thatching for winter lodges. Bark was also used to line pits where dried fruits were stored (Chamberlin 1964:372).

Pinus nuts, particularly pinon pine nuts, are noted to have been widely exploited ethnohistorically. The nuts were harvested in the fall or early winter, and a bumper crop was expected approximately every seven years (Harrington 1967:323). The nuts were usually collected when the cones

Analysis of Fremont Paleobotanic Materials

opened and the seeds fell to the ground. If the cones were not open, they were roasted to open them. The seeds were eaten raw or roasted and were frequently roasted prior to storage. Once the seeds were roasted, they may have been cracked between rocks, such as a mano and metate, and the hulls winnowed out. Pine needles have been used to make tea, and the inner bark, which may be dried and ground into meal, is noted to have been used as a starvation food (Harrington 1967:323). Young male cones may also have been boiled for an emergency food. Cheno-ams are a group of plants that include the goosefoot family (Chenopodiaceae) and pigweed (Amaranthus) and were exploited for both their greens (cooked as potherbs) and seeds. The greens are most tender when young, in the spring, but may be used at any time. The seeds were ground and used to make a variety of mushes and cakes. The seeds are usually noted to have been parched prior to grinding. Chenopodium and Amaranthus are both weedy annuals capable of producing large quantities of seeds. Atriplex, which occurs as both an annual herb and perennial shrub, may also be exploited for both its greens and seeds. Saltbush leaves have a salty taste and have been used as a seasoning. Saltbush seeds do not ripen until midfall and may remain on the shrubs throughout the winter into the next growing season (Chamberlin 1964:366; Gallagher 1977:12-16; Gilmore 1977:26; Harrington 1967:55,57,71; Rogers 1980:43, 66; Schopmeyer 1974). The seeds may be harvested in the late summer and fall.

Helianthus (sunflower) is a member of the morphological pollen group of High-spine Compositae. Sunflower seeds are very high

Analysis of Fremont Paleobotanic Materials

in oil and may be ground into paste for batter or roasted and eaten. Other members of the Compositae family were used in a variety of ways, including medicinally and as food. Another species of Helianthus (Jerusalem artichoke) produces roots which may be boiled or baked and eaten (Harrington 1967:313-315). Rabbitbrush may be used as fuel. Most composite seeds ripen in the late summer and fall.

Several members of the Cruciferae (mustard family) are noted to have been exploited for their greens, which were used as potherbs while the plant was young. In addition, seeds may have been parched, ground into flour and used for making pinole, mush, bread, or to thicken soup (Harrington 1967:308). Tansy mustard (Descurainia) greens are eaten in the spring or used to make pottery paint. Tansy mustard seeds may also be parched and ground into meal (Colton 1974:309-10; Harrington 1967:307; Stevenson 1915:60). These greens are available primarily during the spring and early summer, after which the plants tend to dry up. The seeds are also available relatively early in the growing season--usually early to mid-summer.

Eriogonum (wild buckwheat) roots are noted to have been ground to produce a powder which may be used medicinally. The root may also be sliced or boiled to produce a tea used to cure sore throats associated with colds, help wounds heal, or to relieve a "general miserable feeling" (Stevenson 1915:49). Whiting (1939:73) notes that Eriogonum has been used by the Hopi medicinally. The stems may be eaten raw or cooked while young. A tea may also be made and used medicinally and the blossoms

may be mixed with organ meats and rubbed into hides to bleach them (Rogers 1980:84).

Members of the Gramineae (grass) family, particularly Oryzopsis (Indian ricegrass), have been widely used as a food resource. Oryzopsis produces an abundant quantity of seeds, which were utilized by many Native American groups, including the Gosiute (Chamberlin 1964:375). The seeds were often parched and ground into meal to make various mushes and cakes (Harrington 1967:322).

Several other species of grasses are also noted to have been cooked as greens (Rogers 1980: 32-40). Grass is also reported to have been used as a floor covering (Chamberlin 1964:372). Grass seeds ripen during the summer and fall. Some members of the Malvaceae are edible such as Malva neglecta (mallow, cheese weed). This plant grows as a weed, particularly in disturbed areas and has been introduced from the old world. Other related species of Malva were probably used in a similar manner. The leaves may be used either as a pot herb or raw as a salad. Immature fruits were often eaten raw or cooked in soups or stews (Harrington 1967: 315-317).

Opuntia (prickly pear cactus) fruits were eaten, frequently boiled. The fruits may also be dried and ground into meal. Prickly pear pads were boiled and eaten, frequently with syrup (Beaglehole 1937:70; Nequatewa 1943:18-9; Robbins et al. 1916:62; Stevenson 1915:69; Whiting 1939:85-6). Mammillaria (pincushion cactus) resembles Echinocactus (ball cactus) both in form and in having small seeds. Ethnographic

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Features 1 and 4 were sampled for pollen and macrofloral analysis (Tables 1, 2, and 3).

The level underlying the Fremont occupation yielded a radiocarbon age of 2330 B.P. This lowest level yielded a burial, cordage, a metate fragment, and a juniper tumpine basket. The radiocarbon age was obtained from the basket. Hundreds of corn kernels were associated with this basket, and some of these are described in this report.

The pollen records from Features 1 and 4 are similar to one another. Moderately large frequencies of Pinus pollen (Table 4) indicate the proximity of pine to the rockshelter. Lesser quantities of Abies, Juniperus, and Picea pollen are noted. Betulaceae pollen is noted only in Feature 1. The absence of Pseudotsuga (Douglas fir) pollen is not unusual, as Pseudotsuga is frequently not encountered in the pollen record in spite of the fact that it may grow locally. Douglas fir is nearly absent from this area today.

Non-arboreal pollen noted in this record is dominated by Artemisia (sagebrush) in both features. Small quantities of Cheno-am, Sarcobatus, Low-spine and High-spine Compositae, Ephedra nevadensis-type, Gramineae, Leguminosae, Onagraceae, Opuntia, Penstemon, Rosaceae, and Solanaceae also indicate vegetation in the vicinity of this rockshelter. No pollen types were recovered in sufficient quantity to indicate subsistence activity. It is possible, however, that the Opuntia pollen recovered from Feature 1 might be present through exploitation of the prickly pear.

accounts for the use of Echinocactus include reference to the use of the fruit, stems, and seeds for food. The small black seeds, when parched and ground are noted to make good bread or mush (Bye 1972; Castetter 1935; Palmer 1871). Prickly pear fruits ripen during the summer and fall, whereas the pads may be harvested at almost any time of year. On the plains the fruits were eaten raw, stewed, or dried for winter use, and the stems were also peeled and roasted. The roots were also boiled to make a medicinal tea (Rogers 1980:61). In addition, the seeds may have been parched and ground into meal to be used to make mushes or cakes. The spines may have been burned off both the fruit and stems in preparation for consumption (Harrington 1967:24), thus introducing pollen into a fire hearth.

Sambucus (elderberry) grows in damp places, often along streams and at the base of cliffs. Harrington (1967:279-281) notes that these berries are extensively used wherever they grow. Elderberries grow in clusters providing relatively large quantities of fruit on a single shrub. The fruits may be eaten raw or dried for storage.

The Fremont layer beneath the possible Numic occupation yielded a radiocarbon age of 1110 B.P. A single shallow bowl-shaped feature (Feature 4) was recovered. This level feature contained a single charred grub and numerous grasshopper fragments (Truesdale, personal communication, March 5, 1990). Botanical remains removed from the same level as this feature included cucurbit fragments and corn cobs, which were located to the south of the feature.

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Table 1. Provenience of Samples from Site 42UN1724

Sample No.	Feature No.	Level	Test Unit	Description	Macro	Pollen
23	1			Feature fill	X	X
32	4			Lower portion	X	X
Item 3:		3	8-9N 8-9.5E	One seed		
13		2	8-9N 8-9.5E	Rind fragments		
12		2	8-9N 8-9.5E	One stem		
Item 4:		7	9-10N 9-10E	104 corn kernels		
Item 5:		2	8-9N 8-9.5E	4 corn cobs (FS 7,8,9 & 12)		
Item 6:		3	8-9N 8-9.5E	One 3.5 cm cordage		
Item 7:		2	8-9N 8-9.5E	One fiber cordage attached to juniper bark		
Item 8:		2	8-9N 8-9.5E	One strand cordage, 15 cm		

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Table 2. Macrofloral Contents of Samples from Feature 1 at Site 42UN1724

Identification	Part	Charred Whole Frag		Uncharred Whole Frag	
cf. Conifer	Anther				1
cf. Pinus	Seed		4		
<u>Juniperus</u>	Seed	6	11	1	4
<u>Juniperus</u>	Aril (berry)		4		
<u>Juniperus</u>	Stem		X		X
<u>Pseudotsuga</u>	Needle		4507*	28*	105*
Cactaceae	Spine		5*		
cf. Cactaceae	Embryo		5*		
<u>Cercocarpus</u>	Seed		12*		2
cf. <u>Cercocarpus</u> <u>ledifolia</u>	Leaf	12*	245*	10*	164*
Cheno-am	Seed		1		
Compositae	Seed				1
Compositae	Pappus		1		
Gramineae	Seed	12*	1	6*	6*
Leguminosae	Seed		1		
Nyctagenadeae/ Onagraceae	Seed				1
Unknown A	Seed			12	1
Unidentifiable	Seed		2		
Unidentified	Leaf				1
Unidentified	Embryo				1
Charcoal:					
<u>Juniperus</u>					
Insect Fragments			X		238*

*Indicates an estimated seed or seed fragment frequency based on sort of a portion of the total volume floated.

Table 3. Macrofloral Contents of Samples from Feature 4 at Site 42UN1724

Identification	Part	Charred		Uncharred	
		Whole	Frag	Whole	Frag
cf. Conifer	Anther			2	
<u>Juniperus</u>	Seed	1	3	2	6
<u>Juniperus</u>	Stem		X		X
<u>Pinus</u>	Needle			15*	18*
<u>Pseudotsuga</u>	Needle		32*	22*	131*
cf. Boraginaceae	Nutlet			3*	
Cactaceae	Spine w/ base			1	
Cactaceae	Spine	9*		2	
<u>Echinocactus</u>	Seed		9*	1	
<u>Cercocarpus</u>	Seed		3*	6	1
<u>Cercocarpus</u>	Seed awn				1
cf. <u>Cercocarpus</u>	Leaf	24*	46*	34*	138*
Cheno-am	Seed	1	15*	2	
Compositae	Pappus				2
Cruciferae	Seed		3*		3*
cf. <u>Eriogonum</u>	Seed		6*		
Gramineae	Seed	10*			6*
Gramineae	Floret			7*	
Gramineae	Palea			3*	
Malvaceae	Seed	3*			
<u>Opuntia</u>	Seed				4
<u>Opuntia</u>	Embryo			1	
<u>Sambucus</u>	Seed	4*			
Unknown A	Seed				2
Unknown F	Seed	1*			
Unidentifiable	Seed	25*			
Unidentified	Leaf				2
Unidentified	Pedicle				1
Unidentified	Fruit			1	
Unidentified	Calyx			1	
Charcoal:					
Diffuse porous (cf. <u>Populus</u>) (dominant)					
<u>Pinus</u> (sub-dominant)					
<u>Juniperus</u> (secondary)		X			X
Bone					3970*
Insect fragments					X
Rodent feces					X
Flake					X

*Indicates an estimated seed or seed fragment frequency based on sort of a portion of the total volume floated.

Table 4. Pollen Recorded in Samples from Site 42UN1724

Scientific Name	Common Name	Feature	
		1	4
ARBOREAL POLLEN:			
<u>Abies</u>	Fir		1
Betulaceae	Birch Family	1	
<u>Juniperus</u>	Juniper	4	3
<u>Picea</u>	Spruce	1	1
<u>Pinus</u>	Pine	31	39
<u>Quercus</u>	Oak		
NON-ARBOREAL POLLEN:			
Cheno-ams	Amaranth and pigweed families	5	6
<u>Sarcobatus</u>	Greasewood	2	1
Compositae:	Sunflower family		
<u>Artemisia</u>	Sagebrush	22	21
Low-spine	Includes ragweed, and cocklebur	6	3
High-spine	Includes aster, rabbit-brush, snakeweed, sunflower	2	2
<u>Ephedra nevadensis</u> -type	Mormon tea		
Gramineae	Grass family	1	3
Leguminosae	Legume or pea family		1
Onagraceae	Evening primrose family	1	
<u>Opuntia</u>	Prickly pear cactus		1
<u>Penstemon</u>			2
Rosaceae	Rose family	1	
Solanaceae	Potato/tomato family		1
Indeterminate		19	17
TOTAL POLLEN		100	100
Spores:			
Trilete		4	1

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Macrofloral samples collected from Features 1 and 4 contained a wide variety of charred and uncharred remains. The fact that the features were located within a rockshelter indicates the preservation of uncharred remains from the period of occupation is possible. Therefore, interpretation is not based entirely on recovery of charred remains, but instead includes uncharred remains as well.

Douglas fir (*Pseudotsuga*) was apparently abundant in the vicinity of this rockshelter in the past, as Feature 1 contained thousands of charred and uncharred Douglas fir needle fragments (Table 2). Feature 4 contained a much smaller quantity of these remains.

Feature 1 contains a large variety of both charred and uncharred remains. Most of the uncharred remains are also represented as charred remains in this feature. Evidence of both *Pinus* and *Juniperus* is present, primarily in the form of seeds and stems. The presence of both *Pinus* and *Juniperus* seeds suggests that pine nuts and juniper berries may both have been exploited as foods. Charred Cactaceae spines were noted, suggesting that a cactus was processed in the feature. Composite seeds are also rare in the record and may be associated with either exploitation or accidental introduction. Recovery of Gramineae seeds as both charred and uncharred seeds may represent food processing activities. A single charred Leguminosae was also recovered and may be present through food processing or accidental introduction. A single uncharred seed similar to members of both the Nyctaginaceae and Onagraceae families was recorded. Members of these families are

common weeds and its presence in the feature is most likely accidental. All of the charcoal identified from this feature was *Juniperus* (juniper).

Feature 4 also contained evidence of both *Juniperus* and *Pinus*, although no pine seed fragments were recovered. This record suggests that perhaps only juniper berries may have been processed. Cactaceae spines were observed both charred and uncharred, suggesting that they may have been present through food processing activities. The *Echinocactus* seeds and seed fragments were also recovered, suggesting that these seeds were processed. *Cercocarpus* seeds and leaves were present in this feature, as they were in Feature 1. Cheno-am seeds, however, were much more numerous in this feature and definitely suggest food processing activities. Compositae seeds are represented only by a few uncharred pappus fragments, which may be present either through food processing activities or accidentally. A small quantity of charred and uncharred Cruciferae seed fragments suggests that mustard seeds may also have been processed in this feature. Charred probable *Eriogonum* seed fragments may also represent food processing activities. Gramineae is represented by charred seeds, as well as uncharred seeds and other parts. The presence of the charred grass seeds in particular points to food processing activities. Charred Malvaceae seeds are also noted and may be present through food processing activities. *Opuntia* seed fragments and an embryo were recovered as uncharred remains and might be present through food processing activities. Alternatively, they may have been introduced either at the time of occupation

or later as a contaminant. The charred *Sambucus* seeds (elderberry) are probably present through food processing activities.

Charcoal recovered in this feature was diverse, including a diffuse porous charcoal that was most similar to *Populus* (cottonwood and aspen) as the most common, *Pinus* (pine) as the subdominant type, and *Juniperus* (juniper) as the least abundant type of charcoal present. The charcoal present indicates use of a variety of fuel types.

Item 3 (Table 1), recovered from the 1110 B.P. Fremont occupation, includes a peduncle or stem of *Cucurbita pepo* and a seed identified to *Cucurbita pepo*. The peduncle compares favorably with *C. pepo* peduncles reported by Gasser (1981). Rind fragments, probably representing a single pumpkin or squash, are also included in Item 3. The cellular structure of the rind was examined and compares most favorably with *Cucurbita* spp. (Gasser 1981:63).

The corn cobs (Table 1, Item 5) also date to the 1100 B.P. Fremont occupation. Measurements for the individual cobs are presented in Table 5. All cobs are uncharred and contain no kernels. One of the cobs (FS 9) is impaled on a stick. Another cob (FS 7) has a hole in the base suggesting that it, too, may have been impaled on a stick. Winter (1973) notes several of the Fremont cobs he examined were impaled on a stick. Three of the four cobs (FS 7, 9, and 12) have variable numbers of rows. One cob has 14 rows, two have 10 rows, and the fourth is 8-rowed. All cobs except the 8-rowed cob are wider at the base and taper toward the

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tip, a characteristic of Fremont cobs. The 8-cob is also narrower at the base than the mid-section, which is typical of 8-rowed "Mais de Ocho" and Chapalote cobs pictured in Winter (1973:449). Eight-rowed cobs are noted to be more common in Anasazi sites, mixing with Fremont populations less often in northern Utah than in southern Utah (Winter 1977:106).

Item 4 (Table 1) was recovered in association with the basket dated to 2330 B.P. from the earliest occupation. This item was composed of *Zea mays* kernels. All kernels have been measured (Table 6) to provide a quantitative description of the kernels. The kernels have also been divided into dented, weakly dented, and undented types to facilitate description. Dented kernels have a marked dent and when the kernel is examined in cross-section the soft starchy endosperm extends to the tip of the kernel. The cornaceous or horny endosperm is observed only on the sides of the kernel. Slightly dented kernels have slightly more cornaceous or horny endosperm on the top of the kernel and retain cornaceous endosperm on the sides of the kernel. Undented kernels exhibit a thicker layer of cornaceous endosperm along the top of the kernel, as well as similar amounts of cornaceous endosperm on the sides. Comparisons of endosperm were made with drawings contained in Cutler (1966:43), Powers (1984:155), and Gasser (1981:32). Photos of Fremont dent corn in Winter (1973:443) and Jennings (1978:160) show kernels on single cobs ranging from severely dented to weakly dented to undented. No description of the cross section categorizing the endosperm is available in either of those reports. In the absence of information to

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Table 5. Corn Cob Measurements from Site 42UN1724

Spec. No.	Butt Diam. (mm)	Mid-Cob Diam. (mm)	Cob Length (cm)	cob shape	Cupule Width (mm)	Cupule Height (mm)	Row No.	Row Regular
7	16.5	13.0	14.5	Tapered	5.3 6.0 6.2	1.5 (3.5*) 1-1.5 (3.9*) 1.5 (4.0*)	14	No. 12-14
8	18.0 21*	13.0 18*	13.7	Tapered Twisted	7.9 8.0 8.1	1.0 (2.5*) 1.2 (2.6*) 1.0 (2.8*)	10	Yes
9	12.5 17*	9 17*		Tapered	8.0 8.0 8.0	1.6 (2.0*) 1.5 (3.5*) 1.5 (3.5*)	10	No. 8-10
10+								
11+								
12	8.5 11.5*	7.5 17.4	11.5	Cigar-shaped Thin	8.1 8.4 8.3	2.0 (3.5*) 1.8 (3.5*) 2.0 (3.9*)	8	No. 6-8
14+							12	
16+			12.6				8	
18+			13.4				8	
19+			6.4				12	
20+			7.7				10	

*Indicates measurement with spikelet bases.
+ Indicates fragment.

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understand the distribution of cornaceous of horny endosperm relative to that of the softer starchy endosperm within kernels on the same cob of Fremont dent, it is difficult to interpret the variation in corn kernels from Juniper Ledge Shelter. A thorough understanding of this distribution is necessary prior to interpreting the significance of the variability of the kernels in this population from Juniper Ledge Shelter.

Items 6, 7, and 8 (Table 1) are twisted fibers forming cordage recovered from the Fremont occupation. Item 6 is identified as animal hair bearing some similarity to rodent hair, although at present it is unidentified. Items 7 and 8 are plant fibers most similar to *Linum* sp. (flax). Jennings (1978:86) notes that *Linum* cordage was recovered from Danger Cave in Utah.

SUMMARY AND CONCLUSIONS

Pollen analysis of samples from Features 1 and 4, representing the late Fremont/Numic and Fremont occupations, exhibit relative stability of vegetation in the vicinity of this shelter. The charred macrofloral record indicates that a wide variety of plants might have been utilized or processed in this shelter. This variety is typical of Fremont

occupations where native resources often contributed heavily to subsistence. In addition, remains of cultivated plants including *Cucurbita pepo* and *Zea mays* were recovered. *Cucurbita pepo* peduncle and seeds are noted, as well as *Cucurbita* spp. rind. The corn recovered is most similar to Fremont dent, as represented by cob morphologies from the 1110 B.P. occupation.

Radiocarbon dates obtained from the corn kernels themselves substantiates the early date for corn. This Fremont dent corn appears to be fully evolved. Winter (1973) notes that dent corn may have been transported from Mexico through western Arizona into southwestern Utah, then diagonally up the river valleys. Alternatively, the Fremont dent may have evolved in place from a primitive form of pop or flint corn, a form of flour corn, and maize with "relatively high amounts of Teosinte germ plasm" (Winter 1973:450). Only one of the four cobs recovered was the typical 14-rowed Fremont dent type, although all but one of the cobs tapered from the widest measurement at the butt to the narrowest at the tip. Two of the four cobs recovered had been impaled on sticks, a trait common in the Fremont culture.

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Table 6. Measured Dimensions of Corn Kernels

Length*	Width	Thickness	Length	Width	Thickness
7.992 (9.324)	8.14	4.144	8.584	8.584	4.44
8.436	9.028	3.848	8.14 (9.028)	7.844	4.588
6.956	8.584	5.18	7.4 (8.288)	7.992	5.18
7.844 (8.88)	8.584	4.144	7.548(8.732)	7.844	3.7
7.992 (8.888)	7.548	5.032	8.436	7.992	3.7
8.14	9.472	4.444	8.14 (8.88)	9.768	6.068
8.14 (9.028)	9.472	3.552	8.14 (8.584)	7.548	3.848
7.844	9.102	5.032	7.252	7.548	3.848
8.88	9.472	4.884	7.4	7.548	3.7
8.288	7.548	5.18	6.6 (7.548)	8.14	3.848
8.14	10.286	5.18	8.584	8.14	5.772
8.732 (9.028)	7.844	4.44	6.216 (6.66)	7.178	4.884
8.288	5.92	4.44	7.844	7.4	4.292
7.252	7.104	5.328	8.584	9.472	4.588
6.66 (8.584)	6.068	5.90	6.66	7.252	5.772
8.288	8.88	4.292	7.992	8.88	4.588
6.956 (8.732)	7.844	6.068	8.14	7.992	4.292
7.252 (7.844)	9.176	5.18	8.436	8.288	6.068
7.696 (9.324)	8.88	4.588	6.66	9.324	6.216
8.584 (9.62)	8.88	5.18	7.252	8.436	5.92
8.14	7.992	3.7	8.288	10.656	5.328
8.288 (9.62)	8.584	5.032	7.992	9.176	8.436
6.364	7.252	5.18	8.288 (8.752)	9.028	4.292
8.436 (8.88)	7.696	6.512	8.14	7.844	3.7
6.66 (7.4)	9.472	5.476	6.956	6.808	5.476
6.808	7.326	5.18	7.548	8.14	3.848
5.032	7.77	6.216	8.584	6.66	5.92
7.104 (7.696)	6.956	6.66	7.696 (8.288)	8.288	4.44
6.364 (7.696)	8.288	6.512	7.696 (8.88)	8.436	6.216
5.92	5.92	3.404	8.288 (9.028)	8.14	5.032
8.288	7.104	4.588	8.288	7.992	3.848
7.696(10.064)	7.548	4.736	5.328 (6.364)	5.772	4.588
8.14	8.88	3.7	7.4 (8.14)	8.288	4.588
6.66 (8.288)	7.326	5.18	7.4 (7.696)	7.252	3.552
7.252	8.436	4.144	6.364	7.844	4.292
7.104 (7.992)	7.4	5.772	6.66	8.436	6.068
7.4	7.696	4.292	7.4	7.252	4.736
6.216	9.176	5.772	7.992 (8.732)	7.4	3.848

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Table 6. Measured Dimensions of Corn Kernels

Length*	Width	Thickness	Length	Width	Thickness
7.4	8.288	4.44	8.584	7.104	2.664
8.14 (8.436)	9.472	4.44	7.548 (7.849)	7.992	4.292
7.4 (7.992)	7.252	4.588	7.548	8.584	4.44
7.104 (7.4)	7.4	6.216	7.252	9.176	5.476
7.992 (8.288)	8.14	4.736	7.992	7.844	3.7
6.808	7.252	6.66	7.104	7.4	5.92
7.4 (8.288)	6.66	3.404	7.992	8.14	3.552
8.14	7.844	4.588	6.068 (6.66)	7.252	5.032
6.66	7.4	5.828	7.992 (9.028)	7.252	8.288
7.104 (7.992)	7.252	6.068	6.364	5.18	3.256
7.696	8.88	4.736	6.364	8.584	7.252
5.624	6.66	5.476	7.548 (7.992)	7.992	5.328
6.512	7.104	4.884	5.772	6.364	5.032
5.624	6.808	5.92			

* Length () = includes kernel base attachment. All measurements in millimeters.

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Appendix B

**Radiocarbon Calibration Dates and Ages
for C14 Samples Collected at Juniper Ledge Shelter**

Calculated from the University of Washington Quaternary Isotope Lab

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**RADIOCARBON CALIBRATION DATES AND AGES FOR C14 SAMPLES
COLLECTED AT JUNIPER LEDGE SHELTER**

Beta-34326

Radiocarbon Age BP	2330.0	q 80.OE
Calibrated age(s)	cal BC 399	
	cal BP 2348	
cal AD/BC (cal BP) age ranges:		
One Sigma**	Cal BC 481- 473(2430-2422)	427- 422(2376-2371)
	413- 376(2362-2325)	373- 364(2322-2313)
Two Sigma**		
	cal BC 762- 682(2711-2631)	659- 632(2608-2581)
	621- 611(2570-2560)	590- 340(2539-2289)

Intercepts and maximum range:

One Sigma	cal BC 481 (399)	265
	cal BP 2430 (2348)	2214
Two Sigma	cal BC 762 (399)	210
	cal BP 2711 (2348)	2159

Beta-36605

Radiocarbon Age BP*	1650.0	q 80.OE
Calibrated age(s)	cal AD 408	
	cal BP 1542	
cal AD/BC (cal BP) age ranges:		
One Sigma**	cal AD 259- 281(1691-1669)	290- 299(1660-1651)
	323- 433(1627-1517)	454- 465(1496-1485)
	503- 511(1447-1439)	516- 531(1434-1419)
Two Sigma**	cal AD 177- 197(1771-1753)	220- 580 (1730-1370)

Intercepts and maximum range:

One Sigma	cal AD 259 (408)	531
	cal BP 1691 (1542)	1419
Two Sigma	cal AD 177 (408)	580
	cal BP 1773 (1542)	1370

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Radiocarbon Calibration Dates

Beta-34325

Radiocarbon Age BP 1110.0 q 50.OE
Calibrated age(s) Cal AD 902, 918, 955
972, 975
cal BP 1048, 1032, 995
978, 975

cal AD/BC (cal BP) age ranges:

One Sigma** Cal AD 784- 786(1166-1164) 885- 987(1065- 963)
Two Sigma** cal AD 777- 793(1173-1157) 800-1000(1150- 950)
1008-1019(942- 931)

Intercepts and maximum range:

one sigma cal AD 784 (902, 918, 955, 972, 975) 987
cal BP 1166 (1048, 1032, 995, 978, 975) 963
two sigma cal AD 777 (902, 918, 955, 972, 975) 1019
cal BP 1173 (1048, 1032, 995, 978, 975) 931

Beta-34324

Radiocarbon Age BP 700.0 q 60.OE
Calibrated age(s) Cal AD 1280
cal BP 670

cal AD/BC (cal BP) age ranges:

One Sigma** Cal AD 1262-1301(688- 649) 1372-1381(578-569)
Two Sigma** cal AD 1220-1330(730- 620) 1344-1394(606-556)

Intercepts and maximum range:

one sigma cal AD 1262 (1280) 1381
cal BP 688 (670) 569
two sigma cal AD 1220 (1280) 1394
cal BP 730 (670) 556

* This date is C12/C13 adjusted.

** This standard deviation (error) may include an error multiplier.

1 sigma = square root of (sample std. dev) + (curve Std. Dev.)

2 sigma = 2 x square root of (sample std. dev.) + (Curve Std. Dev.)

0* represents a "negative" age BP

1955* denotes influence of bomb C-14

>2497 BC represents end of calibration data.

Appendix C

McKee Spring Rock Art Research: a Discussion

By
Clay Johnson

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INTRODUCTION

As an in-situ artifact, rock art should owe some design and depositional factors to the environment in which it was constructed. Binford (1983) suggests there should be correlations between the structure of an archaeological site and seasonal factors such as temperature and natural light. An intensive study of the McKee Spring rock art was initiated in 1989 to examine the degree to which site environmental factors such as location, directional orientation, local topography, cyclic flora and fauna presence, and yearly meteorologic cycles might be related to elements of the rock art itself.

Literature on Utah rock art tends toward merely describing some of the panels at a site and suggesting cultural affiliations based on style. Martineau (1973) suggested rock art panels to be "stories" decipherable with sufficient cultural background by treating the shapes of various elements as modifiers for a somewhat standardized symbolism. Burton (1971) suggested rock art in Dinosaur National Monument changed stylistically over time. Barnes (1986) quoted suggestions to the effect that some panels acted as calendric indicators for solstices or equinoxes, or as symbols representing spectacular astronomic events such as the A.D. 1054 supernova. Clifford Duncan (1991, personal communication), historian for the Uintah and Ouray Ute Tribe, mentioned that sunrise was an important time of the day. Conversations with amateur rock art enthusiasts in Utah elicited occasional photos of rock art panels in Utah with interesting coincidences of shadows aligning with lines of rock art elements. None of these sources seemed to

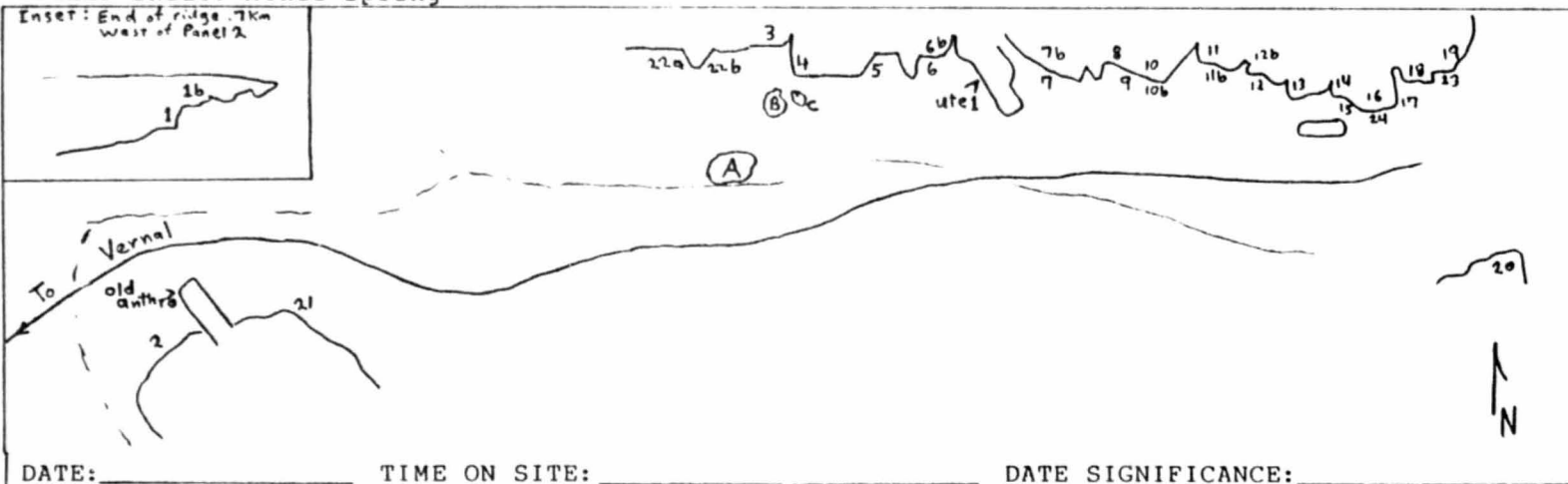
McKee Spring Rock Art Research

have spent long periods of time at any one rock art site, or to have visited one site repeatedly throughout the year.

The initial methodology chosen was simply to select and visit one site repeatedly throughout a year, spending as much time as possible at the site, noting factors such as available flora and fauna, water, physical comfort range, and shadows on the panels during the time of each visit. It was assumed that in a basically blind observational approach such as this, a large concentration of the artifacts to be studied would increase the chance of identifying and comparing correlations. Thus, McKee Spring was chosen at random from several major rock art sites within a one hour drive of the researcher's home as the main research site. Other sites nearby, then, could act as controls, or places to check developing hypotheses. Research began in October of 1989 with once or twice weekly visits to the site, initially at sunrise through mid-morning. A field form (Fig.1) was developed on which to record site observations.

Since the site had not been recorded fully or with attention to a standardized definition of the term "panel," each panel was assigned a number by the researcher for purpose of the study. On the basis of incoming data, it was found necessary to spend entire days at the site, from before sunrise to after sunset. It was noted that panels photographed and sketched in one light revealed further elements or more intricate shapes at another time of the day or year due to change in the angle and quality of light on the panels. Some panels were found to not receive

FIELD SHEET: McKee Spring



DATE: _____ TIME ON SITE: _____ DATE SIGNIFICANCE: _____

CONDITION: D = dark L = lit A = sun & shadow on glyph

INTERACTIONS: N = non-significant M = suggestive S = significant alignment I = no data

Panel# & Name	Panel# & Name	Panel# & Name
1. 42UN1708	7b. Sun Priest	15. Monkey Face
1b. Flat Panel	8. Rocking Horse	16. Confluence
2. S&M King	9. Little Man	17. Wet Sheep
Old Anthro	10. Pinwheel	18. Flat Top Fam
3. Wife Killed	10b. Low Anthro	19. Kokopelli
4. Lone Combnd	11. Cut Belly	20. Rock Shelter
5. Dot Man	11b. Lasso Anthro	21. Snake Map
6. Comb Family	12. Flat Top	22a. West Eye
6b. Hiding Man	12b. Dot Sheep	22b. East Eye
Ute 1	13. K7	23. Old Box
7. Bug Man	14. 3 Knives	24. Below P16

COMMENTS (Also back of sheet):

Figure 1. McKee Spring Petroglyph Field Record Sheet/Form

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sunlight at all during portions of the year, or to not receive sunlight before a certain time of day all year. Other panels were found to change back and forth from sunlit to shadowed several times during one day. A form (Fig. 1) was developed to track changes in condition for the panels.

Collected data in the form of 35 mm slides demonstrated that some glyph elements were so constructed as to match the shape of shadow patterns on the panels, and that the matches were most perfect on certain days. It was also noted that certain types of shadow patterns (such as an "arrow" or wedge of sunlight on a darkened panel) tended to be aligned in similar ways with glyph elements regardless of which panel they occurred on, and that panels which could be presumed to be related by having similar elements or symbols tended to use similar shadow shapes and/or to be most accurate on the same day. Days upon which the correspondence of element shapes with shadow shapes were most prevalent and accurate were on the equinoxes, the solstices, and on days halfway between solstices and equinoxes, which were being referred to by amateur groups as "crossquarter" dates.

On the basis of the evidence, a resurvey was made of the amateur literature, most specifically the collected papers of the symposia of the Utah Rock Art Research Association (Garn and Everitt 1983; Everitt and Madsen 1985; Bowen 1989; Morris 1990a, 1990b, 1991), and it was found that observations from various locales around Utah tended to support data from McKee Spring. Certain natural shadow shapes were being used repeatedly in very similar ways

at widely scattered rock art sites within Utah.

It also became apparent that no one had developed any standard way to observe, describe, and compare these shapes and their correspondence with elements on rock art panels. Without some standardized methods, no progress was likely. This researcher thus developed a terminology for describing interactions and recurring utilized natural shadow shapes, a methodology for observing and photographing shadow activity on a panel, and some observations on the kind of conceptual changes needed to properly protect rock art sites, based on the implications of the evidence for interactions between the panels and shadow shapes (Johnson 1990a, 1990b, 1990c).

Using the aforementioned terminology and methodology, in 1990-1991 this researcher concentrated field efforts on identifying and recording any alignments on all panels at McKee Spring, on testing the methodology by spot checking other sites within Dinosaur National Monument for interactive shapes or elements identified at McKee, and upon developing a theoretical tool that could be used to extract archaeological information from interactive panels. With this tool (Johnson 1991) it is possible to date some interactive panels, to determine to some degree the Fremont concept of certain events such as equinox, and test hypotheses regarding the meaning of the elements on some panels.

Observations of cyclic changes in on-site flora and fauna resources and their behavior, and of broad weather patterns (National Weather Service 1973a-c, 1974a-i)

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throughout the year, indicate a strong correspondence with the dates observationally established as important to the Fremont at this site. Certain elements or symbolic representations are seasonally linked: the alignments with shadow shapes, and the apparent symbolism of the shadow shapes used, is specific to a certain date or a certain season of the year. Spot checks indicate that the same elements are being used in the same ways at other sites. All this suggests that in addition to acting as a calendar, one purpose of some rock art is to act as an almanac, predicting certain seasonal activities or events. It is also tempting to speculate that because of similarities in elements and interactions observed for the same date at widely dispersed sites, this usage of rock art may be widespread and standardized to some degree for at least Fremont occupations. Given there now exists a terminological and methodological framework within which to investigate other sites, that speculation may be supported in another twenty years or so of investigation at the current rate of progress.

An example of the possible almanac function for some panels, and of the similarity of interaction on a given date for multiple panels is shown on Figures 2a, 2b, 3 and 4. Figures 2a and 2b shows two portions in the interaction for panel 12B at McKee Spring. The shadow, moving from the left, first cups the relatively empty oval within the stomach area of the sheep zoomorph (Fig. 2a) at the same time as it outlines the small abstract shape above. The moving shadow then becomes a sun arrow (Johnson 1990a) at the cervix of the sheep (Fig. 2b), which remains in place for a protracted number of

minutes. This portion of this interaction occurs from approximately 3:45 to 4:22 p.m. MST on May crossquarter. Figure 3 shows an interaction on panel 17 on the same day. Elements involved are a fully formed, horned sheep zoomorph followed by a partially formed, hornless sheep zoomorph. A shadow arrow descends from above to touch the hornless sheep, after which a matching sun arrow forms and moves to the cervix of the horned sheep, before moving down off the glyph. This takes place from 12:26 a.m. to 1:04 p.m. on May crossquarter.

Figure 4 also shows a sun arrow from the cervix area of a sheep zoomorph on panel 7, which occurs at approximately 10:15 a.m. on May crossquarter. There are a total of four panels present at McKee Spring which depict sheep zoomorphs. Three of the panels display a shared shadow shape and symbolism on May crossquarter. The fourth panel is anomalous in placement, design, and certain elements, not officially recorded as part of the site, and may or may not share a mutual origin with the main portion of the site. May crossquarter occurs at the end of the first week in May each year, and was determined in conversations with Utah Division of Wildlife Resources personnel to be the time of the beginning of bighorn sheep birthing in this area.

Other events are portrayed at McKee Spring which appear to be capable of being linked in a similar manner to seasonally specific or physically verifiable natural phenomena. If the purpose of constructing elements of the panels to align with shadows on certain dates were merely to identify those dates for an observer, a couple of small marks on one

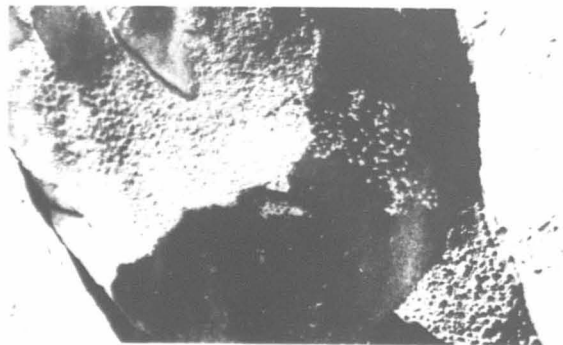


Figure 2a. View to NW at Panel 12b at McKee Spring

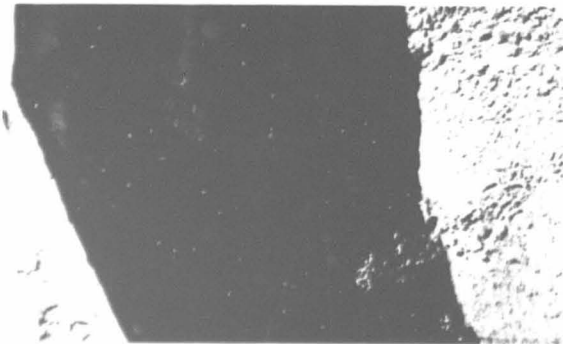


Figure 2b. View to NW at Panel 12b at McKee Spring

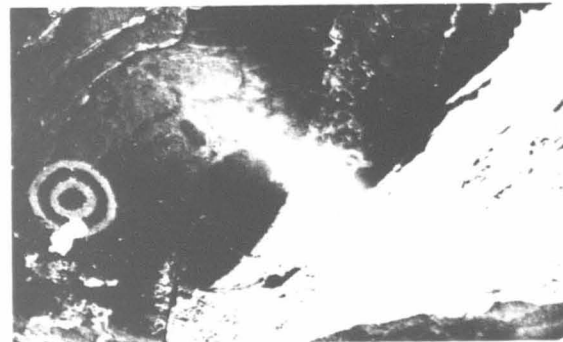


Figure 3. View to west of Panel 17 at McKee Spring



Figure 4. View to north of Panel 7 at McKee Spring

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rock would suffice. Instead, each key date is treated with extreme redundancy, requiring observers to be at the site from sunrise to sunset on that day to see all that is taking place.

The term "panel" is defined herein as a cluster of elements or glyphs separated by an expanse of bare rock from other clusters of elements or glyphs. Data suggests that aggregates of glyphs or elements which their makers might have defined as panels do not meet this definition. The Fremont definition of panel can be understood by examining the times and seasons interactions take place on an aggregate of glyphs. Of 26 panels considered by this researcher to comprise the McKee Spring Panel complex, one (Ute 1) is clearly post-contact. This panel is interactive on May crossquarter. One panel (42UN1708) is 0.5 km west of the main group, stylistically variant, located above a buried cultural component radiocarbon dated to 1790 years before present, and is probably Archaic or proto-Fremont. The site 42UN1708 panel has not been investigated for interactions.

At McKee Spring, one heavily repatinated anthropomorph is located adjacent to panel 2 and was discovered by Blaine Phillips (Bureau of Land Management Vernal District Archeologist) in 1991 as we examined panel 2 together. It has not been investigated for interactions or assigned a panel number. Panel 20, as mentioned above in the discussion of the panels portraying sheep, is anomalous in several ways from the majority of the panels at McKee. It is interactive on all key dates except winter solstices.

The remaining 22 panels either fit the Fremont style category (15 panels) or do not have elements which are stylistically diagnostic (seven panels). Of these 22 panels, interactions have been identified for 20 (90 percent). The two panels for which interactions have not been identified are in the stylistically non-diagnostic category. Many of the panels have alignments on all of the key dates.

As mentioned above, certain elements are placed to align with shadows only on certain dates or for certain seasons, while other elements may align with a portion of the shadow for each key date. For a number of the panels for which data are relatively complete, the panel itself can be shown to be the "result" of the shadows, in that every line on the panel corresponds precisely with a shadow position for one or more of the key dates of the year. Figure 5 shows a sample panel function form for one key date. Interactions are defined as per Johnson (1990a) as nonsignificant, which means no apparent correlation between the shadow shapes and the glyph elements, or as suggestive or significant. Suggestive status means that some feature of the shadow seems to suggest some shape or feature of the glyph design, but that the glyph elements and the moving shadow are not involved in a series of sequential alignments. Significant status indicates that as the sun-shadow line moves across the panel, there are a series of conspicuous alignments of the shadow edge with constructed features of the glyphs in somewhat standard ways as delineated by the standard descriptive terminology. Although it will be noted that many interactions overlap the same time

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SITE: McKee Spring

TIME of YEAR: Summer Crossquarter

CIRCLE: MST or DST

N = non-significant

M = suggestive

S = significant

I = incomplete data

— = dark

- - - = lit

□ = interactive

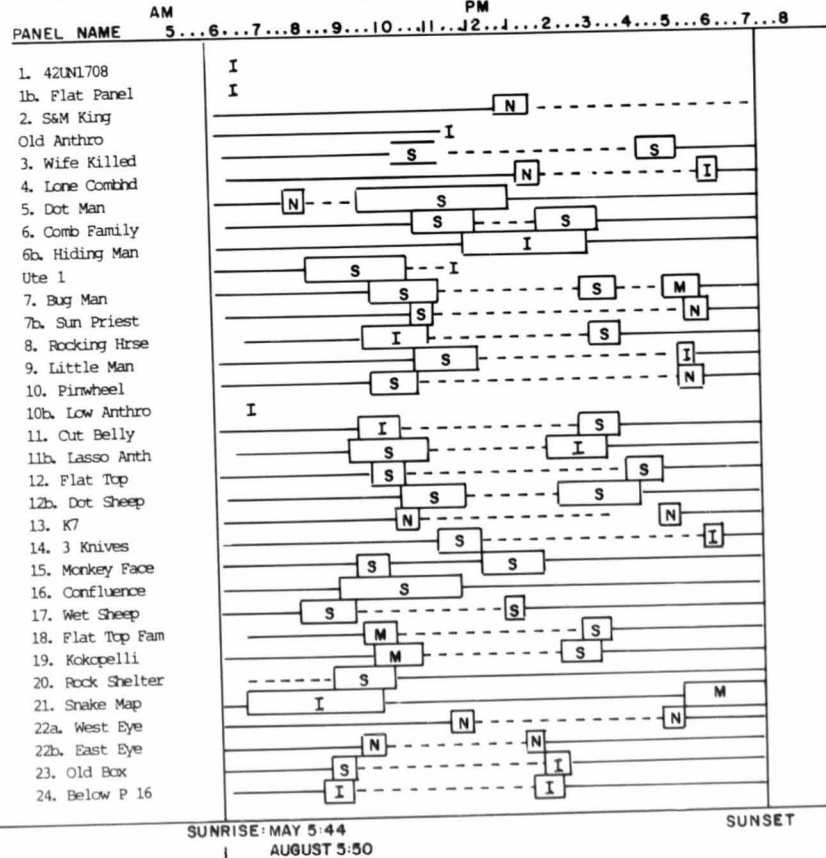


Figure 5. Panel Function Over One Day

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period, the significant part of an interaction may be somewhat shorter than the total time of function. That is to say, a shadow may (for instance) impinge on one element at the left side of a panel, but remain relatively motionless for some time before beginning to move quite rapidly across the glyphs in a series of sequential alignments. The panel function sheet identifies the entire time period or periods during which a panel is interacting rather than just the most spectacular, significant portion. Due to the physical placement of the panels, some can be watched from one spot, whereas others may require a five minute walk across the canyon to get from one panel to another. Several instances have been identified in which two panels on one side of the canyon finish interacting just in time for observers to walk across the canyon to observe two more panels begin interactions.

Figures 6a and 6b graph the utilization of rock art panels at McKee Spring through the day for five key dates of the year. The dotted line charts the number of panels functioning (i.e. the number of panels having sun and shadow mixtures on the glyphs) at a given time. The solid charts the number of panels having significant or suggestive interactions at the time indicated. Several panels remain undocumented, especially for the winter quarter of the year, as to the exact time of function. Those panels are not reflected in either line. For several panels, the class of interaction (non-significant, significant, or suggestive) is undocumented, although the time bracket for function is known. Those panels are included in the dotted line, but not reflected in the solid line. It is thus expected that the value of the dotted line will be higher when

the study is complete, and the solid line will have a higher value in some cases in relation to the dotted line.

It is estimated that for the summer crossquarter date charted in Figure 5, three observers would be required for most of the day in order to observe the interactions *en toto*. In other words, nearly 40 hours of observation are required on the day of summer crossquarter to observe panels identified as having significant interactions. Although data are still incomplete for winter solstice, it is estimated that the number of panels interacting, and the time needed and number of observers required to celebrate each key date, remains relatively constant throughout the year. Key dates so far identified at McKee Spring are the solstices, the equinoxes, and the summer and winter crossquarters, for 8 key dates per year.

Figures 6a and 6b suggest several points.

1. Panels were utilized throughout the day, rather than at one or two specific times of day.
2. Panel utilization remains relatively consistent throughout all seasons of the year.
3. Greater than five panels functioning, there appears to be decreased utilization of interactive potential. Greater than ten panels functioning, there appears to be effectively no utilization of interactive potential. Interactive utilization probably depends on two factors. The first factor is that some instances of panel function have no definite shadow pattern with the potential for utilization. The shadow is vague, undefined, or "blotchy," so that no amount

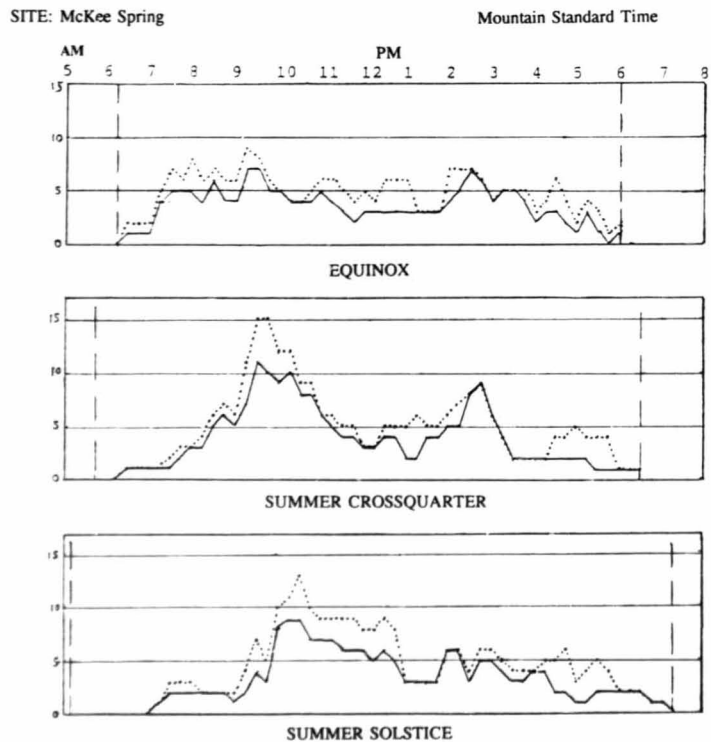


Figure 6a. Interactive Panel Utilization

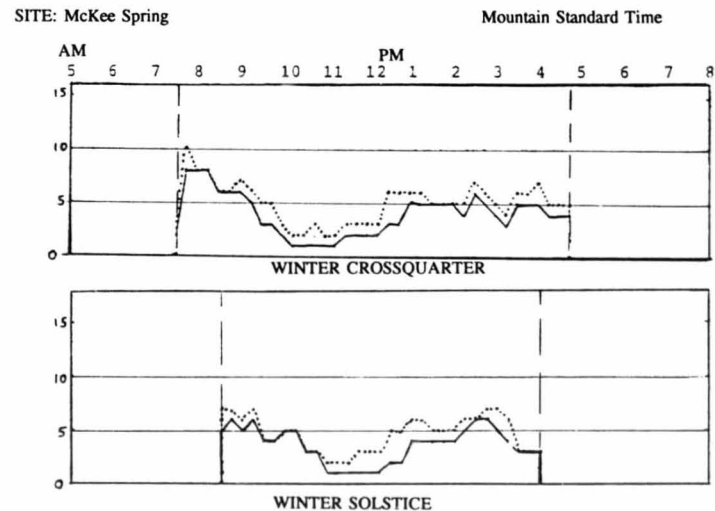


Figure 6b. Interactive Panel Utilization Continued

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of technological alteration or "fixing" employed by the makers would yield a useful shadow pattern. The second factor is that presumably only a certain number of panels could be utilized (observed) by available personnel at any one time.

4. There appears to be slightly greater utilization of panels as a percentage of functioning panels, at sunrise and sunset.

5. Some panels utilized for part of the year are at other key dates either fully lit (no shadows) or fully dark (no sunlight) at any time of the day. This in itself could be a factor in selection of the rock surface to be utilized for a panel.

6. Graphs of other interactive sites do not display similar peaks and valleys for the times of day reflected at McKee Spring. Thus, the times of utilization on a key date, or peaks and valleys at given times, are more a function of the broad pattern of sun and shadow at a site on key dates than they are due to selection of specific times for observation by the makers. In other words, rock surfaces were chosen for panels based on certain interesting and spectacular shadow shapes on key dates, rather than selection being based on function at certain times of day.

CONCLUSIONS

Although research is incomplete at this time, the data already obtained through hundreds of hours of direct observation and recorded in thousands of sequential photographs for this site suggest a number of tentative conclusions. In work of this nature, one

often wonders what hidden assumptions are held by the researcher. On the basis of (variously) widely accepted beliefs about who in a culture group constructed rock art, incoming data, or analogy with broad human behavior it is assumed:

1. Since most of these panels share (a) a common site and style attribution, (b) a relatively similar repatination, (c) element or figure matches from panel to panel, (d) similar interactions with panels to which they seem otherwise related, (e) concurrency (timed sequential interactions with another panel), (f) an overall pattern of function which allows economy of time for observational personnel, (g) together appear to make up a coherent pattern of behavior covering the entire year, and (h) depict seemingly similar symbolic concerns, it is tentatively assumed that each panel is unless clearly determined otherwise a part of an overall site design attributable to one episode of panel construction. No assumption is made as to how long that episode was. It is estimated it would be physically possible, given clear days at critical times and a work force of three people for about twenty days per year, to design and construct the panels at McKee Spring in two years at an absolute minimum.

2. If a panel was designed to function over the period of two hours on a certain day, that implies someone was watching it for two hours, and at least on that particular day. The premise is that humans who expend considerable effort to create impressive pageantry, tend not to get up and leave as soon as the event begins.

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3. Based on evidence, these panels were created by designing alignments with shadow positions on certain key dates already known to the makers, the sum total of the alignments chosen serving to delineate the glyphs on the panel. Some admixture of inspiration or desire to introduce a particular symbolism was combined with the available choices of shadow positions for each key date to create the overall design of a panel.

4. Humans do not build a calendar or almanac at great expense in time and effort in a location where they will not be present to use it.

5. Evidence indicates that the alignments were designed to be as precise as possible with shadow elements on key dates already understood by the makers, and thus any variance from precise alignments for an interactive panel on a key date must be explained. Glyph elements were located so as to align with shadows cast primarily by natural gnomons on certain dates, thus no control of shadow location on days other than those designed for was possible.

This means that whether an alignment changed relatively swiftly or relatively slowly before or after the "best" alignment on the key date was not within the control of the makers. Smaller divisions of the year, or other key dates may have been designed for, but have not yet been identified at this site.

Given those assumptions, the researcher offers these comments as tentative conclusions suggested by facts of this site as understood at present.

The people we call Fremont, who constructed most of the panels at McKee Spring around A.D. 1000, devoted considerable cultural resources to the design, construction, and observation of a technologically sophisticated, ornate, and complicated construct which would report certain key dates of the year, identify periods such as the birthing seasons for certain faunal resources, and demarcate the time for certain natural cyclical events of the year such as the onset of the snow blanket, or the beginning of the time the days turn cooler. They somehow had correctly identified the days of the solstices, which could be gained from direct observation of the sun, and the correct days for equinoxes, which could not. They also observed the crossquarter dates, which are approximately half the day count between equinoxes and solstices. Site and panel selection seems to have been based to a large degree on the coincidence of interesting and somewhat standardized natural shadow shapes on the rock surfaces at certain key dates over the entire year. Their construct was far more accurate than a simple horizon calendar, as well as allowing the recording of symbolic information in a permanent context. They were tied to a concern with and observation of time to an amazing degree. They maintained a presence at McKee Spring essentially year-around for however long the panels were used. They would have found the calendar useful for predicting when to expect game to move into this low park, when to expect certain plants to emerge, when to prepare for serious winter or when to expect warmer days. Other correlations at this location for the dates demarked are estimated to be when the rains generally

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become snow and vice-versa, when to expect the seeds of wild plants to be ripening, when to expect the coldest and the hottest times of the year to begin, when to expect reptiles to be out and when to expect water sources to be ice-free.

This apparent amount of concern and effort in the view of this researcher, is inconsistent with seasonal occupations for the site, or with the site as one of many territories utilized for a short period in a lifetime of rounds by a group of hunter-gatherers practicing an occasional and sporadic horticulture.

It seems instead to suggest a people who were willing and able to support a considerable amount of activity by some of their group at a permanent site throughout the year to perform a complicated series of activities for predicting, observing, and possibly ceremonially assisting, a great number of natural events. It seems to suggest a primarily non-mobile people who took the time to design and construct a beautiful and impressive as well as functional piece of equipment which saw frequent ceremonial use throughout the year.

There exist scattered about Dinosaur National Monument a number of small, relatively simple rock art sites, some of which have been identified (Johnson, work

in progress) as one or two-date horizon calendars, such as might have been simply constructed and handily used by people engaged in seasonal rounds. For the most part, these also vary stylistically and in apparent degree of relative repatination from the major rock art sites. There is also evidence of a heavily repatinated widely scattered layer of rock art. One other major rock art site has been spot checked and gives indications that a large number of its panels are interactive, including three of the so-called "supernova" panels (Johnson 1991), which by their interactions as well as their archaeo/astronomic implications suggest a construction date of July 5th and 6th, A.D. 1054.

No rock art has been located at Juniper Ledge Shelter proper (Truesdale, 1991 personal communication). Several rock art sites within 1 km of the shelter remain to be investigated.

This new methodology for investigating rock art sites offers the opportunity to check certain of our assumptions about Fremont lifeways, and to develop and test hypotheses about the rock art itself. Findings from rock art sites will need to be explained and correlated with the data from more standard archaeological investigations to develop tenable hypotheses about the Fremont lifeway.

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ARCHEOLOGICAL TESTING AT SITE 5MF2645 AND DATA RECOVERY OF THE POOL CREEK BURIAL

By
James A. Truesdale

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Introduction

INTRODUCTION

Site 5MF2645, Pool Creek, was located during a Section 106 (of the National Historic Preservation Act, as amended) archeological survey of the Echo Park Road in 1988. Testing was conducted later that year to determine the site's nature, extent, and integrity to evaluate its eligibility for the National Register of Historic Places. In addition, a data recovery plan was developed to salvage a human interment based upon the following criteria: (1) human bone was exposed on the surface and was continuing to erode, endangering its existence; (2) the remains continued to be impacted by grazing and rodent activities; and (3) because of the proximity to the Echo Park Road, the site might be impacted by collectors and vandalism (Truesdale 1988).

SETTING

The Pool Creek Site (5MF2645) is located on a east-west trending ridge, which slopes gently (0-8 degrees) uphill to the west and intersects with a north-south trending sandstone cliff face. The site is at an elevation of 1646 m (5400 ft) AMSL and approximately 150 m (492 ft) west of the Echo Park Road. Vegetation on the site is characteristic of a pinyon/juniper community with juniper, sagebrush, and bunch grasses dominating the landscape. A riparian community may be found 200 m (610 ft) to the east along Pool Creek. Pool Creek is the nearest permanent water source. Soils on the site consist of sandy silts which range in color from tan to light brown to red.

DESCRIPTION

Site 5MF2645 consists of two separate moderately dense concentrations (Localities A and B) of debitage, chipped stone tools, and groundstone (Fig. 1). In addition, human remains (the Pool Creek burial) were located on the site (Fig. 1). The site covers an area 50 m north-south by 215 m east-west (10,700 sq.m./2.656 acres). The site has been impacted by grazing, erosion, collection, and possible vandalism.

Locality A is located on a small terrace bench in the eastern portion of the site (Fig. 1), and consists of a moderately dense chipped stone tool and debitage scatter. Artifacts inventoried in Locality A consist of three bifaces, one core, one utilized flake, two primary, one secondary, and 26 tertiary flakes, and ten pieces of chipped stone shatter. An inventory list and description of the tools may be found in Table 1. All of the tools, with the exception of one siltstone biface fragment, are made from chert. Of the debitage inventoried in Locality A, chert represents 77 percent, quartzite 20.5 percent, and ignimbrite 2.5 percent of the assemblage. All of these tool stone materials are common to the region and can be found locally (Table 2). The high frequency of tertiary flakes (66.6 percent) suggests that stone tool manufacturing and/or maintenance activities occurred in this area of the site. One collector's pile was recorded in the extreme southeastern portion of the site (Fig. 1).

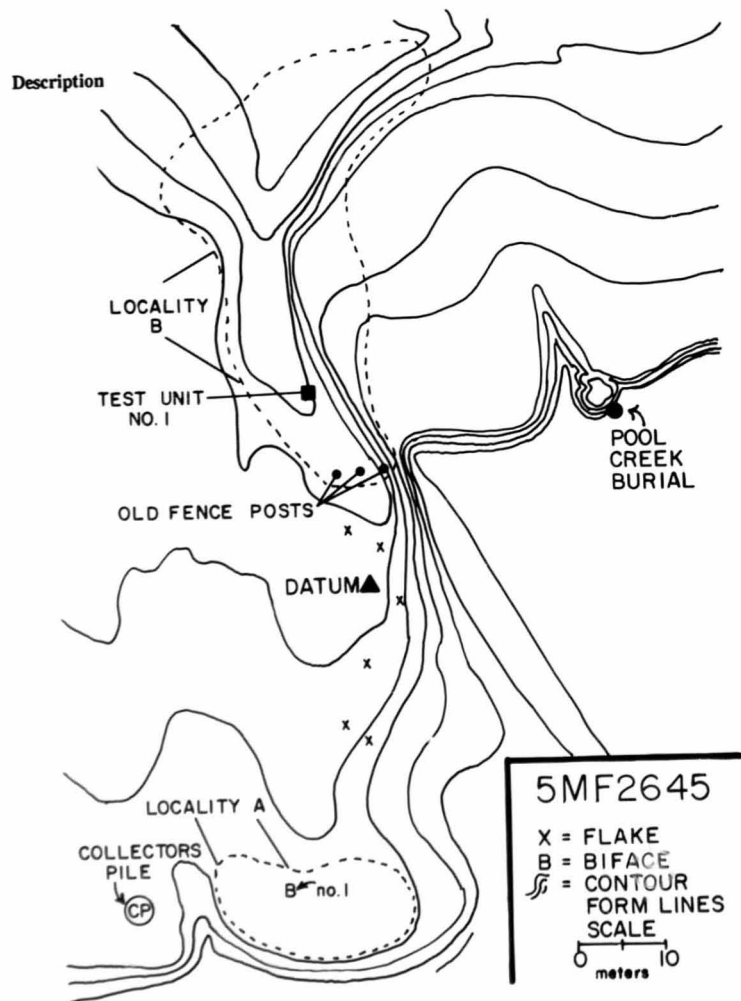


Figure 1. The Pool Creek Site (5MF2645) site map

Description

Table 1. Inventory and description of stone tools recorded on the surface from Localities A and B at site 5MF2645

LOCALITY A:

1. Maroon-gray chert utilized tertiary flake (straight-convex edge).
2. Red-yellow chert core.
3. Tan siltstone/biface fragment.
4. Gray-black (banded) chert biface fragment (base).

LOCALITY B:

1. Red (fire-altered) sandstone mano.
2. Dark brown chert biface fragment (base).
3. Maroon-brown chert biface fragment (blade).
4. Gray chert biface fragment (tip/possible drill fragment).
5. Brown (dendritic) chert core.
6. Red-brown chert utilized tertiary flake (typical graver/single straight edge).
7. Tan to light brown siltstone biface (crudely made).
8. Tan to light brown siltstone biface fragment.
9. Red (fire-altered) sandstone hammerstone.

Locality B (Fig. 2) is upslope from Area A and situated in the western portion of the site. Locality B consists of seven chipped and one ground stone tools, one hammerstone, four primary, ten secondary, and 96 tertiary pieces of chipped stone debitage, and 24 pieces of chipped stone shatter. In addition, burnt and unburnt bone and gray (charcoal-stained) soil were observed eroding from the northern slope of the east-west trending ridge. The tools consisted of five bifaces, one core, one utilized flake, one mano, and one hammerstone. The occurrence of the mano suggests the possibility that vegetal food processing may have been an activity at Locality B.

A description and inventory of tools recorded on the surface in Locality B may be found in Table 1. Of the chipped stone debitage inventoried on the surface at Locality B, 89.5 percent are made from chert and 10.5 percent are made from quartzite (Table 2). The frequency of primary and secondary flakes in Locality B (10.4 percent) suggests that some primary and secondary tool stone reduction was taking place in the area. In addition, a high frequency (69.4 percent) for tertiary flakes indicates that chipped stone tools were being manufactured and/or maintained in Locality B at site 5MF2645.

Description

Table 2. Breakdown of surface chipped stone debitage by material type from Localities A and B, at site 5MF2645

LOCALITY A						
Material Type	PRI	SEC	TER	SH	BTH	TOTAL
CHERT:						
Brown (dendritic)	0	1	3	2	0	6
White	0	0	5	1	0	6
Maroon (gray)	0	0	1	0	0	1
Purple (heat treated)	0	0	3	0	1	4
Red (heat treated)	0	0	3	3	0	6
Pink-yellow	0	0	2	2	0	4
Gray (banded)	0	0	0	2	0	2
Green-gray	0	0	1	0	0	1
CHERT TOTALS	0	1	18	10	1	30
IGNIMBRITE	0	0	1	0	1	1
QUARTZITE:						
Brown	2	0	5	0	0	7
Gray	0	0	1	0	0	1
QUARTZITE TOTALS	2	0	6	0	0	8
LOCALITY A TOTALS	2	1	25	10	1	39
PERCENTAGES	5.1%	2.6%	64.1%	25.6%	2.6%	

Description

LOCALITY B						
Material Type	PRI	SEC	TER	SH	BTH	TOTAL
CHERT:						
Brown (dendritic)	2	1	37	3	2	45
Red (heat treated)	0	2	17	16	0	35
White	1	3	8	1	0	13
Black	0	0	11	1	0	12
Green	0	1	2	0	0	3
Gray-white (banded)	0	0	4	0	0	4
Purple-maroon	0	0	6	1	1	8
CHERT TOTALS	3	7	85	22	3	120
QUARTZITE:						
Gray	0	0	2	0	0	2
Red	0	1	1	0	0	2
Brown	1	2	5	2	0	10
QUARTZITE TOTALS	1	3	8	2	0	14
LOCALITY B TOTALS	4	10	93	24	3	134
PERCENTAGES	3%	7.4%	69.4%	17.9%	2.3%	
LOCALITIES A AND B TOTALS						
LOCALITIES A AND B TOTALS	6	11	118	34	4	173
PERCENTAGES	3.4%	6.5%	68.2%	19.6%	2.3%	

Test Excavation Results

TEST EXCAVATION RESULTS

A 1 meter square excavation unit (TU 1) orientated to true north was judgmentally placed in Locality B (Fig. 1). This unit is situated where charcoal-stained soil, burnt and unburnt bone, and artifacts appear to be eroding from the hillside. This unit was excavated to determine the nature, extent, and integrity of the possible buried cultural materials.

Level 1 (surface to 20 cm below datum) was excavated into gray charcoal-stained sandy silty loam with poorly sorted sandstone colluvial gravels. Materials recovered during excavation of Level 1 consisted of one unburnt and five burnt bone fragments, one biface, one retouched flake, one primary, one secondary, and 35 tertiary flakes, and nine pieces of chipped stone shatter. The bone consisted of unidentifiable long bone fragments of a small rodent-sized mammal. The retouched tool was a tertiary flake with a typical graver/drill working edge made from brown (dendritic) chert. The biface preform was made from a brown (dendritic) chert and exhibited serrated blade edges.

Level 2 (20-25 cm below datum) was excavated into a poorly sorted sandy silt which ranged in color from tan to orange to a charcoal-stained gray. Four features were revealed during excavation of this level (Fig. 3: F-1, F-2, F-3, and F-4). In addition, one burnt and two unburnt bone fragments, one utilized flake, 67 tertiary flakes and 12 pieces of chipped stone shatter were recovered from Level 2. The utilized flake was a tertiary flake of red chert which exhibited crazing from being altered by heat

and an irregular but straight working edge.

Feature 1 was located in the northwest corner of the unit (Fig. 3: F-1). Feature 2 was located in the southwestern corner of the unit (Fig. 3: F-2). Feature 3 was located in the southeast corner of the unit (Fig. 3: F-3). Feature 1 consisted of a semi-circular gray (charcoal-stained) sandy silty fill with moderate amounts of charcoal and some fire-altered sandstone. Feature 2 is a large semi-circle exhibiting a yellow-red silty loam fill with white sandstone gravels. Feature 3 exhibited a fire-reddened sandstone slab which extended into the center of the feature. Feature 4 is a posthole (Fig. 3: F-4) measuring 12 cm in diameter, located in the eastern portion of this unit at this level. Many cultural pithouses from the Archaic Period (Eakin 1984; Eakin et al. 1987; Harrel and McKern 1986; McKern 1987; Metcalf and Black 1988; Truesdale and Eckerle 1986) and the Late Prehistoric "Fremont" Period (Breternitz 1970; Leach 1966; Madsen and Lindsay 1977) have revealed multiple features constructed into the floors similar to Features 1 through 4 in TU-1, Locality B at site 5MF2645.

A sample of charcoal was collected from between the three features and sent to Beta Analytic, Inc. for radiocarbon dating. A date of 1500 ± 70 BP (Beta-27679) resulted.

Level 3 and 4 (25-35 cm below datum) were partially excavated. Only the west half of the unit was excavated so that the soils in the west wall could be photographed and profiled. These two levels produced 12

Test Excavation Results

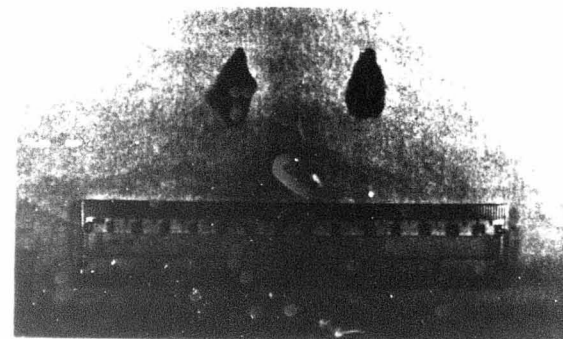


Figure 2. Chipped stone tools recovered during test excavations of TU1, Area B, site 5MF2645

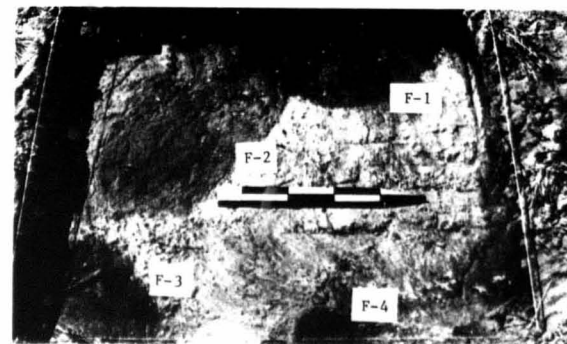


Figure 3. Features revealed during excavation of TU1, Area B, site 5MF2645, (1500 ± 70 BP, B-27679)

Test Excavation Results

profiled. These two levels produced 12 tertiary flakes and ten pieces of chipped stone shatter. After the west wall was profiled and photographed (Fig. 4), the excavation was terminated and the unit was backfilled. The features remain intact for future excavation and study.

Test Unit 1 in Locality B at Site 5MF2645 was excavated 20 cm below the surface into tan to light brown sandy silts. The test excavation revealed the presence of a buried Late Prehistoric "Fremont" pithouse

structure dating to 150 ± 70 BP. The excavation recovered three unburnt and six burnt unidentifiable bone fragments, one preform, one graver/drill, one side scraper, one primary, one secondary, 113 tertiary flakes, and 29 pieces of chipped stone shatter. A breakdown of debitage recovered during excavations from Levels 1-4 in TU 1 by material types may be found in Table 3. Evidence suggests that the possibility of retrieving significant intact buried archaeological materials at the site and in this locality is good.

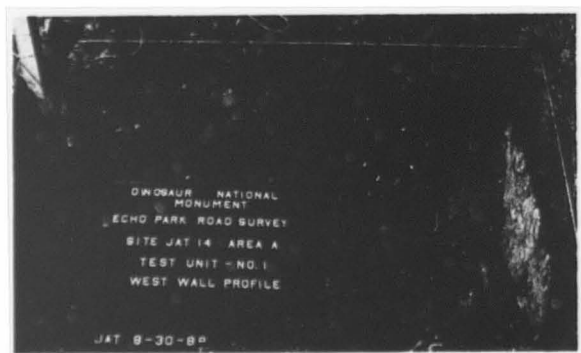


Figure 4. West wall profile of Test Unit 1, Area B, Site 5MF2645, (Area designation in photo should read Area B)

Test Excavation Results

Table 3. Breakdown of chipped stone debitage by material type recovered during excavation, Test Unit 1, Levels 1-4, Locality B, Site 5MF2645

Material Type	PRI	SEC	TER	SH	BTH	TOTAL
CHERT:						
Brown (dendritic)	0	0	23	2	0	25
Red (dendritic)	0	0	37	19	0	56
Gray-brown	1	1	28	1	0	29
Clear	0	0	0	1	0	1
Multi-colored	0	0	0	1	0	1
Milky white	0	0	8	0	0	8
Black	0	0	2	1	0	3
Tan	0	0	0	0	1	1
Purple	0	0	1	0	0	1
CHERT TOTALS	1	1	99	25	1	127
QUARTZITE:						
Brown	0	0	5	4	0	9
Red	0	0	1	2	0	3
Purple	0	0	2	0	0	2
Gray	0	0	4	0	0	4
Yellow	0	0	1	0	0	1
QUARTZITE TOTALS	1	0	13	6	0	19
OBSIDIAN:	0	0	1	0	0	1
TOTALS	1	1	113	31	1	147
PERCENTAGES	.6%	.6%	76.8%	21.4%	.6%	

The Pool Creek Burial

THE POOL CREEK BURIAL

The Pool Creek burial was found May 2, 1988 and is situated in Moffat County, Colorado, at an elevation of 1640 m (5380 ft) AMSL. The interment is 150 m (492 ft) west of the Echo Park Road and 200 m (656 ft) west of Pool Creek.

AMERICAN INDIAN CONCERNS

Department of the Interior regulations and National Park Service policies require that notification and consultation with appropriate Native Americans be undertaken when archeological programs might affect their religious or other cultural interests.

A general letter indicating Dinosaur National Monument's commitment to cooperate with Native Americans in Section 106 consultation was initiated on June 1, 1988. This letter initiated consultation with the Uintah and Ouray Ute Indian Tribe concerning when they wished to be notified and consulted regarding cultural resource management activities (Section 106 compliance, assessment of effect, surveys, salvage and testing, mitigation of impact, excavation, finding of human remains, and consultation prior to disturbance/salvage of human remains). Meetings were held between the Dinosaur National Monument archeologist Jim Truesdale and Clifford Duncan (Director, Uintah and Ouray Ute Cultural Rights Protection Office) that resulted in further understandings about Native American concerns and treatment of Native American burials. Duncan later visited the Dinosaur National Monument curatorial facility to inspect the conditions

under which human remains from the park were stored.

The human remains of an adult and infant were discovered by the author. At the time of discovery, biological and ethnic affinity and age of the remains were unknown. An evaluation of the situation to consider management actions was conducted by the Rocky Mountain Regional Archeologist (Adrienne Anderson), the Dinosaur National Monument Chief of Interpretation (David Whitman), and the Dinosaur National Monument Archeologist (James A. Truesdale). A decision to salvage the interment was made based upon the following criteria: (1) human bone was exposed on the surface and was continuing to erode, endangering its existence; (2) the remains continued to be impacted by grazing and rodent activities; and (3) because of the proximity to the Echo Park Road, the site might be impacted by collectors and vandalism (Truesdale 1988).

On August 19, 1988, a second letter notified the Uintah and Ouray Ute Tribe of the decision to draft a data recovery plan and to conduct subsequent data recovery of the burial feature. This letter confirmed that on May 2, 1988 the author located human remains which were eroding from the talus slope adjacent to a cliff wall. At the time, there was no indication that the human remains were of Ute or any other specific ethnic or biological origin. However, the remains were exposed by erosion and their existence was threatened by continued erosion, rodent activities, possible collection

and vandalism. In early October, 1988, data recovery was undertaken on the Pool Creek Burial.

BURIAL DESCRIPTION

The burial was at the base of a north-south trending sandstone cliff (Fig. 5). The interment was against the rock wall where contact with the talus slope is made (Figs. 5 and 6). The remains were exposed and eroding east downslope. Bones exposed on the surface included the distal ends of the left and right ulnae and radii of an adult, and a left ilium and six vertebrae of an infant. All of the bones exposed on the surface exhibited signs of weathering (bleaching, longitudinal dry bone fractures and splintering). The excavation consisted of a 2 by 3 sq m block against a sandstone cliff wall (Fig. 7). Five whole or partial 1 sq m units were excavated to bedrock. Elevations were taken from a line level attached to a datum stake positioned above the burial. All material was screened through a 1/16 inch wire mesh. Soils on the site consisted of reddish-brown sandy silty loam with some clay and moderate amounts of colluvial sandstone gravels, cactus spines, juniper branches and seeds, pack rat midden matrix, and rodent fecal material.

RESULTS

The burial was located against a sandstone rock wall, on bedrock, and covered by talus. Excavation down slope from the excavation unit (1-2N, 2-3W) revealed no intact deposits of human remains. However, screening of these lower units recovered several human maxillary teeth and bone

The Pool Creek Burial

fragments, four kernels of corn, and 190 non-human bones and bone fragments.

The remains were located approximately 5-15 cm below the surface of the talus slope and situated on the sandstone bedrock. Strips of juniper bark were exposed on the surface and encountered immediately. The juniper bark covered a portion of the remains and lined the upper portion of the burial niche along the sandstone wall. The mandible was discovered immediately with portions of juniper bark adhering to it. Maxillary teeth were mapped in and around the mandible. Excavations revealed an articulated vertebral column from the 11th thoracic to the 5th cervical (Figs. 6 and 7). The remaining cervical vertebrae were located near the mandible and vertebral column. In addition, 10-11 left ribs were articulated to the vertebral column. The lower elements of the adult were missing. These elements included all of the lumbar vertebrae, innominate, sacrum, femora, tibiae, fibulae, tarsals, and phalanges. In addition, all of the carpals and hand phalanges, and the skull were missing.

The infant was articulated from the lower thoracic to the cervical vertebrae with most of the left and right ribs still articulated to the vertebral column (Figs. 6 and 7). However, no long bones, carpals, tarsals, mandible, or skull were present.

The burial had been disturbed by erosion, rodent activity, and vandalism. Excavation revealed that the remains of the adult were placed against the sandstone wall in a semi-flexed or sitting position with the infant cradled in the arms and covered with strips

The Pool Creek Burial

of juniper bark. Sandstone rocks located around the exterior portion of the remains (Fig. 7) suggest that a sandstone rock wall was placed around the remains to cover and conceal the interment. Evidence indicates that subsequent erosion removed most of these rocks and a greater portion of the adults right rib cage and lower torso.

Following this erosion, the articulated remains (skull to 12th thoracic) appeared to

have slumped to the north onto the right side and were subsequently buried by continued erosional fill sequences creating the present day talus slope. The presence of the atlas and axis, the mandible, and hyoid bones indicate that the upper portion of the adult's remains, including the skull, was still intact and articulated when the slumping occurred.



Figure 5. The Pool Creek Burial, 5MF2645, (1300±80 BP, Beta-28935)

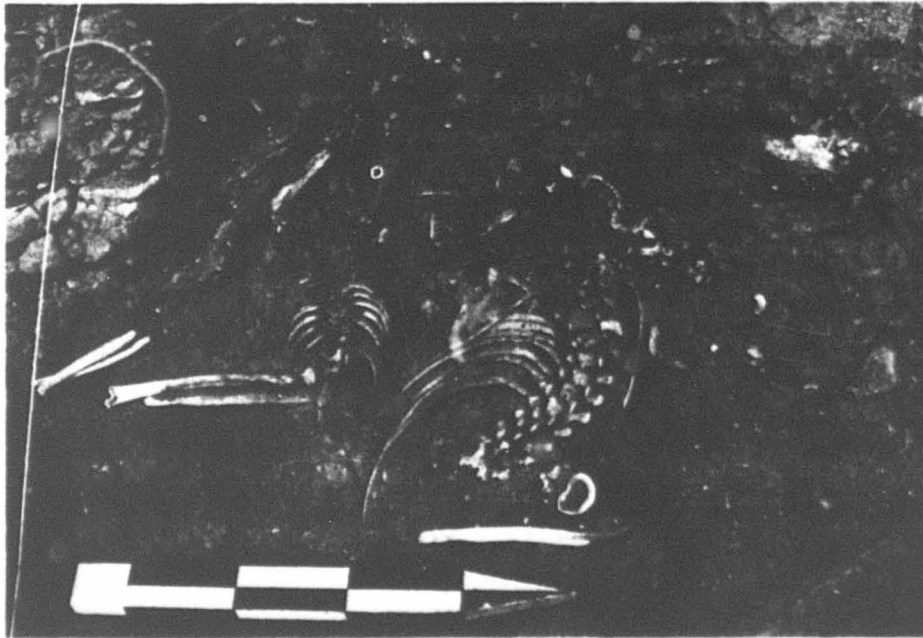


Figure 6. The Pool Creek Burial, 5MF2645, (1300±80 years BP, Beta-28935)

The mandible appeared to be situated in its anatomical position, with juniper bark clinging to its left side, and exhibiting no evidence of exposure to surface weathering and/or deterioration (bleaching, longitudinal dry bone fractures or splintering). This would suggest that the skull was articulated to the mandible at the time the remains slumped. If the skull had been exposed and eroded away by weathering processes, the mandible would have been exposed to such processes as well. This evidence suggests that the skull was exposed later in time, was found then and possibly removed by collectors. In this scenario, the remainder of the interment was then covered and left.

Most of the infant's remains were most likely lost during the initial erosional

processes which caused the burial to slump to the north. Soils in and around the remains consisted of reddish sandy silty colluvium. The soil in and around the infant was dark brown, possibly stained from decomposing organic remains. These soils and the interment were situated on a reddish sandstone bedrock. During the course of the excavation, no evidence of a burial pit was encountered. In fact, there is a possibility that the remains were intentionally placed against the sandstone cliff wall without excavation. The individuals' personal items and/or grave goods were then placed in with the remains and subsequently covered with juniper bark. Large sandstone slabs and rocks were then stacked around and placed over the remains to conceal it.

POOL CREEK BURIAL

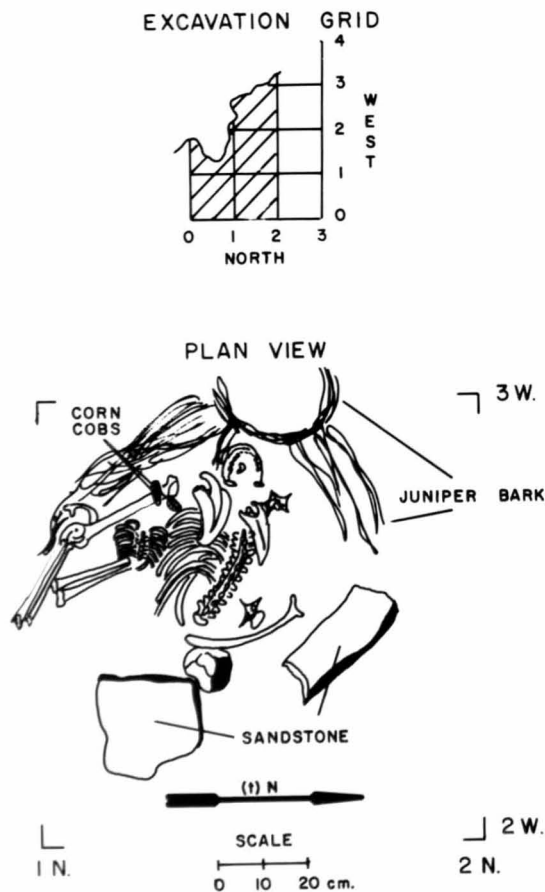


Figure 7. Plan View of the Pool Creek Burial excavation grid and map

Artifacts recovered during the excavations include a sandstone metate, one yellow (dendritic) chert tertiary flake, four kernels of corn, and two corn cob fragments (Fig. 8). The fragments of corn cobs and kernels have not been identified as to type of taxonomy.

A sample of juniper bark was sent to Beta Analytic, Inc. for radiocarbon dating. A date of 1300 ± 80 BP (Beta-28935) (Appendix) resulted.

Skeleton Number 1

The Pool Creek adult skeleton is that of a middle-aged American Indian female. These determinations were made from a complete mandible (Fig. 9) and complete humeri and clavicles (Fig. 10). Other postcranial bones present but less pertinent to the analysis are all other limb bones; all remaining ribs, a complete sternum, both scapulae (Fig. 11) and the 12th thoracic to the 1st cervical vertebrae.

Sex determination was made by examining and observing a few features on the long bones (robusticity, clavicle and humeri length). The length of the clavicles and humeri, and the vertical head diameter of the left humerus (41.5 mm) suggest an assessment of female (Krogman 1962). Age has been set at 35-40 years based upon Hrdlicka's scale of attrition on the dentition (Ubeaker 1978), the deeply cupped distal ribs (Iskan et al. 1985) and the beginning of arthritic lipping on some of the vertebrae. Race is clearly American Indian as evidenced by the tooth form and wear as well as the cultural context of the burial. Living stature has been calculated from

the complete long bones (Table 4) and was 154.3-155.6 cm (approximately 5ft-1 inch), according to the most accurate Trotter formula for female Caucasoids (Krogman 1962; Trotter 1970). The particular formula used (Caucasoid) produces the greatest internal consistency for Northwestern Plains Indian females as demonstrated in an earlier, more complete, analysis of long bone proportions (Gill 1976). The formulae of Genoves (1967), developed from a skeletal series of Central American Indians, are frequently utilized by human osteologists working with North American Indian populations, but these produce especially unreliable results for specimens from the Rocky Mountain area. Therefore, the Genoves formula was not applied in this case.

Abscesses of the left lateral incisor and cavities in the left M1, M2, and the right M1 and M3 were in progress at the time of death. Slight arthritis was evidenced along the spine.

Skeleton Number 2

The Pool Creek infant skeleton is that of a newborn. This determination was based upon aspects of growth from the pelvis and vertebrae (Anderson 1969; Reynolds 1945). The only remaining portion of this individual was an articulated vertebral column with articulated left and right ribs (Fig. 7). It was not possible to calculate sex and stature because of the age and paucity of diagnostic bone needed for these studies. However, race is most likely American Indian as suggested by the individual's cultural context with Skeleton No. 1, the adult female.



Figure 8. Corn cobs and kernels recovered during excavation of the Pool Creek Burial, Site 5MF2645

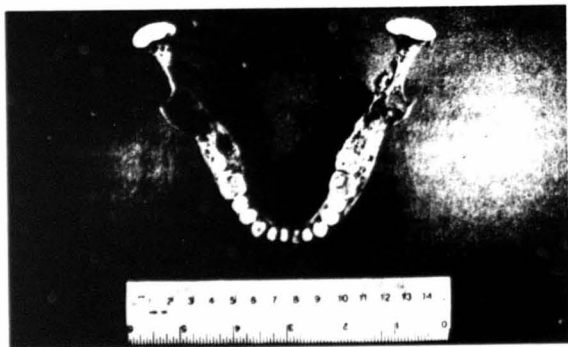


Figure 9. Mandible from Skeleton No. 1 recovered during excavation of the Pool Creek Burial, Site 5MF2645

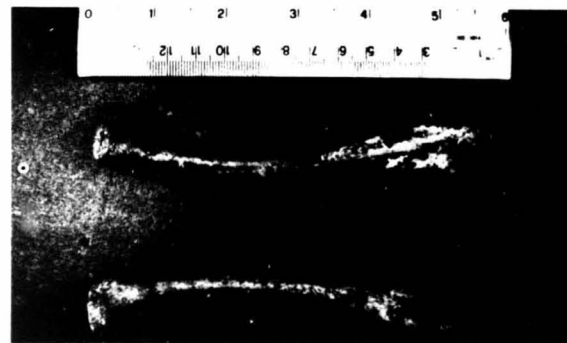


Figure 10. Clavicles from Skeleton No. 1 recovered during excavation of the Pool Creek Burial, Site 5MF2645

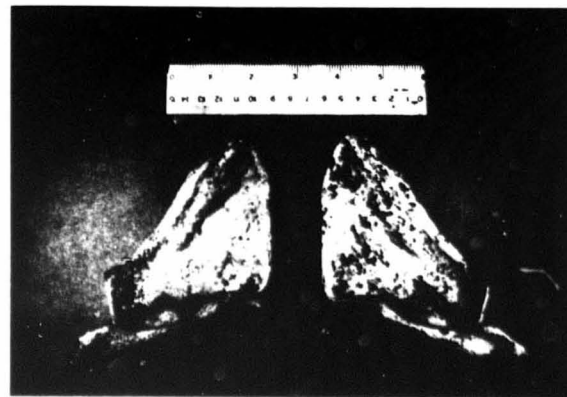


Figure 11. Scapulae from Skeleton No. 1 recovered during excavation of the Pool Creek Burial, Site 5MF2645

The Pool Creek Burial

Table 4. Measurements and indices of the Pool Creek Burial Skeleton No. 1

MEASUREMENTS*			
MANDIBULAR			
Symphyseal height			30
Bigonial diameter			91
Bicondylar diameter			120
Ascending ramus height			56
Ascending ramus breadth			30
Corpal length			77
Gonial angle			27 degrees
POST CRANIAL			
(Maximum length)	L	R	
Clavicle	138	---	
Radius	---	---	
Ulna	---	---	
Humerus	293	296.5	
Femur	---	---	
Tibia	---	---	
Fibula	---	---	

*Measurements are given in millimeters unless otherwise indicated.

SUMMARY

The Pool Creek Burial was a "Fremont" primary interment of a middle-aged (35-40 year old) female and a newborn infant radiocarbon dating to 1300 ± 80 B.P. [A.D. 682], (Beta-28935) (Appendix). The female was placed in a sitting position facing west against a sandstone cliff wall with the baby cradled in her arms, grave goods and/or personal items placed in with the remains, covered with strips of juniper bark, and then covered with rocks to conceal the interment. It is apparent that the burial was a simple

disposal or primary interment involving inhumation, interment, or burial by concealing the body in the ground. Juniper bark has been found in association with burials from other time periods in the Rocky Mountain Region (Truesdale and Gill 1986).

The interment is atypical in burial attribute comparison to other Fremont burials recorded in the Uinta Basin (Ambler 1969; Breternitz 1970; Leach 1970). More burials have been recovered from internal pits

located in the floors of house pit structures (Ambler 1966). Truesdale (1987) reported that most of the burials recovered in the Rocky Mountain Region were primary interments located in pits with the remains placed in a flexed position facing east.

In the Uinta Basin, the Late Prehistoric pithouse structures are attributed to the Fremont occupation. These structures exhibit a moderate amount of diversity in their size, depth, and internal arrangement. Most pithouses measure 4 to 6 meters in diameter, and vary in depth from several centimeters to 1 meter, and may have more than six subfloor features (Ambler 1966; Breternitz 1970; Truesdale 1990a). In addition, structures recorded at sites 42UN1877 and 42UN1773 have a prepared clay floor located near the central fire pit (Truesdale 1990, 1991). After A.D. 400, many of the central fire pits within the pithouses exhibit an adobe collar around the rim of the feature. The pithouse structure at the Pool Creek site is similar in architectural type and style associated with the Uintah Fremont who occupied the area. Breternitz (1970) and Truesdale (1990) excavated several pithouses associated with village sites along the Cub Creek area in Dinosaur National Monument. It is thought that these village sites are winter habitation localities.

One of the differences between the Pool Creek site and those along Cub Creek is their localities. Most of the pithouse village sites in the region are located on secondary streams of the Green River, along the northern edge of the Uinta Basin at the base of the foothills where they would potentially be situated below minimal snow pack.

The Pool Creek Burial

However, the Pool Creek site is situated approximately one mile from the confluence of the Green and Yampa rivers surrounded by their steep canyon systems. The Cub Creek sites are located at an elevation of approximately 5044 feet AMSL and the Pool Creek site is at 5400 feet AMSL. There is little difference in elevation of the two localities, but the Pool Creek site is surrounded by canyon walls and mountains that are impassible in the winter.

Archaeological studies and interpretations of mortuary practices and burial attributes have greatly benefited in recent years from several thoughtful discussions of such data and their implications for topics such as cultural change, cultural variability, and the study of specific burial customs (Alekshin 1983; Bartel 1982; Brown 1971; Chapman et al. 1981; O'Shea 1984; and Tainter 1978). Truesdale (1987) studied mortuary practice and burial attribute data on 144 individual prehistoric and historic burials from the Rocky Mountain Region. Nickens (1988) presented archaeological evidence of Eastern Ute mortuary practices. The availability of such exhaustive studies serves as the literature background to the present study and also makes it unnecessary to repeat the data that combine to form a theoretical basis for archeological study of mortuary practices.

Binford (1971:6) states "both the number and specific forms of the dimensions of the social persona commonly recognized in mortuary ritual vary significantly with the organizational complexity of the society as measured by different forms of subsistence

The Pool Creek Burial

practice" and concludes that "much of contemporary archaeological conjecture and interpretation regarding processes of cultural change, cultural differentiation, and the presence of specific burial customs is inadequate as well as the ideational propositions and assumptions underlying these notions." Thus, "inferences about the presumed "relationships" compared directly from trait lists obtaining among archaeological manifestations are useless without knowledge of the organizational properties of the pertinent cultural systems" (Binford 1971:6).

Therefore, when dealing with the human remains and associated artifacts from the Pool Creek burial, we must reconstruct the culture, organizational properties of the individuals' society, their settlement and subsistence, and review other burials recorded in the same geological area (Uinta Basin) contemporary with the Fremont culture.

Archaeologists defined the Fremont in the Uinta Basin as a horticultural/hunter and gatherer culture that occupied the Uinta Basin between A.D. 100 and 1250 (Truesdale 1990). The Fremont had various technologies (horticulture, bow and arrow, ceramics, use of adobe, and rock art) in this time period. However, the complexity of their culture and society is just now beginning to be understood. The Fremont in the Uinta Basin were generally isolated within the basin, the northern and eastern flanks of the Uinta mountains and the steep canyons of the Green and Yampa rivers. Many burials have been recorded from the Uinta Basin; however, only 15 individuals from six sites are considered to be

contemporaneous and have ethnic affinities to the Fremont.

Nine burials were recovered during 1964 excavations of Caldwell Village (Ambler 1966). At least four of the burials were placed in storage pits within house floors, three were in abandoned borrow pits, and two were in pits prepared specifically for burial (Ambler 1966:30). Ambler (1966:30) adds that the most striking characteristic of the burials at Caldwell Village is the apparent carelessness with which the bodies were interred. It could be inferred that the burial attributes observed at Caldwell Village were not necessarily standard mortuary practices of the Fremont. The only radiocarbon date from Caldwell Village dates to 1430 ± 70 years B.P. [GX-0357] (Ambler 1966:66).

Other human remains and burials have been excavated in Dinosaur National Monument (Breternitz 1970, Truesdale 1991b). The charred remains of an adult male and female were recovered from the floor of Structure 1 at Burnt House Village (Breternitz 1970:58 Fig.6). It is suspected that these individuals fell prey to cannibalism (Breternitz 1970:71). A radiocarbon age from wood recovered in Post Hole B, Structure 1 at Burnt House Village dated to 1920 ± 70 years B.P. [Beta-33907] (Truesdale 1990). At Arrowhead Point, a primary inhumation of a 5 year old child was recovered resting on bedrock in a semi-flexed position facing west (Breternitz 1970:118-119). No artifacts were recovered in association with the adolescent remains and no radiocarbon age is available for Arrowhead Point.

At Juniper Ledge Shelter, remains of an adult female were recovered along with a tumpine burden basket filled with a small amount of corn kernels (Truesdale, this volume). A sample of the corn kernels recovered from the basket in Cultural Component 3 at Juniper Ledge Shelter yielded a radiocarbon age of 1650 ± 80 years B.P. (Beta-36605). Data on the Juniper Ledge Shelter individual and its burial attributes are slim because the archaeological investigations were halted so as not to disturb the remainder of the interment. However, it was evident that the remains were located in a canyon rock shelter and buried into the shelter sediments, possibly in a pit.

An additional human burial was salvaged from the shore of Steinkaker Reservoir (Truesdale 1991a). The burial was a simple primary inhumation of a 6.5 year old child which had been placed in a pit. The interment had subsequently slumped onto the sandy beach because of continual raising and lowering of the water level and wave action against the terrace/bench. Therefore, additional burial attribute data, other than the vehicle of disposal, could not be determined. However, the profile of a Fremont pithouse with a prepared clay floor was observed in the exposed wall of the terrace. This pithouse feature was less than three meters from the human interment.

Finally, the remains of a simple primary inhumation of a newborn to six month old infant, who had been wrapped in a hide blanket and placed on a cradle board, was recovered from an alcove in the Red Fleet Reservoir State Park north of Vernal (Truesdale 1993:31). The infant and cradle

board had been placed in a crevice between a detached sandstone rock and the back wall of an alcove. The cradle board was essentially a twined construction with rigid warp elements and a set of flexible and rigid weft elements. Two radiocarbon dates of 1380 ± 60 (Beta-54243/cams 3015) and 1190 ± 60 (Beta-54244/cams 3016) years B.P. resulted from samples of leather thong and hide (Truesdale 1993:32).

The interment at Pool Creek used a common vehicle of disposal (the crevice/rock shelter). Even though a higher percentage of burials were recovered from pits, it appears that crevice and rock shelters were commonly used by the Fremont to dispose of their dead as well.

The radiocarbon age for the Pool Creek Site appeared to be early for Fremont occupation in the area. Breternitz (1970:160-164) thought that the age of the 'Cub Creek Phase' sites would range between A.D. 100 and 1150 (800-950 B.P.), give or take 50 years at either end. With this in mind, it appeared that the dated occupation at Pool Creek of A.D. 400 and 600 could be defined either as terminal Late Archaic or early Fremont.

To resolve this apparent age discrepancy and correlate some level of context and association between the Cub Creek Fremont Sites and the Pool Creek Site, samples from five Cub Creek Sites were radiocarbon dated. These carbon samples were recovered from the Breternitz collection, which is located in the curatorial facilities at the Dinosaur National Monument headquarters. These samples were weighed and sent to Beta Analytic for radiocarbon

The Pool Creek Burial

Table 5. Description of calibrated radiocarbon dates

B-48790	110 +/- 50	42UN1850	-Charcoal from buried cultural level.
B-48405	160 +/- 60	5MF2961	-Burnt bone from rectangular rock surface structure.
B-8561	430 +/- 50	42UN1103	-Charcoal from buried level.
B-48789	650 +/- 60	5MF2960	-Charcoal from firepit in surface rock structure.
B-48791	660 +/- 50	42UN1850	-Charcoal from firepit.
B-8560	670 +/- 50	42UN1103	-Charcoal from buried level.
B-34324	700 +/- 60	42UN1724	-Juniper Ledge Shelter - Charcoal from firepit.
B-8559	800 +/- 140	42UN1103	-Charcoal from firepit.
AA7823	882 +/- 60	5MF1	-Flicker Feather Headdress, Ermine fur.
AA7824	1000 +/- 52	5MF1	-Flicker Feather Headdress, Leather thong.
B-27983	1030 +/- 60	5MF2656	-Wood from sandstone/wattle and daub storage facility.
GX-0894	1030 +/- 80	42UN178	-Deluge Shelter - Level 3, Charcoal from firepit.
B-34325	1110 +/- 50	42UN1724	-Juniper Ledge Shelter - Charcoal from firepit.
UN-1	1200 +/- 60	5MF9	-Marigold Cave - Wood from log post.
GX-0895	1215 +/- 85	42UN178	-Deluge Shelter - Level 4, Charcoal from firepit.
RL-11	1260 +/- 150	5MF1	-Mantle's Cave -
B-33004	1290 +/- 50	42UN199	-Walton's Cist - Wood from wattle and daub storage facility, fishhook.
B-50426	1290 +/- 130	42UN1708	-Charcoal from firepit.
B-28935	1300 +/- 70	5MF2645	-Pool Creek Burial - Juniper Bark.
B-30451	1310 +/- 50	42UN57	-Wholeplace Village-Charcoal from central adobe rimmed firepit in Structure 2.
B-30450	1340 +/- 50	42UN49	-Wagon Run - Charcoal from central adobe rimmed firepit in Structure 4.
B-28934	1410 +/- 80	5MF2639	-Sand Canyon Shelter - Charcoal from firepit.
B-27679	1500 +/- 70	5MF2645	-Pool Creek Site - Charcoal from floor of Pithouse.
B-33908	1510 +/- 90	42UN280	-The Dam Site - Charcoal from adobe rimmed firepit.
B-38589	1530 +/- 50	42UN1773	-Charcoal from bell-shaped firepit in floor of pithouse.
B-38588	1550 +/- 60	42UN1773	-Charcoal from floor of pithouse.
B-33906	1560 +/- 60	42UN83	-Fremont Playhouse - Wood from NE corner post of structure.
GX-0896	1625 +/- 95	42UN178	-Deluge Shelter - Level 5, Charcoal from firepit.
B-36605	1650 +/- 80	42UN1724	-Juniper Ledge Shelter, Corn ass/w loosely woven juniper bark burden basket (B-34326).
B-33005	1790 +/- 80	42UN1708	-Charcoal from buried cultural level.
B-33907	1920 +/- 70	42UN279	-Burnthouse Village - Charcoal from posthole b.
B-34326	2330 +/- 80	42UN1724	-Juniper Ledge Shelter - Juniper bark from loosely woven burden basket.
B-27680	2340 +/- 100	5MF2649	-Charcoal from firepit.
GX-0897	3260 +/- 120	42UN178	-Deluge Shelter - Level 8, Charcoal from firepit.
B-27678	3500 +/- 70	5MF2637	-Opencampsite, charcoal from firepit.
GX-0898	3840 +/- 210	42UN178	-Deluge Shelter - Level 11, charcoal from firepit.

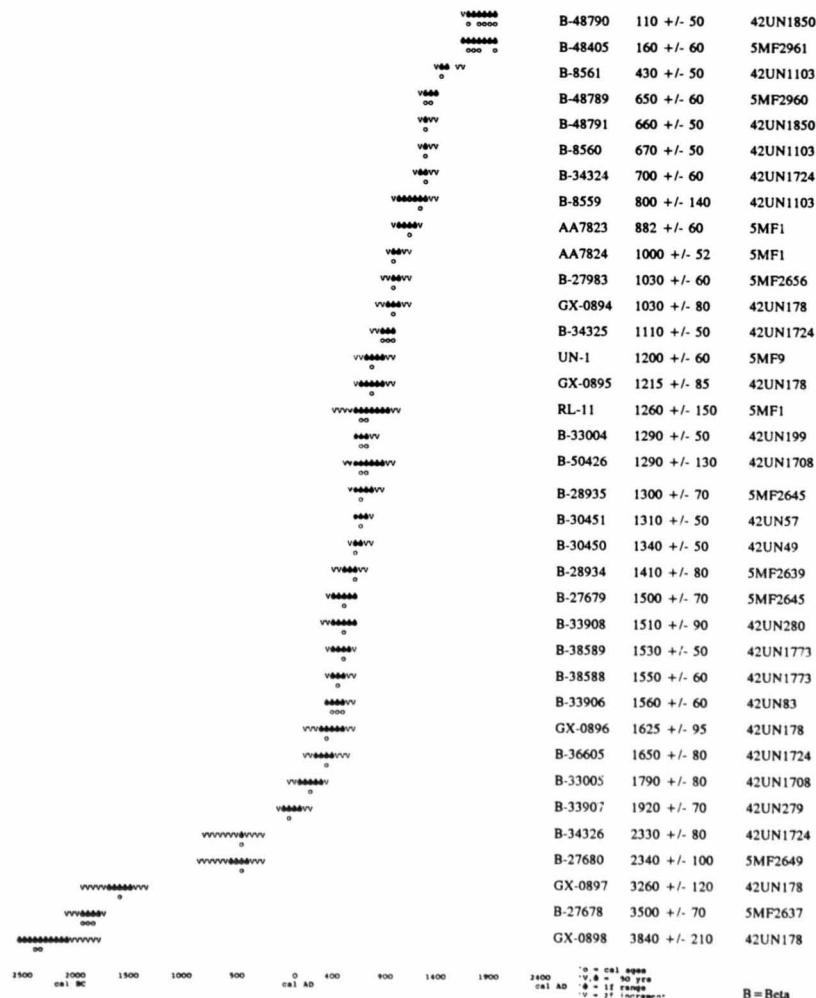


Figure 12. Calibrated radiocarbon dates

The Pool Creek Burial

dating. Because the samples were 24 years old, there was some concern as to whether or not the samples had retained their integrity.

The first charcoal sample had been collected from a central adobe rimmed fire pit (Feature 1) in Structure 2 at Wholeplace Village [42UN57] (Breternitz 1970:13, Fig. 6). A recalibrated radiocarbon age of A.D. 650 (1310 ± 50 years B.P., Beta-30451) resulted. The second charcoal sample had been collected from a central adobe rimmed fire pit (Feature 1) in Structure 4 at Wagon Run Village [42UN49] (Breternitz 1970: 35, Fig 6). A recalibrated radiocarbon age of A.D. 610 (1340 ± 50 years B.P., Beta-30450) resulted. The third charcoal sample had been collected from an adobe rimmed fire pit at the Dam Site in Feature 1 (Breternitz 1970:75, Fig. 3). A recalibrated radiocarbon age of A.D. 642 (1410 ± 80 years B.P., Beta-28934) resulted. The fourth sample was wood from the northeast corner post of the Fremont Playhouse [42UN83] (Breternitz:1970:42, Figure 3). A recalibrated radiocarbon age of A.D.470 (1560 ± 60 years B.P., Beta-33906) resulted. The fifth and last charcoal sample had been collected from Post Hole B in Structure 1 at

Burnt House Village (Breternitz 1970:58, Figs. 6 and 7). A recalibrated radiocarbon age of A.D. 69 (1920 ± 70 years B.P., Beta-33907) resulted. The radiocarbon dates place the Cub Creek occupation 900 to 400 years earlier than originally thought by Breternitz.

Between 1988 and 1992 the number of radiocarbon dates for Dinosaur National Monument grew from 10 to 40. Thirty six of these radiocarbon dates were recalibrated using the University of Washington Quaternary Isotope Lab Radiocarbon Calibration Conversion and Display program. The plotted results of the recalibration program along with a brief description of the samples provenience may be found in Table 5 and Figure 12, which illustrates that there is no hiatus between the Late Archaic/Fremont transition or between the Fremont/Numic transition periods. In addition, these results indicate that the "Uintah" Fremont occupied the Dinosaur National Monument area roughly between A.D. 100 and 1250. Therefore, the radiocarbon age for the Pool Creek Site is consistent with the other dates attributed to Fremont occupation in Dinosaur National Monument.

Pool Creek Site Conclusions

POOL CREEK SITE CONCLUSIONS

Excavations at the Pool Creek site (5MF2645) have yielded evidence of a buried Fremont pithouse dating to 1500 ± 70 years B.P. Additional amorphous charcoal stains exposed on the surface along the ridge system where the test excavation was located indicate that other pithouse structures are present at the site. This would lead to the conclusion that a Fremont village is located in the center of Dinosaur National Monument along Pool Creek.

In addition, the Pool Creek Site yielded a simple primary inhumation of an adult female and newborn to six month old child dating to 1300 ± 80 years B.P. The type and style of burial attributes (vehicle and form of disposal, body preparation, degree of flex, position of arms, deposition and burial

items) appear to be consistent with other inhumations attributed to the Fremont in Dinosaur National Monument and the Uinta Basin. Whether the Fremont in the Uinta Basin differentiated between the type of burial and the status, role, age, and/or sex of individuals within their culture is still unknown.

The age of the pithouse and burial are contemporaneous with other Fremont occupations dated within Dinosaur National Monument. How the Pool Creek Site fits into the subsistence and settlement strategies for this horticultural/hunter and gatherer culture is unknown. However, it appears that the Fremont were placing long-term camps within the interior of the canyons.

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Appendix

Pool Creek Site

Description of Calibrated Radiocarbon Dates

**POOL CREEK SITE
DESCRIPTION OF CALIBRATED RADIOCARBON DATES**

Beta-27679

Radiocarbon Age BP	1500.0 q 70.0E
calibrated age(s)	cal AD 558
	cal BP 1392
cal AD/BC (cal BP) age ranges:	
One Sigma**	cal AD 432- 518(1518-1432) 529- 639(1421-1311)
Two Sigma**	cal AD 410- 660(1540-1290)

Intercepts and maximum range:

one sigma	cal AD 432 (558) 639
	cal BP 1518 (1392) 1311
two sigma	cal AD 410 (558) 660
	cal BP 1540 (1392) 1290

Beta-28935

Radiocarbon Age BP	1300.0 q 70.0E
calibrated age(s)	cal AD 682
	cal BP 1268
cal AD/BC(cal BP) age ranges:	
One Sigma**	cal AD 650- 776(1300-1174) 794- 797(1156-1153)
Two Sigma**	cal AD 604- 630(1346-1320) 640- 890(1310-1060)

Intercepts and maximum range:

one sigma	cal AD 650 (682) 797
	cal BP 1300 (1268) 1153
two sigma	cal AD 604 (682) 890
	cal BP 1346 (1268) 1060

References for datasets [and intervals] used: Stuiver, M. and Becker, B. 1986 *Radiocarbon* 28:863-910

**This standard deviation (error) may include an error multiplier.

1 sigma = square root of (sample std. dev.) + (curve std. dev.)

2 sigma = 2 x square root of (sample std. dev.) + (curve std. dev.)

0* represents a "negative" age BP

1955* denotes influences of bomb C-14

> 2497 BC represents end of calibration data.

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