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## REPORTS

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### Radiocarbon Evidence Relating to Northern Great Basin Basketry Chronology

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*Adovasio et al. (1986) described Early Holocene basketry from the northern Great Basin as "simple twined and undecorated." Cressman (1986) reported the presence of decorated basketry during the Early Holocene, which he characterized as a "climax of cultural development" in the Fort Rock Basin in Oregon. These contrasting interpretations are the product of relatively small basketry assemblages reliably dated to the Early Holocene from this area, as well as the questionable recovery context of some critical specimens. We report on the direct AMS dating of a number of basketry specimens central to this issue. Early Holocene basketry from the northern Great Basin does include decorated and complex structures; however, since most of the dated specimens fall toward the end of the Early Holocene, the evidence presented here does not provide definitive closure to the issue.*

**THE** most comprehensive and widely known discussions of northern Great Basin basketry technology and chronology are those of Adovasio (1970, 1974, 1986a; cf. Adovasio et al. 1976, 1986), who identified this area as one of three principal Great Basin "centers" of basketry technology. Adovasio identified three significant chronological stages for this locally stable tradition, which exhibits remarkable continu-

ity over a span of nearly 10,000 years (cf. Cressman 1942, 1986; Connolly 1994). Stages 1 and 2 are divided at 7,000 years ago, the approximate time of the Mt. Mazama eruption which deposited a significant tephra chronological marker throughout the region. Stage 3 begins after 1,000 years ago,<sup>1</sup> when traits associated with Northern Paiute basketmaking traditions appear (Adovasio 1986a; Fowler and Dawson 1986; Adovasio and Pedler 1995; Fowler 1995).

During Stage 1, from 11,000 to 7,000 years ago, Adovasio (1986a:196) asserted that northern Great Basin basketry was limited to open and close simple twining with z-twist (slanting down to the right) wefts. Fort Rock and Spiral Weft sandals were made (see Cressman [1942] for technical details of sandal types). Absent were s-twist wefts (slanting up to the right) and decorative embellishment of any kind. Also absent in this region were construction techniques other than simple twining; Adovasio (1986a:196; also see Adovasio et al. 1976:7, 1977:21) argued that diagonal twining, coiling, and plaiting are absent.

Basic basketry structures—dominated by open and close simple twining with z-twist wefts—continue during Stage 2 (7,000 to 1,000 B.P.), with the first appearance of s-twist wefts early in the stage, as well as decorative embellishments such as false embroidery and overlay, and structural elaborations, including diagonal twining. Fort Rock sandals were initially made but quickly disappeared, and the initial predominance of Spiral Weft sandals waned in favor of the Multiple Warp type. Coiled basketry and rigid-warp twined structures with s-twist wefts appear only in Stage 3 (<1,000 B.P.). There is little real disagreement regarding Adovasio's basic chronology, save for a number of minor published

**Table 1**  
**RECENTLY DATED BASKETRY SPECIMENS RELATING TO CHRONOLOGY**  
**IN THE NORTHERN GREAT BASIN BASKETRY CENTER**

Accession/ Specimen No.	Probable Fiber	Site Name	Significance	Predicted Age	AMS Age	Lab No.
100KC, 1-14707	<i>Scirpus</i>	Fort Rock Cave	false embroidery	pre-Mazama (>6,750 B.P.)	4,430 ± 60	AA-19150
100BP, 1-5345	<i>Scirpus</i>	Paisley Cave No. 1	overlay	pre-Mazama	145 ± 50	AA-19151
100BP, 1-5344	<i>Scirpus</i>	Paisley Cave No. 1	false embroidery, 3-strand twine	pre-Mazama	6,560 ± 70	AA-19153
404, A3-6/1-B68	<i>Scirpus</i>	Dirty Shame Rockshelter	diagonal twine	pre-Mazama	6,950 ± 110	AA-19154
Pe3d.259	<i>Scirpus</i>	Guano Cave	overlay, 3-strand twine	unknown	6,795 ± 55	AA-11594
60, 1-8694	<i>Salix</i>	Roaring Springs	S weft, rigid warp	≤500 ± 500 B.P.	20 ± 50	AA-19152
35LK94-15	<i>Salix</i>	South Warner Cave	rigid warp, open diagonal twine	<500 ± 500 B.P.	150 ± 55	AA-6445
35LK94-16	<i>Salix</i>	South Warner Valley Cave	coiling	<500 ± 500 B.P.	80 ± 55	AA-6482
35LK94-21	<i>Salix</i>	South Warner Valley Cave	rigid warp, close diagonal twine	<500 ± 500 B.P.	25 ± 95	AA-6482

skirmishes (e.g., Cressman 1951:308, 1986:123; cf. Adovasio 1986a:196) which provide the focus of this discussion.

Adovasio's chronology posited a clearly evolutionary perspective (e.g., Adovasio et al. 1976), in that the primary criteria which distinguish Stage 1 basketry from later materials is its structural simplicity and absence of decorative features. Adovasio et al. (1986:32) argued that "in all cases, the pre-Mazama-age basketry . . . is simple twined and undecorated" (emphasis in original). In asserting this chronology, Adovasio et al. (1986) downplayed the few significant claims, principally by Cressman (1942:39, 1951:308, 1986:123), for the occurrence of complex structures in purported pre-Mazama contexts. Cressman (1986:122; cf. Bedwell 1973) has long characterized portions of the pre-Mazama period as a "climax of cultural development" in the northern Great Basin, with its basketry exhibiting the more elaborate features that Adovasio et al. (1986) assigned only to post-Mazama contexts.

The basis for such differing interpretations clearly derives from the relatively small basketry assemblages reliably attributable to a pre-Mazama age, and the questionable recovery context of

some of the critical specimens. Fortunately, some of these questions are potentially resolvable by direct radiocarbon dating. This report discusses the results of an accelerator dating program sponsored by the Bureau of Land Management, Lakeview District, for a number of specimens at the center of the controversy (Table 1). It also adds data on the dating of some Stage 3 textiles, aimed at testing current assumptions regarding basketry chronology in the northern Great Basin.

### SIGNIFICANCE AND DATING OF SPECIMENS

#### Questions Related to Early Holocene Basketry Technology

When Cressman excavated the northern Great Basin sites in the 1930s that produced the bulk of the materials used to characterize the Northern Basin basketry center (Fig. 1), the antiquity of the basketry technology was unanticipated. While Cressman (1942:3) quickly realized the significance of the Mazama tephra layer, thought at the time to be at least 5,000 years old, his primary concern was in stylistic comparisons to discern "the relationship of the culture of the

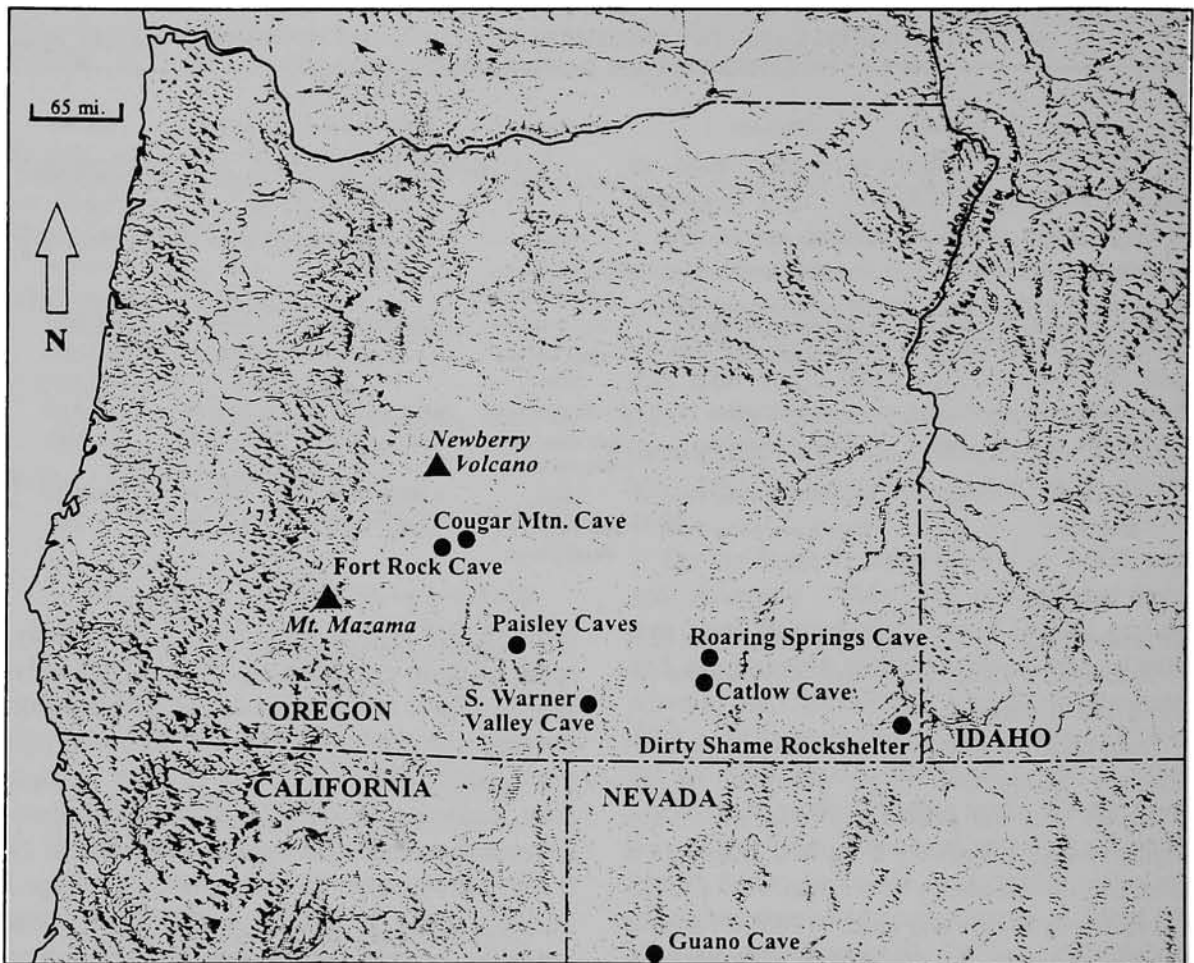


Fig. 1. Location of sites mentioned; base map modified from landform map in Raisz (1957).

caves of south-central Oregon in the northern Great Basin to the widespread Basket Maker type," from the more widely known Southwest. His observations regarding Early Holocene basketry were limited entirely to materials reportedly found below the Mazama tephra, now known to have been deposited some 7,500 years ago.

In 1938, Cressman recovered at least 95 whole or fragmentary sandals from below Mazama tephra at Fort Rock Cave, but no close-twined basketry. Collectors provided Cressman with several fragments of close-twined basketry, some decorated, from purported pre-Mazama layers at the site. Cressman also recovered cordage and matting from below Mazama ash at

Paisley Caves, but he was only able to discuss possible pre-Mazama-age decorated basketry provided to him by another private collector. Excavations at Dirty Shame Rockshelter (Andrews et al. 1986) provided the largest *in situ* pre-Mazama-age basketry assemblage known for the area, a total of only 15 woven structures.

**Paisley Cave No. 1.** In correspondence to Luther Cressman at the University of Oregon, Walter Perry reported finding cultural materials, including basketry, above and below a layer of tephra in a series of small caves overlooking the Summer Lake basin. Cressman and his crew made short visits to the caves in 1938 and 1939 to make collections and to verify the stratigraphy

reported by Perry. Cressman found cordage and matting made of sagebrush bark below the tephra, identified as deriving from the Mt. Mazama eruption. However, two pieces of Catlow Twine basketry, one (Specimen 1-5344) decorated with false embroidery and one (Specimen 1-5345) with overlay, were recovered by Perry when he first explored Paisley Cave No. 1 in 1937 (Oregon State Museum of Anthropology, Accession 100BP). Regarding these specimens, Cressman (1942:39) reported that:

Since it was only later that the importance of the stratigraphic sequence became evident, it is not absolutely certain whether the specimens came from above or below the pumice. Perry, an unusually careful observer, believes they came from below. Evidence from subsequent excavation leads me to concur in his opinion, for at the point where the test pit had been dug most of the top deposit was a mass of white ash. No other basketry came from below the pumice, but there were loose warps which prove that basketry was made.

Fiber from Specimen 1-5345 (with overlay decoration; Fig. 2, top) returned a date of  $145 \pm 50$  B.P. (AA-19151). At 2 sigma, this reflects an age later than ca. A.D. 1660, indicating manufacture in the post-Columbian period.<sup>2</sup>

Specimen 1-5344 (Fig. 3) is an especially interesting piece. Like most close-twined basketry from this area, it has a cord warp and z-twist weft. It is decorated with false embroidery, employing both grass and feather quill as decorative overlay fibers. Cressman (1942:41-42) described this piece in some detail, noting "a number of technical features in addition to false embroidery," including the use of different decorative fibers, rows of "three-strand twining arranged so that the weft elements overlap to form a diagonal pattern," and "modified three-strand twining" in which the outer weft strand passes over one, two, or three warps, "obviously for decorative effect."

A fiber from this specimen returned a date of  $6,560 \pm 70$  B.P. (AA-19153). Dendrocali-

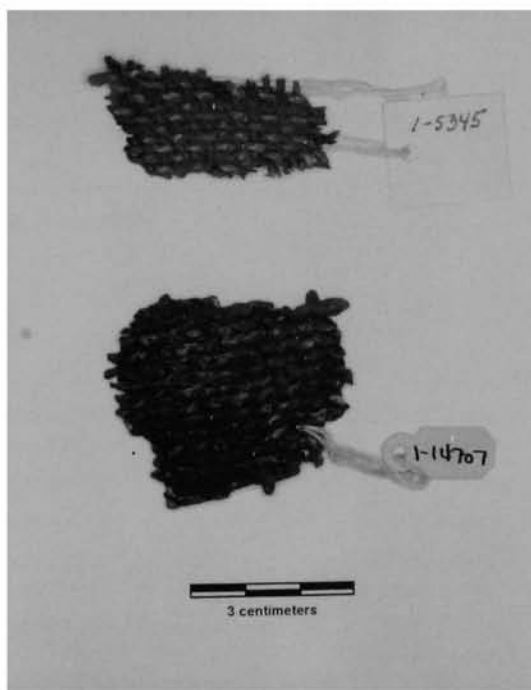


Fig. 2. Top: close simple twine basketry with overlay decoration from Paisley Cave (Specimen 1-5345); bottom: close simple twine basketry with false embroidery decoration from Fort Rock Cave (Specimen 1-14707).

bration of this radiocarbon determination provides an approximate age of 7,400 years. While this is younger than the commonly cited date of the climactic Mt. Mazama eruption by about 230 years (6,850 radiocarbon years B.P., or ca. 7,630 dendrocalibrated years ago, based on the weighted average of four dates [Bacon 1983]), it is consistent with a considerable number of radiocarbon dates from indisputable sub-Mazama contexts that are also several hundred years younger than the commonly cited event date (Table 2).

The discrepancy in age between the two specimens from Paisley Cave is startling, and provides caution regarding the use of poorly documented contextual evidence; clearly there was basketry below the ash, but not all the recovered basketry was from this context. Only one of the

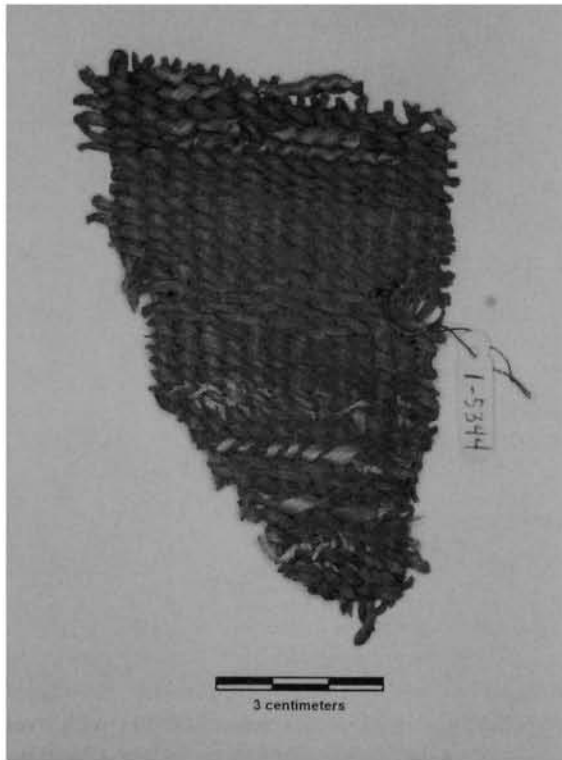


Fig. 3. Close simple and three-strand twined basketry with grass and feather quill false embroidery (Specimen 1-5344), of pre-Mazama age from Paisley Cave.

two Paisley Cave specimens in question can be assigned to a pre-Mazama context. In spite of their dramatically different ages, these fragments appeared to be in a comparably well-preserved condition.

**Guano Cave, Nevada.** Although not technically from the Northern Great Basin Center, another recently obtained date on a piece of decorated Catlow Twine is worth citing. In 1993, a fragment of a very fine, decorated Catlow Twine basket/bag (Pe3d.259), housed at the Nevada State Museum, yielded a date of  $6,795 \pm 55$  B.P. (AA-11594). The piece was recovered from Guano Cave on the east shore of Winnemucca Lake in western Nevada in the 1950s. It was one of roughly 200 basketry fragments and whole textiles from this and several other sites in

the immediate vicinity excavated by Phil Orr, all with less than satisfactory provenience (Ellis-Pinto 1994). This particular piece, somewhat like the Paisley Cave No. 1 specimen described by Cressman, features a number of bands of three-strand twining as well as overlay decoration. Although Catlow Twine is not the dominant basketry type in these collections, its frequency is such that dating it is important to the overall history of the type here as well as in the Northern Basin Center (Fowler and Cannon 1992). This date also seems to be pre-Mazama in age, lending strength to the date for the Paisley Cave No. 1 textile.

**Fort Rock Cave.** Of the 95 sandals recovered by Cressman in 1938 from below Mazama ash at Fort Rock Cave, most were in extremely fragile condition, and were treated with a preservative. In 1950, an untreated sandal and about two dozen pieces of Catlow Twine basketry—all apparently from the same basket and some decorated with false embroidery—were donated to the Oregon State Museum D. B. McFadyen (Accession 100KC). This untreated sandal returned a radiocarbon age of  $9,050 \pm 350$  B.P. (Cressman 1951). A second sandal fragment from the site, collected in 1965, returned a date of  $8,500 \pm 140$  (I-1917; Bedwell 1973). Cressman (1986: 123, cf. 1951:308) claimed that the decorated basketry fragments “were properly associated with the sandal and, therefore, carry the same date”; however, Adovasio (1986a:196) expressed caution regarding the reported association.

A fiber from Specimen 1-14707 (Fig. 2, bottom), a fragment from the McFadyen donation decorated with false embroidery, returned a date of  $4,430 \pm 60$  B.P. (AA-19150). This provides a calibrated age of ca. 5,000 years, clearly post-Mazama in age and squarely within Adovasio’s Stage 2. Jenkins (1994; cf. Aikens and Jenkins 1994; O’Connell 1975) noted that the northern Great Basin contained relatively more permanent water during the period from 5,000 to 3,500

Table 2  
**RADIOCARBON DATES FROM PRE-MAZAMA CONTEXTS YOUNGER  
 THAN THE 6,845 ± 50<sup>a</sup> MAZAMA AGE**

Site Name (Number)	Radiocarbon Age	Lab. No.	Material	References
<b>Archaeological Samples</b>				
Marmes Rockshelter (45FR50) <sup>b</sup>	6,200 ± 475	I-638	shell	Sheppard et al. (1984)
Box Canyon (35UM64) <sup>b</sup>	6,320 ± 200	WSU-2356	charcoal	Burtchard (1981)
Tiller Ranger Station (35DO37) <sup>b</sup>	6,500 ± 60	Beta-69517	charcoal	Bevill et al. (1994)
Shanty Creek Site (35WS231) <sup>b</sup>	6,590 ± 150	Beta-57184	wood	Bailey et al. (1995)
Dry Creek (35DO401)	6,540 ± 170	Beta-48725	charcoal	O'Neill (1996)
	6,630 ± 180	Beta-50250	charcoal	O'Neill (1996)
Paulina Lake Site (35DS34) <sup>b</sup>	6,540 ± 150	Beta-56721	charcoal	Connolly (1995)
Johnson Site (35JE51B) <sup>b</sup>	6,770 ± 60	Beta-53621 <sup>c</sup>	charcoal	Pettigrew and Hodges (1995)
Odell Lake (35KL231)	6,730 ± 70	Beta-75044	charcoal	Jaehnig (1994)
	6,770 ± 70	Beta-75043	charcoal	Jaehnig (1994)
Susan Creek CG (35DO383) <sup>b</sup>	6,790 ± 60	Beta-58849	charcoal	Musil (1994)
	6,840 ± 70	Beta-58852	charcoal	Musil (1994)
<b>Geological Samples</b>				
Muir Creek, Oregon	6,453 ± 250	C-247	charcoal	Arnold and Libby (1951)
(split from same sample)	6,500 ± 500	M-21	charcoal	Crane (1956), Kittleman (1973)
Arrow Lake, Washington	6,600 ± 400	W-776	peat	Rubin and Alexander (1960) Powers and Wilcox (1964)
(sample from same section)	6,630 ± 400	W-777	peat	Rubin and Alexander (1960) Powers and Wilcox (1964)
Toketee Falls, Oregon	6,640 ± 250	W-858	charcoal	Rubin and Alexander (1960)
Covington, Washington	6,700 ± 200	L-269C	peat	Broecker et al. (1956)
Lost Trail Pass Bog, Montana	6,700 ± 100	WSU-1552	charcoal	Mehring et al. (1977)
	6,720 ± 120	WSU-1553	charcoal	Mehring et al. (1977)
Wildcat Lake, Washington	6,750 ± 90	WSU-1742	charcoal	Blinman et al. (1979)
Wildhorse Lake, Oregon	6,765 ± 70	WSU-2035	charcoal	Blinman et al. (1979)

<sup>a</sup> From Bacon (1983).

<sup>b</sup> Older pre-Mazama radiocarbon ages are also reported.

<sup>c</sup> CAMS-2990.

B.P. than at any other time in the post-Mazama period. He reported small villages in the Fort Rock Basin along wetland margins, excavations of which produced artifact assemblages evincing relative residential stability, including ceramic pipes, stone spoons, bone and shell beads, bone spoons, and net weights (Jenkins 1994).

**Dirty Shame Rockshelter.** Adovasio et al. (1986:28) noted that the pre-Mazama-age levels

at Dirty Shame Rockshelter (Zone VI, 9,550 to 7,950 B.P. and Zone V, 7,950 to 6,850 B.P.) contained "open simple and open diagonal twining with Z twist wefts as well as close simple twining with S twist wefts" (from Zone VI), a single piece of "close simple twining with S twist wefts" (from Zone VI), and a single piece of "cross-warp twining" (from Zone V). They consider the occurrence of the diagonal twining

and the piece of s-twist weft twining intrusive in Zone VI, as these structures are not thought to occur that early based on comparisons with other pre-Mazama contexts. The cross-warp twining is termed “enigmatic,” as it does not occur elsewhere in the deposits. Adovasio et al. (1986) did not address the reported pre-Mazama occurrence of diagonal twining at Fort Rock Cave (Cressman 1942:56).

The piece selected from Dirty Shame Rockshelter for dating is one of two specimens identified as diagonally twined, and recovered from pre-Mazama-age levels. Specimen A3-6/1-B68 (Oregon State Museum Accession 404; Fig. 4), a fragment of open diagonal twine matting (made from *Scirpus* sp.), was assigned to Zone VI, the earliest component of the site. Fibers from this artifact returned a date of  $6,950 \pm 110$  B.P. (AA-19154), providing a calibrated age of ca. 7,700 years. While this specimen is younger than Zone VI, to which it was assigned, it is clearly of pre-Mazama age. The assertion by Adovasio et al. (1986:28) that diagonal twining is intrusive into the pre-Mazama cultural zones is not supported. Based on this, it would be useful to date the s-twist weft piece from Zone VI, as well as the cross-warp piece from Zone V, as they may not be as questionable in these contexts as previously assumed.

### Observations on Late Prehistoric Period Basketry Technology

The vast majority of basketry from the northern Great Basin is constructed with z-twist wefts over a flexible cordage warp. It has been argued that the Northern Paiute entered the northern Great Basin in relatively late prehistoric times, an incursion supported by the basketry evidence (Adovasio and Pedler 1995; Fowler 1995). Rare occurrences of basketmaking techniques associated with the Northern Paiute—including coiled basketry and diagonally twined rigid warp basketry with s-twist wefts—are known from late prehistoric/historical contexts in

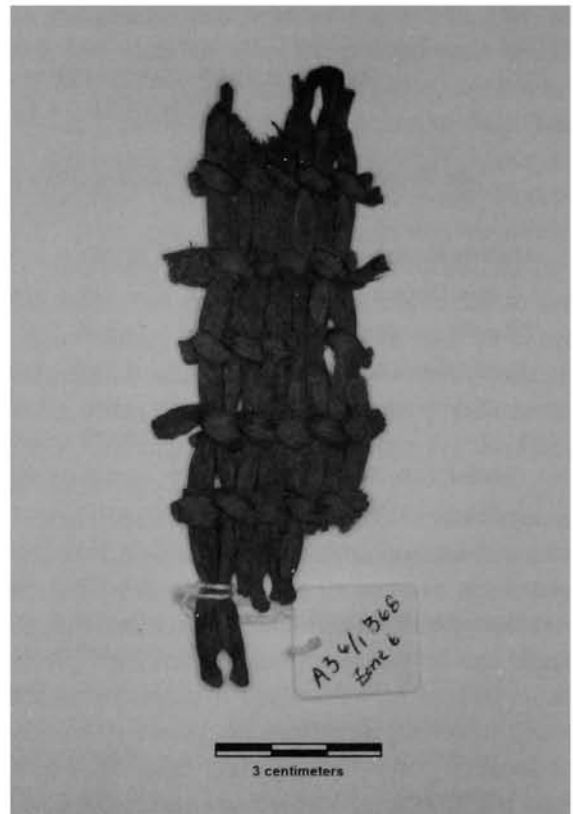


Fig. 4. Open diagonal twine fragment (Specimen A3-6/1-B68) of pre-Mazama age from Dirty Shame Rockshelter.

southeast Oregon, but are not well dated. At Dirty Shame Rockshelter, Adovasio et al. (1986:28) noted the presence of both of these types in Zone I (ca. A.D. 850 to 1550), and also added coiled and twined trays and seed beaters as characteristics of Stage 3 (A.D. 500 to 1600) in the northern Great Basin Center.

**Roaring Springs Cave.** Materials collected by Cressman and his crews during the summer of 1938 from a number of northern Great Basin sites, including Roaring Springs Cave, are assigned to Oregon State Museum Accession 60. Cressman (1942) reported several fragments of coiled basketry and diagonal twining with “Basin” (i.e., southerly) features from surface and near surface contexts in Catlow and Roaring



Springs caves. Specimen 1-8694 (Fig. 5) is close diagonal twining with a rigid warp, split stem (probably *Salix*) weft, and s-twist wefts (Cressman 1942:39-40). The material and technique are associated with Paiute basketry forms (e.g., Adovasio 1986a; Adovasio and Pedler 1995; Fowler 1995). Woody weft material from Specimen 1-8694 returned a date of  $20 \pm 50$  B.P. (AA-19152). At two sigma, this date represents a time following A.D. 1700.

**South Warner Valley Cave.** South Warner Valley Cave (35LK94) is a site on Bureau of Land Management property that was badly vandalized in the 1980s. In 1989, as part of an Archaeological Resources Protection Act (ARPA) case, roughly 200 perishable artifacts from the site were sent to the University of Nevada, Reno, for analysis and curation. Although lacking in provenience other than site location, the collection contained four classes of materials: close plain twining over cordage warps (Catlow Twine), open diagonal twining over rigid warps, close diagonal twining over rigid warps, and close coiling on a mixed rod and bundle foundation. In 1993 and 1996, pieces from these four classes were submitted for dating, and the three latter categories returned the following: open diagonal twining (Cat. No. 35LK94-15),  $150 \pm 55$  B.P. (AA-6445); close diagonal twining (Cat. No. 35LK94-21),  $150 \pm 50$  B.P. (AA-19788); and close coiling (Cat. No. 35LK94-16),  $80 \pm 55$  (AA-6482). As with the Roaring Springs Cave date, these are all quite recent, representing some time after A.D. 1600. The dates on the Catlow Twine (three separate pieces) ranged between approximately 600 and 700 B.P.

### DISCUSSION

Cressman (1942, 1951, 1986) argued that sophisticated basketry structures and elaborate decorative features are characteristic of the pre-Mazama period in the northern Great Basin, which he viewed as a "climax" period of cultural development in the region, while Adovasio

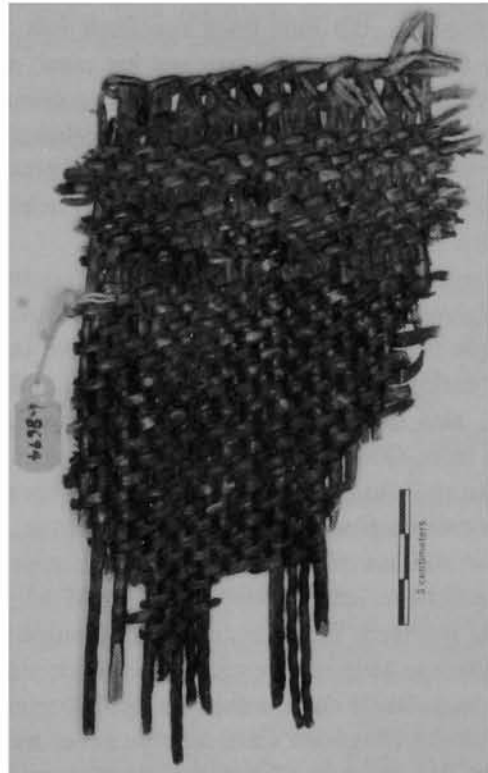


Fig. 5. Close diagonal twine fragment, with rigid warp and split stem s-twist weft, postdating A.D. 1700 from Roaring Springs Cave.

(1986a; Adovasio et al. 1986) characterized Early Holocene basketry as structurally simple and lacking any decorative embellishments. Radiocarbon dating has clarified the status of at least some basketry specimens at the center of this controversy. However, because the earliest dates reported here cluster toward the end of the Early Holocene period in question, they do not resolve all questions regarding Early Holocene basketry.

A diagonally twined specimen from Dirty Shame Rockshelter has now been dated to ca. 7,700 years old. This piece is structurally similar to a diagonal twined fragment reported by Cressman (1942:56) from sub-Mazama deposits at Fort Rock Cave (Cressman [1942] described Specimen 1-9139, mistakenly identified as 1-9138, which is a sandal fragment). Unlike some

of the other controversial specimens discussed by Cressman, the Fort Rock specimen was actually collected by Cressman and his crew, and its provenience is not in question. The demonstrated age of this Dirty Shame Rockshelter piece also suggests that the example of s-twist twining in Zone VI and the cross-warp twining in Zone V should be reevaluated.

Paisley Cave produced a basketry fragment with false embroidery decoration and the use of multiple twining techniques for decorative contrast, dating to ca. 7,400 years ago. A similar piece, also decorated and pre-Mazama in age, came from Guano Cave, Nevada. The use of feather quill (rachis) as a decorative fiber on the Paisley Cave piece is of particular interest, in light of the use of feather decoration in prehistoric and historical basketry in the Far West. A second fragment from Paisley Cave, thought by Cressman to have been associated with this older piece, apparently dates within the last 300 years.

Cougar Mountain Cave also deserves mention in the context of the present discussion. This site was excavated by amateur John Cowles in 1958, who subsequently produced a self-published volume on the site. It is clear from Cowles' (1959) publication that he maintained some provenience records, as he reported findings with reference to arbitrary levels and position relative to a tephra layer (Cowles reported this layer as Newberry ash, as Cressman originally believed the Ft. Rock Cave ash to be; it is almost certainly from Mt. Mazama). A radiocarbon date of  $8,510 \pm 250$  on a Fort Rock-style sandal from below the ash is consistent in age with the sub-Mazama footgear from Fort Rock Cave (Ferguson and Libby 1962; Connolly 1994). Unfortunately, the private museum that now owns the Cowles collection claims no knowledge of associated documentation, and provenience information is principally limited to figure captions in Cowles' (1959) publication. Plates 32 and 34 show examples of close-twined basketry with overlay decoration, identified as

deriving from subtephra levels (Cowles 1959).

While the sample of pre-Mazama basketry from the northern Great Basin remains small, what is remarkable is not the lack of decoration, but the richness of manufacturing techniques and decorative styles represented among so few specimens. Radiocarbon dating confirms the Early Holocene age of diagonal twining, false embroidery, and several variations of three-strand twining (at Dirty Shame Rockshelter, Roaring Springs Cave, and Guano Cave). Probable Early Holocene associations that have not yet been directly dated include overlay decoration (at Cougar Mountain Cave) and cross-warp twining (at Dirty Shame Rockshelter). It appears that the basketry of this region was complex in the pre-Mazama period, blurring the prior distinctions made by Adovasio (1986a) between basketry assemblages of pre- and post-Mazama age. In actuality, although the eruption of Mt. Mazama is probably not a good boundary date for changes in this technology, perhaps the roughly 1,000 years prior to Mt. Mazama may be.

Evidence from the northern Great Basin (e.g., Aikens and Jenkins 1994) indicates that residential settlements have been intermittently present throughout the Holocene, corresponding to periods of relatively greater moisture that filled basin lakes and expanded marshlands. At the same time, basketry forms and structures indicate a remarkable degree of continuity throughout this period. The distinctive close-twined basketry commonly referred to as Catlow Twine (Cressman 1942:33) has been identified in northern Great Basin sites which span the Holocene in age (Cressman 1951, 1942; Adovasio 1986a; Connolly 1994), and Cressman (1942:45) observed that "most of the ethnographic traits of Catlow Twine [were] carried on among the Klamath-Modoc" into the historical period. These facts point to a persistent tradition of basket-making among peoples resident along the northwestern margins of the Great Basin, who took advantage of resource abundances in the Basin

when available, and who may have retreated to better watered westerly valleys and uplands during periods of relative resource scarcity in the Basin. This evidence is consistent with the model proposed by Aikens (1995:43; cf. Aikens and Witherspoon 1986) of cyclical "expansions and contractions of . . . peoples across the tension zone between Great Basin and surrounding environments."

Finally, the recent age (<250 years) of rigid warp, open and close diagonal twined basketry with s-twist wefts, and coiling in Roaring Springs Cave and South Warner Valley Cave matches the consistently young age of these structures in the northern Great Basin (Fowler and Cannon 1992). This complex of basketry features is consistent with a late incursion of Central and Southern Great Basin basketry technologies most frequently associated with Numic groups (Adovasio 1986b; Fowler 1995). The corresponding late persistence of Catlow Twine structures in this area may further attest to the recency of these southern influences into the northern Great Basin, or the probable complexity of the contacts that may have included continued joint use of the region, trade, or other economic relationships.

#### NOTES

1. The Stage 2/3 boundary was placed at A.D. 500 by Adovasio et al. (1986) and at A.D. 900 by Adovasio (1986a).

2. We recognize that there are problems with radiocarbon dates from the last 300 to 400 years (e.g., Bowman 1990:46-47), and we are thus reporting them not with the implication that they are firm, but to show that they give a relative chronology to the issues being discussed.

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## Earliest Island Fox Remains on the Southern Channel Islands: Evidence from San Nicolas Island, California

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*The island fox Urocyon littoralis, a diminutive cousin of the mainland gray fox U. cinereoargenteus, occurs on six of the eight California Channel Islands. For years, researchers have reported finding the remains of these animals in archaeological sites. Biogeographic studies have tried to determine the evolutionary relationships of island foxes and the nature and timing of their dispersal to each of the islands. These data, along with the fossil and archaeological records, place them on the northern Channel Islands about 16,000 B.P. and on the southern Channel Islands at about 3,800 B.P. Recent archaeological excavations on San Nicolas Island recovered the remains of an island fox that dates to about 5,200 B.P. This find contributes to our current understanding of island fox colonization of the southern Channel Islands.*

**ANIMALS** living on remote islands have been a subject of human curiosity for generations.

The plethora of scientific studies, documentary films, and popular articles attest to their importance and fascination. In fact, it could be argued that the study of island biogeography has been as important in the development of biological thought as any other subject matter. Darwin's finches are just one example of many where island life has helped to shape and develop ideas about biology. One relationship that emerges prominently from island studies is the role that humans have played in the distribution of animals across space and through time. Through processes of domestication (dogs, pigs, sheep) and as transporters of stowaways (insects, spiders, rodents), people have influenced the movement of animals the world over. The island fox of the California Channel Islands is one example where people have contributed to the spread of a species.

The Channel Islands are subdivided into two groups based on their different geologic origins. The islands of Anacapa, Santa Cruz, Santa Rosa, and San Miguel comprise the northern Channel Islands, while Santa Catalina, San Clemente, Santa Barbara, and San Nicolas Islands make up the southern group (Fig. 1). The northern Channel Islands were once connected, representing one island mass (Santa Rosae), and separated from the mainland by as little as six kilometers (Johnson 1983). The more widely dispersed southern islands have remained separate throughout their development and are located much further from the mainland. All but Anacapa Island and Santa Barbara Island are home to the island fox.

### NORTHERN ISLAND FOXES

The island fox has been the subject of numerous scientific investigations, but recent genetic data (Gilbert et al. 1990; George and Wayne 1991; Wayne et al. 1991a, 1991b) and skeletal studies (Collins 1982, 1991a, 1991b) suggest a possible scenario concerning their origins and distribution. Collins (1991a) used cranial mor-