ERRATA

Perishable Industries from Dirty Shame Rockshelter
Malheur County, Oregon

1. Page 15, Line 41: Artemisia sp. should be Artemisia sp.

2. Page 136, Figures 80, 81:
   The Fort Rock sandal illustrated in these figures is not from Dirty Shame Rockshelter. The specimen is from Fort Rock Cave, Oregon, and is shown because no complete examples of this type are represented at Dirty Shame Rockshelter.

3. Page 141, bottom and Page 142, top, Figures 91, 92:
   The Multiple Warp sandal illustrated in these figures is not from Dirty Shame Rockshelter. The specimen is from Catlow Cave No. 1, Oregon, and is shown because of its degree of completeness.

4. Pages 150-151, Figures 108-111:
   The Spiral Weft sandals illustrated in these figures are not from Dirty Shame Rockshelter. The specimen shown in Figures 108 and 109 is from Catlow Cave No. 1, Oregon. The specimen shown in Figures 110 and 111 is from Roaring Springs Cave, Oregon. Both of these are illustrated because of their overall completeness or preservation of particular attributes.

5. Throughout the monograph, Dubois should be DuBois.

6. Riddell 1956 should be Riddell 1956a; Riddell 1957 should be Riddell 1956b.

7. Adovasio and Fry 1970 should be Fry and Adovasio 1970.
PERISHABLE INDUSTRIES FROM DIRTY SHAME ROCKSHELTER
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FOR

LUTHER SHEELEIGH CRESSMAN

Who First Recognized
the Potential Significance
of Prehistoric Perishables
in
the Northern Great Basin
PERISHABLE INDUSTRIES FROM DIRTY SHAME ROCKSHELTER, MALHEUR COUNTY, OREGON

A Series of Chapters

by

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FOREWORD

Dirty Shame Rockshelter was excavated by the University of Oregon in the summer of 1973. The work was made possible by a grant from the National Science Foundation and by additional support from the Department of Anthropology and Museum of Natural History, University of Oregon, and the Smithsonian Institution Radiation Biology Laboratory in Rockville, Maryland. Initial reports on the site include an account of the excavation and dating of the site (Aikens, Cole, and Stuckenrath 1977), an explanation of site geology (Keittiman 1977), a discussion of fauna (Grayson 1977), the coprolite evidence for human diet (Hall 1977), an analysis of the flaked stone tool and debitage assemblage (Hanes 1977), and a summary discussion of the perishable artifact industries (Adovasio, Andrews, and Carlisle 1977). A later manuscript by Willig (1981), describing in detail the remains of brush wickup structures found at the site, is now being prepared for publication. The report by Aikens, Cole, and Stuckenrath (1977) is reprinted with some modifications as the introduction to the present volume with the kind permission of B. Robert Butler and the Idaho State University Press, to establish the archaeological context of the Dirty Shame Rockshelter perishable materials.

The co-principal investigators wish to thank Mel and Anita Boyer of Lexington, Oregon, for bringing the site to their attention and for their continued interest in support of the work. Roger Campbell and Clayton Davis of Morrow County, Oregon, discovered the site in 1972 and aided in its investigation. Robert Campbell of McDermitt, Nevada, permitted the field crew to use land, buildings, and water at Antelope Corral, where the field camp was established. Jane Gray, Curator of Paleobotany, University of Oregon Museum of Natural History, directed the collection of pollen and plant macrofossils from the site and gathered comparative botanical material from the Antelope Creek locality. Georgia Mason, Curator of the Herbarium, University of Oregon Museum of Natural History, identified selected plant macrofossils from the deposits. David Brewer, John L. Faga, Julie Followsbee, Rashana Keselman, Joanne M. Mack, Shari K. Reynolds, Patricia Sanford, Vern Scarborough, David Westerfield, and Rick Morschdorf were the University of Oregon students who worked at the site for part or all of the field season, and some of them also assisted with subsequent laboratory work. Rick Minor, James Dodge, Jean McNeal, Judy Gerrard, and Michael Poulosdis assisted in artifact cataloguing and in several phases of analysis. Larry McCuen and Helen Spiller drew the illustrations reproduced in the Introduction, and Ruth Brown and Thelma Zinn typed earlier drafts of that chapter.

Other detailed reports on Dirty Shame Rockshelter will be published in future issues of the University of Oregon Anthropological Papers. A monograph study by Richard C. Hanes (1980) on the flaked stone assemblage is being revised for publication, as is a monograph by Patricia R. Sanford (1983) on the plant macrofossil and pollen evidence from the site. A final site report is planned to bring together the results from all preceding contributions and will be presented in a format designed to serve both the professional archaeologist and the general public that ultimately supported the research.

C. Melvin Aikens,
David L. Cole
Co-Principal Investigators

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PREFACE

The results of the analyses reported here are based on the most recent radiocarbon chronology and provenience data available from Dirty Shame Rockshelter. The observations, interpretations, and conclusions presented within this monograph therefore differ somewhat from those offered in earlier, preliminary treatments of these data (Adovasio, Andrews, and Carlisle 1976a, 1977). The essential data presented in these earlier reports are basically correct, but certain detailed changes, notably in chronology, have been incorporated into the present work.

R. L. Andrews
J. M. Adovasio
R. C. Carlisle
Pittsburgh, Pennsylvania
August, 1986
ACKNOWLEDGMENTS

The authors wish to express their gratitude to Georgia Mason, Curator of the Herbarium, University of Oregon Museum of Natural History, and to D. B. Madsen, Utah State Archaeologist, for the loan of botanical specimens used for comparison in the analysis reported here. We also wish to thank M. A. Walsh, Department of Biology, University of Pittsburgh; Kimball T. Harper, Department of Botany and Range Science, Brigham Young University; Gary F. Fry, Department of Anthropology, Youngstown State University; and Kathleen Cushman, Boulder, Colorado, for their assistance in plant fiber identifications. Robert D. Drennan, Department of Anthropology, University of Pittsburgh, was of tremendous help in the quantitative analysis and interpretation of the perishables data. Gary A. Cooke, Department of Geology and Planetary Sciences, University of Pittsburgh, very kindly analyzed the sediment from one of the Dirty Shame Rockshelter sandals and prepared the results that appear in APPENDIX I.

Artifact photographs, in addition to those by J. M. Adevasio, are by V. Krantz, Smithsonian Institution, Washington D. C. Photographic figures were printed by V. Krantz and S. Jorstad. William Doyle, Children's Hospital, Pittsburgh, Pennsylvania, assisted in the attempts to identify tooth impressions on the Dirty Shame Rockshelter quids. This monograph was typed at various times by G. LoAlbo Piacone, J. Sharik, S. Lindner, F. Canzelliere, and T. Torres at the Department of Anthropology, University of Pittsburgh.
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INTRODUCTION

C. M. Aikins
D. L. Cole
R. Stuckenrath

Dirty Shame Rockshelter (35ML63) lies in an archaeologically unexplored region, roughly equidistant between the better known Great Salt Lake and Snake River Plain regions of Utah and Idaho on the east, and the Fort Rock, Warner, and Surprise valleys of south-central Oregon and northern California on the west (Figure 1). Excavation of the site has provided data on the culture history of a previously unknown area, offering a 9,000 year record of cultural adaptation to an upland streamside environment in the desert. The rockshelter’s unique local setting is important for the contrast it provides. Most of the well-known archaeological sites of the western deserts are restricted to a single environmental context—the shores of ancient Pleistocene lakes (Loud and Harrington 1929; Steward 1937; Cressman 1942; Smith 1911; Jennings 1937; Riddell 1960; Heizer and Krieger 1956; Heizer and Napton 1979; Aikins 1970; Bedwell 1973; O’Connell and Hayward 1972). There are exceptions (Gruhn 1961; Swansom 1972; Butler 1972; Fowler, Madison, and Hattori 1973; Fagan 1974), but there is still far from adequate knowledge of prehistoric human adaptations to the broad spectrum of varied local environments that characterize the Desert West as a whole. Documentation of human activities in a range of environmental contexts is requisite to a full understanding of prehistoric human ecology in the greater region. The cultural record preserved at Dirty Shame Rockshelter is summarized in this volume and other publications (Kittleman 1977; Hanes 1977, 1980; Hall 1977; Grayson 1977; Willig 1981; Sanford 1983) as a contribution toward that understanding.

Figure 1. Location of Dirty Shame Rockshelter (35ML63) on the Owyhee Plateau in Malheur County, Oregon (from Aikins, Cole, and Stuckenrath 1977: 3, Figure 1).
Site Description

Dirty Shame Rockshelter (335AL65) is located on the Owyhee Plateau, a dissected lava upland lying in extreme southeastern Oregon and adjacent parts of Nevada and Idaho. The site is 56.3 km (35 mi) north of the Oregon-Nevada border and 29.1 km (15 mi) west of the Oregon-Idaho border at 47°26.6'N; 117°20.6'E. It lies on Antelope Creek, a westbank, second-order tributary of the Owyhee River. The Owyhee River system has its source in northern Nevada, southwest Idaho, and southeast Oregon. Its eventual outlet is the Columbia River. Lands immediately south and west of the Antelope Creek area belong to the internal drainage system of the Great Basin (see Figure 1). A detailed description of Dirty Shame Rockshelter's setting is available in Kittleman (1977), and salient features of the local biota are summarized by Hall (1977), Grayson (1977), and Sanford (1983).

The rockshelter is in a weathered seam at the base of a nearly 100 m (328 ft) high rhyolitic cliff on the northwest side of Antelope Creek (Figure 2). The overhang is approximately 100 m (328 ft) long, but the area of actual human occupation as shown by surface indications and testing was limited to a space only 12 m to 14 m (39.4 ft to 45.9 ft) across, beneath the eastern half of the overhang. The sheltered area was ca. 6 m (19.7 ft) wide from back wall to drip line at the original surface of the site, and it was found to widen as deposits were excavated from the sloping back wall of the rockshelter. Four hundred ten man-days of excavation were carried out at Dirty Shame Rockshelter in July and August 1973 under the direct supervision of D. L. Cole. The maximum area of the excavation was 32 m² (634 ft²), an area that became smaller as the excavations deepened. The greatest depth achieved was 9.8 m (32.3 ft) in a single 2 m x 2 m (6.6 ft x 6.6 ft) unit, and a total of 92 m³ (3,286 ft³) of fill was removed (Figure 3).

A dry deposit of accumulated cultural debris some 2 m (6.6 ft) deep and with abundant artifacts (Stratum I) was underlaid by a moister, but still heavily organic layer usually less than 1 m (3.3 ft) in thickness that contained large amounts of fallen rock (some of it massive chunked) but relatively fewer artifacts (Stratum II). Below the rocky layer, and extending down at least 2.2 m (7.2 ft) where excavation ceased, was a clean deposit of clays, silts, sands, and gravels laminated in its lower portions by stream action (Stratum III). Rare stone flakes and isolated specks of charcoal were found in this deposit, but they seem to be either intrusive or redeposited (Figure 4).

The upper 2 m (6.6 ft) of the deposits contain most of the evidence of occupation. A substantial portion of this fill is cultural accumulation—sticks, branches and grass—carried in by the human occupants of the site. The presence of creosote and in some places fine ash indicated that layers of combustible material had burned in situ beneath the current surface; this reduced some areas of fill and caused irregular settling of overlying deposits. Decomposition of organic materials due to increased moisture near the front of the rockshelter also seems to have caused settling of the deposits in front of the overhang, creating both a stratigraphic problem (discussed below) as well as a problem for the preservation of perishables.

Excavation Procedures

Excavation was conducted and provenience controlled within a grid of 2 m x 2 m (6.6 ft x 6.6 ft) squares with vertical control based on a modified arbitrary level system. In the field, artifact provenience was recorded first in terms of arbitrary 20 cm (7.8 in) levels and within these levels, in terms of the cultural phenomena encountered, thus, specimens from a level in which a cultural feature was found were further provenanced according to their occurrence above, within, or below that feature. This system allowed artifacts to be correlated with a set of six cultural zones defined after the field work was complete on the basis of relationships among the cultural features. The level system also permitted other subdivisions to be made in the cultural zones for certain analytical purposes, as has been done by Grayson (1977) in his analysis of faunal remains from the site.

No sterile strata are observed within the cultural accumulations, and although horizontal bedding is present in limited areas, no discrete, clearly bounded depositional layers are definable. Stratification within the stream-deposited sediments in the depths of the site is clear, but this occurs below the level of human occupation. A basis for vertical subdivisions is present, however, in the ash lenses, patches of grass, dense artifact scatters, cache pits, and structural remains common in the dry upper deposits. They adjoin or overlap in such a way that it is possible to define six sequential cultural zones (Zones I-VII), each comprising roughly contemporaneous cultural features and their enclosing deposits. These cultural zones do not represent occupation floors but simply groups of overlapping cultural features that occur between similar feature groups above and below. Not all cultural features within a zone are strictly contemporaneous; there are cases of superposition of features within as well as between zones. The dividing lines between zones do not necessarily reflect major discontinuities or episodes in site occupation and are arbitrary in the sense that they were made simply where it was sufficiently possible to disentangle the complicated interrelationships of the cultural features to allow some distinctions to be drawn. In a few cases, toward the margins of the excavation, units of deposition are not directly relatable to cultural features. These units are assigned, on the basis of their absolute elevations within the deposits, to the zone that included cultural features at the same levels. There is only one feature below Zone IV, and the distinction between Zones V and VI is an arbitrary metric division.

Radiocarbon Chronology

Radiocarbon dating of the rockshelter deposits produced several dates that were anomalous within the cultural zones as initially defined. In particular, a date of 5973 ± 80 B.C. from the back of the rockshelter was some 1,400 years older than dates at a comparable elevation toward the front that had been assigned to the same cultural zone (Zone V). This led to the hypothesis that organic materials in the early deposits toward the dripline of the rockshelter that lay on moist sediments had decomposed and been compressed so that the deposits there came to rest at a significantly lower elevation than deposits of comparable age farther back in the rockshelter. Dates from lower elevations toward the front of the
Figure 2. The location of Dirty Shame Rockshelter (lower left) at the base of a cliff, on the northwest side of Antelope Creek which is at bottom right (from Aikens, Cole, and Struckmeyer 1977:4, Figure 2). The scale of the site can be approximated by noting the excavators at work in the site.
rockshelter were similar to the early date from the back, reinforcing this interpretation. Dates from a second series of radiocarbon samples confirmed the greater age of deposits in the back of the rockshelter, and the significantly younger age of deposits at a comparable depth toward the front of the overhang. On the basis of this confirmation, the site records were re-examined, the relationships between cultural features re-assessed, and the dividing lines separating cultural Zones IV, V, and VI gerrymandered in order to bring the zonal divisions more into line with the radiocarbon dates. The 22 radiocarbon determinations for the site are listed in Table 1, and their proveniences are shown in Figure 5.

The series of composite plan/profile drawings in Figures 6, 7, and 9 show the feature composition of the cultural zones as finally determined. Zones V and VI are not represented because Zone V had no features and Zone VI only one. These illustrations show that even with the realignment of cultural features not all dating problems were fully resolved. A date of A.D. 515 ± 70 from Zone I apparently dates material pulled up from Zone II. It was observed at the time of excavation that the feature being dated was an apparent refuse area. A determination of 5150 ± 85 B.C. associated with Feature 10 in Zone III is of an age appropriate for a feature underlying Zone V. A date of 4385 ± 100 B.C. from among some large blocks of roof fall in Zone V suggests that the dated material was introduced between the rocks from overlying Zone IV, where materials of comparable age occur. The strata correlation problems, the corrective maneuvering, and the residual anomalies inevitably cast doubt on the precision of the stratigraphic sequence defined for the site. The complexity of the deposits, with the events of many thousands of years compressed into 2.5 m (8.2 ft) of III, practically guarantees that some admixture has occurred and that the reconstruction of the site's depositional history is less exact than might be achieved under more auspicious circumstances. On the other hand, there is no reason to doubt the basic outlines of the succession, which are supported by both stratigraphic superposition and radiocarbon dates. There are no dating reversals in any of the cases where directly superposed samples were assayed (see Figure 9). On the whole, the site seems to provide a valid archaeological and chronological record provided that it is not over-interpreted to a level of detail unjustified by the character of the deposits.

Approximate bracketing dates assigned to the six cultural zones are: Zone I, A.D. 850-1550; Zone II, 750 B.C. - A.D. 850; Zone III, 4350-3950 B.C.; Zone IV, 4850-4350 B.C.; Zone V, 5950-4850 B.C.; and Zone VI, 7530-5930 B.C. The ca. 3,200-year hiatus between Zones II and III was surprising to the investigators, who held other preconceptions, but it seems
Figure 4. Profile of the 24-Y axis along the center line of deposits from the front to the back of Dirty Shame Rockshelter. Scales at left and right are elevation in meters above an assumed datum. (From Aikens, Cole, and Stuckenrath 1977:7, Figure 4).
well-supported. After an initial series of radiocarbon samples yielded no dates in the interval 4250-550 B.C., four additional determinations on samples carefully chosen from parts of the deposit bracketed between these dates succeeded only in reducing a hiatus of 3,700 years to one of ca. 3,200 years. There is no evidence of a sterile accumulation of sediment and rock fall representing this time span or of erosion that might have removed part of the depositional record. Analysis of the

<table>
<thead>
<tr>
<th>Zone</th>
<th>Sample Description</th>
<th>Laboratory Designation</th>
<th>Date</th>
</tr>
</thead>
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<tr>
<td>Zone I</td>
<td>Charcoal and semi-charred twigs</td>
<td>SI-1762</td>
<td>365 ± 30 B.P.; A.D. 1585</td>
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<td>Charcoal and charred twigs</td>
<td>SI-1763</td>
<td>1905 ± 70 B.P.; A.D. 945</td>
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<td>Zone II</td>
<td>Grass thatch**</td>
<td>SI-2263</td>
<td>1140 ± 95 B.P.; A.D. 810</td>
</tr>
<tr>
<td></td>
<td>Grass thatch**</td>
<td>SI-2264</td>
<td>1175 ± 70 B.P.; A.D. 775</td>
</tr>
<tr>
<td></td>
<td>Charred sticks</td>
<td>SI-1765</td>
<td>1480 ± 75 B.P.; A.D. 470</td>
</tr>
<tr>
<td></td>
<td>Charred sticks</td>
<td>SI-1769</td>
<td>1715 ± 70 B.P.; A.D. 235</td>
</tr>
<tr>
<td></td>
<td>Charcoal</td>
<td>SI-1766</td>
<td>2003 ± 75 B.P.; 55 B.C.</td>
</tr>
<tr>
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<td>Charcoal</td>
<td>SI-1767</td>
<td>2355 ± 80 B.P.; 395 B.C.</td>
</tr>
<tr>
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<td>Grass**</td>
<td>SI-2270</td>
<td>2780 ± 80 B.P.; 970 B.C.</td>
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<tr>
<td>Zone III</td>
<td>Grass thatch** (small sample</td>
<td>SI-2267</td>
<td>5855 ± 125 B.P.; 3903 B.C.</td>
</tr>
<tr>
<td></td>
<td>counted at reduced pressure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Charcoal</td>
<td>SI-1769</td>
<td>6210 ± 65 B.P.; 4260 B.C.</td>
</tr>
<tr>
<td></td>
<td>Grass thatch** (small sample,</td>
<td>SI-2269</td>
<td>6315 ± 195 B.P.; 4365 B.C.</td>
</tr>
<tr>
<td></td>
<td>diluted, counted at reduced pressure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uncharred twigs</td>
<td>SI-2266</td>
<td>7160 ± 55 B.P.; 5150 B.C.</td>
</tr>
<tr>
<td>Zone IV</td>
<td>Charcoal</td>
<td>SI-1770</td>
<td>6855 ± 55 B.P.; 4855 B.C.</td>
</tr>
<tr>
<td>Zone V</td>
<td>Charcoal</td>
<td>SI-1772</td>
<td>6355 ± 100 B.P.; 4855 B.C.</td>
</tr>
<tr>
<td></td>
<td>Charcoal</td>
<td>SI-1771</td>
<td>7850 ± 120 B.P.; 5950 B.C.</td>
</tr>
<tr>
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<td>Charcoal</td>
<td>SI-1773</td>
<td>7880 ± 100 B.P.; 5980 B.C.</td>
</tr>
<tr>
<td></td>
<td>Uncharred twigs and bark</td>
<td>SI-1768</td>
<td>7925 ± 80 B.P.; 5975 B.C.</td>
</tr>
<tr>
<td>Zone VI</td>
<td>Uncharred twigs</td>
<td>SI-2268</td>
<td>8350 ± 75 B.P.; 6910 B.C.</td>
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<tr>
<td></td>
<td>Charcoal</td>
<td>SI-2265</td>
<td>8865 ± 95 B.P.; 6915 B.C.</td>
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<tr>
<td></td>
<td>Charcoal</td>
<td>SI-1773</td>
<td>8905 ± 75 B.P.; 6955 B.C.</td>
</tr>
<tr>
<td></td>
<td>Charcoal</td>
<td>SI-1774</td>
<td>9500 ± 95 B.P.; 7350 B.C.</td>
</tr>
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</table>

*Based on 5,770 year half-life. Not tree ring-corrected. Where necessary, samples received nitration pretreatment for removal of all uncharred cellulose, especially roots and dissolved root material. See Figure 5 for sample provenience within site.

**Corrected for metabolic effects by analysis of $^{13}C/^{12}C$ ratio.

[Figure 5. Distribution of radiocarbon date samples from Dirty Shame Rockshelter by square and level, showing schematically the manner of correlating arbitrary level and cultural zone systems (from Aikens, Cole, and Stuckenrath 1977: 9).]
rockshelter sediments (Kittelman 1977) shows that Antelope Creek never entered the rockshelter after the time of its initial human occupation. It is possible that some deposits were removed by man before the Zone II structures were built (Figure 8), but even so, this alone should not account for the large hiatus in the cultural record. The one complete structure floor discernible among the traces of repeated building is slightly depressed, but no more than 16 cm (6.3 in) below the adjacent surfaces. To judge from dated portions of the deposits, 3,200 years of cultural accumulation might have been as much as 1 m (3.3 ft) in thickness, and the major unconformity and disturbance caused by the shifting of so much fill would hardly have gone undetected in excavation. Building and other subsequent activity might, however, account for the failure to observe a sterile layer representing a time of non-occupation as such a layer presumably would be thin and easily dispersed, rendering it undetectable in excavation. Based on these considerations, the 3,200-year interval for which no dated deposits were identified appears in fact to represent a legitimate period of non-occupation of the site.

Cultural Features

Cache pits, concentrations of artifacts, and structural remains compose the more significant cultural features at Dirty Shame Rockshelter. The dimensions and other characteristics of these features are summarized in Table 2. In addition to the perishable artifacts discussed in this monograph, lithic artifacts from the features are treated by Hanes (1977).

Cultural features in Zone I include only a small, shallow pit, a cluster of metate fragments with two manos, and a hopper mortar base (see Figure 6). Zone II contains a complex set of features representing small, circular pole-and-thatch huts or windscreens—perhaps as many as six of them—built and rebuilt on the same spot (see Figures 7, 8). Dates on grass thatch from the uppermost structure in the series are A.D. 810 ± 95 and A.D. 775 ± 70. Dates on charred twigs and poles from the lower parts of the deposits are: A.D. 470 ± 75, A.D. 470 ± 75, and A.D. 235 ± 70, 55 ± 75 B.C., and 595 ± 75 B.C. This date spread is surprising, and at first the idea was entertained that perhaps ancient driftwood brought down to the site by Antelope Creek, or wood long preserved in the dryness of the rockshelter might have been used in the structures, however, this row seems unlikely. The dates of A.D. 810 ± 95 and A.D. 775 ± 70 from the same structure and same level in adjacent squares (D2 and C2) are in perfect agreement. The date of 595 ± 70 B.C. is on a pole from square C2 beneath the dated thatch but within the same 20 cm (7.8 in) level. The date of A.D. 470 ± 75 on a structural member comes from square B3, a few centimeters above another member in the same square, which is dated at 55 ± 75 B.C. The date of A.D. 235 ± 70 is on a charred pole from a little distance away, in square D4. As the two clearly associated dates are identical and as older dates underlie the younger ones in both cases where directly superposed samples were assayed, the dates are not anomalous as they stand despite the unexpectedly broad range between them. The conclusion that the structures were indeed built over a span of time indicated by the radiocarbon determinations thus seems as reasonable as any other interpretation.

The uppermost structure in the series is quite well-preserved (see Figure 8). It was erected over a dish-shaped depression that either was intentionally scooped out or which perhaps was the result of compaction during occupation. Construction of the structure involved placing paired vertical willows (Salix sp.) branches 2 cm 6 cm (0.8 in - 1.6 in) in diameter in a series of small pits 20 cm to 40 cm (7.8 in - 15.8 in) deep and anchoring them with rocks and/or dirt. These paired uprights were placed 30 cm - 40 cm (11.8 in - 15.8 in) apart to form a roughly circular framework 3 m (16.4 ft) in diameter. To the inside of the framework were lashed a series of slender, horizontal branches bundled together in multiples of two, three, or four. The uprights may have been drawn together at the top, giving the structure a domed or conical shape, or they may have been left free, leaving the unit as a simple windscreens or subconical structure with a smokehole. There is no direct evidence of the appearance of the top of the structure. The door may have faced east, toward the front of the rockshelter, but there is a gap in the alignment of the vertical members on that side, and the heaviest members found were on annside of the gap. Unfortunately, this area of the structure floor had been disturbed by previous digging.

Large bundles of grass, some as much as 1 m (3.3 ft) long and ca. 10 cm (3.9 in) thick, were added horizontally around the outside of the framework. In most cases, these bundles were attached to the framework with bent, U-shaped willow "pins" by inserting one end of the pin between the paired vertical frame members. In a few instances the ends of the pins had been twisted or tied. An outer layer of vertically set thatch bundles was attached by tucking the upper ends under or into the horizontally set bundles. Two or three rows of the vertically set bundles were placed so that their lower edges covered the upper end or tuck of the thatch bundles below, thus creating a shingled appearance. In one instance, several thin branches ca. 80 c (3.1 in) long were found overlying the vertical thatch, perpendicular to the alignment of the bundles. These branches may have been used to secure the thatch, but there are no indications of how they were attached. Rock slabs found around the outside of the structure probably served to anchor the base of the thatched wall. The unit closely resembles the Northern Palouse winter dwellings figured by Wheat (1967), but corresponds in less detail to those mentioned by Kelly (1932) and Steward (1933).

A cluster of artifacts including four metates, two manos, fragments of wood, and textile specimens lay beneath the structures (Figure 9). A grass-lined pit nearby, also beneath the structure complex, contained a metate, a mano, flakes, burned and broken bone, mussel, and clays fish shell, a few seeds, and tuber or rhizome fragments (Figure 7A). Apparently a cache pit, it represents the earliest cultural feature of Zone II.

Cultural Zone III is characterized by a compact series of small, adjacent and partially overlapping features, all contained within a few vertical centimeters of the deposits (see Figure 9). In descending order, these features include a shallow, grass-lined basin containing a metate, manos, some projectile points, and a sandal or mat fragment (Figure 12, 12A; see Table 2); a small patch of grass associated with sandal and knotted netting fragments (Figure 11); a small, shallow pit filled with stones, containing a slab knife fragment, flakes, bones, and grayfish esoskeleton fragments (Figure 22, 27A); an extensive scatter of sandals and sandal fragments along with manos, wooden shafts, a projectile point, and twined basketry fragments (Figures 16, 10A, 13, 13A); and a fairly large, grass-lined pit containing a metate, a mano, an abrader, a knife, a mat fragment, and two projectile points (Figures 20, 20A, 20B, 21).
<table>
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<tr>
<th>Cultural Zone</th>
<th>Feature Number</th>
<th>Excavation Unit</th>
<th>Elevation (in meters)**</th>
<th>Feature Description</th>
<th>Feature Measurements (diameter/depth)</th>
<th>Feature Contents/Associations</th>
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<tr>
<td>I</td>
<td>1</td>
<td>D2</td>
<td>49.93</td>
<td>hopper mortar base</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>B2</td>
<td>49.50 to 49.36</td>
<td>shallow pit</td>
<td>45 cm x 50 cm</td>
<td>four metate fragments and two manos</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D2</td>
<td>49.06 to 49.71</td>
<td>metate and mano cluster</td>
<td>70 cm x 80 cm</td>
<td>described in text</td>
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<td>II</td>
<td>3, 5, 6A-H</td>
<td>B2, B3, C2, C3, D2, D3</td>
<td>48.60 to 48.99</td>
<td>remains of pole-and-thatch structures</td>
<td>4 m x 6 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7A</td>
<td>B3</td>
<td>48.60 to 48.00</td>
<td>grass-lined pit</td>
<td>88 cm x 92 cm 23 cm deep</td>
<td>metate fragments; mano fragments; obsidian flakes; burned and broken bone; mussel shell; crayfish exoskeleton; seeds; root fragments</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>B3</td>
<td>48.80 to 48.03</td>
<td>artifact cluster</td>
<td>2 m x 2.3 m</td>
<td>four metates; two manos; wooden peg possible atlatl fragment; wooden shaft; twisted basketry fragment</td>
</tr>
<tr>
<td>III</td>
<td>10, 10A, 13, 13A</td>
<td>C3, C4</td>
<td>48.68 to 48.89</td>
<td>artifact cluster</td>
<td>2 m x 4 m</td>
<td>projectile point; two manos; worked flakes; two wooden shafts; two complete sandals ca. 30 sandal fragments; three twisted basketry fragments; fur or hair pad</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>B3</td>
<td>48.80 to 48.90</td>
<td>grass patch fragment</td>
<td>40 cm x 55 cm</td>
<td>sandal fragment; knotted netting</td>
</tr>
<tr>
<td></td>
<td>12, 12A</td>
<td>B3</td>
<td>48.54 to 48.82</td>
<td>grass-lined pit</td>
<td>56 cm x 94 cm 24 cm deep</td>
<td>two projectile points and point fragments; kille; metate and fragments; mano abrader; sandal or mat fragment</td>
</tr>
<tr>
<td></td>
<td>20, 20A, 20B, 21</td>
<td>A2</td>
<td>48.60 to 48.80</td>
<td>grass-lined pit</td>
<td>1 m x 2 m 16 cm deep</td>
<td>two projectile points; metate and metate fragments; two manos; finely woven wood fragment; twig &quot;tie&quot;</td>
</tr>
<tr>
<td></td>
<td>22, 22A</td>
<td>B2</td>
<td>48.89 to 48.96</td>
<td>shallow, stone-filled pit</td>
<td>66 cm 13 cm deep</td>
<td>slab imitation; obsidian waste flakes; bone fragments; crayfish exoskeleton fragments</td>
</tr>
<tr>
<td>IV</td>
<td>14A</td>
<td>B3, B4</td>
<td>58.67 to 58.61</td>
<td>grass-lined pit</td>
<td>55 cm x 88 cm 14 cm deep</td>
<td>two slab knives; debitage flakes; pumice stone fragment; antler fragments</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>C4</td>
<td>68.35 to 68.72</td>
<td>artifact cluster</td>
<td>2 m x 2.2 m</td>
<td>metates; mat fragments</td>
</tr>
<tr>
<td></td>
<td>16, 16A</td>
<td>B3</td>
<td>68.82 to 68.65</td>
<td>ash-filled pit</td>
<td>50 cm x 60 cm 23 cm deep</td>
<td>metate and metate fragments; mano; sandal fragments</td>
</tr>
<tr>
<td></td>
<td>18, 19</td>
<td>B3, C3</td>
<td>48.20 to 48.33</td>
<td>artifact cluster</td>
<td>2 m x 2 m</td>
<td>bilace fragments; two metates; four manos; antler fragments; sandal fragments</td>
</tr>
<tr>
<td>VI</td>
<td>14C-G</td>
<td>B3, B4</td>
<td>48.68 to 48.53</td>
<td>artifact cluster</td>
<td>2 m x 2 m</td>
<td>projectile points; small lithic flakes; one large lithic flake; flat rock; mussel shell; cut stick; mat fragments; knotted netting fragment; cordage fragments; 10 sandal fragments</td>
</tr>
</tbody>
</table>

*After Aikens, Cole, and Stuckenrath (1977: 23-26, Table 2). Notes: Zone V has no cultural features. ** See Figure 4.
Figure 6. Composite plan and profile of cultural Zone 1 at Dirty Shame Rockshelter (from Aikens, Cole, and Stuckenrath 1977:12, Figure 4).
Figure 7. Composite plan and profile of cultural Zone II at Dirty Shame Rockshelter (from Aikens, Cole, and Stuckenrath 1977: 13, Figure 7).
Figure 9. Composite plan and profile of cultural Zone III at Dirty Shame Rockshelter (from Aikens, Cole, and Stuckenrath 1977: 14, Figure 8).
Introduction

Cultural features in Zone IV include Feature 14A, a small, grass-lined pit containing two slab knives, antler fragments, and flakes; an ash-filled pit with mano and metate fragments (Feature 16, 16A); an artifact cluster consisting of a metate, sandal, and mat fragments (Feature 15); and a cluster of manos, metates, sandals, and antler fragments (Features 18, 19; Figure 10).

No cultural features are present in Zone V. In Zone VI a scatter composed of basketry, cordage, sandal, and knotted netting fragments, a projectile point, flakes and mussel shell fragments was identified (Feature 14C-G).

The cultural features show cache pits and grinding stones in association throughout the occupational history of Dirty Shame Rockshelter. This suggests that preparation of stored plant foods was always an activity of major importance at the site. The presence of structures in Zone II that resemble Northern Paiute winter houses suggests that occupation may have extended into the cold months of the year, an interpretation not incongruent with the evidence for food storage.

Aboriginal Life at Dirty Shame Rockshelter

Native peoples came to the rockshelter during the late summer and stayed into the fall. It is conceivable that they stayed through the winter. The dry, south-facing overhang in the bend of a canyon and at the base of a cliff is protected from the elements, and Antelope Creek provides a dependable water supply. It would have been a comfortable camp in any season. If people were to remain in the cold, snowy Owyhee Uplands over the winter, this protected rockshelter would surely have been one of the warmer, more habitable locations available to them. It was undoubtedly hot in summer, but the narrow, deep gorge immediately downstream from the site would have been shady and cool even at midday, with a couple of rock-cut pools deeper than a man is tall only a short distance from the camp.

The well-watered little valley of Antelope Creek, widening out upstream from the rockshelter, afforded the occasional irrigable but a more dependable supply of small mammals, fish, molluscs, and crayfish. Plants of several kinds provided both food and a source of raw materials. Several similar though smaller valleys within a radius of a few miles probably yielded comparable resources. The rolling, sage-covered upland into which the creek beds are incised is the habitat of pronghorn antelope (Antilocapra americana), deer (Odocoileus sp.), jack rabbit (Lepus sp.), and, formerly, bison (Bison sp.), but these species were only rarely taken by the inhabitants of Dirty Shame Rockshelter. Stone tools were manufactured and used at the site, some made of locally available materials and some of materials apparently obtained at a distance and brought to the rockshelter for finishing.

The archaeological deposits reflect the aboriginal life of the camp. Grass, leaves, bark, twigs, infructescences, nuts, seeds, and organic residue from plant decay represent food, fuel, bedding, and manufacturing materials brought into the rockshelter where they were used, discarded, and fragmented underfoot over countless seasons. Animal dung, principally pellets of rabbit (Sylvilagus sp.) and woodrat (Neotoma sp.), occurs throughout the fill, signifying that these animals occupied the rockshelter during seasons when its human inhabitants were elsewhere. No hearths were distinguishable in the site, but abundant ash and charcoal and some major areas where the predominant organic deposits caught fire and burned in situ suggest that domestic fires were commonplace at the site. Cache pits, usually grass-lined, are present throughout the deposits except in the lowest two stratigraphic zones (Strata II and III), where decomposition restricted the archaeological record. As noted previously, fairly substantial dwellings characterize Zone II, but evidence of similar structures is elsewhere lacking in the site.

All of the foods identified from the human feces (coprolites) and bone debris of the site (Hall 1977; Grayson 1977) were locally obtained, and most represent species of the moist canyon-bottom habitat of the immediate site vicinity. Bone fragments and hair of the antelope and smaller mammals are common in the human coprolites. The bulk of the animal remains from the coprolites are unidentified, but the bones from the site deposits represent at least 30 vertebrate taxa as well as some unidentified birds, amphibians, and fishes. Large game of the upland habitats, represented only sporadically and in small numbers in the faunal collection, were pronghorn antelope, deer, bison, and mountain sheep (Ovis canadensis). Smaller game common to the upland were jack rabbits and cottontail rabbits (Sylvilagus floridanus). Cottontails, however, favor the cover afforded by riparian vegetation and rocky ledges and so would have been concentrated along Antelope Creek. Crayfish and molluscs, still to be found in Antelope Creek next to the rockshelter, were recovered throughout the deposits. That they were eaten by the human residents of the rockshelter is demonstrated by their presence in several human coprolites. The yellow-bellied marmot (Marmota flaviventris), beaver (Castor canadensis), mink (Mustela vison), river otter (Lutra canadensis), weasel (Mustela sp.), and raccoon (Procyon lotor) as well as a variety of small rodents are also creatures of the moist habitat along the creek. Their occurrence in all stratigraphic zones of the water-loving mink, otter and beaver reinforces the evidence of the mollusc and crayfish remains in demonstrating the presence of permanent water near the site throughout its period of human occupation.

The cottontail and marmot together account for some 75% of all identified mammalian skeletal remains (or 96% of the estimated minimum number of individuals) from the site. Although one large mammal would provide as much meat as many of these smaller creatures, such a kill was very rare, and future two species from the immediate neighborhood were clearly the most important sources of animal protein throughout the occupation of Dirty Shame Rockshelter. Next in probable importance based on ease of availability and dependability (though the remains do not lend themselves easily to quantification), are fresh-water molluscs and especially the crayfish, which is common at the site.

Occasional remains of dog (Canis familiaris), wolf (Lupus lupus), coyote (Canis latrans), fox (Vulpes sp.), and bobcat (Lynx rufus) may suggest that some of the bones in the site are due to predation by these carnivores rather than to human activity, but breakage, charting, and the occurrence of bone in human coprolites are evidence that most of them are products of human consumption. The presence of raccoon in the faunal assemblage might mean that the crayfish and mollusc fragments reflect his, not human dietary activities. It was not that the charred shell and exoskeleton fragments of
Figure 10. Composite plan and profile of cultural Zone IV at Dirty Shame Rockshelter (from Aikens, Cole, and Stuckenrath 1977:15, Figure 9).
these species are found in many of the human feces and in man-made cache pits at the site. Body parts of termites and ants found in several human coprolites indicate that the ethnographic practice of harvesting insects is an ancient one at Dirty Shame Rockshelter.

Vegetal foods identified from coprolites also closely reflect components of the local landscape. Wild onion (Allium cernuum) and sego lily (Lilium sp.) bulbs, wild cherry (Prunus sp.) seeds, wild rose (Rosa sp.) hips, and unidentified sedge seeds represent plants from the relatively moist canyon bottom. Goosefoot (Chenopodium sp.), sunflower (Helianthus annuus), and especially prickly pear (Opuntia sp.) cactus may represent human harvesting activities on the uplands, though all these taxa would be at home as well among Antelope Creek. The goosefoot, sunflower, and wild cherry seeds are cracked and broken, an indication that they had been milled, and some fragments of prickly pear epidermis are charred, a sign that the cactus pads were baked in a fire. Both practices are known ethnographically (Steward 1938).

Analysis of plant macrofossil and pollen remains from the rockshelter deposits has significantly expanded the list of utilized plants. Identifications of select, well-preserved specimens by Georgia Mason, Curator of the Herbarium, University of Oregon Museum of Natural History, document the presence of a number of plants known to have been economically important to ethnographic Great Basin peoples. Indian hemp (Apocynum sp.), milkweed (Asclepias sp.), sagebrush (Artemisia sp.), and other plants afforded raw materials for fiber manufactures. Soft woods include willow (Salix sp.), cottonwood or aspen (Populus sp.), birch (Betula sp.), alder (Alnus sp.), and juniper (Juniperus sp.). Food plants include ryegrass (Elymus sp.), buckwheat (Fagopyrum sp.), seeds (Phragmites sp.), rushes (Scirpus sp.), sedges (Carex sp.), cattails (Typha sp.), unidentified sedges (Cyperaceae), lily (Liliaceae), onion (Allium sp.), evening primrose (Oenothera sp.) and horsetail (Equisetum sp.). This monograph thoroughly discusses the interrelationships between plants and one element of aboriginal technology, the production of fiber crafts.

A nutritious diet of locally available plant and animal foods was available to the aboriginal inhabitants of the Antelope Creek area; however, none of the taxa are now conspicuously abundant or concentrated in the vicinity of the site, and it is unlikely that they were abundant even before the native vegetation was modified by cattle and sheep grazing. The relatively low biotic yield of the Antelope Creek area undoubtedly affected the size of the human group. A small number of human residents at any one time is probable considering the limited area for occupation within the rockshelter. A nuclear family unit, such as Steward (1938) described as typical of ethnographic Great Basin peoples, would have been appropriate to the local conditions and might have maintained itself for weeks on the resources available within a few miles of the rockshelter. The members of a small group, under favorable conditions, might have been able to store enough reserve food to see them through the winter (see Hall 1977)

Artifacts of several kinds and of considerable technical variation are well-represented at the site. As discussed in later chapters, fragments of twined basketry and a few pieces of coiled basketry are the remains of containers no doubt used in gathering and preparing vegetal foods. Plant fiber cordage, sandals, and sandal fragments are common to most cultural zones except Zone V, where moisture may have prevented or severely diminished their survival. Large chipped stone dart points occur throughout, but small arrow points are predominant in the two youngest cultural zones (Zones I and 10). Knives, scrapers, gravers, drills, and other flake tools also occur as do metates and hand stones used in processing seeds and perhaps bulbs for food. Bone artifacts include awls, fishers, and wooden artifacts, a nail-used fire drill, an atlatl fragment, and several probable atlatl dart foreshafts, among other items.

Evidence for the manufacture of everyday equipment at the site is abundant. As discussed later in this monograph, a few specimens of cut or twisted but otherwise unmutilated plant fibers may represent raw materials for making cordage or weaving basketry and sandals. Twisted plant fiber cordage (see CORDAGE) could be used alone or in making basketry and sandals but also for nets, snares, and for harrowing projectile points. Traces of sagebrush (Artemisia sp.) bark in some human coprolites may have resulted from stripping this favored raw material between the teeth when making sandals or other perishables. Bone awls would have been useful in stitching coiled basketry and for inserting the bindings on sandals. Awls are often assumed to have been used for leather working too, but leather manufactures are conspicuously absent from the site.

A complete, apparently unused foreshaft of an atlatl dart and some cut and notched sticks suggest manufacture of the atlatl/dart combination and perhaps the bow and arrow; however, finished examples of the bow and arrow are absent. Chipped stone gravers, scrapers, and casual flake tools in the lithic assemblage could have served in this manufacturing process.

Relatively crude flakes from shaping obsidian, basalt, and chalcedony nuclei, as well as small retouched flakes and broken or otherwise aborted bifacial and unifacial preforms indicate an active lithic manufacturer. Large quantities of stone debris, such as the products of initial quarrying and roughing-out of usable nuclei, are not present at the site. This, and the absence of suitable stone for knapping in the immediate area of this site, indicate that for the most part raw materials were obtained elsewhere and brought to the site in partially finished condition. Locally obtainable lithic materials were, however, used in making two tools. Thin, flat slabs of vein agate, available in outcrops on Antelope Creek a distance below the site, were made into rather crude "slabs knives" simply by flaking the edges of the small slabs. Local rhyolites and basalts, which tend to break naturally into slabs along planes of flow, were utilized as milling stones.

Cultural Affiliations and Temporal Change

As discussed throughout the remainder of this monograph, the best single indicators of the probable cultural affiliations of the aboriginal peoples who once lived at Dirty Shame Rockshelter are the perishables. The basketry and sandals are of types recognized at a number of other sites in the desert regions of south-central Oregon and adjacent parts of California and Nevada, aligning the site's textile tradition with what Adovasio (1974, n.d.a) has termed the Northern
Basin Center. This tradition in the fiber arts is believed to be one marked by continuity and technological conservatism extending from a time more than 7,000 years ago to, in some places, the ethnographic present.

 Projectile points also closely parallel types known from other sites in the Northern Great Basin; however, there are fewer bipointed knives/projectile points than in the Fort Rock and Conley caves farther west. In this respect, the lithic assemblage shows more affinity with localities to the east and south, in northern Utah/Nevada (Bennings 1957; Alkens 1970; Clewlow 1968), but this sort of difference is not unexpected given the intermediate geographic position of the site and does not contravene assignment of the rockshelter to the Northern Great Basin perishables tradition.

 Aspects of both continuity and change are evident in the Dirty Shame Rockshelter lithic and perishables assemblages. Hanes (1977) has reported his study of the lithic artifacts, utilizing three statistical programs (SERIATE, CLUS III—both Q and R-mode—and MDSICAL). The R-mode cluster analysis showed that four out of five lithic artifact sets identified from the site occur throughout all five analyzed zones. Zone VI contains too few lithic artifacts to be used in the analysis. One type of artifacts, the small projectile points, occurs only in Zones I and II. A second set made up of core tools and gravers, is best represented in Zones I and II, but also occurs in Zone IV. A third set, unifacial scrapers, utilized flakes, miscellaneous bifacial tools, and drills occurs throughout the five zones, but the constituent types are more common in Zones I and II. A fourth set, manos, block milling stones, irregular and leaf-shaped bifacial knives, and larger projectile points is about equally represented in Zones I, II, IV, and V but is more substantially represented in Zone III. A final set is made up of slab milling stones, slab bifacial knives, and irregular bifacial knives. It is present in all zones, but the constituent items are somewhat more common in Zones III, IV, and V than in Zones I and II. The R-mode analysis shows a strong continuity in the kinds of lithic tool-using activities conducted at the site throughout its period of occupation.

 Change in material culture over time is also visible in the archaeological record. All three lithic statistical analyses indicate a division between Zones I-II and Zones III-V. Between these two major units, of course, is the 3,200-year occupation hiatus which undoubtedly contributes to the clarity of the statistical separation. The presence of small projectile points exclusively in Zones I and II indicates the introduction of the bow and arrow at some point after 2,700 BC. The persistence of larger projectile points in these same zones, however, implies that the atlatl and dart were not entirely abandoned although these large points could have been used as saws or knives (Wylie 1973). Utilized flakes, unifacial scrapers, bifacial tools, drills, gravers, and core tools are more common in Zones I and II, reducing the earlier prominence of grinding stones and bifacial knives. The increased number of artifacts apparently associated with routine domestic maintenance activities suggests that Dirty Shame Rockshelter may have been occupied over a larger portion of the annual round during Zone I-II times. Perhaps the season of occupation eventually was extended into the winter months, the remains of structures in Zone II that resemble the Northern Paiute winter house suggest that this was the case.

 It is interesting that Hane's (1977) comparative analysis, which combines data from Hognup and Danger caves in Utah with those from Dirty Shame Rockshelter, shows a significant difference between lower and upper occupation levels in all three sites. A full discussion of the implications of this observation is not possible here, but it is intriguing to note that whereas Dirty Shame Rockshelter seems to have become increasingly important as a long-term base camp during the latter part of its occupation, the opposite is the case at Hognup Cave (Alkens 1970).

 The distribution of the perishable artifact types described in the following chapters conforms to the general pattern of cultural continuity and change established by the lithic analysis. There are changes over time, but the basic techniques and manufacture are remarkably persistent. Twining occurs throughout all zones where basketry is present, but coiling, appearing only in Zone I, is a late introduction to the site. Sandals show a more pronounced change: the Fort Rock and Spiral Jetty types dominate in Zones IV and VI whereas Multiple Warp sandals dominate the Zone III inventory. Zones II and V preserve relatively few sandals.

 Climatic change, or more precisely change in the local environment, has been inferred from study of the vertebrate fauna in the rockshelter deposits (Grayson 1977). The ratio of animals preferring moister microenvironments to those preferring drier ones declines over time, signifying a gradual decrease in the effective moisture of the local habitat around the rockshelter. The most sensitive but also the most tentative measure of change shows this trend reaching a low point at ca. 3950 B.C. in Zone III, after which there is a ca. 3,200-year hiatus in the record of the site. When the record resumes at ca. 750 B.C. with Zone II, there are indications of an effective moisture regime comparable to or slightly more favorable than that found just before the hiatus.

 Implications of the Dirty Shame Rockshelter Excavations for Future Work in the Region

 The artifactual and biotic evidence shows that basically similar patterns of human activity persisted at Dirty Shame Rockshelter throughout the time it was occupied. Various activities occurred at the site. In early times it probably served as a summer-fall base camp for groups exploiting the narrow canyon of Antelope Creek and other nearby small streams. Radiocarbon dates indicate that occupation began ca. 3750 B.C. and that it continued until ca. A.D. 1550. For some 3,200 years, between roughly 3950 B.C. and 750 B.C., there is no evidence of men's presence at the site. Cessation of the cultural record at a time of decreasing effective moisture and its subsequent resumption at a later time of apparently increased moisture may mean that when the Antelope Creek locality dried beyond a certain point, it was no longer desirable as a resource area and was abandoned entirely. People returned when the area was once more able to support a base camp population. Tached structures resembling Northern Paiute winter dwellings in Zone II and evidence of increased domestic activity at the site throughout the post-hiatus period are thought to mean that seasonal occupations may have extended from late summer through the winter months.

 There is a tantalizing hint in the coprolite evidence of changes in aboriginal dietary tendencies. A greater variety of seeds is represented in earlier specimens while animal remains are more diverse in later periods. Because the sample is so
very small, however, it is unwise to magnify these observations into a "trend." In fact, the numbers and kinds of coprolites from all three cultural zones yielding these specimens show a remarkable stability of diet throughout the occupation.

The bow and arrow appears with the resumption of occupation in Zone II. It became the major projectile weapon but probably did not entirely supplant the earlier atlatl and dart. Though the new weapon may have modified hunting styles in some way, the faunal assemblage offers no evidence that it brought about any increase in productivity or a change in the species of animals hunted. Coiled basketry appears in the uppermost cultural zone (Zone I), but evidence that it made a significant functional impact on the human lifestyle at the site is lacking.

Stylistic drift accounts for the major cultural changes observed in the artifact inventory at Dirty Shame Rockshelter. Formal change is most evident among the projectile point types, but basketry weaving techniques also show trends that presumably reflect stylistic changes and, in one case, actual population replacement. Other artifact classes are either nondescript or too few in number to yield a comparable picture. This heightens the interpretative importance of the perishable artifacts as a whole for enhancing or sharpening our perception of day-to-day life at Dirty Shame Rockshelter as it was experienced by generations of aboriginal American Indians.

It seems certain that Dirty Shame Rockshelter was occupied most recently by the Northern Paiute in whose territory it lies. Linguists have argued from glottochronological evidence that the Numic-speaking peoples of whom the Northern Paiute are a branch expanded into their historic range within the last 1,000 years or so from a homeland near the California-Arizona-Sonora border (Lamb 1958; Goss 1968; Miller, Tanner, and Foley 1973). Some archaeologists have resisted this conclusion on the grounds that archaeological evidence in the western and northern Numic territories indicates cultural continuity rather than replacement within the last 1,000 years (Heizer and Naption 1970; Swanson 1972; Hester 1973). Freeze and Ianucci (1974) proposed a significant restructuring of the linguistic classification on which the theory is based, and the theory itself has come under attack by one of its former leading proponents (Goss 1975). Dirty Shame Rockshelter provides additional information that can be woven into the debate.

Cultural Zones I and II are divided at about A.D. 800, give or take 100 years, and this marks the influx of new cultural traits at a date congruent with the linguistic theory and which could represent the advent of Northern Paiute to the site. Coiled basketry and Desert Side-notched, Rose Spring Indented-base, Pinto Square-shoulder, Pinto Shouldlerless and Pinto Slaping-shoulder projectile points all appear for the first time after this date. Evidence for sandals, present in Zone I and II and earlier levels, is missing (except for one possible sandal cushion) from Zone I (planes 1972: Table 2; Adovasio, Andrews, and Carlisle 1972: Tables 1, 3; see also this volume). Similarly, the lacustrine structures of Zone II do not continue into Zone I. Some projectile point and basketry types do show continuity from Zone II or earlier levels into Zone I, which could be interpreted as an amalgamation of immigrant Northern Paiutes with people already present in the region. This evidence, however, could also mean that a common cultural background was to a large extent shared by the Northern Paiute and the previous inhabitants of the region. These seemingly alternative interpretations are not mutually exclusive; indeed, both seem likely possibilities. The evidence from Dirty Shame Rockshelter thus adds to the case made by Madsen (1975) for archaeological verification of the linguistic hypothesis.

Attempts to define the ecological relationships among human societies over the past 10,000 years in the Desert West have produced a variety of models. All depend to a greater or lesser degree on Steward's (1938) ethnohistoric description of Western Shoshone cultural ecology as an archetype and on the Neothermal climatic fluctuations first sketched by Antevs (1948) as a prime force in cultural adaptation. It is certain that a number of regional models will be necessary to characterize the range of human adaptations that have evolved across space and through time in the West as a whole, and several have been developed. Weide (1972), Heizer and Naption (1970), and Madsen and Berry (1975) have discussed lacustrine adaptations. Swanson (1972), O'Connell (1971), Thomas (1972), and Green (1972) have dealt with transhuman or shifting occupation patterns in anthropogenically varied mountain and valley topographies. Riverine adaptations have been a focus for several archaeologists working in the Columbia and Snake River drainages (Butler 1968; Leubhard and Rice 1970; Rense 1972).

It would be premature to offer an ecological model for the Owyhee region based upon Dirty Shame Rockshelter alone, but some indications of what such a model might entail can be offered. A preliminary survey based on air photos and published sources shows that the Western Owyhee Plateau surrounding Dirty Shame Rockshelter is composed of two major environmental zones: 1) an extensive sagebrush-covered upland that constitutes most of the region; and 2) moist canyon bottoms of very restricted extent. Upland microenvironments include steep slopes, pinyon, marshes, and spring mounds. Canyon-bottom microenvironmental variation is not definable from the air photos, but ground survey indicates significant local biotic variation and concentration of potential resources. Forty-one native plants of known economic importance to ethnographic Great Basin peoples have been identified from the area (Keyser 1975), and Grayson's (1977) analysis of mammals from the archaeological site itself indicates over 30 species without doubt taken locally. Antelope and jack rabbits are abundant in the uplands today, and bison were present in prehistoric times. Reports from wilderness enthusiasts and archaeological aerial reconnaissance indicate the presence of possible hunting blinds and hunting drive paths in some areas.

Only a portion of the exploitable biota of the Owyhee region has been found at Dirty Shame Rockshelter itself, allowing the supposition that the site represents only one of several kinds of activity stations to be discovered in the area. Assuming that the paleoecology of this site primarily exploited the moist canyon-bottom environment, stations occupied to exploit the broad upland and its several microenvironments probably remain to be discovered. Air photos and low-level aerial reconnaissance provide a good idea where these stations should be sought out, and future work will use Dirty Shame Rockshelter as an anchor point for elaborating upon the evidence for human adaptation to an environmental context new to archaeological investigation in the Desert West.
The 2,310 plant fiber artifacts recovered during the 1973 excavations at Dirty Shame Rockshelter are allocated to five perishable artifact classes that include basketry, cordage, sandals, miscellaneous perishables, and quids. The constituents of the first three of these classes are examined as the products of three interrelated although technologically distinct human industries. Miscellaneous perishables and quids represent respectively a residual "catch-all" category including such diverse items as netting, trap fragments, gaming pieces, "fetishes," cut but otherwise unmodified plant fibers, etc., and the products of human mastication of plant fibers. Each of these artifact classes from Dirty Shame Rockshelter is described in this monograph in its own chapter. Integral discussions of these artifacts are included at the end of each chapter. Following the presentation of the data on each perishable artifact class, there is a concluding chapter (OVERVIEW) that attempts to place the perishables from Dirty Shame Rockshelter in a wider interpretative context.
BASKETRY

J. M. Advasio
R. L. Andrews
R. C. Carlisle

Introduction

Basketry includes several distinct kinds of items including rigid and semiflexible containers or baskets proper, matting, and bags. Matting is comparatively “two-dimensional” or flat whereas baskets are more clearly “three-dimensional." Bags can be interpreted as intermediate forms because they are more or less two-dimensional when empty but three-dimensional when filled. As Driver (1961: 159) points out, these artifacts can be treated as a unit because the overall technique of manufacture is the same in all instances. All forms of basketry are manually woven without frame or loom. As all basketry is woven, it is technically a textile class or variety; however, the term is often restricted to cloth fabrics.

There are three major subclasses of basketry that are usually distinct: twining, coiling, and plaiting. Twining is a subclass of basket weaves made by sewing stationary (passive) vertical elements, or warps, with moving (active) horizontal elements called wefts. Twining is used to produce containers, mats, and bags as well as fish traps, cradles, hats, clothing, and other less typical basketry forms.

Coiling is a subclass of basket weaves made by sewing stationary horizontal elements (the foundation) with moving vertical elements (stitches). Coiling techniques are used almost exclusively in making containers and hats but are very rarely used for bags. Mats and other forms are seldom, if ever, produced by coiling.

Plaiting is a subclass of basket weaves in which all elements pass over and under each other without engagement. For this reason, plaited basketry is technically described as woven, not sewed. Plaiting can be used to make containers, bags, and mats as well as a wide range of other, less standard forms.

Analytical Procedures

The Dirty Shame Rockshelter basketry specimens were first cleaned of soil, human, bat and/or rodent dung, and other surface contaminants. Inspection of each specimen was accomplished either with a seven power hand lens or with a variable power stereoscopic microscope. In cases of technological complexity or obscurity, specimens were carefully and minimally dissection under being photographed and/or drawn to ensure accurate recognition of the manufacturing techniques employed. The specimens were measured using Hellman needle-nosed dial calipers, and all measurements were recorded in the metric system.

Criteria of Classification

One hundred thirty basketry fragments were recovered during the 1973 excavations at Dirty Shame Rockshelter. These include 71 pieces of twining that can be assigned to a specific type, three pieces of coiling, and 56 fragmented specimens of miscellaneous basketry constructions not assignable to one of the three major technical subclasses of basketry or to a specific structural type. Plaiting is absent from the site. The basketry from Dirty Shame Rockshelter was analyzed, typed, and described using procedures and terminology discussed in Advasio (1977). Classification and terminology of all knots follows Shaw (1972).

Twined basketry specimens from the site are allocated to seven structural types based upon the spacing of the weft rows (either open or close) and on the number and sequence of warps engaged at each weft crossing. When feasible, all twined specimens were analyzed for selvage, method of starting, method of insertion of new warp and weft elements, method of preparation of warps and wefts, form, wear patterns, function, decorative techniques, and the type and mechanics of mending.

Coiled specimens are allocated to three structural types based on the kind of basket wall or foundation technique and the type of stitch employed. These specimens were also assessed for type of rim finish, method of starting, work direction, decorative patterns and mechanics, type and mechanics of mending, form, wear patterns, function, method and preparation of foundation and sewing elements, and type of splice.

"Miscellaneous basketry constructions" are specimens that cannot be assigned to any of the major Dirty Shame Rockshelter basketry subclasses. They are assigned to eight arbitrary categories based upon their predominant technological, structural, and formal attributes.

The basketry structural types established during the analysis and other descriptive data are presented below by basketry subclass. The term "type" is used purely for purposes of classification. Whether or not these etic types also reflect the mental templates or emic typology of the Dirty Shame Rockshelter basket makers is moot. The attributes evaluated in the analysis of the Dirty Shame Rockshelter basketry and the analysis rationale itself are more fully discussed in Advasio (1977).

The Dirty Shame Rockshelter Basketry Industry

TWINING

The 71 pieces of twined basketry from Dirty Shame Rockshelter are allocated to seven structural types, each of which is described below by numerical prefix.
TYPE I: CLOSE SIMPLE TWINNING, Z TWIST WEPT (Figures 11, 12).

No. of specimens: 5.

Types of specimens: Wall fragments without selvage, 4; wall fragment with selvage, 1.

Types of individual forms represented: 5.

Types of forms represented: Basket (i.e., a semirigid to rigid container), 3; matting, 1; matting or sandal, 1.

Technique and Comments: These specimens employ plain twined weaving over single warps. In all cases, warps are paired, and warps are not visible between weft rows. Two of the three basket fragments of this type have two ply, S spun, Z twist cordage (Type III; see CORDAGE) warps while the third possesses single ply, S spun warps. All matting fragments have unspun warps. No end fringes are present on the basket fragments, but one very fragmented specimen of what is either matting or the sole of a Type II sandal (see SANDALS) has a side selvage in which, after the final warp crossing, the wefts are folded at right angles to the weft row (parallel to the terminal warp) and then woven back into the body of the specimen to form the next weft row. This selvage treatment is known as the continuous weft type because the weft rows course back and forth across the specimen without interruption. One basket specimen is decorated using two strands wrapped twined overlay with half twist (Adovasio 1977: 45, 46, Figure 56); this is used on all weft rows. The method of insertion of new warp elements is identifiable on one basketry fragment in which new warps are simply inserted into pre-existing weft crossings. No basket centers are represented, nor are any specimens pitched or naturally watertight due to the tightness of the weave. Wear patterns are undiagnostic, and no specimens show mending.

Measurements:
- Range in diameter of warps: 0.90-5.10 mm.
- Mean diameter of warps: 3.02 mm.
- Range in diameter of wefts: 1.05-7.85 mm.
- Mean diameter of wefts: 4.14 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp. and Xerophyllum sp.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE II: OPEN SIMPLE TWINNING, Z Twist Wept (Figures 13-16).

No. of specimens: 43.

Types of specimens: Wall fragments without selvage, 24; wall fragments with selvage, 19.

No. of individual forms represented: 26 (minimum).

Types of forms represented: Matting, 13 (minimum); bag (i.e., a flexible container), 1; matting or bag, 28 (minimum); other, 1.

Technique and Comments: These specimens employ plain twined weaving over single warps. In all cases, the weft rows are spaced at regular intervals to expose warps. Warps are always paired, but warps include 32 examples that are single ply, unspun fiber; six examples that are single ply, Z spun; one example that is single ply, S spun; and one example of unpaired, unspun, untwisted elements that function as a single warp. In one other specimen, a length of two ply, S spun, Z twist cordage (Type III; see CORDAGE) is employed as a warp element. In two specimens the warps are too decomposed to specify the method of preparation. Four specimens have end selvedges produced by folding the exhausted warp at a 180° angle into the immediately adjacent warp row where it is bound by the weft crossing (see Adovasio 1977: 36, Figure 38b). Fourteen specimens have continuous weft side selvedges (see Adovasio 1977: 39, Figure 40). Two other specimens exhibit a variation of this selvedge type in which the weft is wrapped two to four times around the final warp before it is reweven into the basket wall. This selvedge permutation is called "continuous weft with wrap" and is illustrated in Figures 15 and 16. New wefts are added either by laying the fresh element under the exhausted weft (one specimen) or by tying the new weft with an overhand knot to the warp adjacent to the exhausted weft (three specimens). In one specimen, new warps have been added by V-splicing (see Adovasio 1977: 41, Figure 50). No specimens are decorated, pitched, or naturally watertight; however, the regular use of Artemisia sp., warps and Ancyrum sp. warps does yield a regular geometric pattern because of the color difference of the raw materials. No centers are present. Wear patterns are undiagnostic, and no specimens show mending.

Measurements:
- Range in diameter of warps: 0.90-11.0 mm.
- Mean diameter of warps: 6.08 mm.
- Range in diameter of wefts: 1.50-16.80 mm.
- Mean diameter of wefts: 4.36 mm.
- Range in warps per centimeter: 1-4.
- Mean warps per centimeter: 1.97.

Provenience:

<table>
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<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Juniperus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

Range in wefts per centimeter: 1-2.
Mean wefts per centimeter: 1.20.
Range in gap between weft rows: 3.50-80.40 mm.
Mean gap between weft rows: 21.9 mm.
Provenience (cont.):

<table>
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<tr>
<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Aprocynum sp. and Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp.</td>
<td>17</td>
</tr>
<tr>
<td>V</td>
<td>Aprocynum sp. and Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Aprocynum sp. and Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
</tbody>
</table>

**TYPE III: CLOSE DIAGONAL TWISTING, Z TWIST WEFT** (Figures 17, 18).

- **No. of specimens**: 2.
- **No. of individual forms represented**: 2.
- **Types of forms represented**: Basket, 1; bag, 1.
- **Technique and Comments**: These specimens employ diagonal twined weaving over paired warps. Weft rows are tightly spaced to conceal warps. Wefts are paired, but warps in the bag fragment are single elements; in the basket fragment, warps are two plies, 5 spams, 2 twist cordage (Type III; see CORDAGE). No side or end selvages are present, nor are any specimens decorated. In the bag fragment, new warps are added by inserting them at pre-existing weft junctures. No centers are represented, nor are any specimens pitched or naturally watertight. Wear patterns are undiagnostic, and no specimens show mending.

**Measurements**:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Range in diameter of warps: 1.35-3.60 mm.</th>
<th>Range in warps per centimeter: 2-3.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean diameter of warps: 2.17 mm.</td>
<td>Mean warps per centimeter: 2.50.</td>
</tr>
<tr>
<td></td>
<td>Range in diameter of wefts: 2.35-3.75 mm.</td>
<td>Range in wefts per centimeter: 2-4.</td>
</tr>
<tr>
<td></td>
<td>Mean diameter of wefts: 3.15 mm.</td>
<td>Mean wefts per centimeter: 3.00.</td>
</tr>
</tbody>
</table>

**Provenience**:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Aprocynum sp.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

**TYPE IV: OPEN DIAGONAL TWISTING, Z TWIST WEFT** (Figures 19-30).

- **No. of specimens**: 16.
- **No. of individual forms represented**: 16 (minimum).
- **Types of forms represented**: Basket, 3; bag, 3; matting, 10.
- **Technique and Comments**: These specimens employ diagonal twined weaving over paired warps. Weft rows are spaced at intervals to expose warps. Wefts are always paired, but warps include 11 examples that are single plies, 4 spams; and five examples that are single plies, 5 spams. Side selvages, when present, are either of the continuous weft variety (two specimens; Figures 21, 22) or of the continuous weft with wrap variety (one specimen; Figures 23, 24). One of the specimens with a continuous weft selvage on both margins may be a detached sandal flap (Figures 25, 26). In the continuous weft with wrap selvage, the weft elements wrap the final warp three times between each successive weft course. End selvages are absent. New warps are inserted at pre-existing weft junctures (one specimen); new warps are added either by tucking the new element under the exhausted weft (two specimens) or by laying the new weft at the end of the exhausted weft with no overlap (one specimen). Two of the bag fragments are decorated. In the first decorated specimen, bands of light Rhus sp. wrap darker Scirpus sp. warps producing simple linear designs. There are two variations of this technique in the same bag. In one portion of the bag, two warps are wrapped individually yet consecutively; the next warp is un wrapped; the next pair is wrapped. This results in a simple 21/2 pattern (Figures 27, 28). In another portion of the bag, the wrapping interval is wrap 2, skip 3, wrap 2, skip 1, wrap 2 (Figures 29, 30). In the other decorated specimen, double rows of lighter colored continuous wrapping of greater width than the average weft row in the body of the fabric are added to produce simple linear patterns. No specimens are pitched or naturally watertight. Centers are absent. Wear patterns are undiagnostic, and no specimens show mending.

**Measurements**:

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Range in diameter of warps: 1.32-3.75 mm.</th>
<th>Range in wefts per centimeter: 1-2.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean diameter of warps: 4.18 mm.</td>
<td>Mean wefts per centimeter: 1.62.</td>
</tr>
<tr>
<td></td>
<td>Range in diameter of wefts: 1.00-8.20 mm.</td>
<td>Range in gap between weft rows: 0.29-3.95 cm.</td>
</tr>
<tr>
<td></td>
<td>Mean diameter of wefts: 3.45 mm.</td>
<td>Mean gap between weft rows: 1.10 cm.</td>
</tr>
<tr>
<td></td>
<td>Range in warps per centimeter: 1-6.</td>
<td>Mean warps per centimeter: 2.28.</td>
</tr>
</tbody>
</table>

**Provenience**:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Scirpus sp.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Rhus sp. and Scirpus sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Aprocynum sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>
Provenience: (cont.):

VI

Scrips sp.
2

Scrips sp.
2

TYPE VI: CLOSE SIMPLE TWINING, S TWIST WEFT (Figures 31-33).
No. of specimens: 2.
Types of specimens: Wall fragment without selvage, 1; wall fragment with selvage, 1.
No. of individual forms represented: 2.
Types of forms represented: Basket, 1; bag, 1.

Technique and Comments: These specimens are identical to those of Type I twining except for the twist of the wefts. The single Type V bag fragment has paired wefts and single ply, S spin warps. The basket fragment has paired wefts and rigid, unspin warps. End or rim selvage on the bag fragment is of the 180° variety with warps folded back into immediately contiguous weft rows where they are subsequently truncated below the final weft course (see Cressman 1972: Figure 14). The bag fragment lacks selvages. No centers are represented. Neither of these specimens is decorated, and wear patterns are undiagnostic. Though unpitched, the basket fragment is so tightly woven that it is potentially watertight. No specimens show mending.

Measurements:
Range in diameter of warps: 2.50-2.60 mm.
Mean diameter of warps: 2.55 mm.
Range in diameter of wefts: 1.95-4.5 mm.
Mean diameter of wefts: 3.00 mm.
Range in warps per centimeter: 2-3.
Mean warps per centimeter: 2.50.

Provenience:

<table>
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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
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</thead>
<tbody>
<tr>
<td>III</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Aposcynum sp. and Salix sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE VII: CLOSE DIAGONAL TWINING, S TWIST WEFT (Figures 34, 35).
No. of specimens: 2.

Types of specimens: Wall fragments without selvage, 2.
No. of individual forms represented: 2.
Types of forms represented: Bag, 2.

Technique and Comments: These specimens are identical to those of Type III twining except for the twist of the wefts. Both Type VI specimens have paired wefts with one example of two ply, S spin, Z twist cordage (Type III; see CORDAGE) warps and one example of single ply, S spin warps. No centers, selvages, or decorative patterns are present, nor is either specimen pitched or naturally watertight. Wear patterns are undiagnostic. No specimens show mending.

Measurements:
Range in diameter of warps: 1.20-2.15 mm.
Mean diameter of warps: 1.68 mm.
Range in diameter of wefts: 3.00-3.90 mm.
Mean diameter of wefts: 3.45 mm.
Range in warps per centimeter: 2-3.
Mean warps per centimeter: 2.50.
Range in wefts per centimeters: 2-3.
Mean wefts per centimeter: 2.50.

Provenience:

<table>
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<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Scrips sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Aposcynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE VII: CROSS-WARP TWINING, Z TWIST WEFT (Figure 36).
No. of specimens: 1.

Type of specimen: Wall fragment without selvage, 1.
No. of individual forms represented: 1.
Type of form represented: Unknown, 1.

Technique and Comments: This minute, burned twining specimen has two ply, Z twisted wefts that engage X-crossed warps at each warp crossing, thus producing a lattice work appearance. Selvages are not represented nor is the specimen decorated, mended, pitched, or, of course, watertight.

Measurements:
Diameter of warps: 1.70 mm.
Diameter of wefts: 1.33 mm.
Warps per centimeters: 4 in 2 pairs.

Wefts per centimeters: 2 (by extrapolation).
Gap between weft rows: N.A.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>
COILING

The three specimens of coiled basketry from Dirty Shame Rockshelter are allocated to three structural types, each of which is described below by numerical prefix.

TYPE VIII: CLOSE COILING, WHOLE ROD FOUNDATION, INTERLOCKING STITCH (Figures 37, top; 38, top).

No. of specimens: 1.
Type of specimen: Wall fragment, 1.
Type of form represented: Tray, 1.
Work direction: Right to left, 1.

Technique and Comments: A basket foundation consisting of a single, undecorated whole rod with cortex is sewn with interlocking stitches that regularly pierce the rod. Work surface is concave. Some accidental splitting of the stitch is apparent on the non-work surface. The specimen is unspliced, undecorated, unmended, and not watertight. Splices have tag ends and moving ends (Adovasio 1971: 90-94) clipped short. The rim and center are absent. No wear patterns are apparent.

Measurements:
Range and mean diameter of coils: 5.85 mm.
Range in width of stitches: 2.80-4.00 mm.
Mean width of stitches: 3.25 mm.

Range and mean gap between stitches: 0.
Range and mean coils per centimeters: 3.
Range and mean stitches per centimeters: 3.

Proveniences:
Zone | Raw material | No. of specimens
-----|--------------|-------------------
1    | Rhus sp. or Salix sp. | 1

TYPE IX: CLOSE COILING, HALF ROD FOUNDATION, INTERLOCKING STITCH (Figures 37, middle; 38, middle).

No. of specimens: 1.
Type of specimen: Wall fragment, 1.
Type of form represented: Tray, 1.
Work direction: Left to right, 1.

Technique and Comments: A foundation consisting of a single decorticated half rod oriented with the flat side toward the center of the basket is sewn with interlocking stitches that do not pierce the rod. Work surface is concave, and there is some accidental splitting of stitches on the work surface. The specimen is unspliced, undecorated, unmended, and not watertight. No wear patterns are apparent.

Measurements:
Range in diameter of coils: 6.45-6.55 mm.
Mean diameter of coils: 6.50 mm.
Range in width of stitches: 1.65-2.25 mm.
Mean width of stitches: 1.94 mm.

Range and mean gap between stitches: 0.
Range and mean coils per centimeters: 2.
Range and mean stitches per centimeters: 3.

Proveniences:
Zone | Raw material | No. of specimens
-----|--------------|-------------------
1    | Rhus sp. or Salix sp. | 1

TYPE X: CLOSE COILING, TWO ROD AND WELT Bunched FOUNDATION, NON-INTERLOCKING STITCH (Figures 37, bottom; 38, bottom).

No. of specimens: 1.
Type of specimen: Wall fragment, 1.
Type of form represented: Bowl, 1.
Work direction: Right to left, 1.

Technique and Comments: A triangular foundation consisting of decorticated whole rods surrounded by a flat welt or splint is sewn with non-interlocking stitches that regularly pierce the welt. Work surface is convex. Some accidental splitting of the stitches is found on the non-work surface. The specimen is unspliced though possibly watertight, unmended, and undecorated. No splices are discernible, nor is there any rim finish. The center is absent. The inner (concave) surface of this container exhibits heavy attrition presumably from extensive use as a storage vessel.

Measurements:
Range in diameter of coils: 4.40-4.75 mm.
Mean diameter of coils: 4.58 mm.
Range in width of stitches: 1.75-3.30 mm.
Mean width of stitches: 2.02 mm.

Range and mean gap between stitches: 0.
Range and mean coils per centimeters: 2.
Range and mean stitches per centimeters: 4.

Proveniences:
Zone | Raw material | No. of specimens
-----|--------------|-------------------
1    | Rhus sp. and/or Salix sp. | 1

MISCELLANEOUS BASKETRY CONSTRUCTIONS

The 56 specimens here termed "miscellaneous basketry constructions," are allocated to eight more or less arbitrary categories that are briefly described below without numerical prefixes.
UNTYPED FLEXIBLE TWINNING FRAGMENTS

No. of specimens: 13.

Technique and Comments: Included here are badly macerated fragments of what appear to be twined mats or fragments of sandal slaps (see SANGLAS). In each instance one or another critical attribute is missing or obscured, and this precludes the assignment of these specimens to one of the seven twining types listed above. Seven of the specimens are Z twisted though the weft interval and warp engagement interval are unknown. Of these, one has both a continuous weft side selvage and a 180° end selvage while two others have a continuous weft side selvage. One specimen has a unique side selvage in which the wefts (?) are S spun until they engage a two ply, S spun, Z twist cordage (Type III; see CORDAGE) terminal warp. At this juncture, the weft row bifurcates and engages the warp producing a two ply, Z twist construction that consists of one S spun element and a two ply, S spun, Z twist cordage (Type III; see CORDAGE) element. Two other fragments are open Z twisted with irregular alternation of simple and diagonal warp engagement patterns. One of these specimens has new warps added by inserting them at pre-existing weft junctures; the other has a continuous weft side selvage. The four remaining specimens include two examples of simple twining with unknown intervals and two minute fragments of individual terminal warps with segments of continuous weft side selvages affixed to them. The simple twining specimens with unknown weft intervals have a continuous weft side selvage and a warp twisted side selvage, respectively.

Measurements: None taken.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
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</tr>
<tr>
<td></td>
<td>Apocynum sp. and Scirpus sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>7</td>
</tr>
</tbody>
</table>

UNTYPED SEMIFLEXIBLE TWINNING FRAGMENT

No. of specimens: 1.

Technique and Comments: This specimen employs plain twined weaving over single warps. Weft row interval is unknown. Warps in the extant weft row are paired while warps are unspun. The specimen lacks selvages and is unpitched, undecorated, and not watertight.

Measurements:

| Range in diameter of warps: 2.10-3.40 mm. | Range and mean warps per centimeter: 3. |
| Mean diameter of warps: 2.23 mm.          | Range and mean wefts per centimeter: N.A. |
| Range in diameter of warps: 2.90-3.60 mm. |                                            |
| Mean diameter of wefts: 3.25 mm.          |                                            |

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

UNTYPED RIGID TWINNING FRAGMENT

No. of specimens: 1.

Technique and Comments: This specimen possibly employs plain twined weaving over single warps. Weft row interval is unknown. Fragments of the extant weft row indicate that warps are paired; the extant warp is unspun. Both the warp and weft elements are rigid, partially decorticated, and charred. The extant warp element is foiled in a way suggesting that it is a part of a 180° end selavage. Though fragmentary, this specimen may have been a part of a large, rigid pack basket or cradle frame.

Measurements:

| Width of warp: 6.50 mm. | Width of weft: 5.25 mm. |

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

CONSTRUCTION MATERIAL

No. of specimens: 35.

Technique and Comments: Included here are 17 pairs of Z twist weft elements; three individual Z twist weft elements; one pair of S twist weft elements; three single S twist weft elements; five single, untwisted warp elements and six two ply, S spun, Z twist cordage (Type III; see CORDAGE) warps (see Cressman 1992: Figure 80). Indentations along the warp elements and the spacing of the twists in the weft elements indicate that these are portions of twined mats, bags, or baskets (see Adovasio 1977). Thirty-one of the 35 specimens of construction material appear to have been employed in flexible or semiflexible constructions. Only four are components of rigid basket forms.

Measurements: Z twist warps:

| Range in length: 2.25-8.20 cm. | Range in diameter: 2.30-7.00 mm. | Mean length: 4.67 cm. | Mean diameter: 3.66 mm. |


Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Scirpus sp.</td>
<td>9</td>
</tr>
<tr>
<td>VI</td>
<td>Salix sp.</td>
<td>9</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Scirpus sp.</td>
<td>4</td>
</tr>
</tbody>
</table>

Measurements: S twist wefts.

Range in length: 1.35-3.03 cm.
Mean length: 3.71 cm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Scirpus sp.</td>
<td>4</td>
</tr>
</tbody>
</table>

Measurements: unspun warp elements.

Range in length: 2.90-8.75 cm.
Mean length: 5.91 cm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Scirpus sp.</td>
<td>2</td>
</tr>
<tr>
<td>VI</td>
<td>Scirpus sp.</td>
<td>2</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

Measurements: two ply, S spun, Z twist cordage warps.

Range in length: 1.30-6.80 cm.
Mean length: 4.79 cm.
Range in diameter: 2.60-3.65 mm.
Mean diameter: 3.07 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Scirpus sp.</td>
<td>6</td>
</tr>
</tbody>
</table>

LATTICE WORK (??)

No. of specimens: 1.

Technique and Comments: This very fragmented specimen consists of a single "horizontal" segment of longitudinally split Typha sp. that has been perforated in three places at irregular intervals. Three "vertical" elements, also of Typha sp., are inserted into these perforations perpendicular to the "horizontal" piece. The original form and function of this specimen are unknown.

Measurements:

Width of horizontal element: 7.50 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

FRINGE (??) FRAGMENT (Figures 39, 40).

No. of specimens: 1.

Technique and Comments: This charred specimen consists of a length of two ply, Z spun, S twist cordage (Type IV; see CORDAGE) to which seven more pieces of the same type of cordage are affixed with a running stitch. Originally, this fragment may have functioned as fringe on a bag or mat.

Measurements: N.A.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Specynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

HALF-HITCH WRAPPED RING (Figures 41, 42)

No. of specimens: 1.

Technique and Comments: A fiber ring is sewn around its circumference with a series of seven half-hitch loops. The loops are terminated by truncating the final half-hitch. This specimen vaguely resembles one figured by Cressman (1942: Figure 93) that is identified as a gaming piece; however, the Dirty Shame Rockshelter specimen may simply be a "doodle."

Measurements:

Maximum interior diameter of ring: 4.85 mm.
Maximum exterior diameter of ring: 6.35 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Xerophyllum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>
COILED FIBERS

No. of specimens: 3.

Technique and Comments: All of these specimens are lengths of flat, decorticated plant fiber drawn into rough circular or oval shapes. Although they strongly resemble stitch fragments from coiled basketry, their size and stratigraphic position in the site would seem to preclude this possibility.

Measurements:
- Range in maximum interior diameter of coils: 1.185 mm.
- Mean maximum interior diameter of coils: 1.03 mm.
- Range in maximum exterior diameter of coils: 1.30-6.90 mm.
- Mean maximum exterior diameter of coils: 4.51 mm.
- Range in width of fiber strips: 3.50-4.15 mm.
- Mean width of fiber strips: 3.83 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Salix sp.</td>
<td>2</td>
</tr>
</tbody>
</table>

Internal Correlations

TECHNOLOGY

The frequency and distribution of basketry at Dirty Shame Rockshelter are plotted in Table 3 by raw material type and cultural zone. Twining clearly dominates the industry and collectively accounts for nearly 96% of all basketry specimens excluding the miscellaneous basketry constructions. If the 53 of the 56 miscellaneous constructions that are clearly some variety or portion of twining are added to this total, the overall percentage of twining is of the same general magnitude (93%).

Of the seven twining types, two varieties -- open simple twining, Z twist weft, and open diagonal twining, Z twist weft -- are the predominant construction media accounting for ca. 63% and ca. 24% of the typed twining assemblage, respectively. The remaining twining types are not numerically significant.

It is noteworthy that most of the twining, whatever the type, is flexible and was used to produce mats and bags. Rigid and semirigid containers are not as scarce. Open weave types and Z twist weft predominate over close weave types and S twist weft constructions. The general absence of decoration is also apparent as is the technical simplicity of the end and side selvages as well as the method of insertion of new warp and weft elements. Although they are absent from the Dirty Shame Rockshelter assemblage, basket and bag centers or "starts" were also probably uncomplicated.

The three coiled specimens are numerically inconsequential but nevertheless attest to the occurrence of this basketry subclass as well as to the specific occurrence of both single rod and bunched foundations as well as interlocking and non-interlocking stitch patterns in the geographical area of the site. There appears to be a slight preference for right to left work direction, splices with fag and moving ends clipped short, concave over convex work surfaces, and tray forms over bowls, but little else can be said about the technical characteristics of the coiling industry. It is perhaps significant that the tray fragments do not exhibit the characteristic wear on the concave surface that results from parching. This may mean that coiled basketry in this area may not have played the identical role in food preparation activities that it did elsewhere in the arid American West (see External Correlations and Adovasio 1978a).

The 71 typed basketry fragments from Dirty Shame Rockshelter seem to represent an unusually large number of individuals or mats. Very few specimens are clear portions of the same form. Despite a rigorous attempt to match all fragments that might have come from the same form, the ratio of fragments to individual forms remained constant. The high ratio of fragments to containers and the absence of mended fragments suggest that basketry was literally used until it disintegrated at which time new specimens were produced. Although slightly unusual in the prehistoric Great Basin, generally similar practices have been noted in prehistoric northern Mexico and the Southwest (see Adovasio 1978a, 1978b).

RAW MATERIALS

Plant taxa used in the basketry at Dirty Shame Rockshelter are listed by basketry type and cultural zone in Table 3. Artemisia sp. is clearly the favored material earlier in the cultural sequence. Scirpus sp. is the preferred fiber source above Zone IV. The remaining plant fibers used alone or in combination are relatively scarce.

There seems to be a positive correlation between particular raw materials and certain basketry types. For example, Artemisia sp. appears to have been used principally for open simple twining whereas Scirpus sp. was extensively used in making open diagonal twining. Rhyn sp. and Salix sp. are the exclusive materials used for both rods and stitches in coiling.

The use of specific fiber sources for particular basketry types at Dirty Shame Rockshelter is a practice paralleled to some extent in other segments of the site's perishables. The potential significance of these correlations is discussed in greater detail in the OVERVIEW.

HORIZONTAL DISTRIBUTIONS AND ASSOCIATIONS

The nature of the depositional units at Dirty Shame Rockshelter and the character of the excavation techniques make it difficult to draw many inferences from the horizontal distribution of basketry remains within the site. Furthermore, although certain basketry types are apparently associated with certain cultural features, it is generally impossible to identify any functional relationships arising from these associations. The distribution of basketry or, indeed, any other kind of artifact within a habitation site, however temporary the occupation may have been, is virtually never random. The non-

random artifact distribution pattern reflects specific human activities conducted within the site, assuming that there is no post-deposition disturbance or differential artifact preservation. The identification of a distribution pattern, however, rarely gives a specific answer to questions about the activities that produced that pattern. This is particularly true for basketry, which is often multifunctional, highly portable, and notably prone to both in-use disintegration and extensive post-deposition disturbance and decay.

All of these caveats notwithstanding, certain observations can be offered on the distribution of basketry within Dirty Shame Rockshelter. Although two cultural zones (Zones II and VI) yielded far too few remains to indicate any patterns, the basketry in Zones I, III, IV, and VI is sufficiently numerous to permit the following observations.

Unlike many closed sites in arid western North America (e.g., Frightful Cave in Coahuila, Mexico), there is no long-used perishable "dump" or refuse area within the excavated portions of Dirty Shame Rockshelter. The extant basketry remains as well as all other perishables were apparently randomly discarded in different portions of the site throughout its period of aboriginal occupation.

All of the basketry from Zone VI (to discuss the artifacts in chronological order from oldest to most recent) is restricted to the mouth of the rockshelter. This leads one to believe either that this was the primary aboriginal activity area of the site during this period or that this was the Zone VI midden area. Zone V, as noted above, produced an insufficient amount of basketry to identify any distribution patterns. The basketry from Zone IV is restricted to the center of the western edge of the site occupation area. Within that precinct, some of the basketry remains from this zone are loosely associated with Features 14A and 15, which appear to be activity areas of food preparation and/or consumption.

As Table 3 indicates, most of the basketry at Dirty Shame Rockshelter is from Zone III where it is concentrated at the mouth and in the central and western sections of the rockshelter occupation area. The majority of the construction material is from this zone at or near the mouth of the site. This may indicate that at least some making of basketry was undertaken in this area, or that unused construction material was discarded there. The remaining basketry includes specimens associated with a grass-lined pit (Feature 12 and 12A), another grass-lined pit (Feature 2G, 20A, 20B), and a midden-like sector of the site (Features 10, 10A, 13, 13A).

The few basketry remains in Zone II are in the central portions of the site that are not directly associated with the pole-and-thatch structures of this cultural period. In Zone I, however, there is a relatively dramatic shift in the intrusive distribution of basketry over that of previous periods. The majority of the Zone I basketry is confined to the eastern edge of the site roughly from the mouth back to the back of the rockshelter. Although this shift in disposal or use patterns may be significant, it is difficult to explain it by looking only at the types and distribution of basketry.

In general, the intrusive basketry distributions seem to show some vague shifts in favored activity and/or disposal areas over time. With the exception of Zone III, which is a possible basketry making area at the mouth of the rockshelter, little else can be inferred from the distribution of the basketry remains. There is no significant positive correlation between basketry and feature types or areas within the site.

**CHRONOLOGY**

The earliest basketry in the Dirty Shame Rockshelter sequence is from Zone VI (ca. 7550-5950 B.C.) and includes open simple and open diagonal twining with Z twist wefts as well as close simple twining with S twist wefts. For the reasons discussed below, the examples of open diagonal twining with Z twist wefts as well as the sole representative of close simple twining with S twist weft are considered intrusive into this cultural zone.

The next basketry type to appear is a solitary example of cross-warp twining in Zone V (ca. 5930-4850 B.C.). The prehistoric incidence of this technique is rare, and its occurrence in Zone V and in no other Dirty Shame Rockshelter cultural zone is enigmatic.

Two types of twining are found in Zone IV (ca. 4850-3950 B.C.). These include open simple and open diagonal twining with Z twist wefts. Simple twining dominates over diagonal varieties in numbers of specimens.

Five types of twining occur in Zone III (ca. 3930-3150 B.C.). In addition to the two types observed in Zone IV, close simple twining, Z twist wefts; close simple twining, S twist wefts, and close diagonal twining, S twist weft are also found. Simple twining types predominate over diagonal varieties in numbers of specimens.

Zone II (ca. 750 B.C. to A.D. 850) is nearly devoid of basketry with only one specimen each of close simple twining and close diagonal twining, both with Z twist wefts. This is the first occurrence of close diagonal twining, Z twist weft basketry at the site.

Five types of twining again occur in Zone I (ca. A.D. 850-1550) with both diagonal and simple types represented. Diagonal types are slightly more numerous. The first and only examples of three types of coiling from the site are confined to this zone and numerically constitute a very minor part of the total assemblage.

**External Correlations**

As a unit, the 71 typed basketry specimens from Dirty Shame Rockshelter currently represent the best example of a basketry sequence in the Northern Great Basin that can be compared to other assemblages from the arid West. Exhaustive comparisons are not possible, but a few observations on the technological relationships between the Dirty Shame Rockshelter materials and selected basketry collections from other Great Basin sites and sites in adjacent areas are possible.

**THE NORTHERN BASIN CENTER**

With several exceptions the Dirty Shame Rockshelter basketry closely parallels the assemblages from Fort Rock Cave, Roaring Springs Cave, Catlow Cave No. 1, the Paisley Five Mile Point caves, Table Rock No. 1, Seven Mile Ridge,
Connley Cave No. 6, the Warner and Guano Valley caves, Antelope Overhang, Plush Cave, Crump Lake Cave, DeGorna Cave, and the Massacre and Tule Lake caves. With the exception of Massacre Lake Cave and the Tule Lake caves, which are in northwestern Nevada and northern California respectively, all of these sites are in arid south-central Oregon.

The general uniformity of the basketry from these sites indicates that they are the products of a prehistoric basketry tradition of considerable time depth (Adovasio 1970a; 6; 1974). This basketry center has been previously labeled the Northern Basin Center (Adovasio 1974), and this convention is followed here.

Discussion of the similarities and differences among the basketry assemblages from the various Northern Basin Center sites requires a capsule summary of these localities; this is provided below.

**FORT ROCK CAVE**

References: Cressman 1942; Cressman and Bedwell 1968; Bedwell 1973.

No. of subclasses represented: 1.

Subclass represented: Twining.

Number of types represented: 4(?).

Types represented: Close simple twining, Z twist weft; open simple twining, Z twist weft; open diagonal twining, Z twist weft; mixed open and close simple and diagonal twining, Z twist weft.

Dominant type: Too few specimens to determine.

Forms represented: Baskets (trays and carrying baskets), bags, and mats.

Decoration and mechanics: None.

**ROARING SPRINGS CAVE**

References: Cressman 1942; Adovasio 1970a.

No. of subclasses represented: 2.

Subclasses represented: Twining and coiling.

Dominant subclass: Twining.

No. of types represented: 10.

Types represented: Close simple twining, Z twist weft; close diagonal twining, Z twist weft; open simple twining, Z twist weft; open diagonal twining, Z twist weft; close simple twining, S twist weft; close diagonal twining, S twist weft; open diagonal twining, S twist weft; close coiling, two rod horizontal foundation; split stitch on the non-work surface; close coiling, two rod stacked foundation; non-interlocking stitch; close coiling, three rod bunched foundation; split stitch on the non-work surface.

Dominant type: Close simple twining, Z twist weft.

Forms represented: Twining - mats, bags, baskets (various shapes); coiling - trays, bowls.

Decoration and mechanics: Twining - plain twined overlay on one or two strands; wrapped twined overlay; false embroidery; dyes and combinations of the above; coiling - none.

**CATLOW CAVE NO. 1**

References: Cressman 1942; Adovasio 1970a.

No. of subclasses represented: 2.

Subclasses represented: Twining and coiling.

Dominant subclass: Twining.

No. of types represented: 1.

Types represented: Close simple twining, Z twist weft; close diagonal twining, Z twist weft; open simple twining, Z twist weft; open diagonal twining, Z twist weft; close coiling, whole rod foundation, interlocking stitch; close coiling, one rod and weft stacked foundation; split stitch on the non-work surface; close coiling, three rod bunched foundation; split stitch on the non-work surface; close coiling, two rod and weft bunched foundation; split stitch on the non-work surface.

Dominant type: Close simple twining, Z twist weft.

Forms represented: Twining - mats, bags, baskets (various shapes); coiling - trays, bowls, water vessels (1).

Decoration and mechanics: Twining - identical to Catlow Cave No. 1; coiling - none.

**PAISLEY FIVE MILE POINT CAVES**

References: Cressman 1942; Adovasio 1970a.

No. of subclasses represented: 1.

Subclass represented: Twining.

No. of types represented: 2.

Types represented: Close simple twining, Z twist weft; open simple twining, Z twist weft.

Dominant type: Open simple twining, Z twist weft.

Forms represented: Baskets (various shapes), matting, and bags.

Decoration and mechanics: None.
TABLE ROCK NO. 1

No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 6.
Types represented: Close simple twining, Z twist weft; open simple twining, Z twist weft; close diagonal twining, S twist weft; open simple twining, S twist weft.
Dominant type: Too few specimens to determine.
Forms represented: Baskets (trays and carrying baskets), bags, and mats.
Decoration and mechanics: None.

SEVEN MILE RIDGE

References: Cressman and Bedwell 1968.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 1.
Type represented: Close simple twining, Z twist weft.
Form represented: Baskets (shapes unknown).
Decoration and mechanics: N.A.

CONNLEY CAVE NO. 5

No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 1.
Type represented: Close simple twining, Z twist weft.
Form represented: Baskets (shapes unknown).
Decoration and mechanics: None.

WARNER VALLEY CAVES

References: Cressman 1942; Adovasio 1970a.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 1.
Type represented: Close simple twining, Z twist weft.
Form represented: Baskets (shapes unknown).
Decoration and mechanics: Plain twined overlay; number of overlay strands unknown.

GUANO VALLEY CAVE

References: Cressman 1942; Adovasio 1970a.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 1.
Type represented: Close simple twining, Z twist weft.
Form represented: Baskets (shapes unknown).
Decoration and mechanics: None.

ANTELOPE OVERHANG

No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 3.
Types represented: Close simple twining, Z twist weft; open simple twining, Z twist weft; open diagonal twining, Z twist weft.
Dominant type: Open diagonal twining, Z twist weft.
Forms represented: Bags and matting.
Decoration and mechanics: None.
PLUSH CAVE, CRUMP LAKE CAVE, DEGORMA CAVE

References: Cressman 1942.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 1(2).
Type represented: Open simple twining, Z twist weft.
Forms represented: Bags and matting.
Decoration and mechanics: Plain twined overlay; number of overlay strands unknown.

MASSACRE LAKE CAVE

References: Heizer 1942; Adovasio 1970a.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 3.
Types represented: Close simple twining, Z twist weft; open simple twining, Z twist weft; open diagonal twining, Z twist weft.
Dominant type: Open diagonal twining, Z twist weft.
Forms represented: Baskets (bowls, flat circular trays), bags, and matting.
Decoration and mechanics: Plain twined overlay; number of strands unknown.

TULE LAKE CAVES

References: Heizer 1942; Adovasio 1970a.
No. of subclasses represented: 1.
Subclass represented: Twining.
No. of types represented: 2.
Types represented: Close simple twining, Z twist weft; open diagonal twining, Z twist weft.
Dominant type: Too few specimens to determine.
Forms represented: Baskets (shapes unknown), bags, and matting.
Decoration and mechanics: Plain twined overlay; number of strands unknown.

Basketry Technology in the Northern Basin Center

The basketry assemblages briefly described above are clearly dominated by twining to the virtual exclusion of coiling and the near absence of plaiting. In most instances, whatever the form, the twining is remarkably similar. It shares, among other things, the following attributes that can be considered diagnostic for this basketry center:

1. General predominance of simple over diagonal twining although the ratio between the two is often highly variable.
2. Predominance of Z over S twist wefts.
3. Predominance of two ply over any other weft combination (e.g., three ply).
4. Predominance of continuous weft side selvages and 180° end selvages though other forms occur.
5. Insertion of new warps at pre-existing weft juncures.
6. Relatively simple starts or centers of bags and baskets.
7. General similarity in range of forms produced.

Despite the many similarities in the basketry assemblages of sites in the Northern Basin Center, there are also some significant differences. The frequency of close simple and close diagonal twining with Z twist wefts to all other types is quite variable as is the occurrence of baskets relative to all other forms and the presence of decorative embellishment. It appears that all of these variations are interrelated and are possibly ecologically or functionally based.

Close twining, whether simple or diagonal, is used more often in making baskets than other forms. The frequency of decoration is directly proportional to the incidence of baskets because most other forms are undecorated. Most of the variation in the basketry of Northern Basin Center sites is directly tied to the making and use of rigid and semirigid baskets. In turn, this is probably related to ecological/functional parameters or to group preferences. The low incidence of baskets, decoration, and close simple and diagonal twining at Dirty Shame Rockshelter are thus typical of one pole of the Northern Basin Center basketry spectrum. Sites such as Roaring Springs and Catlow Cave No. 1 are typical of the other pole.

The predominance of baskets over other forms may be related, as suggested by Cressman (1942: 39), to the hydrological and ecological abundance of the areas within which specific groups of basket makers operated. Sites in ecologically rich biomes do tend to have more baskets in their deposits. Sites in more arid and biotically impoverished zones often lack these forms. Dirty Shame Rockshelter once again appears to be typical of the latter situation; Roaring Springs and Catlow Cave No. 1 represent the former.

Whatever variations exist among the basketry industries of various Northern Basin Center sites, the similarities among them far outnumber the differences. This fact reinforces not only the reality of the Northern Basin Center construct but also supports the inclusion of the Dirty Shame Rockshelter basketry industry within that center.
Chronology of Basketry Manufacture in the Northern Basin Center

Many of the sites noted above lack precise radiometric age determinations, nevertheless, the basketry assemblages of some of them can be correlated chronologically thus producing a relative basketry chronology for the center as a whole. The simple twined, undecorated basketry from Unit III at Fort Rock Cave (ca. 9000-6000 B.C.) is certainly earlier than most of the basketry from Dirty Shame Rockshelter. Fort Rock Cave may well represent the basal substratum for basketry making in the Northern Basin Center. Basketry preserved below the Mazama pumice in any of the aforementioned sites (e.g., Paisley Five Mile Point Cave No. 1, Cougar Mountain No. 1) is likewise older than most of the Dirty Shame Rockshelter basketry and other perishables, which post-date the ca. 5000 B.C. Mazama eruption. In all cases, the pre-Mazama age basketry from other sites in the Northern Basin Center is simple twined and undecorated. The remarkably uniform character of the pre-Mazama materials strongly suggests that the diagonal twining and the 5 twist weft twining in Zone VI at Dirty Shame Rockshelter are indeed intrusive into this cultural zone.

Post-3000 B.C. basketry assemblages in the Northern Basin Center are more difficult to correlate with the Dirty Shame Rockshelter materials because of the apparent occupational hiatus at the site and the general dearth of dates from other sites; however, certain trends are apparent. Post-Mazama-age basketry from Northern Basin Center sites invariably includes diagonal as well as simple twined examples. It is suggested that assemblages with proportionately more simple than diagonal twining are roughly contemporaneous with Zone IV at Dirty Shame Rockshelter and that assemblages with more or less equal amounts of simple and diagonal twining are post-4000 B.C. or so in age, hence equivalent to Dirty Shame Rockshelter Zone III or later.

Post-Mazama-age assemblages can be further distinguished by the presence or absence of 5 twist wefts. With the single exception from Zone VI at Dirty Shame Rockshelter, twining with 5 twist wefts is generally restricted to assemblages dating after ca. 4000 B.C. with a dramatic increase after ca. 2500 B.C. Decorative embellishments first appear after ca. 3000 B.C. and increase steadily, notably after 2500 B.C.

The introduction of coiling is the last major technological event to occur in the Northern Basin Center basketry industry. Coiling appears after ca. A.D. 1 and probably in the post-A.D. 300 period, a period that subsumes the meager coiling assemblages from Dirty Shame Rockshelter Zone I, Roaring Springs, and Cottlow Cave. As noted below, the appearance of coiled basketry in Northern Basin Center sites may well have been accompanied by the arrival of Numic-speaking aboriginal populations. Basketry making in the Northern Basin Center can therefore be detailed in terms of three subsequent stages:

Stage I: 5000 B.C. - 3000 B.C.: Basketry is first evidenced archaeologically in the Northern Basin Center in the form of open and close simple, 2 twined bags, mats, burden baskets, trays, and coarse receptacles of indeterminate configuration. All of the known specimens from this period lack decoration (cf., Crossman 1962: 42). Diagonal twining and coiling are absent.

Stage II: 3000 B.C. - A.D. 500: Diagonal twining, absent beneath the ca. 5000 B.C. Mazama pumice at all Northern Basin Center sites, appears above that marker bed and probably represents an elaboration of earlier simple twining forms. Simple twining persists and dominates the early portion of this stage. Later assemblages in Stage II include more examples of diagonal twining, again in the basic forms seen previously. 5 twist wefts (with a down-to-the-left slant or pitch) appear early in this stage and increase in frequency after 2500 B.C. Decorated twining may have been produced early in this interval and is certainly well-represented by the end of it. All basic decorative methods are now in use, but coiling is absent throughout this stage. However catastrophic the ca. 5000 B.C. Mount Mazama blast may have been in ecological terms, the basketry and related perishable industries of the Northern Basin Center continued without fundamental change.

Stage III: A.D. 500 - A.D. 1600+: Coiling appears in minor quantities in the form of bowls, water bottles, or jugs and is integrated into the twining-dominated Northern Basin Center basketry tradition. Coiling appears never to have attained significant popularity, and most of the older twining forms persist with several notational additions. These include the triangular tray and possibly the seed beater. Most of the decorations typical of the preceding period are rare in the meager twining assemblages of this stage.

The Western Basin Center

The closest extra-regional affinities of the Dirty Shame Rockshelter basketry are to the south where clear ties are evident to the highly developed basketry of the Western Great Basin. This area, which encompasses much of west-central Nevada and contiguous portions of California, supported an ancient basketry making center the antiquity of which is probably as great as that of its northern neighbor (see Adovasio 1970a, 1974).

The long and more or less continuous technological relationships between the Northern and Western Basin Centers have been discussed in detail by Adovasio (1974). It suffices to note that throughout the sequence in both centers, technological ties in the form of shared basketry technology, forms, etc., are more common between these areas than either center shares with the Eastern Basin Center (see below).

Before discussing the relationships between the Dirty Shame Rockshelter basketry and basketry from other areas, it should be emphasized that the depauperate collected basketry inventories from this site and from other Northern Basin Center sites almost certainly represent the products of knowledge in the fiber arts that entered the area directly from the Western Basin Center. In all technological particulars, including foundations, stitch types, work directions, centers, rim finishes, splices, forms, etc., the Northern Basin Center coiling duplicates materials from the Western Basin Center where the antiquity of coiling extends to at least 4500 B.C. (see Adovasio 1970a, 1976). The relatively late appearance of coiling and its scant acceptance in the Northern Basin Center is probably due to the overwhelming preference for twining, a tradition established for millennia, as well as to the general absence of food preparation techniques requiring parching trays, a use for which coiling is specifically suited and twining similarly ill-adapted.
THE EASTERN BASIN CENTER

It already has been observed that the technological ties between the Dirty Shame Rockshelter basketry -- and that from the Northern Basin Center in general -- to basketry-making techniques in the Eastern Basin Center are slight. The character of these affinities is detailed in Adovasio (1970a, 1974). Fundamentally, these connections are indirect and include only the sporadic occurrence in the Northern Basin Center of S twist twining and of coiling, both of which ultimately have an Eastern Basin Center origin. S twist twining was the preferred medium for twined basketry construction in the Eastern Basin Center since at least 9000 B.C., and its diffusion from that area into western Nevada and ultimately into southern Oregon is well-established. As a subclass of basketry, coiling is likewise of great antiquity in the Eastern Basin Center (ca. 7000 B.C.) whence it spread to Nevada and lastly to Oregon though much changed en route.

AREAS OUTSIDE THE GREAT BASIN

The technological relationships between the Dirty Shame Rockshelter basketry and basketry from areas outside the Great Basin generally parallel the affinities of Northern Basin Center basketry as a unit to these same regions. The nature of these connections, most of which are slight, is discussed in Adovasio (1970a, 1974, n.d.a), and the reader is referred to these sources for additional information.

ETHNOGRAPHIC CONTINUITIES

As Cressman (1942: 42-43) has observed, certain 'features' of archeologically recovered Northern Basin Center basketry persist into historic times among one or another ethnographic population on the Northwest Coast, Columbia Plateau, and contiguous areas. The same observation can be made for the Dirty Shame Rockshelter basketry assemblage, specifically, and as a representative of Northern Basin Center basketry.

By comparing selected technological attributes such as stitch slant, texture (i.e., flexibility of the basket wall), and warp splicing techniques (and to less extent basket wall type, method of starting, rim finish, and decorative mechanics), Cressman (1942: 43) has concluded that prehistoric Northern Great Basin twining had its closest technological affinities to the basketry of the Klamath-Muskogee of the Columbia Plateau and somewhat more remotely to the Tlingit of the Northwest Coast.

On the basis of shared traits in coiled basket foundations, Cressman (1942: 50) linked the limited Northern Great Basin coiling most closely with prehistoric southwestern "Basketmaker" wares (with which he specifically included the products of prehistoric western Nevada weavers). He also noted similarities to Ute and Tsimshian basketry and to the coiling recovered from Wahluke in Washington.

It is true that most of the attributes of prehistoric Northern Basin Center twining and coiling do occur in the basketry of the groups Cressman cites; however, these similarities do not appear to indicate a genetic relationship between the basketry industries in question. Furthermore, it is not likely that the basketry from Dirty Shame Rockshelter or that from any other Northern Basin Center site can be linked with certainty to any specific ethnographic group. Indeed, Cressman (1942: 42) has observed that attempts to compare prehistoric Northern Basin Center basketry with ethnographic wares is hampered by "... the lack of precise description of technological features from ethnographic sources." This hindrance still partially exists. Cressman (1942:42) also observed that "making comparisons of a culture of an earlier period with that of a later one to discover range of distribution (i.e., of technological traits) involves a methodological problem as well." This problem, one that is still generally unresolved, is the lack of a demonstrable cultural continuity between most historic native American tribes and their prehistoric predecessors. This is especially true in the Dirty Shame Rockshelter study area.

Whatever the pitfalls in making archaeological/ethnographic material culture comparisons, at least the later materials from Dirty Shame Rockshelter can be profitably examined with an eye toward drawing possible historical relationships. The perishable assemblage from Zone I at Dirty Shame Rockshelter has yielded radiocarbon dates ranging from ca. A.D. 547 ± 70 to A.D. 1585 ± 80 and contains all but two of the site's 10 basketry types. The basketry assemblage specifically includes twining Types I, II, III, IV, and VI and coiling Types VIII through X (see Table 3). Interpretation of the twined specimens is equivocal, but the coiling definitely leads to the conclusion that at least the Zone I perishables are the products of one or more populations of Late Prehistoric or Protohistoric Numeric speakers. Data discussed elsewhere in this volume also indicate that a portion of the Zone II perishables can be attributed to some Numeric group, but the basketry sample itself is too small either to support or to offer contrary evidence for this conclusion.

Despite the unevenness of the coverage and the imprecision of some of the recording, trait distribution ethnography was conducted among many Numeric-speaking and non-Numeric-speaking populations in the first half of this century (e.g., Pracke 1937; Driver 1939; Stewart 1941, 1943; Stewart 1941, 1942). Employing these data, most of which were not available to Cressman at the time he examined the Fort Rock, Roaring Springs, and related cave collections, it is possible to generate perishable industry trait profiles that effectively characterize the perishable industries of most of the Numeric speakers as well as their immediate neighbors. Tables 4 and 5 (folio) summarize selected basketry-construction attributes documented for both Numeric and contiguous non-Numeric groups. These tables also summarize data on preferred forms, selvages, raw materials, and other technical details. As these tables indicate, certain basket wall types and forms are nearly "pan-Numeric" in distribution whereas others are more restricted. Without reiterating the data in the tables, it is clear that one can distinguish the ethnographic basketry of the Numeric speakers from that of their immediate neighbors by comparing the trait distribution lists. The twined seed beater, the twined triangular winnowing tray, and to less extent the twined conical carrying basket are the principal basketry hallmarks of the Numeric speakers (see OVERVIEW). The starting techniques, rim finishes, splicing patterns, and raw materials vary from group to group, but the very presence of these types/forms in so many Numeric groups is itself significant. Although not nearly so widespread, the coiling of the Numeric speakers is also unique in attributes and forms.
Comparison of the 10 specimens of twined basketry from Zone I at Dirty Shame Rockshelter indicates that none of the three "diagnostic" Numic twining forms is present. All of the Zone I twining is flexible to semiflexible and represents matting or bags (cf., Cressman 1942,'coarse containers'). The structural types represented in the Zone I twining do occur, however, in ethnographic Numic assemblages as do the semiflexible forms. However, these forms and types also occur in the basketry industries of non-Numic-speaking groups, such as the Klamath and Modoc. Their presence in Zone I at Dirty Shame Rockshelter is not therefore diagnostic especially considering that the specimens are extremely fragmented and frequently are missing many useful, often culturally diagnostic attributes (e.g., selvages and sollices).

The three specimens of Dirty Shame Rockshelter coiling are not so equivocal in terms of their cultural affinities. Indeed, the very presence of the coiling types is alone sufficient to herald the arrival of Numic-speaking populations (the Northern Paiute) in the study area. Analysis of the small Dirty Shame Rockshelter coiling assemblage indicates that two represented coiling foundations, whole and half rod (usually with non-interlocking stitches) are reported for various populations of Northern Paiute (Steward 1934; 1941: 241, 1943: 72; Kelly 1965; Spier 1930: 190; Stewart 1941, 1942: Wheat 1963). More important, other construction details of the Dirty Shame Rockshelter coiling such as predominance of right to left work direction, decortication of foundation roots, and splices with fag and moving ends clipped short, correspond to attributes seen in ethnographic Northern Paiute coiling but in no other ethnographic group. It is not impossible that the constellation of coiling attributes represented in the Zone I Dirty Shame Rockshelter coiling sample as well as in contemporaneous coiling from the upper levels of Castlow Cave No. 1, the upper one-third of Roaring Springs Cave, from the Tule Lake and Massacre Lake caves and possibly from the Warner and Guano Valley caves, might be indicative of some other linguistic or ethnic entity, but in the absence of supporting archaeological or ethnographic data, this possibility does not appear to warrant acceptance. Whatever the reported occurrence of the other Zone I basketry types, the sudden and unanticipated appearance of coiling is sufficient in itself to mark the arrival of Numic-speaking populations at Dirty Shame Rockshelter. There are considerable supporting data for this interpretation beyond the basketry, and this topic is further discussed in the OVERVIEW.

Previous comparisons of the twining and coiling from Fort Rock, Roaring Springs, Castlow Cave No. 1, and the other Northern Basin Center assemblages were necessarily conducted without benefit of radiometric dates and often without clear stratigraphic control over the recovered perishables. Cressman (1942) treated all the basketry and related perishables as essentially synchronous, with a baseline of unspecified antiquity. The occurrence of one or another structural or decorative trait among the archaeological basketry specimens and the appearance of the same trait in an ethnographic inventory dating thousands of years later were therefore deceptively easy to link or string together into a presumed cultural continuum. When these collections are arranged chronologically, however, most of the postulated similarities can be interpreted as the products of the persistence of generally conservative cultural attributes or attribute clusters extending from a common and quite ancient source rather than as indicators of specific prehistoric to ethnographic connections in the manner of the Hohokam-Piman/Papago. This does not apply to the most recent materials recovered and analyzed by Cressman as these collections, like those from Dirty Shame Rockshelter Zone I, are probably all of Late Prehistoric or Protohistoric Numic manufacture (see OVERVIEW).

Summary

The salient features of the Dirty Shame Rockshelter basketry industry are these:

1. The basketry from Dirty Shame Rockshelter is part and parcel of the general milieu of Northern Basin Center basketry.

2. The Dirty Shame Rockshelter basketry sequence, when viewed in conjunction with sequences from other sites in the Northern Basin Center, can be used as an aid to establish basic trends in basketry technology throughout this region.

3. The Dirty Shame Rockshelter basketry shows the basic affinities of other basketry assemblages in the Northern Basin center to basketry traditions elsewhere in the Great Basin and surrounding areas.

4. The persistence of twined basketry manufacturing techniques at Dirty Shame Rockshelter from earlier prehistoric levels into the Late Prehistoric/Protohistoric cannot be used to link the site with specific ethnographic populations; however, the coiled basketry does strongly suggest ties with northern Numic-speaking populations.
Figure 11. TYPE I: CLOSE SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface.
NOTE: Both specimens exhibit two ply, S spun, Z twist cordage warps.

Figure 12. TYPE I: CLOSE SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface.
NOTE: Both specimens exhibit two ply, S spun, Z twist cordage warps.
Figure 13. TYPE II: OPEN SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface. NOTE: The side selavage on this specimen is of the continuous weft with wrap variety. The color distinction between the wefts and warps is due to the use of different raw materials.

Figure 14. TYPE II: OPEN SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface. NOTE: The side selavage on this specimen is of the continuous weft with wrap variety. The color distinction between the wefts and warps is due to the use of different raw materials.
Figure 15. TYPE II: OPEN SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, close-up of continuous weft with wrap side selvage, obverse surface.

Figure 16. TYPE II: OPEN SIMPLE TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, close-up of continuous weft with wrap side selvage, reverse surface.
Figure 17. TYPE III: CLOSE DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface.

Figure 18. TYPE III: CLOSE DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface.
Figure 19. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface.

Figure 20. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface.
Figure 21. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface. NOTE: The side selvage is of the continuous weft variety.

Figure 22. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface. NOTE: The side selvage is of the continuous weft variety.
Figure 23. TYPE IV: OPEN DIAGONAL TWINNING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface. NOTE: The selvage is of the continuous weft with wrap variety.

Figure 24. TYPE IV: OPEN DIAGONAL TWINNING, Z TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface. NOTE: The side selvage is of the continuous weft with wrap variety.
Figure 25. Type IV: Open Diagonal Twinning, 2 Twist Weft basketry from Dirty Shame Rockshelter, obverse surface. NOTE: The side selavage on both margins is of the continuous weft variety. This specimen may be a detached sandal flap.

Figure 26. Type IV: Open Diagonal Twinning, 2 Twist Weft basketry from Dirty Shame Rockshelter, reverse surface. NOTE: The side selavage on both margins is of the continuous weft variety. This specimen may be a detached sandal flap.
Figure 27. TYPE IV: OPEN DIAGONAL TWI宁, Z TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface. NOTE: This specimen exhibits a linear design produced by wrapping Scirpus sp. warps with Rhus sp. in a 2/1/2 pattern. This specimen and the specimens illustrated in Figures 28 - 30 are portions of the same bag.

Figure 28. TYPE IV: OPEN DIAGONAL TWI宁, Z TWIST WEFT basketry from Dirty shame Rockshelter, reverse surface. NOTE: This specimen exhibits a linear design produced by wrapping Scirpus sp. warps with Rhus sp. in a 2/1/2 pattern. This specimen and the specimens illustrated in Figures 27, 29, and 30 are portions of the same bag.
Figure 29. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shane Rockshelter, obverse surface. **NOTE:** This specimen exhibits a simple linear design produced by wrapping Scirpus sp. warps with Rhus sp. in a 2/3/2/1/2 pattern. This specimen and the specimens illustrated in Figures 27, 28, and 30 are portions of the same bag.

Figure 30. TYPE IV: OPEN DIAGONAL TWINING, Z TWIST WEFT basketry from Dirty Shane Rockshelter, reverse surface. **NOTE:** This specimen exhibits a simple linear design produced by wrapping Scirpus sp. warps with Rhus sp. in a 2/3/2/1/2 pattern. This specimen and the specimens illustrated in Figures 27-29 are portions of the same bag.
Figure 31. TYPE VI: CLOSE SIMPLE TWINING, S TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface. NOTE: The specimen at left is a bag fragment with a 180° end selvage.

Figure 32. TYPE VI: CLOSE SIMPLE TWINING, S TWIST WEFT basketry from Dirty Shame Rockshelter, reverse surface. NOTE: The specimen at left is a bag fragment with a 180° end selvage.
Figure 33. TYPE V: CLOSE SIMPLE TWINING, S TWIST WEFT basketry from Dirty Shame Rockshelter, close-up of 180° end selvage on a bag.

Figure 34. TYPE Vi: CLOSE DIAGONAL TWINING, S TWIST WEFT basketry from Dirty Shame Rockshelter, obverse surface.
Figure 35. TYPE VI: CLOSE DIAGONAL TWINING, S TWIST WEPT basketry from Dirty Shame Rockshelter, reverse surface.

Figure 36. TYPE VII: CROSS-WARP TWINING, Z TWIST WEPT basketry from Dirty Shame Rockshelter, obverse surface.
Figure 37. Top, TYPE VIII: CLOSE COILING, WHOLE ROD FOUNDATION, INTERLOCKING STITCH; Middle, TYPE IX: CLOSE COILING, HALF ROD FOUNDATION, INTERLOCKING STITCH; Bottom, TYPE X: CLOSE COILING, TWO ROD AND WELT BUNCHED FOUNDATION, NON-INTERLOCKING STITCH basketry from Dirty Shame Rockshelter, work surface.

Figure 38. Top, TYPE VIII: CLOSE COILING, WHOLE ROD FOUNDATION, INTERLOCKING STITCH; Middle, TYPE IX: CLOSE COILING, HALF ROD FOUNDATION INTERLOCKING STITCH; Bottom, TYPE X: CLOSE COILING, TWO ROD AND WELT BUNCHED FOUNDATION, NON-INTERLOCKING STITCH basketry from Dirty Shame Rockshelter, non-work surface.
Figure 39. FRINGE (?) FRAGMENT from Dirty Shame Rockshelter, obverse surface.

Figure 40. FRINGE (?) FRAGMENT from Dirty Shame Rockshelter, reverse surface.
Figure 41. HALF-HITCH WRAPPED RING from Dirty Shame Rockshelter, obverse surface.

Figure 42. HALF-HITCH WRAPPED RING from Dirty Shame Rockshelter, reverse surface.
CORDAGE

R. L. Andrews
J. M. Adovasio
R. C. Carlisle

Introduction

Cordage is a class of elongate fiber constructions that are generally subsumed under the English terms string and rope. The manufacture of cordage is the oldest fiber-based technology in the New World archaeological record. Cordage from Level D 1 at Danger Cave is attributable to the 10th millennium B.C. (Jennings 1957), and similar specimens from Guatarrero Cave in the north-central Andes of Peru are dated to the 9th millennium B.C. (Adovasio and Lynch 1973; Adovasio and Maslowski 1980). The technological sophistication of these very early cordage specimens indicates considerable antecedent development. Cordage manufacture was very likely part and parcel of the technological repertoire of the earliest migrants to this hemisphere.

Analytical Procedures

Prior to analysis, all of the Dirty Shame Rockshelter cordage specimens were cleaned using the same procedures specified for basketry (see BASKETRY). Analysis was then undertaken by inspection, or if warranted, the specimens were examined under a variable power Bausch and Lomb stereoscopic scanner. In cases of technical complexity or obscurity of construction, specimens were partially and carefully disassembled to insure proper recognition of the manufacturing techniques employed. All specimens were measured using Helios needle-nosed dial calipers, and all measurements were recorded in the metric system.

The identification of plant materials used in Dirty Shame Rockshelter cordage was made by comparison with type specimens in various stages of processing or maceration. These specimens ranged from virtually unmodified leaves, stalks, and stems to heavily macerated, stripped, or otherwise prepared floral elements.

Criteria of Classification

Eight hundred fourteen fragmented cordage specimens were recovered during the 1973 excavations of Dirty Shame Rockshelter. These are allocated to 12 structural types and to three residual categories. The 12 structural types were established on the basis of three interrelated construction attributes:

1. Number and composition of plies (1, 2 or more; simple or compound)
2. Direction of initial "spin" (5 or Z)
3. Direction of final twist (5 or Z).

These attributes are familiar to many readers, but some of them require explanation as identical terms are often employed by different analysts to designate various cordage attributes. The term ply, as used here, means a strand or bunch of fibrous material that is almost always twisted. These strands can be used alone to form single- ply cordage or in groups to form multipply cordage. Multipply cordage is produced by twisting two or more "single" plies together.

An individual ply is simple if it consists of a single strand or bunch of material with the same twist, or it may be compound. Compound plies are constructed with multiple strands or bunches of material individually twisted and then twisted with each other in the opposite direction. Compound plies are therefore separate pieces of cordage which when twisted with other such plies form a technically distinct final cordage type.

Very few, if any, of the cordage specimens or individual plies from Dirty Shame Rockshelter were made by actually spinning the fibers (see Emery 1966:9). Virtually all of the Dirty Shame Rockshelter cordage is made from what Emery (1966:9) calls "fibers of limited length." These fibers have been twisted to form single plies or components of compound plies, but they are not spun in the manner of cotton, wool, bast, etc. Thus, "spin" here denotes the initial twist imparted to a fiber strand or bunch of fibers, and final twist records the direction imparted to several plies that have been twisted together. Using Emery's (1966) terminology, all of the Dirty Shame Rockshelter cordage is twisted but not spun. The term spin is used here to designate the initial twist of a ply because this term is virtually universal in the archaeological literature on cordage and because it facilitates cordage descriptions. The direction of initial spin or final twist can only be S or Z, and these terms have exactly the same meaning as specified by Emery (1966:11).

Each Dirty Shame Rockshelter cordage specimen was also analyzed for splices, knots, the angle of final twist, and other cordage manipulations such as rat-tailing, wrapping, etc. Knot terminology follows Shaw (1972). Angle of twist measurements were recorded using procedures outlined by Emery (1966:11).

The reader will note that following the type number for each of the 12 types of cordage distinguished at Dirty Shame Rockshelter there is a symbol designating that type (Table 6). For example, Type IIIb Two ply, $S$ spin, $Z$ twist is symbolized as $Z$. In this symbol, $S$ denotes the final twist, and the two stacked letters indicate that this cordage is made up of two plies each of which has a spin of $S$. These symbols provide, as Hurley (1979) and others have noted, an economic means of encapsulating the essential data on any piece of cordage. The 12 structural cordage types, the three residual categories established using these procedures, and other pertinent descriptive data are presented below. It should again be noted that "type" is used here only as a classificatory term.

The Dirty Shame Rockshelter Cordage Industry

TYPE I: SINGLE PLY, $Z$ TWIST (2)

No. of specimens: 48 (Figures 43-45).
### TABLE 6
Cordage Types Identified at Dirty Shame Rockshelter and Their Structural Formulae

<table>
<thead>
<tr>
<th>CORDAGE TYPE</th>
<th>STRUCTURAL FORMULA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>$Z$</td>
</tr>
<tr>
<td>II</td>
<td>$S$</td>
</tr>
<tr>
<td>III</td>
<td>$Z^3S$</td>
</tr>
<tr>
<td>IV</td>
<td>$Z^2Z$</td>
</tr>
<tr>
<td>V</td>
<td>$Z^2Z$</td>
</tr>
<tr>
<td>VI</td>
<td>$S$</td>
</tr>
<tr>
<td>VII</td>
<td>$Z^2S$</td>
</tr>
<tr>
<td>VIII</td>
<td>$S^2Z$</td>
</tr>
<tr>
<td>IX</td>
<td>$Z^2S^2$</td>
</tr>
<tr>
<td>X</td>
<td>$S^2Z^2$</td>
</tr>
<tr>
<td>XI</td>
<td>$Z^2S^2$</td>
</tr>
<tr>
<td>XII</td>
<td>$ZS^3S$</td>
</tr>
</tbody>
</table>

**Technique and Comments:** A single strand or bunch of fibrous material was given a Z twist. Two of the 98 specimens are clearly single plies of two ply, Z spin, S twist cordage (Type IV; see below). The remaining 46 specimens were made as single-ply constructions. Two of these 46 specimens are bent into circles. Their ends overlap, but the specimens are otherwise unsecured. Two other specimens of this group are loosely bent into loops. One of these looped specimens exhibits a splice in which a second Z twist element lies parallel with and is twisted with a portion of the first. Presumably, this was done either to increase the cordage length or as a preparatory step to some more complex operation. None of the specimens is knotted or rat-tailed.

**Measurements:**
- Range in length: 0.4–14.7 cm.
- Mean length: 5.67 cm.
- Range in diameter: 0.9–14.8 mm.
- Mean diameter: 4.78 mm.
- Range and mean angle of twist: N.A.
- Range and mean twists per centimeter: N.A.
- Range in inner diameter of circular constructions: 1.45–3.35 mm.
- Mean inner diameter of circular constructions: 2.60 mm.
Range in outer diameter of circular constructions: 5.85-5.95 mm.
Mean outer diameter of circular constructions: 5.99 mm.

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Raw Material</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Asclepias sp.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Salix sp.</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Apocynum sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Asclepias sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(includes both circular constructions)</td>
<td></td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Type II: Single Ply, S Twist (S)**

No. of specimens: 128 (Figures 96-99).

Technique and Comments: A single strand or bunch of fibrous material was given an S twist. Thirty-seven of the 128 specimens are clearly single plies of two ply, S spun, Z twist cordonage (Type III, see below). The remaining 91 specimens were made as single-ply constructions. One specimen is formed into a simple open-ended loop, and six specimens are knotted. The knotted specimens include three examples of single overhand knots, two examples of figure eight knots, and a single example of a bow knot. Among the knots, only two of the single overhand knots actually occur on individual pieces of cordonage. The remaining knotted specimens all involve two separate pieces of cordonage knotted together. One piece of Type II cordonage is stained with red ochre. One is crepe-twisted. In crepe-twisting, a piece of cordonage is twisted so tightly that it retwists upon itself when not under tension (see Emery 1966:12). None of the Type II cordonage specimens is rat-tailed.

Measurements:

<table>
<thead>
<tr>
<th>Provenience</th>
<th>Raw Material</th>
<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
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</tr>
<tr>
<td></td>
<td>Apocynum sp. and Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Artemisia sp.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>1</td>
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<tr>
<td>III</td>
<td>Artemisia sp.</td>
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<tr>
<td></td>
<td>Scirpus sp.</td>
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<td>IV</td>
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<td></td>
<td>(includes specimen stained with red ochre)</td>
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</tr>
<tr>
<td>VI</td>
<td>Scirpus sp.</td>
<td>2</td>
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<tr>
<td></td>
<td>Artemisia sp.</td>
<td>8</td>
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<tr>
<td></td>
<td>Scirpus sp.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Salix sp.</td>
<td>1</td>
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<tr>
<td>Prov. Unk.</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

**Type III: Two Ply, S Spun, Z Twist (Z +)**

No. of specimens: 480 (Figure 99-99).

Technique and Comments: "Two" single strands or bunches of fibrous material were initially S spun and then Z twisted together. In 57 specimens, a single strand of S spun material was folded at a 180° angle and Z twisted with itself producing the functional equivalent of two separate plies. Thirty-seven specimens are knotted. The knots include 13 single overhands, seven square knots, one double square knot, one truncated granny knot, six lark's head knots, one sheet bend knot, and a series of combination knots. The multiply knotted specimens include three examples of a twin overhand with one overhand, and one example each of a single weaver's knot with one whipping knot, one overhand with one square knot, one figure eight with one square knot, one overhand with one whipping knot, and one overhand with one double overhand. Of the knotted Type III cordonage, all 13 of the single overhands, one of the square knots, three of the lark's head knots, all three of the combination overhand knot with lark's head knots, the single combination figure eight knot with square knot, both combination double square knots with overhand knot, the single combination overhand knot with whipping knot, and
one of the combination twin overhand knots with one overhand knot are actually tied on individual pieces of cordage. The remainder involve two pieces of cordage bound together or, in the case of one of the combination twin overhand knots with one overhand knot, three separate pieces of cordage. In addition to the knotted specimens, two examples of Type III cordage are formed into simple unsecured loops, and one is bent into an open-ended crescent. Twenty-six specimens are terminated by systematically diminishing the diameter of the cordage (i.e., rat-tailing), and two specimens are terminated by tucking the plies back into each other. One specimen is terminated by a single overhand knot followed in sequence with a whipping knot. Five specimens are crepe-twisted, and one is stained with red ochre (Figure 58). Splices include four examples in which a new ply is simply wrapped around one of the pre-existing plies and two examples in which a pair of plies is inserted through and secured by the 180° terminal fold of a piece of cordage. A number of Type III cordage specimens may have been portions of more complex constructions. Specifically, the single-element square knot (or square loop) may have been a binding for a bundle of construction material or the lashing for a sandal strap (see SANDALS), while the single-element sheet bend may represent a knot fragment (see MISCELLANEOUS PERISHABLES). All three of the single-element lark's head knots may represent either slip nooses for snares or lashings for sandal straps, and several of the combination knots may also represent snares/strap parts or sandal lashings. The two-element combination weaver's knot with whipping knot specimen may be the termination of a casting net. Finally, one specimen of Type III cordage was recovered with adhering fragments of fur. The source of this fur is Eutamias minimus, the least chipmunk.

**Measurements:**

- **Range in length:** 1.0–16.0 cm.
- **Mean length:** 11.4 cm.
- **Range in diameter:** 0.8–25.8 mm.
- **Mean diameter:** 4.9 mm.

**Provenience:**

<table>
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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
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<tr>
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<td>Apocynum sp.</td>
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<td>Typha sp.</td>
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<td>(includes one specimen stained with red ochre and specimen with fur of Eutamias minimus)</td>
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<tr>
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<td>Apocynum sp.</td>
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<td>Apocynum sp. and Artemisia sp.</td>
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<td>V</td>
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<td>1</td>
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<td>VI</td>
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<td></td>
<td>Scirpus sp.</td>
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</table>

**TYPE IV:** TWO PLY, Z SPUN, S TWIST (S \(Z\)

**No. of specimens:** 25 (Figures 60–64)

**Technique and Comments:** "Two" single strands or bunches of fibrous materials were initially Z spun then S twisted together. In one specimen, a single strand of Z spun material was folded at a 180° angle and subsequently S twisted producing the exact functional equivalent of two separate plies. Eighteen specimens are knotted. The knots include eight overhands, five square knots, one weaver's knot, one double overhand, one twin overhand, one overhand noose, and one combination of a single overhand knot with multiple figure eight knots. Among the knotted specimens, all of the overhand knots, five of the square knots, the double and twin overhand knots and the overhand noose are tied on individual pieces of cordage. The weaver's knot is effected from two pieces of cordage. One of the square knots is effected from five separate pieces of Type IV cordage (Figure 60). The specimen with combination overhand and multiple figure eight knots also consists of two separate pieces of cordage. Two specimens are crepe-twisted. One specimen is rat-tailed. Splices include one example in which new plies are simply laid between and twisted with the exhausted plies. Several specimens of Type IV cordage may have been portions of more complex constructions. Specifically, one specimen consisting of two separate pieces of cordage that are interlooped and twisted into a circular form could represent a "doodle." The five-element square knot is almost certainly a portable "bundle" of cordage construction material. The specimen knotted with an overhand noose may be part of a snares, and the specimen with combination overhand with multiple figure eight knots suspiciously resembles the termination of a bowstring. In this last specimen, a single piece of Type IV cordage some 65.0 cm long is folded in half, and the loose ends are joined with a very tight overhand knot. About 12.0 cm from the folded end, a bundle of untwisted fiber is tightly wrapped with a series of figure eight knots around both segments of cordage. This wrapping is not unlike that seen at either end of a modern bowstring; nor does it differ from ethnographic examples of bowstrings. Unfortunately, the provenience of the specimen in the site is unknown.
Cordage

Measurements:

- Range in length: 0.8-6.5 cm.
- Mean length: 7.8 cm.
- Range in diameter: 0.8-9.0 mm.
- Mean diameter: 2.9 mm.
- Range in angle of twists: 17.7°.
- Mean angle of twist: 44.6°.
- Range in twists per centimeter: 0.5-12.0.
- Mean twists per centimeter: 3.7.

Provenience:

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<th>No. of specimens</th>
</tr>
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<tbody>
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<td>I</td>
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<tr>
<td></td>
<td>Apocynum sp.</td>
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<td>Typha sp.</td>
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<td>Artemisa sp.</td>
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</tr>
<tr>
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<td>Apocynum sp.</td>
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<tr>
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<td>Apocynum sp.</td>
<td>0</td>
</tr>
<tr>
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<td>Scirpus sp.</td>
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<tr>
<td>IV</td>
<td>Artemisa sp.</td>
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<tr>
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<td>Apocynum sp.</td>
<td>19</td>
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<tr>
<td>V</td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Apocynum sp.</td>
<td>4</td>
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<td>Prov. Unk.</td>
<td>Artemisa sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

(the possible bowstring fragment)

TYPE VII: TWO PLY, Z SPUN, Z TWIST (Z Z)

No. of specimens: 1 (Figure 66).

Technique and Comments: Two bunches of fibrous materials were initially Z spun and then Z twisted together. As might be expected from a simple examination of the dynamics of cordage making, this construction technique has produced a very poor example of cordage with virtually no structural integrity. One of the plies contains a single overhand knot. This curious item may represent either a child's first essay in the cordage craft or the work of someone in great haste.

Measurements:

- Length: 3.0 cm.
- Diameter: 3.7 mm.
- Range and mean twists per centimeter: 1.0.

Provenience:

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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE VIII: THREE PLY, S SPUN, Z TWIST (Z Z)

No. of specimens: 3 (Figure 67).

Technique and Comments: Three strands or bunches of fibrous material were initially S spun and then Z twisted together. None of the specimens is knotted. One is rat-tailed.

Measurements:

- Range in length: 7.9-70,8 cm.
- Mean length: 34.9 cm.
- Range in diameter: 2.5-8.9 mm.
- Mean diameter: 5.8 mm.
- Range in angle of twists: 34-89°.
- Mean angle of twist: 91.3°.
- Range in twists per centimeter: 2.0-2.5.
- Mean twists per centimeter: 2.2.

Provenience:

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<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisa sp.</td>
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</tr>
<tr>
<td>Prov. Unk.</td>
<td>Artemisa sp.</td>
<td>1</td>
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</tbody>
</table>

TYPE VIII: THREE PLY, Z SPUN, S TWIST (S Z)

No. of specimens: 5 (Figures 68, 69).

Technique and Comments: Three strands or bunches of fibrous material were initially Z spun and then S twisted together. One of the specimen has an overhand knot. None is rat-tailed.

Measurements:

- Range in length: 2.2-6.7 cm.
- Mean length: 4.7 cm.
- Range in diameter: 4.2-5.4 mm.
- Mean diameter: 4.7 mm.
- Range in angle of twists: 37-63°.
- Mean angle of twist: 39°.
- Range in twists per centimeter: 0.5-4.0.
- Mean twists per centimeter: 2.4.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
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<tbody>
<tr>
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<td>Artemisa sp.</td>
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<tr>
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<td>Apocynum sp.</td>
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</tr>
<tr>
<td>VI</td>
<td>Apocynum sp.</td>
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</tbody>
</table>
TYPE VIII: COMPOUND, TWO PLY, Z SPUN, S TWIST (S Z S Z)

No. of specimens: 1 (Figure 70).

Technique and Comments: Two strands of fibrous material were S twisted together. One strand or ply is a single ply of Z twisted fiber while the other consists of two S spun elements which were then Z twisted together. The single-element ply and the cordage ply were then S twisted together to form the final cordage construction. In effect, this specimen was produced by twisting together an example of Type I and Type III cordage.

Measurements:
- Length: 2.8 cm.
- Angle of twists: 16°.
- Diameter: 3.6 mm.
- Range and mean twists per centimeter: 1.5.

Provenience:

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<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE IX: COMPOUND, TWO PLY, S SPUN, Z TWIST (Z S Z S)

No. of specimens: 1.

Technique and Comments: In this specimen, a single length of Type IV cordage was folded at a 180° angle and then Z twisted with itself to effect the final cordage construction.

Measurements:
- Length: 18.0 cm.
- Diameter: 15.1 mm.
- Range and mean twists per centimeter: 0.5.

Provenience:

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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE X: COMPOUND, TWO PLY, Z SPUN, S TWIST (S Z Z S)

No. of specimens: 2 (Figures 71, 72).

Technique and Comments: Each of these specimens warrants a separate description. Specimen 1 (Figure 71) consists of two plies. Each ply is a separate length of Type III cordage. These were then S twisted together. The product was then joined to a second piece of Type III cordage with a square knot. Specimen 2 (Figure 72) probably is part of a drop spool and could have been allocated to a "miscellaneous" category. However, it is retained in the cordage category because its principal component is a piece of Type X cordage. Specimen 2 consists of two plies, each of which is also a length of Type III cordage. These plies differ slightly in that one consists of two separate S spun elements subsequently Z twisted together while the other ply is actually a single, longitudinally split element (Scirpus sp.) with one end left unsplit. The split halves of this element were S spun and then Z twisted together producing the exact functional equivalent of the opposing Type III cordage. The complete specimen is terminated by wrapping one ply around the other in a pseudo-whipping knot.

Measurements:
- Range in length: 5.1-7.0 cm.
- Mean length: 6.3 cm.
- Range in diameter: 3.1-3.8 mm.
- Mean diameter: 3.5 mm.
- Range in angle of twists: 20-25°.
- Mean angle of twists: 22.9°.
- Range and mean twists per centimeter: 1.4.

Provenience:

<table>
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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Scirpus sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE XII: COMPOUND, TWO PLY, Z SPUN, Z TWIST (Z Z S)

No. of specimens: 10 (Figure 73).

Technique and Comments: "Two" plies, each of which consists of a length of Type III cordage, were Z twisted together in three specimens, a single length of Type III cordage was folded at a 180° angle and subsequently Z twisted with itself thus producing the functional equivalent of two separate plies. Neither specimen is knotted or rat-tailed.

Measurements:
- Range in length: 3.8-27.0 cm.
- Mean length: 16.6 cm.
- Range in diameter: 3.7-16.1 mm.
- Mean diameter: 7.7 mm.
- Range in angle of twists: 25-51°.
- Mean angle of twists: 37.3°.
- Range in twists per centimeter: 0.3-3.0.
- Mean twists per centimeter: 1.4.

Provenience:

<table>
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<tr>
<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Artemisia sp.</td>
<td>1</td>
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<tr>
<td>Prov. Unk.</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE XIII: TWO PLY, Z AND S SPUN, Z TWIST (Z S Z S)

No. of specimens: 2 (Figure 74).

Technique and Comments: In these unusual specimens, a ply consisting of a bunch of S spun fibrous material (Type II cordage) was joined with a second ply consisting of a length of Type III cordage and given a final Z twist. Neither specimen is knotted or rat-tailed.
Cordage

Measurements:
Range in length: 4.5-7.0 cm.
Mean length: 5.8 cm.
Range in diameter: 4.9-6.9 mm.
Mean diameter: 5.9 mm.
Range in angle of twist: 31-36°.
Mean angle of twist: 33.5°.
Range in twists per centimeter: 2-3.
Mean twists per centimeter: 2.5.

Provenience:

<table>
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<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
</tbody>
</table>

RANDOM TWIST CORDAGE

No. of specimens: 9.

Technique and Comments: Included here are single-ply specimens that exhibit both Z and S twists. Generally, one end of the specimens is twisted in one direction while the other end is twisted in the opposite direction. Two specimens actually consist of two separate, randomly twisted pieces of cordage loosely bound to each other by irregular wrapping and/or twisting. None of the specimens is knotted or rat-tailed.

Measurements: N.A.

Provenience:

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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>4</td>
</tr>
</tbody>
</table>

WRAPPED CORDAGE

No. of specimens: 23 (Figure 75).

Technique and Comments: Wrapped cordage is a special functional subclass of cordage in which an inner core consisting of a strand or bunch of untwisted fibers or a length of some type of cordage is sequentially encircled or wrapped with an outer covering. The purpose of the outer covering is to minimize wear on the inner core as well as to provide added shear and tensile strength to the finished construction. Eleven of these specimens have inner cores of single-ply, untwisted fiber. Of these, four are wrapped with single-ply, untwisted fibers; three are wrapped with single-ply, Z twisted fiber (Type I cordage); three are wrapped with single-ply, S twisted fiber (Type II cordage), and one is wrapped with Type III cordage. Four other specimens have inner cores of Type III cordage. Of these, one is wrapped with single-ply, untwisted fiber; another with single-ply, S twisted fiber (Type II cordage), and a third with single-ply, Z twisted fiber (Type I cordage). The last specimen of this group is wrapped with Type III cordage in a figure eight stitch. A single wrapped cordage specimen has a core of Type IV cordage and is also wrapped with 15 circuits of Type IV cordage (Figure 75). Two additional wrapped cordage specimens are thought to be gaming pieces. In the first of these, a Z spin element (Type I cordage) has been evenly folded and encircled 14 times with S spin (Type III cordage). The foundation of the second gaming piece is unspun and untwisted, and it is wrapped eight times with an unmodified piece of Scirpus sp. The wrapping slants to the right in the first specimen and to the left in the second specimen. The remaining wrapped cordage examples include one specimen with an inner core of Type II cordage wrapped with an outer core of the same material and four specimens of wrapping in which the inner core is now absent. Two of these wrappings are single-ply, untwisted fiber; one is Type I cordage; the other is Type II cordage. Work direction (G.E., the direction in which the core was wrapped) on all but three of the wrapped cordage specimens is left to right. The reverse work direction (right to left) characterizes one specimen with a single-ply, untwisted fiber core wrapped with Type II cordage; one specimen with a core of Type III cordage wrapped with Type I cordage, and one specimen with a core of Type III cordage wrapped with Type IV cordage in a figure eight stitch. None of the specimens is knotted or rat-tailed, but seven are knotted. All seven of these knots are overhand noses suggesting that wrapped cordage was extensively used in making snares or traps.

Measurements: Undetermined core type wrapped with untwisted fiber.

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<td>Mean wrapping length</td>
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<td>Range in wrapping diameter</td>
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<td>Mean wrapping diameter</td>
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<td>Range and mean number of wrapping circuits per centimeter</td>
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<td>Range and mean distance between wrapping circuits</td>
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Measurements: Undetermined core type wrapped with TYPE I: SINGLE PLY, Z TWIST cordage.

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<td>Range and mean number of wrapping circuits per centimeter</td>
<td>10.0</td>
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<tr>
<td>Range and mean distance between wrapping circuits</td>
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</tbody>
</table>

Measurements: Undetermined core type wrapped with TYPE II: SINGLE PLY, S TWIST cordage.

<table>
<thead>
<tr>
<th>Range and mean core length</th>
<th>N.A.</th>
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</thead>
<tbody>
<tr>
<td>Range and mean core length</td>
<td>N.A.</td>
</tr>
<tr>
<td>Range and mean wrapping length</td>
<td>1.15cm</td>
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<tr>
<td>Range and mean core diameter</td>
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<tr>
<td>Range and mean core diameter</td>
<td>1.45mm</td>
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<td>Range and mean number of wrapping circuits per centimeter</td>
<td>5.0</td>
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<tr>
<td>Range and mean distance between wrapping circuits</td>
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</tr>
</tbody>
</table>
**Measurements**: Single-ply untwisted fiber core wrapped with single-ply untwisted fiber.

Range in overall construction length: 1.36 - 7.00 cm.
Mean overall construction length: 3.39 cm.
Range in core length: 1.34 - 1.82 cm.
Mean core length: 1.57 cm.
Range in wrapping length: 1.38 - 3.72 cm.
Mean wrapping length: 2.55 cm.
Range in overall construction diameter: 4.05 - 4.50 mm.
Mean overall construction diameter: 4.28 mm.
Range in core diameter: 1.68 - 2.56 mm.
Mean core diameter: 2.12 mm.
Range in wrapping diameter: 1.95 - 3.72 mm.
Mean wrapping diameter: 2.84 mm.
Range in number of wrapping circuits per centimeter: 0.5 - 4.5.
Mean number of wrapping circuits per centimeter: 2.5.
Range and mean distance between wrapping circuits (one specimen only): 0.

**Measurements**: Single-ply untwisted fiber core wrapped with TYPE I: SINGLE PLY, Z TWIST cordage.

Range in overall construction length: 1.03 - 9.90 cm.
Mean overall construction length: 3.78 cm.
Range and mean core length: N.A.
Range and mean wrapping length: N.A.
Range in overall construction diameter: 2.00 - 11.30 mm.
Mean overall construction diameter: 6.75 mm.
Range and mean core diameter: N.A.
Range in wrapping diameter: 1.36 - 6.33 mm.
Mean wrapping diameter: 3.99 mm.
Range in number of wrapping circuits per centimeter: 1.0 - 2.6.
Mean number of wrapping circuits per centimeter: 1.3.
Range and mean distance between wrapping circuits (one specimen only): 0.

**Measurements**: Single-ply untwisted fiber core wrapped with TYPE II: SINGLE PLY, S TWIST cordage.

Range in overall construction length: 4.17 - 16.90 cm.
Mean overall construction length: 5.84 cm.
Range in core length: 1.12 - 2.10 cm.
Mean core length: 1.61 cm.
Range in wrapping length: 0.78 - 5.95 cm.
Mean wrapping length: 3.37 cm.
Range in overall construction diameter: 7.16 - 16.29 mm.
Mean overall construction diameter: 11.7 mm.
Range in core diameter: 3.70 - 13.62 mm.
Mean core diameter: 8.36 mm.
Range in wrapping diameter: 3.64 - 5.02 mm.
Mean wrapping diameter: 4.33 mm.
Range in number of wrapping circuits per centimeter: 2.0 - 3.0.
Mean number of wrapping circuits per centimeter: 2.5.
Range and mean distance between wrapping circuits: 0.

**Measurements**: Single-ply spun core wrapped with TYPE III: TWO PLY, S SPUN, Z TWIST cordage.

Range and mean overall construction length: 7.60 cm.
Range and mean core length: 7.60 cm.
Range and mean wrapping length: 6.20 cm.
Range and mean overall construction diameter: 33.20 mm.
Range and mean core diameter: 5.90 mm.
Range and mean wrapping diameter: 11.39 mm.
Range and mean angle of wrapping: 20°.
Range and mean number of twists per centimeter of wrapping: 1.0.
Range and mean number of wrapping circuits per centimeter: 1.0.
Range and mean distance between wrapping circuits: 0.

**Measurements**: TYPE I: SINGLE PLY, Z TWIST cordage core wrapped with TYPE II: SINGLE PLY, S TWIST cordage.

Range and mean overall construction length: 10.27 cm.
Range and mean core length: 10.27 cm.
Range and mean wrapping length: 5.00 cm.
Range and mean overall construction diameter: 17.81 mm.
Range and mean core diameter: 19.22 mm.
Range and mean wrapping diameter: 2.32 mm.
Range and mean number of wrapping circuits per centimeter: 3.0.
Range and mean distance between wrapping circuits: 1.5 mm.
Measurements: TYPE II: SINGLE PLY, S TWIST cordage core wrapped with TYPE III: SINGLE PLY, S TWIST cordage.
Range and mean overall construction length: 11.95cm.
Range and mean core length: 11.95cm.
Range and mean wrapping length: 2.82cm.
Range and mean overall construction diameter: 2.79mm.
Range and mean core diameter: 2.93mm.
Range and mean wrapping diameter: 2.15mm.
Range in number of wrapping circuits per centimeter: 1.0 - 3.0.
Mean number of wrapping circuits per centimeter: 1.5.
Range and mean distance between wrapping circuits: 0.

Measurements: TYPE III: TWO PLY, S SPUN, Z TWIST cordage core wrapped with single-ply, untwisted fiber.
Range and mean overall construction length: 8.27cm.
Range and mean core length: 8.27cm.
Range and mean wrapping length: 2.15cm.
Range and mean overall construction diameter: 12.38mm.
Range and mean core diameter: 9.29mm.
Range and mean wrapping diameter: 5.54mm.
Range and mean core angle of twist: N.A.
Range and mean number of core twists per centimeter: 1.5.
Range and mean number of wrapping circuits per centimeter: 2.0.
Range and mean distance between wrapping circuits: 0.

Range and mean overall construction length: 6.15cm.
Range and mean core length: 4.49cm.
Range and mean wrapping length: 2.06cm.
Range in overall construction diameter: 4.20 - 7.83mm.
Mean overall construction diameter: 6.03mm.
Range and mean core diameter: 4.83mm.
Range and mean wrapping diameter: 3.69mm.
Range in core angle of twist: 35 - 40°.
Mean core angle of twist: 36°.
Range and mean number of core twists per centimeter: 2.0.
Range and mean number of wrapping circuits per centimeter: 3.0.
Range and mean distance between wrapping circuits: 0.

Range and mean overall construction length: 11.06cm.
Range and mean core length: 11.06cm.
Range and mean wrapping length: 9.37cm.
Range and mean overall construction diameter: 9.23mm.
Range and mean core diameter: 8.49mm.
Range and mean wrapping diameter: 9.37mm.
Range and mean core angle of twist: N.A.
Range and mean angle of wrapping: N.A.
Range and mean number of twists per centimeter of core: N.A.
Range and mean number of twists per centimeter of wrapping: N.A.
Range and mean number of wrapping circuits per centimeter: 1.0.
Range and mean distance between wrapping circuits: N.A.

Range and mean overall construction length: 11.15cm.
Range and mean core length: 11.15cm.
Range and mean wrapping length: 8.41cm.
Range and mean overall construction diameter: 9.45mm.
Range and mean core diameter: 4.75mm.
Range and mean wrapping diameter: 3.86mm.
Range and mean core angle of twist: 34°.
Range and mean angle of wrapping: N.A.
Range and mean number of twists per centimeter of core: 2.0.
Range and mean number of twists per centimeter of wrapping: 62°.
Range and mean number of wrapping circuits per centimeter: 4.0.
Range and mean distance between wrapping circuits: 0.

Range and mean overall construction length: 8.20cm.
Range and mean core length: 8.20cm.
Range and mean wrapping length: 8.20 cm.
Range and mean overall construction diameter: 4.35 mm.
Range and mean core diameter: 3.03 mm.
Range and mean wrapping diameter: 1.20 mm.
Range and mean core angle of twist: N.A.
Range and mean angle of wrapping: 60°.
Range and mean number of twists per centimeter of core: N.A.
Range and mean number of twists per centimeter of wrapping: 8.
Range and mean number of wrapping circuits per centimeter: 15.0.
Range and mean distance between wrapping circuits: 0.

Provenience:

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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
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</thead>
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<tr>
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<td>Artemisia sp.</td>
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<tr>
<td>III</td>
<td>Artemisia sp.</td>
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<tr>
<td></td>
<td>Apocynum sp.</td>
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</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>1</td>
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<tr>
<td></td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Apocynum sp. and Artemisia sp.</td>
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</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Typha sp.</td>
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<tr>
<td>VI</td>
<td>Apocynum sp.</td>
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</tr>
<tr>
<td></td>
<td>Scirpus sp.</td>
<td>2</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp. and Scirpus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

UNIQUE CORDAGE

No. of specimens: 11.

Technique and Comments: These specimens are not assignable to any of the numbered cordage types or to the residual cordage categories. Because of their individuality, they are separately described. Specimen 1 is a length of Type I cordage loosely and irregularly wrapped with a length of unspun fiber. Specimen 2 is a length of Type III cordage with a length of unspun fiber inserted between the piles. Specimen 3 is a bundle of partially chared, unspun fibers; the specimen is also a bundle of fibers that includes Type III cordage and untwisted elements. Specimen 5 is an extensively macerated fiber bundle with a few associated strands of Artemisia sp. bark. Specimens 3-5 are probably bundles or packets of cordage construction material. Specimen 6 is charred and is composed of a length of Type I cordage looped through and around a length of Type II cordage. Specimen 7 consists of a length of Type III cordage the piles of which are knotted together near one end with a weaver's knot. The knot is made in a piece of untwisted material. Specimen 8 is also a length of Type III cordage looped around a length of Type II cordage. Specimen 9 consists of a length of Type IV cordage that has been folded at a 180° angle. The ends are joined with a suspended overhand knot. The construction is partially wrapped with a length of unspun fiber and may represent a snare part. Specimen 10 is a multiply-knotted construction composed of a length of Type III cordage with an overhand knot and two segments of Type II cordage joined to the first element with a second overhand knot. Specimen 11 is also a three-element, multiply-knotted construction in which a length of Type III cordage engages a length of untwisted fiber in a square knot. This element in turn engages another length of untwisted fiber in a second square knot. Specimens 7 and 10 may be mended sandal ties. Specimens 2 and 6 are most likely fragments of sandal ties and sandal loops (see SANDALS). Specimen 11 is probably a repaired sandal welt.

Measurements: Measurements for this variable cordage category are presented below when it has been possible to obtain meaningful information.

Measurements: Specimen 2.
Overall cordage length: 9.10 cm.
Range and mean diameter of untwisted fibers: 4.67 mm.
Range and mean diameter of Type III cordage: 8.90 mm.
Range and mean angle of twist of Type III cordage: 89°.
Range and mean number of twists per centimeter of Type III cordage: 0.7.

Measurements: Specimen 3.
Overall construction length: 1.26 cm.
Overall construction width: 1.69 cm.
Overall construction thickness: 3.55 cm.

Measurements: Specimen 4.
Overall construction length: 3.36 cm.
Overall construction width: 2.85 cm.
Overall construction thickness: 4.39 mm.
Range and mean diameter of Type III cordage: 1.51 mm.
Range and mean angle of twist of Type III cordage: 49°.
Range and mean number of twists per centimeter of Type III cordage: 3.0.

Measurements: Specimen 5.
Overall construction length: 7.00 cm.
Overall construction width: 3.50 cm.
Overall construction thickness: 0.88 cm.
Measurements: Specimen 7.
Overall construction length: 20.5 cm.
Range and mean diameter of untwisted fibers: 8.00 mm.
Range and mean diameter of Type III cordage: 8.66 mm.
Range and mean angle of twist of Type III cordage: 30°.
Range and mean number of twists per centimeter of Type III cordage: 0.5.

Measurements: Specimen 9.
Overall cordage length: 31.2 cm.
Range and mean cordage diameter: 2.00 mm.
Range and mean angle of cordage twist: 56°.
Range and mean number of twists per centimeter of cordage: 4.0.

Measurements: Specimen 10.
Overall construction length: 7.0 cm.
Range and mean diameter of Type II cordage: 5.02 mm.
Range and mean diameter of Type III cordage: 4.67 mm.
Range and mean angle of twist of Type III cordage: 35°.
Range and mean number of twists per centimeter of Type III cordage: 1.5.

Measurements: Specimen 11.
Overall construction length: 23.0 cm.
Range in diameter of untwisted fibers: 8.64 - 9.35 mm.
Mean diameter of untwisted fibers: 9.00 mm.
Range and mean diameter of Type III cordage: 13.55 mm.
Range and mean angle of twist of Type III cordage: 52°.
Range and mean number of twists per centimeter of Type III cordage: 1.0.

Provenience:
<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>4</td>
</tr>
<tr>
<td>VI</td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Apocynum sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

Internal Correlations

TECHNOLOGY

The frequency and distribution of cordage at Dirty Shame Rockshelter are plotted by raw material and stratigraphic zone in Table 7. As indicated, Type III is by far the most common variety of cordage throughout the occupation sequence accounting for 59% of the cordage sample. If the wrapped specimens with Type III cordage inner cores and/or wrapping, then unique specimens partially or predominantly composed of Type III cordage, and the minority types, which consist either of 180° folded Type III cordage or separate lengths of Type III cordage, are added to this figure, the overall frequency of two ply 5 spun, Z twist cordage is ca. 66.2% of the entire cordage sample.

Type II cordage is a distant second in frequency constituting only 15.7% of the cordage sample. This is followed in descending order of frequency by Type IV and Type I cordage. The eight remaining cordage types and the three residual cordage categories are numerically insignificant components of the cordage sample.

The cordage inventory from Dirty Shame Rockshelter varies widely in its technical excellence and includes both extremely well-made, "hard spun" specimens with angles of twist consistently greater than 25° (Emery 1966: 12) as well as very coarse, nearly "unspun" lengths of fiber. No particular trends in quality or level of technical execution are apparent through time.

Knots

The frequency and distribution of specific knot types in the Dirty Shame Rockshelter cordage sample are plotted by stratigraphic zone in Table 8. The single overhand knot and its permutations dominate the assemblage and collectively account for 37.3% of all knotted cordage specimens. Square knots, alone and in combination, constitute 24.7% of the knot sample; lark's head knots, alone and in combination, represent only 12.3% of the knotted cordage sample. All other individual knot types are numerically insignificant.

Function

(with R. D. Drennan)

The diversity seen in the cordage sample from Dirty Shame Rockshelter is ample evidence that this class of artifacts served numerous functions throughout the occupation of the site. Small diameter, "hard spun" cordage (Emery 1966: 12) was apparently used for net making, hafting, snare, and trap manufacture as well as for warps or veils in certain types of twined basketry. Larger diameter cordage with a softer "spin" was used in making other basketry types and especially for
sandalas but the small and large diameter cordage must also have served a very wide range of tying, binding, and lashing functions.

A multidimensional scaling analysis was conducted to investigate whether the four measurements made on cordage specimens made it possible to sort these out into well-defined functional groups that might correspond to the artifacts of which they had been part (e.g., nets, sandals, etc.). A random sample of 100 pieces of cordage was selected from those for which all four measurements could be made. Euclidean distances were calculated between each pair from this sample of 100. Multidimensional scaling solutions were obtained for this distance matrix in 1, 2, 3, 4, 5, and 6 dimensions. A reasonably good fit was obtained in two dimensions (Guttman-Lingoes Coefficient ofAlienation = 0.12862), but there was no clear division of the specimens into clusters that might indicate well-differentiated "functional" populations.

RAW MATERIALS

(with R. D. Drennan)

Plant fibers used in cordage at Dirty Shame Rockshelter have been listed in Table 7 by structural type and zone. Artemisia sp. is clearly the favored material throughout the sequence (67.6% of all cordage). It is used for all cordage types except Types V and X. Apocynum sp. and Scirpus sp., representing 21.6% and 8.2% of the sample, are the only other relatively common raw materials used in cordage. Apocynum sp. is employed in all structural types except Types VI, VIII, IX, XI, and XII while Scirpus sp. is used only for Types I-IV, and X. Scirpus sp. is also employed in three specimens of wrapped cordage. The remaining plant raw materials, used either alone or in combination, are comparatively scarce.

Artemisia sp. and Apocynum sp. probably prepared for cordage making in different ways. The outer bark of the Artemisia sp. plant was discarded. The inner bark was then peeled off, lightly shredded, and soaked. Initial twisting of the fibers probably was done by rolling the dampened, shredded fibers either up or down the thigh producing 2 or 5 spun plies, respectively. The direction of rolling was then usually reversed (except, for instance, in Type V cordage) for final twisting using four or more plies or one ply doubled back on itself. The outer Artemisia sp. specimens may just have been manually twisted.

In preparing Apocynum sp., the outer bark was stripped off, extensively shredded, and dampened. The fibers were then spun and twisted as described for Artemisia sp. With the exception of occasional longitudinal splitting and soaking, the other raw material types such as Scirpus sp., Typha sp., and Salix sp. were essentially unprocessed prior to cordage production.

Comparison of critical measurements for majority cordage Types III and IV (Table 9) indicates that Apocynum sp. is consistently used in small diameter, "hard spun" cordage whereas Artemisia sp. cordage on the whole is of larger diameter and is "soft spun." The differences between cordage made of Artemisia sp. and cordage made of Apocynum sp. are highly significant for all four measurements taken. The mean length of Artemisia sp. specimens is 11.59 cm of Apocynum sp. specimens, 6.33 cm (t = 5.04, p < 0.0001). The mean number of twists per centimeter for Artemisia sp. is 1.3; for Apocynum sp. it is 4.3 (t = 26.58, p < 0.0001). Artemisia sp. specimens average 5.81 mm in diameter; Apocynum specimens, 2.28 mm (t = 13.33, p < 0.0001). Artemisia sp. specimens are twisted at a mean angle of 34.95°; Apocynum sp. specimens, at 47.39° (t = 3.85, p < 0.0001). These material preferences cross-cut both cordage types and are doubtless based on the structural properties of the raw materials themselves. It therefore appears that raw materials properties and the intended use of the finished cordage form were far more important considerations to the cordage maker than structural type per se. In short, intended use seems to have strongly conditioned the choice of cordage raw materials.

In Table 10, major measurements on cordage Types III and IV are plotted by cultural zone. Angle of twist of the number of twists per centimeter for Apocynum sp. varies reasonably consistently through time although diameter is variable. For Artemisia sp., the angle of twist and number of twists per centimeter show slighter greater variability through time, notably in Zone II when both characteristics increase. The diameter of Artemisia sp. cordage through time remains relatively consistent. The smallest mean diameter Artemisia sp. cordage occurs in Zone II, an attribute that correlates with the increase in angle of twist and the number of twists per centimeter.

Adjacent stratigraphic units were examined for sharp changes in any of the four measurements that might indicate chronological discontinuities in the sequence of occupation. Since the sample from Zone V was so small, the comparisons were made between Zone VI and Zone IV, Zone IV and Zone III, Zone III and Zone II, and Zone II. Very few major changes from one zone to the next were noted for specimens made of Apocynum sp. The only significant shifts are between Zone IV and Zone III, when the mean number of twists per centimeter decreases from 4.6 to 3.8 (t = 2.49, p = 0.0180) and the mean diameter increases from 2.09 mm to 2.39 mm (t = 3.39, p = 0.0009). Artemisia sp., however, shows several significant changes. These begin between Zone VI and Zone IV, when the mean angle of twist decreases from 36.1° to 32.5° (t = 2.68, p = 0.0077). This change reverses between Zone IV and Zone III, when the mean angle of twist goes back to 36.1° (t = 3.92, p = 0.0001). Several significant changes take place between Zone III and Zone II, when the mean number of twists per centimeter increases from 1.3 to 2.2 (t = 2.47, p = 0.017) and the mean number of twists per centimeter increases from 6.25 mm to 4.12 mm (t = 2.47, p = 0.0171). Finally, the mean angle of twist increases further from 36.1° to 37.5° (t = 3.36, p = 0.0013), and the mean number of twists per centimeter returns to approximately its Zone III value, now 1.3 (t = 3.01, p = 0.0031). At no time in the sequence does mean cordage diameter of either preferred raw material fall below 0.8 mm. This is possibly the minimum optimum diameter for cordage of either raw material type.

The frequency of knot types varies with the overall frequency of cordage raw materials and is independent of cordage structural type. Slightly less than 62% of the knots occur in Artemisia sp. cordage, ca. 35% are Apocynum sp., and ca. 38% are Typha sp.
### TABLE 7
Distribution of Cordage at Dirty Shame Rockshelter by Raw Material and Cultural Zone*

<table>
<thead>
<tr>
<th>ZONE</th>
<th>CORDAGE TYPE **</th>
<th>TOTALS BY RAW MATERIAL</th>
<th>PERCENT OF TOTAL</th>
</tr>
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<td></td>
<td></td>
<td>RECENT</td>
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</table>

* Raw material types are abbreviated as follows: Ag = Agave spp.; Ar = Artemisia sp.; As = Atriplex sp.; Sa = Salix sp.; Sc = Scirpus sp.;
** = Table 6; Ap = Atriplex sp.; and Artemisia sp.; Ar/As = Atriplex sp. and Artemisia sp.;
*** = Table 6 for complete structural formulae.
<table>
<thead>
<tr>
<th>TOW *</th>
<th>Single Overhand</th>
<th>Double Overhand</th>
<th>Two Single Overhand</th>
<th>Suspender Overhand</th>
<th>Single Overhand/ Single Overhand</th>
<th>Single Overhand/ Single Underhand</th>
<th>Overhand Bosun</th>
<th>Half Hitch</th>
<th>Figure Eight</th>
<th>Square Knot</th>
<th>Sea Loop Knot</th>
<th>Single Bow</th>
<th>Turkish Round</th>
<th>Link's Head</th>
<th>Weaver's</th>
<th>Short Bow</th>
<th>Single Overhand/ Square Loop</th>
<th>Single Bight</th>
<th>Macrame Loop</th>
<th>Figure Eight</th>
<th>Square Knot</th>
<th>Pendent Knot</th>
<th>Pendent Knot/ Round</th>
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<th>PERCENT OF TOTAL</th>
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<td>--</td>
<td>100</td>
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</table>

| PERCENT OF TOTAL | 37.0 | 1.4 | 2.8 | 1.6 | 1.4 | 1.4 | 1.4 | 2.8 | 17.8 | 2.8 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | Total 100 |

* Approximate dates for cultural zones are provided on Table 7.
### Table 9

Comparison of Select Metric Attributes of Type III and Type IV Cordage Made of *Artemisia* sp. and *Apocynum* sp. from Dirty Shame Rockshelter

<table>
<thead>
<tr>
<th>ATTRIBUTE</th>
<th>TYPE III CORDAGE</th>
<th>TYPE IV CORDAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Artemisia sp. (N=344)</td>
<td>Apocynum sp. (N=100)</td>
</tr>
<tr>
<td>Range in length</td>
<td>1.0 - 168.0 cm</td>
<td>1.6 - 24.2 cm</td>
</tr>
<tr>
<td>Mean length</td>
<td>13.38 cm</td>
<td>6.22 cm</td>
</tr>
<tr>
<td>Range in diameter</td>
<td>1.0 - 25.8 mm</td>
<td>0.8 - 18.0 mm</td>
</tr>
<tr>
<td>Mean diameter</td>
<td>5.94 mm</td>
<td>2.35 mm</td>
</tr>
<tr>
<td>Range in number of twists per centimeter</td>
<td>0.1 - 7.0</td>
<td>0.5 - 11.0</td>
</tr>
<tr>
<td>Mean number of twists per centimeter</td>
<td>1.33</td>
<td>4.40</td>
</tr>
<tr>
<td>Range in angle of twist</td>
<td>14 - 71°</td>
<td>23 - 67°</td>
</tr>
<tr>
<td>Mean angle of twist</td>
<td>34°</td>
<td>48°</td>
</tr>
</tbody>
</table>

* See Table 6 for cordage construction formulae.
### Table 10
Comparison of Select Metric Attributes of *Artemisia* sp. and *Apocynum* sp. Cordage from Dirty Shame Rockshelter by Cultural Zone

<table>
<thead>
<tr>
<th>ZONE</th>
<th>ARTEMISIA sp.</th>
<th>APOCYNUM sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range and Mean Length (cm)</td>
<td>Range and Mean Diameter (mm)</td>
</tr>
<tr>
<td>I</td>
<td>N=22</td>
<td>2.9-32.6</td>
</tr>
<tr>
<td></td>
<td>12.9</td>
<td>5.6</td>
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<tr>
<td>II</td>
<td>N=10</td>
<td>1.0-56.6</td>
</tr>
<tr>
<td></td>
<td>10.6</td>
<td>4.4</td>
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<tr>
<td>III</td>
<td>N=100</td>
<td>1.6-40.8</td>
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<tr>
<td></td>
<td>10.6</td>
<td>6.4</td>
</tr>
<tr>
<td>IV</td>
<td>N=187</td>
<td>1.2-80.4</td>
</tr>
<tr>
<td></td>
<td>12.4</td>
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<tr>
<td>V</td>
<td>N=2</td>
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<tr>
<td>VI</td>
<td>N=39</td>
<td>3.3-168.0</td>
</tr>
<tr>
<td></td>
<td>18.6</td>
<td>5.5</td>
</tr>
</tbody>
</table>

*Excludes one Type VIII and one Type XI cord in Zone V.*
There seems to be no correlation between termination techniques (e.g., rat-tailing and whipping) with specific raw material types, but the incidence of specimens produced by 180° folding and twisting is far greater in Artemisia sp. cordage than the frequency of this raw material alone suggests. Specifically, 84.4% of the folded and twisted pieces are Artemisia sp. Only 3.1% are Aegopodium sp. Testing the significance of such a top-sided distribution is somewhat tenuous, but a chi-square score of 11.1 (p < 0.0001) does confirm the obvious. There appears to be no structural explanation for this, and it is possible that most of the folded Artemisia sp. pieces were intended for basketry, where such elements are exceedingly common (see SANDALS). This suggestion is strengthened by the fact that all sandals are made of Artemisia sp.

HORIZONTAL DISTRIBUTIONS AND ASSOCIATIONS

(with R. D. Brennan)

The distribution of cordage in Dirty Shame Rockshelter corresponds in general to the distribution of basketry at the site. Virtually all cordage from Zone VI is restricted to the mouth of the rockshelter, and this reinforces the idea that this was either the primary perishables-producing area at this period or that this area represents the Zone VI midden (see BASKETRY).

Zone V, where preservation of perishables in general is poorer than in other cultural zones, produced insufficient cordage to warrant comment. Cordage from Zone IV is restricted entirely to the west-central edge of the occupied area. Some of the cordage in this area and zone is associated with Features 14A and 15 that are connected with food preparation/consumption functions. Unlike basketry, which is most numerous in Zone III, the bulk of the cordage from Dirty Shame Rockshelter occurs in Zone IV.

The Zone III cordage, like the basketry, is concentrated in the central and western sections of the occupation area and at the mouth of the rockshelter. Some cordage is directly associated with the same features as the basketry from that unit (see BASKETRY). Cordage is scarce in Zone II, and most of it is from the center of the site and the mouth of the rockshelter. None of it is directly associated with the pole-and-thatch structures of this zone.

As in the basketry, there is a relatively pronounced shift in the distribution of Zone I cordage remains over earlier distributions. Most of it is limited to the east-central and eastern portions of the utilized area, roughly from the center of the site to the innermost limits of human occupation. Once again, the significance of this shift is not apparent from the types or distributions of cordage alone.

Given the general scarcity of unprocessed or lightly processed raw materials clearly intended for cordage making, it is difficult to identify areas of the site that could have been cordage making locations. Cordage in virtually all zones is confined to squares A3, A5, B3, and C3 in the central and western portions of the site, but this does not mean that these were cordage-making areas.

A more accurate indication of intrasite cordage-making areas may be the distribution of Types I and II cordage, or at least those specimens that are clearly elements of two-ply constructions, however, such remains occur in no significant concentrations in any one area or zone. The distribution of raw material types through time indicates only that most of the Salix sp. cordage occurs in the (very restricted) center of the site during Zone II times. This is an indication that some Salix sp. cordage was made, used, or discarded at this spot, but plotting such distributions sheds no light on the making of the majority cordage types from either of the most common cordage raw materials.

As noted for the basketry, the distributional changes outlined above may reflect changing preferences for activity or disposal areas in the site through time but, unfortunately, little else. With the exception of several minority cordage types found only in square B3 at the mouth of the rockshelter, there is no strong correlation between specific cordage types and cultural features or areas within the site. With the exception of the Salix sp. "concentration" noted above, there is also no correlation between raw material types and specific cultural features or intrasite loci.

CHRONOLOGY

Cordage Types I through IV are the earliest and most enduring of the major cordage varieties in the Dirty Shame Rockshelter cultural sequence. These types appear in Zone VI and persist (with a brief hiatus in the case of Types I and II) for the duration of Zone V through Zone I. Also represented in Zone VI are minority cordage Type VII and Type XII as well as several specimens of wrapped and unique cordage. The minority types may be intrusive into Zone VI (see External Correlations).

Two cordage types (VIII and XI) first appear in Zone V. Type VIII cordage does not recur in younger cultural zones, and Type XI extends only into Zone IV. Nine cordage varieties and two residual categories are represented in Zone IV. It is worth noting that three of these Zone IV varieties (Types V, VI, and IX) are not found in the younger cultural zones of the rockshelter deposits above Zone IV. These types are rare or unique occurrences, however, and it would be unwise to overinterpret this observation.

With the exception of a few examples of cordage Types VII and X in Zone III, this level and Zones I and II are dominated by cordage Types I-IV. Perhaps significantly, the frequencies of Types III and IV approach parity only in Zones I and II (see ETHNOGRAPHIC CONTINUITIES and OVERVIEW).

The chronology of the knot types at Dirty Shame Rockshelter is relatively simple. As shown in Table 8, overhand knots and permutations are represented in all zones where knotted specimens are preserved. Square knots, alone or in combination, are likewise represented virtually throughout the sequence with the exception of Zones II and V. Although the restriction of lark's head knots to Zones I and IV and weaver's knots to Zones I and III may be significant, the sample size for these knot types as well as all other minority knot types is simply too small to warrant generalization. No definite trends are apparent in the number or frequencies of various knot types in the Dirty Shame Rockshelter cordage. Five examples of overhand and square knots or knot combinations come from Zone VI, and three of these same knots or knot combinations are still represented in the youngest site deposits in Zone I. No knotted cordage specimens were identified in
Zone V, but the greatest number of knotted specimens (28) and the greatest number of knot types or combinations of types (10) is found in Zone IV. Zone III knotted cordage shows a marked decrease in the number of specimens over Zone IV (18), and only six knot types or knot combinations are represented. Only the single overhand and square knot types are common to both Zone III and Zone IV knotted cordage. Zone II times at Dirty Shame Rockshelter are represented by only four knotted cordage specimens of four types, a marked decrease over the proliferation of knot types and knot combinations that characterized Zone IV times. The half hitch and the truncated granny knot types on cordage are found only in Zone II. Knotted cordage specimens again become more numerous (15) in Zone I, and seven knot types or knot combinations are represented. Four of the latter are common to both Zone I and Zone IV, but only the single overhand knot type is common to Zones I through IV as well as to Zone VI. This is followed by the square knot, which is represented in Zones I, III, IV and VI. Thus, the single overhand is the sole knot type of the 23 identified knots and knot combinations that occur virtually throughout the cultural sequence at Dirty Shame Rockshelter (with the exception of Zone VI). As noted earlier, it is also the single most numerous knot type (42 or 37.5% of all knots and knot combinations). This is followed by the square knot and its combinations with 18 occurrences (14.7% of all knots and knot combinations) and at a distance by the lark's head knot with nine examples (12.3% of all knots and knot combinations). Collectively, these three knot types and their combinations account for 94.5% of all knots in the cordage sample from the site.

External Correlations

The 844 cordage specimens from Dirty Shame Rockshelter represent the largest such assemblage published for the Northern Great Basin. Comparisons of these materials to cordage from other Great Basin sites are desirable but are hampered by a lack of adequately described and dated material from other sites. This drawback notwithstanding, some selected observations on the technological and potential cultural affinities of the Dirty Shame Rockshelter cordage to other cordage assemblages from the same and adjacent areas are offered below.

THE NORTHERN BASIN CENTER

Cordage apparently was recovered from most if not all the basketry-bearing sites cited earlier in this monograph (see BASKETRY), but descriptions of cordage assemblages are either incomplete, misleading, or simply excluded. According to Cressman (1942:77), all of the cordage from Fort Rock Cave, Roaring Springs Cave, Cutlow Cave No. 1, and Paisley Five Mile Point Caves 1 and 2 is two ply, Z spun, S twist (Type IV) or single ply, Z twist (Type II). Cressman (1942: Figure 92, I) illustrates but does not discuss a Type III (two ply, S spun, Z twist) cordage specimen from Roaring Springs Cave. This clearly indicates that at least one type of undescibed cordage is present at Roaring Springs Cave, but there is no information on other types that may have been recovered at this or other Northern Basin Center rockshelter and cave sites. Later reports by Cressman and Bedwell (1968) and Bedwell (1973) add little to clarify the range of cordage types recovered from these sites.

Cressman and Bedwell (1968:8) list 29 cordage specimens from Seven Mile Ridge but give no descriptive data. Heizer (1942:122) indicates that three-ply cordage was recovered from Massacre Lake Cave but does not indicate the direction of its spin/twist. Two-ply cordage, again of unspecified spin/twist, is also reported by Heizer (1942:124) for Tule Lake Cave No. 1; however Heizer (1942:125) does indicate that cordage of two ply, S twist (and presumably Z spin) type is present in Tule Lake Cave No. 2. As far as is known, no published data are available on cordage from any other basketry-bearing sites in the Northern Basin Center.

Given the general absence of cordage data it is not surprising that discussions of other aspects of cordage technology in the Northern Great Basin are equally scarce. Cressman (1942:77) indicates that "rope" and "string" were abundant at sites he tested or excavated but also notes that his figures are "skewed" because during the latter stages of excavation at most sites, cordage was not retained. It is not known if such decisions made during excavation can account for the apparent lack of diversity in cordage types or the equally apparent scarcity of cordage in the western caves of the Fort Rock Basin. Artemisia sp. is the only raw material Cressman (1942) lists for cordage. Knot types are not identified. Technological and intrasite distribution data for virtually all other cordage-bearing sites is equally slim. The inevitable conclusion is that this diagnostic artifact category more often than not has simply been ignored or dismissed in the course of many excavations.

Chronological data on cordage from Northern Basin Center sites are even more meager than descriptive data. It is uncertain what if any kind of cordage was recovered beneath the Fort Rock pavime, but it appears that cordage from virtually all other closed sites with a Mazama pavement layer is restricted to units above the pavement. The chronology of cordage from sites lacking the convenient Mazama time marker must be reckoned with correlation with the associated basketry; therefore, it is not possible to specify what cordage types occur in any given chronological/cultural period.

Cordage Technology and Chronology in the Northern Basin Center

It is impossible to specify which cordage-making techniques (if any) are "typical" of the Northern Basin Center, or what types occur at particular sites. Uniformity may have characterized cordage making in this area (just as it does basketry production), but the available data are simply too few and imprecise to pursue this question. One must be reluctant therefore to propose any chronology or sequence for cordage making in this area. Nevertheless, on the basis of the data from Dirty Shame Rockshelter and the limited information available from other sites, the following general development schema is advanced.

If Cressman's (1942) data are taken at face value, the cordage industries in the western portion of the Northern Basin Center were exceedingly conservative. Cordage making was established by 9000 B.C. at the very latest and apparently involved the production of at least two types of cordage—two ply, Z spun, S twist (Type IV) and single ply, Z twist (Type II). These types thereafter dominated the Fort Rock Basin until the historic period.
In the Dirty Shame Rockshelter area, at least four types of cordage were being made by 7500 B.C., but the industry was dominated by the exact reverse of the techniques noted for the western sites. Two ply, 5 spun, Z twist (Type III) and single ply, 5 twist (Type I) were the favored construction media from the earliest period to the end of the aboriginal sequence. A greater variety of types is apparently able to be documented in the eastern part of the Northern Basin Center, especially after 5000 B.C., but the cordage industry in this area was fundamentally as conservative as its contemporaries to the west. It seems most unlikely, but it appears that the eastern and western sectors of the Northern Basin Center shared the same basic basketry tradition but developed individual cordage traditions. The origins of both traditions are probably the same, but the regional specializations were fully developed by 7500 B.C. and thereafter persisted relatively unchanged, though with one notable exception discussed below (see ETHNOGRAPHIC CONTINUITIES).

THE WESTERN BASIN CENTER

Despite the extensive data available on basketry from more than 30 sites in the Western Basin Center, comparable data on cordage are rare. Cordage assemblages from very early sites, such as Fishbone Cave (ler 1956, 1976) and Falcon Hill (Rolazier 1961), are barely mentioned in various "interim" reports. The cordage from most later sites, such as Leonard Rockshelter (Heizer 1935) and Humboldt Cave (Heizer and Krieger 1956), is treated only in a cursory fashion. Better data are available on cordage from Lovelock Cave (Loud and Harrington 1929), but the dating of much of it is imprecise. This huge collection is therefore of limited comparative value. Information on knot types from all of these sites except Lovelock Cave is practically nonexistent.

Cordage making in the Western Basin Center is fully as old as it is in both the northern and eastern sectors and seems to include at least some of the same techniques. Cordage in Level 4 at Fishbone Cave, dated between 9265 ± 250 B.C. and 8755 ± 350 B.C., is of the two ply, 5 spun, Z twist type (Type III), and other sites (e.g., Cowbone, Stick, Crypt, and Guano Caves) in the Winnemucca Lake area reflect the persistence of this cordage type through the 6th century A.D. Identification and dating of other cordage types from this area are hampered by a lack of adequate published data. The cordage specimen figured by Heizer (1951) from the Lovelock culture level at Leonard Rockshelter appears to be two ply, 5 spun, Z twist (Type III), but the earlier "Leonard Culture" specimens were apparently produced by the reverse technique (two ply, Z spun, S twist, Type IV). Any earlier cordage materials from the site are not discussed.

The apparently substantial cordage assemblage from Humboldt Cave, most of which is post-A.D. 1 in age, is not described beyond indicating that its "...nature and variety is analogous to Lovelock Cave" (Heizer and Krieger 1956: 62). Similarly, no cordage data have been published from any of the Falcon Hill rockshelters (Hattori 1942).

As the enormous Lovelock Cave cordage sample is, by default, the best described assemblage of its kind in the Western Basin Center, it deserves further discussion. Eight hundred thirty-two pieces of "coarse rope" (mean diameter 3 mm-40 mm) and 1,973 pieces of "fine twine" (mean diameter 0.4 mm-7 mm) were recovered during Loud and Harrington's excavations at this site. Most (86.6%) of the "coarse rope," predominantly Scirpus sp. or Juncus sp., has a final Z twist only 13.2% is terminally S twisted. Most (93.3%) of the "fine twine," however, has a final S twist only a small percentage (6.7%) is Z twisted.

Within these gross categories, a number of types similar in construction to those from Dirty Shame Rockshelter can be distinguished. The "coarse" category includes two ply, 5 spun, Z twist (Type III); three ply, 5 spun, Z twist (Type VI); and two ply, Z spun, S twist (Type IV) as well as several types not represented at Dirty Shame Rockshelter. These include four ply, 5 spun, Z twist (Type V) and compound, two ply, Z spun, S twist (Type VI). Of these, the most common types are two ply variants with a final Z twist.

The Lovelock Cave or string category, which is made from Apocynum sp. and perhaps Linum sp. and/or Urtica sp., includes five basic types: two ply, Z spun, S twist (Type I); two ply, S spun, Z twist (Type II); three ply, S spun, Z twist (Type III); three ply, 5 spun, Z twist (Type IV); and four ply, Z spun, S twist (Type V). The two ply, final S twist variant is by far the most common. Lovelock Cave also yielded wrapped cordage with a two ply, Z spun, S twist (Type IV) cordage core and a left to right, single ply, Z spun (Type I) wrap as well as seven types of braid, generally of Juncus sp., Scirpus sp., or Opuntia sp. The braids include three, four, five, six, seven, 16, and 18 plies. Over 80% of the braid is of three ply construction and is made of Juncus sp.

Fortunately for our knowledge of Western Great Basin knotting techniques, Lovelock Cave produced 604 knotted specimens with a minimum of six knot types represented. Fishnet knots, which dominate the extensive Lovelock Cave netting inventory, are the most frequently observed knot type followed by overhand, clove hitches of two permutations, granny, slip, and reef knots. Other knot types exist but are not identified.

With less than complete stratigraphic control at Lovelock Cave and the near absence of cordage data from other Western Basin Center sites, it is no more possible to discuss cordage developments over time here than it is for the Northern Basin Center. From the available evidence, the earliest and most enduring cordage types were two- or three-ply variants with a final Z twist. These types were the standard until ca. A.D. 300 when similar types but with a final S twist were numerically dominant. This pattern is similar to that at Dirty Shame Rockshelter. The potential cultural significance of this observation is treated elsewhere in this monograph (see OVERVIEW).
THE EASTERN BASIN CENTER

In distinction to other sectors of the Great Basin, cordage data from the Eastern Basin Center are extensive and detailed. As noted earlier in this chapter, the excavations at Danger Cave produced the oldest cordage specimens now known in the world (Jennings 1957: 227-230). Level D 1 at that site contained cordage of Type II (single ply, S twist) construction, a fragment of Type IV (two ply, Z spin, S twist) lacks head knotted cordage netting, and a length of untwisted fiber that could be construction material. All three specimens date between 9201 ± 570 B.C. and 3320 ± 650 B.C. The raw material is not specified but at least in the case of the Level D 1 netting fragment appears to be Apocynum sp. or Linum sp.

The later levels at Danger Cave (D II-D V), which span most of the Holocene from ca. 8300 B.C. to ca. A.D. 1, produced 582 provenanced cordage specimens and 52 specimens whose provenance is unknown. Nearby Jukebox Cave yielded an additional 74 cordage specimens from Level J III, of uncertain absolute age but Archaic cultural attribution. The Danger Cave assemblage contains a minimum of eight cordage types, six of which have analogues to Dirty Shame Rockshelter: single ply, Z twist (Type II); single ply, S twist (Type IV); two ply, S spin, Z twist (Type III); two ply, Z spin, S twist (Type IV); three ply, S spin, Z twist (Type V); three ply, Z spin, S twist (Type VII); and two varieties of four-ply cordage types, one each with a final S and Z twist. The last two may be analogous to Dirty Shame Rockshelter Types X and XI. Jukebox Cave produced only three cordage types including Types I, III, and IV as described above for Dirty Shame Rockshelter (see Table 6).

The Danger Cave cordage is dominated by two types: two ply, S spin, Z twist (Type III) and its reverse, two ply, Z spin, S twist (Type IV), from at least the beginning of Level D II times through the end of Level D V. Both types show percentage parity except in Level D III where the final Z twist variety is three times as common as its S twist counterpart. Jennings (1957: 227-230) has observed for the Danger Cave cordage that:

There was a rather wide range of preferred vegetable fibers used in manufacture. . . . There were also differences in raw material by level. This assumption, of course, that our random sample of string for identification is adequate; some 330 pieces, about 1/3 of the string studied, appear on the list of identifications. . . . The total, for example, does not include any of the cordage recovered during the 1953 excavation season. In level D III the preferred material was Apocynum (hemp) with Juniperus or cedar and Linum or flax respectively. Likely next in popularity, during Level D IV times Artemisia tridentata or common sage brush bark was used almost exclusively. During level D V times the Artemisia (common sage) remained popular but Asclepias (milkwort) and Scirpus americanus (bulrush) were heavily used. So far as our sample identifications go, Apocynum (hemp) was not used after level D III times, Juniperus (cedar) sparingly and Linum (flax) only once. The sample reveals no Artemisia (common sage) used before level D IV times.

In addition to the 6 species listed above, Salix exigua or sandbar willow, Cowania stenobriaria or cliff rose, Linum lewisii or flax and Stipa or needle grass are also used, but their use is infrequent and is confined to periods D IV and D V.

Jennings (1957: 229) also noted that 'several hundred' knots were identified on Danger Cave cordage specimens including examples of 11 different types (overhand, girth hitch, square, granny, single sheet bend, slip knot, half hitch, clove hitch, overhand with double loops, double half hitch, and lark’s head). Jennings (1957: 229) states:

... level D V yields the greater variety, as was true in the matter of preferred fibers. The overhand knot occurred on all levels. The square and granny knots are represented on the upper four levels. The slip knot occurs on levels D II and D IV, the clove hitch on D II and D V, and the half hitch on levels D II and D V. The girth hitch is seen on levels D I and D V.

Some 50 km (50 mi) northeast of Danger Cave, Atkens (1970: 121-127) recovered 1,242 pieces of cordage from Hogup Cave, a deeply stratified locality spanning some 8,650 years of intermittent seasonal utilization (ca. 6800 B.C.-A.D. 1850). All the single-ply and two-ply cordage types from Danger Cave are also present at Hogup Cave. Only 21 three-ply cords with unspecified final twist are represented. Four-ply cordage types occur. Twelve specimens of braided three-ply cordage were also recovered as well as a variety of simple cordage constructions.

As at Danger Cave, the two-ply cordage variants with final S or Z twist are the most common elements in the Hogup Cave cordage inventory throughout its long cultural sequence. Atkens (1970: 121, 129) indicates that:

Tabulation of the cordage collection by direction of twist shows 575 pieces of S-twist, and 667 pieces of Z-twist. Both types persist throughout the stratigraphic sequence, but their relative percentages of occurrence in successive strata differ markedly. Cordage with a Z-twist preponderates slightly over that with S-twist in strata I through 8, but above Stratum 8 there is a spectacular rise in the percentage of S-twist cordage over Z-twist.

There is another "reversal" of twist patterns between Strata 14 and 15 which despite a small sample size seems to show a return to a predominantly Z final twist pattern. The possible significance of these frequency changes is discussed below. Unfortunately, knot types are not specified for the Hogup Cave cordage assemblage. Analysis of cordage raw materials from Hogup Cave (Atkens 1970: 127) indicates that:

The plant most frequently utilized is Asclepias, used in 582 pieces of cordage. Next in frequency is Apocynum, with 338 pieces, followed by Artemisia with 188, Juniperus with 36, and Cowania with 18.

In the stratigraphic frequency distribution shows that these plants maintain similar relative frequencies throughout each of the 16 strata of the site. Asclepias and Apocynum are the materials of major importance throughout. Artemisia maintains a low frequency, but is consistent in occurrence. Juniperus and Cowania are only sporadically present in small quantities. 

Fibrous stalks of Asclepias and Apocynum yield the materials used in making cordage, and the finest cordage is made from these materials. Artemisia and Juniperus are woody plants which yield coarse fibers from their leaves, woody bark, and the cordage made from them is correspondingly coarse and characterized much greater in diameter than that made of Asclepias and Apocynum.
Several other sites on the borders of the Eastern Basin Center have yielded either very ancient examples of cordage or long sequences of cordage manufacture. These include Cowboy Cave in southeastern Utah (Jennings 1980), Sand Dune, and Dust Devil caves north and east of Navajo Mountain, Utah (Lindsay, Ambler, Stein, and Hobler 1969). 

Cowboy Cave spans nearly 8,800 years of intermittent occupation beginning ca. 7000 B.C. and ending ca. A.D. 500. Within the sequence are four major occupational “episodes” of ca. 400-1,000 years duration separated by long hiatuses ranging from ca. 900 to ca. 2,600 radiocarbon years. The four cultural zones produced 483 pieces of cordage and a limited number of cordage constructions. Both Z and S final twist types are represented in nearly equal quantities and persist throughout the sequence. Z twist is predominant early in the sequence (ca. 7000-4300 B.C.), and S twist examples are slightly more numerous later in the sequence. Other minority cordage types include single ply of unspecified size, two ply, 5 spin, Z twist (labeled "harbor" by Hewitt 1980: 66), and six compound specimens. The compound types include compound, two ply, Z spin, Z twist (X Z Y Z) and compound two ply, S spin, Z twist (X Z Y Z).

The older materials from Cowboy Cave are ascribable to the so-called Desha complex. This appears to be locally ancestral to Basketmaker II and was defined at two sites (Sand Dune Cave and Dust Devil Cave) discussed below. Adjacent to Cowboy Cave is Walsers Cave with a single radiocarbon date of 6525 B.C. It yielded 180 specimens of cordage including only Dirty Shame Rockshelter types III and IV as well as single-ply cordage of unspecified twist.

At both Cowboy and Walsers caves, Apocynum sp./Asclepias sp. were generally used to make small-diameter cordage. Yucca sp. grasses or bark were ordinarily used for “coarser” cordage. According to Hewitt (1980: 66-67):

Six varieties of knots are recognized in the cordage from Cowboy Cave. The occurrence of each type is apparently related to its specific intended purpose. The sheetend was the most desirable knot for netting, though less popular for this purpose. When joining two cords together, which was a common practice, a square knot was best. Granny knots were also used for joining purposes. Many overhand knots in the ends of cords probably prevented the fibers from unraveling ... the sheetend is the most common knot, the overhand second, and the square knot third.

Two closed sites excavated in connection with the Glen Canyon project produced very ancient cordage inventories. These are Sand Dune Cave, at the base of the southeast side of Navajo Mountain, and Dust Devil Cave, also northeast of Navajo Mountain, Utah (Lindsay, Ambler, Stein, and Hobler 1969). The upper levels at both sites have perishables with distinctly southwestern affinities, but the deepest units at both sites have perishables with unmistakable Great Basin connections. These materials, which constitute the “type” Desha complex collections, include two Type IV cordage specimens (two ply, Z spin, S twist) from the unrelieved Desha level at Sand Dune Cave and one specimen each of Type II (single ply, S twist) and Type III (two ply, S spin, Z twist) from the “pure” Desha level at Dust Devil Cave (Lindsay, Ambler, Stein, and Hobler 1969: 81, 117). These items, apparently made of Yucca sp. fibers, are dated at ca. 6000-5000 B.C. Knot types represented in the Desha levels include square, overhand, granny, and single bow. The mixed Desha/Baskemaker II levels at both sites produced considerably more knotted and unknotted cordage, but discussion of these collections is outside the scope of the present comparison. It is necessary to note that many of the cordage types found in the Desha-affiliated levels of Cowboy Cave also occur at the type localities of this “proto-Basketmaker” manifestation.

A relatively large number of other eastern Basin Center sites or sites in contiguous areas with pronounced eastern Great Basin affinities have produced cordage inventories that are generally well-described. In contrast to most of the sites just discussed, however, most of these localities have small collections of limited time range. These include most of the Fremont or Fremont-related basketry-bearing sites discussed by Adeus (1975a, 1979b) as well as several sites with somewhat earlier materials (e.g., Swallow Shelter, Utah Dalley 1976). In most cases, however, the cordage assemblages post-date A.D. 1 and seldom number more than 50 specimens. These collections are dominated by cordage types of two plies. Final Z and final S twist variants are found. Interestingly, in sites with unambiguous stratigraphic associations of perishables it appears that Fremont populations employed cordage with a final S twist while their Numic-speaking "successors" in the area may have employed the reverse final twist (e.g., Hogup Cave, and the Fremont caves; see ETHNOGRAPHIC CONTINUITIES.

The large number of stratified cordage-bearing sites in and near the Eastern Basin Center and the abundant number of available radiocarbon dates (a contrast to the other major centers) permits a more refined summary of cordage developments. Danger Cave Levels D I and D II (ca. 9200-8600 B.C.) demonstrate that cordage was being produced in the Eastern Basin Center by the end of the Pleistocene or the very beginning of the Holocene. The data suggest that two-ply cordage types are present from the outset with final S and final Z twist cordage in evidence. Thereafter, other cordage types appear, but none of them ever achieve the relative popularity of the two-ply cordage variants. Cordage with a final Z twist dominated some areas for long periods whereas the reverse technique was more frequent at other places. Two major shifts can be noted. These include the "swamping" of Z twist cords by S twist cordage after ca. 1200 B.C. at Hogup Cave and the apparent return to Z twist very late in the Eastern Basin Center sequence. It is difficult to date precisely, but this later reversal (sometime after ca. A.D. 1200-1300) may be synchronous with the disappearance of the Fremont and the arrival of Numic-speaking populations in this region.

In sum, there appear to be few similarities between the cordage industries of the Eastern and Northern Basin Centers except perhaps until near the end of the aboriginal cultural sequence in both. The same cordage types are in evidence throughout most of the Holocene occupation record in both areas, but the frequencies of types differ. The dramatic shifts seen in Hogup Cave after Stratum VIII times have no counterpart at Dirty Shame Rockshelter, nor do the cordage frequency changes in evidence earlier in Danger Cave Level D III have their counterparts. The shifts in cordage frequencies in both areas, however, may be due to the same causal mechanisms this subject is taken up below.
ETHNOGRAPHIC CONTINUITIES
(with R. D. Drennan)

By utilizing the same sources employed in the discussion of basketry (see BASKETRY), it is possible to profile the cordage attributes of historic Numic-speaking tribes. Select cordage attributes of these groups and some of their non-
Numic-speaking neighbors are presented in Table II (below).

As Table II indicates, the cordage of historic period Numic-speaking groups is dominated by two ply, final 5 twist (presumably with 2 spin ply) nearly to the exclusion of the reverse technique. This type also prevails among populations in adjacent northeast California as well as in northern Nevada. Preferred raw materials include Aconitum sp. followed by Artemisia sp. and Serapias sp. with overhand, square, weaver’s, and bowline knots documented.

Before discussing the possible cultural affinities of the later Dirty Shame Rockshelter cordage, several points about cordage making should be made. First, it is clear that final twist direction in cordage, though controlled by very simple physical manipulations, is normally a very standardized, population-specific attribute, much like weft (stitch) slant in twined fabrics (see Wettish 1932; Adovasio 1977, 1979, 1983; Adovasio and Carlisle 1982; Andrews and Adovasio 1986; Adovasio and Fry 1970; Peterson and Hamilton 1984).

"Population" in this sense explicitly equates with an ethnic group in the sense that Pima or Paiute, Karok or Kwakiutl, Cheyenne or Shoshone are ethnic groups. While several linguistically related or unrelated groups may share the same stitch slant (as well as other aspects of production), rarely if ever does any one group regularly employ both of them even if some individuals may opt to use a non-customary pattern. Put another way, although a minor amount of idiosyncratic variation in twisting weft manipulation preference may exist within a given population of weavers, rarely if ever will any group systematically exploit both possible stitch slants. Twining stitch slant (like work direction in the production of coiled baskets as well as initial spin or final twist in cordage manufacture) is not dependent on handedness. The preponderance of one or another twist direction or its apparent coexistence in some numbers cannot be explained on the basis of idiosyncratic terms alone. Indeed, there are virtually no ethnographic parallels for the coexistence of both twisting twist directions in the same residence unit unless two different populations of weavers have been amalgamated, peacefully or otherwise (Adovasio and Carlisle 1982: 848).

The archaeological examples cited above and virtually the entire ethnographic record on the subject provide, as noted by Peterson and Hamilton (1984: 433):

... documentation of the distinctive patterning which characterizes technological learning networks, with preferred twist or weft slant ranging from 70-80% and often exceeding 90% in large samples of fiber perishables. Whether derived from the archaeological or ethnographic record, one or the other of the binary attribute states (S or Z) typically dominates a site-specific or regionally derived sample ... The important point here is that once a population adopts a particular cordage twist or wefted twist, they rarely if ever change it.

Given this background, the Dirty Shame Rockshelter cordage industry (except for the inadequate Zone V collection) was statistically examined level-by-level for final twist frequencies of the two dominant cordage types. This study calculated chi-square values for cordage Types III and IV and showed that the differences between Zones IV and VI are not significant (chi-square = 1.391, p > 0.2). Differences between Zones I and IV (chi-square = 0.638, p > 0.3) are also not significant. There are, however, significant differences between Zones II and III (chi-square = 6.084, p < 0.05) in the proportion of cordage Types III and IV. The difference between Zones I and II is again insignificant (chi-square = 0.849, p > 0.7).

If the cordage frequencies in Zones I, III, IV, and VI are jumped and compared to those from Zones I and II, the chi-square value is 24,863 (p < 0.001). This indicates that these two samples have less than one chance in 1,000 of deriving from the same artifactual, or, by extension, human population. This relationship between the stratigraphic zones is illustrated by the scale in Figure 76. The scale was produced by measuring the similarity of each zone to each other zone (omitting Zone V because of its very small sample) with respect to the percentages of Type III and Type IV cordage. The measure of similarity used was the Brainerd-Robinson coefficient. The matrix of similarities was then scaled metrically, beginning with Zone I, and positioning each other zone in relation to Zone I according to the average of its distances from all points already positioned. The sharpness of the break between Zones III and II is quite apparent. The same sort of analysis was conducted again, including all cordage types instead of just Types III and IV. The resulting scale is illustrated in Figure 77. Zones III, IV, and VI again are quite similar in regard to proportions of cordage types, and there is a wide gap between Zone III and Zone II as before. In contrast to the scale based just on Types III and IV, however, this one shows a wide difference between Zones II and I. Both analyses, then, reveal patterns of extremely close relationships between the cordage assemblages in the lower zones, but show a major change between Zone III and Zone II. The entire cordage assemblage also changes strongly between Zone II and Zone I, but this is not reflected in the proportions of Type III and Type IV cordage. Given the likelihood that at least the coiled basketry of Zone I signals the advent of northern Numic-speaking groups to the study area, it is possible that their arrival can be "pushed back" somewhat into Zone II times on the basis of the "cordage discontinuity." This discontinuity in site occupation is strongly supported by the statistical analyses of the lithics reported by Hanes (1977) and by the excavation interpretation in general (see INTRODUCTION). Although the "cordage discontinuity" discerned between Zones II and III might conceivably be attributed to some other group in the study area, it is probably not coincidental that the only Numic speakers to make both final S and Z twist varieties of cordage were the Northern Paiute.
Summary

In retrospect, the salient features of the Dirty Shame Rockshelter cordage industry are these:

1. Technically sophisticated string and/or rope was produced in this portion of the Northern Great Basin from as early as the 9th millennium B.C.

2. The Dirty Shame Rockshelter cordage cannot be adequately compared to that from any other site in the Northern Basin Center, principally due to a lack of comparable descriptive data from other sites.

3. The Dirty Shame Rockshelter cordage inventory cannot be used in isolation to postulate a sequence for cordage making in the Northern Basin Center, nor do the limited data from other Northern Great Basin sites presently permit the advancement of such a sequence.

4. The Dirty Shame Rockshelter cordage industry appears on the basis of extant information to differ in some particulars from the "industries" represented in the Fort Rock Basin area and may constitute a localized tradition in cordage making not paralleled at other Northern Basin Center sites.

5. The cordage inventory from Dirty Shame Rockshelter reflects an essentially conservative approach to cordage making with no culturally significant changes evident until the termination of Zone III times, ca. A.D. 500 or slightly later.

6. The change in composition of the cordage assemblage in Zones I and II compared to that in Zones III, IV, and VI supports conclusions arising from examination of the basketry (see BASKETRY) and suggests that the advent of northern Numic-speaking populations to the area had specific technological as well as cultural consequences.
Figure 43. TYPE II: SINGLE PLY, Z TWIST cordage from Dirty Shame Rockshelter.

Figure 44. TYPE II: SINGLE PLY, Z TWIST cordage from Dirty Shame Rockshelter.
Figure 45. TYPE I: SINGLE PLY, Z TWIST cordage from Dirty Shame Rockshelter.

Figure 46. TYPE II: SINGLE PLY, S TWIST cordage from Dirty Shame Rockshelter.
Figure 47. TYPE II: SINGLE PLY, 5 TWIST cordage from Dirty Shame Rockshelter.

Figure 48. TYPE III: SINGLE PLY, 5 TWIST cordage from Dirty Shame Rockshelter.
Figure 49. TYPE III: TWO PLY, 5 SPUN, Z TWIST cordage from Dirty Shame Rockshelter. NOTE: In this specimen, a single strand of 5 spun material was folded at a 180° angle and Z twisted with itself producing the functional equivalent of two separate plies.

Figure 50. TYPE III: TWO PLY, 5 SPUN, Z TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits an overhand knot on one end and a whipping knot on the opposite end. The end with the whipping knot is also rat-tailed.
Figure 51. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter.

Figure 52. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen is crepe-twisted.
Figure 53. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter.

Figure 54. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter.
Figure 55. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen is rat-tailed.

Figure 56. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame rockshelter. NOTE: The specimen is rat-tailed.
Figure 37. TYPE III: TWO PLY, 5 SPUN, 2 TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen is rattailed.

Figure 38. TYPE III: TWO PLY, 5 SPUN, 2 TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen at right is stained, possibly with red ochre.
Figure 59. TYPE III: TWO PLY, S SPUN, Z TWIST cordage from Dirty Shame Rockshelter. NOTE: In the specimen, a single strand of S spun material was folded at a 180° angle and Z twisted with itself. The specimen has been untwisted to facilitate photography.

Figure 60. TYPE IV: TWO PLY, Z SPUN, S TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits an overhand knot.
Figure 61. TYPE IV: TWO PLY, Z SPUN, 5 TWIST cordage from Dirty Shame Rockshelter.

Figure 62. TYPE IV: TWO PLY, Z SPUN, 5 TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits an overhand knot.
Figure 63. TYPE IV: TWO PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen is rat-tailed.

Figure 64. TYPE IV: TWO PLY, Z SPUN, S TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: In this specimen, five separate lengths of cordage are joined in a square knot.
Figure 55. TYPE IV: TWO PLY, Z SPUN, S TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits an overhand node.

Figure 56. TYPE V: TWO PLY, Z SPUN, Z TWIST cordage from Dirty Shame Rockshelter.
Figure 67. TYPE VII: THREE PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter.

Figure 68. TYPE VII: THREE PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter.
Figure 69. TYPE VII: THREE PLY, Z SPUN, S TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits an overhand knot.

Figure 70. TYPE VIII: COMPOUND, TWO PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter.
Figure 71. TYPE X: COMPOUND, TWO PLY, Z SPUN, S TWIST knotted cordage from Dirty Shame Rockshelter. NOTE: In this specimen a length of TYPE X cordage engages a length of TYPE III cordage in a square knot.

Figure 72. TYPE X: COMPOUND, TWO PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter. NOTE: The specimen exhibits a pseudo-whipping knot.
Figure 73. TYPE XI: COMPOUND, TWO PLY, Z SPUN, Z TWIST cordage from Dirty Shame Rockshelter.

Figure 74. TYPE XII: TWO PLY, Z AND S SPUN, Z TWIST cordage from Dirty Shame Rockshelter.
Figure 75. WRAPPED CORDAGE from Dirty Shame Rockshelter.

Figure 76. Positions of cultural zones along a scale of relative similarity based on proportions of TYPE III: TWO PLY, S SPUN, Z TWIST and TYPE IV: TWO PLY, Z SPUN, S TWIST cordage from Dirty Shame Rockshelter.
Figure 27. Positions of cultural zones along a scale of relative similarity based on proportions of all cordage types from Dirty Shame Rockshelter.
SANDALS

R. L. Andrews
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Introduction

All sandals from Dirty Shame Rockshelter are twined footwear. Following Cressman (1942), the term "sandal" is applied here to all twined footwear regardless of shape or configuration. The making of sandals is one of the older fiber-based technologies in the New World archaeological record with a documented antiquity extending to at least the 9th millennium B.C. In fact, sandals from the Northern and Western Basin Centers are presently the oldest examples of this industry now known (see External Correlations).

Analytical Procedures

When necessary, the Dirty Shame Rockshelter sandal specimens were cleaned using the same procedures specified for basketry (see BASKETRY) and cordage (see CORDAGE). Analysis was then undertaken by inspection, or if warranted, the specimens were examined under a variable power Bausch and Lomb stereoscopic scanner. In cases of technical complexity or obscurity of the construction techniques, specimens were partially and carefully disassembled to insure accurate recognition of the manufacturing techniques. All specimens were measured using Helios needle-nosed dial calipers, and all measurements were recorded in the metric system. Qualitative and quantitative data from the sandal analysis were then computerized and evaluated using the Statistical Package for the Social Sciences (SPSS). The results were then interpreted (see Internal Correlations) for technological, distributional, and chronological interpretations of the site and to assist in comparing and contrasting the Dirty Shame Rockshelter sandals with other archaeological and ethnographic sandal assemblages (see External Correlations).

Criteria of Classification

One hundred sixty-nine sandal soles and sandal fragments were recovered during the 1973 excavation of Dirty Shame Rockshelter (Table 12). The sandals are allocated to three structural types and to one residual category. The three major structural types are those initially defined by Cressman (1942) for the Northern Great Basin. They include the Fort Rock, Multiple Warp, and Spiral Welt sandal types. It was possible to divide the Fort Rock and Multiple Warp types into subtypes based upon consistent if often minor differences in the method by which the sandal sole was made. The descriptive terminology used to discuss the Dirty Shame Rockshelter sandals follows Cressman (1942) and Adovasio (1977). Knot terminology once again follows Shaw (1972). Angle of "spin" or twist was measured according to procedures specified by Emery (1966).

The Dirty Shame Rockshelter Sandal Industry

FORT ROCK SANDALS, TOE COVERS, AND BINDINGS

FORT ROCK SANDALS AND SANDAL COMPONENTS

No. of specimens: 30, fragmentary (Figures 78-99).

Types of specimens: Soles with toe covers and bindings, 6; soles with toe covers, 9; soles with bindings, 2; soles, 3; toe covers, 5.

No. of individual forms represented: 22 (minimum).

Technique and Comments: TheDirty Shame Rockshelter sandalsof this type exhibit the salient characteristics or attributes of Cressman's (1942: 57-58) Type I: Fort Rock sandals. The Fort Rock sandal is produced by plain twining over five "single" warps. There are no complete Fort Rock sandals from Dirty Shame Rockshelter, but whole specimens from other sites consist of three major parts: sole, toe cover, and binding (see Cressman 1942). Fort Rock sandals lack heel pockets and resemble slippers in their shape. No Fort Rock sandals from Dirty Shame Rockshelter are decorated.

Three Fort Rock sandal soles from Dirty Shame Rockshelter are complete. The fragmented soles include nine examples of toe with adjacent midsection, seven midsections, three toe portions, and one example each of a heel, a heel and midsection, and a midsection with adjacent portions of both toe and heel.

The Fort Rock sandal sole is roughly rectangular in shape. It is possible to distinguish right and left sandal on the basis of wear patterns (see below), but soles were not produced specifically for right and left feet. The Fort Rock sandal sole is uniform in its cross section, those from Dirty Shame Rockshelter are not thicker in the area of the ball of the foot, a characteristic that was noted by Cressman (1942: 57) among the Catlow Cave No. 1 specimens (see External Correlations). Sole width is relatively consistent, but the concave heel area is slightly narrower due to the mechanics of construction. There is an increase in sole width near the toe, but this is probably attributable to the spread of the fibers when the sandal was worn and to the gradual molding of the sandal to the shape of the foot during wear rather than to techniques of sandal construction.

The Dirty Shame Rockshelter Fort Rock sandals are constructed identically to those Cressman (1942: 57) describes for Catlow Cave No. 1 and for Fort Rock Cave itself. The sandal sole is constructed with exactly five warps created from three lengths of fiber. The longest fiber bundles are laid down in two concentric parabolas (see Figure 78). This creates four functional warp elements that form the long axis of the sole. The outer parabola is consistently larger in
<table>
<thead>
<tr>
<th>ZONE</th>
<th>DATE</th>
<th>Fort Rock</th>
<th>Multiple Warp</th>
<th>Spiral Weft</th>
<th>Untyped Sandal Fragments</th>
<th>PERCENT OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Weft Loop</td>
<td>Selvage Loop</td>
<td>Composite Loop</td>
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<td>--</td>
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<td>--</td>
<td>--</td>
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</tr>
<tr>
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<td>3</td>
<td>1.8</td>
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<tr>
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<td>III</td>
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<td>14</td>
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<td>2</td>
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</tr>
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<td>15</td>
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<td>--</td>
<td>2</td>
</tr>
<tr>
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</tr>
<tr>
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<td>22</td>
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<tr>
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<tr>
<td>750 B.C.</td>
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<td>11.8</td>
<td>9.5</td>
<td>1.2</td>
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</tbody>
</table>

* All sandals are made of Artemisia sp.
** Unattached toe covers.
*** Does not include untyped sandal binding fragment that may be from Fort Rock sandal.
diameter than the inner warps. This construction technique probably increased the durability of the sole. The third warp element is straight and is placed in the middle of the sole between the arms of the parabolas. The open end of this parabolic construction forms the toe of the sole. The number of warps preserved in each Fort Rock sandal specimen from Dirty Shame Rockshelter is listed in Table 13.

There is no apparent consistency in the direction of warp twist: untwisted, Z twisted, and S twisted examples are represented. The Z or S twisted parabolic warps may reflect the original spin given the fiber bundles, or the spin may have resulted from bending the bundles into the parabolic shape. A certain amount of warp spin may also come from the twining process itself.

Sole width is a function of individual warp and weft diameter. Sandal sole length varies directly with warp length. The required length of the sole warps was not excessive, so warp splicing was used only to increase the diameter or width of certain warps.

Fort Rock sandal soles always have two-ply wefts. Individual elements in each weft pair can be untwisted, Z twisted, or S twisted. Twining began at the heel or closed end of the parabolas and proceeded toward the open or toe end. The process was begun by folding a length of fiber around the outer warp and was continued by twining this element as a weft pair across each successive warp in the sole. The outer warp at the heel is not twined, however, and wearing the sandal causes this warp to rise slightly above the plane of the sole. This may have provided some slight support for the heel of the wearer. The absence of a heel pocket from the Fort Rock sandal is probably related to the constraints of using only five warps in the sole (cf., Multiple Warp sandals).

Fort Rock sandal weft rows are closely spaced and conceal the warps. The maximum number of weft rows represented in any single Dirty Shame Rockshelter specimen of this type is 18. This specimen is also the largest Fort Rock specimen in the assemblage. Side selvages are of the continuous weft with twist variety (see BASKETRY). Twining of the sole is not actually terminated but grades into the twining of the toe cover (Figure 79). No Dirty Shame Rockshelter Fort Rock sandal specimen has "grids" or the indentations produced by grids as were noted on the soles of the Fort Rock Cave sandals by Cressman (1942: 57-58). Also absent from the Dirty Shame Rockshelter specimens of this type is caulk used as a lining or repair technique on the sole. No children's or "toy" sandals are represented, and the assemblage contains no two sandals that can be identified as a set or pair.

Soles are of two subtypes identified on the basis of prevailing weft row stitch slant. Twenty-three Fort Rock sandal soles have Z twisted wefts (Subtype I). The footedness of 17 of the soles is not discernible. On the remaining eight soles, wear patterns suggest that five were worn on the right foot and three on the left. Fifteen Fort Rock sandal soles are constructed using untwisted warps; six warps are slightly Z twisted. Two soles contain warps with different twist directions. Each of these specimens has an outer and inner parabolic warp that have been Z and S twisted, respectively. The central warp in the first specimen is also S twisted but is untwisted in the second. Only one Fort Rock sandal sole exhibits a warp splice in which additional warp material has been folded in half and laid on a pre-existing warp to increase its width. Individual weft plies on two soles are slightly S twisted; those on the remaining specimens are untwisted. Weft length is usually increased by inserting new material beneath the exhausted ply. This type of splice occurs both at the side selvage and within the body of the sole. One specimen contains weft splices in which exhausted plies are joined to new material with an overhand knot.

Two Subtype I Fort Rock sandal soles have special attributes. In one specimen a shredded, compressed mass of Artemisia sp. measuring 12.5 cm in length, 8.0 cm in width, and 8 mm in thickness is positioned between the sole and toe cover. Cressman (1942: 57) recorded a similar arrangement of pine (Pinus sp.) needles inside one Fort Rock sandal from Catlow Cave No. 1. He proposed that this represented a lining or cushion, but the perforation of the sole beneath the pad in the specimen from Dirty Shame Rockshelter indicates that, at least in this instance, the fiber mass functioned as a temporary repair. The curved heel area of another Subtype I sole, including the outer and inner parabolic warps, is wrapped with Type III cordage (see CORDAGE). This was probably an attempt to reinforce or stabilize the exposed, untwined outer warp.

All of the Subtype I specimens are extensively worn on the bottom, sides, and ends of the sole. Five soles are completely worn through at the ball and/or heel. The remaining specimens have been fragmented through extreme attrition and post-depositional deterioration. Embedded in the sole bottoms is debris, probably from the floor of the rockshelter or its environs. Identified debris material includes whole and split, decorticated Salix sp. rods, macerated Apocynum sp. fibers, and coprolitic material. The margins of eight Subtype I specimens are slightly charred.

Subtype II Fort Rock sandals include two sole fragments with S twisted wefts. The footedness of these specimens is unknown. Warps in both soles are untwisted and apparently unspliced. Individual weft plies are untwisted. Weft splices insert new material beneath the exhausted weft. The specimens are worn to the point of fragmentation. One specimen is charred.

Measurements: Subtype I, Z twist weft.

| Range in length | 23.0-28.0 cm.                  | Range in interior warp diameter | 6.3-12.6 mm.                |
| Range in width  | 10.4-13.2 cm.                  | Mean interior warp diameter    | 9.4 mm.                     |
| Mean length     | 24.8 cm.                       | Range in warps per centimeter  | 0.5-1.5.                    |
| Mean width      | 12.1 cm.                       | Mean warps per centimeter      | 0.8.                        |
| Range in sole thickness | 1.2-1.9 cm.                  | Mean weft width                | 4.9-14.1 mm.                |
| Mean sole thickness | 1.6 cm.                      | Mean weft width                | 9.1 mm.                     |
| Range in outer warp diameter | 8.3-20.9 mm.                 | Range in weft rows per centimeter | 1.0-2.5.               |
| Mean outer warp diameter | 12.8 mm.                      | Mean weft rows per centimeter  | 1.2.                        |
|                |                                | Range and mean gap between weft rows | 0. |
### TABLE 13

Number of Preserved Sole Warps in Sandals at Dirty Shame Rockshelter by Sandal Type

<table>
<thead>
<tr>
<th>NUMBER OF PRESERVED SOLE WARPS PER SPECIMEN</th>
<th>Fort Rock</th>
<th>SANDAL TYPE</th>
<th>Spiral Warp</th>
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<td></td>
<td>Weft Loop</td>
<td>Selvage Loop</td>
<td>Composite Loop</td>
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<td>--</td>
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</tr>
<tr>
<td>3</td>
<td>5*</td>
<td>3*</td>
<td>--</td>
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<td>4</td>
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<td>1</td>
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</tr>
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<td>2</td>
<td>--</td>
</tr>
<tr>
<td>12</td>
<td>--</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
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<td>20</td>
<td>16</td>
</tr>
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</table>

PERCENT OF TOTAL

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<tr>
<th></th>
<th>Weft Loop</th>
<th>Selvage Loop</th>
<th>Composite Loop</th>
<th>Loop Type Unknown</th>
<th>TOTAL</th>
<th>PERCENT OF TOTAL</th>
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</thead>
<tbody>
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<td></td>
<td>20.3</td>
<td>16.3</td>
<td>13.0</td>
<td>0.6</td>
<td>13.8</td>
<td>35.8</td>
</tr>
</tbody>
</table>

*Entries marked with an asterisk indicate that the number of warps preserved in the sandal probably does not reflect the original complement.
SANDALS

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>17</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
</tbody>
</table>

Measurements: Subtype II, 5 twist weft.

- Range in mean length (complete soles): N.A.
- Range in mean width (complete soles): N.A.
- Range in sole thickness: 1.2-1.3 cm.
- Mean sole thickness: 1.25 cm.
- Range in outer warp diameter: 8.7-10.2 mm.
- Mean outer warp diameter: 9.9 mm.
- Range in interior warp diameter: 7.6-9.8 mm.
- Mean interior warp diameter: 8.7 mm.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
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<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>1</td>
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</table>

FORT ROCK SANDAL ATTACHED TOE COVERS

- No. of specimens: 15 (see Figures 79, 80, 80).
- Types of specimens: Toe covers attached to Subtype I Fort Rock sandals, 14; toe cover attached to Subtype II Fort Rock sandal, 1.
- No. of individual forms represented: 15.
- Technique and Comments: Fifteen Fort Rock sandals have attached toe covers or flaps. Two flaps are nearly complete, but 13 are fragmentary. Fourteen flaps are attached to Subtype I soles; one flap is on a Subtype II sole. The Fort Rock sandal flap emanates from the toe of the sole and is attached at both the medial and lateral sides of the sole. The flap extends approximately to the area of the tarso/metatarsal articulation of the foot. Maximum flap width is ca. 3-5 cm greater than the sole, perhaps to accommodate the shape of the foot and its arch.

The details of the flaps on the Dirty Shame Rockshelter specimens correspond to those provided by Cresman (1992) for sandals from Fort Rock Cave and Cottonwood No. 1. In fact, flap construction on the Dirty Shame Rockshelter Fort Rock sandals is identical to that of the Fort Rock Cave type specimen. Warps longer than the sole of the sandal were used. After the sandal sole had been twined, ca. 15-30 cm of untwined warp was left extending from the toe. Each of the five warps of the sole was then subdivided into two or three smaller, untwisted fiber bundles creating 14-17 flap warps. These warps were folded back on top of the sole. The number of warps was increased throughout the twining process by using various splicing techniques until a maximum of 23-28 warps were produced at the final weft crossing. The diameter of the flap warps within any given specimen and even among flaps of different specimens is remarkably consistent. This suggests idiosyncratic or group standardization of this attribute and perhaps functional necessity in a structure designed to optimize comfort, strength, and flexibility.

Flap width was controlled primarily by varying the number of warps. Flap warp splices include "V" splicing, "half-V" splicing, and insertion of new warps at pre-existing weft crossings. (See Adovasio 1977 for descriptions of all these techniques.) Another splicing technique, the "weft to warp" splice, is discussed below. The diameter and length of certain flap warps were increased by laying new warp material on top of the old warp. The end of the added material was occasionally bound under the weft. Flap warps extend untwined, as loose material, up to 3 cm beyond the final weft row. The warp ends on one flap appear to have been cut, creating a clipped end selvage, but the remaining specimens are unclipped. All flap wefts are two ply, Z twist.

The major portion of the flap is open twined, but the initial three to four weft rows are closed twined and conceal the warps. This area of close twining near the toe of the sole stabilizes the flap where warp division occurs, reinforces an area of heavy wear, and protects the foot of the wearer. The sole weft is continued into the flap and provides untwisted material for the first few flap weft rows. Side selvages of these initial wefts are of the continuous weft variety. Close twining in the flap is terminated by Z twisting the weft plies together and then using this element as an additional warp. A new weft course is initiated ca. 1 cm from the final close twined weft row. The two plies of this weft are created in the following manner: A group of untwisted fibers is inserted between the outer and adjacent parabolic sole warps. These fibers are then Z twisted together one time enclosing the exterior warp of the sole. Each free end of this element then forms a new weft ply. After completing one row of twining, the weft plies are again Z twisted together to form a single element. This element encircles the outer sole warp opposite its point of origin. The free end of the weft, which is now between the outer and adjacent parabolic warp, is drawn back onto the top of the sole parallel to the long axis where it is engaged as a warp by succeeding weft rows. All succeeding weft rows originate in this way, and all but the last weft course are terminated by becoming a warp for the next weft course. Fragmentation precludes an exact determination of how the final weft course was terminated. Most probably, the exhausted weft was knotted after encircling the outer sole warp.

It appears that it was in the flap construction stage that right and left sandals may have been determined. The number of sandal soles with both flaps and wear patterns indicative of which foot wore them are few, but these sandals consistently have flap wefts that originate on the medial side of the sole. This may have been a more stable method of attachment, or it may have been a construction (achieved by warp splicing) to allow the flap to expand to accommodate the expansion of the foot during walking. This technique of flap manufacture thus served five basic functions. First, it secured the flap to the sole and formed a protective covering for the sides of the foot. Second, it provided efficient and durable...
method for increasing the number of warps. Third, this technique accommodated the foot's arch by expanding the flap width relative to the shape of the foot. Fourth, the flap helped to keep the sandal on the foot. Finally, this type of "hinged" flap attachment to the sides of the sole allowed a degree of flexibility or "give" during walking. All of these considerations reflect more than a cursory knowledge of practical anatomy of the foot. Furthermore, they testify to the ability of the native artisan to adapt form to function by varying the techniques of manufacture.

The number of weft rows in the more nearly complete flaps ranges from six to 10. Logically, this attribute is a function of both flap length and weft row spacing. Flap weft splices are of four varieties, the most common of which involves the simple addition of new material beneath an exhausted weft ply. A variation of this is found on one specimen in which the new weft material was wrapped around the exhausted weft ply before being bound beneath the same weft ply. The "double weft" and overhand knot splice types occur less frequently.

Wear is usually apparent near the end selvage of the flap and at both sides where the flap may have become detached from the sole. Extreme attrition also occurs at the toe of the flap from the wearer treading not only on the sole but also on that part of the flap near its juncture with the sole. Five Fort Rock sandal soles from Dirty Shame Rockshelter retain only a small portion of the original flap. The clipped ends of these flaps may indicate that once a flap was heavily worn it was simply sheared off and the sandal worn without a toe cover. One perforated flap was mended by knotting the warps adjacent to the damaged area together with an overhand knot. Five specimens show slight charring.

**Measurements:**

| Range in length: | 19.0-22.6cm (complete sections). |
| Mean length: | 20.5 cm. |
| Range in width: | 13.3-18.0cm (complete sections). |
| Mean width: | 14.7 cm. |
| Range in warp diameter: | 3.5-7.3 mm. |
| Mean warp diameter: | 4.9 mm. |

| Range in warps per centimeters: | 1.0-3.0. |
| Mean warps per centimeter: | 1.9. |
| Range in weft width: | 2.3-6.7mm. |
| Mean weft width: | 3.8mm. |
| Range in close-twined weft rows per centimeters: | 1.0-2.5. |
| Mean close-twined weft rows per centimeters: | 1.6. |
| Range in gap between open-twined weft rows: | 0.6-3.5cm. |
| Mean gap between open-twined weft rows: | 1.7cm. |

**Proveniences:**

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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>10</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>5</td>
</tr>
</tbody>
</table>

**FORT ROCK SANDAL DETACHED TOE COVERS**

No. of specimens: 5.

**Type of specimens:** Probable toe covers from Fort Rock sandals, 5.

No. of individual forms represented: 5.

**Technique and Comments:** Five small, mat-like items were recovered from Dirty Shame Rockshelter that are possible portions of five Fort Rock sandal flaps. Although not directly associated with Fort Rock sandals when identified in the excavations, they conform in shape and construction technique to the flaps of this sandal type (see above). The specimens are incomplete in all dimensions but preserve five, seven, eight, nine, and 17 warps, respectively. Three flaps have warps that are slightly twisted; in the others the warps are untwisted. In one specimen, adjacent warps are "V" spliced; in another, non-adjacent warps exhibit "W" splicing. In the third flap, splicing is effected by inserting new warp material beneath the weft crossing. All specimens are open simple, Z twist twined. Wefts are paired, and plies are either unspun (three specimens) or slightly S spun (two specimens). All flaps have side selvages in which the warp units become weft plies (see above). No end selvages are preserved. The number of extant weft courses ranges from two to eight. Weft splicing is effected by inserting the new material at the warp crossing. One specimen from Zone VI is associated with a length of Type III cordage (see CORDAGE) which may represent a strap fragment. Another specimen is encrusted with coprolitic material and is associated with an unidentified bone fragment.

**Measurements:**

| Range in length: | 8.5-32.0 cm. |
| Mean length: | 18.9 cm. |
| Range in width: | 4.9-10.3 cm. |
| Mean width: | 6.6 cm. |
| Range in warp diameter: | 3.4-6.5 mm. |
| Mean warp diameter: | 4.9 mm. |
| Range in warps per centimeters: | 1.3-3.0. |
| Mean warps per centimeters: | 2.4. |

**Proveniences:**

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<th>Zone</th>
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<th>No. of specimens</th>
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</table>
No. of individual forms represented: 10.

Technique and Comments: Ten sandal binding remnants are attached to eight Subtype I Fort Rock sandals. Two sandals retain two ties each; the others retain one tie each. The bindings are not "strap" but are identical to Cressman's (1942: 57) "tie loops." They are lengths of cordage secured to the sandal sole that function as "eyes" or "guides" for lacing. These tie loops were probably fastened to the sandal after the sole and flap were made. The tight weave of the sole and flap almost certainly required an awl to introduce the binding element.

The Dirty Shame Rockshelter Fort Rock sandal tie loops are similar in construction and attachment to those described by Cressman (1942: 57) for Fort Rock Cave and Catlow Cave No. 1. As Cressman (1942) noted, there are two principal arrangements of these binding loops. In the first, one tie loop is affixed to the left lateral margin of the sole. In the second arrangement, an additional tie loop is secured to the medial side. The binding loops run from the toe to the heel of the sole parallel to the long axis of the sandal.

Seven Fort Rock sandals from Dirty Shame Rockshelter retain incomplete tie loops in which only one end remains fastened to the sole. At least two of these specimens are of the single lateral loop variety. One of the seven soles contains a tie loop on its medial margin. Presumably, this specimen originally had a loop on its lateral side and was of the double loop variety. Footedness among the remaining sole fragments is also undeterminable, as is the loop variety.

One complete sole has two binding loops. The ends of both loops are affixed to the sole. This specimen is also of the double tie loop variety and permits a reconstruction of the method of binding loop manufacture and attachment. A tie loop was first secured to the outer sole warp with a folded lark's head knot a minimum of four wefts courses from the toe. A length of spun fiber was folded 180° and twisted with itself creating an eye or opening at one end. The cordeage was then inserted between the outer and adjacent parabolic warp of the sandal sole, and its free end was drawn through the eye. The outer sole warp stabilizes the knot. The loose end of the cordeage was then reinserted between the exterior sole warps at least four wefts courses from the heel and was wrapped around the outer warp. Among the eight fragmented bindings, four have the folded lark's head knot binding at the toe. In the other four, the binding is simply wrapped around the outer warp at the heel. The two methods of attaching bindings to the sole appear to be relatively "standardized" and originate 6.5-8.0 cm from the toe and heel, respectively. Tie loop length is probably a function of sole length.

All incomplete or fragmented tie loops are made from Type III cordeage (see CORDAGE). The complete specimen is unique; it has one tie loop of Type III cordeage on the medial side of the sole and another tie loop of Type XI cordeage (see CORDAGE) on the lateral side. The latter is actually two tie loops that function as one. It is probably a mend executed when the original tie loop of Type III cordeage broke free from the heel. Another Type III cordeage element was folded 180° and twisted with itself producing a Type XI cordeage (see CORDAGE) mend that was secured to the outer warp adjacent to the broken tie loop. Ultimately, the binding was wrapped around the outer warp at the heel. The robust complexity of this ply was probably an intentional design to minimize the chance of fraying or breakage.

Two other sandal soles have mended tie loops. In one sandal that appears to have been worn on a right foot, two fragments of a lateral binding loop were rejoined with a square knot. This same tie loop also tore free from the outer sole warp at the toe. It was then affixed to a warp in the sandal toe cover with a square knot made in the two plies of the cordeage binding. This would have been a temporary mend at best. Another specimen probably had its binding replaced at the heel of the sole. The original, frayed cordeage is visible between the outer and adjacent parabolic sole warp, but a new element was wrapped around the adjacent warp. The binding was probably attached in this new location because the outer warp had disintegrated.

Cordage in the bindings was occasionally spliced by simply inserting new material between the plies. One sandal sole is associated with four unattached lengths of Type III cordeage (see CORDAGE), probably tie loop or strap fragments. One of these cordeage specimens apparently was mended using a square knot. Most sandal tie loops show wear and very often are nearly disintegrated from use. This may help to explain their low frequency of recovery at the site.

The Fort Rock sandals from Dirty Shame Rockshelter retain no intact tie strings or straps; thus, the reconstruction of the lacing technique that was used must remain conjectural. Similarities to the Fort Rock Cave and Catlow Cave No. 1 binding loops, however, suggest a parallel similarity in the lacing process. Cressman (1942: 57) proposed two lacing techniques that correspond to the two binding loop varieties. In the first technique, a separate length of cordeage was attached to the lateral tie loop, wrapped around the ankle, and then secured to the medial side of the sole. In the double loop variety, the strap was ultimately fastened to the tie loop on the medial side of the sole after encircling the ankle. Cressman (1942: Figure 91a) also indicates that a second strap bound the toe area. It ran either from one tie loop to the other across the foot, or it passed diagonally across the flap. Exact details of the lacing process, however, are conjectural, and the absence of attached straps in the Dirty Shame Rockshelter sample exemplifies the amount of wear that these items must have received in the course of daily use.

Measurements: Type III cordeage bindings.

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</thead>
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<tr>
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Measurements: Type XI cordeage binding.

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Provenience:

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<th>No. of Specimens</th>
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</thead>
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<td>9</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

Mean angle of twist: 310°.
Range in twists per centimeter: 0.8-1.3.
Mean twists per centimeter: 1.0.
Twists per centimeter: 0.3.
MULTIPLE WARP SANDALS, TOE COVERS, AND BINDINGS

Multiple Warp Sandals

The 58 Multiple Warp sandal fragments from Dirty Shame Rockshelter are very similar in overall construction to those described by Cressman (1942: 58-60) from Roaring Springs Cave, Catlow Cave No. 1, Paisley Caves No. 1 and No. 2, and Plush Cave. Specifically, all specimens, which represent a minimum of 46 separate sandals, are plain twined over a variable number of single warps. This sandal type consists of three principal variations: the heel loop, selvage loop, and composite loop. These correspond in general to types distinguished by Cressman (1942: 58, 60) but deviate in certain construction details and attributes. Another variety, which lacks loops entirely, is also represented among the Dirty Shame Rockshelter sandals.

There are no complete Multiple Warp sandals in the Dirty Shame Rockshelter assemblage. The Multiple Warp sandal type as defined by Cressman (1942) consists of a sole and integral heel pocket, toe cover, and bindings; however, some of the Dirty Shame Rockshelter sandal specimens were not always constructed with heel pockets. With the heel pocket, the Multiple Warp sandal effectively covers all parts of the foot and is essentially a twined shoe. The absence of a heel pocket exposes the heel and part of the sole of the foot and presents a slipper-like appearance similar to that of the Fort Rock sandal type (see above). The Multiple Warp sandals from Dirty Shame Rockshelter includes 33 soles, 15 soles with attached toe covers, 5 soles with bindings, 3 detached toe covers, and 2 soles with both toe covers and bindings. The specimens are undecorated.

The Multiple Warp sandal sole is rectangular in shape and of standard form. Among the Dirty Shame Rockshelter sandal types, the Multiple Warp form is the most tailored in the sense of conforming to the outline of the human foot. In specimens with a heel pocket, this custom fit was accomplished, perhaps unintentionally, by drawing up the sides of the sole onto the top of the foot and securing them with the binding. All soles, with or without heel pockets, attain their maximum width at the ball of the foot and are narrowest at the heel and toe. The heel is slightly narrower than the toe due to the parabolic layout of the warps. With reduction at the toe of the sole results from merging one to four warp pairs by binding two warps at one end. There is no regular pattern in the number or position of the amalgamated warps, but the center and/or exterior warps are frequently involved. Warp amalgamation is a preparation for production of the toe cover and is evident in specimen 1-3716 from Roaring Springs Cave (Cressman 1942). The Multiple Warp sandal sole is uniform in thickness from toe to heel but was not itself made specifically for the right or left foot. No two specimens in the Dirty Shame Rockshelter assemblage form what could be termed a "pair," i.e., the right and left sandals worn by one individual.

The construction technique of the Multiple Warp sandal sole differs little from that of the Fort Rock sandal type (see above). The fundamental difference is the use of more than five warps. In the Dirty Shame Rockshelter specimens, seven to 12 sole warps are used. Cressman's (1942: 60) type specimens contained eight to 16 warps but tended to have an even number of sole warps. In the Dirty Shame Rockshelter sample, both even and odd numbers of warps are observed (see Table 13). The seven to 12 warps are created from four to six lengths of fiber arranged in two basic patterns (Figure 90). If the final number of warps is even (e.g., 8, 10, or 12), four, five, or six elements, respectively, would be laid out in a series of concentric parabolas. Each length of fiber thus yields two functional warps. An extra, straight element can be added between the arms of the innermost parabola along the midline of the sole to create an odd number of warps. This second construction technique is simply an elaboration of that used in the Fort Rock sandal sole, which as noted above, is made by adding a straight fiber element at the center of two concentric parabolas producing five and only five functional warps.

Warp patterns in the Multiple Warp sandal type are smaller in diameter than the warps in the Fort Rock sandal. Use of more though smaller warps increases both the flexibility and (theoretically, at least) the durability of the Multiple Warp sole over the Fort Rock pattern. Like the Fort Rock sandal, the open ends of the concentric parabolas form the toe of the Multiple Warp sandal. Unlike the Fort Rock specimens, however, the diameter of all warps in the Multiple Warp sandal soles is consistent; no warp in the sole is by accident or design greater in diameter than any other warp. As with the Fort Rock sandal, sole length was determined principally by the length of the warps, and the warps had to be long enough to provide for a heel pocket, if that design feature was to be included. Because the selection of suitably long warps was an essential part of sandal making, warp splicing was unnecessary unless the diameter of individual warps needed to be increased.

Sole width was controlled by varying both the number and diameter of the warps. For example, a sole with a maximum width of 18 cm can be constructed with seven warps. One 12-cm-wide specimen exhibits 12 warps. In specimens with a heel pocket, the central layout of the sole required an additional 2.4 cm of material on both sides of the sole, and all soles were made with 1.3 cm of extra material on either side of the sole. This added material was drawn back over the toes before binding the sandal to the foot.

Sole warps were constructed from untwisted, S-spun or Z-spun fibers. At times, there is no apparent consistency in the twist direction, and various combinations of twist directions can appear in one sole. This is unrelated to the number of warps in the sole and may be due to the same processes noted previously for the Fort Rock sandal. Cordage warps, which are occasionally found in Multiple Warp sandal soles, may be recycled cordage scrap.

The Multiple Warp sandal soles always contain two-ply wefts with a stitch slant of Z. Individual weft plies are spun or S spun. As with the Fort Rock sandal sole, twining began at the heel or closed end of the parabola and proceeded toward the open end or toe. Twining apparently began by folding a length of fiber around the outer warp and then manipulating each end as an individual weft element within the weft pair. Sole warp arrangement and the location of the first weft row are contingent upon the presence or absence of a heel pocket.

The Dirty Shame Rockshelter Multiple Warp sandals without a heel pocket might be assigned to a separate type as all of Cressman's (1942: 58-60) Multiple Warp sandals had heel pockets. Specimens without heel pockets are retained here in a single Multiple Warp sandal type, however, because the overall mechanics of construction are identical. Soles with heel pockets tend to have more warps than do specimens without them, but this may be a factor of sampling. The additional warps, however, may also have been necessary to construct soles with heel pockets. In specimens without a heel pocket,
the sole warps, excluding those at the toe, are arranged so that the sole is flat. The resulting configuration is almost identical to that of the Fort Rock sandal type. The first welt row begins a maximum of 1.5 cm from the heel. All curved portions of the parabolic sole warps are ultimately enclosed by twining except that segment of the outermost warp at the heel. This remains exposed. As with the Fort Rock sandals, wear causes the curved segment of this exterior warp to rise slightly above the horizontal plane of the sole, and this may have provided a slight support for the heel of the foot.

A second approach incorporates a heel pocket into sole construction. The convex portions of two to four outer warps are drawn up above the plane of the sole. The outermost warp is elevated above its adjacent inner warp, and so on. This process forms an envelope-shaped structure widest at the extremities of the sandal and narrowest at its midline. Twining on this heel pocket begins ca. 2-3 cm down one arm of the outer parabolic warp and proceeds across the sole warps parallel to the width of the sandal. The curved segments of the raised warps remain unwound and essentially constitute the heel pocket itself. Only occasionally is the heel pocket as high as 3.8 cm. This appears to be significantly less than the height of the "ample" heel pockets noted on Multiple Warp sandals by Cressey (1942: 58). All of the Dirty Shame Rockshelter Multiple Warp heel pockets are extremely deteriorated. At most, they retain half of their original size and shape. Inherent in their mode of construction is a tendency for the heel pockets to split down the long axis when the sandal is worn. This observation supports Cressey's (1942: 58) suggestion that the "cut and sewn" variant of the Multiple Warp sandal heel pocket may indeed represent a mending technique.

Twining on the Dirty Shame Rockshelter Multiple Warp sandals does not end at the toe of the sole for the sole welt provides the construction material for the toe cover. The Multiple Warp sandal soles have closely spaced welt rows that conceal the warps. The greater number and smaller diameter of the sole warps in this sandal type compared to the Fort Rock type also permit the warps to be narrower, but welt width is less internally consistent than for the Fort Rock type.

Side selvages between the Multiple Warp sandal binding loops are of the continuous welt variety with one twist (see BASKETRY). As on Cressey's (1942: 58) specimens of this type, binding loops are periodically created along both the medial and lateral sides of the sandal by extending the welt planes beyond the margins of the sandal. Based on the construction techniques used to produce the binding loops, the Multiple Warp sandals from Dirty Shame Rockshelter can be assigned to the three main varieties noted above. The first two varieties, Weft Loop and Selvage Loop, involve significantly different mechanics of construction whereas the third variety, Composite Loop, is a combination of the first two techniques. Each loop variety of the Multiple Warp sandal type is described and discussed in the following sections as are sandals that lack binding loops altogether.

MULTIPLE WARP SANDALS, WEFT LOOP VARIETY

No. of specimens: 20, fragmentary.
Types of specimens: Soles with toe covers, 6; soles with bindings, 3; soles, 11.
No. of individual forms represented: 16 (minimum).

Technique and Comments: Two of the soles in this Multiple Warp sandal variety are nearly complete, and four others, though more fragmentary, have significantly complete sections. Among the latter, two sandals are disintegrated near the toe, midsection, and heel; another consists of the toe and midsection of the sole, and the last includes the midsection and heel. The 19 remaining items represent, in varying states of preservation, a fragment of a midsection and heel, five midsections complete in width, and eight fragmentary midsections. Four Multiple Warp sandals of the Weft Loop variety are constructed with heel pockets that range from 1.8-3.8 cm in height. Five other specimens have heel at the side of the sole, perhaps an indication that they originally had a heel pocket. Among the remaining specimens, three soles were made without a heel pocket and in eight others, this attribute is not able to be evaluated. Wear patterns on five specimens suggest that three were worn on a left foot and two on a right foot. Wear on the remaining 15 specimens is either non-diagnostic or the specimen is simply too worn to determine on which foot it may have been worn.

Twelve Multiple Warp sandals of the Weft Loop variety are complete in width. Four of these soles are constructed with nine warps each. In contrast, the majority of the Multiple Warp sandals of this same variety from Roaring Springs Cave, Catlow Cave No. 1, and Paisley Caves No. 1 and No. 2, and Plush Cave were made with 10 or 12 warps each (Cressey 1942: 60). In the number of warps may be related to differences in "standard" or customary warp diameters between these two samples, but it is not correlated with differences in overall sandal width. The eight, 10, and 11-warp Dirty Shame Rockshelter sandals each comprise 16.7% of the Multiple Warp sandal, Weft Loop variety; soles with seven and 12 warps constitute 8.3%, each. The number of sole warps retained in eight specimens of incomplete width have been provided in Table 13. Among the five specimens with intact toes, the outer and outermost set of warps at both the medial and lateral sides of two specimens are merged into one warp at the toe. Sandal width at the toe of one specimen is drastically reduced by the coalescence of eight sole warps into four; another sole combines six warps into three. The two central warps of the last sole are amalgamated at the toe.

Twelve soles of Multiple Warp sandals of the Weft Loop variety are made with untwisted warps. The warps of one specimen are slightly 2 twisted, and those of another have been slightly 5 twisted. Two soles were constructed with a combination of untwisted and either 5-, or 2-twisted warps. Another specimen contains unspun warps, 5-twisted warps, and 2-twisted warps.

One sandal sole was made with nine warps that are created with four lengths of Type III cordage (see CORDAGE). The central warp is a single length of fiber folded 180° and given a slight 2 twist. Cressey (1942: 60) recorded that eight soles were constructed with "rope warps" among his Multiple Warp sandals, Weft Loop variety type specimens. Cordage warps in the Dirty Shame Rockshelter sandal specimen probably represent the recycling of discarded cordage elements, but the practice may also have been an attempt to increase stability and durability of the sole. One sandal specimen has a "Y" splice in which new material was introduced that thickens the adjacent warps.
All soles of Multiple Warp sandals of the Weft Loop variety from Dirty Shame Rockshelter have slightly S-twisted weft plies. The maximum number of weft rows observed on a single specimen is 20. Weft plies were made by inserting new material beneath the exhausted weft ply. The binding loops are positioned along the medial and lateral sides of the sole and technically are a type of continuous weft side selvage (see Basketry). The binding loops function as eyes or guides for the straps or laces. These loops were formed at the end of a weft course by twisting the two weft plies together four to six times before beginning the next weft row. The number of twists per binding loop is correlated with the diameter of the weft plies. This technique produces Type III cordage loops with the loop eyes perpendicular to the plane of the sole. These binding loops are almost as wide as they are long. Six sandal soles retain only one weft loop five other specimens retain four loops each. Four specimens have seven loops per sole, and two specimens preserve six. The three remaining soles retain one, three, and nine loops per sandal sole, respectively. Inherent in this mode of loop construction is a tendency for the loops to detach or "twist off" the twined rows under the force exerted by the strap or lace. This, plus the extreme wear at the sides of the sandal, make it difficult to determine the original total number of loops. Though the maximum number of loops retained on any one specimen is 10 (five per side), it is likely that the number of weft loops simply varied with the total number of weft rows, that is, with the length of the sole. It is also likely that both sides of the sole were made with an equal complement of loops.

The first binding loop was apparently produced after the first two to four rows of twining at the heel of the sole had been completed. Ten sandal soles of this sandal variety probably had binding loops at every third weft row; however, two of these specimens have weft loops in two adjacent weft rows on the lateral side of the sole. The loop nearest the toe is two weft courses below the toe. These loops near the toe are slightly larger in diameter than the side loops along the soles. The larger of the two added loops may have been used in fastening the side of the sole over the top of the foot. It also strengthened the attachment area. Due to the highly fragmented condition of the Multiple Warp sandals of the Weft Loop variety, it is not possible to say whether or not this loop configuration was the customary or typical practice or if a similar set of loops was positioned along the medial margin of the sole at the toe. If not, the Multiple Warp sandal, Weft Loop variety sole may have been specifically constructed for right and left feet. One sole was made with binding loops every four or five weft rows; another contains loops on every other weft course. As both specimens are fragments, it is impossible to determine whether the separation or distance between the binding loops is a correlate of sandal length. Due to the nature of the twining process, the weft loops do not directly oppose one another; rather, they are staggered or offset by a distance of one row of twining. Comparisons between the Dirty Shame Rockshelter examples and the tie loops on the specimens described by Cressman (1942: 58, 60) are provided in a subsequent section of this chapter (see Multiple Warp Sandal Bindings).

One of the Dirty Shame Rockshelter Multiple Warp sandals measures a maximum of 18 cm in length by 8 cm in width (including side folds and heel pocket) and may have been worn by a child or woman. No sole, however, shows mends or repairs. All of the sandals are heavily worn along the sides, toe, heel, and bottom of the sole. Two specimens are extensively worn at the ball and heel of the soles; another sole is actually perforated at both of these locations. One sandal is worn so extensively that it has split along the transverse arch; another is longitudinally split. Five sandals are slightly charred, and another has burned into two fragments.

Measurements:

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<tr>
<th>Measurement</th>
<th>Value</th>
<th>Description</th>
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</thead>
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<td>Mean binding loop width</td>
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<td>Mean binding loop element diameter</td>
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<td></td>
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</tbody>
</table>

Range in distance between binding loops formed on non-adjacent weft rows: 1.6-4.3 cm. Mean distance between binding loops formed on non-adjacent weft rows: 2.7 cm.

Provenience:

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MULTIPLE WARP SANDALS, SELVAGE LOOP VARIETY

No. of specimens: 16, fragmentary.

Types of specimens: Soles with toe covers and bindings, 2; soles with toe covers, 3; sole with binding, 1; soles, 8.

No. of individual forms represented: 14 (minimum).
Technique and Comments: Sixteen Multiple Warp sandal soles are of the Selvage Loop variety. This is similar to Cressman's (1972: 50) Multiple Warp sandal, Running Loop variety, but it differs in some particulars. Two specimens are nearly intact; three are at least two-thirds complete. One of these has disintegrated portions of the toe, midsection, and heel. The other two specimens consist of the toe and midsection, and midsection and heel, respectively. The remaining 11 sole fragments represent six midsections and heels, one toe and midsection, three portions of midsections, and one deteriorated toe segment.

Three Multiple Warp sandals of the Weft Loop variety were made with heel pockets that range from 2.8 cm to 3.4 cm in height. Another specimen has a 2.8-cm-long side fold that suggests it was originally constructed with a heel pocket. Among the remaining 12 soles, five were made without heel pockets but the presence or absence of a heel pocket cannot be evaluated on the others. Nine specimens lack the diagnostic wear patterns to determine the foot on which the sandal was worn. Attrition wear on seven soles indicates that five were worn on left feet and two on right feet.

The width of nine sandal soles is complete. Of these, the seven, eight, nine, and 12-warp soles constitute 22.2% of the sample. Unlike the Weft Loop variety sandal (see above), only 11.1% of the Selvage Loop soles contain nine warps. The difference in the frequency of nine-warps soles is attributed to sampling. In both of Cressman's (1942: 60) type specimens of the Running Loop variety sandal as well as in the Dirty Shoe Rockshelter collection, the average number of warps used in sole construction is relatively circumscribed.

The number of extant sole warps preserved in Dirty Shoe Rockshelter specimens of incomplete width has been provided in Table 13. Four soles have intact toes, so the number of sole warps merged in this area can be determined. In two specimens, the outer and adjacent warp sets at the medial and lateral sides of the sole converge. In another sole, the two center warps are also merged producing nine sole warps instead of 12. The two center sole warps in two final specimens coalesce into one warp. Twelve Selvage Loop variety soles are constructed with untwisted warps as in the Weft Loop variety (see above); however, in two of the Selvage Loop specimens, the warps exhibit a slight S twist at the heel from twisting the material counterwise to create the parabolic warp layout. Two soles have loosely S-twisted warps. The outer warps in two other Selvage Loop soles are a single length of Type III cordage (see CORDAGE). The interior warps of one of these specimens are untwisted, but those of the other are slightly Z twisted. In this case, an exterior cordage warp may have strengthened the highly stressed margins of the sole. Cressman (1942: 60) did not observe cordage warps among his Running Loop variety sandals.

Warp diameter in two Selvage Loop variety sandal soles was increased by splicing. In the first specimen, additional material was laid atop the pre-existing warp and was bound under by the weft. The second specimen contains a VI splinte in which the diameters of two non-adjacent warps were increased simultaneously.

Fourteen Selvage Loop variety sandal soles have slightly S-twisted weft plies. Wefts on the other two specimens are untwisted. The maximum number of weft rows retained in any one specimen is 29. Weft plies are made by adding new material beneath the exhausted weft ply. A variation of this splicing technique occurs on one specimen in which the new material is first folded in half. Binding loops on the Selvage Loop variety sandal are created using a series of bifurcated wefts. This technique is functionally similar to the Running Loop variety binding described by Cressman (1942: 58), but the method of construction is quite different. A reverse twist at the end of a weft course was not used to create the "eye" in the weft plies; rather, when a row of twining was completed, an additional Z twist was made in the weft row around a "temporary warp" (e.g., a finger or stick) beyond the margin of the sandal. When the temporary warp was withdrawn, a single-pla loop remained that was secured and stabilized by increasing tension on the opposing weft ply. This single-ply loop variety is not as structurally sound as the Weft Loop variety (see above), which is actually composed of cordage formed from both weft plies.

One sole with two binding loops shows a variation on the usual selvage loop binding pattern. In this specimen, the weft ply that forms one loop was halved and the halves then Z twisted together creating a loop of Type III cordage (see CORDAGE) with a diameter of 8.6 mm. Extreme deterioration makes it impossible to know how this loop's exact position on the sole. Although assigned to the Selvage Loop sandal variety, this specimen reflects both Selvage Loop and Weft Loop construction techniques. It may have been an attempt to increase durability of the selvage loop, an imitation of the weft loop design, an accident, or simply an idiosyncrasy. This specimen is also important because it demonstrates the contemporaneity of the Selvage Loop and Weft Loop sandal varieties. The usual binding loop in the Selvage Loop variety sandal is single-ply S-twisted fiber. An advantage to this loop variety, perhaps compensating for a lack of durability, is that the eye can pivot parallel to the plane of the sole. This minimizes strain on the loop from the binding (see below).

Six Selvage Loop variety sandals retain six loops each; four other specimens retain three, and two others have five loops each. The remaining four soles retain one, six, seven, and 13 loops, respectively. Eleven soles were probably made with binding loops every three weft rows, but one specimen has loops every four weft courses. Three of these 11 soles have an additional loop at the toe or heel. As on certain Weft Loop variety soles (see above), one Selvage Loop variety specimen has two loops on adjacent weft courses at the lateral side of the toe close to the sandal flap. Unlike the Weft Loop variety, however, another Selvage Loop specimen retains loops on adjacent weft rows at the outer heel. A third Selvage Loop variety sole has the two adjacent loops at the toe and two more at the heel on the medial side. The remaining two soles each retain only one set of adjacent loops.

Extreme attrition wear and deterioration along the sides of the Selvage Loop variety sandals make it impossible to know if paired loop sets were regular features on one or both sides at the toe and heel. As noted for the Weft Loop variety sandals, adjacent loops at the toe would have been an aid in fastening the side of the sole over the top of the foot and would also have strengthened the attachment area. Two adjacent loops at the sole heel may have been necessary on the Selvage Loop variety sandals to increase the durability of this attachment; however, one cannot be certain that this is not an accident of preservation. In all probability, both sides of the Selvage Loop variety sandals were made with equal number of rows, as is the case for the Weft Loop variety specimens.
The maximum number of loops retained on any one Selvage Loop variety sandal is 13, but loop spacing indicates that 14 may have been the original complement. The same specimen, however, is also the longest sole in the Selvage Loop variety sample. The binding loops are spaced at an interval of three well rows (excluding the adjacent loops at the toe and heel). These observations support the idea (see MULTIPLE WARP SANDALS, WETT LOOP VARIETY) that the number of well rows between loops is not a function of sandal length and that the number of loops is simply a function of sole length. The consistency of binding loop spacing at three-row intervals suggests either that this was the accepted cultural standard among Dirty Shane Rockshelter's inhabitants over many centuries or that this spacing has certain structural advantages. Although the number of well rows between loops remains relatively constant, the actual distance between a pair of binding loops on any one side of the sandal varies with the width of the well rows. The same is true for the Wet Loop variety sandals (see above).

No Multiple Warp sandals of the Selvage Loop variety are specimens of child's footwear, and no examples are toy sandals. Associated with one specimen is an unidentified bone fragment. All specimens are extensively worn along the margins and on the bottom of the sole. Three soles are worn through at the heel and ball of the foot. Seven specimens are charred, and one is encrusted with coprolitic material.

**Material:**
- Range in length: 21.0-28.5 cm
- Mean length: 24.8 cm
- Range in width: 10.0-14.1 cm
- Mean width: 12.1 cm
- Range in heel pocket height: 2.8-3.9 cm
- Mean heel pocket height: 3.2 cm
- Range in sole thickness: 0.8-1.7 cm
- Mean sole thickness: 1.2 cm
- Range in warp diameter: 3.2-13.8 mm
- Mean warp diameter: 8.1 mm
- Range in cording warp diameter: 4.5-7.3 mm
- Mean cording warp diameter: 6.0 mm
- Range in warps per centimeter: 1.0-2.0
- Mean warps per centimeter: 1.3
- Range in well width: 5.6-16.6 mm
- (specimens with unequal-sized wells)
- Mean well width: 7.1 mm (smaller wells); 11.7 mm (larger wells) (specimens with unequal-sized wells)
- Range in well rows per centimeter: 1.0-1.5
- Mean well rows per centimeter: 1.3
- Range and mean gap between well rows: 0
- Range in binding loop length: 6.6-3.9 cm
- Mean binding loop length: 2.9 cm
- Range in binding loop width: 0.8-2.9 cm
- Mean binding loop width: 1.9 cm
- Range in binding loop inner diameter: 6.7-1.9 cm
- Mean binding loop inner diameter: 1.2 cm
- Range in binding loop element diameter: 5.5-8.4 mm
- Mean binding loop element diameter: 7.3 mm
- Range in distance between binding loops formed on non-adjacent well rows: 2.6-4.0 cm
- Mean distance between binding loops formed on non-adjacent well rows: 3.2 cm

**Proveniences:**

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**MULTIPLE WARP SANDALS, COMPOSITE LOOP VARIETY**

No. of specimens: 2, fragmentary.

Types of specimens: One with toe cover, 1 sole with binding, 1

No. of individual forms represented: 2.

Technique and Comments: This Multiple Warp sandal variety employs both Wet Loop and Selvage Loops. Although only two specimens are identified, some sandal soles assigned to the Wet Loop and Selvage Loop varieties probably originally had both wet and selvage loops. The identification of only two Composite Loop sandals among the better preserved Carlow Cave specimens (Cressman 1942: 60) may mean that this sandal variety was never abundant in southeastern Oregon. One Dirty Shane Rockshelter Composite Loop sandal sole is complete. The second specimen is a missection fragment of a sole.

The complete sole is 32 cm-34 cm in length and 12 cm-16 cm in width. It is equivalent to a modern size 12-13 C width shoe and exceeds the 30 cm x 14 cm dimensions of the Paisley Cave No. 1 specimen documented by Cressman (1942: 60) as the "largest found yet in southeastern Oregon." The heel of the Dirty Shane Rockshelter sole is slightly worn, but it was made without a heel pocket. This attribute cannot be assessed on the second specimen. One of the two soles was worn on the right foot, but the wear patterns on the other are unspecfic.

Both specimens are complete in width and have seven and 11 warps respectively. In the 11-warp sole, four sets of warps merge to form seven warps at the toe. Both specimens utilize untwisted warps; however, in one sole the warps were twisted counterclockwise into the parabolic configuration. This produced a slight S twist at the heel. Warps splices are absent.

Wet plies were slightly S twisted before twining. The complete Composite Loop sandal sole is made with 26 rows of twining. One specimen has two different wet splicing techniques. In the first technique, new material is inserted beneath the exhausted wet ply at a warp crossing. In the second technique, the additional fiber is wrapped around the warp before twining.

The complete sole retains nine binding loops; five are on the lateral side of the sole, and four are on the medial side. The original complement of loops was probably 12 with six loops per side. Five wet loops and four selvage loops occur on this specimen. The wet loops are on both sides at the heel and at the midsection of the sole. The selvage loops are restricted to the medial and lateral margins at the toe. The first wet loop occurs two well rows from the heel. Though
part of the midsection is absent, succeeding weft loops apparently were made every three weft courses. Paired selvage loops were formed at the ends of two adjacent rows of twining, three and two weft courses, respectively, from the toe cover. The two adjacent selvage loops probably made the attachment to the foot more secure. The vertical selvage loop openings may also have helped in drawing up and securing the margins of the sole at the toe.

The second Composite Loop sandal retains one weft loop and two adjacent selvage loops along one side of the sole. Fragmentation of this specimen, however, makes it impossible to determine the position of these loops relative to those at the heel and toe. The Composite Loop variety specimens are extensively worn along the sides and bottoms of the soles. The complete sole is worn through at the ball and heel of the foot. The other sole fragment is charred.

**Measurements:**
- Range and mean length: 39 cm (complete sole).
- Range in width: 14.5-16.0 cm.
- Mean width: 15.3 cm.
- Range in sole thickness: 1.0-1.2 cm.
- Mean sole thickness: 1.1 cm.
- Range in warp diameter: 6.9-14.0 mm.
- Mean warp diameter: 9.9 mm.
- Range and mean warps per centimeter: 1.
- Range in warp width: 6.9-14.1 mm.
- Mean warp width: 8.3 mm (smaller warps); 13.4 mm (larger warps).
- Range and mean weft rows per centimeters: 1.
- Range and mean gap between weft rows: 0.
- Range in weft loop length: 3.5-3.8 cm.
- Mean weft loop length: 3.0 cm.
- Range in selvage loop length: 2.9-3.0 cm.
- Mean selvage loop length: 2.95 cm.
- Range in weft loop width: 1.0-3.9 cm.
- Mean weft loop width: 2.4 cm.
- Range in selvage loop width: 2.1-2.3 cm.
- Mean selvage loop width: 2.2 cm.
- Range in weft loop inner diameter: 1.5-1.6 cm.
- Mean weft loop inner diameter: 1.55 cm.
- Range in selvage loop inner diameter: 1.1-1.4 cm.
- Mean selvage loop inner diameter: 1.2 cm.
- Range in weft loop element diameter: 7.8-9.9 mm.
- Mean loop element diameter: 8.8 mm.
- Range in selvage loop element diameter: 7.6-8.3 mm.
- Mean selvage loop element diameter: 8.0 mm.

**Provenience:**

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**MULTIPLE WARP SANDALS, NO LOOP VARIETY**

No. of specimens: 17, fragmentary.

Types of specimens: Soles with toe covers, 3; soles, 14.

No. of individual forms represented: 15 (minimum).

Technical and Comments: This "variety" includes all Multiple Warp sandal soles that do not preserve binding loops. Presumably, these sandals were originally made with one or another binding loop form as discussed in previous sections. All sandal soles are incomplete in length and width. The most nearly intact specimen is a sole midsection measuring 18.0 cm in length by 15.5 cm in width. Ten other specimens are midsection fragments; four are toes and two are heels. No specimen displays a heel pocket, and there is no indication that they were made with one. Wear patterns are unspecific for determining "toothiness." The extent number of warps per sole fragment is given in Table 13.

The outer and adjacent warp on two specimens merge at the toe. Ten soles are made with untwisted warps, but three are slightly 2 twisted. Three others have a random combination of untwisted and 2-twist warps. The last sole retains three warps created from Type III cordage (see CORDAGE).

Two soles have warp splicing techniques that increase the warp diameter. In the first technique, additional warp material was laid atop the pre-existing warp and bound under by the weft. The second specimen contains a "in" splice in which the diameter of two adjacent warps is simultaneously increased.

Eleven soles have loosely 5 twisted weft plies; wefts in the remaining six specimens are untwisted. Weft plies usually insert new material beneath the exhausted weft ply; however, in one specimen the new fiber was first folded around a weft ply, and each half then formed one ply of the weft pair.

Children's sandals and toy sandals are absent. All of these soles show severe attrition, but there are no distinctive wear patterns or perforations. One specimen is encrusted with coprolitic material. Six soles are moderately to extensively charred.

**Measurements:**
- Range and mean length: N.A.
- Range and mean width: N.A.
- Range and mean heel pocket height: N.A.
- Range in sole thickness: 0.7-1.9 cm.
- Mean sole thickness: 0.9 cm.
- Range in warp diameter: 4.9-11.2 mm.
- Mean warp diameter: 7.1 mm.
- Range in warps per centimeter: 1.0-2.0.
- Mean warps per centimeter: 1.1.
- Range and mean weft width: 7.6 mm (specimens with equal-sized warps).
- Range in weft width: 4.3-23.6 mm (specimens with unequally sized warps).
- Mean weft width: 6.5 mm (smaller warps); 9.9 mm (larger warps) (specimens with unequally sized warps).
- Range in weft rows per centimeters: 1.0-2.0.
- Mean weft rows per centimeter: 1.1.
- Range and mean gap between weft rows: 0.
### Table: Provenience

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**Multiple Warp Sandal Toe Covers**

Unlike Cressman's (1962: 38) type specimens, the Multiple Warp sandals from Dirty Shame Rockshelter normally include a twined toe cover similar in many respects to the "tongue" of a modern shoe. As on the Fort Rock sandals (see above), the flap emanates from the toe of the sole, but the Multiple Warp toe cover is not attached to either side of the sole. Prior to facing the sandal (see below), the flap was folded back over the top of the foot. The sides of the sole were then drawn up over the margins of the flap and secured with a lace or strap. It is not as long as the Fort Rock sandal toe cover, but the Multiple Warp sandal flap would have covered one-half to two-thirds of the top of the foot. Toe cover length is obviously a function of overall sole length. Once again, as with the Fort Rock sandal toe flap when the sole had been completed, ca. 10 cm-25 cm of untwined warp material was intentionally left extending beyond the toe. This was integral to construction of the sole and to the subsequent manufacture of the flap. Unlike the Fort Rock sandal flap, however, the width of the Multiple Warp flap is significantly less than that of the sole, and there is a narrow range of variation in width among the extant toe covers. This indicates a technical consistency in the production of this attribute that may have been culturally prescribed or at least technologically related to the construction of an efficient sandal. Flap width was comparatively fixed, but the sole was constructed with an allowance in width to ensure that its sides could overlap the flap when the sandal was worn. Construction attributes of the Multiple Warp toe cover are extremely conservative and are identical for the binding loop varieties of this type.

It is interesting to note that Cressman's (1962: 38) Multiple Warp sandals usually drew the untwined warp extensions back to the top of the toe, and a few specimens in Cressman (1962: Figure 76) sample show the addition of new warps to the sole to form the flap. This process is also evident in the Dirty Shame Rockshelter Multiple Warp sandals. Unlike the Fort Rock sandal type, warps in the sole of the Multiple Warp sandals are neither increased in number nor decreased in diameter prior to or during toe cover construction; rather, the sole warps are decreased in number by merging them together, and certain warps are thus increased in diameter at the toe, a process that helps to shape that area of the sole to the shape of the human foot. Warps may also be reduced in number in the first few rows of the flap where one or two additional warp sets may be merged. There is no observed regularity in the number or position of these amalgamated warp sets. The process apparently was governed by the desired final width of the flap which, as has been noted, was apparently standardized and quite unrelated to sole width.

Approximately 56%–89% of the warps in the sole are used in the warp units of the flap. Warps in the Multiple Warp toes can be untwisted, Z twisted, cordes, or various combinations thereof. Flap warp treatment is usually the same as that in the sole warps. Splicing may increase the width and/or thickness of an exhausted warp, and, in some cases, warp splices probably softened the coarseness of the flap. Warp ends in the Multiple Warp sandal flaps are usually unclipped and simply extend unbound a short distance beyond the terminal weft row.

All Multiple Warp sandal flaps from Dirty Shame Rockshelter are constructed using two open-twined, unspun weft plies with a final stitch slant of Z. The weft rows are irregularly spaced because as twining proceeds from side to side, the distance between the weft rows was gradually increased producing a diagonal zig-zag weft row pattern. This construction technique requires the minimum number of weft rows needed to stabilize the toe cover warps. Most of the complete Multiple Warp sandal flaps have only three weft courses. The maximum number is five. Construction of the Multiple Warp flap involved little time or effort compared to that of the Fort Rock sandal flap (see above). In fact, twining the flap could only have taken minutes longer than leaving the warp material untwined as in Cressman (1962: 38) Multiple Warp "flaps." Ease of construction may have been the principal advantage of this Multiple Warp flap technique over a more complicated or elaborate design. The Multiple Warp sandal flap was probably a much less crucial component of its sandal type than was the Fort Rock sandal's flap, and this may also help to explain its simpler construction. The Fort Rock sandal flap protected the sides and top of the foot, but the brought-up sides of the Multiple Warp sandal sole assumed much of this role.

The zig-zag twining pattern in the Multiple Warp flap also minimized the amount of weft material necessary to construct the flap. Wefts in the Multiple Warp sandal sole provide the weft material for the flap. Unlike the Fort Rock sandal, the flap warp material was not drawn back over the top of the sole before twining; instead, the flap warps extend in the plane of the sole warps.

Flap side selvages are of the continuous weft variety with one to three twists. Twining is terminated at the end of a weft course by securing the two weft plies with an overhand knot or by simply Z twisting the plies together two or three times. In both techniques, the ends of the weft plies beyond the knot or twist are then used as additional warps. The Multiple Warp sandal flaps from Dirty Shame Rockshelter are usually complete in width, an indication that wear and tear on this area of the sandal compared to the sole was minimal. The main function of the Multiple Warp sandal flap was to protect the top of the foot against chafing by the straps or by the pull-up margins of the sole and also to protect the wearer from the natural hazards that could be encountered in the course of daily use. Increased warmth was an added benefit. In sum, although the Multiple Warp sandal flap does not provide the tailored fit of its Fort Rock sandal counterpart, it does provide most of the same advantages without the attendant difficulties of construction. Additional information on Multiple Warp sandal toe covers from Dirty Shame Rockshelter is provided below by major sandal variety.
MULTIPLE WARP SANDALS, WEFT LOOP VARIETY TOE COVERS

Technique and Comments: Six Multiple Warp sandals of the Weft Loop variety retain portions of toe covers that are one-half to three-fourths complete in length. The width of all the flaps is complete. Two specimens are constructed with five flap warps and are affixed to soles that have seven and nine warps, respectively. Two other flaps, which are attached to nine and 11-warped sole soles, are each made using eight warps. One six-warped flap is attached to a nine-warped sole. The sole attached to a seven-warped toe cover is incomplete in width, and the number of sole warps is therefore unknown.

Three of these flaps are made with untwisted warps; another exhibits slightly Z-twisted warps. One flap has both untwisted and Z-twisted warps. The remaining specimen contains Type III cordage warps in the sole and also has cordage warps in its flap. The flap warps were “V” spliced with unspun lengths of fiber that are folded into the initial weft row of the flap. Splicing probably utilized unspun fibers to create a softer, more protective toe cover. “V” splices are the normal splicing technique in the other specimens as well. Three specimens have continuous weft side selvages with one twist; another has a continuous weft side selvage with two twists. The last two flaps have continuous weft one-three and two-three twist side selvages, respectively. One flap has a clipped end selvage.

The Multiple Warp sandal, Weft Loop variety flaps retain two to three weft courses each. Wefts were caught by inserting the raw material beneath the exhausted weft ply. Twining was terminated by fastening the weft around the outer warp with an overhand knot. No specimens are mended. Attrition wear occurs along the top of the flap but as might be expected is especially severe at the toe. Only one specimen is charred.

Measurements:

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MULTIPLE WARP SANDALS, SELVAGE LOOP VARIETY TOE COVERS

Technique and Comments: Seven Multiple Warp sandals of the Selvage Loop variety have toe covers. One of these flaps is intact, but the six remaining specimens are in various states of preservation. Six of the flaps are complete in width. Four of these last noted toe covers are made with six warps; two of these four flaps are affixed to soles composed of eight and nine warps, respectively. The other two of these four flaps are attached to 12-warped soles. Two seven-warped sandals have flaps. One of these flaps is constructed with four warps, and another is composed of five warps. The remaining toe cover is incomplete and retains only two warps.

All Selvage Loop variety sandal flaps are made with untwisted warps. End selvages are absent. Warps are usually spliced by folding the new material in half, laying it atop the exhausted warp and securing it by the weft; however, in one specimen, an additional warp was “created” by dividing an extant warp, though this was probably accidental.

The flap specimens retain two to four weft rows each. Six flaps have continuous weft side selvages with one twist. One specimen has a two-twist side selvage. Wefts are spliced by binding the additional material beneath the exhausted weft ply. Flap twining is terminated by twisting the weft plies together two or three times. The weft ends beyond the twist become additional warps.

A torn weft on one toe cover has been mended with a folded length of material in which the ends of the fiber bundle are employed as individual weft plies. Wear is generally most extensive at the toe and along the top edge of the flap.

Measurements:

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MULTIPLE WARP SANDALS, COMPOSITE LOOP VARIETY TOE COVER

Technique and Comments: This specimen is an 8.7 cm x 6.6 cm flap fragment. It is incomplete in length though complete in width. Three sets of the 11 sole warps are merged to create the five warps of the flap. Both the sole warps and the flap warps are untwisted. Warp and weft splicing techniques and the method of twining termination are undeterminable. This specimen preserves one to one and one-half weft rows. The flap is unaltered, but its top edge is extensively worn.
Measurements:
Length: N.A.
Width: 6.6 cm.
Range and mean warp diameter: 11.3 mm.
Range and mean weft width: 6.8 mm.
Range and mean weft rows per centimeter: 1.
Range and mean maximum gap between weft rows: N.A.

Proveniences:
Zone III Raw material Artemisia sp.
No. of specimens 1

MULTIPLE WARP SANDALS, UNKNOWN VARIETY TOE COVERS

Technique and Comments: Three Multiple Warp sandal soles without binding loops retain portions of toe covers. The flaps are incomplete in length and width. The most nearly complete flap is 21.3 cm long and 6.3 cm wide. It contains five loosely Z-twisted warps. The two other specimens are made with untwisted warps. Warp splices are made by adding material to the top of a pre-existing warp. The most nearly complete flap preserves three weft rows; the others preserve one weft row each. Side selvages are of the continuous weft, one twist variety. Weft elements are spliced by binding new material beneath the exhausted ply. In the first flap, the outer warp is employed together with one of the weft plies in a single row of twining. This may represent a warp splicing technique, a warp reduction method, or simply an accident. The specimens are unmended and are extensively worn.

Measurements:
Range and mean length: N.A.
Range and mean width: N.A.
Range in sole thickness: N.A.
Mean sole thickness: N.A.
Range in warp diameter: 7.3-19.9 mm.
Mean warp diameter: 11.7 mm.
Range and mean warps per centimeter: 1.
Range in weft width: 6.5-9.7 mm.
Mean weft width: 7.6 mm.
Range and mean weft rows per centimeter: 1.
Range and mean maximum gap between weft rows: 3.1 cm.

Proveniences:
Zone III Raw material Artemisia sp.
No. of specimens 7

MULTIPLE WARP SANDALS, DETACHED TOE COVERS

Technique and Comments: Three unattached toe covers were recovered from Dirty Shame Rockshelter. They are not directly associated with Multiple Warp sandals, but the flaps conform in both configuration and construction technique to flaps of this sandal type. The specimens are incompletely preserved, but the number of extant warps ranges from two to five. Warps are untwisted, and warp splices are made by folding the added material around the exhausted warp. Wefts are two ply, unspun, and open Z twined with irregular weft row spacing. One to three weft courses are preserved. Side selvages are continuous weft with one twist. Wefts are spliced by inserting the new material beneath the exhausted ply. Twining on one specimen is terminated by simply Z twisting the weft plies together once and including them as loose warps. Specimens are unchared.

Measurements (two specimens only):
Length: 21.3 cm
(only nearly complete specimen only).
Width: 6.9 cm
(only nearly complete specimen only).
Range in warp diameter: 7.3-19.9 mm.
Mean warp diameter: 11.5 mm.
Range and mean warps per centimeter: 1.
Range in weft width: 6.5-9.3 mm.
Mean weft width: 7.9 mm.
Range and mean wefts per centimeter: 1.
Range in maximum gap between weft rows: 2.0-3.9 cm.
Mean maximum gap between weft rows: 3.9 cm.

Proveniences:
Zone III Raw material Artemisia sp.
No. of specimens 3

Multiple Warp Sandal Bindings

The Dirty Shame Rockshelter sandals and those from Roaring Springs Cave, Catlow Cave No. 1, Peasly Caves No. 1 and No. 2, and Plush Cave (Cressman 1962: 38) show similarities in the relative positions of the sole and toe cover before the sandals were laced. The flap was drawn back over the top of the foot, and the sole margins were secured over the edges of the flap with a lace or tie. The amount of overlap between the sides of the sole and the toe cover varied with the flap width and how tightly the sandal was bound to the foot. Unfortunately, no Dirty Shame Rockshelter Multiple Warp sandals have intact straps or laces from which to reconstruct the lacing pattern. One Wett Loop variety specimen has a length of cording drawn through four binding loops, but there are differences in binding loop construction, shape, orientation, and dimensions between the Dirty Shame Rockshelter specimens and those described by Cressman (1962). This implies differences in lacing patterns as well. Cressman's (1962: 38) Wett Loop and Running Loop varieties of the Multiple Warp sandals show greater variation in binding loop configuration (and thus probably in lacing technique) than do their Dirty Shame Rockshelter Wett Loop and Selvage Loop counterparts. Specifically, Cressman's Wett Loop sandals have very long tie loops and short running loops, whereas those in the Dirty Shame Rockshelter sample have no significant differences in binding loop size or position. This suggests that their lacing techniques were probably similar. The inner loop diameters on the Dirty Shame Rockshelter Wett Loop and Selvage Loop varieties of the Multiple Warp sandal are similar; thus, the diameters on the lacing or binding cord may also have been about the same. The binding loops on these two varieties of
Dirty Shame Rockshelter Multiple Warp sandals are most similar in size to Cressman's Running Loop variety and to the Dirty Shame Rockshelter Spiral Weft sandal (see below). Cressman's (1942) Running Loop variety of the Multiple Warp sandal and the Dirty Shame Rockshelter Spiral Weft sandal employ almost identical patterns of lacing, though they differ in certain details. According to Cressman (1942: 58), in the Running Loop variety, a cord was fastened through the binding loops along the margins of the sandal. The tie string was created by extending and twisting the weft plies together into cordage as they emerged at the toe. "... the weft is now run back forth through this rope, that is, through the eyes" (Cressman 1942: 58). A weft-formed tie string may be the only difference in binding between Cressman's Multiple Warp sandal Running Loop variety and the Dirty Shame Rockshelter Multiple Warp sandal. The absence of a weft-formed strap on the Dirty Shame Rockshelter's Multiple Warp sandals is possibly related to another structural aspect of this sandal type. The Dirty Shame Rockshelter specimens have a turned flap, the weft of which is continued from the sole, thus, the formation of a tie string from the wefts at the toe of the sole is impossible. Similarly, the use of a folded length of fiber to create the weft row pair prevents any extension of the weft at the heel. The Dirty Shame Rockshelter Multiple Warp sandals were therefore bound in two possible ways. In the first, two separate lengths of cordage were used, one of which was drawn through the binding loops while the other functioned as a tie. This produced a binding similar to Cressman's Multiple Warp sandal, Running Loop variety. The second possible binding method used one strap, and the lacing pattern would have been identical to that suggested below for the Spiral Weft sandal. This technique began, like the first, with a single length of cordage passed along the outer margin of the sandal with each end drawn through the binding loops on alternate sides of the sole. The free ends of the cordage were extended past the sole and were drawn diagonally across the toe. Each end then encircled the strap segment that had been inserted through the binding loops on the opposite sides of the sole. The binding operation proceeded toward the heel where the binding was secured, probably by knotting.

Both lacing techniques discussed above are essentially the same. They differ only in that in the second procedure, one lace function as two. In the second technique, the greater loop diameter may allow for the binding loops to be drawn over the foot toward the center of the sandals. This would have produced a similar configuration to the long tie loop of Cressman's (1942: 58) Weft Loop sandal variety. The weft of selvage loops in the Dirty Shame Rockshelter sample are tie loops in the manner of the Fort Rock sandal. Only construction techniques differ between the two types. The Multiple Warp lacing technique may be a structural improvement over the Fort Rock pattern because rather than placing tension on two to four points along the sole, it was more evenly distributed along the entire sole. The durability of the sole may also have been increased by securing the binding loops through the cordage-like loops at the ends of the weft rows rather than simply affixing them to an unwisted warp. The Multiple Warp "tie loops" also restrict the motion of the tie string and do not allow movement from one end of the sandal to the other. Although this limited the flexibility of the sandal it provided a better fit and to a degree reduced the friction on the loops and binding. All of these features probably increased the "lifespan" of the Multiple Warp sandal and minimized the need for repair or replacement of the binding.

The two loops found on adjacent weft courses at the toe and/or heel of Multiple Warp sandals at Dirty Shame Rockshelter is a trait not observed by Cressman (1942: 58). These doubled loops may have made a more durable binding attachment but may also have been used in lacing the sandal. There is a knotting technique called by Shaw (1962: 127) "two iron or brass rings." In this method, commonly used for fastening belts, an element is inserted through two loops or rings. The free end is then drawn over one of the loops and back through the other. This produces a flexible knot. Although it is conjectural, perhaps a similar technique was used in lacing the Multiple Warp sandals. In the first lacing pattern described above, this method may be used to attach the separate length of cordage that was drawn through the binding loops at both sides of the toe and heel. More likely, however, is the possibility that these adjacent loops served as a type of buckle for securing one or both ends of the tie string. Loops at both the heel and toe may indicate a variation on this lacing procedure. In the second lacing technique discussed above, the adjacent loops may have supported the cord drawn through the binding loops along the heel and/or toe, thus permitting control over the length of the "tie loops." This would also have eliminated the necessity of readjusting the binding string each time the sandal was worn, and the doubled loops would also have been a buckling device for the tie string. The small number of doubled selvage loops at either side of the Composite Loop variety sandal may support this reconstruction. The Selvage Loop sandal was better suited for this buckling technique than the Weft Loop sandal because the selvage loop allowed the "eyes" to pivot parallel to the plane of the sole. The loops are also closer to each other than on the Weft Loop variety. There are, therefore, many potential ways in which the doubled loops, tie strings, and bindings may have been employed on the sandals. Although each potential reconstruction has its speculative elements they deepen one's appreciation of the aboriginal knowledge of the fiber arts.

MULTIPLE WARP SANDALS, WEFT LOOP VARIETY BINDINGS

No. of specimens: 3, fragmentary.

Technique and Comments: Three Multiple Warp sandals of the Weft Loop variety have general associations with cordage fragments that may be remnants of bindings. Only one strap, however, is affixed to a sole. In this specimen, a length of Type III cordage (see CORDAGE) is drawn through three of the four binding loops at one side of the sole. The binding had broken and had been repaired with a square knot. The two remaining specimens are also Type III cordage. Although not attached to their respective sandal soles, these probably represent sandal strap fragments. None of the specimens is spliced.

Measurements: Attached strap.

Length: 40 cm.
Diameter: 6.1 mm.

Range and mean twist per centimeter: 1.5.
Range and mean angle of twist: 28°.
Measurements: Unattached straps.
Range in length: 9.3–10.3 cm.
Mean length: 9.8 cm.
Range in diameter: 3.2–6.0 mm.
Mean diameter: 5.6 mm.
Range in twists per centimeter: 1.0–1.5.
Mean twists per centimeter: 1.3.
Range and mean angle of twist: 26°.

Provenience:
Zone III
Raw material: Artemisia sp.
No. of specimens: 3

MULTIPLE WARP SANDALS, SELVAGE LOOP VARIETY BINDINGS

No. of specimens: 3, fragmentary.

Technique and Comments: Three Multiple Warp sandals of the Selvage Loop variety are associated with lengths of Type III cordage (see CORDAGE) and may be fragments of sandal bindings although none is presently attached to a sandal sole. One specimen was constructed by folding a length of S-spin fiber and Z twisting the free ends together. Another specimen has a splice in which new construction material was inserted between the pre-existing plies. One of the presumed straps has been mended with a square knot.

Measurements:
Range in length: 8.5–12.1 cm.
Mean length: 10.7 cm.
Range in diameter: 6.1–7.2 mm.
Mean diameter: 6.6 mm.
Range in twists per centimeter: 1.0–1.5.
Mean twists per centimeter: 1.3.
Range and mean angle of twist: 30°–36°.
Mean angle of twist: 33°.

Provenience:
Zone III
Raw material: Artemisia sp.
No. of specimens: 3

MULTIPLE WARP SANDALS, COMPOSITE LOOP VARIETY BINDING

No. of specimens: 1, fragmentary.

Technique and Comments: One Multiple Warp sandal of the Composite Loop variety is associated with an unattached length of Type III cordage. This specimen is unspliced and has been repaired with a square knot.

Measurements:
Length: 1.6 cm.
Diameter: 7.1 mm.
Range and mean twists per centimeter: 1.
Range and mean angle of twist: 32°.

Provenience:
Zone III
Raw material: Artemisia sp.
No. of specimens: 1

SPIRAL WEFT SANDALS, TOE COVERS, AND BINDINGS

SPIRAL WEFT SANDALS AND SANDAL COMPONENTS

No. of specimens: 44, fragmentary (Figures 107–113, 116).

Types of specimens: Sole with sock and binding; 1 sole with detached toe cover and binding; 1 soles with bindings, 21 soles with detached bindings, 4; soles, 36.

No. of individual forms represented: 37 (minimum).

Technique and Comments: The Spiral Weft sandals from Dirty Shame Rockshelter, of which there are no complete examples, correspond in general to sandals of the same type described by Cressman (1942: 59) from Roaring Springs Cave and Catlow Cave No. 1; however, certain attributes noted by Cressman, such as heel pockets, are absent from the Dirty Shame Rockshelter sample. The Spiral Weft sandal does not normally have a toe cover and is an open, flat sandal that in its shape resembles a braided rug. The Dirty Shame Rockshelter specimens are undecorated and are radially twined over Z twisted or S twisted warps (see Figure 107).

There are no intact Spiral Weft sandal soles from Dirty Shame Rockshelter. The most nearly complete specimen lacks the final weft circuit at the heel. The heel and toe of this sandal type are very similar in construction thus, although three specimens are nearly two-thirds complete, it is impossible to determine whether they are midsections and toes or midsections and heels. When it was worn, the Spiral Weft sandal sole tended to disintegrate most quickly at the outer weft circuit. Thirteen specimens from Dirty Shame Rockshelter represent the inner weft circuits of the sole, and 18 others are fragments of outer weft circuits. The remaining specimens are a variety of deteriorated warps and wefts.

Spiral Weft sandals are round to oval in shape. Unlike the type specimens from Catlow Cave No. 1 and Roaring Springs Cave, the sole of the Dirty Shame Rockshelter specimens lies flat with no indication that the margins were pulled slightly upward over the sides of the foot when laced. Maximum thickness usually occurs at the center of the sole, and this may have provided a slight support for the arch of the foot.

The Dirty Shame Rockshelter Spiral Weft sandal soles do not appear to have been made for right and left feet. Judging from wear patterns, however, two soles were worn on a right foot, and one was worn on a left foot. The 91 remaining specimens lack diagnostic wear patterns. In comparison to either the Fort Rock or Multiple Warp sandal types, the Spiral Weft sole is less yielding and does not readily conform to the shape of the foot. Spiral Weft sandals also probably tended to unravel before wear patterns were evident. Two soles may represent a right and left sandal pair. There are no "toy" or children's sandals in the assemblage, but judging by size the most nearly complete sole may have belonged to a woman or older child.
Twelve Spiral Weft sandal soles were constructed using three warps (see Table 13). This is the maximum number of warps in the Dirty Shame Rockshelter sample of this sandal type, but it is possible that some specimens originally contained more. Seven Spiral Weft soles are made with two warps. The remaining specimens are too fragmentary to determine the original number of sole warps. Among these sole fragments, 16 retain one warp, and seven others contain two warps. Two specimens are deteriorated with warps without warps. Sole warps were constructed from a ca. 24 cm-44 cm length of "spun" fiber or cordage which was folded in thirds so that the ends intersect at the midpoint. The warp was then twisted, probably by rolling it up or down the thigh. The cordage ends are secured by the initial weft circuit. Each Spiral Weft sandal warp is therefore a self-contained unit the length of which varies directly with the width of the sole. The warps are roughly perpendicular to the long axis of the sandal sole and are spaced at 2 cm-3 cm intervals. There are no warps at the heel and toe, so these areas are less stable than the rest of the sole. When the sandal was worn, the warps tended to shift or float throughout the sole. The measured distance between warps is therefore an approximation of the original distance in most instances.

The number and spacing of the sole warps has little or no correlation with overall sole length. There is only a 0.9 cm difference in average distance between the outer warps in the two-warped and three-warped sandals. The third warp may have helped to stabilize the sole.

The Spiral Weft sandal soles from Dirty Shame Rockshelter have four different warp constructions. Thirty-seven specimens are constructed from a slightly S-spun fiber which was then Z twisted with itself forming a Type III cordage warp (see CORDAGE). Four sandal soles have Type IV cordage warps, each created from a length of Z-spun fiber that was folded and S twisted with itself. Three Spiral Weft soles have compound cordage warps constructed with two-ply or three-ply cordage. Two of these specimens have Type IX cordage warps (see CORDAGE). The third specimen is constructed with compound cordage warps created by folding and Z twisting a length of Type VI cordage with itself. These three warps may either have been made from discarded cordage, or their construction may reflect an intentional attempt to strengthen the warp and improve the binding loop function. It is not established whether binding loops were established before or after the warp, and binding loops do not occur in specimens with cordage warps. New plies are added by inserting the new material beneath the exhausted ply.

An "eye" or loop is formed at each end of the warp when the ends are folded toward the middle. These are the binding loops for lacing the sandal, and they are found on both the medial and lateral sides of the sole (see Spiral Weft Sandal Bindings). The eye is kept open by the outer weft circuit, but the loop itself can rotate to diminish some of the torsion exerted on it by the binding. Twenty-six Spiral Weft sandals preserve binding loops. Ten (39.4%) specimens preserve one or more loops while five others (19.2%) have two loops preserved. Sandals with three, four, and six loops number three (11.5%), five (19.2%), and nine (31.5%) specimens in the sample, respectively.

It stands to reason that if two or three warps were standard in these sandals, the normal complement of loops was four or six, that is, two or three per side. As the loop is the folded end of a warp, it is a single-element construction. In most cases, the loop is also a single-ply element. Thirty-six loops are constructed with slightly S-spun material, and four are slightly Z spun. Warps made of compound cordage produced more durable loops.

The spatial relationship between the loop and the outer weft course is visible on only one specimen. The warp loop extends ca. 1.5 cm beyond the sole. The width and inner diameter of the loop are 2.8 cm and 0.7 cm, respectively. The size of the loop was principally determined when the warp was made, but it also depended upon the width of the weft in the sole and the diameter of the binding cord that was used.

Examination of two Spiral Weft sandal soles from Roaring Springs Cave and Catlow Cave No. 1, shows differences in warp construction and arrangement over the specimens from Dirty Shame Rockshelter. The Roaring Springs Cave and Catlow Cave No. 1 soles have continuous warps formed from a single length of cordage laid out in a sinuosoidal pattern. In contrast, the Dirty Shame Rockshelter Spiral Weft sandal warps are usually thicker, less flexible, and are individual constructions specifically made for use in these sandals. The cordage warps in the Roaring Springs Cave and Catlow Cave No. 1 specimens extend beyond the sole at the point of each change in warp direction. This forms a cordage loop that has a greater length, inner diameter, and, in most instances, greater strength than those on the Spiral Weft sandals from Dirty Shame Rockshelter. This continuous warp technique also produces four or six binding loops, but it requires four or six warps in the body of the sandal instead of the two or three seen in the Dirty Shame Rockshelter assemblage. This produced a more stable and more durable sole.

The continuous cordage warps found in the Roaring Springs Cave and Catlow Cave No. 1 collections have another advantage over the individual warp constructions found at Dirty Shame Rockshelter. The cordage plies can be untwisted a short distance from the toe or heel and pulled parallel to the long axis of the sandal. Each ply of the cordage warp is then used as an individual warp in the final three or four weft circuits. This helps stabilize the weft and consequently extends the useful life of the sandal. The ply ends are clipped just beyond the final weft circuit at the toe. At the heel, the cordage warps function with the weft to form a heel pocket. It can be readily appreciated that the individual, self-contained warps in the Dirty Shame Rockshelter Spiral Weft sandals do not confer these advantages. This may account for the absence of heel pockets from the Spiral Weft sandal inventory and may also explain the relatively large number of extensively fragmented specimens. Each of the two warp construction techniques has its own benefits and limitations. Continuous cordage warps probably produced a more durable sandal and one that could have a heel pocket whereas Spiral Weft sandals made with individual warps may have been able to be made more quickly.

All Spiral Weft sandal soles from Dirty Shame Rockshelter utilize two-ply, Z-twist warps. In 43 specimens, the individual weft plies are slightly S twisted. The sandal sole with compound cordage warps (see above) also has compound cordage weft plects. The use of cordage as both warps and wefts in this specimen possibly reflects an attempt to produce a more durable sole.

Twinning of the sole was begun by folding a length of twisted fiber or cordage 180° around the middle of a prepared warp. Both ends of this element function as weft plies, and they were Z twisted together two or three times before enclosing the second warp. In three-warped soles, the weft pair would be twisted two or three more times before engaging
the third warp. The direction of twining was then reversed and the pattern repeated as the weft spiraled out clockwise from the center of the sole. The comparatively few warps and large wefts produce a flexible sole but one that lacks the stability produced by frequent engagements of warps and wefts. The toe and heel of the sole are particularly unstable because of the lack of warps in these areas.

The looser weave of the Spiral Weft sandal may have dissipated heat better than the Fort Rock or Multiple Warp sandal forms; a function which the spiral design of the sole may itself have assisted, much like the wall of a coiled basket (see Adovasio 1970a) or a modern electricoven element.

Twining in the two Spiral Weft sandals from Catlow Cave No. 1 and Roaring Springs Cave is generally similar to that described above but was not begun by folding an element around a warp unit. Two weft plies were twisted together, and their "free" ends were laid out perpendicular to the other sole warps. These weft plies then became warps for the heel pocket and were engaged by each succeeding weft circuit at the heel in close simple twining with continuous weft selvages. Additional warp units were inserted into the initial weft course for stability. Twining was terminated by overhand knotting the weft to a binding loop at the heel pocket.

The fragmentation of most of the Dirty Shame Rockshelter Spiral Weft sandals obscures the technique by which twining was terminated and the weft secured. In one specimen, however, the outer weft circuit was secured to a warp with a square knot; however, this may be a mend. One Spiral Weft sandal sole preserves five weft circuits. This is the maximum number of weft rows seen in the Dirty Shame Rockshelter sample, but most sandals probably had one to three additional rows. Ten of the soles consist of preserved weft circuits, one of which is complete. The remaining four-weft, two-weft and one-weft circuit configurations are fragments and constitute 9.1%, 9.1%, and 2.9% of the sample, respectively. The number of complete weft circuits on 26% of the Spiral Weft sandal soles is undeterminable. The more nearly complete specimens have the same general number of weft circuits as noted by Cressman (1942: 61) for the Roaring Springs Cave and Catlow Cave No. 1 sandals. Cressman indicates that these soles are nine, 10, or 12 "wet rows across." This means that these specimens have four to six revolutions of twining.

Original length can be estimated on only one Dirty Shame Rockshelter Spiral Weft sandal sole. Stone length is, obviously, a correlate of the number and diameter of the weft circuits. As the number and spacing of the individual warps remained relatively the same, even when warp diameter was increased, the Spiral Weft sandal sole was possibly less stable at longer lengths. This may have set a maximum upper limit on its length.

Although there is some variation in the width of the weft row in various Spiral Weft sandal specimens, 13 of the soles are sufficiently intact to conclude that, in general, wefts were thicker at the center of the sandal sole (where twining begins) but became progressively thinner as the weft spiraled out toward the outer margin of the sole. This, of course, promoted greater flexibility at the sides of the sandal and, conversely, greater rigidity and support beneath the center of the foot.

The Dirty Shame Rockshelter Spiral Weft sandals exhibit two main weft splicing techniques. In the first and most common method, a bundle of slightly spun material is inserted beneath the exhausted weft ply. Two specimens display variations on this technique. In one sole, the new S-spun element is 2 twisted together with the exhausted weft ply. In another sole, a weft splice in the outermost weft circuit has been created by inserting a folded length of Type III cordage (see CORDAGE) between each S-spun weft. Each half of the folded cordage supplies new weft material for the twining process, and this again indicates a possible use for discarded pieces of cordage. The second major weft splicing technique joins new S-twist material to the old material with an overhand knot.

In 14 Dirty Shame Rockshelter Spiral Weft sandals, the work surface (as defined by Cressman 1942, the side that contains the splints) is the top of the sole, whereas in six other specimens the work surface is the sole bottom. The work surface of 26 soles is not discernible. Work surface is not correlated with warp type, number of warps, or sandal provenience.

Two Spiral Weft sandal soles have unique attributes. The top of one sole, the most nearly complete Spiral Weft sandal in the assemblage, contains a length of slightly S twisted fiber located 6.9cm from the toe. The 9.2cm-long fiber bundle parallels the sandal's short axis. The ends of this element are inserted between the outer and adjacent weft circuit at the medial and lateral sides of the sole. The fiber bundle is disintegrated on the bottom of the sole, but the ends were probably originally joined by knotting. This may be a type of "grid" similar to that noted by Cressman (1942: 51-53) for the Fort Rock sandal type; however, it seems more likely that it is a reinforcement for the weft circuits.

Another specimen has three indentations on the bottom of the sole parallel to the warps. These are the imprints of three elements, each measuring 3.5mm in diameter and separated at a distance of 3.5cm and 5.8cm. The indentations are directly beneath the sole warps and the binding loops and may be from the binding straps. Alternatively, they may be "grids" or reinforcements similar to the one described above.

Only one Dirty Shame Rockshelter Spiral Weft sandal sole contains a possible mend. The outermost weft of this specimen is secured to a warp with a square knot. The scarcity of mends on these sandals may be a valid observation or may itself be an artifact of preservation. Logically, mends would have been most frequent at the margins of the sole where abrading was greatest. This is the part of the sandal that is least well-preserved in the Spiral Weft assemblage. It is also possible that making new sandals was simply easier than repairing old ones. Only one sole in the Spiral Weft assemblage, for example, has been worn to the point of perforation. This suggests that these sandals were more likely to have "come apart" before they could be worn through.

Shredded and macerated Acaciaum sp. fibers are associated with two Spiral Weft sandal soles. One specimen is encrusted with coprolitic materials. Thirteen soles are slightly charred.

Measurements: Specimens without preserved warps.
Length: N.A.
Width: N.A.
Measurements (cont.):

Sole thickness: N.A.
Range in wet width: 8.9-10.4 mm.
Mean wet width: 9.7 mm.
Range and mean wett width per centimeter: 1.
Range and mean gap between wett width: 0.
Range and mean binding loop element diameter: N.A.

Provenience:

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<th>No. of specimens</th>
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<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>7</td>
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Measurements: Specimens with Type III cordage warps.

Range in length (more complete specimens): 6.5-21.0 cm.
Mean length: 13.8 cm.
Range in width (more complete specimens): 9.0-21.0 cm.
Mean width: 16.3 cm.
Range in sole thickness: 0.9-2.5 cm.
Mean sole thickness: 1.3 cm.
Range in warp diameter (specimens with equal-sized warps): 8.1-17.5 mm.
Mean warp diameter (specimens with equal-sized warps): 12.1 mm.
Range and mean warp diameter (specimens with unequal-sized warps): 11.9-18.2 mm.
Range and mean warps per centimeters: 1.
Range in gap between warps: 2.3-7.0 cm.
Mean gap between warps: 3.9 cm.
Range in wet width (specimens with equal-sized warps): 8.7-20.1 mm.
Mean wet width (specimens with equal-sized warps): 13.3 mm.
Range in wet width (specimens with unequal-sized warps): 6.5-24.9 mm.
Mean wet width (specimens with unequal-sized warps): 14.4-16.6 mm.
Range and mean wett width per centimeters: 1.
Range and mean gap between wett width: 0.
Range in binding loop element diameter: 3.9-11.4 mm.
Mean binding loop element diameter: 6.9 mm.

Provenience:

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<td>19</td>
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<td>VI</td>
<td>Artemisia sp.</td>
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Measurements: Specimens with Type IV cordage warps.

Length: N.A.
Width: N.A.
Range in sole thickness: 1.2-2.5 cm.
Mean sole thickness: 1.9 cm.
Range in warp diameter: 5.6-12.7 mm.
Mean warp diameter: 9.2 mm.
Range and mean warps per centimeters: 1.
Range and mean gap between warps: N.A.
Range and mean wet width (specimens with equal-sized warps): 14.9 mm.
Range in wet width (specimens with unequal-sized warps): 10.1-18.2 mm.
Mean wet width (specimens with unequal-sized warps): 14.2 mm.
Range and mean wett width per centimeters: 1.
Range and mean gap between wett width: 0.
Range in binding loop element diameter: N.A.
Mean binding loop element diameter: N.A.

Provenience:

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<td>Artemisia sp.</td>
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Measurements: Specimens with Type IX cordage warps.

Range in length: 11.0-16.0 cm.
Mean length: 13.6 cm.
Range in width: 11.3-17.5 cm.
Mean width: 15.3 cm.
Range in sole thickness: 1.1-1.3 cm.
Mean sole thickness: 1.2 cm.
Range in warp diameter: 7.4-10.1 mm.
Mean warp diameter: 8.3 mm.
Range and mean warps per centimeters: 1.
Range in gap between warps: 3.2-3.8 cm.
Mean gap between warps: 3.3 cm.
Measurements (cont.):
- Range and mean weft width (specimen with equal-sized wefts): 11.5 mm.
- Range and mean weft width (specimen with unequal-sized wefts): 10.2-13.1 mm.
- Range and mean weft rows per centimeter: 1.
- Range and mean gap between weft rows: 0.
- Range in binding loop element diameter: 5.2-8.3 mm.
- Mean binding loop element diameter: 7.0 mm.

Provenience:

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Measurements: Specimen with repiled Type VI cordage warps.

- Length: 6.0 cm.
- Width: 20.0 cm.
- Sole thickness: 1.7 cm.
- Warp diameter: 17.5 mm.
- Warps per centimeter: 1.
- Range and mean gap between warps: N.A.
- Weft width: 17.4 mm.
- Range and mean weft rows per centimeter: 1.
- Range and mean gap between weft rows: 0.
- Range in binding loop element diameter: 7.3-9.5 mm.
- Mean binding loop element diameter: 8.6 mm.

Provenience:

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<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
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</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>1</td>
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SPIRAL WEFT SANDAL TOE COVERS AND SOCK

Technique and Comments: As previously noted, the Spiral Weft sandal does not normally have a flap or toe cover. This is probably due to the structural aspects of the sole which do not accommodate any of the more conventional methods of flap construction, that is, there is no way to extend the sole warps or to transform them into flap warps. The absence of toe covers may also be related to function. If the suggestion (see above) that the Spiral Weft sandal dissipates heat more effectively than other sandal types is correct, a toe cover would work against this purpose. Thus, this sandal type may usually have been made without a flap or toe cover. Nevertheless, two of the Dirty Shame Rockshelter Spiral Weft sandals do have what appear to be makeshift toe covers. The first of these specimens contains an artifact that is interpreted to be a sock (see Figure 112). It is a twined globular bag in association with a sandal sole made with Type III cordage warps. The bag is constructed by simple or plain twining on single-ply, unspun warps. The warps are two-ply, unspun elements with a final stitch slant of 2. Weft rows are regularly spaced at intervals and expose the warps. The method of starting is obscured by wear but appears to be rotary twining over perpendicular warps. Approximately 4 cm from its center the bag bifurcates, and the rotary twining ceases. The point of bifurcation is reinforced with an unspun length of fiber. This element was inserted around the outermost warp on one side of the bifurcation and around the warp adjacent to the outermost warp on the other side. The ends of this fiber bundle were probably originally joined by knotting, but attrition has caused its partial disintegration. The side selvage on the bifurcated edges are of the continuous weft with one twist variety. The end selvage is unaseasable but probably consisted of simple warp truncation. Additional warps were simply inserted into pre-existing weft crossings. The ends of the new warps are unclipped. New weft material was secured to the exhausted weft ply with an overhand knot. The original sock length exceeded 18.5 cm and would have covered the toes, bottom, sides, and most of the top of the foot. Only the arch of the foot above the split in the sock, and the heel would have been exposed. The sock was probably bifurcated to admit the foot and ankle of the wearer. The sock would have cushioned the foot, provided warmth, and protected the wearer from binding strap abrasion and environmental hazards. The sock is associated with a sandal that seems to have been worn on the right foot. On the basis of size, it was probably the footwear of a child or woman. The toe of the sock is extremely worn, probably from repeated shifting backwards and forward when it was being used. Part of the sock heel is missing.

Another Spiral Weft sandal sole with Type III cordage warps has a small mat-like item on top of it. This twined mat is not attached to the sole and in fact may be a fortuitous association. The specimen is extremely friable and for this reason could not be more closely examined. The width of this flap-like mat does fall within the range of the soles of the Spiral Weft sandals, so it may be an impromptu flap laid over the foot before lacing. It is made of plain twining over 13 single, unspun warps that parallel the long axis of the sandal sole. Warps in the presumed flap are two-ply, unspun material with a final stitch slant of 2. The weft rows are regularly spaced and expose the warps. Although incomplete in length, the specimen contains three extant weft rows. The warps at one end are clipped, but the warp treatment at the other end is not assessable. New weft material was wrapped around the warp before twining began. No warp splices are evident. Part of one end of this specimen appears to have been cut off during excavation. Attrition wear is visible on one side of this flap. As is true of the associated sole, one end of this item is slightly charred. Some isolated specimens that are very similar in construction to this were also recovered at Dirty Shame Rockshelter and are discussed in the chapter on miscellaneous perishables (see also Untyped Sandal Toe Covers).

Measurements: Sock.

- Maximum length (along warp axis): 18.5 cm.
- Maximum width (along weft axis): 11.5 cm.
- Range in weft width: 2.5-3.4 mm.
- Mean weft width: 4.6 mm.
Measurements (cont.):
Range in warp width: 5.3-10.3 mm.
Mean warp width: 7.8 mm.
Range in warps per centimeter: 1-2.
Mean warps per centimeter: 1.5.

Range and mean wefts per centimeter: 1.
Range and mean gap between weft rows: 1.9 cm.

Proveniences:

<table>
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<th>Zone</th>
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<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
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</table>

Measurements: Flap.
Maximum length (along warp axis): N.A.
Maximum width (along weft axis): N.A.
Range in warp width: 7.9-10.8 mm.
Mean warp width: 9.6 mm.
Range in warps per centimeter: 1-2.
Mean warps per centimeter: 1.5.
Range and mean wefts per centimeters: 1.
Range and mean gap between weft rows: 3.9 cm.

Proveniences:

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<td>Artemisia sp.</td>
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SPIRAL WEFT SANDAL BINDINGS

Techniques and Comments: Only two Spiral Weft sandals from Dirty Shame Rockshelter retain bindings or straps that are attached to the sole. In the less complete sandal specimen, a 50.5 cm length of Type III cordage is inserted through two of the binding loops on one side of the sole. The previously described specimen with the twines sock also gives the best evidence of how these sandals were laced. This specimen contains two lengths of Type III cordage, one of which is strong through the two extent loops along the medial margin of the sole.

Based on these two specimens, it appears that a length of two-ply cordage was run along the margin of the sandal with each end drawn through the warp loops located at the sides of the sole. If this cord was not strong through the loops before the sole was twined, an awl would have been necessary to introduce it. The free ends of this cord were extended beyond the body of the sole at the toe, and both ends were then drawn diagonally (left over right) across the sole wrapping that portion of the strap between the first two loops on either side of the sole. The extant binding is fragmented at this juncture, but the two strap ends were probably then reconsecrated and wrapped around the cordage between the second (where present) and third warp loop of the heel. The lace was then probably knotted. Other lacing techniques may also have been used. Note that in the Dirty Shame Rockshelter Spiral Weft sandal lacing technique, the cordage element that makes up the two straps also forms the tie loops. This contrasts with the binding components of the Roaring Springs Cave and Callow Cave No. 1 specimens in which tie loops are produced in the warps of the sole. The Roaring Springs Cave and Callow Cave tie loops are long enough for them to have been drawn up on top of the foot and secured with a tie string (Cressman 1942:59). The Dirty Shame Rockshelter warp loops, however, are too short for this. This reconstruction of the lacing pattern may also help to explain the absence of heel pockets from the Dirty Shame Rockshelter Spiral Weft sandals. The strap that ran across the heel of the sandal sole may also have provided sufficient support for the heel of the wearer's foot. Both of the straps described above are attached to sandal soles that are themselves constructed with Type III cordage warps. The binding cord diameter fluctuates considerably along its length, and splices are made by inserting new 5-span material beneath the exhausted ply. One strap had been repaired twice in antiquity, each time with a square knot. After the first break, the two cordage fragments were simply knotted back together. The second tear required a new cordage element that was square knotted to the strap remnant. Both straps show wear from abrasion and from tension being placed on them.

Four Dirty Shame Rockshelter Spiral Weft sandals are associated with but not attached to possible strap cords. These cordage specimens were recovered with three sandal soles that use Type III cordage warps and one sole that employs Type IX cordage warps (see CORDAGE). Three straps are made of Type III cordage. The fourth specimen is compound cordage of Type III and Type II Apocynum sp. cordage plus an unspun bundle of Artemisia sp. fiber. These three elements are tied together with overhand, square, and lark's head knots. This item may or may not be a strap fragment, but if it is, it not only represents a repair but also an apparent attempt to strengthen the strap by substituting Apocynum sp. cordage. One strap fragment has a splice in which new 5-span material is inserted between the two plies.

Measurements: Attached straps.
Range in length: 30.0-51.5 cm.
Mean length: 36.8 cm.
Range in diameter: 4.7-10.3 mm.
Mean diameter: 5.8-8.9 mm.

Range and mean twists per centimeter: 1.0.
Range in angle of twist: 30°-42°.
Mean angle of twist: 36°.

Proveniences:

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<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>2</td>
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</table>
Measurements: Detached straps.
- Range in length: 10.5-28.0 cm.
- Mean length: 17.2 cm.
- Range in diameter (specimens of equal diameter): 6.1-10.3 mm.
- Mean diameter (specimens of equal diameter): 8.2 mm.
- Mean diameter (specimens of unequal diameter): 2.3 mm.
- Range in twists per centimeter: 1.0-2.0.
- Mean twists per centimeter: 1.5.
- Mean angle of twist: 34°.

Proveniences:

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<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp./Agropyrum sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
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MISCELLANEOUS, UNTYPED SANDAL FRAGMENTS AND SANDAL COMPONENTS

This category consists of 37 Dirty Shame Rockshelter sandal fragments, many of which are badly decomposed, that cannot be assigned to a specific sandal type.

UNTYPED OPEN-TWINED SANDALS

- No. of specimens: 2, fragmentary (Figures 114, 115).
- Type of specimens: soles, 2.
- No. of individual forms represented: 2.

Technique and Comments: Two badly fragmented Dirty Shame Rockshelter sandals cannot be assigned to any one of the three types proposed by Cressman (1942) that are discussed above. The two specimens, which do not compose a pair, resemble the Multiple Warp sandal. Weft Loop variety in that they are plain twined over a variable number of warps. Apparently, the sandals were rectangular to oval in outline and shoe-like or slipper-like in appearance. The sides of the soles would have been extended up and over the foot when the sandal was laced. The sandals are, however, open twined, whereas Multiple Warp sandal soles are closed twined. Wefts were also used in the soles are uniform in thickness although somewhat thinner than Multiple Warp sandal soles. Wear patterns on one sole suggest it was worn on a right foot, but wear patterns on the other sole are unspecific. Neither sole was intentionally made for right and left feet.

The more nearly complete fragment is a 17.0 cm long by 12.5 cm wide portion of the heel and adjacent sole. The other specimen is a 15.0 cm long by 8.0 cm wide midsection fragment. Both appear to be from adult footwear. The more nearly complete sole was probably not constructed with a heel pocket. As with Multiple Warp sandals, the sole warps were apparently arranged in a series of concentric parabolas. The open end of this configuration forms the toe, and the warps are parallel to the long axis of the sole. Sandal size was probably determined in the way that Multiple Warp sandal size was controlled (see above). Neither sole is complete in its width, but they preserve eight and 11 untwisted warps, respectively. The original warp pattern is unknown, but in the 11-warps sole, five warps are merged with an adjacent warp to form six warps, and conversely, six warps are subdivided to form 11 warps. Warp splice techniques also include laying new material on top of the pre-existing warp and securing it with the two-ply, Z twist weft. Wefts in one specimen are untwisted; those on the other are Type III cordage. One weft splice shows new material bound under the exhausted weft. Twining probably began at the heel and proceeded toward the open end or toe although this is uncertain. The method of twining termination is unknown. Side selvages are of the continuous weft with one twist variety.

There is no indication, of course, of a toe flap, but binding loops on the two miscellaneous sandals are similar to those on Multiple Warp sandals of the Weft Loop variety, i.e., they are formed by Z twisting the ends of the two weft plies together two to seven times before beginning the next weft course. In one case, this has produced a loop of Type III cordage. The loops are as wide as they are long, and the number of twists per loop varies with the diameter of the weft plies. The loop eyes are perpendicular to the plane of the sole. Each specimen retains two loops. On one specimen, both loops are on adjacent weft rows along the medial margin of the sole. The loops on the other specimen are also on adjacent weft rows beginning with the third row of wefts. The position that other loops would have occupied on the sandals cannot be reconstructed.

The soles show no nicks or repairs, but both are charred and extensively worn along the sides and bottom; one specimen is perforated at the heel.

Measurements:
- Extant length (more nearly complete specimen): 17.0 cm.
- Extant width (more nearly complete specimen): 12.5 cm.
- Extant length (second specimen): 15.0 cm.
- Extant width (second specimen): 8.0 cm.
- Range and mean heel pocket height: N.A.
- Range in sole thickness: 7.6-7.7 mm.
- Mean sole thickness: 7.63 mm.
- Range in untwisted warp diameter: 4.5-11.2 mm.
- Mean untwisted warp diameter: 7.2 mm.
- Range and mean cordage warp diameter: 4.5 mm.
- Mean weft width: 6.7 mm.
- Range and mean weft rows per centimeter: 1.
- Range in gap between weft rows: 1.6-2.2 cm.
- Mean gap between weft rows: 1.9 cm.
- Range in binding loop length: 1.7-2.1 cm.
- Mean binding loop length: 1.9 cm.
- Range in binding loop width: 1.3-3.0 cm.
- Mean binding loop width: 2.3 cm.
- Range in binding loop inner diameter: 0.87-1.6 cm.
- Mean binding loop inner diameter: 1.1 cm.
Measurements (cont.):
Range in warps per centimeter: 1.0-1.3.
Mean warps per centimeter: 1.2.
Range in weft width: 5.5-8.3 mm.

Proveniences

<table>
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<tr>
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<th>No. of specimens</th>
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<tbody>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>2</td>
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UNTYPED SANDAL SOLE FRAGMENTS

No. of specimens: 24, fragmentary.
Type of specimens: Soles, 24.
No. of individual forms represented: N.A.

Technique and Comments: Twenty-four sandal fragments from Dirty Shame Rockshelter are too incomplete to assign them to any established type. They probably represent a variety of worn-out sandals and fragments thereof. All specimens are plain twined over single warps. Fifteen specimens retain one warp; seven other soles preserve no warps, and two others contain two warps each. Thirteen specimens use untwisted warps. Two specimens have loosely Z twisted warps; another has slightly S twisted warps. Warp treatment on seven sole fragments is unknown. Another sole fragment retains a single warp of Type III cordage (see CORDAGE). One specimen shows "W" splicing of adjacent warps.

All specimens use two-ply wefts. Twenty-one fragments have a final stitch slant of Z; the stitch slant cannot be determined on the other fragments. One to three weft courses are preserved. Eight specimens are close twined and conceal the warps. The remaining sole fragments retain only part of a single weft row thus obscuring the original weft row spacing. The individual weft plies of 13 specimens are slightly S twisted while those of 11 others are untwisted. Extant weft splice types include the insertion of additional material beneath an exhausted weft ply and the attachment of the new weft material to the old with an overhand knot. Eight fragments represent sandal sole margins with continuous weft side selvages of the one twist variety. The specimens are unmended but heavily worn. Seven specimens are encrusted with coprolitic material, and six are charred.

Nine of these fragments are possible remnants of Spiral Weft sandals; six others are probably from Fort Rock Sandals. Seven specimens are either fragments of Fort Rock or Multiple Warp sandals.

Measurements:
Length: N.A.
Width: N.A.
Heel pocket height: N.A.
Range in warp diameter: 5.1-10.1 mm.
Mean warp diameter: 8.1 mm.

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<tr>
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<th>No. of specimens</th>
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<tbody>
<tr>
<td>III</td>
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<td>13</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>9</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
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UNTYPED SANDAL TOE COVERS(?)

No. of specimens: 6, fragmentary.
Type of specimens: Toe covers(?) 6.
No. of individual forms represented: 6.

Technique and Comments: Six small mat-like constructions were recovered from Dirty Shame Rockshelter that are rectangular in plan, uniform in cross section, but variable in size. No one specimen is complete in all dimensions, but five of them are complete in width. The specimens are open plain twined over eight to 13 single warps. Specimen width varies with the number and diameter of the warps. Four items have slightly Z twisted warps. One specimen has untwisted warps, and another exhibits loosely Z twisted warps and an outer warp of Type III cordage (see CORDAGE). New warps are created by subdividing old warps, usually two per specimen. Warps are spliced by laying new warp material over old warps at a weft crossing. Two specimens have clipped end selvages; another exhibits a 90° self selvage. Wefts are untwisted and invariably two ply with a final stitch slant of Z. Weft row spacing is slightly irregular. The technique used to initiate twining is unknown. Weft plies are spliced by inserting new material beneath the exhausted ply or by knotting it to the old ply with an overhand knot. Side selvages are of the continuous weft variety with one or two twists between each weft row.

These specimens are identical in shape and construction to the potential flap found on top of a Spiral Weft sandal (see SPIRAL WEFT SANDAL TOE COVERS AND SOCK). We speculate that these six mat-like constructions may have been foot and ankle guards used in combination with the Spiral Weft sandal. It is also conceivable that they are some type of Multiple Warp sandal toe cover or, perhaps artifacts whose function was unrelated to sandals. If these are sandal flaps, one of them to judge by its smaller size, may have been used by a child. The specimens are uncharred. Associated with one artifact is a length of Type III cordage (see CORDAGE) that may be part of a sandal strap or binding.
Measurements: Toe covers.
Range in length: 11.6-34.0 cm.
Mean length: 17.6 cm.
Range in width: 6.0-13.7 cm.
Mean width: 9.3 cm.
Range in warp diameter: 1.5-12.0 mm.
Mean warp diameter: 6.3 mm.
Range and mean cordage warp diameter: 8.8 mm.

Provenience:
Zone Raw material No. of specimens
III Artemisia sp. 1
IV Artemisia sp. 2
VI Artemisia sp. 3

Measurements: Type III Cordage binding (9).
Length: 19.1 cm.
Diameter: 6.6 mm.

Provenience:
Zone Raw material No. of specimens
IV Artemisia sp. 1

UNTYPED SANDAL BINDING FRAGMENTS
No. of specimens: 2, fragmentary.
Type of specimens: Bindings, 2.
No. of individual forms represented: 2.

Technique and Comments: Two lengths of Type III cordage (see CORDAGE) are associated with but not attached to two untyped sandal sole fragments (see above). Both specimens are probably remnants of straps or other binding accessories. One specimen was made by folding a length of 5 twisted fiber 180° and 2 twisting both ends together. This technique is known for Fort Rock sandals and suggests that the strap and its associated sole belong to this sandal type. Splices in the binding secure new material beneath the exhausted ply.

Measurements:
Range in length: 6.5-12.0 cm.
Mean length: 9.3 cm.
Range in diameter: 6.7-8.2 mm.
Mean diameter: 7.4 mm.

Provenience:
Zone Raw material No. of specimens
III Artemisia sp. 1
IV Artemisia sp. 1

SANDAL CUSHIONS (9)
No. of specimens: 5, fragmentary.
Type of specimens: Sandal cushions(9), 5.
No. of individual forms represented: 5.

Technique and Comments: Five compressed pads of Artemisia sp. fibers were recovered from Dirty Shame Rockshelter. The material is stripped and folded but otherwise unprepared. Each pad has a rounded or curved end similar in shape and size to the toe of sandals from the site. As indicated in the discussion of the Fort Rock sandal cushion (see above), these pads may have been used as temporary mending devices for the sandal sole or as cushions. Although we speculate that these fiber pads may have been used in conjunction with sandals, they are not directly associated with them; thus, the pads may also have been used in bedding, as construction material, or for a variety of other purposes.

Measurements:
Range in length: 7.5-14.0 cm.
Mean length: 9.6 cm.
Range in width: 7.5-14.0 cm.

Provenience:
Zone Raw material No. of specimens
I Artemisia sp. 1
II Artemisia sp. 1
VI Artemisia sp. 2
Prov. Unk. Artemisia sp. 1

Internal Correlations

TECHNOLOGY

The frequency and distribution of sandals at Dirty Shame Rockshelter have been plotted in Table 12 by stratigraphic zone. As indicated there, Multiple Warp sandal types collectively dominate the assemblage (36% of all sandals). Spiral
Sandals

Weft sandals are next most populous and make up 26% of the assemblage. Fort Rock sandals represent ca. 18%. The remaining ca. 22% includes miscellaneous sandal fragments of unknown type. Excluding the last of these categories, the Multiple Warp, Spiral Weft, and Fort Rock sandal types represent ca. 94%, 33% and 23%, respectively, of sandal specimens that can be assigned to a specific type.

Within the numerically preponderant Multiple Warp type, the Weft Loop variety accounts for slightly more than 30%; the Selvage Loop and Composite Loop varieties constitute 28% and slightly more than 3% of this type, respectively. Specimens of unknown loop type also make up somewhat more than 34% of the Multiple Warp sandal inventory.

All Dirty Shame Rockshelter sandals that can be typed are close simple twined with paired wefts over single warps. Warp and weft preparation is usually minimal with a very slight twist of a single element in the case of the Multiple Warp and Fort Rock sandal types. The Spiral Weft sandal type can use "cordage" warps, although this is not cordage in the strict sense of the term but rather a doubled and twisted length of fiber.

The technological simplicity of sandal construction, the raw materials chosen, and the nearly complete absence of sandal reinforcement produced footwear that was serviceable and easily made but also fragile. It is therefore unsurprising that complete sandals are absent from the assemblage. Table 13 has summarized the recovered sandals in terms of the number of preserved warps. As examination of that table suggests, most Dirty Shame Rockshelter sandals are badly disintegrated from use. Their condition is not attributable in most cases to post-depositional decomposition. The Spiral Weft sandal is the most prone to premature disintegration among the Dirty Shame Rockshelter sandal types as it tends to unravel very easily. Despite the potential for greater durability inherent in a Multiple Warp sandal sole (see p. 100), the Fort Rock sandal, in practice, is the most durable of the three types. This directly attributable not only to its stable sole design but to its more regular execution. Not one of the three major Dirty Shame Rockshelter sandal types would have required the amount of time necessary to produce, for example, a Basketmaker/Anasazi woven sandal, but the Fort Rock sandal did demand the greatest expenditure of time in raw material preparation, layout, and execution among the three types. The Spiral Weft sandal was possibly the most easily made of the three sandal types. It required the least raw material preparation, and its workmanship is far less precise than that of the other two sandal types. The Multiple Warp sandal was probably intermediate both in the time required to make it and in its durability.

Comparison of measurable attributes on the three major sandal types shows few statistically significant differences within each type from different zones. Attributes such as warp diameter were compared for each sandal type within each zone in which they occur. The Zone VI and IV Fort Rock sandals show no significant differences in sole width (t = -0.95, p = 0.3692), warp diameter (t = -0.16, p = 0.8811), or weft diameter (t = 0.02, p = 0.9811).

The Zone III Multiple Warp sandals are significantly longer (t = 3.48, p = 0.0000), have more binding loops (t = 5.50, p = 0.0071) than those from Zone IV. The number of warps (t = 2.30, p = 0.020), and weft diameter (t = 1.23, p = 0.243), however, show no significant zonal differences.

Within the Multiple Warp sandals of Zone III, there are no statistically significant differences between sandals of the Weft Loop and Selvage Loop varieties with respect to overall length (t = 0.51, p = 0.6199), warp diameter (t = 0.20, p = 0.834), weft diameter (t = 0.13, p = 0.895), number of binding loops (t = 0.85, p = 0.406), or distance between adjacent binding loops (t = 0.52, p = 0.6199). The sample size of Multiple Warp sandals of identifiable loop variety is too small to permit similar comparisons.

Statistical analysis of Zone VI and IV Spiral Weft sandal attributes also reveals no significant differences in the number of warps used (t = 0.09, p = 0.932), the number of weft circuits (t = -1.43, p = 0.161), overall length (t = -1.08, p = 0.293), distance between warps (t = -0.36, p = 0.723), weft diameter (t = -0.24, p = 0.808), or warp diameter (t = 1.36, p = 0.194).

The analysis of the Dirty Shame Rockshelter sandals suggests that although they were important in their way they were also artifacts with a very limited longevity in the day-to-day life of the site's inhabitants. The near absence of major mending and the relatively large numbers of fragments suggests that sandals were worn until worn out or, more likely, until they fragmented. Old sandals were most probably discarded and new ones quickly made from readily available raw materials that required a minimum of processing or preparation.

Use and Functions

In some prehistoric societies, sandals and other footwear were often elaborately made and the objects of decoration. In other populations (e.g., the prehistoric Coastluteans), sandals are effective cultural markers for the archaeologist. Wherever they were in use aboriginally, sandals served a variety of specific functions. A few of these functions are discussed below based upon documentation available in the ethnographic literature.

**Winter Wear/Snow Travel:** Among the Modoc (Kroeber 1933) and Klamath (Spier 1930; Barrett 1910), "tule slippers" were worn during the winter. The Achomawi (Voegelin 1942) used a sagebrush (Artemisia sp.) sandal. The Washo (Price 1962) are said to have used a sagebrush (Artemisia sp.) sock or cedar (Juniperus sp.) bark wrapping inside their moccasins during cold weather. Other groups are reported to have used sandals specifically for walking on snow. Tule sandals also were used by the Shasta (Voegelin 1942), Modoc (Kroeber 1933; Voegelin 1942), Klamath (Voegelin 1932), and Paiute (DeAngelo and Freel 1929) expressly for this purpose. Of the Klamath, Fremont (1853) observed that their shoes were made of straw or grass and that they were well-adapted for snowy country. The Paiute also wore sagebrush (Artemisia sp.) sandals in the snow as did the Panamint. The Shiwish (Lowe 1922) wore yucca (Yucca sp.) sandals for the same purpose.

**Marsh Wear:** The Modoc (Kroeber 1923) and Klamath (Barrett 1910) were tule (Scirpus sp.) "slippers" for marsh wading. Barrett (1910:225) reports of Klamath tule slippers: "A layer of dry grass is placed in the bottom to make them warm, and it is said that one might in the dead of winter walk with comparative comfort through marshes where the water is extremely cold."
Wet Wear: The Achomawi (Kroeber 1935; Vogel 1942) wore tule (Scirpus sp.) "slippers" in wet spring weather (Vogel 1942). The Paiute (DeAngulo and Freedland 1929) wore both tule (Scirpus sp.) and sagebrush (Artemisia sp.) "moccasins" under the same conditions. Johnson (1975:12) notes that sagebrush (Artemisia sp.) bark was used for "shoes" because it "...did not shrink like buckskin does after getting wet." Kelly's (1932:109) Surprise Valley Paiute informant, however, claimed that tule (Scirpus sp.) was no good for shoes. Sagebrush (Artemisia sp.), however, was said to be warm even if it got wet. Sagebrush (Artemisia sp.) "moccasins" were apparently worn to fetch water.

Rough Terrain Wear: The Gabrieliño wore yucca (Yucca sp.) fiber sandals for traveling over rough terrain, while the Diegueno (Kroeber 1935) wore mesquite (Prosopis sp.) sandals when traveling over "thorny ground.

House Wear: The Modoc (Kroeber 1935) wore tule (Scirpus sp.) "slippers" around the house.

Traveling: For traveling, the Klamath (Spier 1930) made "moccasins" of "swamp grass" instead of tule (Scirpus sp.) whereas the Southern Paiute (Wheeler 1973) manufactured yucca (Yucca sp.) "figure eight type" sandals for the same purpose.

One cannot be certain that the Dirty Shame Rockshelter sandals were used in any of these ethnographically documented ways, but certain uses can be inferred with some confidence based upon the technological aspects of sandal construction. The ingenious twined flap of the Fort Rock sandal and to a lesser degree the toe cover of the Multiple Warp type would have warmed and protected the foot. The twined Dirty Shame Rockshelter Multiple Warp sandal flap would have been as effective for these purposes as the long bindings of Cressman's (1942) Multiple Warp sandals when the latter had been drawn back over the untwined toe covers. The absence of a toe flap from the Spiral Well sandal type suggests to us that warmth and protection for the top of the foot were not primary considerations in using this sandal type.

The narrower Fort Rock sandal and the Multiple Warp sandal types both distribute weight evenly along the long axis of the foot. The Spiral Well sandal, however, "gives" at the sides distributing weight over a broader area. It therefore may have been better adapted for walking on snow (perhaps used with a sock or stuffing), sand, or swampy ground. The Klamath, for example, wore snowshoes or snowshoe-like footgear for traveling over marshy ground (Barrett 1910; Spier 1930), and it is likely that the Spiral Well sandal was used in the same way at Dirty Shame Rockshelter.

Personal experimentation by the senior author subjectively indicates that fiber sandals provide greater traction on wet ground than do bare feet or moccasins. (It is interesting to note that during World War II Japanese soldiers in China often reverted to making the traditional peasant straw sandals, varajii, which were said to be better in muddy terrain than leather boots. The picture presented by Elson 1976:144-145 is one of the few we know of that shows the sandal-making process.) Whatever the functional differences, twining of the Spiral Well and Fort Rock sandals produced a very different tread than did the radial twining of the Spiral Well sandal. The effect on traction of switching the orientation of the warps and wefts is not known but would be a useful study if pursued through replicative experimentation. It is interesting to note in this regard that Cressman (1942) suggested that the cordage grids wrapped around the Fort Rock sandals may have increased their traction.

Earlier in this chapter we touched upon the possibility that the Spiral Well sandal may dissipate heat better than either of the other two sandal types. This hypothesis will also require experimentation. None of the Dirty Shame Rockshelter sandal types would have been appropriate gear for lengthy travel. Given the raw materials from which the sandals are made, walking any distance, particularly over rocky, hot ground, would have been uncomfortable by modern standards. A variety of other data are available from Dirty Shame Rockshelter, however, to suggest that such travel may not have been necessary, at least on a day-to-day basis. Foods identified in the human coprolites and the fauna identified from bone remains at the rockshelter were all locally available. Hall (1977) and Grayson (1977) both indicate that most of the exploited fauna represent species found in the moist habitat of the canyon bottom adjacent to the site. Crayfish and molluscs are available even today in Antelope Creek, which flows next to the rockshelter, and they occur throughout the site's deposits and in human coprolites. Additional evidence for the lengthy human exploitation of the riparian habitat at Dirty Shame Rockshelter includes the remains of a variety of water-loving creatures (e.g., mink, otter, beaver) or those which prefer moist, creek-side habitats (e.g., yellow-billed marrot, weasel, raccoon).

The cattail (Typha sp.) quids that are so numerous at the rockshelter were also locally available (Sanford 1983). Aikens also develops the theme of local ecotone exploitation.

Vegetal foods identified from coprolites again closely reflect the local habitats. Wild onion and sego lily hulks, wild cherry seeds, wild rose hips, and unidentified sedge seeds represent plants of the relatively moist canyon bottom. Goosefoot, sunflower, and especially prickly pear cactus may represent harvesting activities on the uplands, though all these taxa would be at home as well along Antelope Creek.

Thus, the floral data as well as other information suggest that Dirty Shame Rockshelter was occupied in the summer (Hall 1977:8) and that occupation perhaps continued through the fall and into winter as the floral and faunal resources of the nearby moist canyon bottom as well as perhaps the adjacent uplands were exploited. In such a scenario, one can well imagine the roles that sandals must have played in the efficient acquisition of riparian floral and faunal foods by providing footgear well-adapted to treading through marshy, creek-side ground. An attempt was made to determine the origin of sediment clinging to the sole of one Dirty Shame Rockshelter Multiple Warp sandal (APPENDIX IX); however, the results were equivocal. Though unelaborate in appearance and undoubtedly difficult to maintain, sandals must have filled a critical role in sustaining the synergetic life at Dirty Shame Rockshelter.

Our interpretation of the various archaeological data leads us to conclude that the three major sandal types at Dirty Shame Rockshelter are probably best explained or accounted for by different functional adaptations to food or other resource procurement and/or by seasonality of site use. There are, of course, other possibilities. The Fort Rock and Multiple Warp sandal types may be related in some derivative way. Technologically they are related and together represent something very distinct from the Spiral Well "traditions." Perhaps, as Cressman (1942) suggested, these represent the products of different human populations using the site, or perhaps one sandal type was worn by men and the other by women. Spiral Well sandals may have been better suited for wear in or around the site itself whereas Fort Rock and Spiral Well types may have served more effectively in heavier brush at some distance from the site. We have already commented
that the Spiral Weft sandal may have been worn in warmer weather with either of the other two sandal types being worn in winter. Thus, site utilization at various seasons of the year from summer through winter, and by the same or different groups may help to explain the existence of various sandal types. Unfortunately, our perceptions of this antique way of life, particularly given the lack of complete sandals in the assemblage, are not sufficiently refined to answer these and related questions satisfactorily. Strict chronological succession, however, does not appear to resolve the matter for all three major sandal styles are in evidence from Zone VI times through Zone III times, a period roughly from 760 B.C. to 430 B.C.

Any footwear affords protection, but the cushioning available in a thick fiber sandal not only damps the shock of walking, but helps to protect the foot from punctures. Unless it is well-padded, this protection is not available to the same degree in a hide moccasin. Moccasins, however, are usually more durable. Although none of the Dirty Shame Rockshelter sandals probably lasted for very long, sandals from other parts of the Great Basin (e.g., the figure eight sandals from Etna Cave; see External Correlations), the Southwest, Lower and Trans-Pecos Texas are very durable. As noted above, fiber sandals may be well-suited for traversing marshy ground, an environment to which moccasins are similarly ill-suited. Jennings (1997: 221) suggests:

It is easy to visualize a foot weary wearer disgustedly kicking off the heavy sodden mass after a trip across the sand's glistening, salt flats, which are even today almost impossible after a sudden shower. And of course the moccasin leaked.

Based on ethnographic information (see ETHNOGRAPHIC CONTINUITIES), many Great Basin and nearby groups customarily walked barefoot though some of them alternated between this practice and wearing some sort of footwear. Unfortunately, the circumstances governing the choice are not clear in the ethnographic record, but one cannot jump to the conclusion that sandals or footgear of another sort were a necessity of life in the way that contemporary western culture prescribes. The calloused human foot can cover a great deal of ground without the need of moccasins, sandals, or anything else. On the whole, our review of the available information suggests that the use of sandals at Dirty Shame Rockshelter was probably strongly correlated with the need to maneuver in marshy, creek-side environments where either hide moccasins (assuming that mammals of sufficient size were available from which to make them) and that the hides were not more important as dietary contributions) or the naked foot are less well-adapted.

Wear Patterns and Foot Pathologies

Few Dirty Shame Rockshelter sandals are substantially complete specimens, but most of the sole fragments do have wear patterns that indicate normal human weight distribution on the sandals (Figure 116). Nine specimens, however, have depressions or perforations near the sole midline or at the "nuzzle" of the foot. Three of these soles are of the Fort Rock sandal type (Zone IV, two specimens; Zone VI, one specimen). The others include five Multiple Warp sandals from Zone III and one Spiral Weft sandal from Zone IV. These perforations may have resulted from a hypermobility of the first metatarsal bone or from a "...concentration of body weight upon the second metatarsal bone in walking..." (Morton 1966: Figures 74, 75). This disorder, called "Morton's Foot," or, more properly, Morton's Metatarsalgia, is genetically transmitted and is found in both men and women. It results in an abnormally short first metatarsal bone and a subsequent shift in weight distribution and balance. The condition is not fatal but is debilitating and painful if not corrected.

Obviously, one cannot say on the basis of such limited evidence whether or not a small percentage of Dirty Shame Rockshelter's aboriginal inhabitants may actually have suffered from this or some other pathology or whether pathology actually accounts for the observed sandal wear patterns. Wear on these nine specimens is very different from the "normal" wear found on many other sandal soles in the assemblage, but given the small sample size and without the sort of supporting evidence that might come, for example, from a paleopathological examination of human burials, the sandal data must remain only suggestive.

There is also no clue why the Spiral Weft sandal type is under-represented among these specimens, but perhaps its radially twined construction and greater fragility work against the chance that these sandals will preserve identifiable wear patterns.

RAW MATERIALS

The salient characteristic of the Dirty Shame Rockshelter sandal assemblage is the unwavering preference shown over nearly 9,100 years of the site's occupation for the fibers of the sagebrush (Artemisia sp.). This is the only raw material from which sandals, of whatever type, were made. To be sure, sagebrush is plentiful and readily available in the dry uplands around the site, but this alone may not account for its ubiquitous selection in sandal making. Other suitable raw materials (e.g., juniper; Juniperus sp.) were also available. Perhaps the many pores, visible in Artemisia sp. under a microscope, conveyed some special advantages. Buoyancy, reduction of the weight of the finished sandal, and warmth from trapping air in the many natural pockets are three notions that come to mind, all of which could be explored via replicative experimentation. Whatever reason or reasons behind its selection, the enduring use of this plant for making sandals reflects a 9,000-year technological continuum in matching product with purpose.

HORIZONTAL DISTRIBUTIONS AND ASSOCIATIONS

As in the case of basketry and cordage, sandals are not evenly distributed horizontally or vertically within the inhabitable portions of the site. Nothing can be inferred from the distribution of the meager sandal remains in Zones I and II, but there are sufficient sandals from Zones III, IV, and VI to offer the following observations.

The Zone VI sandals are restricted to the mouth of the rockshelter, a distribution paralleled by the basketry and cordage. This again suggests that this area was either the primary activity locus of the site or the perishables midden of this time horizon. The sandal inventory from Zone IV includes 33 specimens, most of which are confined to the central
section on the western edge of the occupied portion of the rockshelter. Within that area, 20 sandals are associated with Feature 14A, a grass-lined pit, and the remainder derive from "middenish" areas of the site (Features 16, 16B, 17, 18, and 19; see INTRODUCTION, Table 2 and Figure 10). As noted previously, Feature 14 appears to occur in an activity area associated with food preparation/consumption.

Nearly half (80) of the Dirty Shame Rockshelter sandal specimens occur in Zone III concentrated in the central and western sections of the occupation area. Seventeen sandal specimens each are associated with Feature 10 and 19A and Feature 13 and 13A, both of which are artifact cluster midden areas. Six specimens are from Features 12 and 12A, a grass-lined pit.

Insufficient numbers of sandals come from Zones 1 and 2 to discuss general distribution patterns, but these patterns tend to follow both basketry and cordage except that the sandals are often from specific features rather than general site fill. Whether these clusters are small sandal "dumps" like those at the back of Frightful Cave (Taylor 1966) in Coahuila, Mexico, or activity areas related to food processing or consumption cannot be determined. It is also impossible to assess the potential significance of the clustering of specific sandal types exclusively in certain features. Basketry shows no patterning in its distribution of types by features, but the Dirty Shame Rockshelter sandals do exhibit a more patterned distribution. Only Fort Rock sandal types are associated with midden areas (Features 18, 19) in Zone IV, and only Multiple Warp sandal types occur in the Feature 10 midden of Zone III. It is tempting to interpret these distributions in some functionally meaningful way, but the contextual data simply do not support such efforts.

CHRONOLOGY

Examples of all three major sandals types apparently occur in Zone VI at Dirty Shame Rockshelter, which dates ca. 7550-3950 B.C. The Spiral Weft type is slightly more numerous here than the Fort Rock type (eight specimens and seven specimens, respectively). The Multiple Warp sandal type is in the minority during Zone VI times and is represented by only one specimen of the Selvage Loop variety.

Only three Multiple Warp sandals of unknown variety are reported from Zone V (ca. 5950-4850 B.C.), where perishables preservation in general is poor, but all three major types recur in Zone IV (ca. 4350-3950 B.C.) where Spiral Weft sandals again slightly outnumber Fort Rock specimens (22 specimens and 16 specimens, respectively). Multiple Warp sandals of unknown loop type are represented by only two specimens in Zone IV.

All three types again recur in Zone III (ca. 4200-3950 B.C.). By Zone III times, however, the proportion of sandal types to each other had changed markedly. Multiple Warp types of all three selvage varieties dominate the Zone III sandal inventory outnumbering the Spiral Weft type almost four to one. The Fort Rock type is clearly "on the wane" and is represented by only four specimens. Zone II (ca. 750 B.C. to A.D. 850) is relatively barren of sandals (as it is of basketry and cordage) with only two Multiple Warp sandals and one miscellaneous sandal fragment represented. Zone I (ca. A.D. 850-1350) has only one possible sandal cushion fragment.

External Correlation

THE NORTHERN BASIN CENTER

Although they are more coarsely made than virtually all other Northern Great Basin sandals, the sandals from Dirty Shame Rockshelter have their closest technological affinities to sandals from other dry sites in the Northern Basin Center. Eight of the sites in this area that have basketry also yielded sandals. The typological uniformity of these sandals suggests that, as with the basketry, they represent the products of a sandal-making tradition or traditions of great time depth and considerable continuity. A synopsis of the sandal assemblages at other Northern Basin Center sites is presented below only for purposes of comparison to the Dirty Shame Rockshelter sandals.

FORT ROCK CAVES

Type and number of sandals represented: Fort Rock sandals, 75.

Comments: Fort Rock Cave is the "type site" for the Fort Rock sandal. Although similar in most respects, the Fort Rock sandals from Fort Rock Cave differ from the Dirty Shame Rockshelter specimens of this type in four rather minor details: 1) The Fort Rock Cave specimens have exclusively Z-twist twining. Two specimens at Dirty Shame Rockshelter show S-twist twining. 2) Four Fort Rock Cave sandal soles have cordage warps, but the remainder, as is true of those from Dirty Shame Rockshelter, are constructed with lightly twisted fiber warps. 3) Twelve to 16 of the Fort Rock Cave specimens have "grips," which Cressman (1942: 58) defines as "... a rope which is looped under the ball of the foot, usually about four times." 4) At Dirty Shame Rockshelter, the Fort Rock Cave sandal soles are made of Artemisia sp.; however, five or six specimens from Fort Rock Cave use the stalks instead of shredded fiber from this plant for warps. Unique sandals in the Fort Rock Cave assemblage include two that are painted red and a single "toy" sandal (Cressman 1942).

ROARING SPRINGS CAVES

Type and number of sandals represented: Multiple Warp sandal, Weft Loop variety, 7; Multiple Warp sandals, Loop Loop variety, 2; Multiple Warp sandals, Loop Loop variety, unknown, 5; Spiral Weft sandals, 4.

Comments: Cressman (1942) gives no specific features that distinguish the Roaring Springs Cave Multiple Warp sandals from those at Coulis Cave No. 1 (see below); thus, it is assumed that similarities to Dirty Shame Rockshelter sandals parallel those presented for Coulis Cave No. 1. The Roaring Springs Cave Multiple Warp sandal soles, however, do tend to have an even number of warps and correspond to the primary Dirty Shame Rockshelter warp arrangement plan.

Roaring Springs Cave Multiple Warp sandals of the Weft Loop variety have soles with seven or eight warps (one specimen), eight warps (one specimen), 10 warps (one specimen), and 12 warps (three specimens). The number of warps in
one sole is unknown. One sandal is made with cordage warps, and all but one specimen (which is Scirpus sp.) utilize Artemisia sp.

Two Roaring Springs Cave sandals are of the Multiple Warp type, Running Loop variety. One of these has eight warps on the other contains 12 cordage warps. Both sandals have Artemisia sp. warps, but the wefts in one specimen are Scirpus sp. and in the other are rabbit fur.

Four Roaring Springs soles on which the loop variety is unknown are also too fragmentary to determine the number of warps. One specimen has eight cordage warps. Four specimens are of Artemisia sp., and one sole uses Artemisia sp. warps and a Juncus sp. weft.

Four Roaring Springs sandals are of the Spiral Weft type. Technological details are incomplete, but the specimens probably share the same affinities with the Dirty Shame Rockshelter specimens of this type as do the Catlow Cave No. 1 specimens. A detailed description of a Roaring Springs Cave Spiral Weft sandal is provided elsewhere in this chapter, but in two specimens from this site (see also Catlow Cave spirals) one sandal is attached to the sole with cordage. One of these specimens has three warp loops. Each of the soles has 10 weft circuits. One specimen has Juncus sp. and grass warps and a Juncus sp. and Scirpus sp. weft, and the other has Juncus sp. and grass warps and an Artemisia sp. weft. The two remaining Spiral Weft soles are constructed of Artemisia sp. and Scirpus sp., respectively.

CATLOW CAVE NO. 1

Type and number of sandals represented: Fort Rock sandals, 12; Multiple Warp sandals, 1; Running Loop variety; 2; Composite Loop variety, 1; Multiple Warp sandals, 1; Multiple Loop variety, 1; Spiral Weft sandals, 9.

Comments: The Fort Rock sandals from Catlow Cave No. 1 closely resemble those from Fort Rock Cave and Dirty Shame Rockshelter. All of them are made of sagebrush (Artemisia sp.). Cressman (1949: 51-52) notes that the cordage warps, absent from the Dirty Shame Rockshelter sandals of this type, are more common in the Catlow Cave No. 1 inventory than among the Fort Rock Cave sandals. The Catlow Cave No. 1 specimens are apparently coarser and less well-made than those from Fort Rock Cave. The sole is thicker and broader near the heel of the foot.

The Catlow Cave No. 1 Multiple Warp sandals also generally resemble those from Dirty Shame Rockshelter but have a heel pocket. This is formed either by bringing up the parabolic end of the warps during the twining process or by clipping the warps and shaping the heel pocket by sewing. The Dirty Shame Rockshelter specimens, in contrast, do not always have heel pockets. Whether this is a post-depositional condition resulting from fill compaction is unknown.

Three binding loop sandal varieties and one miscellaneous Multiple Warp sandal category are present at Catlow Cave No. 1. The four Multiple Warp sandals, 1; Running Loop variety, 7; Composite Loop variety, 8; Spiral Weft sandals, 9. Cordage warps are absent. The Weft Loop variety toe flap is formed from the sole warps but is usually not twined. Apparently, a separate toe flap construction was also occasionally used. The Multiple Warp sandal binding loops at Catlow Cave No. 1 were made using a method identical to that noted among the Dirty Shame Rockshelter specimens. They are less frequent on each sandal (usually two or three per side) and of much smaller diameter (5 cm-8 cm) than their counterparts at Dirty Shame Rockshelter. Unlike the Dirty Shame Rockshelter specimens, however, in which the weft of the sole also twines the flap, the sole weft at the toe of the Catlow Cave No. 1 sandals provides the material for the lacing strap. Only one Dirty Shame Rockshelter specimen preserves a strap fragment, but its position on the sandal is different, and it is smaller in diameter than the Catlow Cave example. The Catlow Cave No. 1 lacing technique for this sandal variety may have simply threaded the cordage back and forth across the foot alternately engaging loops on either side of the sole. Once again, all of the Catlow Cave No. 1 sandals use sagebrush (Artemisia sp.)

Two Catlow Cave No. 1 Artemisia sp. sandal are of the Multiple Warp type, Running Loop variety. One specimen has 10 warps (corresponding to the first Dirty Shame Rockshelter warp pattern), but the number of warps in the second sole fragment is undetermined. Neither specimen has cordage warps. Presumably, the toe cover was similar to that on the Weft Loop variety. The loop on the Catlow Cave No. 1 Running Loop variety sandals is similar in appearance, function, and size to that on the Dirty Shame Rockshelter Sedge Loop variety sandals, but the method of construction is different. Cressman (1949: 54) notes that the Running Loop weft element was given "...a reverse twist at the end of a course opening a space between its strand to form an eye." The Catlow Cave No. 1 Running Loop variety lacing technique, however, is identical to that proposed for all Multiple Warp sandal varieties from Dirty Shame Rockshelter. A length of cordage was drawn around the sole through the running loops. The tie string was then threaded back and forth and engaged this cord which was strung between the loops. The cord around the perimeter of the sole functioned in the same way as did the weft loops described above.

Two other Catlow Cave No. 1 Artemisia sp. sandal have both running loops and weft loops and are therefore equivalent to the Dirty Shame Rockshelter Multiple Warp sandal, Composite Loop variety. Both specimens have 13 non-cordage warps. Flap construction and lacing technique are not described by Cressman (1942) but presumably are identical to the Multiple Warp sandal, Running Loop variety technique.

The two final sandal from Catlow Cave No. 1 do not preserve binding loops. One specimen is too fragmental to determine the number of warps used, but the other has eleven cordage warps. One sandal is made completely of Artemisia sp.; the other uses Artemisia sp. warps but rush (Scirpus sp.) wefts.

Nine Catlow Cave No. 1 sandals are of the Spiral Weft type and are made of Artemisia sp. They are generally similar to those from Dirty Shame Rockshelter, but they have heel pockets, and the margins of the sole would have extended slightly upward over the sides of the foot when laced. The apparent absence of heel pockets from the Dirty Shame Rockshelter Spiral Weft specimens may be due to the use of heavy, stiff, inflexible twining elements and rather coarse weaving. As is true for the Dirty Shame Rockshelter Spiral Weft sandal type, an integral toe cover is absent from the Catlow Cave No. 1 specimens, only two of which are complete. These sandal have nine and 12 weft courses, with two and
three binding loops, respectively. Other differences between the Dirty Shame Rockshelter specimens and a typical Catlow Cave Spiral Weft sandal specimen have been specified previously in this chapter.

PAISLEY FIVE MILE POINT CAVE NO. 1

Type and number of sandals represented: Multiple Warp sandals, Weft Loop variety, 4; Multiple Warp sandal, Running Loop variety, 1; Multiple Warp sandal, Loop variety unknown, 1.

Comments: Paisley Five Mile Point Cave No. 1 produced six sandals of a single type. Specimens are identical in general configuration to those from Catlow Cave No. 1. All of the soles have an even number of warps. Four specimens correspond to the Multiple Warp sandal, Weft Loop variety. Two of these soles are constructed with 10 cordage warps; another has 12 untwisted warps, and the final specimen is made with 16 cordage warps. All soles are composed of Scirpus sp.

A single sandal is representative of the Multiple Warp sandal, Running Loop variety. The specimen is made with 19 warps and is also Scirpus sp. The final sandal specimen preserves no binding loops. The total number of sole warps is unknown, but those present are cordage. The specimen has grass warps and a Juncus sp. weft.

PAISLEY FIVE MILE POINT CAVE NO. 2

Type and number of sandals represented: Multiple Warp sandal, Weft Loop variety, 1.

Comments: This sandal conforms to the Catlow Cave No. 1 Multiple Warp sandal, Weft Loop variety. The sole has 12 cordage warps of grass and a Juncus sp. weft.

SEVEN MILE RIDGE

Type and number of sandals represented: Fort Rock sandals, 3.

Comments: Cressman and Bedwell (1968) report three sandals from Seven Mile Ridge. Details are few, but Bedwell (1973: 123-126) says the specimens are essentially identical to those described by Cressman (1942: 57). The Seven Mile Ridge Fort Rock sandal specimens may therefore also be similar to those from Dirty Shame Rockshelter.

ANTELOPE OVERHANG

Type and number of sandals represented: Fort Rock sandals, 2; Spiral Weft sandals, 5.

Comments: Among the Northern Basin Center Fort Rock sandals, those from Antelope Overhang, also located in Malheur County, Oregon, bear the closest resemblance to the Dirty Shame Rockshelter specimens. Specifically, the coarseness of the twining and the simplicity of material preparation that is typical of the Dirty Shame Rockshelter assemblage is likewise seen in the Antelope Overhang sandals. Sole construction, method of flap manufacture, overall shape, technique of binding attachment, splicing techniques, and raw material are all identical to the Dirty Shame Rockshelter examples.

The Antelope Overhang Spiral Weft sandals are also identical to their Dirty Shame Rockshelter counterparts in the coarseness of the weave and in the use of large diameter wefts. The Artemisia sp. is stripped but otherwise barely altered. For all purposes, the sandals from these two sites are indistinguishable.

FLUSH CAVE

Type and number of sandals represented: Multiple Warp sandal, Weft Loop variety, 1.

Comments: The Flush Cave sandal has the same overall pattern of construction as the Multiple Warp sandal, Weft Loop variety specimens from Catlow Cave No. 1. The sole consists of 12 Scirpus sp. warps and a Juncus sp. weft.

Sandal Technology in the Northern Basin Center

The data summarized in the preceding section indicate that three sandal types were made in the aboriginal Northern Basin Center. These include the Fort Rock type of only one variety, the Multiple Warp type of three varieties, and the Spiral Weft type, again of a single variety. Although broadly similar in certain basic attributes, these types differ, sometimes quite markedly, from one another in a variety of ways. All Northern Basin Center sandals were apparently unidirectionally close twined using paired wefts. Beyond these characteristics, however, there are certain critical differences among and within the types.

The Fort Rock sandal is the most technologically sophisticated and most consistently made of all the major Northern Basin Center sandal types. It is always constructed of Artemisia sp., has five warps, a parabolic warp layout, and an integral, open-twined toe cover secured at the sides of the sole. The toe flap is structurally the most complex and highly standardized attribute of any Northern Basin Center sandal. Twining apparently always began at the heel and ended with the production of the toe cover. Reconstruction of the lacing pattern is speculative because the laces are the least well-preserved aspect of the extant specimens, but it appears to have been a uniform pattern throughout the Northern Basin Center sites where the sandal is found. Variations within the Fort Rock sandal type include:

1. Warp preparation - A minority of specimens have cordage warps, and an even smaller number have warps of Artemisia sp. "stalks" (Cressman 1942: 54).
2. Presence or absence of "grids" - This attribute is apparently limited to the Fort Rock Cave specimens themselves (Cressman 1942: 58).
3. Direction of twist.
4. Coarse twining - The Catlow Cave No. 1 specimens are apparently coarser than either the Dirty Shame Rockshelter or Fort Rock Cave specimens, but the Dirty Shame Rockshelter Fort Rock sandals are coarser than those from Fort Rock Cave.

5. Thickening and broadening of the sole near the ball of the foot - This attribute is seen only on the Catlow Cave No. 1 Fort Rock sandals.

The number of warps in the Fort Rock sandal is consistently five, and sole width was therefore controlled by varying warp diameter rather than warp number. The Multiple Warp sandal can be viewed as a derivation and modification of the Fort Rock sandal. The Multiple Warp sandal uses six to 16 warps arranged in a parabolic pattern. A single central warp used in the Multiple Warp type was probably a means of controlling width. Unlike the Fort Rock sandal, the Multiple Warp type may have a heel pocket, but it does not consistently have a toe cover. In Multiple Warp specimens with a toe flap, the flap warps are simply extensions of the sole warps, and wefts are also continued from the sole. This is the same pattern seen in the Fort Rock sandal; however, in the Multiple Warp type, flap warp twining (when they are twined) is both loose and irregularly spaced. Unlike the Fort Rock toe flap, the Multiple Warp flap is not secured at the sides of the sole. Binding straps are not secured to the exterior sole warps as they are on the Fort Rock specimens but are attached via binding loops along the perimeter of the Multiple Warp sandal sole. The Multiple Warp sandal has three distinct varieties based upon the method used to form the binding loops.

The Multiple Warp sandal type is neither as conservative nor as consistently made as the Fort Rock type and exhibits relatively greater intersite and intrasite variations which may include:

1. Presence or absence of a heel pocket - When present, the heel pocket is usually an integral part of the sole. It can be formed by actually pulling up the U-shaped warp ends above the plane of the sole and twining them or by shaping the warps to the heel of the wearer by using the sandal bindings. The latter method also displaces the warps vertically. Heel pockets are more typical on the Catlow Cave No. 1 and Roaring Springs Cave specimens.

2. Presence or absence of a toe cover - When present, the toe cover is either an untwisted extension of the sole (e.g., Catlow Cave No. 1, Roaring Springs Cave, Paisley Five Mile Point Caves No. 1 and No. 2, and Plush Cave) or, as at Dirty Shame Rockshelter, is a loosely and irregularly twisted flap.

3. Configuration of binding loops - Binding loops on the Multiple Warp sandal, Weft Loop variety are the same throughout the Northern Basin Center, but the Dirty Shame Rockshelter variety is smaller in diameter than those at other Oregon caves. The Running Loop variety is similar in appearance and size at Catlow Cave No. 1, Roaring Springs Cave, and Paisley Five Mile Point Caves No. 1 to the Dirty Shame Rockshelter Selvage Loop variety, but different procedures were used to make the loop. The Composite Loop variety is present at only two sites (Dirty Shame Rockshelter and Catlow Cave No. 1).

4. Lacing techniques - The larger diameter binding loops and the absence of a twisted flap on the Multiple Warp sandals of the Weft Loop variety from Catlow Cave No. 1, Roaring Springs Cave, Paisley Five Mile Point Caves No. 1 and 2, and Plush Cave suggest that a different lacing procedure was used than is proposed for the Dirty Shame Rockshelter specimens of this variety. At all of these sites except Dirty Shame Rockshelter, the cordage strap was formed from weft material in the sole that was threaded alternately through loops formed at the periphery of the sole. The loops were then drawn back over the top of the foot. The Dirty Shame Rockshelter Multiple Warp sandal, Weft Loop and Selvage Loop varieties were probably laced in a similar way to the Running Loop variety at Catlow Cave No. 1, Roaring Springs Cave, and Paisley Five Mile Point Cave No. 1. A length of cordage was drawn through the binding loops around the edge of the sole. A cordage strap was then laced back and forth across this continuous cordage circuit in the fashion described for the Weft Loop variety footwear.

5. Raw material - All of the Dirty Shame Rockshelter Multiple Warp sandals are made of Artemisia sp., but the other Northern Basin Center sites show a greater variation in raw material selection. Warps at Catlow Cave No. 1 and Roaring Springs Cave are consistently of Artemisia sp., and wefts are mainly Artemisia sp. with a small number of Scirpus sp., Juncus sp. or rabbit fur elements. Paisley Five Mile Point Caves No. 1 and No. 2 and Plush Cave use Scirpus sp., grass, or Juncus sp. in sandal construction.

Among the three Northern Basin Center sandal types, the Spiral Weft sandal is unique. The looped warps suggest the Multiple Warp sandal running loops and selvage loops, and the lacing process was probably similar to that used for the Multiple Warp sandal, Running Loop variety; however, this sandal type differs from the other two in several ways. The Spiral Weft sandal is close radially twined on parallel or zig-zag warps. This pattern is the most circumscribed in the number of sites at which it occurs and structurally is the least sound (as evidenced by the lack of complete Spiral Weft soles at Dirty Shame Rockshelter) of all the Northern Basin Center sandal types. The Spiral Weft sandal is also the least homogeneous Northern Basin Center sandal type. Major variations occur in technological attributes of the sole, including:

1. Flexibility - The Catlow Cave No. 1 and Roaring Springs Cave specimens of this type show finer twining with generally smaller diameter warps and wefts than the Dirty Shame Rockshelter and Antelope Overhang sandals of this type. Finer twining produces greater flexibility in the sandal sole.

2. Warp arrangement - The Dirty Shame Rockshelter and Antelope Overhang Spiral Weft sandal soles use two or three warps, each formed from a separate length of folded and twisted fiber. The four to six warps of the Roaring Springs Cave and Catlow Cave No. 1 specimens are produced from a single length of cordage that alternates or "zig-zags" across the sole.

3. Binding loops - In all the Northern Basin Center sites, binding loops are created on the warps. In the Dirty Shame Rockshelter and Antelope Overhang specimens, these loops form eyes or openings at the end of each warp. The Roaring Springs Cave and Catlow Cave No. 1 Spiral Weft sandal cordage loop openings are larger in diameter than the Dirty Shame Rockshelter and Antelope Overhang binding loops.
4. **Heel pockets** - The Catlow Cave No. 1 and Roaring Springs Cave sandals have a heel pocket formed from the sole warp and weft elements. The Antelope Overhang and Dirty Shame Rockshelter Spiral Weft sandals do not have this feature.

5. **Toe covers** - The Catlow Cave No. 1, Roaring Springs Cave, and Antelope Overhang Spiral Weft sandals do not have toe covers. The Dirty Shame Rockshelter specimens do not have a toe flap that is integral with the sole; however, two soles of this sandal type are associated with a twined globose bag and twined mat fragment that may be portions of a sock and makeshift toe cover, respectively.

6. **Lacing technique** - One specimen from Dirty Shame Rockshelter suggests that Spiral Weft sandals were laced by first threading cordage through the binding loops. Each free end of the cordage was then functioned as a strap alternately crossing, then engaging that part of itself secured by the binding loops. In the Roaring Springs Cave and Catlow Cave No. 1 sandals, the tie loops are drawn up on top of the foot and are secured with a strap. As in the case of the Multiple Warp sandals, tie loops of different diameters may have required different lacing techniques.

7. **Raw material** - Spiral Weft sandals from Dirty Shame Rockshelter, Antelope Overhang, and Catlow Cave No. 1 are consistently made of *Artemisia* sp. Specimens from Roaring Springs Cave are either *Artemisia* sp., *Juniperus* sp., *grash*, and *Scirpus* sp.; *Juniperus* sp., *grash*, and *Artemisia* sp.; or *Scirpus* sp.

The variations noted above notwithstanding, the overlying impression of Northern Basin Center sandals is, like the basketry, one of essential uniformity. Whatever their derivation, Fort Rock, Multiple Warp, and Spiral Weft sandals are recognizable, if distinct, yet within their type much the same throughout the prehistoric Northern Basin Center. There is no ready explanation for the existence of just three major types. It is conceivable that the Fort Rock and Multiple Warp types share to some extent the same function and that the Spiral Weft type may have had a different function, but it is extremely unlikely that all three types served radically different purposes. At least some of the variability may be culturally based reflecting different stylistic preferences in various populations or ethnic groups, sexual differences, etc. Geographical distribution of the Northern Basin Center sandal types indicates that the Fort Rock and Spiral Weft types extend in a relatively narrow band from the easternmost to westernmost border of the study area. The Multiple Warp type also occurs throughout the entire Northern Basin Center but with a marked distribution farther to the south than the other two types. Unfortunately, this sheds little light on the reasons why only three major sandal types are identified in the Northern Basin Center.

**Sandal Chronology in the Northern Basin Center**

As is the case for basketry, it is difficult to specify a chronology for sandals in the prehistoric Northern Basin Center given the absence of a tight radiocarbon chronology for sandals from other Northern Basin Center sites; however, by utilizing the hypothesized basketry sequence (see BASKETRY) and data from the few radiocarbon-dated sites in the area, it is possible to suggest some temporal trends for Northern Basin Center sandals.

All three sandal types occur in Zone VI at Dirty Shame Rockshelter and also co-occur at Catlow Cave No. 1, but it is likely that the Fort Rock sandal is the oldest Great Basin sandal type based on its exclusive occurrence in large numbers in Unit III at Fort Rock Cave, ca. 9000-6000 B.C. Indeed, the oldest directly radiocarbon-dated sandal in the world is a Fort Rock specimen from Fort Rock Cave with a date of 7103 ± 350 B.C. As this sandal is from well above the base of Unit III, it is possible that the Fort Rock sandal type may extend as far back as the 9th or 10th millennium B.C.

If the Zone VI dates at Dirty Shame Rockshelter are accurate and if the Multiple Warp and Spiral Weft sandal types ascribed to that unit are in situ, then both of these types had appeared by ca. 5900 B.C. at the very latest. This age is substantiated, at least for the Spiral Weft type, by its occurrence well beneath the Mazama pumice at Paisley Five Mile Point Cave No. 1. Fort-Mazama-age sandal assemblages seem to contain all three sandal types, at least at Catlow Cave No. 1 and Dirty Shame Rockshelter. The Fort Rock type then diminishes in number, and there is a corresponding increase in the number of Multiple Warp and Spiral Weft examples. If the Dirty Shame Rockshelter chronology is accurate, the Fort Rock sandal was at least locally extinct by ca. 3900 B.C. or was the Spiral Weft type, but it is by no means certain that this chronology applies to the entire Northern Basin Center. Indeed, the co-occurrence of Spiral Weft sandals and coiled basketry at Catlow Cave No. 1 may mean that this sandal type persisted well after 3900 B.C. Similarly, the occurrence of Multiple Warp sandals at Catlow Cave No. 1 and in Zone II at Dirty Shame Rockshelter also indicates that this type probably continued to be made until at least ca. A.D. 900. This chronology appears to correspond to a trend away from the very conservative and highly standardized Fort Rock sandal type to the less standardized, more variable, and less sophisticated Multiple Warp type. It seems unlikely that the Spiral Weft sandal preceded the Fort Rock type (cf. Creiman 1942: 61).

Sandal chronology in the Northern Basin Center can be outlined in three sequential stages:

**Stage I:** 3900 - 3500 B.C. - Sandals were first made in the Northern Basin Center during this period. Early in this stage, only the Fort Rock type was probably represented. By ca. 3500 B.C., at the earliest or 3900 B.C. at the latest, both the Multiple Warp and Spiral Weft types had appeared. Technologically, the Multiple Warp type was apparently derived out of the Fort Rock type, but the origin of the Spiral Weft type is obscure.

**Stage II:** 3500 B.C. - A.D. 500 - Spiral Weft and Multiple Warp sandals increased in numbers at the expense of the Fort Rock type which disappeared by ca. 3900 B.C. Spiral Weft sandals are more common earlier in this period with Multiple Warp types more common later in the stage.

**Stage III:** A.D., 500 - 1600 - Multiple Warp and Spiral Weft sandals are both in evidence at the beginning of this period, but only Multiple Warp variants may survive to the end of this period (see ETHNOGRAPHIC CONTINUITIES).
THE WESTERN BASIN CENTER

The closest extra-local affinities of the Dirty Shame Rockshelter sandal types, as is true for the basketry, lie to the south in the Western Basin Center. Potentially, the oldest sandal from the Western Basin Center is from Fishbone Cave in the Winnemucca Sink of western Nevada. Fishbone Cave sandal is from Level 4 and is apparently bracketed by radiocarbon dates of 9360 ± 75 B.C. and 5860 ± 120 B.C. The Fishbone Cave sandal is generally similar to the Dirty Shame Rockshelter Multiple Warp sandal. It consists of close single Z-twist twining over 10 roughly 5 twisted warps. Rozaire (1976:65) observes that the warps "at the heel end are bent back and shredded to form a pad for the back of the foot."

The curvature of the warps near the heel and the fragmented condition of the sole in this area suggests that the warps were originally displayed in a series of U-shaped concentric parabolas similar to the pattern seen at Dirty Shame Rockshelter. The photograph of the Fishbone Cave specimen (Rozaire 1976:91, Figure 24) indicates that there is a heel cushion, but it appears to represent a separate item. The fragment of the heel makes it impossible to tell if a heel pocket was present. The techniques of initiation and termination of twining are unreported. The specimen as illustrated does not have a toe cover, but the toe end of the sandal is missing. Side selvage is of the continuous weft variety. There are six binding loops that resemble those of the Dirty Shame Rockshelter Multiple Warp sandal, Weft Loop variety. Lacing thread is Scirpus sp. cordage through the loops in a pattern slightly different than that suggested for the Dirty Shame Rockshelter sandals. Raw material is unspecified, but the specimen appears to be constructed of Scirpus sp.

Three other sandals recovered in the Winnemucca caves are from undated contexts. These include a fragmented specimen from Stick Cave and two other fragmented examples from Horse Cave. Stick Cave is reportedly a "cache site" without stratigraphy, but the presence of Lovelock wickerware in the deposits and in the upper three levels of Horse Cave indicates that both localities may have been occupied by Lovelock Culture populations for at least part of their occupational histories. The Horse Cave sandals are from the Lovelock wickerware-bearing levels; thus, they are presumably associated with some phase of that culture, although the exact dating of these sandals is not known.

The Stick Cave sandal is generally equivalent to the Dirty Shame Rockshelter Multiple Warp sandal type. It consists of the midsection of a sole of very regular, close simple Z-twist twining. The specimen has 11 parallel fiber warps. The original arrangement of the warps near the heel is obscure. A unique attribute is that both sides of the sandal are reinforced. Lengths of 5 twisted Scirpus sp. fiber are wrapped left to right around each exterior warp. New elements are bound beneath the warp. There are no binding loops or straps. The side selvage is a relatively uncommon variant of the continuous weft side selvage. The specimen is apparently made of Scirpus sp.

The Horse Cave sandal varies somewhat from the Dirty Shame Rockshelter Multiple Warp pattern. It is composed of close diagonal Z-twist twining. There are a minimum of 11 warps of twisted Scirpus sp. As is true of the Stick Cave sandal, the Horse Cave specimen is a fragmented midsection; thus, warp arrangement is not identifiable. An interesting attribute of one end of this sandal is the subdivision of the sole warps into groups of three. The procedure is reminiscent of that employed in the Dirty Shame Rockshelter Fort Rock sandal type for preparing sole warps for the toe flap. This in turn suggests that the Horse Cave sandal, which appears to be of Scirpus sp., originally may have had a toe cover. Side selvage is of the continuous weft variety. According to Rozaire (1976:65): "This may represent the splitting of a binding loop in a method analogous to that employed in a single specimen from Humboldt Cave."

Several other sites in the Western Basin Center have also produced sandals. These include Hidden Cave (Grosnopp 1956) in Churchill County, Nevada, and Tommy Tucker Cave (Penenga and Riddell 1969; Riddell 1956, 1957) in Lassen County, California. The sandals from Hidden Cave are not described but are said to resemble these from Lovelock Cave (Grosnopp 1956:61).

The sandals from Tommy Tucker Cave are unlike any of those discussed so far from the Western Basin Center. Three sandals were recovered from this site, which Grossnopp cited in Penenga and Riddell (1969) says are "...not like Oregon types but are more suggestive of them than the early southeast types." Essentially, the Tommy Tucker Cave sandal types are Multiple Warp twined sandals made with only four apparently untwisted warps. One specimen is close twined; the two others are open twined. All three soles have Z-twist paired warps. The close-twined specimen is the midsection of a sole with two binding loops on opposite sides of the sole. These are formed as in the Dirty Shame Rockshelter Multiple Warp sandal, Weft Loop variety method and are of greater diameter. A strap of Type III cordage (see CORDAGE) is drawn back and forth between the loops and is finally secured in a slip knot. Both open-twined specimens also have binding loops of the Weft Loop variety though apparently of smaller diameter (ca. 3.5 cm) than those on the close-twined specimen. These open-twined sandal warps are produced at the end of every weft course, unlike the Dirty Shame Rockshelter close-twined specimens. One specimen has one large-diameter loop and one of smaller diameter. Binding straps are absent. The Tommy Tucker Cave sandal types do not exhibit toe flaps, but none of the specimens is a complete sole. All sandals are of Scirpus sp. Hester (1973:101) suggests that the Tommy Tucker Cave materials can be attributed to a late phase of the Lovelock Culture, but the sandals described above are from the top of the deposits and are alleged to be of Northern Paiute affinities by the excavators (see ETHNOGRAPHIC CONTINUITIES).

Lovelock Cave (Loud and Harrington 1929), the type locality of the Lovelock Culture, yielded 87 probable sandals and sandal fragments. All specimens are analogous to the Dirty Shame Rockshelter Multiple Warp sandal type in that they consist of close simple twining on six or more concentric parabola warps. As with the Dirty Shame Rockshelter specimens, the Lovelock Cave sandal soles are relatively flat, and the heel pocket is formed by the vertical stacking of the exterior parabolic warps at the sandal heel. The extend height and shape of the heel pocket may have been influenced by the deposits in which the sandals were buried, the fill weight having flattened the sandal sole. As on the Dirty Shame Rockshelter soles, it is difficult to determine if the heel pocket was actually produced during sandal manufacture, developed during the wearing of the sandal, or was shaped by the pull of the bindings. The Lovelock Cave heel pocket is ca. 3.81 cm high suggesting that it was intentionally made. Like the Dirty Shame Rockshelter specimens, twining began at the heel. The method of twining initiation and termination cannot be discerned from the published photographs (Loud and Harrington 1929:Figures 22, 23). Side selvages are of the continuous weft variety.
Nine Lovelock Cave specimens have toe covers that are nearly identical to the Dirty Shame Rockshelter toe flaps. Once again, flap warps are provided by the extension of the sole warps. Weft material from the sole is continued past the toe and becomes the flap weft; however, flap twining is open simple with somewhat irregular spacing. This loosely twined toe cover is not attached at the sandal sides. Whether the 78 specimens without toe covers were actually made without them or simply represent fragmented soles of what originally were covered sandals is unknown.

Photographs of Lovelock Cave sandals (Loud and Harrington 1929: Figures 22, 23) show only one type of binding loop which is equivalent in its manufacture, though of larger diameter, to those on the Dirty Shame Rockshelter Multiple Warp sandals. Weft Loop variety in which the weft plies are twisted together past the sole's margin before re-engaging the sole warps. The Lovelock Cave weft loops appear to be of similar dimensions to the Oregon Cave types (Gressman 1933). The photographs of the Lovelock Cave specimens (Loud and Harrington 1929) also lead to the conclusion that the sandals were laced by drawing cordage through loops on each side of the sole near the toe. Each cordage end was then crossed, threaded through another loop closer to the heel, and crossed again. Apparently, the cordage ends were secured in a knot near the instep before drawing them through a heel loop. This lacing technique is different from that suggested for the Dirty Shame Rockshelter sandals; however, the greater length of the tie loops on the Lovelock Cave sandals also allows them to assume some of the binding functions that must be served by the Dirty Shame Rockshelter binding straps.

The major difference between the Lovelock Cave and Dirty Shame Rockshelter Multiple Warp sandal specimens is raw material. The Lovelock Cave sandals are *Scripus* sp. and *Juncus* sp. while those from Dirty Shame Rockshelter are entirely of *Artemisia* sp.

The Lovelock Cave sandals are of two structural subtypes. The subtype called by Loud and Harrington (1929) "sandal of finer type" was made from two different raw materials, tule (*Scripus* sp.; 17 specimens) and rush (*Juncus* sp.; five specimens). This subtype is unlike the Dirty Shame Rockshelter Multiple Warp sandals. The Lovelock soles are only 5 mm in thickness, and the wefts form a "succession of Y's" (Loud and Harrington 1929: 55) by alternating the stitch slant in successive weft rows (see Adovasio 1971). Apparently there is also a gap between each successive weft course. The number of warps in each sole ranges from 18 to 24, but, unlike most Dirty Shame Rockshelter specimens, the warps appear to be of cordage. Four sandals have toe covers. Loud and Harrington (1929: 55) suggest that the tule (*Scripus* sp.) sandals were worn by men and women around camp and that rush (*Juncus* sp.) sandals were worn only by women, but there is no direct evidence of this. A 20 cm-long specimen may have belonged to a small-footed adult or to a child.

Sixty-four specimens are designated by Loud and Harrington (1929) as "sandal of coarser type." This category includes 53 sandals of *Scripus* sp. and 11 sandals of *Juncus* sp. These Lovelock Cave specimens are most similar to their Dirty Shame Rockshelter Multiple Warp counterparts. The weft slant remains consistent; alternate weft rows do not change slant. Sole thickness varies from 10 mm to 15 mm, which is well within the Dirty Shame Rockshelter range. The number of warps in each sole ranges from seven to nine, and they may be spun or lightly twisted. Five specimens have a toe cover or flap.

Sandals were also recovered from another Lovelock Culture site in the Humboldt Sink, Humboldt Cave (Heizer and Krieger 1956). Humboldt Cave yielded 12 sandal specimens; four of these are nearly complete sandals and eight are fragments. The construction is similar to the Lovelock Cave "sandals of coarser type" (Loud and Harrington 1929). In the Humboldt Cave sandals, warps number from nine to 13, which is slightly greater than the seven to 12 warps noted for Dirty Shame Rockshelter. Warp configuration is identical to the second arrangement observed at Dirty Shame Rockshelter, i.e., warps are always odd in number with four to six warp lengths doubled and laid out in concentric parabolas with each length of fiber functioning as two warps. An additional single element is then inserted in the middle of the parabolic warps. This arrangement is simply an elaboration of the Dirty Shame Rockshelter Port Rock sandal sole but is unlike the Callow Cove (*Scripus* sp.) warp configuration, which uses an even number of parabolic warps with no central warp. The Humboldt Cave warps, however, are cordage and not tule. During the course of the twining, the curved, V-shaped portions of the warps were raised or brought up to produce a heel pocket. This may be the same procedure that was used in the Dirty Shame Rockshelter specimens. Twining began near the heel pocket by folding a single length of fiber about the exterior warp. Each end then functioned as a weft ply. Side selvages are of the continuous weft variety except where a binding loop is provided. Unlike the Dirty Shame Rockshelter Multiple Warp sandals, twining on the Humboldt Cave sandal sole is terminated with a knot. Toe flaps are identical to those at Dirty Shame Rockshelter. On all but two Humboldt Cave sandals, the binding loops are of the Weft Loop variety. Loop diameter is intermediate between that of the smaller Dirty Shame Rockshelter specimens and the larger-looped Lovelock sandals. Of the remaining specimens, one has a length of tule (*Scripus* sp.) cordage secured to the sole along one side, and the other has separate pieces of cordage bound beneath the weft. Four Humboldt Cave sandals have a length of braided tule (*Scripus* sp.) of unknown function attached along the side of the sandal. Lacing began by knotting a length of cordage near the toe of the sole and threading it through the loops, probably in a fashion similar to that described for the Lovelock Cave specimens. Two Humboldt Cave sandal specimens are *Juncus* sp. The remainder are *Scripus* sp. Raw materials are therefore similar to Lovelock Cave (Loud and Harrington 1929) but unlike Dirty Shame Rockshelter.

Two possible sandal fragments of open simple and diagonal twining were also recovered from Humboldt Cave. One specimen is from a disturbed context, and the second was found at a depth of 61-76 cm (i.e., in the 39th-35th level in Section 2 of the site).

Loud and Harrington (1929: 131) also report a sandal from Ocah Cave, 8.8 km (5 mi) southeast of Ocah, Nevada. The sandal is alleged to be identical to one or another variant of the Lovelock Cave sandals, and *Scripus* sp. and, interestingly, is lined with *Typha* sp. "down."
the possible exception of the Tommy Tucker Cave specimen), do not appear to be associated with the historic Numic speakers (see ETHNOGRAPHIC CONTINUITIES).

Other dry Western Basin center sites, including some with relatively early components, have either yielded no sandals (e.g., Leonard Rockshelter, Heizer 1956; the other Winnemucca caves, Orr 1974, Rozsaie 1970; Hanging Rock Cave, Tuhy 1969; Gatecliff Shelter and the other Monitor Valley rockshelters, Adovasio and Andrews 1983; and ZPEB, Baumhoff 1958) or the perishables are only partially reported.

Moccasins have been recovered from several Western Basin center sites. These include a single scrap of rawhide possibly representing a moccasin fragment from Hanging Rock Cave (Tuhy 1969), four moccasins from Lovebeck Cave (Loud and Harrington 1929), and a single fragment from Humboldt Cave (Heizer and Krueger 1956).

THE SOUTHWESTERN GREAT BASIN

Reports of sandals are sparse in the published archaeological record for the Southwestern Great Basin. Three or possibly four sandal specimens are known from Coville Rockshelter (Meighan 1953). Two are close simple twining over paired warps. Both of these specimens are made from Joshua fiber (Yucca brevifolia). In the more fragmentary specimen, twining was either initiated or terminated with a square knot. The more nearly complete specimen was made for a small-footed person or child. Warps in this sandal are Type IV cording (see CODAGE2), and the specimen has a toe loop. As on sandals plated with a figure eight stitch (see Cosgrove 1947), warp elements cross only once per course. Three associated pieces of Type IV cording may be strap fragments. According to Meighan (1953: 182) this specimen resembles the close-twined, four-warp sandal from Tommy Tucker Cave (see above and Fenenga and Riddell 1949) in the Western Basin Center.

We have already observed that Cressman (cited in Fenenga and Riddell 1949) thought the Tommy Tucker Cave sandals more similar to the Oregon types than to Southwest sandals though with some differences. Despite broad similarities in technology, the absence of details reported for the Coville Rockshelter specimens prevents comparison with the Dirty Shame Rockshelter sandals. Meighan (1953: 182) does note, however, that footwear of the same age in southern California bears the closest resemblance to the Coville Rockshelter specimens.

The other two sandal specimens from Coville Rockshelter are either a juniper (Juniperus sp.) sandal or mat fragment and a second, more complete and highly unusual specimen that integrates a fragment of rabbit skin blanket with strips of juniper (Juniperus sp.) bark to form a sandal.

A pair of untwined twined yucca (Yucca sp.) leaf sandals is reported from the Twenty-nine Palms area (Campbell 1931), but when excavated are said to have disintegrated upon contact with the air. The sandals were discovered in a cave situated beneath an alfalfa. The cultural associations are unspecified. Three fragments of "hide sandals" were also recovered from the Twenty-nine Palms area, but technical details are unreported.

THE SOUTHEASTERN GREAT BASIN

Sandals occur in generally late contexts at several sites in the Southeastern Great Basin. Excavations at Etna Cave (Wheeler 1973) in southeastern Nevada produced 62 sandals of four types, one of which can be divided into three subtypes. The so-called "twined-woven" sandal type from Etna Cave includes seven open simple twined specimens and one close simple twined specimen with what appear to be 5 twisted warps (Fowler, MacLaren, and Naito 1973: 17, Figure 16a, b). These sandals were recovered from the surface of the site to a depth of ca. 36 cm (13 in) and resemble Multiple Warp sandals from Dirty Shame Rockshelter. The Etna Cave twined specimens have multiple concentric parabola warps greater than 15.2 cm (6 in) in length, paired warps, and a heel pocket. The toe warps, excluding the two exterior warps, were drawn back over the foot. The two ends of the outermost warp appear in published figures to be knotted around the interior warps in a square or some other double bight knot. A tailored appearance was created by pulling up the exterior warps vertically near the ankle and tying them. Twining initiation and termination methods cannot be determined from the published figures.

The Etna Cave and Dirty Shame Rockshelter sandals differ in several important ways. Six Etna Cave twined specimens have irregularly open-twined soles using yucca (Yucca sp.) warps. The Dirty Shame Rockshelter specimens are rather loosely twined, but the weft row spacing in the sole is always close. Etna Cave sandal flaps are not integral with the sole as they are on the Dirty Shame Rockshelter specimens rather, a small, soft, twisted juniper (Juniperus sp.) bark mat was placed under the sole warps when they were drawn back over the foot, probably to help prevent chafing when the sandal was laced. This use of juniper (Juniperus sp.) may be a vestige of an earlier time when the plant was used for the entire sandal. The Etna Cave sandals have a maximum of one binding loop near the heel. The lacing procedure is described by Wheeler (1973: 18):

From the remains of the strings on three of the specimens it appears that two of the extended warp elements were brought back, passed around the outer warp at the sides of the heel (13-F-911 and 13-F-977), or through a heel loop (168-C-310), and tied in front of the ankle. In the last mentioned specimen, the ends of the heel loop were attached to the outer warp at the sides of the heel.

A fourth specimen (BP-3395) shows that the foot was slipped into the sandal which was held on by a string passed around the outer warp at the heel and the ends tied in front of the ankle.

Unfortunately, the potential significance of the Etna Cave twined sandals for comparison with the Dirty Shame Rockshelter assemblage is reduced by the lack of firm temporal provenience and definitive cultural associations in the former. Broadly speaking, the Etna Cave twined sandals are vaguely Basketmaker/Anasazi in affiliation, an ascription supported by the general appearance of the other sandals and by the limited contextual data that are available (see Wheeler 1973: 18).
The remaining Etna Cave sandal types include the numerically preponderant Figure Eight Plaited variety (30 specimens) with three subtypes (single, double, and triple loop) and the so-called Yucca Slab sandal represented by a solitary specimen. These have no analogues in the Dirty Shame Rockshelter assemblage and apparently represent a distinct and technologically unrelated sandal-making tradition with decidedly Basketmaker/Anasazi affinities.

Elsewhere in the Southwestern Great Basin, sandals have been recovered from Gypsum Cave (Harrington 1933). Two hemp (Apocynum sp.) "two ply rope sandals" were recovered from Layer I, Room 1. These are apparently of Pueblo affiliation but are not described in the published reports. They resemble nothing in the Dirty Shame Rockshelter sandal inventory.

Farther north than Gypsum Cave, twisted yucca (Yucca sp.) sandals have been recovered from Lost City Cave 2 (two specimens), Footprint Rockshelter, Warshild Rockshelter (five specimens), and Chuckwalla Cave (one specimen; Shutter 1961). Though undescribed, the specimens from Footprint and Warshild rockshelters apparently resemble the Etna Cave twisted specimens. All of these sites, except Chuckwalla Cave, are Basketmaker-Pueblo and Pueblo in cultural affiliation. The Chuckwalla Cave specimen is from Level 2 at that site and apparently is of Pueblo ascription.

Two buckskin moccasins of unknown type were recovered from O'Malley Shelter (Fowler, Madson, and Hattori 1973) in Unit VI (post-A.D. 1060) which is Anasazi, Fremont, and Southern Pueblo in affiliation. Etna Cave (see above) also yielded one moccasin of the Fremont River type in a putatively Pueblo II context. Two allayed moccasin flaps were recovered from Lost City Cave 2 (Shutter 1961). Gypsum Cave (Harrington 1933) yielded various fragments of buckskin or mountain sheep hide that may be portions of moccasins; one of these is alleged to have been encrusted with soapstone when excavated.

THE EASTERN BASIN CENTER

Sandals of twisted or plaited plant fibers do not appear to have been made in the prehistoric Eastern Basin Center. Among the relatively extensive perishables from Danger Cave, Hogup Cave, and the Promontory Caves, there is no hint of an indigenous sandal industry. No excavated site in this area, including those with excellent preservation, such as Promontory Caves No. 1 and No. 2 (Steward 1937), Hogup Cave (Aikens 1970), or Danger and Jukebox Caves (Jennings 1957) have sandals or sandal fragments. Neither do they appear in sites with moderate to poor preservation such as Deer Creek Cave (Shutter and Shutter 1963), Median Village (Marwitt 1970), Sandwich Shelter (Marwitt, Fry, and Adovasio 1971), Stone Canyon Shelter I (Fowler and Sharrack 1973), Swallow Shelter (Dalley 1976), Black Rock Cave (Steward 1937), West Canyon Shelter, (DeLisio 1971), and Newkaw Cave, (Fowler and Matley 1979). Several of these Eastern Basin Center sites did yield moccasins, however. So-called "hock moccasins" as well as moccasins of the Hogup and Fremont types were recovered from Hogup Cave (Aikens 1970) in small numbers, and Danger Cave (Jennings 1957) yielded a single "hock" specimen and three miscellaneous fragments. Jukebox Cave (Jennings 1957) yielded four moccasins of unspecified configuration. Mocassins of the highly distinctive Fremont type were also recovered from the Promontory Caves in conjunction with non-Fremont moccasin types. Fremont moccasins were recovered at Stone Canyon Shelter I (Fowler and Sharrack 1973). Five possible moccasin fragments were recovered from Swallow Shelter (Dalley 1976).

The apparent absence of sandals from the prehistoric Eastern Basin Center is remarkable, and consequently there are no analogues of the Dirty Shame Rockshelter sandal types anywhere in the Eastern Great Basin. Sandals are known from very early contexts at a series of sites near the southern border of the Eastern Great Basin on the northern fringes of the American Southwest. These sites include Sand Dune Cave and Dust Devil Cave (Lindsay, Ambler, Stein, and Holder 1968) and Cowboy Cave (Jennings 1990).

Sand Dune Cave and Dust Devil Cave are in the Navajo Mountain area of southern Utah's Rainbow Plateau. The basal levels at both sites have produced archaeological materials, including perishables, ascribed by the excavators to the Desha Complex, a cultural entity thought to be locally ancestral to Basketmaker. The Desha Complex sandals have six to 10 parallel warps. They are exclusively open simple twined with paired, Z-twist wefts. Both warps and wefts are whole yucca (Yucca sp.) leaves. Several of these sandals have been directly dated by the radiocarbon method. One sandal yielded a date of 5590 ± 120 B.C. The second (actually two small fragments) dates to 5720 ± 120 B.C. Grass tiring from another sandal yielded a date of 5000 ± 130 B.C. (Lindsay, Ambler, Stein, and Holder 1968: 96). These sandals are therefore among the oldest ever recovered outside the Northern and Western Basin Centers.

Very similar sandals have been recovered from Stratum 1b in Unit III, late in Unit IV, and early in Unit V at Cowboy Cave in Wayne County, Utah, on the western edge of the Canyonlands Province of the Colorado Plateau (Clemin sin 1980). Nine of the Cowboy Cave sandals have "inner soles" of Artemisia sp. or grass, and some of the 13 recovered detached pads of grass and two of Artemisia sp. may also be sandal inner soles (Hewitt 1980: 71).

The Stratum 1b specimens from Cowboy Cave date to 6625 ± 80 B.C. While the Unit III sandals range in age from 4775 ± 75 B.C. to 5265 ± 75 B.C. (Jennings 1980: 58). The Cowboy Cave sandals are also ascribed to the Desha Complex which Jennings (1980) concurs is locally ancestral to Basketmaker/Anasazi.

The Desha Complex at these sites apparently fostered a lengthy sandal-making tradition that includes both exquisitely made and more utilitarian varieties; however, these sandals have no regional counterparts in Mogollon, Hohokam, or in North Mexican/Lower Pecos contexts. The Desha Complex sandals and other Desha diagnostics, such as its coiled basketry, seem to be distant Great Basin derivatives. The closest general resemblance of the Desha Complex sandals is, as noted by Lindsay, Ambler, Stein, and Holder (1968: 91), to Multiple Warp sandal types in the Western Basin Center. Specific technological similarities between the Dirty Shame Rockshelter sandal types and the Desha Complex sandals are not apparent, nor is there any comparison with the presumably Desha-derived Basketmaker/Anasazi types in the Southwest. Assuming that a Western Great Basin - Desha Complex cultural connection can be established, the Dirty Shame Rockshelter Multiple Warp sandals may have been part of a perishables tradition that provided a model for the open-twined sandals of the Desha Complex.
ETHNOGRAPHIC CONTINUITIES

The near total absence of sandals from Zone I at Dirty Shame Rockshelter makes it very difficult to discuss potential ethnographic continuities in sandal types for the area. A brief discussion of the ethnographic literature on sandals for the area is, nevertheless, instructive (Table 14, folio).

Northern Paiute

As Table 14 indicates, most Northern Paiute groups customarily walked barefoot (Steward 1911; Steward 1941). All the groups had moccasins of one-piece or two-piece types, but 11 groups also made a "twined bark moccasin." Eight groups are said to have worn a "twined bark overshoe," and seven wore "bark sandals." All groups who used footgear also used bark stuffing to pad them.

When hide was unavailable, the Surprise Valley Paiute twined "...a moccasin...of tule or of sagebrush bark" (Kelly 1964: 109). Sagebrush (Artemisia sp.) seems to have been the preferred raw material of the two plants. The model constructed by Kelly's (1964) informant was an irregularly close simple twined Multiple Wasp sandal of the Wet Loop variety with what appear to be unintentional gaps between the S-twist weft rows. The number of sole warps is not discernable in published photographs. A toe cover was made in the same way that has been described for Dirty Shame Rockshelter. Twelve weft loops (six per side) were fashioned along the margins of the sole. These appear to be nearly identical in size and shape to those seen on the Dirty Shame Rockshelter sandals of the same type. A strap of Type III cordage (see CORDAGE) was secured to an exterior sole warp adjacent to the flap with what appears to be a lark's head knot. The raw material may be either Artemisia sp. or Juniperus sp. The completed sandal is oval in plan, and the narrow end is near the toe. The shape is therefore different from the Dirty Shame Rockshelter Multiple Wasp sandal.

According to one of Riddell's (1960: i) informants, the Honey Lake Paiute constructed sandals of "tules and bark." Johnson (1975: 12) reports that the Walker River Paiute wore sagebrush (Artemisia sp.) "shoes" in the winter. Steward's (1934) informants among the Owens Valley Paiute denied the use of sandals.

Whitlow (1950) and DeAngelo and Freeland (1929) confirm the use of twined tule (Scirpus sp.) or sagebrush (Artemisia sp.) "moccasins" among the Northern Paiute. Lowe obtained an unmatched pair of twined tule sandals (figured in Lowe 1924: 207, Figure 3b, c). One of these is open simple Z-twist twining over 11 untwisted warps. The warps use five parabolic warps and a single warp unit in the center. The second sandal has irregular open diagonal twining with S-twist wefts over more than 20 warps. The gap between the weft rows on both specimens is highly variable, and the execution is very uneven. Neither specimen has binding loops. In their overall shape, these specimens are only reminiscent of the Dirty Shame Rockshelter Multiple Wasp sandal type.

Southern Paiute

Three Southern Paiute groups usually walked barefoot. Two groups wore moccasins of the Wissler Type 4, while the Antarianant produced a woven bark "moccasin." The San Juan constructed a woven yucca (Yucca sp.) "moccasin" and one of woven bark. The Kibah and San Juan Paiute apparently made a woven bark or yucca (Yucca sp.) overshoe. The Shiwits, Kibah, and San Juan Paiute produced yucca (Yucca sp.) fiber sandals but also wrapped their feet with "bark stockings."

Kelly's (1976: 59) Kibah informant stated that "... old people were 'cliffrose bark' (Cowania stansburiana) and used yucca sandals." It was said that these "... gave out quickly if you walked around much" (Kelly 1976:53). The Kibah yucca sandals were worn for the most part in snow, occasionally with a bark pad to cushion the foot (Kelly 1976:53), and were believed to be durable for this purpose. Hide moccasins were preferred in summer (Kelly 1976:53). Shiwits sandals (Lowe 1924: 218) were made of shredded Yucca sp. leaves and were worn by both men and women. The model specimen (Lowe 1924: 207, Figure 5a) is a sandal with a figure eight stitch not unlike those reported from the upper levels of Etna Cave (Wheeler 1973). This specimen is very similar to ethnographic sandals among the Cahuilla (see below).

Shoshone

All Shoshone groups produced moccasins, but 12 groups customarily walked barefoot (Steward 1941; Steward 1942). The Morey, Ely, Elko, and Snake River Shoshone (Steward 1941) as well as the Fort Hall and Grouse Creek Shoshone (Steward 1942) made "woven bark moccasins." Seven groups constructed woven bark overshoes. The Lida, Great Smoky Valley, Smith Creek, and Cache Valley Shoshone apparently also produced a bark sandal. Lowe (1924, 1939) does not, however, report twined footgear for any Shoshone group. Comparison of the Shoshone "woven bark moccasins" and sandals with the Dirty Shame Rockshelter types is not possible given the lack of detailed technological data available in the ethnographic accounts.

Gosiute

Steward (1943) reports that the Deep Creek Gosiute customarily walked barefoot but coated their feet with pitch (see also Malouf 1974), and wrapped them in hide. Steward (1942) reports that both the Skull Valley and Deep Creek Shoshone were twopiece moccasins, but Steward (1943) suggests that the practice was unknown to the latter group. Both Steward (1943) and Steward (1942) report "woven bark moccasins" for the Deep Creek Shoshone. Details of this footgear are not presented, and this once again prohibits substantive comparisons with the Dirty Shame Rockshelter sandal types.
Ute

Four groups of Ute customarily walked barefoot (Stewart 1942). One group smeared pitch on the soles of their feet, and two others wrapped their feet with sections of hide. Six groups manufactured two-piece moccasins either of the Wissler Type I or II configuration. One group wore a buckskin boot, and another used a woven bark moccasin. Two groups produced twisted yucca (Yucca sp.) overshoes, and two others made a bark and a yucca (Yucca sp.) sandal, respectively, both of which were used with a "bark stocking." Once again, no description of the twined footwear is provided; thus, potential resemblances to the Dirty Shame Rockshelter sandals cannot be discussed.

Smith (1974: 72) reports that sagebrush (Artemisia sp.) bark "in lieu of anything better" as well as yucca (Yucca sp.) fiber were used to construct Northern Ute sandals. A pair of coarsely twined Artemisia sp. sandals are illustrated (Smith 1974: Plate 25b). These sandals appear to be open simple twining with 2-twist wefts over loosely twisted warps. No other details are available. These sandals are similar in overall shape to the Dirty Shame Rockshelter Multiple Warp sandal type, but further comparisons are impossible due to the lack of descriptive ethnographic data.

Washo

According to both Stewart (1917) and Price (1962), the Washo customarily walked barefoot but did produce moccasins (Barrett 1917; Lowie 1939). Stewart (1917) reports "woven bark moccasins" as well as bark sandals for this group, and Price (1962) indicates that a "sagebrush or cedar bark sock" was used instead of a moccasin in cold weather. Lack of additional technological details prevents effective comparison of the twined Washo footwear with the Dirty Shame Rockshelter sandal types or with the twined "sock" from the site.

Klamath

The Klamath of Klamath Marsh made moccasins as well as twined tule "slippers" (Voegelin 1942; Spier 1930; Barrett 1910; Cressman 1956). These "slippers" were apparently worn with a layer of "grass" between the foot and slipper sole (Barrett 1910). Spier (1930) indicates that the slipper was made without a heel, but Barrett's models (Barrett 1910: 277, Figures 2, 4) have ample heel pockets. Like the Dirty Shame Rockshelter Multiple Warp specimens, the heel pocket on these sandals is created in the parabolic ends of the U-shaped warps. The Klamath specimens represent a type of open simple twined Multiple Warp sandal of the Weft Loop variety that closely parallels its Dirty Shame Rockshelter close-twined counterpart. They bear an even closer resemblance to the Catlow Cave No. 1, Roaring Springs Cave, and Paisley Five Mile Point Caves No. 1 and No. 2 specimens, and are almost identical to Lowie's (1924: 205, Figure No. 6) Northern Paiute sandals described above. Fourteen warps are used in the Klamath man's sandal whereas the woman's sandal has 13 warps. The wefts are 5 twisted, and twining begins at the heel as it does in the Dirty Shame Rockshelter, Catlow Cave No. 1, and Roaring Springs Cave Multiple Warp sandals. The woman's sandal is twined over cordage warps, but the man's sandal seems to have untwisted warps. Unlike the Dirty Shame Rockshelter type, these specimens do not have a twisted toe flap. Like the Catlow Cave No. 1, Roaring Springs Cave, and Paisley Five Mile Point Caves No. 1 and No. 2 sandals, toe flaps simply consist of the loose extensions of the sole warps. The weft provides material for the cordage strap at the toe. Binding loops occur along the margin of the sole at the end of every other weft course. The loops are identical in shape to the weft loops on sandals at Dirty Shame Rockshelter, Catlow Cave No. 1, Roaring Springs Cave, and Paisley Five Mile Point Caves No. 1 and No. 2, but their dimensions are closer to those represented at the last three of these sites. The lacing pattern is different from that proposed for the Multiple Warp sandal type at Dirty Shame Rockshelter, but parallels the Catlow Cave No. 1, Roaring Springs Cave, Paisley Five Mile Point Caves No. 1 and No. 2 technique. Finally, the exclusive use of tule (Scirpus sp.) in sandal production is characteristic of Paisley Five Mile Point Caves No. 1 and No. 2, but this raw material is not used in the Dirty Shame Rockshelter assemblage.

Achomawi

Stewart (1941) reports that the Achomawi customarily walked barefoot, but both he and Voegelin (1942) note the use of moccasins. Voegelin (1942) attributes the production of a bark sandal to the eastern Achomawi however, Stewart (1941) does report the use of a "woven bark moccasin" among the Warner Range group. Kniffen (1928: 101) notes the presence of twined "shoes," and Spier (1930) records tule "slippers." Whether the difference is due to ethnographic terminology or to aboriginal technology is unknown. These twined moccasins, sandals, or shoes were apparently open twined tule (Scirpus sp.; Kroeber 1933). The lack of published details prevents further comparison with the Dirty Shame Rockshelter assemblage.

Atsugewi

The Atsugewi are credited with producing bark sandals (Voegelin 1942) and tule (Scirpus sp.) "slippers" (Voegelin 1942; Spier 1930), but no other information is presented that might permit comparisons with the Dirty Shame Rockshelter sandal.

Shasta, Modoc

The Shasta and Modoc (Voegelin 1942) produced moccasins as well as "tule slippers" (Spier 1930).
Chemehevi

The Chemehevi (Driver 1937; Drucker 1937) only made high moccasins and leather sandals (Drucker 1937).

Panamint

The Death Valley, Saline Valley, and Koso area Panamint (Driver 1937) wore both high and low moccasins. The Death Valley and Koso area groups also produced leather sandals. Only the Koso area Panamint made yucca (Yucca sp.) fiber sandals (of unrecorded configuration) and seasonally used Artemisia sp. fiber sandals and leggings.

Western Mono

Three Western Mono groups reported by Driver (1937) used moccasins, and two groups manufactured milkweed (Asclepias sp.) fiber sandals.

Pomo

The Pomo wore skin moccasins (Barrett 1932: 297) and a very elaborate open twined tule (Sisypus sp.) "moccasin" (MacLendon and Lowy 1978) that is shoe-like in appearance and very unlike either the Dirty Shame Rockshelter or other Oregon Cave sandal specimens.

Cahuilla

Kroeber (1933: 807) states:

In southern California the sandal of the Southwest begins to appear. In its characteristic local form it consists of mescal fiber, untwisted handles of which are woven back and forth across a looped cord, forming a pad nearly an inch thick.

Bean (1978) also reports this "figure eight" sandal type but manufactured of Yucca sp. instead of Agave sp. Bean (1978: 579), however, does note that mescal (Agave sp.) fiber sandals were "whitened" by soaking them in mud. Drucker (1937) confirms the use of yucca (Yucca sp.) and mescal (Agave sp.) fiber sandals for all Cahuilla groups. This sandal type is identical to the specimens reported from Etta Cave (Wheeler 1929) and for the Shuvwts (Loewe 1941: 207, Figure 9a). Only the Pais Cahuilla manufactured high moccasins, but Drucker (1937) notes that all groups commonly walked barefoot.

Gabriellino, Luiseño, Ipai, Tipai, and Diegueño

Yucca (Yucca sp.) and mescal (Agave sp.) fiber sandals are reported for all five of these groups, but walking barefoot was also common (Drucker 1937).

Tribes of the Greater Southwest

Many ethnographic groups in the American Southwest made, or in rare cases, still make sandals, but these items either are part of the Basketmaker/Anasazi, Mogollon, or Hohokam traditions or represent sandal-making traditions of northern Mexican origin. In either case, no ethnographic Southwestern sandals remotely resemble those from Dirty Shame Rockshelter or sandals from other archaeological sites in the Northern Basin Center.

Ethnographic Overview

Based upon the non-exhaustive summaries presented above, we suggest that although a number of Great Basin and California Indian groups produced a variety of twined sandals, very few of these sandals resemble the Dirty Shame Rockshelter specimens. The data therefore lead us to conclude that the Fort Rock and Spiral Well sandal types are either unknown or are under-represented in the archaeological inventories of other sites. Ethnographically they are undescribed. The Multiple Warp sandal type, on the other hand, was made by most ethnographic groups (except those closest to the Southwest), but the products are hardly "carbon copies" of the Dirty Shame Rockshelter Multiple Warp sandals.

The closest ethnographic analogues to the Dirty Shame Rockshelter Multiple Warp sandals are those of the Northern Paiute and Klamath. Sandals in the first of these two groups appear almost to be a decadent style, but the Klamath sandal represents a zenith among Multiple Warp sandals. As noted previously, the Klamath sandals resemble even more closely the Multiple Warp sandals from the other Oregon Caves (Cressman 1942) than do the Dirty Shame Rockshelter footwear. The principal difference is that the ethnographic examples (both Northern Paiute and Klamath) are open twined. Given the posited Numic affiliations of the Zone I coaling (see BASKETRY) and perhaps also of the associated perishables in this unit and in Zone II, the resemblance of Zone II Multiple Warp sandals to Northern Paiute footwear may not be fortuitous.
Summary

In retrospect, the salient features of the Dirty Shame Rockshelter sandal industry are these:

1. The sandals from Dirty Shame Rockshelter are part of a wider tradition of Northern Great Basin sandals as represented at other archaeological sites.

2. The three technologically distinct sandal types (Fort Rock, Multiple Warp, and Spiral Welt) were probably very important adaptations in the riparian lifeway of the site's aboriginal occupants.

3. The Dirty Shame Rockshelter sandals and their distribution in the site can be used with data from other sites in the Great Basin to set out the major chronological trends in sandal production throughout this region.

4. The Dirty Shame Rockshelter sandals and those from other Northern Basin Center sites where sandals occur share technological affinities with sandals from other parts of the Great Basin and surrounding culture areas. The closest resemblance of the Dirty Shame Rockshelter sandals is to the south in the Western Basin Center where sandals also may have functioned in riparian economic adaptations.

5. The Dirty Shame Rockshelter Multiple Warp sandal type has its closest technological and stylistic ethnographic affinities to sandals produced by the Klamath and certain groups of Northern and Southern Paiutes.
Figure 78. Schematic diagram of Fort Rock sandal sole.

Figure 79. Schematic diagram of Fort Rock sandal toe cover.
Figure 80. Fort Rock sandal from Dirty Shame Rockshelter, obverse surface. NOTE: Toe cover is seen at left.

Figure 81. Fort Rock sandal from Dirty Shame Rockshelter, reverse surface. NOTE: Wear patterns are visible on the bottom of the sole (see Figure 116).
Figure 82. Fort Rock sandal from Dirty Shame Rockshelter, obverse surface.

Figure 83. Fort Rock sandal from Dirty Shame Rockshelter, reverse surface.
Figure 84. Fort Rock sandal from Dirty Shame Rockshelter, obverse surface.

Figure 85. Fort Rock sandal from Dirty Shame Rockshelter, reverse surface.
Figure 86. Toe and midsection fragment of Fort Rock sandal from Dirty Shame Rockshelter, obverse surface. NOTE: The open simple Z twined toe cover is visible.

Figure 87. Toe and midsection fragment of Fort Rock sandal from Dirty Shame Rockshelter, reverse surface. NOTE: Considerable wear is evident in the area of the ball of the foot.
Figure 88. Toe and midsection fragment of Fort Rock sandal from Dirty Shame Rockshelter, obverse surface. NOTE: The open simple Z twisted toe cover is visible.

Figure 89. Toe and midsection fragment of Fort Rock sandal from Dirty Shame Rockshelter, reverse surface. NOTE: Considerable wear is evident in the area of the ball of the foot.
Figure 90. Schematic diagram of Multiple Warp sandal sole.

Figure 91. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 92. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 93. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 78. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 95. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 96. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 97. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 98. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 99. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 100. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 101. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 102. Multiple Ware sandal from Dirty Shame Rockshelter, reverse surface.

Figure 103. Multiple Warp sandal from Dirty Shame Rockshelter, obverse surface.
Figure 104. Multiple Warp sandal from Dirty Shame Rockshelter, reverse surface.

Figure 105. Close-up of Multiple Warp sandal, Weft Loop variety from Dirty Shame Rockshelter, obverse surface. NOTE: Three weft loops are visible.
Figure 106. Close-up of Multiple Warp sandal, Weft Loop variety from Dirty Shame Rockshelter, reverse surface. NOTE: Two weft loops are visible.

Figure 107. Schematic diagram of Spiral Weft sandal sole. NOTE: In this diagram, weft separation has been exploded to show details of construction.
Figure 108. Spiral Weft sandal from Dirty Shame Rockshelter, obverse surface. NOTE: The cording warps extend far beyond the body of the sandal and serve as binding loops. Heel pocket is visible at right.

Figure 109. Spiral Weft sandal from Dirty Shame Rockshelter, reverse surface. NOTE: The spiral twining of the sole is evident.
Figure 110. Spiral Welt sandal from Dirty Shame Rockshelter, obverse surface. NOTE: A portion of the sole midsection and the heel pocket (right) are preserved.

Figure 111. Spiral Welt sandal from Dirty Shame Rockshelter, reverse surface. NOTE: The spiral twining of the sole is evident.
Figure 112. Spiral Weft sandal from Dirty Shame Rockshelter, obverse surface. NOTE: This specimen preserves a warp loop and contains a simple twined bag-like sock.

Figure 113. Spiral Weft sandal from Dirty Shame Rockshelter, reverse surface. NOTE: This is the reverse surface of the specimen illustrated in Figure 112.
Figure 114. Sole fragment of untyped sandal from Dirty Shame Rockshelter, obverse surface.

Figure 115. Sole fragment of untyped sandal from Dirty Shame Rockshelter, reverse surface.
Figure 116. Identifiable wear patterns on Fort Rock, Multiple Warp, and Spiral Weft sandals from Dirty Shame Rockshelter by cultural zone. NOTE: No sandals with identifiable wear patterns were recovered from Zones VI, II, or I.
MISCELLANEOUS PERISHABLES

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Introduction

"Miscellaneous perishables" is a class of modified plant products that includes a variety of aboriginal constructions. Their functions are almost always less certain than is true of basketry, cordage, or sandals although in construction techniques there are similarities. Some of the Dirty Shame Rockshelter miscellaneous perishables may once have had magico-religious significance though we do not suggest this; others may be the results of a child's fledgling attempts to emulate the products of his elders, and some may simply be byproducts of idle human time.

As the miscellaneous perishables class is essentially a residual or catch-all category, it contains a far greater range of morphotypes than do previously described classes. Most of the constituents of this perishables class are seemingly mundane, utilitarian items (e.g., knotted fiber, netting fragments, or possible snare parts), but a number of interesting and seldom seen forms such as a whistle segment, possible gaming pieces, and a probable aboriginal cigarette, are also preserved. Although not numerous, such artifacts transcend the day-to-day requirements of rockshelter living and as such portray their makers and users as far more human than the all too faceless forms whose lives we tend to see as wholly absorbed in subsistence-related tasks.

Analytical Procedures

Prior to analysis, all of the Dirty Shame Rockshelter miscellaneous perishables were cleaned using the same procedures specified for basketry (see BASKETRY). Analysis was then undertaken by inspection, or if warranted, the specimens were examined under a variable power Bausch and Lomb stereoscopic scanner. In cases of technical complexity or obscurity of construction, specimens were partially and carefully disassembled to insure proper recognition of the manufacturing techniques employed. All specimens were measured using Helios needle-nosed dial calipers or a Max-Cal electronic digital caliper, and all measurements were recorded in the metric system.

The identification of plant materials used in the Dirty Shame Rockshelter miscellaneous perishables was made by comparison with type specimens ranging from virtually unmodified leaves, sticks, and stems to heavily macerated, stripped, or otherwise prepared floral elements.

Criteria of Classification

One hundred twenty-seven specimens not readily assignable to any other major perishables class, category, or structural type were recovered during the 1973 excavations at Dirty Shame Rockshelter. These have been allocated to 21 categories based upon predominant technological, structural, or formal attributes. All miscellaneous perishables were analyzed for technique of raw material preparation, splices, mends, decorative patterns and mechasics, wear patterns, and possible function.

Netting is the most standardized of the miscellaneous perishables. It is a class of open-work fabrics built up by the repeated interworking of a continuous element with itself (Emery 1966:30). According to Emery (1966:30), the structure of any single-element fabric:

- is based on the formation of rows of courses or 'stitches' of varying types and degrees of complexity, into which successive rows are worked. Is is classified according to the type of connection that the element makes with the previous row. The element is used in one of two ways: either it is the free end and the full length of the element is drawn through the appropriate opening, or a loop of that part of it closest to the working edge of the fabric. The active use of the free end is exemplified by the various forms of linking and looping; the drawing of a loop through a loop, by forms of linking and looping; the drawing of a loop through a loop, by interlooping (e.g., knitting and crocheting). The free-end process is closely related to sewing (whether or not a needle or shuttle is used); many of the same structures are found in sewing (accessory stitches); and the terms for equivalent sewing and embroidery 'stitches' are frequently used to describe the structures of linked and looped fabrics. The free-end process definitely limits the length of yarn or cord that can be conveniently handled; interlooping (a loop through a loop) does not—although if no implement is required for preparation of the element, the disadvantage of working with a limited length is readily overcome by tying or spinning additional fiber on to the free end as the work progresses.

- It is possible to develop any of the single-element fabric structures in either of two ways: spirally (i.e., round and round) to form cone-shaped, tube-shaped, or flat circular fabrics, or back and forth in the same plane to produce square, rectangular, or otherwise shaped fabrics. A certain amount of elasticity is characteristic of any fabric fashioned from a single element.

The five specimens of nets recovered from Dirty Shame Rockshelter were made using the free-end process and are looped rather than linked fabrics. These specimens are allocated to a "knotted loop" category, which is also called "knotted netting" (Andrews and Adovasio 1980:31). They are ascribed to a single structural type within the "knotted loop" category based on the type of knot used in the mesh.

The Dirty Shame Rockshelter Miscellaneous Perishables Industry

KNOTTED NETTING

No. of specimens: 5, fragmentary (Figures 117-120).
Types of specimens: Body fragments, 4; throwline (?), 1.
No. of individual forms represented: 3 (?).

Type of forms represented: Unknown.

Technique and Comments: A quadrilateral net mesh is constructed in the body fragments from rows of sequential, regularly spaced and fixed weaver's knots. The knots are asymmetrical, and the knot faces are dissimilar. In three of these specimens each knot row exhibits alternate knot faces on the same surface of the net. Deterioration of the remaining body fragment precludes determination of its knot orientation. The specimens preserve 26, 18, 16, and 9 knots, respectively. The four net body fragments are made of Type IV cordage (see CORDAGE). None of the nets is spliced in the sense that pieces of cordage or independently fashioned segments of netting were added to the main body or fabric of these open-work constructions. Individual cords in the nets, however, were spliced during their production rather than during production of the nets. Cordage splices are effected simply by inserting the new ply beneath the exhausted ply. Among the four body fragments (see Figures 117, 118), both a smaller gauge (ca. 65 mm) and a larger gauge (ca. 170 mm) net are represented by two specimens each. One larger gauge specimen shows a repair in which the frayed cordage was rejoined with a weaver's knot. Two smaller gauge net fragments are slightly charred, but all specimens exhibit slight to moderate attrition wear.

One of the smaller gauge nets was found completely enclosed within a coprolite which when rehydrated with a 10% aqueous solution of trisodium phosphate yielded a dark color suggestive of human origin. The same coprolite also contained three large, cooked crayfish (Astacus sp.) claw parts (Hall 1977: 6). The net itself is bleached, probably as a consequence of passing through the human digestive system (see Figure 119).

As indicated above, the form of the nets that produced the body fragments is unknown; however, some speculations on their possible configuration and uses are provided in the Internal Correlations section of this chapter.

The last specimen in this category is an elongate cordage construction that may be part of a casting net throwline or, less likely, a selvage or reinforced edge of a net body (see Figure 120). The specimen consists of three major lengths of cordage and four minor cordage segments. It appears that two lengths of Type IV cordage (see CORDAGE), each ca. 14.5 cm long, were 5 twisted together producing the functional equivalent of compound two-ply, S spin, S twist (S 5 S) cordage, a type not otherwise represented in the cordage assemblage from this site. Subsequently, ca. 7.5 cm from one extant end of this compound cord, another length of Type IV cordage was grafted to the middle of the compound cordage by separating the two 5-ply sections of the added cord and inserting them alternately beneath one of the compound plies. This added length of cordage was then 5 twisted with the compound element to produce the functional equivalent of compound three-ply, S spin, S twist (S 5 S) cordage. The end of the added ply encircled a 3.4 cm length of Type IV cordage as it was manipulated into an overhand knot. This created a suspended overhand knot in which the enclosed element is movable. The construction is terminated with two knots. One Type IV cordage ply ends in an overhand knot and forms the suspended element of a clove hitch that involves the other Type IV cordage ply. The specimen is neither charred nor stained but shows extensive attrition wear. All specimens are composed of moderately well-rạceterized Aposcyon sp. fibers.

Measurements: Small gauge net fragments.

<table>
<thead>
<tr>
<th>Range in mesh diameter (mm)</th>
<th>Mean mesh diameter (mm)</th>
<th>Range in distance between knots (mm)</th>
<th>Mean distance between knots (mm)</th>
<th>Range in cordage diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>57.3-68.8</td>
<td>61.6</td>
<td>20.27-28.23</td>
<td>21.8</td>
<td>0.97-1.57</td>
</tr>
</tbody>
</table>

Measurements: Compound two-ply, S spin, S twist (S 5 S) cordage.

<table>
<thead>
<tr>
<th>Mean cordage diameter (mm)</th>
<th>Range in cordage angle of twist (°)</th>
<th>Mean cordage angle of twist (°)</th>
<th>Range in cordage twists per centimeter</th>
<th>Mean cordage twists per centimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.23</td>
<td>37-60°</td>
<td>48°</td>
<td>6-9</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Measurements: Large gauge net fragments.

<table>
<thead>
<tr>
<th>Range in mesh diameter (mm)</th>
<th>Mean mesh diameter (mm)</th>
<th>Range in distance between knots (mm)</th>
<th>Mean distance between knots (mm)</th>
<th>Range in cordage diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160.4-173.4</td>
<td>168.6</td>
<td>56.79-61.31</td>
<td>59.37</td>
<td>1.26-1.87</td>
</tr>
</tbody>
</table>

Measurements: Compound two-ply, S spin, S twist (S 5 S) cordage.

<table>
<thead>
<tr>
<th>Mean cordage diameter (mm)</th>
<th>Range in cordage angle of twist (°)</th>
<th>Mean cordage angle of twist (°)</th>
<th>Range in cordage twists per centimeter</th>
<th>Mean cordage twists per centimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.18</td>
<td>47-55°</td>
<td>51°</td>
<td>5-7</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Measurements: Compound three-ply, S spin, S twist (S 5 S) cordage.

<table>
<thead>
<tr>
<th>Mean cordage diameter (mm)</th>
<th>Range in cordage angle of twist (°)</th>
<th>Mean cordage angle of twist (°)</th>
<th>Range in cordage twists per centimeter</th>
<th>Mean cordage twists per centimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.29</td>
<td>67-75°</td>
<td>71°</td>
<td>7-8</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Measurements: Compound three-ply, S spin, S twist (S 5 S) cordage.

<table>
<thead>
<tr>
<th>Mean cordage diameter (mm)</th>
<th>Range in cordage angle of twist (°)</th>
<th>Mean cordage angle of twist (°)</th>
<th>Range in cordage twists per centimeter</th>
<th>Mean cordage twists per centimeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.08</td>
<td>67-75°</td>
<td>71°</td>
<td>7-8</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Provenience:

<table>
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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Aposcyon sp.</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Aposcyon sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Aposcyon sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prov. Link</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aposcyon sp.</td>
<td>1</td>
</tr>
</tbody>
</table>
FIBER-WRAPPEN RINGS

No. of specimens: 3 (Figure 121).

Technique and Comments: These specimens are circular constructions of plant material. In one specimen, the circular foundation is composed of 10 concentric circuits of squashbush (Rhus triolobata) bark (see Figure 121, left), lengths of which are drawn through the center and over the perimeter of this fiber ring. The wrapping is close and completes a single circuit. Wrapping direction proceeds from left to right. The wrapping "stitches" are badly deteriorated; thus, the technique of wrapping initiation and termination and the total number of stitches per circuit are unknown. New wrapping material is simply bound under the old, and the exhausted end is secured beneath the new element. The specimen shows extreme attrition wear and is also moderately charred.

The second specimen is similarly constructed upon concentric layers of squashbush (Rhus triolobata) (see Figure 121, right); however, the foundation is more tightly rolled and has a smaller central opening than does the first specimen. Wrapping this ring with strips of squashbush (Rhus triolobata) bark required an awl. It also closed the central aperture producing a button-shaped object. Wrapping is irregularly spaced and completes two circuits. Eleven stitches of the second circuit occur between those of the first circuit. Work direction is left to right. The passive ends of the wrapping elements are secured beneath subsequent stitches. The final wrapping stitch is clipped short and is stabilized at the center of the foundation roll. The specimen is uncharred but exhibits slight attrition wear.

The last item, from Zone II, is also button-like in appearance. It is constructed upon a ring of decorticated strips of sagebrush (Artemisia sp.). Thin, randomly arranged layers of the same material envelop the foundation, but wrapping elements are not drawn into its center. Methods of wrapping initiation and splicing are not discernible. The end of the exterior wrapping element is not secured after its final circuit. The specimen shows no attrition wear and only slight evidence of thermal alteration. These fiber-wrapped specimens probably represent gaming pieces (see External Correlations).

Measurements: Doughnut-shaped fiber-wrapped ring.
Range in outer diameters: 17.29-18.16 mm.
Mean outer diameters: 17.92 mm.
Range in inner diameters: 5.48-7.26 mm.
Mean inner diameters: 6.37 mm.
Thickness: 6.12 mm.

Foundation thickness: 2.68 mm.
Range in wrapping element width: 2.10-2.84 mm.
Mean wrapping element width: 2.47 mm.
Gap between wraps: 0.

Measurements: Button-shaped fiber-wrapped ring.
Range in outer diameters: 17.47-19.30 mm.
Mean outer diameter: 18.38 mm.
Thickness: 6.65 mm.
Foundation thickness: 2.78 mm.

Range in wrapping element width: 2.26-4.15 mm.
Mean wrapping element width: 3.47 mm.
Range in gap between wraps: 3-3.29 mm.
Mean gap between wraps: 2.64 mm.

Measurements: Button-shaped fiber-wrapped ring.
Outer diameter: 31.90 mm.
Thickness: 13.70 mm.

FIBER RINGS

No. of specimens: 2.

Technique and Comments: In each of these specimens, a length of untwisted and unspun but decorticated and shredded sagebrush (Artemisia sp.) bark is manipulated into a circular configuration. The specimens are neither worn nor charred and may represent prepared foundations for Fiber-Wrapped Rings (see above).

Measurements:
Range in outer diameters: 18.90-34.43 mm.
Mean outer diameter: 26.68 mm.
Range in inner diameters: 2.80-18.90 mm.
Mean inner diameter: 26.68 mm.
Range in fiber element width: 2.55-6.80 mm.
Mean fiber element width: 4.65 mm.

CORDAGE-WRAPPPED TWIGS

No. of specimens: 1 (Figure 122).

Technique and Comments: In this construction, two parallel, decorticated willow (Salix sp.) twigs are wrapped with three Type IV cordage elements (see CORDAGE). One twig is cut at a 67° angle to its long axis. The opposite end of this specimen and both ends of the other twig are broken. Ca. 3.16 cm from the cut twig end, the cordage elements encircle both twigs. Each cord then wraps either the longer, then the shorter stick or the reverse in a figure eight pattern. Wrapping direction is left to right. The wrapping extends 6.8 mm along the twig. Loose cord ends are drawn parallel to the twigs and are secured by wrapping circuits. The four complete cord ends extend to the cut end of the longer twig where they are rat-tailed. The rat-tailing and the apparent absence of cordage splices probably mean that this composite item was manufactured using fixed lengths of cordage. Patches of charred bark indicate that decortication was probably achieved by charring and scraping the twig. The cordage wrap provides a pivot point for the two twigs. The item is probably a fragment of a hinged stick snare (see Cosgrove 1947: 136-137).
Measurements:
Range in twig length: 25.1-75.0 mm.
Mean twig length: 30.6 mm.
Range in twig diameter: 3.25-3.87 mm.
Mean twig diameter: 3.56 mm.
Range and mean overall construction width: 9.89 mm.
Range in cordage diameter: 0.92-1.32 mm.
Mean cordage diameter: 2.74 mm.
Range in cordage angle of twists: 31-45°.
Mean cordage angle of twists: 36°.
Range in cordage twists per centimeter: 3-7.
Mean cordage twists per centimeter: 6.

Provenience:
Zone
Prov. Unk.

Raw material
Twigs, Salix sp.
Cordage, Apocynum sp.

No. of specimens
1

FIBER-PACKED REED

No. of specimens: 1 (Figure 123).

Technique and Comments: An unjointed reed (Phragmites sp.) fragment is tightly packed with what appears to be well-masticated dogbane (Apocynum sp.) fibers. One end is sharply cut perpendicular to the long axis of the reed. Proceeding from this end up the reed a distance of 6.7 mm are a series of narrow (maximum diameter 0.60 mm) parallel, and shallow incisions oriented at a 75° angle to the long axis of the reed. These score marks extend over only half the circumference of the tube.

The opposite end of the specimen is fractured irregularly and is charred. Ca. 21.6 mm from the severed end, 3.6 mm of the reed is wrapped four times with sinew. The wrapping proceeds from right to left for two circuits and then left to right for the final two circuits. The wrapping circuits overlap the intact end of the sinew, which extends ca. 13.2 mm beyond the wrap. Originally, both ends may have been secured with a knot.

This specimen is probably a "cigarette," the cut end of which was the "drawing" end. This may explain why this part of the reed is compressed and somewhat wider than the opposite, sinew-wrapped end. The sinew may have reinforced the wall of the reed, which is longitudinally halved and is also split in three places. Perhaps the reed was first helically filled with dogbane, and then reassembled and secured with the sinew; however, the dogbane is packed near the charred end of the specimen, so alternatively the reed may have been filled by tamping the dogbane from one end. This act, or the repetition of it, may have split the reed.

Measurements:
Overall reed length: 73.36 mm.
Range in reed outer diameter (cut end): 5.39-10.92 mm.
Mean reed outer diameter (cut end): 8.45 mm.
Range in reed outer diameter (charred end): 6.34-9.74 mm.
Mean reed outer diameter (charred end): 8.14 mm.
Range in reed inner diameter: 4.87-8.40 mm.
Mean reed inner diameter: 6.63 mm.
Range in sinew width: 0.39-1.21 mm.
Mean sinew width: 1.02 mm.

Provenience:
Zone
III

Raw material
Tube, Phragmites sp.
Filler, Apocynum sp.
Sinew, taxa unknown

No. of specimens
1

DRILLED REED

No. of specimens: 1 (Figure 129).

Technique and Comments: An unjointed reed (Phragmites sp.) fragment has six perforations of relatively uniform diameter that penetrate to the hollow core. The specimen is cut at a ca. 90° angle near the last perforation. The other end is obliquely (ca. 45° angle) fractured and compressed to a 1.51 mm thickness. This end is also twisted ca. 30° about the long axis of the reed. Five of the perforations occur at 19.72 mm, 28.29 mm, 33.97 mm, 37.59 mm, and 41.34 mm respectively from the oblique end of the reed. A final perforation is 20.77 mm from this end, but it has been drilled at an angle ca. 150° from that of the set of five perforations. The method by which these perforations were produced is unknown. Moderate attrition and discoloration occur at the compressed end suggesting that this was the mouthpiece of a probable toy flute. The specimen is not charred.

Measurements:
Overall length: 49.71 mm.
Outer diameter: 3.77 mm.
Inner diameter: 1.67 mm.
Range in perforation diameter: 1.07-1.20 mm.
Mean perforation diameter: 1.06 mm.
FOLDED RUSH

No. of specimens: 1.

Technique and Comments: The specimen consists of four bunched segments of rush (Scirpus sp.) ca. 45 mm-50 mm in length and folded back on themselves at a 180° angle. The ends are fragmented. The specimen is neither charted nor numbered, and its function is unknown.

Measurements:
- Overall folded length: 20.30 mm.
- Maximum overall width: 12.28 mm.
- Maximum overall thickness: 4.85 mm.

Provenience:
<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Phragmites sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

"DOODLE"

No. of specimens: 1 (Figure 12).

Technique and Comments: Approximately one-quarter of the length of an undecorticated squawbush (Rhus triolobata) twig is folded 180° back upon itself. The unfolded portion of the twig is wrapped in a figure eight configuration around the folded section and then encircles it twice. The wrapping encloses ca. 30 mm of the folded twig. The active end of the twig segment is secured beneath a portion of the figure eight wrap. The twig was simply snapped from its parent tree. It is extensively shredded for ca. 45 mm on either side of the initial fold suggesting that this area was twisted prior to folding.

Measurements:
- Overall length: 70.7 mm.
- Range in twig diameter: 1.65-2.60 mm.
- Mean twig diameter: 2.12 mm.

Provenience:
<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Rhus triolobata</td>
<td>1</td>
</tr>
</tbody>
</table>

TWIG AND BARK CONSTRUCTIONS

No. of specimens: 5.

Technique and Comments: One specimen is a length (ca. 45 mm) of undecorticated willow (Salix sp.) twig twisted clockwise into a circular configuration. Both twig ends are fragmented. The second construction is a decorticated willow (Salix sp.) twig (ca. 75 mm long) that is folded and inserted into a loop constructed from a length (ca. 82 mm) of the same material. One end of the folded twig is cut at a 90° angle to its long axis. The ends of the other three twigs are fractured. Decortication was apparently accomplished by charring and scraping the bark from the twigs. Two of the remaining items are simple willow (Salix sp.) loops. The last specimen is a length (ca. 220 mm) of sumac (Rhus sp.) bark folded back on itself at a 180° angle. All specimens exhibit slight attrition wear, but their function is unknown.

Measurements: Circular twig.
- Outer diameter of construction: 11.30 mm.
- Inner diameter of construction: 5.28 mm.
- Range in twig diameter: 2.59-4.02 mm.
- Mean twig diameter: 3.30 mm.

Measurements: Twig loop construction and twig loops.
- Range in inner loop length: 8.0-21.6 mm.
- Mean inner loop length: 10.8 mm.
- Range in inner loop width: 5.3-6.8 mm.
- Mean inner loop width: 6.2 mm.
- Range in twig diameter: 2.10-2.95 mm.
- Mean twig diameter: 2.55 mm.

Measurements: Folded bark.
- Length: 110 mm.
- Width: 12.25 mm.

Provenience:
<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Rhus sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td>Prov. Unit</td>
<td>Salix sp.</td>
<td>2</td>
</tr>
</tbody>
</table>
BENT TWIGS

No. of specimens: 3 (Figure 126).

Technique and Comments: These three specimens consist of bent, undecorticated willow (Salix sp.) twigs. One specimen is folded almost upon itself into a "U" shape and is shredded at the bend. Another twig has a shallow incision ca. 51 mm long on its convex side. This probably increased the elasticity of the construction. All specimens have fractured but uncut ends and probably represent fragments of snare springs. The specimens are not charred.

Measurements:
- Range in twig length: 57.0-184.0 mm.
- Mean twig length: 128.0 mm.
- Range in twig diameter: 4.12-3.99 mm.
- Mean twig diameter: 5.27 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prov. Unk.</td>
<td>Salix sp.</td>
<td>3</td>
</tr>
</tbody>
</table>

HALF-HITCH CONSTRUCTION

No. of specimens: 1.

Technique and Comments: An undecorticated willow (Salix sp.) twig with rounded ends is wrapped with seven half-hitches of Type III cordage (see CORDAGE). Decortication and the rounding of the ends were achieved by charring and scraping. Left to right wrapping begins 1.7 mm to 2.2 mm from one end and covers some 11.3 mm of the twig length. Cordage splices insert new material beneath the old ply. This artifact is uncharred and slightly worn but is of unknown function.

Measurements:
- Twig length: 178.0 mm.
- Range in twig diameter: 4.27-4.73 mm.
- Mean twig diameter: 4.59 mm.
- Range in distance between wraps: 0-1.13 mm.
- Mean distance between wraps: 0.56 mm.
- Range in cordage diameter: 1.60-1.68 mm.
- Mean cordage diameter: 1.64 mm.
- Range and mean cordage angle of twist: N.A.
- Range and mean cordage twists per centimeter: 6.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>twig, Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>cordage wrap, Apor cynum sp.</td>
<td></td>
</tr>
</tbody>
</table>

SEWN HIDE

No. of specimens: 1.

Technique and Comments: Three small fragments of deer (Odocoileus sp.) hide are sewn with running stitches of Type III cordage (see CORDAGE). Three small, irregular fragments (maximum of 1.8, 2.0, and 3.2 cm² each) of the original skin remain. Each thin (ca. 0.7 mm) section of hide is pierced three times. The two smaller fragments are sewn with two running stitches along what was apparently the edge of the original artifact. The largest fragment covers and is secured to the medium-sized fragment by another cordage element sewn in a single running stitch. The specimen is uncharred and moderately worn. This hide may represent a fragment of a skin bag or skin garment.

Measurements:
- Overall length of construction: 60.0 mm.
- Overall width of construction: 13.0 mm.
- Range in stitch length: 2.85-6.92 mm.
- Mean stitch length: 6.32 mm.
- Cordage angle of twist: 41°
- Range in cordage twists per centimeter: 2.5-3.0.
- Mean cordage twists per centimeter: 2.6.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
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</thead>
<tbody>
<tr>
<td>V</td>
<td>Hide, Odocoileus sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>cordage, Apor cynum sp.</td>
<td></td>
</tr>
</tbody>
</table>

PELLET

No. of specimens: 1.

Technique and Comments: This specimen is circular in plan and bi-concave in profile. It is composed of "sculpted" herbivore feces. The specimen is uncharred and may represent a gaming piece.

Measurements:
- Diameter: 26.42 mm.
- Thickness at midpoint: 9.95 mm.
- Range in thickness at outer edge: 12.07-15.34 mm.
- Mean thickness at outer edge: 13.7 mm.
Provenience:
Zone
Prov. Unk.

Raw material
herbivore feces, taxa unknown

No. of specimens
1

FIBER BUNDLES

No. of specimens: 1.

Technique and Comments: These specimens include two bundles of reed (Phragmites sp.) tops and one bundle of grass stems (taxa unknown) that have been cut with a sharp, hard instrument. One of the reed bundles is encircled once with a strip of sagebrush (Artemisia sp.) bark. The specimens are neither charred nor worn and may represent bedding material.

Measurements:
Range in maximum bundle length: 91.0-138.0 mm.
Mean bundle length: 93.0 mm.
Range in grass stem diameter: 0.2-0.4 mm.
Mean grass stem diameters: 0.3 mm.
Range in reed diameter: 0.8-3.6 mm.
Mean reed diameter: 1.8 mm.
Range and mean binding width: 17.06 mm.

Provenience:
Zone
Raw material
No. of specimens
I
bundle, Phragmites sp.
1
I
binding, Artemisia sp.
1
I
Phragmites sp.
1
IV
glass, taxa unknown
1

FOLDED, LOOPED, OR WRAPPED FIBER

No. of specimens: 12.

Technique and Comments: The first specimen is a small bundle of shredded sagebrush (Artemisia sp.) bark with grass stems (taxa unknown) as a minor constituent. This bundle is folded upon itself at a 180° angle, and one segment is wrapped twice about the other segment. Wrapping direction is left to right. In another item, two parallel bundles of sagebrush (Artemisia sp.) bark are encircled twice by one fiber bundle and once by another bundle, both of the same material. Wrapping direction is right to left. Another specimen is simply a section of rush (Scirpus sp.) that is folded at a 120° angle. The nine remaining items consist of looped single (two specimens) or multiple (seven specimens) bundles of sagebrush (Artemisia sp.) bark. In the first of these specimens, a single fiber bundle is drawn into a simple loop (with an inner diameter of 0.1 mm). In the next specimen, one end of a single bundle is randomly looped about the other. The seven constructions with multiple elements are composed of two (two specimens), three (two specimens), four (one specimen), five (one specimen) or an unknown number (one specimen) of discrete fiber bundles. Seven are concentrically interlooped. The specimens are slightly charred. The function of the first three specimens is unknown. The remainder may be selvages of twined basketry or sandals.

Measurements: Wrapped fiber.
Range in construction length: 42.0-55.9 mm.
Mean construction length: 49.0 mm.
Range in construction width: 22.0-34.0 mm.
Mean construction width: 28.0 mm.
Range in bundle diameter: 2.35-3.95 mm.
Mean bundle diameter: 3.07 mm.

Measurements: Folded rush.
Range and mean construction length: 29.0 mm.
Range and mean width of rush: 4.90 mm.

Range in construction length: 18.0-32.5 mm.
Mean construction length: 25.2 mm.
Range in construction width: 7.3-32.5 mm.
Mean construction width: 8.9 mm.
Range in bundle diameter: 2.70-4.45 mm.
Mean bundle diameter: 3.38 mm.

Measurements: Two-element looped fiber.
Range in construction length: 17.0-31.0 mm.
Mean construction length: 25.8 mm.
Range in construction width: 7.8-17.0 mm.
Mean construction width: 14.0 mm.
Range in bundle diameter: 0.80-7.90 mm.
Mean bundle diameter: 5.28 mm.

Measurements: Three-element looped fiber.
Range in construction length: 21.5-43.0 mm.
Mean construction length: 32.2 mm.
Range in construction width: 17.5-21.5 mm.
Mean construction width: 19.3 mm.
Range in bundle diameter: 2.90-4.80 mm.
Mean bundle diameter: 3.41 mm.
Measurements: Four-element looped fiber.
  Construction length: 33.0 mm.
  Construction width: 16.0 mm.
  Bundle diameter: 1.60 mm.

Measurements: Loop fiber, element number unknown.
  Construction length: 38.9 mm.
  Construction width: 38.0 mm.
  Bundle diameter: 6.70 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
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</tr>
<tr>
<td>I</td>
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<tr>
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<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Schreps sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Artemisia sp.</td>
<td>6</td>
</tr>
</tbody>
</table>

CUT BUNCH GRASS

No. of specimens: 6.

Technique and Comments: Each specimen consists of the root and lower stem portions of a bunch grass (taxa unknown). The grass blades were cut at a 90° angle to their long axis with a sharp instrument. All specimens are charred.

Measurements:
  Range in construction length: 35.2-48.6 mm.
  Mean construction length: 44.2 mm.
  Range in construction width: 21.2-28.3 mm.
  Mean construction width: 23.8 mm.
  Range in construction thickness: 12.0-18.5 mm.
  Mean construction thickness: 14.4 mm.
  Range in grass blade length: 18.2-38.2 mm.
  Mean grass blade length: 26.7 mm.
  Range in grass blade width: 1.5-3.3 mm.
  Mean grass blade width: 1.7 mm.

Provenience:

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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
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</tbody>
</table>

REEDS

No. of specimens: 3.

Technique and Comments: These specimens are uncut reed fragments. A single charred reed is encrusted with coprolitic material. Dissolution of this material in a 10% aqueous solution of trisodium phosphate yields a dark brown color suggestive of human origin.

Measurements: None taken.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
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</tr>
<tr>
<td>III</td>
<td>Phragmites sp.</td>
<td>2</td>
</tr>
</tbody>
</table>

TWIGS

No. of specimens: 4.

Technique and Comments: Each specimen consists of uncut willow (Salix sp.) and (Rhus sp.) twigs. Two of the twigs are decorticated. None are charred.

Measurements: None taken.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
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</tr>
<tr>
<td>III</td>
<td>Salix sp.</td>
<td>2</td>
</tr>
<tr>
<td>VI</td>
<td>Rhus sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

RUSHES

No. of specimens: 2.

Technique and Comments: One specimen consists of an amorphous mass of broken rushes (Typha sp.). The rushes are uncharred but worn. The specimen may represent a much deteriorated mat. The second item is the hollow, broken segment of the lower part of a rush (Typha sp.) stem. The outer leaves have been stripped from the stem. The specimen is neither worn nor charred.
Measurements: None taken.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Prov, Unk.</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

SAGEBRUSH BARK

No. of specimens: 42.

Technique and Comments: Sixteen of these specimens are strips of sagebrush (Artemisia sp.) bark in amorphous masses or clumps. Another 23 items are composed of aligned lengths of sagebrush (Artemisia sp.) bark. The final three specimens are fragments of the same material. Six of these bark items are charred, and two are coprolite-encrusted. The specimens may represent deteriorated sandals, basketry, cordage, or, in the case of the feces-laden masses, the aboriginal equivalent of toilet paper.

Provenience:

<table>
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<th>Zone</th>
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</tr>
<tr>
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<td>Artemisia sp.</td>
<td>3</td>
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<tr>
<td>III</td>
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<td>IV</td>
<td>Artemisia sp.</td>
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<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>8</td>
</tr>
<tr>
<td>Prov, Unk.</td>
<td>Artemisia sp.</td>
<td>8</td>
</tr>
</tbody>
</table>

KNOTTED TWIGS AND FIBERS

This category includes 29 segments of twigs, leaves, bark, stems, or bunches of fiber with eight different knot types represented; however, unlike cordage they are neither spun nor twisted. These artifacts are described and discussed below by knot type.

OVERHAND KNOT

No. of specimens: 9.

Technique and Comments: Each specimen is a single "element" manipulated into an overhand knot. Six of the knotted items are tied with a bundle of sagebrush (Artemisia sp.) bark. The remaining three specimens are composed of an undecorticated willow (Salix sp.) twig, a bundle of grass stems (taxa unknown), and a group of three rush (Typha sp.) stems, the ends of which are cut at 90° angles. Two specimens are charred.

Measurements:
- Range in construction length: 16.0-192.0 mm.
- Mean construction length: 85.0 mm.
- Range in knotted element width: 1.58-15.21 mm.
- Mean knotted element width: 6.76 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>grass, taxa unknown</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Salix sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
</tbody>
</table>

OVERHAND NOOSE

No. of specimens: 3.

Technique and Comments: Each specimen consists of a bundle of sagebrush (Artemisia sp.) bark tied in an overhand noose. The specimens are not charred.

Measurements:
- Range in construction length: 14.0-71.0 mm.
- Mean construction length: 41.2 mm.
- Range in knotted element width: 3.73-7.20 mm.
- Mean knotted element width: 4.99 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

SQUARE KNOT

No. of specimens: 7.

Technique and Comments: Each specimen consists of two "elements" engaged in a square knot. In six of the knotted constructions, these elements are composed of a sagebrush (Artemisia sp.) bark bundle. One specimen is made with rush (Typha sp.) stems. A minimum of four specimens are charred.
Measurements:
Range in construction length: 47.0-275.0 mm.
Mean construction length: 115.7 mm.
Range in knotted element width: 2.65-10.18 mm.
Mean knotted element width: 6.24 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
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<th>No. of specimens</th>
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</thead>
<tbody>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>3</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

SINGLE BOW KNOT
No. of specimens: 3.
Technique and Comments: Each specimen consists of bundles of sagebrush (Artemisia sp.) bark tied in a single bow knot. The specimens are not charred.

Measurements:
Range in construction length: 65.0-111.5 mm.
Mean construction length: 81.5 mm.
Range in knotted element width: 4.20-10.93 mm.
Mean knotted element width: 7.13 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

GRANNY KNOT
No. of specimens: 2.
Technique and Comments: Each specimen consists of two bundles of sagebrush (Artemisia sp.) bark tied in a granny knot. In one construction, one of the four bundle ends is secured in the knot sight. The specimens are not charred.

Measurements:
Construction length (one specimen only): 51.0 mm.
Knotted element width (one specimen only): 9.43 mm.

Proveniences:

<table>
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<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

WEAVER'S KNOT
No. of specimens: 1.
Technique and Comments: This specimen consists of two parallel pairs of rush (Typha sp.) stem fragments tied in a weaver's knot. The specimen is not charred.

Measurements:
Construction length: 259.5 mm.
Range in knotted element width: 6.75-7.45 mm.
Mean knotted element width: 7.10 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

FIGURE EIGHT KNOT
No. of specimens: 3.
Technique and Comments: Each specimen consists of a bundle of sagebrush (Artemisia sp.) bark tied in a figure eight knot. The bark in one specimen has been masticated. The specimens are not charred.

Measurements:
Range in construction length: 19.5-67.5 mm.
Mean construction length: 39.2 mm.
Range in knotted element width: 2.36-4.15 mm.
Mean knotted element width: 3.45 mm.

Proveniences:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Artemisia sp.</td>
<td>2</td>
</tr>
<tr>
<td>VI</td>
<td>Artemisia sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

BOWLINE KNOT
No. of specimens: 1.
Technique and Comments: This specimen consists of an undecorticated willow (Salix sp.) twig tied in a bowline knot. The knot is charred.
Measurements:
Construction length: 28.3 mm.
Knotted element width: 1.76 mm.
Inner loop diameter: 19.5 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Salt sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

Internal Correlations

TECHNOLOGY

The frequency and distribution of miscellaneous perishables from Dirty Shame Rockshelter are plotted in Table 15. As that table indicates, several large groupings are apparent within this artifact class, notably sagebrush bark and knotted twigs and fibers, which account for 33.1% and 27.8% of the artifacts, respectively. The remainder of the miscellaneous perishables, however, have little or nothing in common. They range from quite standardized forms with reasonably determinate functions (e.g., nets; see below) to items that are marginally modified and whose function is unknown. Given the great disparity in the constituents of this heterogeneous group, summary comments are limited to the following observations.

Some of the miscellaneous perishables from Dirty Shame Rockshelter appear to represent complete or nearly complete items. The implication is that these represent finished pieces. Such items include knotted netting, fiber-wrapped rings, fiber-packed or drilled reeds, a "doodlet," and the half-fish construction. Most miscellaneous perishables, such as the various categories of folded rushes, cut grass, reeds, twigs, etc., do not carry such implications. Unfortunately, even in the case of the pieces that appear to be finished, it is often impossible to discern or interpret the function or functions of these artifacts. Many of the items are simply too fragmented to speculate on their techniques of manufacture, final form, or use. To complicate matters, even when the form is recognizable (as in the case of the half-fish construction), the probable function is often not clear.

Despite these limitations, the form and function of some of the miscellaneous perishables can be reconstructed. The least nebulous representatives of this category are the knotted netting fragments (13.9% of the miscellaneous perishables). All of the Dirty Shame Rockshelter knotted net specimens are body fragments produced only from Type IV cordage (see CORDAGE), which may have been the preferred or standard netting construction medium at the site. Without complete nets or large netting fragments with selvages, the exact techniques used (presumably) by the Dirty Shame Rockshelter inhabitants themselves to make nets cannot be specified. Analogy to contemporary net-making methods can, however, illuminate this aspect of prehistoric technology in the study area.

There are two common modern techniques used to make fishnet knot netting. The first method is similar to that figured in Shaw (1972: 118) for the manufacture of weaver's knot netting. In this so-called tennis net method, fixed lengths of cordage are used. Consecutive knots are formed in sets of cords of the required length. In the next row of the incipient net, the members of a given cordage set are separated, and each one along with a member of the adjacent set forms a knot. There is no fixed work direction; knots can be tied from left to right or right to left. Knots are tied on one surface of the construction, and neither shuttle nor mesh is required for manufacture (see Andrews and Adovasio 1980: 309-310, Figures 137-139).

The second technique (Shaw 1972: 117) generally requires a shuttle and mesh, but nets probably could be made just with the mesh (see Andrews and Adovasio 1980: 311-313, Figures 140-144). In this method, the knots are tied in the pendant loops between the knots of the preceding row. Knotting thus occurs in a single length of cordage. To use this technique effectively, lengths of new cordage must be spliced in, or the cordage used in the net must be lengthened by splicing the ply while net making continues. If a two-dimensional or flat net is made using this technique and a single method is used to tie the knot, then work direction is from left to right with ties on both sides of the net after each row is completed. In other words, the net is "turned over" after each row of knots is finished. The consequence of this technique is that alternate rows of knots exhibit opposite faces. The alternative to this is to reverse the knotting process at the end of each row. With this method, work direction alternates between left to right and right to left, but the work surface is confined to one side of the net. This method produces alternate rows with identical knot faces.

Another variation of this theme splices in cordage at the completion of each knot row on the end opposite the completed end. Work direction is consistently in one direction (either left to right or right to left), and each row of knots has the same work surface.

No Dirty Shame Rockshelter knotted netting specimens have body splices. This indicates either that the tennis net technique was used or that the shuttle and mesh method with continuous ply splicing was used. In the Dirty Shame Rockshelter knotted netting body fragments, consecutive rows of knots face in opposite directions suggesting the shuttle and mesh method (i.e., single work direction, alternate work surfaces, and ply splicing).

The final form and functions of the knotted netting from Dirty Shame Rockshelter are impossible to reconstruct. Two mesh gauges (ca. 65 and 170 mm., respectively) are represented, but this is no indicator of function as several mesh sizes can be present in different parts of the same net (Prinson, Andrews, Adovasio, Carlisle, and Edgar 1980). However, using mesh size as a generally reliable guide, the knotted net fragments could be portions of large, elongate "stationary" nets or smaller throw nets used to capture terrestrial or aquatic game ranging from the size of crayfish to small birds and rabbits and perhaps to somewhat larger animals. The possible throwline fragment may argue for the use of thornets, and the crayfish fragments "associated" with one smaller gauge net body probably do document the harvesting of this food resource with nets. The mesh sizes of the Dirty Shame Rockshelter netting fragments are too large, however, to take the species of fish (i.e., chubs and minnows) alleged to have been eaten at the site by Hall (1977: 7). It is not inconceivable that any fishing conducted near the site may have used baskets as well as hand fishing.
<table>
<thead>
<tr>
<th>Material Type</th>
<th>Wood</th>
<th>Bone</th>
<th>Shell</th>
<th>Burnt</th>
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<td>Count</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of Total</td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*The table lists the distribution of miscellaneous perishables at Dirty Shame Rockshelter by raw material and cultural zone.*
Miscellaneous Perishables

Other more or less finished specimens with reasonably clear functions include the fiber-packed reed, which is almost certainly a cigarette, and the drilled reed. The latter appears to be a toy flute. Somewhat more problematical to interpret are the fiber-wrapped rings. These may well be gaming pieces (see External Correlations). The sewn hide fragments may be from a bag, garment, etc. Enigmatic are the "doodle", half-hitch construction, folded rush, and pellet.

Of the remaining miscellaneous constructions, the cordage-wrapped twigs and some of the twigs and bent twigs may be trap or snare parts. The bundles of cut grass and reed tops may be bedding materials. The various categories of slightly modified fibers, grasses, reeds, etc. probably represent construction materials or residue from the production or disintegration of other perishables at the site. Indeed, the co-occurrence of looped fibers (which are probably sandal salvage fragments) and clumps of sagebrush (Artemisia sp.) clearly suggests that these are miscellaneous parts of other classes of perishables.

The relatively large knotted twig and fiber assemblage from Dirty Shame Rockshelter includes eight different knot types. As is the case among specimens of knotted cordage (see CORDAGE) the permutations of the overhand knot (specifically in this case the overhand and overhand noose) and the square knot (specifically the square knot and single bow knot) are numerically dominant. In the miscellaneous perishables, these knot types account for 41.4% and 36.5% of the total knotted element assemblage, respectively. Other knot types are numerically insignificant. Some of the knotted twigs and fibers may be parts of traps or snares, but most of these knotted elements seem to have served simple binding or lashing functions.

RAW MATERIALS

A more varied selection of raw material sources is represented among the miscellaneous perishables than in any other single class of Dirty Shame Rockshelter fiber artifacts. These include Artemisia sp., Apocynum sp., Scirpus sp., Typha sp., Phragmites sp., Salix sp., Rhus sp., grasses of unknown species, deer (Odocoileus sp.) hide, and sinew from an unidentified animal. The distribution of raw materials by zone has been presented in Table 15.

Sagebrush (Artemisia sp.), alone or in combination with other raw materials, accounts for some 63.8% of the miscellaneous perishables. The ubiquity of this plant is a clear reflection of its high incidence in other Dirty Shame Rockshelter perishables classes and testifies to its broad utility to the site's aboriginal occupants, who used it in a great variety of constructions. The remaining raw materials are numerically insignificant in their individual occurrence except for willow (Salix sp.) which is used in 11.0% of the miscellaneous perishables.

There is no consistency in the raw materials from artifact type to type within the miscellaneous perishables inventory. Grasses were simply cut. Reeds and rushes are barely modified except in one instance where the outer leaves were stripped from the lower segment of a Typha sp. stem. Decortication of willow (Salix sp.) twigs was achieved by charring and scraping. The preparation of strips of sumac (Rhus sp.) cambium probably also involved decortication as well as soaking; however, the particulars of these processes are undetermined. Sagebrush (Artemisia sp.) bark appears simply to have been peeled from the plant and used without further alteration. Doghore or hemp (Apocynum sp.) however, underwent the most extensive modification which probably involved soaking, decortication, retting, and mastication. The single specimen of deer hide (Odocoileus sp.) was apparently scraped and possibly tanned.

HORIZONTAL DISTRIBUTIONS AND ASSOCIATIONS

The distribution of miscellaneous perishables at Dirty Shame Rockshelter is generally congruent with the distribution of basketry, cordage, and sandal remains. The limited number of miscellaneous perishables from Zone VI is, like the basketry, cordage, and sandal remains from that level, restricted to the mouth of the rockshelter. This again reinforces the notion that either this was a primary activity area for perishables during this period or that this segment of the site represents a Zone VI midden.

As for all other perishable artifact classes, the meager Zone V miscellaneous perishables inventory warrants no further comments. In Zone IV, the distribution of miscellaneous items parallels the general incidence of the other perishable artifact classes with a marked concentration in the center of the site. Within this area, a large mass of sagebrush (Artemisia sp.) fiber is "associated" with Feature 16A in an activity area characterized by food preparation and/or consumption.

In Zone III, the miscellaneous perishables are concentrated in the central and western sections of the occupation area as well as at the mouth of the rockshelter. There are relatively high densities of these items in excavation units B3 and B2, and some are associated with pit/basin Features 12 and 12A, 2B, 20A, and 20B and a midden-like area that includes Features 10, 10B, 13, and 13B. It is intriguing that the fiber-packed reed "cigarette" as well as the twig "doodle" occur in the same excavation level (5/F) in square A3 at the very mouth of the rockshelter. One of the knotted netting fragments from this zone occurs just above, but apparently not in a "patch of grass" designated Feature 11.

Miscellaneous perishables are not common in Zone II and tend to be confined to the central and east-central portions of the site with a "secondary" concentration at the rockshelter mouth. A number of miscellaneous specimens, including a large and a small mass of sagebrush (Artemisia sp.), the drilled reed (Phragmites sp.) "flute", a fiber-wrapped possible gaming piece, and a single bow-knotted fiber specimen, are directly associated with the pole-and-thatch structures (Feature 6) of this zone.

The miscellaneous perishables from Zone I are confined with very few exceptions to the eastern portions of the site from the mouth of the rockshelter to its innermost habitable recesses. This is a pattern similar to that seen among all other perishables from this zone. Perhaps significantly, two of the fiber-wrapped "gaming pieces" are from contiguous units (C2 and D2), and the two small gauge knotted netting fragments are from square D2 toward the rear of the rockshelter.

The great majority of miscellaneous perishables from Dirty Shame Rockshelter, regardless of their temporal ascription, are from squares roughly near the center of the site; however, there is no evidence (such as raw material caches) that suggests this area was used for the production of these artifacts.
The horizontal distribution of raw materials represented among the miscellaneous perishables is generally nondiagnostic with the exception noted above that certain artifact categories of *Artemisia* sp. tend to cluster in areas where sandals or basketwork are also abundant, thus suggesting some possible relationship among these groups of artifacts.

**Chronology**

There are no apparent chronological trends among the miscellaneous perishables in the sense that this is applied to other Dirty Shame Rockshelter perishable artifact classes. Only the knotted twigs and fiber category is represented in all of these zones (except Zone V, where preservation is poor), but no single knot type spans the entire occupational sequence. Virtually all of the "finished" pieces except the sewn hide (which may be intrusive into Zone V) are restricted to Zone III or above.

It may be significant that examples of knotted netting are confined to the upper three zones of Dirty Shame Rockshelter, but their generally low incidence at the site suggests either that netting was never commonly used at this locality or that it was curated differently here than at most Great Basin closed sites, where examples are generally far more common. Selective preservation does not seem to account for the general dearth of this artifact type. Although the greatest density (33.9% of the assemblage) and diversity (16 categories) of miscellaneous perishables occurs in Zone III, it is uncertain what this distribution reflects in cultural terms.

**External Correlations**

The unstandardized character of the miscellaneous perishables and the cursory treatment: such specimens often receive in published reports make it difficult to compare this body of artifactual remains with broadly analogous specimens from other sites. For these reasons, the format for the external comparisons is modified to treat selected items by descriptive category rather than by geographical area.

**Knotted Netting**

The oldest known netting in western North America and perhaps in the world is from Sand I, Level I at Danger Cave, Utah (Jennings 1957). This specimen of knotted netting is illustrated and labeled simply as cordage in Jennings (1957: 230, Figure 209). It is actually the corner of a net of undefined shape. The net mesh is constructed with what appears to be two-ply, Z spin, S twist (Type IV) cordage (see CORDAGE). The net uses lark's head knots. The Sand I, Level I netting fragment dates between 9200 ± 600 B.C. and 8370 ± 450 B.C. (Jennings 1957: 93, Table 11). Later levels at the site yielded numerous (though untabulated) knotted netting fragments tied with square, sheet bend, and weaver's knots. These net fragments are made from a variety of fibers including dogbane or hemp (*Apocynum* sp.), juniper (*Juniperus* sp.), flax (*Linum* sp.) sedge/sedge (Artemisia sp.), rush (*Scirpus* sp.), and milkweed (*Asclepias* sp.). Few pieces of cordage (and, by inference, netting) from Danger Cave are "large" with the notable exception of a complete casting net of *Apocynum* sp. recovered from Level D III that dates to ca. 5600 B.C. (Jennings 1957: 227). The cordage gauge and mesh size of this and most of the other Danger Cave knotted netting specimens suggest that they were used to trap rabbit-sized or smaller game.

Some 80.4km (50ml) northeast of Danger Cave, Hopog Cave (Aikens 1970) also produced knotted netting virtually throughout its long occupational sequence. The earliest of the 13 netting fragments from the site are from Stratum III with an associated date of 6830 ± 200 B.C. (Aikens 1970: 29). Unfortunately, knot type is not reported for these or for any of the later specimens at the site. Aikens (1970: 125) does indicate that the netting is typically of fine gauge, two-ply cordage with mesh diameters averaging 40 to 50mm. Hopog Cave also produced a spectacular, though untied, complete net measuring ca. 42.7m in length by 1.2m in width (Aikens 1970: 125). The complete Hopog Cave net (Aikens 1970: 129, Figure 83) is made of two-ply, Z spin, S twist (Type IV) cordage. The ca. 40-50mm mesh is constructed with fixed knots of unspecified type. Exact provenience of the net in the site is unknown as it was removed by non-professionals. Aikens (1970: 125) notes:

When found, the net ... was tightly wrapped over two ca. 18 in long, use polished sticks. It has been doubled back and forth across the sticks and then tied with a heavy cord of two-ply, S-twisted cordage made of shredded sagebrush bark.

The complete Hopog Cave net is not unlike a remarkable specimen more recently recovered from a small rockshelter in the Sheep Mountain area of Wyoming (Prisbey, Adovasio, Carlisle, and Edgar 1986). This specimen has been directly radiocarbon dated to 6910 ± 170 B.C. It is a complete rectangular hunting net which, like the complete Hopog Cave net, was found wrapped around sticks, in this case, three in number. The Sheep Mountain net is also made of two-ply, Z spin, S twist (Type IV) cordage but uses juniper (*Juniperus* sp.) The cordage is of variable diameter (0.70mm - 5.20mm) with a variable mesh gauge ranging from 7.1mm to 30.1mm. Unlike the Hopog Cave net, which was clearly intended for small game, the Sheep Mountain net is interpreted to be the earliest archaeological example of a large-game hunting net from North America.

Another site to produce comparatively early knotted netting is Cowboy Cave (Jennings 1980) on the western edge of the canyon lands province of the Colorado Plateau. According to Hewitt (1980), this site yielded 12 specimens assignable to at least five types of knotted, generally narrow gauge (average cordage diameter: 1.4mm; mesh: 40-120mm) netting made of two-ply, S spin, Z twist (Type III) cordage. Both *Apocynum* sp. and *Asclepias* sp. are reported as raw materials. Represented knots include sheet bend, lark's head, square, overhand (?), and slip (?). The earliest netting from this site is from Unit III, Stratum F which is ca. 5000 B.C. in age (Jennings 1980: 23-24). Therefore, netting (12 specimens in all) occurs sporadically throughout the site deposits. The netting would have been suitable for taking small game.

Comparatively late knotted netting is also known from Swallow Shelter (Dailey 1976) in the Goose Creek-Geuse Creek area of northern Utah, from the Promontory Caves (Steward 1937) on the northern margin of the Great Salt Lake,
and from Etna Cave (Wheeler 1973) in southeast Nevada. Swallow Shelter yielded four fragments, possibly from the same net, made of two-ply, Z spun (?), S twist (probable Type IV) cordage of unspecified diameter or raw material. Mesh size and configurations are not identified. The specimen is of Fremont culture ascription (A.D. 830 ± 10) according to Dalley (1976: 20).

The Fremont-age knotted netting fragment from Promontory Cave No. 1 is described by Steward (1937: 35) as made of "...sof fibres, 2-ply twisted clockwise, each 1/16" in diameter." This specimen is probably a bag fragment, not a helmet as proposed by Steward (1937: 35).

Etna Cave, in Lincoln County, Nevada, produced three specimens of knotted netting apparently made of narrow gauge Aparpyum sp. or Asclepias sp. two-ply, Z spun, S twist (Type IV) cordage tied with sheet bend knots (i.e., weaver's knots). According to Wheeler (1973: 22), mesh size varies from 22mm to 64mm. It was thus suitable for taking small game. The specimen are of unknown age but almost certainly are of Basketmaker II ascription.

Outside the Eastern Basin Center and the northern margins of the Southwest, early knotted netting is sporadically represented from such widely separated localities as Hinds Cave in the Lower Pecos region of Texas (Andrews and Adovasio 1980) and, considerable closer to Dirty Shame Rockshelter, Fishbone Cave in western Nevada (Orr 1974).

Hinds Cave contained 35 pieces of knotted netting. Analysis Unit 7 at the site dates between 7550 B.C. and 6050 B.C. and produced both fishnet and lark's head knotted netting made with two-ply, 5 spun, 5 twist (Type III) and two-ply, 5 spun, 5 twist (Type IV) cordage. The agave (Agave lechegilla) cordage is of narrow gauge (6.2 - 2.1 mm) and fine mesh (19.2mm -43mm). These and later nets from the site would have been suitable only for taking rabbits or similar small game. Knot types represented in this netting collection, which is the largest outside the Great Basin, include square knots and combinations of fishnet and lark's head knots or clove hitch and lark's head knots.

Although it is often present in quantities from later sites in the Western Basin Center, knotted netting is usually poorly described and very tentatively dated. Upper Level 4 at Fishbone Cave yielded a fragment of knotted netting of unspecified type, cordage gauge, mesh size, or configuration dated to 5090 ± 330 B.C. (Orr 1974). This is the oldest dated netting from the Western Great Basin.

Some 1,016 netting fragments weighing a total of 2,532g were recovered from Lovelock Cave, Nevada, (Loud and Harrington 1979: 97-99). Apparently, all of these specimens are made with two-ply, Z spun, S twist (Type IV) cordage. Some 82% (by weight) of these specimens range from 0.4 to 0.5mm in cordage diameter (Loud and Harrington 1979: 87). It is interesting that almost 60% (again by weight) of the recovered netting was wrapped "...about the body of a child." Presumably, the remaining 40% occurred throughout the deposits, which span the period from ca. 2700 B.C. to A.D. 1829 (Heizer 1973: 90) with most of the voluminous artifactal inventory from the site ascribable to the period from ca. 1300 B.C. to a massive rockfall dated to ca. A.D. 440. The mesh size of the Lovelock Cave knotted netting ranges from 12mm to 220mm square although most mesh sizes are in the 30mm to 50mm range. The most common netting knot is the weaver's knot, called by Loud and Harrington (1979: 88) the mesh knot, but also known as the sheet bend knot. Any other knots used in the knotted netting are not specified in the available literature.

The Lovelock Cave nets are good examples of bird (specifically waterowl) nets and fishnets. Although the possibility is not discussed, the mesh size of many fragments suggests that the Lovelock nets were also used for taking small terrestrial game. The presumed fishnets include a "fragmentary" dip net "gathered to a point at the bottom" measuring ca. 1.8m to 3.0m in length and breadth, respectively, and a number of other specimens with widths of 1.2m to 1.8m and more. Loud and Harrington (1979: 89) judge from the few nets ripped lengthwise that fishnets were generally from 9.1m to 10.7m in length with one specimen in excess of 12.8m. Of particular interest is the observation that some of these fishnets were apparently dyed and when found occasionally preserved several regularly alternating colors (Loud and Harrington 1979: 90).

Excavations at Humboldt Cave and of so-called Lovelock Culture sites in western Nevada have also produced knotted net specimens that are undescribed in the literature except to note that "their nature and variety is analogous to those of Lovelock Cave" (Heizer and Krieger 1956: 62). Most of these nets probably date ca. A.D. 1-900.

Other Western Great Basin sites have yielded knotted netting (e.g., Ocala Cave, the Falcon Hill and Lake Winnemucca caves), but these artifacts are undescribed and undated. Unfortunately, the same is true of the scarce netting recovered from any of the Northern Basin Center sites, including Roaring Springs Cave, Catlow Cave No. 1, the Massacre and Tule Lake caves, and, perhaps, Seven Mile Ridge. Cressman (1942: 27) reports only 24 pieces of knotted netting including 16 specimens from Roaring Springs Cave and eight from Catlow Cave No. 1. Apparently, the nets from both sites are made of two-ply, Z spun, S twist (Type IV) Aparpyum sp. cordage of unspecified diameter. The nets are tied with fishnet or weaver's knots, but the mesh gauge is unspecified. All of these items are certainly much younger than 5000 B.C., in age, but their exact temporal placement is unknown.

Massacre Lake Cave produced what is described as "abundant" knotted netting fragments made of Aparpyum sp. cordage of unspecified diameter (Heizer 1942: 122). Mesh ranges from 48mm to 73mm (average of 59mm) indicating that nets could have been used for taking small terrestrial or aquatic game. The specimens are of unknown age.


"The netting... accompanying Burial I is made of fine ply, two-ply twisted cord about 1mm in diameter. The mesh spacing is probably about 1mm. It may have been either a rabbit or fishnet.

Cache I yielded several lengths of cordage ca. 1mm in diameter adhering to twined basketry fragments. These are thought to have been net fragments (Heizer 1942: 125). The Burial I and Cache I "netting" is of unknown age.

The only other site in the Northern Basin Center that may have produced knotted netting is Seven Mile Ridge, Cave No. 1. According to Cressman and Redfield (1942: 8, Tables 1, 3), this cave produced 24 specimens of (undescribed) cordage which may date from ca. 50 B.C. to A.D. 930. This assemblage may include some specimens of knotted netting.
On the western edge of the Great Basin, two other localities have knotted netting. These include Tommy Tucker Cave (Pfenenga and Riddell 1940; Riddell 1936, 1937) in northern California and Ceville Rockshelter (Meighan 1953) in the Panamint Basin of California. Excavations at Tommy Tucker Cave produced 48 pieces of cordage or "twisted twine" with 22 knots. Four of these knots are found on one specimen of netting made of two-ply, 2 span, 5 twist (Type IV) cordage that is ca. 0.6 mm in diameter. Mesh size is not specified, but the specimen is tied with mesh knots (i.e., fishnet knots) and is alleged to be a fragment of a gill net. This specimen and several others that may be netting fragments are attributed to a late phase of the Lovelock Culture, ca. 1 B.C., to A.D. 900.

Ceville Rockshelter yielded very late examples of knotted and unknotted cordage which Meighan (1933: 189) places in the 300 years just prior to A.D. 1750. Some of the knotted cordage, which is for the most part thoroughly described by Gregoire (1953), may be netting, at least judging by the knots represented (i.e., sheet bend and square knot); however, no specimen is identified as a net fragment by Gregoire.

FIBER-WRAPPED RINGS

After knotted netting, fiber-wrapped rings arguably represent the second most "standardized" and next most comparable form among the miscellaneous perishables from Dirty Shame Rockshelter. The geographic and chronological distributions of these artifacts, however, are far more restricted than the knotted netting.

Potentially, the oldest fiber-wrapped rings from the Great Basin and its immediate environs are from Cowboy Cave (Hewett 1980: 69, Figure 30 C: 72). Stratum IV at this site, dated to 1685 ± 55 B.C., produced one fiber-wrapped ring and three other ring-like forms called "buttons." Other specimens were recovered from Strata IV (two buttons), Vb (one fiber-wrapped ring and one button), and Vb (two fiber-wrapped rings and two buttons) spanning a date range from 1610 ± 75 B.C. to A.D. 69 ± 65 B.C. Two other fiber-wrapped rings are of unknown provenience. The Cowboy Cave fiber-wrapped rings differ from the "doughnut-shaped" specimen at Dirty Shame Rockshelter. They have a larger inner diameter (ca. 3–11 cm), are not always wrapped over their entire circumference, and are constructed from different materials differently arranged. They are thought to have been used in the widely distributed ring and pin game. The Dirty Shame Rockshelter squashbush (Rhus trilobata) "button" and the button-like items from Cowboy Cave are formed from a "roll" of bark strips. What is more, they are of comparable diameter and were made using an awl. The Cowboy Cave specimens, however, are finished differently and are probably reinforced centers for coiled baskets (see Adovasio 1979). The Dirty Shame Rockshelter specimens are not basket centers.

Somewhat more recent fiber-wrapped rings are reported from Swallow Shelter (Dalley 1976: 63). These include a fiber-wrapped bark ring and an "unidentified object" from Stratum 9, which is of Fremont ascription (A.D. 810 ± 110). The Swallow Shelter wrapped specimen has a greater inner diameter (ca. 2.3 cm) and is of a different raw material (Juniperus sp.) than the "doughnut-shaped" fiber-wrapped ring from Dirty Shame Rockshelter. No functional interpretation is made of the Swallow Shelter bark ring, but it may also have been used in the ring and pin game. The "unidentified object" from Swallow Shelter Stratum 9 superficially resembles the Dirty Shame Rockshelter squashbush (Rhus trilobata) "button" but, as Dalley (1976: 63) suggests, is probably a center for a coiled basket.

The only other fiber-wrapped rings reported from the Eastern Basin Center are two specimens of unknown age from Hogup Cave (Allens 1970: 121). These rings have a larger internal diameter (ca. 5 cm) and are of different raw materials (i.e., bark and wrap of unspecified type of branches). The bundle of Artemisia sp. bark, and wrap of Artemisia sp. bark cordage) than the Dirty Shame Rockshelter specimens. These rings may also be components of the ring and pin game.

Fiber-wrapped rings are not widely reported from the Western Basin Center. Either such forms are rare in that area or, more likely, they have simply been ignored in the artifact descriptions of published reports. Two specimens that do resemble fiber-wrapped rings are illustrated by Loud and Harrington (1929: Plate 40, 10) for Lovelock Cave. These items are "doughnut" and "button-shaped" constructions made of raw materials roughly similar to their Dirty Shame Rockshelter counterparts. No measurements are available, and the specimens are of unknown age.

The only fiber-wrapped ring reported from the Northern Basin Center is a specimen of unknown age from Catlow Cave No. 1 (Cressman 1942: 70). This item is described as a "basketry made with a series of half hitches" (Cressman 1942: 70). Neither raw material nor measurements are given. As noted previously in this monograph (see BASKETRY), the half-hitch wrapped ring from Dirty Shame Rockshelter may be analogous to this Catlow Cave specimen. Cressman (1942: 70) suggests that the latter was used in the dart and ring game. Indeed, the Catlow ring was accompanied by, if not associated with a dart fragment that Cressman (1942: 70) himself suggests was the other component in the game. Game darts without rings are reported by Heizer (1942b: 12, Figure 100 C 4) from Massacre Lake Cave and by Heizer and Krieger (1956: 71, 83) from Humboldt Cave, Nevada.

CORDAGE-WRAPPED TWIGS

Given the great variation possible in cordage-wrapped stick or twig combinations and the variable descriptions accorded such objects in site reports, it is neither feasible nor useful to seek exact analogues for the Dirty Shame Rockshelter cordage-wrapped twigs. For example, Wheeler (1973: 28–29) describes two Pueblo II-age smoothed sticks from Elza Cave ca. 12.1 cm long and 6.4 mm in diameter. Their cut ends had been placed together and the sticks bound near the center with cordage. There is no likelihood that this specimen has more than a "generic" relationship to the Dirty Shame Rockshelter cordage-wrapped twig. Other cordage-wrapped sticks from other Great Basin sites share even fewer similarities to the Dirty Shame Rockshelter example and little is to be gained by expanding upon such matters.

FIBER-PACKED REEDS

These artifacts are relatively common in Pueblo and Basketmaker sites in the Southwest, (e.g., Coe 1977: 121–122) however, fiber-packed reeds are apparently extremely rare in Great Basin sites. A review of published reports identified no reed "cigarettes" with filler reported for any other Great Basin archaeological site.
Aikens (1970:165) describes short, single-joint *Phragmites* sp. cylinders with cut and possibly smoothed ends from Hogup Cave. Eighteen specimens (average length 2.0cm - 5.5cm; outer diameter 7mm - 1.1cm) occur sporadically from Stratum 4 through Stratum 14 (ca. 5865 ± 330 B.C. - A.D. 1330 ± 70). These specimens do not have pierced septa nor are they scorched, but Aikens (1970:165) states that they are similar in both size and appearance to ceremonial reed cigarettes from the Southwest.

Hogup Cave also produced short *Phragmites* sp. cylinders with more than one joint, representing so-called "short tubes," longer *Phragmites* sp. segments, and two fragmentary reed tubes bound with sinew (Aikens 1970). None of these contained fiber fillers, nor do they resemble the Dirty Shame Rockshelter specimen in anything except raw material.

Janetski (1980) reports four short *Phragmites* sp. segments from Cowboy Cave, all of which are one joint in length with intact septa and no evidence of burning. One is carefully cut on both ends; the other is cut on one end and broken on the opposite end. The longest of these segments measures 5.2 cm with a diameter of 1.0 cm. Most of these items are from Stratum V; with an associated date of A.D. 370 ± 60 (Janetski 1980). Janetski (1980) draws broad analogies to the Hogup Cave specimens and identifies these items as possible cigarettes.

Dally (1976:65) reports 10 worked reed fragments from Swallow Shelter, most of which are from the Fremont horizon (ca. A.D. 830 ± 110). All are square-cut on one or both ends. Lengths vary from 1.1 cm to 20.3 cm. The average diameter is 8mm - 1.0cm. The cane septa are unperforated, and the reeds are unburned.

Wheeler (1973:28) briefly describes two short lengths of *Phragmites* sp. with sinew wrappings from Etna Cave but indicates that they are probably atlatl dart or arrow shafts. The same interpretation has been offered for many specimens of sinew-wrapped cane of varying length from Great Basin sites such as Hogup Cave, Cowboy Cave, the Promontory caves, Danger Cave, Jukebox Cave, Remnant Cave, Lovelock Cave, Humboldt Cave, and Swallow Shelter, to name but a few. Many of these specimens are of a diameter consistent with the Dirty Shame Rockshelter specimen, but most are not unambiguously identifiable as "cigarettes."

Sinew-wrapped *Phragmites* sp. fragments and specimens that have no such wrapping are reported from the Northern Basin Center (Cressman 1942: Figures 93 d, d; 160, c5; c7, c8; Table 18), but these are rarely described or discussed. None of the illustrated Northern Basin Center specimens appear to be bona fide cigarette fragments.

**DRILLED REEDS**

Bone flutes have been reported in the Great Basin (e.g., Loud and Harrington 1929:39, Figure 7a), but archaeological examples of wooden and reed flutes are apparently rare. One specimen is known from the Northern Basin Center in Stratum I at Roaring Springs Cave (Cressman 1941:72, Table 18). The flute is of undetermined age and is said to consist of a "large" *Phragmites* sp. fragment with four perforations (Cressman 1941:73). Ethnographic examples of Great Basin whistles and flutes are briefly noted below (see ETHNOGRAPHIC CONTINUITIES).

**RENT AND KNOTTED TWIGS AND KNOTTED FIBERS**

Rent or knotted twigs occur in all portions of the Great Basin and span virtually the entire human occupation sequence. Unfortunately, they are seldom described or discussed in detail, and, like many other miscellaneous perishables, were probably "ignored" in many excavations. Cressman (1941:73) notes that "twig knots" were recovered from Roaring Springs Cave (one specimen) and Catlow Cave No. 1 (two specimens). The age and possible function of these examples are unknown, and no other details are provided.

In the Western Basin Center, Loud and Harrington (1929:91-92) report 24 knotted *Salix* sp. twigs measuring 2-6 mm in diameter and of variable length. Again, these are of unknown function and age. Dally (1976:62) records two Promontory-age bent, decorticated *Salix* sp. branches from Strata 9 and 11 at Swallow Shelter. The function of the Swallow Shelter twigs, like the three 5-beat and knotted specimens from Stratum IV and the two specimens from Stratum IVB at Cowboy Cave (Hewitt 1980:72), is unknown. The Stratum IVC specimens date to 1655 ± 55 B.C. The Stratum IVB items are not directly dated. Janetski (1980:86) also documents a bent stick of unknown use from Stratum IV at Cowboy Cave.

Many bent or knotted twigs and branches were probably snare parts, but they are often too fragmentary to ascribe this function with confidence. Genuine twig snare larvae are reported from a number of Great Basin sites. The largest and best-described collection is from Lovelock Cave (Loud and Harrington 1929:102). Eight snare wires for catching very small animals are represented complete with twig elements and cordage. Also found were parts of snare that consist entirely of bowdquet sticks. The wood is usually willow or birch, probably chosen for its long, slender wands and springiness. A cache of late Lovelock Culture (ca. 1 B.C. to A.D. 900) snare from Pit 12 was associated with the famous duck decoys from that site (Loud and Harrington 1929:115, Plate 48a, b). The twigs are again willow or birch, and the cordage is hemp or dogbane (Apocynum sp.).

In the Northern Basin Center, Cressman (1942:72) reports five bent-twigs snare from Zone I at Roaring Springs Cave but gives no details on them. Helzer (1967:12) Figure 10b) illustrates and briefly discusses a bent-twigs loop snare from Masacre Lake Cave. Raw materials and other details of construction are not provided.

This cursory summary suggests that although one can be nearly certain that no Great Basin aboriginal group lacked one or another kind of snare trap, the archaeological record of that segment of aboriginal technology is not well-represented and, when present, too often has been ignored or down-played in the literature. The same applies to knotted fibers which are abundant in many widely separated localities but are curiously "missing" or simply unreported from others. Hewitt (1980:72) reports 199 knotted yucca (Yucca sp.) strips that come from virtually all levels at Cowboy Cave, and 83 similar items were recovered at the not-too-distant Sand Dune Cave (Lindsay, Ambler, Stein, and Hobler 1968). Knotted fibers are often submerged under single-ply, untwisted, knotted cordage at other sites (e.g., Danger Cave, Hogup Cave). At Lovelock Cave, however, the large collection of knotted fibers is treated as a separate entity (Loud and
Harrington 1979: 83-85). This collection numbers some 400 specimens and consists mainly of *Scirpus* sp., *Typha* sp., and *Juncus* sp., tied with at least eight different knot types. Humblet Cave (Heizer and Krieger 1958) also produced a large number of knotted fibers as did the Lake Winnemucca and Pauco Hill sites. Unfortunately, these collections as well as many others are undescribed. The vast Finds Cave, Texas, knotted fiber collection has been extensively described (Andrews and Adovasio 1980), but the site is simply too far from the study area to be of comparative value in the present case.

OTHER MISCELLANEOUS PERISHABLES

The publication record on some categories of miscellaneous perishables from the Great Basin is clearly uneven. The analytical treatment of only slightly processed vegetal materials (especially those not intended for food) is bleak. Bundles or clumps of unfolded, folded, looped, or wrapped *Artemisia* sp. fiber and other examples of raw materials are too seldom reported from the excavations of dry caves or rockshelters even though such items may constitute a large portion of the perishables from such sites. Occasionally, materials such as shredded fibers and bark bundles are reported in the floral remains sections of monographs because they appear to be unadulterated. Valuable data on the procurement and processing of vegetal resources for perishable artifact production can thus be lost or inadequately treated. Prominent exceptions to this practice include Hogup Cave (Aikens 1970), Cowboy Cave (Hewitt 1980), and Lovelock Cave (Loud and Harrington 1929) where various groups of slightly to extensively modified but otherwise unworked raw materials are at least quantified and tabulated stratigraphically.

Given the lack of good comparative data on most artifacts grouped in this monograph under the rubric "miscellaneous perishables" (except, perhaps, for the knotted netting), it is virtually impossible to discuss these items further. It is not true that these artifacts are always rare in Great Basin sites but rather that they too often have been ignored during excavation or subsequently in published reports. It is therefore impossible to set out anything approaching a "chronology" for this group of perishables (even for knotted netting) in any section of the vast cultural and physiographic province that is the Great Basin.

The Dirty Shame Rockshelter miscellaneous perishables include a wide range of aboriginal fiber products. This implies a similarly broad and diverse range of functions. Indeed, it is probable that such "miscellaneous perishables" (the term itself is dismissive) were utilized in more aspects of day-to-day living than any other single fiber artifact class. Most of the constituents of this "taxon," from the highly standardized and labor-intensive knotted nets to the quickly produced and barely modified knotted fibers, are purely utilitarian. Many other constituents, however, reflect intimate, almost personal glimpses into aboriginal material culture. The toy flute, or the "doodie," and particularly the various possible ring and pin or dart and pin game components afford a rare but admittedly dim perspective on a side of aboriginal Great Basin life that was not wholly bound up in the food quest. None of the Dirty Shame Rockshelter miscellaneous forms are interpreted to have had magico-religious significance (though this can never be certain), and few would qualify as elegant, aesthetic, or artistic. Nevertheless, in their own ways, they were probably as important to their makers and users as the baskets, cords, and sandals which command perhaps a disproportionate share of our attention.

ETHNOGRAPHIC CONTINUITIES

Due to their often fragmented condition and unstandardized character, it is difficult to correlate any of the Dirty Shame Rockshelter miscellaneous perishables with specific ethnographic materials. Several of the more conventional forms, specifically the knotted nets, do have potential ethnographic counterparts, the incidence and function of which merit brief discussion.

Knotted nets were widely used ethnographically in the Great Basin. Long rectangular nets and less commonly net squares for rabbit hunting are reported among groups of Utes and Southern Paiutes (Stewart 1942: 247), the Nevada Shoshone (Stewart 1941: 271), Northern and Gosiute Shoshone (Steward 1942: 293), and the Northern Paiute (Stewart 1941: 368). A range of circular, dome-shaped, tunnel-shaped, flat, small-mesh, and rabbit nets were used by these groups (Stewart 1941: 368; 1942: 267; Stewart 1941: 271; 1942: 295) to capture sagehens, grouse, doves, ducks, and, rarely, eagles. When available, fish were at times caught with dip or scoop nets. Unfortunately, the fragmented state of the Dirty Shame Rockshelter knotted netting prevents us from knowing the net form and therefore of comparing it with ethnographic nets and netting practices.

Attributes of knotted net manufacture among selected ethnographic groups have been presented in Table 11 (see CORDAGE). As indicated there, most Numic-speaking net-making groups employed the shuttle and mesh technique. Although these three different net body knot types are ethnographically reported, only the weaver's knot was apparently used at Dirty Shame Rockshelter. This knot type is documented among the Northern Paiute, Nevada Shoshone, and Gosiute. As at Dirty Shame Rockshelter, dogbane or hemp (*Apocynum* sp.) appears to have been a preferred raw material for nets among virtually all ethnographic Great Basin populations.

Few ethnographic analogies to other Dirty Shame Rockshelter miscellaneous perishables can be drawn. The ring and dart game is reported among groups of Ute-Southern Paiute (Stewart 1942: 283) and Nevada Shoshone (Stewart 1941: 249), but it was not played among the Northern Paiute (Stewart 1941: 402). Groups of Ute-Southern Paiute (Stewart 1942: 283), Nevada Shoshone (Stewart 1941: 283), Northern Paiute (Stewart 1941: 397), and Northern and Gosiute Shoshone (Stewart 1941: 328) played the ring and pin game. The ring, as used ethnographically in both games, differs from the Dirty Shame Rockshelter fiber-wrapped rings in form and hole diameter.

Tobacco (*Nicotiana* sp.)-filled cigarettes of cane (*Phragmites* sp.) and/or elderberry (*Sambucus* sp.) are recorded for the Paiwan Ute, Winnemucca or Wimontnali Ute, San Juan Southern Paiute (Stewart 1942: 293), Fish Spring (Stewart 1941: 308) and Wada dokado (Stewart 1941: 912) Northern Paiute, and the Shoshone of Lida, Morey, Edgar Canyon, Snake River, Reese River, and Battle Mountain (Stewart 1941: 308). The Shoshone of northern Nevada occasionally mixed other ingredients (e.g., dogwood, *Cornus* sp.) with the tobacco (Stewart 1941: 251). We know of no ethnographic reports of dogbane (*Apocynum* sp.)-filled cigarettes.
Cane (Phragmites sp.) whistles and flutes are known for the Koso Panamint, Owens Valley Paiute (Driver 1937: 83), Atsugewi and Eastern (Hammawi) Achomawi (Voegelin 1942: 94). Ethnographic Great Basin whistles and flutes were also made of elderberry (Sambucus sp.), redbud (Cercis sp.), willow (Salix sp.), marsh grass (Poa sp.), and bone (taxa unreported).

Summary

In retrospect, the salient features of the Dirty Shame Rockshelter miscellaneous perishables assemblage are these:

1. The miscellaneous perishables from Dirty Shame Rockshelter do not constitute an internally consistent single class of items as that term is applied to basketry, cordage, or sandals; rather, they include the "products" of a variety of distinct crafts which apparently served a wide range of utilitarian and possibly non-utilitarian functions.

2. There are no demonstrable chronological correlates or sequences among the miscellaneous perishables as a group, nor is it possible to establish craft trends within any of the component artifacts.

3. Analogies for some of the Dirty Shame Rockshelter miscellaneous perishables categories (particularly the knotted netting) can be "tracked" geographically and temporally across the Great Basin, but the data are not presently sufficient either in number of specimens or the completeness of the artifact descriptions to postulate culture-historical affinities or to examine functional similarities and differences.

4. Several artifact categories among the Dirty Shame Rockshelter miscellaneous perishables are reported for one or another ethnographically known population, but only the weaver's knot netting is reliably documented among the Northern Paiute as well as other Numic-speaking groups.
Figure 117. KNOTTED NETTING from Dirty Shame Rockshelter. NOTE: The specimen is from a net of uncertain configuration made with TYPE IV: TWO PLY, Z SPUN, S TWIST cordage (see CORDAGE) tied with weaver's knots.

Figure 118. KNOTTED NETTING from Dirty Shame Rockshelter. NOTE: The specimen is from a net of uncertain configuration made with TYPE IV: TWO PLY, Z SPUN, S TWIST, cordage (see CORDAGE) tied with weaver's knots.
Figure 119. KNOTTED NETTING from Dirty Shame Rockshelter. NOTE: The specimen is from a net of uncertain configuration made with TYPE IV: TWO PLY, Z SPUN, 5 TWIST cordage (see CORDAGE) tied with weaver's knots. This specimen was recovered from a probable human coprolite with the crayfish (*Astacus* sp.) fragments shown in the lower right hand portion of the photo.

Figure 120. Possible throwline segment of a casting net from Dirty Shame Rockshelter.
Figure 121. FIBER-WRAPPED RINGS from Dirty Shame Rockshelter. NOTE: The specimens are made of smawbush (Rhus triabasta) and may be gaming pieces.

Figure 122. CORDAGE-WRAPPED TWIGS from Dirty Shame Rockshelter. NOTE: This construction is probably a fragment of a hinged stick snare.
Figure 123. FIBER-PACKED REED from Dirty Shame Rockshelter. NOTE: This construction probably represents an aboriginal "cigarette."

Figure 124. DRILLED REED from Dirty Shame Rockshelter. NOTE: This construction may be the mouthpiece of a toy flute.
Figure 125. "DOODLE" from Dirty Shame Rockshelter. The function of this specimen is unknown.

Figure 126. BENT TWIG from Dirty Shame Rockshelter. NOTE: The specimen may be a snare spring.
QUIDS

R. L. Andrews
R. C. Carlisle
J. M. Adovasio

Introduction

Quids are polymorphic masses of shredded and masticated plant fibers that are the end products of a unique set of plant procurement and processing behaviors. These singularly "unusual" (Jennings 1957: 220) artifacts are reported for only a few other Great Basin archaeological sites, and even fewer attempts have been made to interpret their potential range of functions within aboriginal society. This circumstance is unfortunate though understandable. At first glance there seems little to learn from these undistinguished fiber wads, and this may explain their frequent absence from archaeological site reports if not from archaeological sites. A working assumption in this monograph is that the occurrence and frequency of quids from archaeological contexts otherwise favorable to perishables preservation are under-reported as a whole and simply unreported in many cases.

Examination of the 1,070 Dirty Shame Rockshelter quids and the bundles of fibers and rhizomes that had been collected in preparation for mastication (here called proto-quids), reveals a remarkable range of shapes and sizes suggestive of several potential uses. Many specimens bear the impressions of human teeth and/or have been moulded to the shape of the human palate and dental arcade. Others appear to be blood-stained and may have served as bandages or menstrual pads.

Quids and proto-quids are frequent constituents in the Dirty Shame Rockshelter perishables assemblage. They are present in all six stratigraphic zones identified at the site and, notably, are present in Zone V (590-4850 B.C.) and Zone VI (7500-5900 B.C.). Quids are therefore the single most numerous, well-distributed, and also among the oldest perishables from the site.

Analytical Procedures

To preserve the clarity and integrity of any remnant tooth impressions, quids were gently brushed free of loose dirt but were not cleaned using trisodium phosphate or any other agent. Analysis was performed by inspection, or specimens were examined under a variable power binocular and long stereoscopic scanner.

The specimens were sorted on the basis of several criteria. These included overall shape and dimensions, weight, plant part and plant taxon, degree of mastication, and evidence of thermal alteration. Tooth and gingiva impressions were recorded and, when possible, were identified by Dr. W. Doyle, Children's Hospital, Pittsburgh, Pennsylvania. All materials found in association with the quids during their examination were also recorded. All specimens were measured in the metric system using Helios needle-nosed dial calipers and were weighed on a Mettler analytical balance. Because the quids could not be thoroughly cleaned before weighing, the results given below provide a relative yet consistently obtained estimate of actual fiber weight.

In nearly all cases, identification of quid raw materials was a lengthy and tedious process that extended intermittently over nearly 10 years. Representative specimens from each stratigraphic level at the site were sent to five paleobotanical specialists (Vaughn M. Bryant, Jr., Kathleen Cushman, Gary F. Fry, Kimball T. Harper, and David Madsen). The analysts individually reported that most of the quids sent to them had been extensively macerated, and that the taxon of the plant material was therefore very difficult to identify. Several analysts identified their quids as the rhizomes and/or lower stems of an aquatic plant or, less likely, a bunch grass. The consensus was that most of the Dirty Shame Rockshelter quids were probably cattail (Typha sp.). Samples of fresh cattail specimens were then collected, cleaned, sectioned, and examined at the University of Pittsburgh. This helped to confirm the identification of the archaeological specimens. The subsequent identification of several "proto-quids" of unchewed Typha sp. rhizomes and related fragments among the Dirty Shame Rockshelter perishables added considerable credence to the plant identification. The reader should note that our preliminary identification of Muhlenbergia sp. as a quid raw material source and reported in Hall (1977) was in error.

Criteria of Classification

The 1,070 quids and proto-quids from Dirty Shame Rockshelter are allocated to nine analytical categories based upon their shape.

The Dirty Shame Rockshelter Quids

TYPE I: CIRCULAR QUIDS
No. of specimens: 48 (Figure 127).
Description and Comments: These quids are circular in plan and lenticular to bi-convex in cross section. Forty-seven circular quids consist of the masticated vascular bundles of cattail (Typha sp.) rhizomes, one of which retains part of the lower outer-stem leaves. The remaining specimen is the moderately well-masticated leafstalk of an unknown bunch grass. Eight of these quids have unidentifiable tooth impressions. Two others preserve the impressions of their chewer's gingiva. The specimens are unstained, but 16 quids show evidence of slight to moderate thermal alteration, and three others are charred. One specimen is associated with charcoal fragments.
**Measurements**: *Typha* sp. quids.
- Range in length: 11.50-39.10 mm.
- Mean length: 23.87 mm.
- Range in width: 2.10-30.20 mm.
- Mean width: 18.17 mm.
- Range in thickness: 1.60-12.35 mm.

**Measurements**: Gramineae quid.
- Length: 22.80 mm.
- Width: 15.80 mm.
- Thickness: 10.65 mm.

**Provenience**:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
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<tr>
<td>II</td>
<td><em>Typha</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td><em>Typha</em> sp.</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>Gramineae</td>
<td>1</td>
</tr>
<tr>
<td>V</td>
<td><em>Typha</em> sp.</td>
<td>4</td>
</tr>
<tr>
<td>VI</td>
<td><em>Typha</em> sp.</td>
<td>3</td>
</tr>
</tbody>
</table>

**TYPE II: SEMICIRCULAR QUIDS**

No. of specimens: 83 (see Figure 127).

**Description and Comments**: These specimens are semicircular to elliptical in plan and lenticular to bi-convex in cross section. The quids in this category consist of well-masticated vascular bundles of cattail (*Typha* sp.). Eighty-two of them are portions of rhizomes; one specimen consists of lower outer-stem leaves. Unchewed portions indicate that the leaves had been cut from the lower stem with a sharp, hard instrument. Thirty-seven specimens preserve tooth impressions; four of these are identifiable and include one specimen each of incisor, canine, premolar, premolar, and molar. Four quids show impressions of the chewer’s gingiva, and another has both unidentifiable tooth indentations and gingival impressions. The specimens are unstained, but 35 quids show slight to moderate thermal alteration, and eight are charred. One specimen is associated with a minute, undecorticated twig (*Salix* sp.) twig.

**Measurements**:
- Range in length: 13.30-67.75 mm.
- Mean length: 29.93 mm.
- Range in width: 6.90-26.90 mm.
- Mean width: 14.60 mm.
- Range in thickness: 2.15-18.75 mm.

**Provenience**:

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<th>No. of specimens</th>
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<tr>
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<td>III</td>
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<tr>
<td>IV</td>
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<tr>
<td>V</td>
<td><em>Typha</em> sp.</td>
<td>14</td>
</tr>
<tr>
<td>VI</td>
<td><em>Typha</em> sp.</td>
<td>2</td>
</tr>
</tbody>
</table>

**TYPE III: OVAL QUIDS**

No. of specimens: 68 (see Figure 127).

**Description and Comments**: These specimens are approximately oval in plan and lenticular to bi-convex in cross section. All specimens are the well-masticated vascular bundles of cattail (*Typha* sp.) rhizomes, but one quid also contains some lower outer-stem leaves. Eighteen of these quids have tooth impressions, three of which are identifiable. These include one example with canine and premolar marks and two examples with molar indentations. A single quid shows the impression of the chewer’s gingiva. The specimens are unstained, but 26 quids show slight to moderate thermal alteration, and eight are charred. One quid is associated with a few unmasticated but decorticated strips of sagebrush (*Artemisia* sp.) bark.

**Measurements**:
- Range in length: 10.35-38.10 mm.
- Mean length: 25.85 mm.
- Range in width: 1.00-33.70 mm.
- Mean width: 16.55 mm.
- Range in thickness: 1.90-18.80 mm.

**Provenience**:

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<th>No. of specimens</th>
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</tr>
<tr>
<td>II</td>
<td><em>Typha</em> sp.</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td><em>Typha</em> sp.</td>
<td>22</td>
</tr>
<tr>
<td>IV</td>
<td><em>Typha</em> sp.</td>
<td>29</td>
</tr>
<tr>
<td>V</td>
<td><em>Typha</em> sp.</td>
<td>6</td>
</tr>
<tr>
<td>VI</td>
<td><em>Typha</em> sp.</td>
<td>6</td>
</tr>
</tbody>
</table>
TYPE IV: TEAR DROP QUIDS

No. of specimens: 15 (see Figure 127).

Description and Comments: The shape of these specimens is roughly tear drop to foliate in plan and lenticular to bi-convex in cross section. All quids in this type are well-masticated vascular bundles of cattail (Typha sp.) rhizomes. Thirty-six of the tear drop quids preserve tooth impressions, but only one, a molar, is identifiable. Six quids preserve impressions of the chewer’s gingiva. Four specimens are stained, possibly with blood. Forty-four quids show slight to moderate thermal alteration, and 11 are charred. Associations include minute, unidentifiable bone fragments (two specimens) and strips of unmasticated but decorticated sagebrush (Artemisia sp.) bark (one specimen).

Measurements:

- Range in length: 10.90-61.00 mm.
- Mean length: 26.57 mm.
- Range in width: 1.23-27.80 mm.
- Mean width: 15.97 mm.
- Range in thickness: 1.55-16.00 mm.
- Mean thickness: 6.35 mm.

- Range in maximum fiber diameter: 0.05-20.35 mm.
- Mean maximum fiber diameter: 2.66 mm.
- Range in weight: 0.063-1.981 g.
- Mean weight: 0.461 g.

Provenience:

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<th>Raw Material</th>
<th>No. of Specimens</th>
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<tr>
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<td>Typha sp.</td>
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<tr>
<td>IV</td>
<td>Typha sp.</td>
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<tr>
<td>V</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Typha sp.</td>
<td>17</td>
</tr>
<tr>
<td>Prov. Unk.</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
</tbody>
</table>

TYPE V: TRIANGULAR QUIDS

No. of specimens: 10 (see Figure 127).

Description and Comments: These specimens are roughly triangular in plan and lenticular to bi-convex in cross section. The quids are the masticated vascular bundles of cattail (Typha sp.) rhizomes. One quid preserves various tooth cusp impressions, but indentations on another quid cannot be identified. A single quid preserves the impression of its chewer’s gingiva. The specimens are unstained, but six quids show slight to moderate thermal alteration, and one is charred.

Measurements:

- Range in length: 18.90-33.10 mm.
- Mean length: 26.42 mm.
- Range in width: 12.83-29.00 mm.
- Mean width: 17.74 mm.
- Range in thickness: 4.00-7.90 mm.
- Mean thickness: 5.38 mm.

- Range in maximum fiber diameter: 0.80-5.95 mm.
- Mean maximum fiber diameter: 2.97 mm.
- Range in weight: 0.139-0.784 g.
- Mean weight: 0.348 g.

Provenience:

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<th>No. of Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Typha sp.</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Typha sp.</td>
<td>5</td>
</tr>
<tr>
<td>VI</td>
<td>Typha sp.</td>
<td>2</td>
</tr>
</tbody>
</table>

TYPE VI: ELONGATE QUIDS

No. of specimens: 231 (see Figure 127).

Description and Comments: These specimens are elongate in plan and roughly lenticular to bi-convex in cross section. Two hundred twenty-eight of these quids are the well-masticated vascular bundles of cattail (Typha sp.) rhizomes. Two specimens are masticated, decorticated sagebrush (Artemisia sp.) bark. The moderately well-masticated leafstalks of an unknown bunch grass constitute another quid. Eighty-one quids exhibit tooth impressions. Eleven of these are identifiable and include: premolar (one specimen), premolar and molar (three specimens), molar (two specimens), and miscellaneous cusp markings (five specimens). Six elongate quids preserve impressions of the chewer’s gingiva. Three specimens are stained, possibly with blood. Eighty-one quids show slight to moderate thermal alteration, and 16 are charred. Two specimens are associated with a few minute strips of decorticated but unchewed Artemisia sp. bark. Fur of an unidentified animal adheres to another quid.

Measurements: Typha sp. quids.

- Range in length: 12.80-66.70 mm.
- Mean length: 30.79 mm.
- Range in width: 1.00-30.90 mm.
- Mean width: 13.52 mm.
- Range in thickness: 1.40-14.45 mm.
- Mean thickness: 5.37 mm.

- Range in maximum fiber diameter: 0.29-16.10 mm.
- Mean maximum fiber diameter: 2.16 mm.
- Range in weight: 0.038-2.459 g.
- Mean weight: 0.462 g.

Measurements: Artemisia sp. quids.

- Range in length: 20.90-47.50 mm.
- Mean length: 34.20 mm.
- Range in width: 8.00-12.35 mm.
- Mean width: 10.18 mm.
- Range in thickness: 3.60-5.00 mm.
- Mean thickness: 4.80 mm.

- Range in maximum fiber diameter: 2.70-3.60 mm.
- Mean maximum fiber diameter: 3.15 mm.
- Range in weight: 0.300-0.874 g.
- Mean weight: 0.587 g.
Measurements: Gramineae quid.
Length: 31.10 mm.
Width: 7.35 mm.
Thickness: 4.18 mm.

Proveniences

Zone | Raw material | No. of specimens
--- | --- | ---
I | Typha sp. | 5
II | Typha sp. | 12
III | Typha sp. | 69
IV | Gramineae | 1
V | Typha sp. | 96
VI | Artemisia sp. | 2
VII | Typha sp. | 17
VIII | Typha sp. | 27
IX | Typha sp. | 2

TYPE VII: CRESCENTIC QUIDS

No. of specimens: 90 (see Figure 127).

Description and Comments: These specimens are roughly crescent-shaped in plan and lenticular to bi-convex in cross section. Eighty-eight of these quids are the well-masticated vascular bundles of cattail (Typha sp.) rhizomes. Two other specimens are masticated, decorticated sagebrush (Artemisia sp.) bark. Twenty-eight quids preserve tooth impressions, but on only one are they identifiable. This specimen preserves both premolar and molar indentations. Five quids retain the impressions of the chewer’s gingsiva. One specimen is stained, possibly with blood. Thirty-two quids show slight to moderate thermal alteration, and two are charred. One quid is associated with a few minute strips of uncharred, decorticated sagebrush (Artemisia sp.) bark.

Measurements: Typha sp. quids.
Range in length: 9.40-74.05 mm.
Mean length: 35.26 mm.
Range in width: 1.60-29.83 mm.
Mean width: 14.59 mm.
Range in thickness: 1.75-16.15 mm.

Measurements: Artemisia sp. quids.
Range in length: 13.00-16.85 mm.
Mean length: 15.93 mm.
Range in width: 3.85-10.00 mm.
Mean width: 9.43 mm.
Range in thickness: 3.05-4.40 mm.

Proveniences

Zone | Raw material | No. of specimens
--- | --- | ---
I | Typha sp. | 6
II | Typha sp. | 23
III | Artemisia sp. | 2
IV | Typha sp. | 50
V | Typha sp. | 3
VI | Typha sp. | 7
IX | Typha sp. | 1

TYPE VIII: DOMED QUIDS

No. of specimens: 13 (see Figure 127).

Description and Comments: These specimens are circular to irregular in plan and concavo-convex in cross section. All quids in this category are the well-masticated vascular bundles of cattail (Typha sp.) rhizomes. Two quids, both from Zone III, preserve tooth impressions. One of these has both premolar and molar impressions. The second has miscellaneous tooth cusp impressions and also preserves the outline and shape of the chewer’s hard palate. Gingiva impressions are absent from this quid type. The specimens are unstained, but seven quids show slight to moderate thermal alteration. Two quids are charred.

Measurements:
Range in length: 20.33 - 43.85 mm.
Mean length: 29.53 mm.
Range in width: 8.90 - 21.90 mm.
Mean width: 15.02 mm.
Range in thickness: 2.35-14.15 mm.

Proveniences

Zone | Raw material | No. of specimens
--- | --- | ---
III | Typha sp. | 6
IV | Typha sp. | 9
TYPE IX: IRREGULARLY SHAPED QUIDS

No. of specimens: 324 (see Figure 127).

Description and Comments: These specimens, as their name suggests, are irregular in plan. They are roughly lenticular to irregular in cross section. Three hundred nineteen quids are the well-masticated vascular bundles of cattail (Typha sp.) rhizomes. Three other cattail (Typha sp.) quids consist of the lower outer-stem leaves (two specimens) and the lower outer-stem leaves and rhizomes (one specimen) of this plant. The two final specimens include masticated, decorticated sagebrush (Artemisia sp.) bark (one specimen) and the moderately well-masticated leafstalks of an unknown bunch grass (one specimen). Two of the cattail rhizomes actually appear to have been chewed from the lower stem of the parent plant. Seventy-nine quids preserve tooth impressions, but on only one example are they identifiable (incisor and canine). Nine other specimens preserve impressions of the chewer’s gingiva. The specimens are unstained. One hundred six quids show slight to moderate thermal alteration, and 30 are charred. A few strands of unmasticated but decorticated sagebrush (Artemisia sp.) bark are associated with four specimens, and one quid is associated with some milkweed (Asclepias sp.) fibers.

Measurements: Typha sp. quids.
Mean thickness: 6.07 mm.
Range in length: 9.20-99.35 mm.
Mean length: 31.09 mm.
Range in width: 1.10-34.60 mm.
Mean width: 16.63 mm.
Range in thickness: 1.00-25.94 mm.

Measurements: Artemisia sp. quid.
Maximum fiber diameter: 1.93 mm.
Length: 31.30 mm.
Width: 13.85 mm.
Thickness: 4.65 mm.

Measurements: Gramineae quid.
Maximum fiber diameter: 1.35 mm.
Length: 46.65 mm.
Width: 18.55 mm.
Thickness: 5.30 mm.

Provenience:

<table>
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<th>Zone</th>
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<th>No. of specimens</th>
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</thead>
<tbody>
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<tr>
<td>II</td>
<td>Gramineae</td>
<td>1</td>
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<tr>
<td>III</td>
<td>Typha sp.</td>
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<tr>
<td>IV</td>
<td>Artemisia sp.</td>
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<tr>
<td>V</td>
<td>Typha sp.</td>
<td>171</td>
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<td>VI</td>
<td>Typha sp.</td>
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<td>Prov. Unk.</td>
<td>Typha sp.</td>
<td>4</td>
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</tbody>
</table>

UNMASTICATED TYPHA

No. of specimens: 67 (Figure 128).

Description and Comments: All of these specimens are unmasticated portions of cattail (Typha sp.). Twenty-nine are the rhizomes of this plant with various amounts of attached root mass. Seventeen are the lower outer-stem leaves and rhizomes, and one specimen consists of the lower outer-stem leaves themselves. All of the rhizome specimens retain plant cortex. Eight of these had been chewed from the lower stem of the parent plant. One rhizome had been cut from the parent plant with a sharp, hard instrument. One specimen made up of the rhizome plus lower outer-stem leaves had also been chewed from the parent plant, and another of the same composition had been cut from the parent plant. The root mass attached to one rhizome had been loosely 2 twisted. Two specimens show slight thermal alteration, but none are stained. Thirty specimens are probably remnants from the process of preparing the rhizomes for chewing. Seventeen others are probable proto-quids (see Internal Correlations).

Measurements: Rhizomes.
Mean thickness: 3.35-10.30 mm.
Range in thickness: 3.35-10.30 mm.
Mean length: 29.78 mm.
Range in length: 10.69-30.60 mm.
Mean width: 12.79 mm.
Range in width: 7.20-23.10 mm.

Measurements: Rhizomes and lower stems.
Mean thickness: 5.94 mm.
Range in thickness: 5.39-3.94 mm.
Mean length: 32.30 mm.
Range in length: 14.40-59.05 mm.
Mean width: 15.11 mm.
Range in width: 9.20-27.10 mm.

Measurements: Lower stem.
Mean thickness: 7.74 mm.
Range in thickness: 4.80-16.80 mm.
Mean length: 27.10 mm.
Range in length: 19.60-30.10 mm.
Mean width: 15.11 mm.
Range in width: 9.20-27.10 mm.

Provenience:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Raw material</th>
<th>No. of specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Typha sp.</td>
<td>7</td>
</tr>
<tr>
<td>IV</td>
<td>Typha sp.</td>
<td>37</td>
</tr>
<tr>
<td>V</td>
<td>Typha sp.</td>
<td>2</td>
</tr>
<tr>
<td>VI</td>
<td>Typha sp.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight: 0.226 g.</td>
</tr>
</tbody>
</table>
Internal Correlations

TECHNOLOGY, FORM, AND FUNCTION

Quids are special perishable artifacts that in many ways are completely unlike the basketry, cordage, sandals, or other perishables discussed in this monograph. They are not, strictly speaking, the products of manual manipulation to a desired and predictable final form but are, nevertheless, artifacts of human behavior, specifically the processes of collection and mastication. Quids also differ from other perishable artifacts in that their final form is a byproduct rather than a purposeful product in the way that a basket or sandal is. In most cases, these artifacts represent the fibrous residues of a food extractive process. This is not the case, of course, for those specimens that may have been used as menstrual pads, bandages, or dressings.

The Dirty Shame Rockshelter quids have been ascribed to nine more or less arbitrary classes based on their final shape and to one residual category (Table 16). Of these, the most common forms are irregular (329 specimens) and elongate (231 specimens) which respectively represent 36.3% and 21.6% of the total number of quids (see Figure 127). Of the remaining shapes, only the tear drop configuration (156 specimens) accounts for more than 10% of the total.

The shape of chewed quids results from the location in which the fiber mass was last held in the chewer's mouth before it was excretorated. The two most common quid forms, irregular and elongate, were probably held along the lingual surface of the posterior teeth, that is between the gum (gingiva) and cheek. The presence of premolar and/or molar tooth indentations support this interpretation (see Table 17). From incisor or canine tooth indentations on the semicircular quids one may infer that they were held between the gum and the labial aspect of the maxillary or mandibular anterior teeth. It is less likely that they were held on the lingual surface of these teeth. Crescentic quids were either held in a similar way or between the occlusal surfaces of opposing teeth. The tear drop, domed, and triangular configurations may have been last retained against the vault of the hard palate.

RAW MATERIALS

As noted previously in this chapter (see Analytical Procedures), mastication of most of the quids recovered from Dirty Shame Rockshelter hindered the identification of the parent plant sources and left little indication of the sequence of preparation among these items. If examined by themselves, most of the quids would be simply unidentifiable macerated plant fibers, but a small percentage of them are unchewed or only slightly chewed (see Figure 128). Comparing these specimens with whole and sectioned root stalks of cattail (Typha sp.) suggests that all but a small fraction of the quids belong to this species (Figure 129). Cattails were probably collected from local wetland ecotones near the rockshelter by simply pulling up the stalk and root system. Either the whole plant was then taken back to the rockshelter or some initial plant processing was performed at the collection site. Cattail parts and pollen, found in some quantity within the rockshelter deposits, indicate that at least some whole cattails were indeed brought back to the site.

Wherever it may have occurred, plant processing with chert, chalcedony, or obsidian tools (or perhaps even by chewing the plant in some cases) left the lower stalk and rhizomes from the upper plant. Further reduction rendered the lower parts into bite-sized portions. The quid was then chewed and its juices and starches extracted. Eventually, it was expectorated, perhaps after being held in the mouth much like chewing tobacco often is in our own time (Figure 130). The plant epidermis is found within many of the chewed Dirty Shame Rockshelter quids, but this is a practice that runs contrary to recent ethnobotanical experimentation (Simms 1984).

A critical question remains about the uses of quids in aboriginal society. The very name artifact has in the archaeological literature expresses the uncertainty surrounding their intended functions or purposes. "Quid" in Latin has a variety of meanings. As a verb, it means "why?". As an indefinite pronoun, it takes the meaning "anything." As an indefinite relative pronoun ("quidquid"), it can have the sense of "whatever" or "whatsoever." It is understandable then that many purposes have been ascribed to these artifacts. Herb strainers, sieves, shovels, and soap have been proposed. Allen (1970: 119) suggests wound shafts or menstrual pads. Mouthwash is also a possibility (Jennings 1937: 226) as are a variety of domestic uses including scouring pads, medicines, and purgatives. The most basic interpretation, however, is that these items were a source of food. This view is strengthened by an examination of the nutritional components of the plant itself and is also supported by ethnographic data (see ETHNOGRAPHIC CONTINUITIES).

The cattail rhizome is found ca. 7.6 - 10.2 cm (3-4 in) below the ground (Harrington 1972: 12) and is particularly rich in starch during the fall of the year "...because (it) increases in starch content during the summer" (Simms 1984: 257). Both Harrington (1972: 12) and Simms (1984: 256) suggest that the root stalk epidermis is best removed before the plant is chewed. The edible center of the root stalk is said to form 30-66% (Harrington 1972: 12) or 79.0-93.81% (Claassen 1919: 184) of the root.

The rhizome also contains a large percentage of indigestible fiber (Simms 1984: 256). Harrington (1972: 13) notes that cattail rhizomes compare nutritionally with wheat, corn, and rice, but when the energy expended in their collection, processing, and mastication is included, the net caloric benefit is substantially reduced (Simms 1984: 256-257).

Steven R. Simms (pers. comm., 1983) chewed Typha sp. plgs over a 30-minute interval and obtained 276 calories per hour of chewing (Simms 1984: 257). This relatively low caloric value of the rhizome suggests that the cattail was never a food staple. Ethnographic data on the Northern Paiute record that they chewed cattail only during "lean" times (Stewart 1941: 424; see ETHNOGRAPHIC CONTINUITIES).

Simms (1984: 256) suggests that in antiquity Typha sp. rhizomes were cleaned and then baked. Four hundred thirty-six (40.8%) of the Dirty Shame Rockshelter quid specimens do show signs of color change associated with thermal alteration (83 altered; 81 charred), but there is no direct contextual evidence definitely linking quids with roasting, baking, or other fire features at the site. Thermally altered quids do occur in all excavation zones (Zone I, Zone II, Zone III, Zone IV, Zone V, Zone VI, Zone VII, Zone VIII, Zone IX, Zone X, Zone XI, Zone XII) at the site. Some quids are found in or near identified features, but there is no statistically significant chi-square (p = 0.1291) association between quids and archaeological features. Inferentially, at least
TABLE 16
Distribution of Quids at Dirty Shame Rockshelter by Raw Material and Cultural Zone*

| ZONE/DATE | Circular | Semi-Circular | Oval | Tear Drop | Triangular | Elongate | Crescentic Domed | Irregular | Unspecified | TOTALS BY RAW MATERIAL | PERCENT OF TOTAL |
|-----------|----------|---------------|------|-----------|------------|----------|-----------------|-----------|-------------|-----------------------|----------------|-----------------|
| A.D. 1550 |          |               |      |           |            |          |                 |           |             | 13                    | 1.2            |                 |
|            | 2        | 2             |      | 5         | 4          |          |                 |           |             | G<1                  |                | G<1             |
| A.D. 1550 |          |               |      |           |            |          |                 |           |             | T<13                  |                |                 |
| 756 B.C.  |          |               |      |           |            |          |                 |           |             | G<1                  |                |                 |
| 756 B.C.  |          |               |      |           |            |          |                 |           |             | T<26                  |                |                 |
| Subtotal  | 1        | 1             | 3    | 2         | 1          | 12       |                 |           |             | 27                    | 2.5            |                 |
| 3910 B.C. |          |               |      |           |            |          |                 |           |             | G<1                  |                |                 |
| 4350 B.C. |          |               |      |           |            |          |                 |           |             | T<3                   |                |                 |
| Subtotal  | 12       | 21            | 22   | 23        | 7          | 70       | 25              | 6         | 92          | 7                     | 290            | 27.1            |
| 4300 B.C. |          |               |      |           |            |          |                 |           |             | G<1                  |                |                 |
| 4850 B.C. |          |               |      |           |            |          |                 |           |             | T<100                 |                |                 |
| Subtotal  | 26       | 45            | 29   | 100       | 5          | 98       | 50              | 9         | 171         | 37                    | 570            | 53.3            |
| 4850 B.C. |          |               |      |           |            |          |                 |           |             | G<1                  |                |                 |
| 5990 B.C. |          |               |      |           |            |          |                 |           |             | T<3                   |                |                 |
| Subtotal  | 3        | 6             | 1    | 17        | 3          | 4        | 2               |           | 36          | 3.4                   |                |                 |
| 5990 B.C. |          |               |      |           |            |          |                 |           |             | G<1                  |                |                 |
| 7550 B.C. |          |               |      |           |            |          |                 |           |             | T<100                 |                |                 |
| Subtotal  | 4        | 14            | 6    | 17        | 2          | 27       | 7               | 46        | 1           | 124                   | 11.6           |                 |
| Provenience Unknown | |   |       |       |           |          |                 |           |             | G<1                  |                |                 |
| Subtotal  | 2        | 1             | 2    | 1         | 4          | 10       |                 |           |             | 10                    | 0.8            |                 |

**Raw material types are abbreviated as follows: Ar = Artemisia sp.; G = Gramineae; T = Typha sp.**
**TABLE 17**

Distribution of Quid Tooth Markings at Dirty Shame Rockshelter by Quid Shape and Cultural Zone*

<table>
<thead>
<tr>
<th>QUID SHAPE</th>
<th>Incisor and Canine</th>
<th>Canine and Premolar</th>
<th>Premolar</th>
<th>Premolar and Molar</th>
<th>Molar</th>
<th>Miscellaneous Tooth Impression</th>
<th>TOTAL</th>
<th>PERCENT OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Semicircular</td>
<td>IV/1*</td>
<td>--</td>
<td>III/1</td>
<td>IV/1</td>
<td>--</td>
<td>--</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Oval</td>
<td>--</td>
<td>IV/2</td>
<td>--</td>
<td>--</td>
<td>IV/2</td>
<td>--</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>Tear Drop</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>III/1</td>
<td>--</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Triangular</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>III/1</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Elongate</td>
<td>--</td>
<td>--</td>
<td>V/1</td>
<td>II/1</td>
<td>IV/2</td>
<td>II/1</td>
<td>11</td>
<td>45.8</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crescentsic</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>IV/1</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Domed</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>III/1</td>
<td>--</td>
<td>III/1</td>
<td>2</td>
<td>8.4</td>
</tr>
<tr>
<td>Irregular</td>
<td>--</td>
<td>IV/1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>PERCENT OF TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.2</td>
<td>4.2</td>
<td>8.4</td>
<td>8.4</td>
<td>20.8</td>
<td>25.0</td>
<td>29.2</td>
<td>100</td>
</tr>
</tbody>
</table>

* Does not include quids with impressions of teeth that are unidentifiable or those with gingiva or palate impressions.

**Roman numeral indicates cultural zone. Arabic number indicates the number of quids.
some of these quids may have been baked before they were chewed as there is no other apparent way to account for the color changes evident in the specimens.

An increase in the proportion of thermally altered quids is observed moving from Zone IV (33.9%) to Zone III (61.4%). The sample size suggests that this difference is significant (chi-square = 62.0450, p = .0000), but it is uncertain what this change actually reflects. Quids from Zone IV do show a significantly greater degree of mastication as estimated by individual fiber size (t = -2.52, p = 0.012) than do those from overlying Zone III. There appears to be an inverse relationship between thermal alteration and the extent of quid mastication. Quite simply, unbaked quids would require more chewing to unlock the plant starch. There is no simple orthogonal trend from unbaked/well-chewed to baked/less well-chewed quids, however, as there is an apparent increase (t = 3.63, p = 0.001) in the number of quids reduced by chewing in Zone II where the incidence of thermal alteration declines slightly.

Eight (7.2%) of the cattail quids (four tear-drop shaped; three elongated; one crescentic) may be stained with blood (Figure 131), but this possibility was not pursued by laboratory tests. If the stains are human blood, these items may well have been aboriginal bandages or menstrual pads.

Although nearly all (99.2%) of the Dirty Shame Rockshelter quids are Typha sp., several other plant taxa are also represented. These include five examples of masticated Artemisia sp. and three specimens of an unknown bunch grass. The Artemisia sp. quids may be byproducts from cordage, basketry, or sandal production. The purpose or function of the bunch grass quids is unknown.

HORIZONTAL DISTRIBUTIONS AND ASSOCIATIONS

The horizontal distribution of quids at Dirty Shame Rockshelter corresponds for the most part to the distribution patterns of the basketry, cordage, and sandals. Quids in Zones V and VI are again restricted to the mouth of the rockshelter. In Zone IV, the large quid inventory (539 specimens) is concentrated in the west-central part of the site. Fifty-seven quids are directly associated with Feature 14, a large grass-lined pit.

The 299 Zone III quids, like the basketry, cordage, and sandals, occur in the central and western sections of the occupation area and at the mouth of the overhang. Two quids are associated with Feature 7, eight with Feature 12, six with Feature 20, and one with Feature 21.

The smaller Zone II quid inventory (27 specimens) is again from the west-central section of the site. The sharp shift in the distribution of perishables noted among the other classes again characterizes Zone I (13 specimens) where virtually all quids are restricted to the east-central and eastern portions of the site.

CHRONOLOGY

The distribution of quids at Dirty Shame Rockshelter has been plotted by zone in Table 16. As that table indicates, quids occur in all zones, but the great majority are from Zones III and IV where 299 quids (27.1% of the total assemblage) and 570 quids (53.3%) occur, respectively. Circular, oval, and elongate quids are the only ones to occur in all zones, but this distribution and the more circumscribed distribution of the other configurations is probably fortuitous. It is interesting, however, that the small numbers of domed quids are known only from Zones III and IV. Quids appear to be scarce both before and after the Zone III/IV expansion, but this may simply reflect differential preservation or recovery. Assuming that the sharp numerical diminution in quids between Zones III and II is not due to sampling, it could reflect any or all of the following: 1) a change in the local availability of Typha sp.; 2) differential utilization of this resource by the same groups who had used the site previously; 3) population replacement by a group or groups of people whose use of cattails was significantly less than that of previous inhabitants; 4) a general reduction in the frequency of site use. Data from several other perishable artifact classes suggest that population replacement may have played a role in the apparent reduction of quids in Zone II times. The quid data alone, however, cannot be used to assess this interpretation (see OVERVIEW).

External Correlations

THE GREAT BASIN

Ethnographic references to the consumption of cattail (Typha sp.) roots are relatively abundant (see ETHNOGRAPHIC CONTINUITES), but references to quids in Great Basin archaeological site reports are rare by comparison. Unlike the Southwest, where quids from a variety of plant sources are common (e.g., Lindsay, Ambler, Stein, and Hooper 1968: 377-378), quids in the prehistoric Great Basin are noteworthy by their scarcity. Where they do occur, however, they are present in the hundreds or even thousands. With the exception of Dirty Shame Rockshelter, quids are reported from no other Northern Great Basin site, and they are likewise absent from reports on Western Great Basin sites. Thousands of these items have been recovered, however, from Danger Cave and Hopug Cave in the Eastern Great Basin. At Danger Cave (Jennings 1957: 234), for example, 1,939 quids were “saved.” Ca. 1,082 of these are from Level D 5. The earliest evidence of quids occurs in Level D II (ca. 7800 to 7000 B.C.). Quids occur throughout the remainder of the long Archaic cultural sequence.

All of the Danger Cave quids are desert bulrush (Scirpus americanus) and appear to represent like their Dirty Shame Rockshelter counterparts chewed rhizomes or “tender leaves.” Jennings (1957: 221) speculated that chewing Scirpus sp. provided a starchy food source and a means of retting fiber for cordage production. Whatever its primary use, Simms’ (1986: 126) more recent work confirms the limited food value of bulrush rhizomes, a plant similar to Typha sp. in overall nutritive value.
Directly east and across the salt flats from Danger Cave, Hogup Cave (Aikens 1970) also yielded a prodigious assemblage of *Scirpus* sp. quids spanning much of the 8,200-year site occupation. Unfortunately, the quids are not discussed in the site report.

Except for Jukebox Cave just northwest of Danger Cave (and which, like its more famous neighbor, also produced abundant *Scirpus* sp. quids; Jennings 1957: 220), very few other Great Basin sites seem to contain these items. Their presence, however, may be terminologically masked. Wheeler (1973), for instance, reports cactus "chews" from Elna Cave in Lincoln County, Nevada. These clearly seem to be quids as defined here.

The apparent scarcity of quids at many dry Great Basin sites (where they should have been preserved if present) may be artificial if quids went unrecognized in the general rockshelter fill. Their rarity may also be a function of their generally low net nutritive value (Simms 1984). The rhizomes of *Typha* sp. or *Scirpus* sp. may therefore have been exploited prehistorically as they were ethnographically — only in circumstances of marginal food availability or where the plants were particularly abundant.

**ETHNOGRAPHIC CONTINUITIES**

Certain Great Basin ethnographic populations as well as some immediately contiguous groups are reported to have eaten *Typha* sp. rhizomes. These include nine bands of the Northern Paiute (Stewart 1941: 428), the Deep Creek Gosiute (Stewart 1942: 231), the Ute (Stewart 1942: 251), Southern Paiute (Stewart 1942: 251), and the Indians of southern California (Driver 1937: 9). Collecting and processing practices are not specified, but Stewart (1941: 428) reports that the Northern Paiute ate *Typha* sp. rhizomes only when other foods were scarce.

**Summary**

In retrospect, the salient features of the Dirty Shame Rockshelter quid assemblage are these:

1. Apparently unlike any other dry Great Basin rockshelters, Dirty Shame Rockshelter produced a prodigious quantity of quids that span the entire cultural sequence at the site.
2. All but eight of the 1,070 Dirty Shame Rockshelter quids are masticated cattail (*Typha sp.*) rhizomes.
3. The cattail quids appear to represent a starchy food resource and dietary supplement.
4. Whatever the degree of its importance as a dietary element, *Typha* sp. rhizomes are most beneficial if eaten in the fall of the year when their starch content is at a maximum (Simms 1984).
5. The apparent reduction in quid frequency in Zones II and I at Dirty Shame Rockshelter may reflect population changes at the site, but this is by no means certain on the basis of the quids alone.
6. The use of *Typha* sp. and *Scirpus* sp. is documented at several widely scattered Great Basin sites from as early as ca. 8000 B.C. through the ethnographic period, but the uneven quality of the evidence for quids makes it difficult, if not impossible, to gauge the scale or importance of this putative food resource or supplement.
Figure 127. Oulds from Dirty Shame Rockshelter. Top row, left to right: circular, semicircular, oval, domed; Middle row, left to right: triangular, crescentic, elongate, elongate; bottom row, left to right: tear drop, tear drop, irregular, irregular.

Figure 128. Unchewed aboriginal Typha sp. rhizome segments.
Figure 129. Recently collected *Typha* sp. rhizome and lower stem sections. Specimens at left and right are obverse and reverse of the rhizome and lower stem. The specimen in the center is a lower stem section without rhizome. Starch is concentrated in the rhizome. The stem is essentially indigestible fiber. Stems were removed from the rhizomes before chewing.

Figure 130. Hypothetical quid processing sequence. Left, un chewed but sectioned rhizome and stem of recently collected specimen; Center, unmasticated aboriginal rhizome plug with stem removed; Right, completely masticated quid.
Figure 131. Stained quids from Dirty Shame Rockshelter. The stains appear to be dried human blood, and these items may represent "bandages" or menstrual pads.
OVERVIEW

R. L. Andrews and J. M. Adovasio

Introduction

The 130 specimens of basketry, 819 pieces of cordage, 169 sandals and sandal fragments, 127 miscellaneous perishable constructions, and 1,070 quids from Dirty Shame Rockshelter are, to date, the largest perishables assemblage recovered, analyzed, and described from the Northern Great Basin and also represent the oldest and longest sequence of such items known from the study area. Despite the 3,200 radiocarbon-year occupation hiatus between Zones III and II, (see INTRODUCTION) the perishables still span some 5,900 radiocarbon years. Considering their relative "completeness" as an assemblage as well as their age, the Dirty Shame Rockshelter perishables offer an unparalleled opportunity to examine certain aspects of the prehistoric utilization of the site and the broader region of which it is a part.

Chronology

All subclasses of perishables except sandals are represented throughout the Dirty Shame Rockshelter stratigraphic sequence. The making or at least use of basketry, cordage, sandals, and miscellaneous perishable artifacts, and the earliest evidence of quids is found at 7550 ± 95 B.C. With the exception of the occupation hiatus between Zones III and II and the notable absence of sandals from Zone I, perishables span the remainder of the site's archaeological record through the Late Prehistoric period (ca. A.D. 1585 ± 80). The comparatively early appearance and longevity of perishables manufacture and utilization at the site is wholly consistent with evidence from other sites in the Northern Great Basin, specifically, and from arid western North America, generally, and is neither unanticipated nor unique.

Given the number of radiocarbon dates from Dirty Shame Rockshelter and the presence of perishables from dated contexts in several other Northern Great Basin localities, it is possible to document the previously posited existence (Adovasio 1976a) of an early perishables producing "center" in this area. It is also possible to outline its technological and chronological progression in broad terms.

Stage I: 7100 B.C. - 3000 B.C.

The making of basketry, sandals, cordage, and other perishables is first documented in the Northern Great Basin during this time period. The earliest basketry is open simple and close simple Z-twined bags, mats, burden baskets, trays, and crude receptacles. The earliest sandals are of the Fort Rock type. Diagonal twining and coiling are absent. By 7500 B.C. at the earliest or 3900 B.C. at the latest, both the Multiple Warp and Spiral Weft sandal types appear. The Multiple Warp sandal type almost certainly derives out of the Fort Rock type, but the origin of the Spiral Weft type is obscure. The earliest cordage and cordage products are made using two ply, 2 spin, 5 twist (Type IV) or two ply, 5 spin, 2 twist (Type III) techniques. These cordage types dominate this area into the historic period. Comparative data show, however, that in the western part of the Northern Great Basin the proportion of these types to one another by 7500 B.C. is precisely the reverse of the eastern pattern. Both "traditions" in cordage production probably derive from the same source, but regional diversity is pronounced by 7500 B.C. Similar regional variation is reflected in the frequency of different sandal types as well as in the presence or absence of quids from site to site. No specific type of miscellaneous perishables is unique to this stage, but knotted netting is found. Virtually all perishables of this period are clearly utilitarian and lack decorative embellishment. Throughout the period the closest technological affinities of the Northern Great Basin perishable industries lie to the south in the Western Great Basin.

Stage II: 3000 B.C. - A.D. 300

Diagonal twining, absent beneath the ca. 3000 B.C. Mazama pumice at all Northern Great Basin perishables-bearing sites, occurs above that well-known marker deposit and probably represents an elaboration out of earlier simple twining forms. Simple twining persists and numerically dominates the early part of this stage, but later assemblages in Stage II include more examples of diagonal twining though in the same basic forms that were found in Stage I. 5-twist weft permutations appear early in this stage, perhaps about the time that the Fort Rock sandal type disappears. S-twist twining increases in frequency after ca. 2900 B.C. Decorated basketry is almost surely in use by the beginning of this interval and is well-represented by the full range of decorative techniques at its end. Coiling is still absent. The Fort Rock sandal type is clearly "on the way out" during this stage, but the Spiral Weft and Multiple Warp types persist and increase in frequency. The Spiral Weft type is more common early in the stage with the Multiple Warp type more common later on.

The predominant cordage types in the western reaches of the Northern Great Basin at this time are not known, but it appears that the basic types of Stage I continue in the same proportions in Stage II while the reverse situation is found in the eastern part of the Northern Great Basin. Pronounced subregional specialization continues, but whatever the ecological consequences of the ca. 3000 B.C. Mt. Mazama eruption were, the basketry and related perishable industries that came afterward continued without fundamental change. Once again, no single miscellaneous perishable type is typical of the period, but quids continue to occur, at least at Dirty Shame Rockshelter. The fundamental technological affinities of the Northern Great Basin perishables continue to be to the south in the Western Great Basin.

Stage III: A.D. 300 - A.D. 1600+

A number of profound changes, the larger significance of which for understanding the spread of Numic-speaking populations is discussed elsewhere in this chapter, characterize the perishables assemblages of this period. These changes
are, perhaps, individually insignificant, but collectively they represent a "turnover" of major proportions. Twining continues to dominate the basketry of this stage, but new forms appear. These include the triangular tray and possibly the seed beater. Coiling also appears in minor quantities in the form of bowls, water bottles, and jugs. Although it never occurs in any quantity, coiling marks a new addition to the perishables complex. Both Multiple Warp and Spiral Weft sandals are in evidence at the beginning of this stage, but only the Multiple Warp type likely lasts to the end of the period. Indeed, at Dirty Shame Rockshelter no sandal type lasts to the historic period. There may be no verifiable changes in cordage preferences in the western part of the Northern Great Basin, but the shift in frequency of majority cordage types between Zones III and II at Dirty Shame Rockshelter is evidence of yet another change in perishables production.

Miscellaneous perishables from a number of sites now include forms that are documented for one or another historic group. Quid use continues (but may be declining) as do the basically southern affinities of the entire perishables complex. The introduction of coiling underscores this posited connection. The earliest Northern Great Basin coiling forms clearly relate to earlier western Nevada types.

Technology, Function, and Raw Materials

(with R. C. Carlisle)

In the introductory chapter to this volume, it is stated that the perishables from Dirty Shame Rockshelter are the products of technologically distinct but related industries. Most archaeological reconstruction of site-specific aboriginal technology tends to focus, not surprisingly, on lithic procurement and reduction or, where it occurs, on ceramic manufacture. Sufficient data are also available from many dry rockshelters of western North America, however, to examine the less durable manifestations of the aboriginal toolkit (e.g., Andrews and Adovasio 1980 and many others). This is certainly the case for Dirty Shame Rockshelter.

The perishable artifact assemblage from Dirty Shame Rockshelter is typologically diverse but in many ways is also a technologically circumscribed and stylistically limited collection of materials. This is not to imply that there is any dearth of types or forms; rather, the range of these types and forms is simply much less than ca. 5,900 years of intermittent but regular site occupation might suggest. Within individual aboriginal industries, for example basketry or cordage, certain types numerically preponderate during virtually all time periods. The same is true for sandals. Only three basic types occur during the entire occupation of the site.

Whatever the cultural significance and chronological sensitivity of certain minority perishable types (topics discussed in detail below), it is apparent that the perishable industries represented at Dirty Shame Rockshelter and at other Northern Great Basin rockshelter sites are remarkably conservative in many ways. Much of this "conservatism" is probably related to relatively few of purposes that the perishable toolkit was called upon to serve and to the limited range of plant sources that was exploited for raw materials.

The presumed functions of basketry, cordage, sandals, miscellaneous perishables, and quids have been discussed in their respective chapters, but a few summary comments are noted here. The principal use of basketry vessels at Dirty Shame Rockshelter was the transport and storage of foods.Netting undoubtedly served a variety of purposes, such as floor coverings, bedding, etc. Cordage fulfilled a more varied range of binding and lashing functions and was a component in net making and the production of composite artifacts such as snares. Efforts to identify subsets and patterns within the cordage based upon statistical analysis of attributes such as cord diameter, number of twists per centimeter, angle of twist, and raw material were unfruitful. It is reasonably certain, however, that sandals might have been a very useful adaptation for the economic exploitation of the environs near the rockshelter, particularly the wetter ecotones. Beyond saying that, however, any particular advantage conveyed by these relatively fragile constructions was probably limited. This is not to minimize their essential importance, but to emphasize their circumscribed range of use.

Few of the miscellaneous perishables can even remotely be considered to be multiple-purpose items with the possible exception of the netting fragments. Quids appear to have fulfilled a primarily dietary purpose although they may have also satisfied a range of personal hygiene and domestic cleaning tasks. Their "absence" or under-representation in archaeological site reports for the area makes it difficult to compare and contrast these possible functions. Additional attention to these artifacts is required in excavation and analysis if progress is to be made toward understanding their multiple roles in aboriginal life.

Comparatively few plants were used in making perishable artifacts at Dirty Shame Rockshelter throughout its period of inhabitation. Only four plant sources (Artemisia sp., Scirpus sp., Rhus sp., and Salix sp.) contribute to the basketry inventory, and only live (Artemisia sp., Scirpus sp., Typha sp., and Salix sp.) were used for cordage. All of the sandals are made of Artemisia sp. (which is in itself remarkable) while eight plants (Artemisia sp., Scirpus sp., Typha sp., Phragmites sp., Salix sp., Rhus sp., and an unidentified grass) contributed to the miscellaneous perishables. With a handful of exceptions (e.g., Artemisia sp. and an unidentified grass) virtually all of the quids are Typha sp.

Distilled to their essence, the perishable artifacts from Dirty Shame Rockshelter incorporate only eight basic plant sources, three of which (Salix sp., Rhus sp., and an unidentified grass) are extremely limited in their artificial occurrence. The use of so few plants over so long a period of time emphasizes the considerable versatility of the more extensively exploited fiber sources and the essentially nonexperimental nature of Dirty Shame Rockshelter weavers, cordainers, and sandal makers. These conditions are, of course, not coincidental.

Relatively little archaeological evidence exists for the extensive fabrication of perishables at Dirty Shame Rockshelter itself, but the basic processes are reasonably apparent. These are illustrated in Figure 132. As that figure...
Figure 132. Hypothetical aboriginal plant procurement and processing flow chart for five plant taxa represented in the Dirty Shame Rockshelter perishables assemblage.
indicates, the process begins with the procurement of suitable raw materials. This has a number of direct scheduling implications. The "right" plants must be gathered in sufficient quantities and at the correct time. In the case of all the preferred Essential Rockshelter raw materials this means in the "green state," not dry or desiccated. Furthermore, it means that the chosen plants must have grown sufficiently to warrant harvesting them for their leaves, stalks, etc. This implies very late spring through early fall collecting. In turn, this suggests that most of the plants used for perishables at Essential Rockshelter might have been collected and converted into artifacts well before groups visited the site each year. The low frequency of caches or raw material discard heaps in the site supports this interpretation. Some measure of actual perishables production clearly did occur at the site, however, a fact that presupposes some degree of local plant procurement. Most of the preferred plants are wetland types that should have been abundant near the site. Of course, a critical part of the procurement cycle itself was the use of perishable containers to transport plants from the field and the presumed wearing of sandals to traverse the muddy wetlands. If ethnographic analogues from the Desert West are remotely suggestive of actual prehistoric practices, then plants were collected in sufficient quantities for both immediate and somewhat later use.

Once harvested with stone tools or by hand, virtually all preferred raw materials were soaked for up to several weeks to prevent desiccation and to assist the retting process. The duration of this phase in perishables manufacture undoubtedly varied with the plant itself, with the immediate need for the finished product from which it was made, and with the distance from base camp to the nearest stand of the growing plant. Plants closer to camp were probably gathered more frequently but in fewer numbers per excursion than desired plants that were more distant.

After collecting and soaking, the extent of additional plant preparation varied with intended use. The same raw material might be treated in different ways depending upon whether it was to be used in cordage, sandals, or other perishables. In this way, a limited number of plant types could be treated in very different ways to produce a fairly restricted repertoire of functionally and technologically diverse artifact classes and types. For example, Typha sp. roots might be eaten while the leaves of the plant might be longitudinally split for (left unsplit) and used for warps or wefts. The same leaves could be macerated to various degrees and used for making cordage. Artemisia sp., Scirpus sp., Salix sp., or any of the minority plant sources could be processed and prepared in the same or similar ways. Plant preparation was therefore probably conditioned by intended use and final product. By the same token, it is this essentially minimalist approach to the selection of raw materials that goes farthest toward providing a possible explanation for the long-term conservatism seen in the Essential Rockshelter perishables as a whole. Once the artisan had mastered the art of preparing fibers from a particular plant for use in a particular way and to achieve a particular product, what need was there of experimentation? Indeed, in this environmental and cultural context, innovation, experimentation, or tinkering with what already worked invited at least failure and at most disaster. The inflexibility of certain tried-and-true plants over a period of time is testimony to the technological conservatism of these pre-industrial crafts, a conservatism enhanced not only by the requirements of a frequently marginal economy but sanctioned as well by the dictates of custom and tradition.

Although the same plant might have been used (in various stages of preparation) for several different products, we do not suggest that the same person or persons were responsible for making all classes of perishable items at any one time. Something approaching the converse is almost certainly more accurate. Ethnographic analogy suggests a basic division of labor in the making of perishables, which, if extended to archaeological populations, virtually precludes the manufacture of the full range of Essential Rockshelter perishables in any one generation by the same person or persons. Specifically, basket making among historic North American Native American groups is almost exclusively the province of women, but net making is almost equally restricted to males. Cordage, sandals, and various other items, such as those included in this monograph as miscellaneous perishables, were variously made by either sex. Thus, some sort of sexual division of labor is implicit for the Essential Rockshelter perishables, and there are a number of possibilities. The most certain assumption is that the Essential Rockshelter baskets were probably produced by females. It is far less certain, however, who may have produced any of the other artifact classes or types. Either men or women may have been responsible for cordage and, by extrapolation, for nets. It is also conceivable (though unlikely) that either sex could have produced finished nets from cordage made by the other sex. A more likely scenario would assign both cordage and net-making responsibilities to males based upon the need for this knowledge in the hunt, a traditionally male role in hunter-gatherer societies. Nets would have required mending in the field from time to time as would the cordage components of snares and traps as well as bowstrings (in more recent times). Parsimony therefore argues for cordage and cordage-related tasks to be assigned to the male inhabitants of the rockshelter.

Whatever the specific case, however, both sexes would have shared a general range of knowledge about the qualities of certain plants and the uses to which they were best adapted. Similarly, both sexes would have needed to share a fundamental knowledge of the manipulative strategies best suited to each plant's inherent physical properties. Men and women would like have shared prescribed plant extraction techniques, including splitting and retting, the ways in which fiber techniques could be combined, and the methods of achieving a desired final product, such as initial and final twisting, splicing, etc. The methods of executing splices are good examples of what probably was a shared tradition pool common to both men and women. Splices can be made in any number of ways (e.g., knotting), all of which are effective. Introducing new material into a construction and simply binding it beneath the exhaust fibers is a good example and one that is found in both basketry (presumably a predominantly female craft) and in cordage making (presumably a predominantly male craft). In this regard, it is worth noting that even in crafts traditionally associated only with females or males some further specialization based on age/skill may also have existed. For example, while all Essential basket makers were probably capable of producing virtually any twining form, the making of the more labor-intensive coiled forms could well have been restricted to several specialists of the group. Similarly, although most men may have made cordage, perhaps only a few produced nets.
Perhaps sandal making represented a sphere of joint male/female participation, at least at Dirty Shame Rockshelter. The twined sandals were made using the full range of technological knowledge demonstrated in the twined basketry from the general study area. Whatever was primarily responsible for sandal making (and we propose that this, like basketry, was probably a female concern as ethnographic information suggests that women played the larger role in the making of clothing) needed to be as fully conversant with the preparation of warps, wefts, twining techniques, execution of selvages, splices, and the formation of toe covers as anyone involved in the production of twined bags or containers. The comparative lack of elegance in the final sandal product is a function of its utilitarian purpose that in no way relieved its maker from the need to have internalized the basic knowledge of how to execute twining. The nearly exclusive use of Artemisia sp. for sandal making is almost certainly attributable for the most part to the ubiquity of that plant near the rockshelter. The effective life of a sandal could not have been long in absolute terms, and repairs, or more commonly, replacement would have required a nearby, dependable, and abundant source of this raw material. The few examples of repairs on sandals may mean that replacement was more efficient than repairing an old sandal and also imply that Artemisia sp. was reliably abundant near the site over virtually the entire time span of its occupation.

The 281 specimens of cordage that are of an appropriate diameter and exhibit other measurements consistent with their use as sandal loops or bindings possibly represent a primarily male contribution to sandal making, though again there is nothing that compels us to believe that there was anything approaching so strict a division of labor along sex lines for the purpose of making sandals. If our assumption is correct that cordage making on the whole was a primarily male sphere of technology at Dirty Shame Rockshelter, however, it is conceivable that bindings and perhaps cordage warps were made separately as sandal components by men (or perhaps boys left at home with their mothers) and that the actual weaving of the sandal was then carried out by women.

Whether or not both sexes worked from the same raw material pool or collected their own is problematic. It is probable that men had access to a wider range of plants encountered while out on the hunt, but women are more likely to have had familiarity with the much more critical and widely used plants that grew near the rockshelter itself. This is a good example of a harmonious division of effort along sex lines. It is essential to stress again, however, that although the range of plant uses was limited, the perishables themselves were critical to the success of the entire economic strategy.

Perishables that became worn would have required periodic mending or maintenance. As already noted, items that could be replaced as readily as they could be mended (e.g., sandals and nets) were probably discarded when worn out. Theoretically, more labor-intensive forms, such as twined bags, would probably have been repaired, a process perhaps repeated over several generations of owners. There are few mended specimens of any kind at Dirty Shame Rockshelter which suggests again a relative abundance of suitable raw material and the comparative ease of manufacture of most items in daily use. Both factors militated against long-term "curation" of fiber artifacts.

The discard of perishables that had reached the end of their useful life was followed by the incorporation of these items into the archaeological record of the site itself, but there do not appear to be any definite intrasite discard patterns. Some perishables were doubtless interred with their dead users or makers, but the site offers no evidence for this practice. Other items were possibly "cached rather than carried," on seasonal rounds, but again no examples of this practice occur at this site. The great majority of the Dirty Shame Rockshelter perishables represent artificial "garbage" - the worn-out residues of vessels, mats, sandals, and lengths of rope or string that were beyond repair or rejuvenation. This detritus in itself testifies to the frequency and intensity of the use of these items, which, even though their individual "lifetimes" were short, collectively represent an aspect of material culture that endured largely unchanged for millennia.

**Differential Intensity of Site Utilization**

Preceding chapters have shown that the perishables from Dirty Shame Rockshelter are not randomly distributed temporally or spatially at this site; rather, the frequency of perishable artifacts varies, in some cases markedly, at any one time and through time.

The horizontal distribution of basketry at Dirty Shame Rockshelter is plotted by zone in Figure 133. Plots are provided for all cordage types in Figure 134, for Type III cordage in Figure 135, for Type IV cordage in Figure 136, for all sandal types in Figure 137, for all miscellaneous perishables in Figure 138, and for quids in Figure 139. Zones VI and V are omitted from all plots due to the small number of squares excavated or to the very low frequency of artifacts.

Figures 133-139 indicate that there is, not surprisingly, a general concordance of distributional shifts in use/discard patterns among perishables through time. There is no long-term perishables "dump" in any excavated portion of Dirty Shame Rockshelter at any point in time. It is not illustrated, but all of the basketry, cordage, sandals, miscellaneous perishables, and quids from Zones VI and V are confined to the mouth of the rockshelter indicating that the principal locus of activity or the Zone V/VI general midden area was situated in this part of the site. The basketry, cordage, sandals, miscellaneous perishables, and quids from Zone IV are predominantly confined to the central and west-central portions of the site with markedly high concentrations associated with Features 16A, 16, 16A, 17, 18, and 19. The Feature 19 complex, which includes Feature 16A, is interpreted as a food preparation/consumption area whereas the remaining features appear to be midden-related phenomena.

Like their Zone IV predecessors, Zone III perishables tend to be concentrated in the central and western portions of the site. Some material does occur at the mouth of the site. This includes most of the basketry, but none of it (with the notable exception of several miscellaneous perishables) seems to be associated with the pole-and-thatch structures (Feature 6) of this zone.
Figure 133a, b. Relative frequency of basketry at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 133c, d. Relative frequency of basketry at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 13a, b. Relative frequency of all cordage types at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 13c, d. Relative frequency of all cordage types at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 15a, b. Relative frequency of Type III cordage at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 135c, d. Relative frequency of Type III cordage at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 136a, b. Relative frequency of Type IV cordage at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 136c, d. Relative frequency of Type IV cordage at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 13a, b. Relative frequency of sandals at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 137c, d. Relative frequency of sandals at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 13a, b. Relative frequency of miscellaneous perishables at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 13c, d. Relative frequency of miscellaneous perishables at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Figure 13a, b. Relative frequency of quids at Dirty Shame Rockshelter: a, Zone I; b, Zone II.
Figure 139c, d. Relative frequency of quids at Dirty Shame Rockshelter: c, Zone III; d, Zone IV.
Interestingly, all of the plots of perishables show a relatively dramatic shift in use patterns in Zone I. The vast majority of its basketry, cordage, miscellaneous perishables, and quids are concentrated on the eastern edge of the site, generally from the mouth to the back of the rockshelter. This shift in disposal or use patterns is not attributable to the occurrence of any particular artifact type and is either a concomitant of a different pattern of site use as a whole or is due to the presence of different human populations at the site. It may also reflect the millennia of accumulation of deposits near the mouth of the rockshelter which precluded further habitation in that area.

The intrasite patterns noted above are not diagnostic for any one mode of human behavior. Collectively, all of the changes seen from Zones VI through II seem to reflect vague shifts in favored activity or disposal areas within the occupied portions of the site, but little else.

Correlation of data for features, various types of perishables, and raw material types is equally uninformative with the few exceptions noted in the respective descriptive chapters. The only exception to this generally repetitive scenario occurs in Zone I where disposal or use-related changes have resulted in a very different perishables distribution pattern. The possible significance of this is treated in the next section of this chapter.

Although delineation of the intrasite distribution of perishables at Dirty Shame Rockshelter is essentially uninformative, the examination of patterns in the uses of perishables, or at least patterns in their discard over time, is more revealing. The frequency of all perishables at Dirty Shame Rockshelter is plotted by zone in Figure 190. With several exceptions, the incidence of all perishables is consistent through time. All perishable subclasses are lightly represented in Zone VI but are extensive in Zones IV and III. The Zones II and I inventories are, by comparison to Zones IV and III, depauperate. It is very likely that if preservation was better in Zone V where all perishables are scarce, the distribution would show a "normal" single-peak distribution with the most intensive use of the site during Zone IV through Zone III times (ca. 4850-3990 B.C.) with much lighter use before and after that period.

Perhaps the only notable internal "inconsistency" to the picture presented above is the greater number of sandals and miscellaneous perishables in Zone III as opposed to the greater concentration of quids, cordage, and basketry in Zone IV. Basketry remains and a number of cordage and sandal fragments appear to be associated with several grass-lined pits (Features 12, 12A, 20, 20A, 20B) and a midden-related feature complex (Features 16, 16A, 17, 18A, 19). As already noted, certain of the cordage types occur in clusters and may reflect construction and/or use, although this is speculative at best.

Miscellaneous perishables are notably abundant in the center of the site, and several of these items that are suggestive of "leisure" time activities occur near the cave mouth. Quids parallel the distribution of other perishable artifact types in this area of the site. The relatively scant perishable remains from Zone II are predominantly restricted to the central or west-central portions of the site.

It is not completely apparent why these distribution patterns occur. There is no one-to-one relationship between the frequency of perishable artifacts per zone and the frequency or duration of site visitation, but some proportionate relationship surely existed. This is corroborated by the incidence of other artifact classes.

**General Character of Site Utilization**

If the frequency of perishable artifacts at Dirty Shame Rockshelter provides a somewhat "clumped" gauge of the intensity of site utilization through time, it also provides a far more sharply defined perspective on the general character of that utilization.

The authors of the introductory chapter of this monograph argue that Dirty Shame Rockshelter was probably always a summer/fall base camp for groups exploiting the narrow canyon of Antelope Creek and its tributaries. This is strongly supported by the perishable artifact data, which are entirely appropriate to an arid-lands base camp interpretation. Indeed, perishables were probably the principal medium for the transportation of most foodstuffs and other items consumed or used at the site. Without them, the site could never have been a base camp. If this claim seems to place disproportionate emphasis on the perishables and rather less on the chipped stone artifacts, consider these facts. The incidence of finished stone tools to perishables is relatively low at this site, a pattern paralleled (but usually ignored) at a great many other sites throughout the Desert West. Projectile points, other bifaces, and unifaces served many tasks including the hunting and disarticulation of game, but they cannot be used to trap, ensnare, or otherwise gather or carry smaller terrestrial game, let alone the crustaceans, seeds, nuts, fruits, roots, etc. that formed, at least in this area, the bulk of the so-called Western or Desert Archaic diet. If this observation is not new. The importance of perishables to the success of the broad spectrum Archaic lifeway has been discussed for years (see Cressman 1964, 1977; Jennings 1957, 1978, 1980; Taylor 1966, inter alia). However, few sites show how clearly the perishable inventory relates to site-specific use as does Dirty Shame Rockshelter. If one considers the locally available resources, the general environmental setting, and the patterns of plant/animal exploitation reflected in the deposits, one must conclude that life at this site in a very real sense revolved around certain key elements in perishables technology, notably sandals, baskets, and cordage. This remains the case throughout the occupation sequence, and it goes a long way toward providing an explanation for the basic conservatism and persistence within the perishable industries over thousands of years. The almost wholly utilitarian character of the Dirty Shame Rockshelter perishables suite and the absence of truly exotic fiber products (e.g., duck decoys) underscores the clean and fundamental connection between the character of site use at this specific locality and perishables.

The perishables from Dirty Shame Rockshelter support an interpretation of the site as a base camp throughout its history, but they are not necessarily supportive of the idea that the fundamental nature of site use changed in Zones II
and I. The suggestion has been made in the introductory chapter, for example, that the Zone II/ base camps at the site may have represented "increased domestic activity." The further suggestion is made that the seasonal occupation may then have been extended from the late summer through the winter months.

The perishables discussed in the previous chapters document a technological turnover between Zone III and Zone II, but this does not necessarily support the idea of either longer visits or more extensive site use, however that may be reckoned. Indeed, the dramatic decrease in perishables of all types bespeaks a much lighter and seasonally more circumscribed use of the site. In fact, the disappearance of sandals, the scarcity of basketry, cordage, and miscellaneous perishables, and the pronounced shift in intrasite disposal patterns at this time suggest not so much increased site use as they do an altered use occasioned not by a lengthier, multi-season occupation but by the arrival of a different human population. The relative scarcity and smaller size of the quids at this time may argue for a somewhat later winter occupation than was usual earlier in the sequence. "Migration hypotheses" as devices to "explain" differences in artifact inventories must be used cautiously, but this sort of "hypothesis" is the most economical for the Dirty Shame Rockshelter
case. This point of view has been advanced before, most recently by Adovasio (1980), and it is upon that statement that the following section is based.

Perishable Artifacts and Ethnicity: A Personal Bias

by

J. M. Adovasio


As I indicated in one of the earliest of these publications (Adovasio 1970a) and as I have reiterated at length in a subsequent work (Adovasio 1977), I was by no means the first or the only person to stress the pronounced qualities of basketry or other perishables as potential indicators of prehistoric "cultural frontiers" or ancient population movements. Indeed, the unique diagnostic attributes of at least basketry have been recognized by a relatively large number of specialists for a rather long time. Rozario (1969:184) has pointed out that

woven objects of themselves have great cultural significance and constitute good sensitive criteria for comparison; the importance of weaving can be better appreciated (especially in contrast to pottery) when one considers its antiquity, its frequency, and its many diagnostic attributes.

A parallel view was expressed by Wettis (1932:108) much earlier in the observation that

Basketry is particularly useful for comparative study. It can be approached and controlled from many points of view because in the basketry art the fundamental mechanical factors involved in the technical process are determined in the product and are not lost in the process of making (emphasized added).

Likewise, King (1975:11) in summarizing her extensive experience with archaeological textiles noted

I have come to regard them [i.e., basketry and textiles] as perhaps the most culturally revealing of all categories of artifacts. These tiny fragments... once were very important part of the lives of individuals in the past... The intimacy of man's association with his textile production is far greater than that with pottery, tools, or other items he manufactures.

The intimacy of the maker's relationship with any type of basket, sandal, or other perishable artifact is predicated on and conditioned by the fact that all of the weaver's "manufacturing choices" are physically represented in the finished specimen. Baumiö (1957:2) in his preface to the English translation of Balfour's (1952) essay on basketry systematics writes

One of the properties of basketry which makes its analysis attractive lies in the fact that its types may be regarded as discrete elements rather than as arbitrary points on a continuum. The basket weaver may twine with a right hand twist or a left hand twist but he cannot be halfway in between. Furthermore, his method of work is perfectly apparent in the finished product so the craftsman himself need not be observed. Thus for most situations in basket making there is only a finite number of logical alternatives...

Of the greatest importance in the present context and indeed in any other study of archaeological or ethnographic basketry, cordage, or sandals the basic aspect is that in the fact that its types may be regarded as discrete elements rather than as arbitrary points on a continuum. The basket weaver may twine with a right hand twist or a left hand twist but he cannot be halfway in between. Furthermore, his method of work is perfectly apparent in the finished product so the craftsman himself need not be observed. Thus for most situations in basket making there is only a finite number of logical alternatives...

As noted in the cordage chapter, recent research also suggests that cordage-making techniques are also population-specific and that such attributes as final twist and splicing techniques may be interpreted in well-controlled archaeological assemblages in much the same fashion as foundations in basket walls.
LEVELS OF SIMILARITY AND DISSIMILARITY IN PERISHABLES AND THEIR SOCIO-CULTURAL IMPLICATIONS

The study of both nominal and ordinal attributes of basketry indicates that it is possible to distinguish the work of individual ethnographic basket makers within the same socio-political entity (Adovasio and Gunn 1977). It is also possible to isolate the products of several weavers or groups of weavers in a more-or-less contemporaneous archaeological assemblage (Adovasio and Gunn 1975, 1977; Adovasio, Gunn, et al. n.d.). Similarly, it is possible to separate the products of two culturally and linguistically disparate groups of basket makers (Andrews, Adovasio, and Fowler 1982). Scrutiny of at least one archaeologically assemblage of cordage suggests that it is possible to identify individual makers within a synchronous population of string/rope makers as well (Adovasio, Andrews, Carlisle, and Drennan n.d.). These considerations aside, the level or order of similarity or dissimilarity in perishables has seldom been addressed formally in terms of its specific socio-cultural implications.

Obviously, basketry, cordage, and sandals where the "recent" or prehistoric manufacture share certain characteristics that, in effect, distinguish them from all other classes or subclasses of artifacts. These, however, are too broad or overarching to be of any utility except in a purely taxonomic or classificatory sense (see below). Put another way, the formal constellation of attributes which distinguishes basketry from woven textiles, sandals, or cordage is of little use in attacking the sorts of problems that archaeologists normally wish to resolve.

Hierarchically beneath these attributes of the first order, however, are a series of "grades," the finest or lowest of which represents the degree of similarity or dissimilarity manifested in the products of the same basket maker, sandal maker, or cordwainer. Obviously, these highly idiosyncratic elements are clearly useful in the solution of "individuals" within either prehistoric or ethnographically gathered assemblages, but the utility of these same attributes is drastically limited by variables that oftentimes are difficult to control. Among these I may list sample size, vessel or form size and configuration, provenance (in the strict sense of the term), and context.

Between these two extremes of the "individual" (as it were) and the perishables "universe," is possible to distinguish taxonomic groupings based on mutual similarities which appear to correspond to "real world" situations or divisions. Before expanding on this theme, however, it is necessary to consider the process of perishables manufacture by reference to its most studied subclass, basketry.

BASKETRY, BASKET MAKING, AND BASKET MAKERS

The term basketry as used in this volume and as I have always used it applies to several very different kinds of items. In addition to rigid and semi-rigid containers, matting, and bags, the term embraces forms as diverse as sandals, fish traps, hats, and cradles. As noted earlier in this monograph in the chapter on basketry, matting consists of items that are essentially two-dimensional or flat, whereas baskets and many of the other forms are more recognizably three-dimensional. Bags are intermediate forms because they are essentially two-dimensional when they are empty but three-dimensional when filled with those items for which they were intended. I have also previously noted that Driver (1961: 159) considers all of these artifacts can be treated as a unit because the overall technique of manufacture is the same, that is, all forms of basketry are manually assembled or woven without a frame or loom. Being woven, they are technically a class or variety of textile. Usually, however, that term is restricted to "cloth" fabrics with continuous plane surfaces produced on or with the aid of some sort of auxiliary apparatus.

I have also previously commented in this volume that basketry is divisible into three subclasses of weaves that are mutually exclusive and taxonomically distinct: twining, coiling, and plaiting. The potential number of technological types within each subclass is relatively great. The assignment of specimens to subclasses or types depends on the identification and quantification of shared attributes or clusters of attributes. Basketry attributes are features of manufacture; the sum total of these attributes is the individual specimen. Any single attribute is the direct product of a specific set of manipulatory techniques which as noted above and as discussed below are highly standardized or culturally prescribed within any basket-making population. The same can be said for cordage or virtually any other kind of perishable artifact.

A variety of attributes are employed to classify basketry. Such diverse criteria as object shape, rigidity (or conversely, flexibility) of the weave, and elements of decoration to name but a few have been used with widely varying degrees of success. I believe that subclasses or types of basketry should be defined exclusively by attributes of "wall" construction.

For the purposes of this discussion, any example of basketry is assumed to have several distinct parts, the most significant of which is its "wall" or main body. In a basketry container, the wall is easily distinguished from other parts such as the rim, selvage (or edge), and the center or point of starting. However, in other forms this distinction may become arbitrary. In mats and other flat or atypical forms, the "wall" is the principal or major portion of the item and subsumes virtually everything that is not clearly "edge" or "center."

The wall or the main body of a specimen of basketry can be constructed by only three basic manipulative procedures or weaves which correspond to the three major basketry subclasses. Specifically, a basket wall can be twined, coiled, or plaited. Very rarely, it is produced by some combination of these techniques. While the basket wall is by no means the only important attribute of basketry, it is the basis of most modern analytical taxonomies.

Basket making is a learned behavior; it is a non-universal craft that, as already noted, is normally not exclusively the province of women (see also Driver 1961; Mason 1954). Basket making in aboriginal situations may be a very important aspect of local technology (see Andrews and Adovasio 1980), or it may be relegated to the "bottom of the list" of "things to
do or make." In either case, the society of which the basket maker is a part maintains--consciously or otherwise--a set of relatively fixed standards of what is and what is not locally "acceptable" basketry. These standards, which are manifested in the finished specimen and, in analytical terms, by attributes, are normally passed on to or inscribed into novice basket makers at a very early age. Thereafter, they are reinforced by the novice's mentor, role models, immediate family, extended family, or some other such "standards of reference."

As with many crafts normally learned at a young age in traditional, non-western societies, basket making is oftentimes a highly conservative technological milieu within which change or innovation in the broadest sense of the term is usually minimal and almost always slow. Very rapid "turnovers" in preferred manufacturing techniques, finishing methods, decorative modes, forms or configurations (which in turn reflect "turnover" in basket making standards) are exceedingly rare. Indeed, except in catastrophic contact situations normally involving a so-called traditional group and an industrialized "modern" western society, rapid changes in basketry technology within the same culture are virtually undocumented ethnographically and certainly prehistorically. Indeed, as will be shown later, where such rapid changes do occur archaeologically, they almost always reflect population replacement.

It is not my intention to imply that change in major or minor attributes does not occur within the basketry or other perishable constructions of any given group. Rather, I suggest that those modifications which do occur are generally undramatic and seldom involve more than a small percentage of the total constellation of construction attributes for any given basketry wall type.

Because of the way knowledge about basket making is normally imparted from an older to an oftentimes much younger weaver of the same local kin group, the closest resemblances in the products of any two definable basketry manufacturing entities are those which reflect the teacher/student relationship. While the initial attempts of the "novice" may at first appear to be but the crudest approximations of the "teacher's" work, there normally will be a certain resemblance even at this rudimentary level. As the novice gains greater skill, the degree of similarity to the "model" increases until the novice produces a culturally "acceptable" duplicate, or more accurately, facsimile.

Space precludes a detailed discussion of the myriad processes and manipulations involved in the production of even the simplest twined, coiled or plaited basket (see Adovasio 1977), but it should be stressed that virtually every aspect of this operation, from the collection and preparation of raw materials through the optional but generally final construction step of decoration, is to a very high degree controlled by or within a set of norms which are passed en bloc to the weaver by his or her instructor(s).

Obviously, there are variations in the exact methods of transfer or transmission of information on basket making from "master" to "novice" in aboriginal North American groups. Nonetheless, the existence of recognizable standards of manufacture, for all intents and purposes, is a universal among all basket-making populations. Indeed, Mason (1906: 37) writing at the turn of the present century noted that in basketry manufacture, "the form, technique and intricate patterns must all be fixed in the imagination before the maker takes the first step" (emphasis added).

In point of fact, so "fixed" are these "forms, techniques and intricate patterns" that despite the complexities introduced by conscious or unconscious borrowing, trade, alien spouse acquisition, the assimilation or capture of foreign or non-local weavers (see Mason 1906), it is possible for a student of ethnographic basketry to distinguish with relative ease the work of a Kawalki from that of a Kwakiutl or the products of a Hopi from those of a Hupa. This is not to suggest that there is a one-to-one relationship between specific basket wall types and particular American Indian ethnic groups. The constellation of basket wall types as well as other attributes habitually used by any one group can be distinguished, however, from those employed by any other group if adequate and representative examples exist for comparison from both groups. This is a hard fact recognized by scholars of perishable technology for nearly 100 years (see Barrett 1958; Mason 1885, 1890, 1900, 1901, 1909; Douglas, various Driver 1939; 1961; Driver and Massey 1937; Dawson and Deetz 1965; Dixon 1902; Drucker 1937; Kroeber 1922, 1925; Ellsasser 1973; O'Neal 1930, 1932; Elsene 1942; Vegeulin 1942; Kelly 1930; Gifford and Kroeber 1939; Dubois 1935).

These statements have served essentially as an elaborate if probably excessive introduction to the potential of basketry analysis and, perforce, to other sorts of perishables analysis in helping to define prehistoric cultural boundaries both temporal and spatial. It is now appropriate to return to a discussion of the cultural significance of similarity and dissimilarity in perishables assemblages by examining some concrete examples.

**BASKETRY IN THE GREAT BASIN**

With the exception of several carbonized fragments of what appear to be plaited basketry from the deepest occupational levels at Meadowcroft Rockshelter in Washington County, Pennsylvania (Adovasio, Gunn, Donahue, and Stuckenrath 1979: 69-69; Stile 1982: 132-135), the Great Basin of western North America has, as noted elsewhere in this volume, yielded the oldest basketry in the world. The relative abundance of dry caves and rockshelters from almost all sections of this physiographic and cultural area has provided (through generally thorough excavations) basketry remains that span nearly 11,000 years of human occupation. This is not only the longest but also the most well-controlled basketry sequence in the world due to the great number of reliable radiocarbon dates both on the perishables themselves and also on materials directly associated with them.

As a result of extensive attribute-oriented comparative studies of virtually all of the extant prehistoric basketry from all parts of the Great Basin initiated by this writer in 1965, it has been possible to reconstruct the development of basketry manufacture in that area in considerable detail. The results of this research are reported at length in a variety of publications (e.g., Adovasio 1970a, 1971, 1974, 1975a, 1975b, 1976a, 1979, 1980a, 1980b, 1980c, n.d.; Adovasio and
Andrews 1980a; Adovasio, Andrews, and Carlisle 1976a, 1977) and will not be reiterated, but it is warranted to provide a summary of the salient aspects of these long-term analyses.

If one employs basketry types predicated on predominant basket wall technique as comparative analytical devices, it is possible to establish the existence of regional prehistoric basketry manufacturing areas within the Great Basin. In post articles (e.g., Adovasio 1976b, 1979, 1985a) and in this volume I have called these manufacturing areas "centers" and have labeled them simply as the Northern, Western and Eastern Basin Centers, though occasionally these limits extend out of the Great Basin physiographic province itself. Each center has its own special characteristics and historical sequence, and each manifests varying degrees of relationship to the others both in time and through time. While it is not feasible to itemize either the principal technological characteristics or the evolutionary sequence within each of these centers, an overview (Adovasio 1974: 116) of all three indicates that:

basketry manufacturing in each extends back to the ninth millennium B.C. In each center, the earliest techniques are twining to the exclusion of all others, and in one of the centers, the Northern Basin, twining dominates the area into historic times. Early coiling, however, is clearly restricted to the Eastern Basin and appears there some two thousand years earlier than any other center. This innovation appears to be a functional necessity in a life way predicated around small seed processing through parching, a use for which twining is ill suited. After two millennia of evolutionary changes, coiling ultimately diffuses to the Western Basin Center and from there to the Northern Basin . . . .

There is a marked trend toward regional specialization and technical divergence in each of the centers through time, though at no period is evidence for mutual influence entirely lacking. Finally, it appears that throughout the evolution of these three centers, the Western and Northern Basin were more closely related than either was to the Eastern Basin . . . .

While I have never explicitly indicated precisely what these Great Basin centers are or were in "real world" terms, it is clear that the level of similarity of the basketry within each is well below the "universe of all baskets" alluded to above but well above the level of the individual weaver. I suggest that each of these centers individually and collectively manifests the same order of magnitude in basketry similarity as is evident among the ethnographically known basketry wares of California.

It is well-known that both prehistorically and ethnographically California constituted (like the Great Basin) both a culture area and an archaeological province within which there is enormous linguistic and technological diversity. Despite the technological diversity, however, it is possible to treat California separately from the Northwest Coast and from the Greater American Southwest just as it is possible to separate the Great Basin from California or any other of these regions.

Taken as a unit, the ethnographic basketry of California is both technologically diverse and structurally complex as well as sufficiently different to distinguish it as an entity from the basketry of any adjacent region. However, through the examination of basket wall attributes, it is also obvious that differences clearly existed within California from north to south as well as within any portion of the north or the south. As noted by Elsasser (1978: 626):

Despite the minute differences in basketry observable from group to group . . . ., there are several features with a comprehensive regional distribution rather than sporadic individual tribal occurrence or random spread. Thus while all groups surveyed here [i.e., in California] made twined baskets . . . ., the people in northwestern California employ this technique exclusively; they have no coiled basketry. Groups to the south can be said to have a preference for coiled baskets . . . ., although the Pomo, the best known of the California basket makers, employ twining and coiling in about equal measure (emphasis added).

Elsasser (1978: 626, 633) goes on to state:

Other examples of regional differences may be cited where simple choices are involved, as in direction of welt pitch in twining or in direction of work, use of interlocking or noninterlocking stitches, or use of split or nonsplit stitches in coiled basketry. . . . northern or central California groups show divergences from northwestern and from southern California, both in twisting (pitch of weft in both directions, for example, for Pomo, Wappo, and Maidu) and in coiling (work direction, interlocking stitch and split stitch use). There is no clear rationale for these peculiar distributions in either environmental or historical terms . . . .

Whatever the "rationale" at work in California or anywhere else, I reiterate that the level of similarity or dissimilarity within and among the three Great Basin centers is broadly analogous to that evidenced in California in the recent past. As such the boundaries between centers are neither territorial nor cultural in the specific sense of either of these terms. Moreover, the Great Basin centers do not equate either to specific tribes or language families. If the California analogue is accurate, these similarities represent instead technologies presumably rooted in environmentally-determined adaptive strategies which cut across many different ethnic units at this level of analysis. On the other hand, when large numbers of temporally and geographically-circumscribed basketry specimens are scrutinized for other construction attributes (i.e., other than basket wall techniques), it is possible to define levels of similarity which more closely approximate genuine ethnic units.

THE FREMONT

Certainly the best example of this level of similarity is evidenced in the basketry of the so-called Fremont culture which flourished in the Eastern Great Basin from ca. A.D. 400-1300. In lieu of becoming ensnared either in the history of research of the Fremont entity or in the multiplicity of its interpretations suffice to note that the basketry of this "complex" has been studied exhaustively and the results made available in a series of papers and articles (Adovasio 1975a, 1980a, 1980b, 1980c, 1980d; Adovasio and Andrews 1980; Adovasio, Andrews, and Fowler 1982).
Without detailing the specific characteristics of Fremont basketry which are provided elsewhere (Adovasio 1975b, 1980a, 1980b, 1980c; Adovasio, Andrews, and Fowler 1982), I wish to repeat that on the basis of the constellation of available attributes for virtually all extant Fremont basketry it is possible not only to derive the basic technology of manufacture from local Archaic antecedents but, more important, to delineate the territorial limits of a Fremont entity based solely on the criteria of distribution of diagnostic basketry. Indeed, it is possible to distinguish the basketry of the Fremont from that of any of their contemporaries (e.g., Magallon, Anasazi, Holokan, etc.) or any local "successors" (i.e., the Numic speakers). More recently, it has been possible to establish some sort of Fremont presence in southern Idaho based in part on basketry criteria (Adovasio, Andrews, and Fowler 1982).

An understanding of the level of similarity manifested in the Fremont basketry assemblage is critical to this argument. We are no longer talking about broad regional resemblances of basic basket wall techniques as in the Northern or Western Great Basin or in north and south California but rather of specific, detailed, point-by-point construction similarities on the order of those exhibited in the basketry of historically-documented ethnic units. Indeed, I suggested in an earlier work (Adovasio 1980a: 730) that the level of resemblance of Fremont baskets was analogous to that manifested in the basketry of the historic Apache. The congruencies in Fremont basketry from area to area are greater than those exhibited within most Apachean basketry assemblages (see Douglas 1934; Roberts 1929). Yet, this is not really the point. What is important is that on the basis of systematic and comparative analysis of shared attributes of Fremont twined and coiled basketry it is possible to establish a level of similarity which is not unlike that evidenced in the basketry of the Apache or for that matter in the basketry of "a hundred" other ethnic groups of the recent past.

Once again, this is not what some may call "baid assertion." These conclusions are derived from long-term systematic assessments of both ethnographic and prehistoric basketry assemblages. To further the point, it is worth observing that to my knowledge no other basketry assemblage from North America displays the degree of internal similarity that one sees in Fremont basketry without it being the product of a single ethnic group. Put another way, the order of attribute congruencies is such that the basketry of all five of the so-called Fremont variants recognized by Marwitt (1970) cannot have been produced by different ethnic groups unless: (1) they all adapted or inherited the same basketry technology from one source and never changed it, or (2) they all employed the same weavers from one area to "mass produce" identical baskets for all of the Fremont subareas. Of course, there is also the very remote possibility that the inhabitants of all the Fremont subareas simultaneously invented exactly the same types of basketry and then used them for the duration of their collective existence, but I believe this to be as absurd as either of the first two options.

Rather than devote any more space to what by this time may be a truly dead horse, I prefer to take this scenario one last, faltering step and attempt to employ basketry as well as other perishables not to establish the character or boundaries of a prehistoric population "in place" but rather to trace, if possible, a group or groups "on the move."

**The Numic Speakers: Not Whence But When?**

by

J. M. Adovasio with R. L. Andrews

As noted by Madsen (1975, 1986), Aikens, Cole, and Stuckenrath (1977), and Bettliger and Baumhoff (1982), the origin and subsequent dispersal of the Numic-speaking peoples in the Great Basin constitutes both an archaeological and linguistic problem of considerable complexity. Linguists have stressed on the basis of glottochronological data that the Numic speakers expanded into their historic range within the last millennium or so from a homeland or dispersion center near the California/Azores/Arizona border (Fowler 1972; Goss 1963, 1968; Lamb 1938; Miller 1966; Miller, Tanner, and Foley 1971). As Madsen (1975: 82) indicates, this linguistic evidence has to date received scant archaeological corroboration. Indeed, Aikens, Cole, and Stuckenrath (1977: 22 and in the introduction to this monograph) stress correctly that a number of archaeologists have resisted the "recent spread" hypothesis because they are convinced that the extent archaeological data, particularly in the Western and Northern Numic range, support archaeological continuity rather than population replacement within the last 1,000 years (Heizer and Napton 1970; Swanssen 1972; Hester 1973). The problem is compounded by the fact that Freece and Ianucci (1974) have postulated a restructuring of the entire linguistic classification upon which the recent dispersal hypothesis is predicated. Moreover, the hypothesis itself has been attacked by one of its creators and former advocates (Goss 1975). Despite Madsen's (1975) convincing demonstration that the dating of Pueblo/Shellon ceramics in various sections of the Great Basin appears to support the late arrival theory, the issue is still far from settled.

The purpose of the remainder of this chapter section is not to explore the myriad ramifications of the dating of the dispersal of the Numic speakers throughout the Great Basin but to summarize the archaeological data on perishables and the ethnographic data, principally on basketry and to a smaller extent on cordage, that bear directly on the problems at hand. Specifically under scrutiny are not only the perishables from Dirty Shame Rockshelter, but also those from Gatecliff Shelter (and related closed sites) in the Moapa Valley of Nevada. Both of these localities have provided data that are not only germane to understanding the timing of the dispersal of the Numic speakers but which are also supportive of the "recent dispersal" hypothesis.

**THE DIRTY SHAME ROCKSHELTER PERISHABLES AND THE EVIDENCE FOR POPULATION REPLACEMENT**

A re-examination of the concluding sections of the preceding five chapters places into sharp relief a number of points about the perishables sequence at Dirty Shame Rockshelter. First, it is clear that whatever perishable subclass or combination of subclasses one might select, the assemblages from Zones VI through III are more homogeneous and technologically similar at any level of comparison than any of these are to the collections from Zone II or particularly Zone
This is graphically illustrated in Figures 76 and 77 (see CORDAGE) and in Figure 141. This figure shows a one-dimension scaling of all five major categories of perishable artifacts at Dirty Shame Rockshelter prepared in exactly the same fashion as those cited in CORDAGE. The "distance" between the Zone I and II inventories and those in the deeper zones is clearly due to factors that are discussed below.

The basketry assemblage from Zone I at Dirty Shame Rockshelter includes twining Types I, II, III, IV, and VI and coiling Types VIII, IX, and X. While interpretation of the twined specimens is equivocal, the coiling definitely supports the conclusion that at least some of the Zone I perishables are products of one or more populations of Late Prehistoric or Protohistoric Numic speakers.

Likewise, the nominal and ordinal data on the cordage from Zones I and II as well as the earlier zones suggest that at some point during the accumulation of Zone II and certainly by the onset of Zone I, a major shift in cordage manufacture had occurred which we believe signals the advent of the Northern Numic speakers to the area.

In a very different way, the absence of sandals from Zone I sets it apart from all other zones, but this in itself is consistent with our linguistic hypothesis if it is recalled that most Northern Paiute groups habitually went barefoot (see SANDALS). Also germane is the fact that Multiple Warp sandal specimens from Zone II are not radically dissimilar from footwear worn by certain populations of Northern as well as Southern Paiutes.

Unfortunately, few of the miscellaneous perishables, with the possible exception of weaver's knot netting, can be positively linked with the Northern Paiute, so this "class" of items is, like the twined basketry, more or less moot on the issue of population movement. Similarly, though there is a diminution in quid frequency in Zones II and I, it is not certain whether this information by itself favors population changes or seasonal roundsite use variables.

We stress, however, that whatever the limitations of any of the perishable artifact data sets by themselves, it is clear that all of them together are most economically explained by recourse to a migration/population replacement scenario.

This is a particularly attractive "explanation," if the already cited statistical conclusions of Hanes (1977) about the Dirty Shame Rockshelter lithic assemblage as well as the albeit brief appearance of Northern Paiute-style thatched structures in Zone II, and the apparently synchronous "arrival" of the bow and arrow are included. While it is certainly not impossible that the constellation of material culture changes enumerated above could be indicative of some other linguistic and/or ethnic entity, we reject this unlikely possibility in the total absence of any supporting data for it. Additionally, and fortunately, the Dirty Shame Rockshelter data are not without analogues.

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Figure 141. Positions of cultural zones along a scale of relative similarity based on proportions of all perishables from Dirty Shame Rockshelter.
THE GATECLIFF SHELTER AND MONITOR VALLEY PERISHABLES INDUSTRIES

Gatecliff Shelter and a series of several subsidiary but much smaller closed sites, Jeans Springs and Triple T Shelter, are located in the Monitor Valley of arid central Nevada just east of the small town of Austin (Thomas 1981, 1983). The perishables from Gatecliff and the two smaller Monitor Valley sites are described and discussed by Adovasio and Andrews (1983) from which the following comments are distilled.

The perishables from these Monitor Valley sites (Table 18) include basketry, cordage, knotted fiber, and a variety of miscellaneous fiber constructions. The entire assemblage is ascribable to the period A.D. 1000-1400 (or later) and specifically subsumes four types of twining (Type I: Close simple twining; S twist weft; Type II: Close diagonal twining; S twist weft; Type III: Open and close diagonal twining, S twist weft; Type IV: Close simple and diagonal twining, S twist weft), one type of coiling (Type V: Close coiling; three rod bunched foundation, non-interlocking stitch) and two types of cordage (Type I: One ply, Z spun; Type II: Two ply, Z spun, S twist). The miscellaneous fiber constructions include such diverse items as modified wood bound with cordage, interlaced twigs, wrapped grass bundles, etc.

Despite the small size of the perishables assemblage recovered from the Monitor Valley, it is clear that the types and forms represented as well as the raw materials and their methods of preparation correspond on a point-by-point basis to the perishables produced in the ethnographic period by one or another group of Central Nuniic speakers. There are no links between these perishables and other non-Nuniic ethnographic groups. Neither are there any connections between the Monitor Valley basketry and contemporary or nearly contemporary Fremont assemblages to the east. In fact, none of the diagnostic Fremont basketry types (see Adovasio 1975a, 1980a, n.d.) are represented in the Monitor Valley collections; this in turn indicates directly that Fremont populations and/or influences never extended this far west. Indeed, the archaeological connections of the Monitor Valley perishables are to the west in the Humboldt/Lake Winnemucca Sink where twining and coiling types nearly identical to those in the Monitor Valley are known (Adovasio 1976a, 1976b, n.d.; Adovasio and Andrews 1983). At the same time, only tenuous connections exist between the Monitor Valley modified wood and cordage constructions and similar materials from the Eastern Great Basin. Taken as a unit, the Monitor Valley perishables, generally, and the basketry in particular indicate that the Central Nuniic speakers had arrived in that portion of the Great Basin by A.D. 1000 or slightly later.

SUMMARY AND CONCLUSIONS

The outline briefly presented above indicates that the Nuniic speakers were "in place" in both the Northern and Central Great Basin at a time more or less congruent with the "late arrival" or "recent dispersal" hypothesis. Moreover, the perishables from the Gatecliff Shoshoni shelter and the Monitor Valley underscore and lend credence to the dating of the Paiute/Shoshoni ceramics described by Meden (1975) as the basis for his advocacy of the "late arrival" theory.

Several handfulls of perishable remains from two widely separated portions of the Great Basin may not seem adequate to substantiate an opinion on so controversial a phenomenon as the spread of the Nuniic speakers. These data, however, do not exist in isolation.

The utter dissimilarity of Fremont and Shoshoni basketry already has been noted and is treated at length by Adovasio, Andrews, and Fowler (1982). So different are these two industries that they cannot be the products of the same ethnic group or groups. Likewise, as stressed by Bettger and Baumhoff (1982), it long has been recognized that the basketry of the ethnographic Nuniic speakers as described by Kelly (1964, 1965), Steward (1939, 1941, 1943), Stewart (1941, 1942), Smith (1970), Fowler and Matley (1979) and Sapir (1910) differs substantially from that manufactured by members of the so-called Lovelock Culture or tradition of the Humboldt and Carson Sink areas of the Western Great Basin (Grosscup 1966; Hester 1973; Heizer and Napton 1970).

Basketry and other perishables associated with the Lovelock Culture (the latter stages of which overlap in part with Fremont) are both well-represented and more or less thoroughly analyzed (if differentially described) from a variety of sites including Lovelock Cave itself (Loud and Harrington 1929) as well as a series of other closed site localities in the Western Great Basin (e.g., Heizer and Krieger 1956; Rozaire 1957, 1974; Hattori 1982).

Although both twining and coiling are present in the Lovelock Culture perishables suite, the most diagnostic and usually the most common basketry type is an unusual and highly localized form of plaiting known as Lovelock Wickerware, which first occurs between 2000 B.C. (Adovasio 1970a, 1974) and 1000 B.C. (Grosscup 1960, 1963). Indeed, so singular is this type in both its major (i.e., wall construction) and minor (i.e., "finishing" or selvage) attributes that it rivals the equally unique close coiled, half rod and bundle stacked foundation, non-interlocking stitch Fremont basket ware as a most distinctive prehistoric Great Basin basketry type. Without restating the attributes of this highly diagnostic type (see Loud and Harrington 1929; 60-64; Heizer and Krieger 1956; 37-41), suffice to note that it was on the wane in "popularity" by A.D. 1 (Adovasio 1974) and nearly extinct by A.D. 1000 if not earlier. The A.D. 1300 ± 80 date at Falcon Hill (Rozaire 1969) is certainly much too late for this basket type which is not radiocarbon dated anywhere else after A.D. 310 ± 110 (Adovasio 1970a:28).

The disappearance of Lovelock Wickerware, which is not known ethnographically among the Nuniic speakers or other groups, signals (like the demise of Fremont basketry which, curiously, also becomes extinct technologically) one of those rare major "turnovers" in a regional basketry sequence which must be attributed to population replacement rather than to simple stylistic change. Similarly, while some of the same simple and diagonal twining and bunched coiled basket wall foundation types found in the Lovelock Culture are also known among one or another Northern Nuniic or Central Nuniic group, the minor attributes of construction, specifically method of starting, splicing techniques, and rim finishes, are totally different. Moreover, the highly distinctive and relatively common large, circular, and flat Lovelock coiled parching
TABLE II
Distribution of Perishable Artifacts from the Monitor Valley by Time Period and Site *

<table>
<thead>
<tr>
<th>BASKETRY **</th>
<th>CORDAGE</th>
<th>COMPOSITE CONSTRUCTIONS</th>
<th>CONSTRUCTION MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twining</td>
<td>Coiling</td>
<td>Knotted Cordage</td>
<td>Shredded Sagebrush</td>
</tr>
<tr>
<td>Open and Close Diagonal Twining, S twist left</td>
<td>Open and Close Simple Diagonal Twining, S twist left</td>
<td>Three, Non-Interlocking Stitch</td>
<td>KNotted Wool Bound with Type II and Type III Cordage</td>
</tr>
<tr>
<td>Type Unknown</td>
<td>Type Unknown</td>
<td>Type Unknown</td>
<td>Modified Wool Wrapped with Shredded Sagebrush</td>
</tr>
<tr>
<td>Type V: Close Coiling, Row Bunched Foundation Stitch</td>
<td>Type VI: One Ply, 2 Span</td>
<td>Knotted Fiber</td>
<td>TOTAL</td>
</tr>
<tr>
<td>Type VI: Close Coiling, Type Unknown</td>
<td>Three</td>
<td>Type Unknown</td>
<td>PERCENT OF TOTAL</td>
</tr>
</tbody>
</table>

| A.D. 1400 | S=1 | G=1 | TT=1 | G=2 | S=1 | G=1 | S=2 | G=1 | S=2 | G=1 | S=1 | S=1 | 15 | 42.9 |
| A.D. 1300 | G=1 | G=1 | G=3 | 5 | 14.3 |
| A.D. 1100 | TT=1 | TT=9 | G=1 | JS=1 | JS=1 | 14 | 40.0 |
| A.D. 1000 | G=1 | 1 | 2.9 |

TOTAL | 1 | 1 | 1 | 1 | 1 | 4 | 2 | 11 | 2 | 2 | 3 | 1 | 1 | 1 | 35

PERCENT OF TOTAL | 2.9 | 2.9 | 2.9 | 2.9 | 11.4 | 5.7 | 31.4 | 5.7 | 5.7 | 8.5 | 2.9 | 2.9 | 5.7 | 2.9 | 2.9 |

* G = Gatecliff Shelter; JS = Jeans Spring Shelter; TT = Triple T Shelter.

** Type I and Type II twining from the Monitor Valley are equivalent to Type V and Type VI twining in the Dirty Shame Rockshelter basketry numbering system (see BASKETRY). Monitor Valley Basketry Types III, IV, and V are not found in the Dirty Shame Rockshelter assemblages. Types I, II, and III cordage from the Monitor Valley sites are equivalent to Types I, IV, and III in the Dirty Shame Rockshelter cordage numbering system (see CORDAGE).

***Note that the Jeans Spring specimens are ascribed to the period A.D. 1000-1400. For convenience they are placed in the period A.D. 1100-1300 in this table.
tray is also absent from the inventory of the Numic-speaking groups (see Heizer 1956). This, too, strongly suggests that whoever the makers of Lovelock Wickerware and associated Western Great Basin twining and coiling were, they were not Northern Pahute or any other Numic-speaking group on typological and formal grounds alone!

It is most interesting, to observe that Bettger and Baumhoff (1982) have also pointed out that the highly distinctive Numic seed beater and triangular winnowing tray are absent from pre-Numic basketry collections and apparently do not appear until the spread of the Numic speakers. As noted above, as shown by Driver and Massey (1957, map 31), and as reiterated by Bettger and Baumhoff (1982), the distribution of the paddle-shaped seed beater and triangular winnowing tray neatly corresponds with the distribution of the ethnographic Numic speakers. These two cases together provide another potent example of the utility of basketry as a prehistoric population boundary maker.

The absence of small seed processing from the pre-Numic Great Basin may be questioned particularly given the coprolite data (Heizer and Napton 1970; Fry 1976) as well as the very early appearance and subsequent importance of flat coiled parching trays, notably in the Eastern Great Basin (Adevareso, various). Nevertheless, there is nothing in the Dirty Shame Rockshelter or Monitor Valley perishibles or indeed in the perishables from any other Great Basin site that we have ever examined that negates or disproves the typological and formal grounds of Bettger’s and Baumhoff’s (1982) thesis.

In addition to the ceramic data cited by Madsen (1979) and most of the glottochronological evidence, there is other information, notably from the Northern Great Basin, that lends credence to the “recent dispersal” argument. Specifically, it appears that at Dirty Shame Rockshelter as well as at other Northern Great Basin closed site loci, a host of “new” projectile point types co-occur with the earliest coiled basketry. These types specifically include Desert Side-Notched, Rose Spring Indented Base, Pinto Square Shoulder, Pinto Shouldered, and Pinto Sloping Shoulder. Additionally, a number of very ancient Northern Great Basin material culture traits, notably all of the Early, Middle, and Late Archaic sandal types, disappear. Thus, all of the perishables, lithics, and linguistic information suggest that a population replacement occurred no later than ca. A.D. 850-900. The most likely candidates for the new arrivals are the Northern Numic speakers.

Conclusions for the Central Great Basin are not nearly so clear-cut in the almost total absence of archaeological perishibles east of the Humboldt/Lake Winnemucca/Carson Sink areas and west of Danger Cave and Hogop Cave that date before A.D. 1000. However, other artifact data from that area also tend to substantiate the “late arrival” hypothesis.

In retrospect, the analysis of the perishables presented in this volume seems to support a relatively late spread of the Numic speakers and accordingly to work against any long-term in situ historical models for this widespread cultural, ethnic, and linguistic group.

To those familiar with our past pontifications on basketry and other perishable artifacts, there is probably little which is startling or new in this summary. Indeed, those who take exception to some or all of our earlier pronouncements will just as likely take even greater exception to these, while those who “accepted” or ignored our previous comments on Great Basin perishables will probably react similarly to this latest “epistle.” To these last, the sympathetic or the bored, we can only offer our thanks for struggling through yet another of what an eminent but (here) anonymous scholar called “pious perishable platitudes.” However, to those who take exception, we would direct a few final remarks. One can only hope that even to the skeptical this personal bias has demonstrated a few of the many purposes that the analysis of prehistoric perishables can serve. Better still would be the outcome if it has demonstrated how basketry, sandals, or cording can be used to define or at least to identify prehistoric populations both “in place” and “on the prowl.” If the data are unconvincing, we suggest that the reader marshall evidence to the contrary or provide counter-data. This, after all, is what scholarly inquiry is about.

We suspect, however, that some who take exception to our interpretations about Great Basin perishables will do so because these “conclusions” are to them unscientific, unprocessual or horror of horrors) culture-historical “just so” stories. These charges are, of course, true in the sense that we have tended to employ perishables or rather the analysis of perishables for taxonomic, descriptive, chronological, and culture-historical ends. By the same token, we recognize now, that nothing of what has been analyzed, described, or tabulated here explains anything with a capital E. Is this sense only, these conclusions and our earlier works may well be “unscientific,” but we think not.

While we are firmly aware of the limitations of the culture-historical approach in contemporary Great Basin archaeology as admirably and succinctly articulated by O’Connell, Jones, and Simms (1982), we also firmly believe that the culture-historical approach is a necessary predecessor or forerunner to any other analytical stratum where the ultimate goal is, rightfully, explanation (see Thomas 1979). The “what,” “where,” “how,” and “when” must be established before the “why.”

In the final assessment, this is what this volume is all about -- the “what,” “where,” “how,” and even the “who” as reflected in prehistoric perishable inventories. This has been an attempt in one case to identify the prehistoric “actors and actresses” as best we can and to reconstruct certain of their activities by assessing a remnant of their overall material culture that is certainly among what we and many others consider to be the most culturally or behaviorally sensitive of their products. There is no overriding or visceral interest in why they necessarily behaved as they did, but the perishables summarized here and elsewhere will no doubt be of considerable interest to those who are disposed to think in such terms.
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APPENDIX I

QUANTITATIVE AND QUALITATIVE ANALYSIS OF SEDIMENT FROM A
DIRTY SHAKE ROCKSHELTER MULTIPLE WARP SANDAL SOLE

by
Gary A. Cooke

Introduction

A sediment sample obtained from the sole of a multiple warp sandal recovered from Dirty Shame Rockshelter was examined by X-ray diffraction. The purpose of this analysis was an attempt to distinguish between two possible origins for the sediment. The two posited possibilities were riparian mud from outside the rockshelter or highly organic fill from inside the site. The analysis was undertaken in an attempt to determine something of the immediate environmental circumstances under which the sandal might last have been worn. A high percentage of clay minerals in the sediment sample could indicate that the sandal had been worn in a muddy, possibly creek-side environment -- a use for which there is some ethnographic evidence.

Methodology

A portion of the sample was ground to pass a 63 micron sieve and was mixed with an aluminum internal standard in a 10:1 sample-to-standard ratio. A random orientation slide of this material was prepared by deposition on a vaseline-coated glass slide. This slide was X-rayed using copper (Cu) radiation and standard scanning parameters to determine bulk sample mineralogy. Although no evidence for clay minerals was observed on the bulk sample run, a second slide was prepared for clay mineral analysis. This was done by taking a portion of the unground sample and suspending it in water with a small amount of sodium carbonate to act as a disaggregant. The suspension was allowed to settle until only material less than 2 microns in size remained in suspension. This material was deposited on a glass slide and allowed to dry. After glycolating, the slide was X-rayed as described above for the purpose of detecting small amounts of clay minerals.

Results and Interpretation

The lack of clay minerals detected by the bulk X-ray analysis indicates that there is less than 5% clay minerals in the sample. The oriented, less-than-2-micron sample should have shown evidence of any clays present in the sample in amounts greater than about 1%, but this also proved negative. All of the material on the less-than-2-micron slide appeared to be amorphous organic material.

The bulk slide showed the presence of quartz, feldspar, and minor amounts of calcite. All of the mineral peaks were greatly reduced in size relative to the aluminum internal standard peak. This indicates the presence of appreciable amounts of amorphous organic material in the sample. Using the internal standard method of calculation, the amount of organic material in the sample can be indirectly estimated by summing the mineral components and taking the difference between this sum and 100%. In order to improve the accuracy of this determination the sample was X-rayed two additional times and the peak intensities for the three runs were averaged. The results of these three runs indicated a sediment sample composition of 13% quartz, 17% feldspar, 5% calcite, and 65% organic material. This sample composition is more consistent with a rockshelter fill origin for the sediment rather than a muddy creek-side or marsh source.