GREAT BASIN ANTHROPOLOGICAL CONFERENCE 1970

SELECTED PAPERS

C. Melvin Aikens

Editor

UNIVERSITY OF OREGON ANTHROPOLOGICAL PAPERS No. 1

1971
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PREFACE

The 12th meeting of the Great Basin Anthropological Conference since its establishment in 1954 was held at the University of Oregon on August 28 and 29, 1970. The papers contained in this volume were selected from a larger number presented at the conference meetings. The relative amount of attention accorded to the several subareas of ethnology, linguistics, and archaeology at the conference is roughly reflected in the content of this collection, which is heavily weighted with papers on archaeological subjects. No contributions relating to physical anthropology were presented. Several papers have been substantially expanded for publication here; others remain essentially as originally delivered.

The sessions were opened by L. S. Cressman of the University of Oregon, who reviewed the development of archaeological research in the Great Basin from the perspective of his 40 years of direct involvement in the field. Meeting sessions were chaired by Catherine S. Fowler, University of Nevada, Reno; Francis A. Riddell, State of California Department of Parks and Recreation; B. Robert Butler, Idaho State University; and J. P. Marwitt, University of Utah. On the Sunday following conclusion of the meetings, many conference members participated in a day-long tour of important early archaeological sites in the Fort Rock Basin of eastern Oregon, led by L. S. Cressman.

Michael D. Southard, John R. White, Ethel E.E.W. Trygg, Kimberley Shaw, and Flora Bruns Kaliouss efficiently handled registration and diverse other tasks essential to the conduct of the meeting. Mrs. Kaliouss also prepared the multilith masters for the printing of this memoir of the conference proceedings. The artifacts illustrated on the cover are from the earliest level of Fort Rock Cave, radiocarbon-dated to 13,200 years ago; they comprise the earliest current evidence of human occupation in the northern Great Basin.

C. Melvin Aikens
Conference Chairman
1958-70
Fig. 1. Pluvial Fort Rock Basin. High Water Level of Pluvial Fort Rock Lake at the 4450 Foot Contour Line.
determined the levels of the beach terraces associated with each lake and provided basic, precise information on the basins. Thus, when archaeological work was resumed in 1966 a firm body of geological information was available.

The name Fort Rock had been given to a dominating feature of the lake bed, the massive remains of a volcano about one mile north and a little west of the village of Fort Rock. The name, by extension, now applies to the whole area. The volcanic cone, nearly circular, has been cut out on the south side by wave action, leaving a sheer rock wall at the western end of the breach and vertical exposures at both ends of the cut. At the exposed ends there are series of terraces cut into the relatively soft tufaceous rock, which clearly define the various stillstands of the lake. On the west side is a stretch where there is no talus, only the wave cut platforms carved into solid rock (Fig. 2). The terraces at Fort Rock itself are, therefore, the referents, both in number and elevation, for terraces throughout the Fort Rock basin, until dessication had proceeded to a point where only small lakes and ponds existed.

There are four clearly defined terraces at Fort Rock, at 4,430, 4,419, 4,406 and 4,386 feet elevation (Figs. 2, 3). The youngest (lowest) terrace we have dated at 12,980 ± 230 C-14 years ago (GaKl752). Dates for the older terraces are unknown. The 4,430 foot terrace marks the height of the lake when the caves and shelters on the shoreline were cut. The maximum depth of the lake at that time was between 140 and 160 feet. Deflation and redeposition have modified the original level of the lake floor in many places.

Three geological features, which contain the sites discussed in this paper, are prominent in the western portion of the basin: (1) the butte containing Fort Rock Cave (Beggarheel Butte), 1 1/2 miles due west of Fort Rock, (2) Cougar Mountain, 9 miles east and slightly north of Fort Rock, and (3) the Connelly Hills, about 12 miles south of Fort Rock (Figs. 4, 5). Table Rock is a part of this latter feature.

When the lake stood at 4,430 feet, all of these features apparently were islands. If so, their use as habitation sites could not have occurred until land connections with the shoreline were established. At Fort Rock Cave such a connection was available by at least 13,200 ± 720 C-14 years ago (GaKl738) the date for earliest occupation of that site. The earliest date from Cougar Mountain Cave Number 2 is 11,950 ± 350 years (GaKl751) and for the Connelly Hills the earliest is 11,200 ± 200 years (GaK2141). The Cougar Mountain connection seems to have been supplied by an extensive lava flow from the north, the date of which is unknown. The lava rests on lacustrine sediments and shows no sign of water action. It is interesting to speculate that the chronological order of the different occupations may reflect the order of the change of the features from island to shoreline status, but present information is inadequate to verify this hypothesis.
Fig. 2. Wave-Cut Terraces, West Side of Fort Rock.

Fig. 3. Position of 4,386 Foot Terrace Shown by Standing Figures. Fort Rock Cave in Background.
Fig. 4. Fort Rock Cave.

Fig. 5. The Connley Caves.
The first scientific archaeological work in the Fort Rock basin was that by Cressman's party in 1938, when a little more than a week at the end of that field season was devoted to it (Cressman, Williams and Krieger 1940). Since this was before C-14 dating, all estimates of dates had to be based on very insecure geological information. All perishable material had been properly treated with preservative, unknowingly rendering it useless for later C-14 dating. Then, just as Libby's early C-14 program was under way, a collector brought in from the cave a sandal fragment, bits of straw, etc., and a small piece of fine twined basketry bearing false embroidery, all of which he insisted were found together in a single cluster. The sandal was dated by Libby and Arnold (Libby 1952) at 9,053 ± 350 C-14 years ago (C-428). Since the sandal was itself dated, there is no doubt about the application of the date to it, and we are convinced of the validity of the association of the basketry. Fort Rock Cave was thus given by an independent authority a date of considerable antiquity for that time, and the date verified the presence of Early Man in the northern Great Basin.

The 1966 and 1967 Research Project

No further scientific excavation was carried out in the Fort Rock basin until 1966 when a program was initiated which provided the information on which this report is based. National Science Foundation grants GS-1259 and GS-1652 to Cressman as Principal Investigator funded the work. Cressman supervised and participated in the 1966 field work and S. F. Bedwell, who served as foreman in 1966, was field supervisor for the eight weeks-long 1967 program. Bedwell was responsible for the laboratory analysis and writing of the comprehensive report (Bedwell 1970).

The 1966 project had three objectives: (1) to verify the geological stratigraphy at Fort Rock Cave; (2) to attempt to find an undisturbed portion of fill in Fort Rock Cave to secure, if possible, samples for C-14 dating; and (3) to survey the Fort Rock basin for additional sites for excavation. The geological stratigraphy was verified by digging a trench more than 26 meters long by tractor and hand from the mouth of the cave out, over, and into the terrace in front (Fig. 6). Two test pits to the west of the trench were also dug to gravel. In the cave we extended the trench by hand and took it down to bedrock. The final exposure was checked by Dr. L. K. Kittleman, Curator of Geology, Museum of Natural History, University of Oregon. Cressman's 1938 interpretation was shown to have been correct.

A small, undisturbed section of cave fill was eventually found and excavated. After about two weeks of work, Cressman exposed a small hearth in the top of the gravel, and by careful work there and later in the laboratory, a sample of charcoal sufficient for C-14 dating was
Fig. 6. Plan of Fort Rock Cave Showing 1966 Excavations.
secured and sent off for assay. Unfortunately, this important sample was apparently lost in the unpackaging room and a lot of hard work and valuable information evidently went into the trash can.

The planned survey was made and a series of shelters was found at the base of the Connelly Hills. Although pretty roughed up by collectors in the upper parts, they were considered, after checking, to be important for excavation. Later in the fall, the Table Rock area was surveyed. Aerial observation in 1967 located Cougar Mountain Cave Number 2, and local informants directed the 1967 party to another cave on Seven Mile Ridge.

Our objectives in 1967 were, first, at Fort Rock Cave, to remove large roof-fall rocks (which we had been unable to move in 1966 with the power equipment then available) to discover if any occupation material might be found under them, and to try to get datable material to undo the disaster of 1966. Bedwell, in charge of the field program, was then to move to excavation of the other sites. At the same time, he was to gather all possible information on the ecological history of the Fort Rock basin. Ten closely spaced caves or shelters at the base of the Connelly Hills (occupied simultaneously, as it proved, from more than 13,000 years ago almost to contact time), provided a situation for an Early Man study unique in North America.

Demolition was required to break up the main fallen rocks in front of Fort Rock Cave, after which their fragments were removed by bulldozer and by hand. These huge angular rocks had fallen with such force that, while there had been occupational debris where they fell, it was smashed and churned to such a degree that it was useless for scientific purposes. Bone, stone, and everything else was smashed.

A large flat rock on the east side of the cave entrance at about the drip line was moved by the bulldozer without demolition. This rock had preserved under it, safe from the depredations of archaeologists and pothunters, a record of human occupation dating from 13,200 to 4,450 C-14 years ago. Four C-14 dates from under the rock are 13,200 ± 720, 10,200 ± 230, 8,550 ± 150, and 4,450 ± 100 years ago (GaK1738, 2147, 2146, 2145). We point out that, except for three lake terrace dates based on carbonates (only one of which, GaK1752, is reported here), all C-14 dates from the Fort Rock research were derived from charcoal.

A concentration of shelters against the south cliff of the Connelly Hills was the source of most of the material for our 1967 study; the other sites above mentioned made significant contributions. The Connelly Hills shelters had been badly "potted" in the rear and sometimes in superficial levels elsewhere, so excavations were made at the front, areas which would, in the long run, be expected to be most productive of non-perishable material. The study covered the period from the earliest cave occupation into the Medithermal, when climatic conditions approximated
those of the present. The Seven Mile Ridge site is excluded from this report because its two C-14 dates of 2,250 ± 100 and 1,060 ± 80 years ago (GaK1747, 1746), place it later in time than the period we are concerned with here.

Establishment of Basic Time-Use Sequences

Since field observation and preliminary laboratory examination failed to indicate any sudden changes in the character of the artifact assemblages from the Fort Rock basin, Bedwell devised a method to discriminate "units of occupation intensity" through time. "At each of the sites, the percentage of total lithic debris in the site by level, the percentage of total artifacts in the site by level, and the percentage of total bone in the site by level was calculated. When these were plotted on graphs by site and square, an interesting pattern emerged. In the majority of cases there appeared to be a high percentage of artifacts, lithic debris, and bone material in the 10,000 to 8,000 B.P. period; then a drop-off, declining to negligible amounts sometime after 7,000 B.P.; then finally a new increase in the 5,000 to 4,000 B.P. period lasting to around 3,000 B.P." (Bedwell 1970: 58). He then set up four tentative periods: Period I from 13,250 to around 10,600 B.P.; Period II from around 10,600 to 7,240 B.P.; Period III from 7,240 to 4,720 B.P.; and Period IV from 4,720 to 3,000 B.P.

The greatest intensity of occupation occurred in the relatively moist Period II between about 10,000 and 8,000 B.P., after which there was a decline in occupational intensity. After the Mount Mazama eruption and the onset of the dry Altithermal period around 7,000 B.P., occupation was only sporadic and probably consisted simply of hunting parties in transit who left little behind in the way of cultural evidence. Beginning about 5,000 B.P., however, in a period of probably increased amounts of rainfall (corresponding to a mild renewal of mountain glaciation at that time), occupational intensity in the caves once again showed a modest increase (particularly between 4,500 and 3,500 B.P.). Nevertheless, by about 3,000 B.P., occupational intensity once again declined to negligible levels, probably reflecting the development in the area of arid conditions like those of the present.

The C-14 dates from the Fort Rock basin cluster in a pattern which supports the validity of Bedwell's periods (see Bedwell 1970: 55, 56). One might be accused of bias in the selection of dates. The answer is that the samples were chosen from where they were available. Since intensity of occupation of the sites studied was calculated from artifacts collected by levels, and the C-14 dates were also collected by levels, the data could be correlated to construct a set of reliably dated periods of occupational intensity.
Environmental Change

Various kinds of data were used as climatic indicators: phyto-
liths, wood used in campfires (from the same samples as were used for
C-14 dating), faunal and other floral remains. Pollen was lacking in
all soil samples from all sites. Cressman excavated a sandal fragment
in 1965 from Fort Rock Cave which was dated at 8,500 ± 140 C-14 years
ago (1-1917) but before sending it to the laboratory he carefully ex-
tracted dirt from among and between the fibers to check for pollen,
thinking the sandal might have picked up pollen in its wearer's wander-
ings around the basin. Dr. Jane Gray, Curator of Paleobotany at the
Museum of Natural History, University of Oregon, made a hasty examina-
tion of the sample and reported the presence of pollen: "...composed
primarily of pine, sagebrush and other Compositae with minor amounts of
Gramineae and Chenopodoaceae. There were also single grains of Tsuga
(hemlock), Betula (birch) or Corylus, Ostrya (hophornbeam) and two grains
of Alnus (alder)." While the small sample does not provide a reliable
record of the pollen rain of the area at that time, it does indicate
something of the character of the vegetation of the area. A period of
greater precipitation than the present 9 to 10 inches annually is sug-
gested; Dr. Gray points out that the last four species are not now found
in the area, also noting, however, that all are wind pollinated.

Before further discussion of environmental change, we must discuss
briefly the Mount Mazama eruption and its probable catastrophic conse-
quences. Bedwell applied a date of 7,000 years ago to the eruption which
deposited unbroken layers of pumice to a depth of about 20 centimeters in
most caves in the Fort Rock basin. In 1965 Dr. L. K. Kittleman, Curator
of Geology at the Museum of Natural History, University of Oregon, and
Cressman, in a renewed study of the pumice problem, returned to the site
near Crater Lake from which Cressman secured the original C-14 sample
dated by Libby using the solid carbon method at 6,453 ± 250 years ago
(C-247, average of four runs). A large sample of charcoal was secured
from the same deposit. Two samples were selected from this material and
sent independently to different laboratories, neither of which knew the
date secured by the other. The dates are 7,010 ± 120 (GaK1124) and
6,940 ± 120 years ago (TX487), so 7,000 C-14 years ago is a valid date
for that sample. Three samples from directly beneath the pumice in the
Connley Caves are dated at 8,290 ± 310, 7,900 ± 170, and 7,240 ± 150 C-14
years ago (GaK1739, 1741, 2140). The disparity in the pattern of dates
from dry caves and from open sites Cressman has discussed elsewhere
(Cressman 1966). We have no answer to the problem at the present time,
but we point out that the dates from the Connley Caves are not necessarily
in conflict with the dates from the open site. Bedwell had to use a date
for the eruption and since a log burned by hot pumice indicates associa-
tion of event and sample, while a sample from "directly below" or "just
below" an ash layer is separated from the ash by whatever time was re-
quired for the intervening deposit to accumulate, the use of the 7,000
year date is justified.
The Mount Mazama eruption occurred sometime after the onset of Altithermal dessication and apparently had a catastrophic effect on the local environment and its life forms. The problem of the effects of the eruption is confused by the fact that Altithermal dessication had already begun when the eruption occurred. The effects of the eruption are best visualized as greatly accentuating the effects of dessication already underway. It not only produced these effects suddenly but probably to a greater degree than climatic deterioration alone would have done. Various life forms, both plant and animal, appear to have been terminated either directly or indirectly through chemical contamination of the life forms lower in the food chain, upon which the higher species depended for food.

A 2.8 meter stratigraphic section outside Conaley Cave Number 4 was prepared for soil analysis by Joel Norgmen of the Department of Soils, Oregon State University. No true soil horizon could be identified except for perhaps a very faint one below the Mazama pumice horizon. Norgmen therefore suggested a grass opal analysis, for the presence and proportion of grass opal in a soil profile may serve as an indicator of certain climatic conditions at the time of deposition. Grasses absorb silica from the soil, which is taken by precipitation into the cells in the form of grass opal, or phytoliths. When the plant dies the phytoliths are released into the earth, where they are preserved; the greater the amount of grasses, the greater the amount of phytoliths. Since change over time in the relative percentage of grasses in an area is an indicator of varying climatic conditions, especially varying precipitation, a decreasing amount of phytoliths indicates an increasingly arid climate, one less favorable for plant growth.

While our phytolith sample is too limited for general conclusions, it is nonetheless indicative of local conditions. All samples were taken by 10 centimeter levels, starting from the bottom of the section. Phytolith percentages from each of the four levels below the Mount Mazama ash varied from 1% to just over 2%. Five levels within the 50 centimeters of deposit immediately above the ash each contained only about .1% of phytoliths. The level-by-level percentages then continued variably for another 40 centimeters, when they steadied to a situation about like that shown before the Mazama eruption. The balance of the profile, which corresponded pretty well with the post-3,000 B.P. period, showed the highest percentage of phytoliths, each 10 cm. level averaging about 2.5%, with one level reaching just above 3%. A rough estimate of the rate of deposition of fill for the five 10-centimeter-thick levels immediately above the ash in the Conley Caves gives a period of about 1,900 years when practically no grasses grew in the area. Such a condition, sudden in its inception, cannot be attributed to a progressively increasing state of Altithermal aridity. It must be attributed to the Mount Mazama eruption, a truly catastrophic event, for the Fort Rock Lake basin and perhaps a much more extensive area.
Charred wood samples identified by the Forest Products Laboratory, Madison, Wisconsin, and taken from the same samples which furnished C-14 dating material, provided dated information on the vegetation cover. Assuming that there was no cultural bias in the selection of firewood; the materials chosen for fuel should be a fair reflection of a certain segment of the vegetation cover. Pinyon pine (the first reported in Oregon) occurs in the earlier levels but disappears perhaps a couple of centuries before the Mount Mazama eruption. Juniper is lacking until just before the eruption but is of major importance during the re-occupation of the caves around 4,500 B.P. Atriplex (saltbush), common in the alkali soils of dry lake beds in the Great Basin, first appears immediately before the eruption. It appears again after the habitat is re-established following the ash fall. Sagebrush and bitterbrush occur in each period of cave occupation. Juniper thus appears to have been extending its habitat, perhaps at the expense of pinyon, just before the eruption. Both trees are indicators of arid climate. Pinyon never became re-established. Whether juniper spread back from less devastated areas after the eruption is unknown. Pinyon appears to have been a victim of the Mazama ash fall, although it seems to have been scarce for some time before the eruption, not appearing as firewood. The evidence from wood clearly indicates a gradual climatic deterioration of the habitat, then the Mount Mazama eruption, then eventually the establishment of the habitat in its present condition by about 4,000 years ago.

Bird bones give some new information on generic presence as well as on climatic conditions. Turkey bones (identified by R. W. Storer and J. G. Struach of the Museum of Zoology, University of Michigan), the first reported in Oregon, occur before the Mount Mazama eruption but not thereafter. The association of these birds with the pinyon pine is clear. Their continuation in the late pre-Mazama period, even after the pinyon pine ceased to be used as firewood, may mean that there was still sufficient pinyon in the area to support a turkey population up to the time of the Mount Mazama eruption. The presence of waterfowl up to the time of the eruption is evidence of at least ponds in the Fort Rock basin then. In Occupation Period IV some 2,000 years after the Mazama eruption and after the close of the Altithermal, waterfowl reappear in reduced numbers, but turkeys do not come back (Fig. 7).

The faunal evidence indicates the presence of larger herbivores, mostly elk and bison and some unidentified varieties, up to about 8,000 years ago. The presence of Equus, camel, and bison are well documented for the neighboring Summer Lake basin at a considerable period of time before the Mount Mazama eruption (Cressman 1942). One small animal, pika (Ochotona), found in the sites at this period, is now found only at elevations of 5,700 to 11,000 feet where the temperature is lower than in the Fort Rock basin and the precipitation is greater.

Small chubs (Gila bicolor, identified by Dr. Richard L. Wilson, Southern Oregon College), present before the Mazama ash fall, occur in
<table>
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<th>Date (B.P.)</th>
<th>FL. R. L. V. periods</th>
<th>Climatic Periods (after Antevs)</th>
<th>Temperature curve based on deviation from present (after Antevs)</th>
<th>FORT ROCK LAKE VALLEY</th>
<th>CLIMATIC CHRONOLOGY</th>
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<tr>
<td>3,000</td>
<td>IV</td>
<td>MEDITHERMAL</td>
<td>-3 -2 -1 -0 +1 +2 +3</td>
<td>Semi-arid</td>
<td>Some ponds and marshes</td>
</tr>
<tr>
<td>4,000</td>
<td>4,720</td>
<td>ALTITHERMAL</td>
<td></td>
<td>Arid</td>
<td>Seeps and springs only</td>
</tr>
<tr>
<td>5,000</td>
<td>III</td>
<td>ANATHERMAL</td>
<td></td>
<td>Semi-arid</td>
<td>Some ponds and marshes</td>
</tr>
<tr>
<td>6,000</td>
<td></td>
<td></td>
<td></td>
<td>Temperate</td>
<td>Numerous ponds, marshes, and perennial streams</td>
</tr>
<tr>
<td>7,000</td>
<td>7,240</td>
<td></td>
<td></td>
<td>Cool and moist</td>
<td>Some ponds and marshes</td>
</tr>
<tr>
<td>8,000</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>9,000</td>
<td></td>
<td></td>
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</tr>
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<td>10,000</td>
<td>10,600</td>
<td>LATE GLACIAL</td>
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</tr>
<tr>
<td>11,000</td>
<td>I</td>
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<tr>
<td>12,000</td>
<td></td>
<td></td>
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<td>13,000</td>
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Fig. 7. Fort Rock Valley: Correlation of Cave Occupation, Climatic Chronology, and Antev's Climatic Sequence.
Occupation Period IV. These fish are still found in the small streams flowing into the basin from beyond Silver Lake. The chubs' presence in Period IV and in present-day small streams indicate (1) that these streams were the chubs' refugia following the Mount Mazama eruption, and (2) that the hilly country, presently forested, in which the streams have their sources was not damaged severely enough by the aridity of the Altithermal or by the Mount Mazama pumice fall to destroy the chubs' habitat.

Artifact Analysis

A total of 2,846 artifacts recovered from the Fort Rock valley sites was grouped into thirty-one classes. Careful analysis of this material revealed four artifactual assemblages, representing four cultural periods. The four cultural periods (not to be confused with the four periods of differing occupational intensity referred to in preceding pages; see Table 1 for correlation) are as follows: Period 1, the late post-Mount Mazama ash period from about 3,000 to about 5,000 years ago; Period 2, the late pre-ash period from around 7,000 to 8,000 years ago; Period 3, the early pre-ash period from about 8,000 to 11,000 years ago; and Period 4, the very early period from about 11,000 to 14,000 years ago. Period 4 is represented only at Fort Rock Cave and Cougar Mountain Cave Number 2; the other periods are found in all the caves under discussion. The process by which these periods were defined is detailed below, under Method of Artifact Analysis.

<table>
<thead>
<tr>
<th>Periods of Occupation Intensity</th>
<th>Cultural Periods</th>
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<tr>
<td><strong>No.</strong></td>
<td><strong>Date</strong></td>
</tr>
<tr>
<td>I 13,250 - 10,600 B.P.</td>
<td>4 14,000 - 11,000 B.P.</td>
</tr>
<tr>
<td>II 10,600 - 7,240 B.P.</td>
<td>3 11,000 - 8,000 B.P.</td>
</tr>
<tr>
<td>III 7,240 - 4,720 B.P.</td>
<td>2  8,000 - 7,000 B.P.</td>
</tr>
<tr>
<td>IV 4,720 - 3,000 B.P.</td>
<td>1 5,000 - 3,000 B.P.</td>
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Table 1. Correlation of Cultural Periods and Periods of Occupation Intensity.

In setting up a classificatory system for projectile points, Bedwell made use of two surface collections from the Fort Rock basin, consisting in all of over 1,500 complete specimens that were on deposit in
the Museum of Natural History of the University of Oregon. This gave him a much larger series for examination than was available from our excavations alone. Forty-three groupings were eventually described for our controlled collection, all but six of which are represented in the surface collections, often by as many as 60 or more specimens in a group. Classification of points was based on shape in plan view and cross-section; various attributes of flaking technique; and mode of manufacture, whether by percussion or pressure flaking. The series has been finely split into a large number of types; should it later become desirable, these may be regrouped into a lesser number of broader categories.

Method of Artifact Analysis

Inspection and comparison of artifacts from the various sites around the Fort Rock basin lead to the preliminary hypothesis that little cultural change took place in the area for the first several thousand years for which we have a record, after which, not long before the onset of the full Altithermal dry period, new characteristics and forms began to appear which carried forward into the assemblages seen at the end of the Altithermal.

In order to test this view, it was decided to record various attributes for each artifact and to study the distributions of these attributes in regard to units of time. If changes had occurred in the assemblages predating the Altithermal, then materials from the levels immediately below the Mount Mazama ash stratum (dated just after the onset of the Altithermal) would show qualitative and quantitative differences from the materials in lower pre-ash levels. Further, if the hypothesis were correct, and these characteristics had persisted into the post-Altithermal period, then many of the attributes seen in the levels just below the Mazama ash would also be seen in the post-Altithermal assemblages just above the ash. Simply stated, if the hypothesis holds, the late pre-ash assemblages and the early post-ash assemblages should show greater resemblances between themselves than either should show with the early pre-ash assemblages.

In order to make such an analysis, one needs a sample large enough to offset chance distributional errors. This meant that data from several excavations would have to be combined, and that they would have to be combined into units which were comparable. The Connelly sites provided the appropriate situation for such an analysis, because there the excavations were all located close together in virtually adjacent though independent caves, and the controls at these sites, which were all dug in a single season, were uniform. The very earliest period was not represented at the Connelly sites, but material from this period could be derived from the recent Fort Rock Cave excavations.
The decision was made to use three temporal units to demonstrate any change in pattern which might be taking place: an early pre-ash period, a late pre-ash period, and a late post-ash period. The decision as to which levels at the Connelly excavations belong to what periods was based in part on continuity of assemblage in terms of typology, flaking technique, and material used; and in part upon relative stratigraphic position (particularly as related to the Mount Mazama ash fall). These criteria were supplemented by the available C-14 dates and by calculations on depositional rates for each of the caves. Thus, using all available data from the Connelly Caves, levels were combined into three units: Period 3 represented the early pre-ash unit; Period 2 represented the late pre-ash unit; and Period 1 represented the post-ash and post-Altithermal unit (Table 1).

The IBM 360 computer was used to calculate frequency distributions for the following artifact classes: projectile point types, knife types, scraper types, graver types, and mano types. These distributions were expressed in terms of frequency of occurrence by unit and percentage of occurrence by unit. Only these classes were used because they were the only ones available in sufficient number to produce statistically meaningful distributions. Chi square values were calculated for each of these distributions (see Bedwell 1970: Appendix VI).

Frequency distributions were calculated for projectile points with regard to two qualitative attributes: flake direction (whether flaking was essentially at right or oblique angles to the midline), and flake carry (whether flake scars regularly carried across, up to, or short of the midline). The results were expressed in terms of frequency of occurrence by unit and percentage of occurrence by unit with a Chi square statement for each table.

Finally, distributions for four quantitative attributes were calculated: total length and thickness for projectile points, scrapers, and knives; flake scar widths (based on representative widths) for projectile points and knives; and, lastly, flake scar width-to-length ratios for projectile points and knives. A Chi square statement was also determined for each of these distributions expressed in terms of frequency of occurrence by unit and percentage of occurrence by unit.

For quantitative attributes another determination was possible. Distribution curves were described in terms of means and standard deviations, and a probability statement as to the significance of the distribution of the means was determined. To produce this statement of significance an F test was used as an analysis of variance (see Blalock 1960: 242).4

A similar analysis was based on the original excavations at Fort Rock Cave. A problem in this case, however, was that the methods of excavation used in 1938 were not closely comparable to those used in
1966 and 1967. The original excavations over thirty years ago at Fort Rock Cave were carried out at the end of a summer field season which had already seen considerable work in other parts of eastern Oregon (and on a total initial budget of only a few hundred dollars), and at the time the cave was excavated, factors of time and money were pressing matters. As a result, the cave was excavated in the only way possible at the time; that is by rather large stratigraphic units above and below the Mazama pumice layer and without precise level control. Cross controls were used and precise elevations were read by transit on individual specimens in situ. With this explanation, the reader will more clearly understand the problems encountered with the data from Fort Rock Cave in this present study.

Having access to all the field notes from the 1938 Fort Rock Cave excavations, Bedwell attempted to isolate stratigraphic units which could be used in his investigation and concluded that there might be four which would serve. These were: Unit 1, which included material from above the pumice layer; Unit 2, material from just below the pumice; Unit 3, the organic, artifact-rich layer below this; and Unit 4, which included materials from the lower levels, near the top of the gravels. This ordering of units relative to the ash parallels the ordering established for the Connelly Caves. To this sample, for a study of distributions, was then added the material from the 1966 and 1967 excavations, with levels again grouped on the same basis as at the Connelly Caves.

The results of the distribution studies at Fort Rock Cave must be interpreted with care, for they are not as reliable as those for the Connelly Caves since accurate assignment of materials to the proper units was difficult to make because of insufficient data. As a result, artifact provenience assignments to Fort Rock Cave Units 2, 3, and 4 should be considered only approximate. The differentiation of material into Unit 1, above the ash, and Units 2, 3, and 4 as a group below the ash is, however, accurate. Moreover, all descriptive data for the earliest period at Fort Rock (Unit 4) were taken from the 1967 excavations and are precisely controlled. Despite the problems encountered, the results of the Fort Rock frequency distributions are interesting for comparative purposes and generally support the results from the Connelly Caves. All references to assemblages from Periods 1, 2, and 3 in the analysis to follow are, however, based on materials from the Connelly Cave sites only unless otherwise noted, while the Period 4 assemblage is derived principally from Fort Rock Cave.

Results of Artifact Analysis

Period 4 assemblage, dated between 14,000-11,000 B.P.; the assemblage from a hearth at Fort Rock Cave dated at 13,200 ± 720 B.P.
(GaK1738) includes a point similar to the Lake Mohave type, and a small unnotched point with slight fluting from a concave base. The slight fluting appears to be simply a thinning technique. Both points are made of obsidian and show rather poor workmanship. In addition, there are several scrapers, gravers, reworked flakes, and surprisingly enough, a mano. Bedwell supervised the excavation and is certain of the mano's association. Cressman believes the core-and-blade technique is present in the assemblage, as well as the true burin. Bedwell is hesitant to accept these identifications, although at least one other archaeologist is convinced we have true burins. There is one specimen, made on a blade-like piece, which Cressman thinks is an incipient crescent, but he may be incorrect (Fig. 8). Cougar Mountain Cave Number 2 yielded only use-reworked flakes at the level dated 11,950 ± 350 B.P. (GaK1751). Bedwell thinks this site was a workshop where large "clam-shell"-like flakes were first struck off from quarried Cougar Mountain obsidian preparatory to further fabrication.

Period 3 assemblage, dated 11,000-8,000 B.P.: six closely spaced C-14 dates falling between 10,200 and 9,500 years ago give on the whole a usable reference for dating this period of maximum cultural activity (Bedwell 1970: 55, 56). All points are unnotched. The Haskett point first reported from Idaho by Butler (1967); the small, unnotched concave based point with slight fluting, comparable to the non-Lake Mohave type from the Period 4 assemblage but better made; the rear portion of a point thinned by fairly long multiple fluting in the Clovis manner; a rather straight-edged, narrow, concave base point; a leaf-shaped point with a straight base; a bipoint; and the Lind Coulee and Windust point types all appear in this period. Edges are typically ground (Fig. 9).

The Haskett point is also found in surface collections from south-central Oregon and the high Lake Lahontan beach in the Fallon area of western Nevada. The fluted specimen has analogues with those in the Tonopah and Borax Lake collections.

The presence of the core and blade technique in this assemblage is clearly shown by a large fragment of a long chert projectile point and a classical (according to Don E. Crabtree, personal communication) end-of-blade scraper made from basalt. Crescents, from Fort Rock Cave, are also a part of the assemblage. Flaking, as in Period 4, appears to be mostly by percussion.

This is the period of the dated sandals and the fragment of fine twined basketry with false embroidery from Fort Rock Cave. Manos, gravers, knives, scrapers, anvil stones and the usual assortment of stone working tools occur. Space does not permit discussion of these in detail.
Early Assemblage from Top of Gravel at Fort Rock Cave

Fig. 8. Early Assemblage from Top of Gravel at Fort Rock Cave.
Fig. 9. Projectile Point Distribution by Units--Conley Caves. (Designators beneath points refer to classification detailed in Bedwell 1970.)
The picture this period presents is one of continued development of techniques and specimens found in the earlier period. There is improvement in workmanship and modification of point types, apparently in the interest of improved hafting, as though the manufacturers were experimenting with solutions to this problem. Successful adaptation to a favorable habitat is clear and what change occurs appears to be internal and developmental.

Period 2 assemblage, dated 8,000-7,000 B.P. this period, which terminates with the Mount Mazama eruption, is one of decreasing use of the caves with a high degree of probability that the decline is a response to the worsening habitat that is implied by climatic indicators. A significant change in the lithic assemblage occurs with the appearance of the corner-notched projectile point. This point type does not appear in sufficient numbers to suggest a population movement but instead there are at first only one or two such points, then a gradual increase in numbers. The Haskett point continues as do several others of the general leaf-shaped variety, but fluting is lacking. For the period as a whole, some 50% of all points are corner-notched and two are side-notched (Fig. 9). The corner-notched points appear as additions to the inventory, and do not suddenly displace earlier types. The tempo of appearance and increase of these points suggests that they represent local internal development in response to the problem of hafting, and that because of their effective solution of this problem they gained rapidly in popularity. On the other hand, the same evidence could equally well be used to argue for diffusion on the first instance, then local adoption. We know of no earlier occurrence of corner-notched points at present which might serve as a source for diffusion. However, such may exist further south in the Great Basin.

Another change during this period is in stone flaking technology. While the previous method of flaking at right angles to the long axis of the artifact continues, the technique of flaking at oblique angles appears, with the flake scar sloping toward the base of the artifact. Bedwell's detailed analysis of flake scars indicates that this change signifies the appearance of pressure flaking. The points generally decrease in size. A bone flaking tool used commonly in pressure flaking also appears at this time.

Use-reworked flakes make up 51% of the inventory of knives and scrapers in the preceding Period 3, but 73% in this one and 79% in the following Period 1.

Two manos and one mortar occur in the Period 2 assemblage.

A significant change occurs in the lithic source material. In the preceding period, basalt comprised 37% and obsidian 53% of the lithic source material. In this period, basalt drops to 8% and obsidian rises to 89%, a condition carrying into the final period.
Period 1 assemblage, dated 5,000-3,000 B.P.; eleven O-14 dates fall in this period with one cluster between 4,700 and 4,300 B.P., and another between 3,700 and 3,000 B.P. (Bedwell 1970: 55, 56). This period clearly represents a further development of the trends seen in Period 2. Since the time between the end of Period 2 at 7,000 B.P. and the beginning of Period 1 at 5,000 B.P. is not represented by significant deposits in the caves, the developmental continuity from Period 2 to Period 1 in the caves must mean that during the hiatus in cave occupation people carrying on the tradition of Period 2 occupied the surrounding area where habitats were favorable. This conclusion is supported by an infant burial from Table Rock Site Number 2 dated at 5,220 ± 210 years B.P. (GaK1748). For the 2,000 years intervening between Period 2 and Period 1, the dessicated and contaminated lake bed was avoided as a habitat but in the meantime improved methods of adaptation were worked out in the surrounding area, to be brought back into the lake bed as it improved as a habitat under the more favorable climatic conditions of the Mediterranean.

A slender corner-notched projectile point makes up 70% of all points in Period 1, while 89% of all the studied specimens of the corner-notched type appear in this unit. (The remaining 11% all occur in the preceding Period 2.) Pressure flaking is now dominant. Oblique flake scars now occur on 56% of all points, while in the preceding Period 2, they were present on 29%, and in Period 3, on 12% (Fig. 9). Basketry and matting occur as grave goods with the Table Rock burial; their absence in the Connley Caves is probably due to deterioration from moisture. The rest of the lithic inventory is that common to the Great Basin at this time period. Our study concludes at 3,000 B.P.

Statistical analysis indicated that the assemblages of each period differed from those of the preceding periods, and that the resemblance between periods 2 and 1 was closer than that between periods 2 and 3, or periods 3 and 4. The hypothesis proposed under Method of Artifact Analysis, above, was thus shown to hold true.

In summary: Fort Rock basin was used as an aboriginal human habitat from before 13,000 years ago until the coming of the white man, although the caves and shelters of the lake bed were used but little between 7,000 and 5,000 years ago. Intensity of occupation was definitely a function of the quality of the habitat for human life. The earliest assemblage, dated at 13,200 years ago, shows sophisticated methods of fabrication of stone tools and weapons. The climax of the early occupation occurs between 10,200 and 9,500 years ago, although the same way of life, as reflected in the material culture, continues with diminishing intensity until 8,000 years ago. During the climax period, a far-flung similarity of artifacts and fabricating techniques occurs across southeastern Washington, the lower Snake River, the middle Columbia River in Oregon, south-central Idaho, the Fort Rock area, the western Great Basin, south-eastern California and the San
Diego County area. Both ends of the Central Valley of California are presently included. Obviously, early historical connections down the eastern flanks of the Cascade-Sierra mountains are indicated by this distribution. The nature of these relationships is not at present understood and the problem provides opportunities for future research.

The culture continuum in the Fort Rock basin confirms the interpretation made many times by various writers that Great Basin culture developed largely on its own terms, mostly by internal innovation, and was a culture remarkable for its capacity to exploit even the harshest environment, even though survival was often at or close to the subsistence level.

The earliest northern and western Great Basin culture appears to have been somewhat different from that of the eastern Great Basin before 8,000 years ago, a situation which, Bedwell believes, might be reasonably used to date the appearance of the Desert Culture, at least in the northern Great Basin. Because of the strong similarities between the Fort Rock area assemblages and assemblages as far south as Lake Mojave in southern California, Bedwell has suggested the name "Western Pluvial Lake Tradition" for the pre-Desert culture appearing in this vast area between about 11,000 and 8,000 years B.P. This cultural similarity is due, in Bedwell's opinion, to the fact that a similar lake-grassland environment extended throughout this area along the eastern edge of the Cascade-Sierra Nevada mountains.

Among the many research problems to emerge from the Fort Rock research, we wish to mention two of great importance for future work: first, the need for discovery and description of the culture of the people who were in the Great Basin area before the lake shore caves became available for habitation; and second, the problem of altithermal dispersion of the population which had previously used the caves for shelter.

Notes

1This article is a slightly expanded and revised version of the paper, Fort Rock Report, which I read at the Northwest Anthropological Conference, Oregon State University, March 26, 1970 and, by request, at the Great Basin Anthropological Conference, the University of Oregon, August 29, 1970. The article is a joint product with neither senior nor junior authors, and our names are given in alphabetical order. I wish to take this opportunity to congratulate Dr. Bedwell on the high quality of his study, on which this paper is based. I consider his work to be one of the landmarks in the study of Great Basin prehistory. (L.S.G.)
A radiocarbon determination (GaK1752) on this shell gave a date of 12,980 ± 230 B.P. A C¹³/C¹² analysis on this shell gave a δ C¹³ 0/00 of -0.08 and a δ C¹⁸ 0/00 of -3.2. According to a report by Dr. L. R. Kittleman of the University of Oregon Museum of Natural History, such a small, negative δ C¹³ value "suggests that contribution from organic carbon is relatively slight and that the terrain is volcanic, there would be negligible contribution from ancient, carbon-14-free marine limestones. The measured δ C¹⁴ value, when corrected for fractionation, should yield a reliable radiocarbon date" (Kittleman 1968: 9). When corrected for fractionation using the formula given by Broecker and Olson (1961: 176) \[ \Delta = \delta C^{14} - \frac{2 \delta C^{13} + 50}{1 + \delta C^{14}} \] gives a corrected date for the shell of 13,380 ± 230 B.P. Thus it seems that the lake edge stood at approximately 4,386 feet elevation at just a little over 13,000 years ago (Bedwell 1970: 69, 71).

The mechanics of handling the tens of thousands of pieces of data which were involved in this study fell to the IBM "360" computer; the task of recording these data fell to myself and my assistant, but for any errors I assume full responsibility (S.F.B.).

For exact results of these determinations, see Bedwell 1970.

References

Allison, Ira S.

Antevs, Ernst

Bedwell, S. F.

Blalock, Robert M., Jr.

Broecker, W. S. and E. A. Olson
Butler, B. Robert

Cressman, L. S.


Cressman, L. S., Howel Williams, and Alex D. Krieger

Kittleman, L. R.

Libby, W. F.

Merriam, John C.
Fig. 1. Location of Sandwich Shelter.
which the burial was interred, and several caches in the rear of the shelter.

In spite of the damage, almost eight feet of cultural deposits remained in the western one-third of the shelter. These consisted of a series of nine rather complacent layers, composed largely of wind blown dust, rock spall and a few large blocks of fall from the shelter roof. The strata were, for the most part, poorly differentiated, and during excavation it was discovered that the upper four, comprising almost half of the total depth of cultural deposits, were badly disturbed by relic-hunter's pits. Accordingly, these four levels were removed as one unit, hereafter designated Layer 1.

Cultural features, that is deliberate human constructions, in the shelter consisted only of four hearths and the burial pit mentioned earlier. Three of the hearths, which were nothing more than shallow ash and charcoal filled basins, were associated with an apparent living surface contained entirely within the oldest cultural stratum and about 10 inches above the floor of the shelter. The fourth hearth (Fig. 3), another shallow basin filled with ash and charcoal, originated at the top of the sterile, decomposing rock spall which formed the shelter floor. A charcoal sample collected from this hearth, the earliest evidence of human occupation at the site, was sent to Radiocarbon, Ltd., for C-14 assay where it yielded a date of 7040 ± 280 radiocarbon years B.P., or about 5090 B.C. (RL-55).

Five natural crevices or niches in the rear wall of the shelter were used for the disposal of domestic debris, but two were also used as caches. Both were associated with the disturbed composite Layer 1. One cache contained eight scapula knives and a slate knife; the contents of the other cache included several scrapers and a shaped shaft smoother.

The artifacts from Sandwich Shelter are not numerous (Table 1). Only one perishable artifact, a so-called "Promontory Peg," was present along with some rather dubious split reeds, in disturbed context very near the surface of the deposits. Pottery, including Great Salt Lake Gray and Ivie Creek Black-on-white was recovered from the upper portions of the site. Both types, as well as the Promontory peg are diagnostic of the Fremont culture, and Ivie Creek Black-on-white has been assigned an approximate time span of A.D. 900 to 1300 in central Utah where it is most abundant.

Projectile points and other chipped stone artifacts were rather scarce at the shelter, but the tools that were recovered closely resemble the chipped stone materials from Hogup and Danger Caves. Although the full range of named types from Hogup and Danger was not present, lithic materials characteristic of at least three of the units defined by Aikens (1970) for Hogup Cave were found. These
Fig. 2. Sandwich Shelter

Fig. 3. Hearth on Shelter Floor, C-14 Dated to 5090 B.C.
include projectile points of the Pinto series, primarily Pinto Barbed and Pinto sloping-shoulder, along with domed scrapers and core knives characteristic of Hogup Unit I, radiocarbon dated to between 6400 and 1250 B.C. Also present were Eastgate Expanding-stem and Rose Spring Corner-notched points characteristic of Hogup Unit II (1250 B.C. to A.D. 400) and Desert Side-notched, Cottonwood Triangular and Rose Spring Side-notched points which can be correlated with Hogup Unit III which has radiocarbon dates ranging from A.D. 400 to 1350. Elko series points, which are present in large quantities over a long time span at Hogup and Danger Caves, are represented at Sandwich Shelter by a single Elko Corner-notched specimen. This was found imbedded in a lumbar vertebra of the human skeleton disturbed by collectors.

Although lithic materials comparable to those from at least three Hogup cultural units were present at Sandwich Shelter, the small number of artifacts and the disturbed nature of the upper levels at the shelter make exact correlation of the two sequences impossible. In general, however, the upper composite Layer 1 at Sandwich Shelter contains lithic materials very similar to those recovered from Strata 9 to 14 at Hogup Cave while the lower levels at the shelter yielded lithics similar to those from Strata 2 to 8 at Hogup. Thus, there is a general similarity between the two sequences, as well as a close similarity between the individual artifacts.

Chert and chalcedony were the favored raw materials for chipped stone artifacts at all levels in the shelter. This is particularly true for scrapers and small projectile points. Obsidian was utilized principally for larger points and for such specialized artifact types as drills and gravers.

Ground stone artifacts from the shelter include a variety of manos, along with grinding slabs, shaft smoothers, large pestles, slate figurines, slate knives and edge-ground cobbles. The edge ground cobbles occurred in all layers except Layer 4, but five of the total seven specimens were found below composite Layer 1 or in the lower half of the cultural deposits. They are nothing more than roughly oval water-worn cobbles with one long edge ground at approximately a right angle to the wide faces of the stone. They seem to be identical in all respects to specimens recovered from the Weis Rockshelter in western Idaho (Butler 1962) and from Hogup Cave. Not present at either Hogup Cave or Sandwich Shelter, however, are the cobble anvils or bases which were associated with the edge-ground cobbles at the Weis Rockshelter. They may have been missed in excavation though, since as Butler points out, they are by no means obvious artifacts.

Butler (1962: 48) regards the edge-ground cobbles as a tradition wholly separate from the mano-metate complex, and equally ancient, with the two complexes involving different modes of grinding of different kinds of foods, reflected ethnographically in the different
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Table 1. Artifacts from Sandwich Shelter.
major vegetable foods utilized by peoples of the Great Basin and the Columbia Plateau. That is to say, the mano-metate complex is associated with the grinding of hard-shelled nuts and seeds in the Basin and the edge-ground cobbles complex is associated with crushing or pulping of roots and berries in the Plateau. But in this regard it is worth noting that at both Hogup Cave and Sandwich Shelter, edge-ground cobbles occurred in company with manos and metates, and at both sites, the layers which produced the greatest numbers of edge-ground cobbles also produced the most manos and metates.

As for the rest of the ground stone complex, slate knives were restricted to composite Layer 1, although a few fragments were found in earlier layers; no significant distribution by layer could be determined for the three large cylindrical pestles, except that all three were found in caches along the rear wall of the shelter. Two small pieces of slate scratched with diagonal hatched lines were recovered from Layer 1 and probably relate to the Fremont culture.

Bone implements from the shelter include several kinds of awls, an eyed needle, a rib flesher, scapula knives or saws, and sections of bird bone with parallel grooves encircling the bone which are usually interpreted as bead blanks. All eight of the scapula knives were found in a single cache along with a stone pestle and a slate knife. The cache relates to Layer 1.

A total of 2652 bones, representing 15 mammal species, including man and domestic dog, in addition to an undetermined number of bird species, were recovered from the shelter. They are listed in Table 2. The number and kind of bones left in the shelter by man cannot be determined with certainty, and the presence of carnivore remains such as coyote, badger and weasel argues that not all bones in the deposits are the result of human agency. However, if it is assumed that the majority of the bones represent human food debris, it is apparent that the most important food animals, in all levels, are the Jackrabbit (649 bones), the Desert Cottontail rabbit (909 bones) and birds (665 bones).

With two exceptions, all of the mammal remains are representative of species which were present historically or are still present in the vicinity of the shelter, and there are no startling changes from level to level throughout the deposits. Since the radiocarbon date of 5090 ± 280 B.C., if correct, indicates that the shelter was first occupied at about the beginning of Antevs' (1948) Altithermal phase, the mammal bones suggest that the climate during Altithermal times was not markedly different from the present climate. In fact, if the relatively high percentages of Yellow-bellied Marmot and Southern Pocket Gopher in Layer 5 are interpreted as indicating the relative extent of the available habitat for these comparatively mesic genera, rather than cultural preference for food by the shelter inhabitants, it could even be said that the local climate during the early Altithermal was slightly cooler
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Table 2. Unworked Bone from Sandwich Shelter.
and/or damper than at present. In general, the faunal data from Sandwich Shelter are in agreement with abundant evidence from Hogup and Danger Caves which shows that the Altithermal age was not marked and was possibly of short duration in the Bonneville Basin, and had little or no effect upon human occupation of the region.

Culturally, the complex of tools and faunal remains from Layers 2 through 5 relates to a manifestation of the long-lived Desert Archaic pattern defined at Hogup and Danger Caves by the presence of specific types of projectile points and other tools. The primary economic emphasis seems to have been upon the collection of seeds such as Allensroflea as evidenced by the large number of grinding tools, and only secondarily upon hunting of small animals such as rabbits, hares and rodents with few sheep and deer being taken. Layer 1, or at least a portion of it, can be attributed to a variant of the Fremont culture. Although Fremont is horticulturally based over most of its range, the distinctive Great Salt Lake regional variant of Fremont culture (Marwitt 1970) seems to have emphasized hunting of large animals and seed-collecting to the almost total exclusion of horticulture. The absence of any considerable quantity of seed processing equipment, together with the relative abundance of projectile points and ungulate remains, argues that the economy represented by Layer 1 was oriented toward hunting of large animals, at least on a seasonal basis.

Unfortunately the churned nature of Layer 1 prevented the recovery of any information which would bear on the transition from the Desert Archaic to Fremont, a problem of crucial importance to interpretations of Fremont culture origins and the temporal span of Fremont. But one important secondary benefit arising from the excavations was the determination of a minimum date before which the Great Salt Lake reached the approximate level of its modern stillstand. Since occupation of the shelter could not have begun before the lake waters dropped below the 4206 foot elevation of the mud bar connecting Stansbury Island with the mainland, the lake must have reached this level, only 5 to 7 feet above the present 4200 foot stand, prior to the first use of the shelter indicated by the hearth which yielded a radiocarbon date of about 5100 B.C.

References

Aikens, C. Melvin

Antevs, Ernst
Butler, B. Robert

Jameson, Sydney J.S.
1958  Archeological notes on Stansbury Island. University of Utah Anthropological Papers 34.

King, Clarence
1877  United States geological exploration of the fortieth parallel. Professional Papers of the Engineer's Department, United States Army 2.

Marwitt, John P.
CULTURAL STABILITY ON THE LOWER SNAKE RIVER
DURING THE ALTI THERMAL

by

Judy Bense
Washington State University

This paper makes some preliminary observations concerning the
effect of the climatic episode known as the Altithermal (Antevs 1948)
on the contemporaneous cultural manifestations of the lower Snake
River in Washington. These observations are based on a detailed
analysis of the artifact content of six archaeological components at
sites 45Wt41 (Granite Point), 45Wt36 (Thorn Thicket), 45Fr36 (Windust
Cave), 45Fr32 (Votaw), 45Wt31, and 45Wt7. Comparative data from
45Fr50 (Marmes Rockshelter) and 45Ww61 are also referred to. The
following statements should be viewed as a report of progress in a
study designed to investigate the ecology of a culture extant during
what may have been a period of ecological stress.

That the Altithermal climatic period affected southeastern
Washington is supported by geologic data from the lower Snake River
region. This evidence consists of a decrease in frequency of rock-
fall from cave and rockshelter ceilings, resulting from a decrease in
freeze-thaw cycles; a stabilization of talus slopes; a decrease in
alluvial sedimentation; an increase in aeolian deposition; a reduction
of stream discharge with a cessation of fan deposition; and a lowering
of the river level (Fryxell and Daugherty 1963: 14). Palynological
evidence presented by Hansen in 1947 indicates that in nearby regions
during this same period there was a decrease in such plants as Pinus
ponderosa and Pseudotsuga menziesii and a corresponding increase in
the grasses and chenopods, a change which apparently resulted from a
decrease in effective precipitation. The Altithermal period, during
which these events occurred, is a portion of the post-glacial climatic
continuum. The boundaries of the Altithermal are set at approximately
8000-5000 B.P., with the period of maximum dryness dated at approxi-
mately 6700-7000 B.P. The bracketing dates represent approximate
times for the beginning and end of the geologic phenomena which mark
the Altithermal.

At some time near, or during, the period of maximum heat and
drought, volcanic ash from the eruption of Mount Mazama in south cen-
tral Oregon was deposited over much of the Northwest. Following the
deposition of Mazama ash there was a period of aeolian loess deposition.
The loess deposits are distinctive because of the inclusion of several
unidentified ashfalls with the loess, which makes it light in color. Because the lower boundary of the loess is the Mazama ash and the upper boundary is marked by an unconformity and related soil formations, the deposit is a recognizable unit. This deposit is informally known as the "Altithermal loess" or "pale loess" or "ash-rich loess." The deposit is distinctive enough that it is considered a time-stratigraphic unit representing the later, post-Mazama, part of the Altithermal. Consequently, dating of cultural material which occurs within this unit is reasonably secure. Pre-Mazama geologic deposits are more varied, and dating depends heavily on correlations based on stratigraphic or soil stratigraphic horizon markers, or on radiocarbon dates.

Essentially coeval with the Altithermal in the lower Snake River region is the archaeological culture defined below as the Cascade Phase. The correlation of this culture with the climatic episode is based on the following radiocarbon and geologic evidence:

1) Radiocarbon dates from sites 45Fr50, 45Wt36, and 45Ww61 indicate that by 8000 B.P. the Cascade Phase had all the essential elements that identify it and separate it from preceding and succeeding cultural manifestations. A terminal date for this phase has not been directly established, but limiting dates on the subsequent Tucannon Phase (Leonhardt 1970) indicate that the Cascade Phase ended before 5000 B.P. Thus the approximate dates of the Cascade Phase are minimally 8000-5000 B.P., the approximate duration of the Altithermal.

2) At sites 45Wt41, 45Wt7 and 45Fr32 the correlation of geologic deposits containing Cascade Phase material with geologic phenomena which define the Altithermal indicates contemporaneity of the cultural and climatic units.

When neither radiocarbon dates nor definite geologic deposits are available for correlation, archaeological components may be assigned to the Cascade Phase in two situations: (a) when their trait assemblages are similar to known Cascade components and/or (b) when the components are in the correct chronological position, that is, when they are preceded in time by components of the Windust Phase and succeeded in time by components of the Tucannon Phase.

The Cascade Phase is a single culture consisting of similar components from several sites. The traits usually shared by the component assemblages are the following:

1) Predominance of the lanceolate projectile points which usually are referable to the Cascade type outlined by Butler (1961). While there may be considerable variation in their outline, most Cascade Phase specimens share both formal and technological traits.
2) Edge-ground cobbles. These are simple but remarkably distinctive tools. They are manufactured from flat, oval river cobbles which have one or more long edges worn or worked to form a relatively straight plane. Battering may appear on one or both edges, or it may not appear at all. These tools are not present in all Cascade components. Of the sites examined so far in my research, three have had them and three have not.

3) End-scrapers. These tools are characteristically made on tabular flakes or keeled flakes and have a steep-angled manufactured edge.

4) Knives. These are oval, triangular and lanceolate bifacial implements.

5) Production of primary flakes of two types. Prismatic blades struck from polyhedral cores comprise one type. These are almost universally reworked into projectile points or retouched to form scraping and cutting implements. When identifiable, the striking platforms are exceedingly small and the bulbs of percussion thin. The cores themselves are uncommon; thus far only one has been found in context. Tabular flakes struck from discoidal or tabular cores comprise the second type. Striking platforms are characteristically faceted. Identifiable cores for such flakes are yet to be found. There seems to be a recognizable technology based on basalt, but it is one that defies description at this point.

The remaining items of the Cascade assemblages generally include various cobble tools such as choppers, utilized spalls and spall scrapers, a few simple bone tools, and pounding stones of various types. Each assemblage also has a small percentage of artifacts that are idiosyncratic to it alone, probably the result of individual variation, experimentation, sampling error, or mixing from earlier or later deposits.

Local archaeologists have previously considered what I call the Cascade Phase to be two distinct cultural entities: an earlier subdivision has been informally called "Cascade" or "Old Cordilleran," and a later subdivision has been called "Cold Springs." Warren (1968) and Nelson (1970) have recently formalized this distinction in print. The distinction is based exclusively on the presence or absence of side-notched projectile points, a trait which Butler (1961) originally defined as indicative of the "Cold Springs Horizon." Also supposedly new at this time are the mano-metate and net sinkers (Warren 1968), but these data remain to be replicated.

I now believe that in southeastern Washington at least, the introduction of the side-notched projectile point did not significantly alter on-going Cascade Phase culture insofar as this culture is
reflected in any Cascade archaeological assemblage yet reported. This assertion is based on the fact that those assemblages which contain the side-notched projectile point and those that do not cannot be otherwise distinguished. As a matter of convenience the Cascade Phase is divided into early and late sub-phases recognized by the absence (early) or presence (late) of the side-notched projectile point, and/or by general pre-Mazama ash and post-Mazama ash associations; that is, by geological provenience. This subdivision is made primarily to give the archaeologist a fairly reliable temporal control point within an otherwise undifferentiated assemblage that persists through a long period of time. The appearance of the side-notched projectile point has been considered to be essentially contemporaneous with the Mazama ashfall (Warren 1968, Shiner 1961). The provenience of such points in at least two sites on the Lower Snake River is below the ashfall (45Wt7 and 45Wt36). Their numbers are not yet convincing; they are possibly intrusive into pre-Mazama deposits, but they must be considered.

To the best of my knowledge there are no other considerations than the side-notched projectile point or geologic provenience which can be used to distinguish the sub-phases of the Cascade Phase.

The Cascade Phase is essentially contemporaneous with the full span of the climatic episode known as the Altithermal. In the past, post-glacial or post-pluvial climatic change has been considered to be the impetus for movement of peoples from the more arid parts of the United States into surrounding regions, that is, from the Great Basin to the Columbia Plateau (Cressman 1960, Daugherty 1962, Warren 1968, Nelson 1970). If indeed there had been movement of peoples or diffusion of ideas between these areas during this time, one would expect to see them reflected in the assemblages of the Cascade Phase. The only data presently known from Cascade Phase components which might reflect such movement or diffusion consist of three small grinding stones considered to be manos which are associated with the early Cascade assemblage at Marmes Rockshelter (45Fr50). There is no other evidence that can be considered as representing "outside influences."

Because Altithermal conditions did not necessarily occur synchronously throughout the western United States, one must consider the possibility that the Cascade Phase itself represents the result of movement of peoples or ideas from further south where conditions would have been hotter and/or drier at an earlier time. However, evidence is accumulating from Marmes Rockshelter (45Fr50) and Windust Cave (45Fr36) that the Cascade Phase is an in situ development out of the preceding Windust Phase.

In sum, there is evidence for the occurrence of distinctive Altithermal conditions on the lower Snake River, but these conditions had no discernible effect on the culture of the resident population insofar as it is reflected in archaeological assemblages associated
with the climatic episode. The introduction of the side-notched projectile point late in the Cascade Phase did not affect the on-going cultural system in any manner that can be detected from present evidence. There is no convincing evidence for contact of Great Basin peoples with those of the lower Snake River region during this climatic episode, thus it is presently held that no such contact was made. The Cascade Phase represents an indigenous Archaic culture, adapted to the environment of the southern Columbia Plateau, which flourished between approximately 8000 and 5000 B.P.

References

Antevs, Ernst

Butler, B. Robert

Crassman, Luther S.

Daugherty, Richard D.

Fryxell, Roald and Richard D. Daugherty
1963 Late glacial and post-glacial geology and archaeological chronology of the Columbia Plateau, Washington. Washington State University, Laboratory of Anthropology, Reports of Investigations 23.

Hansen, Henry P.

Leonhardy, Frank
Nelson, Charles
1970  Sunset Creek site. Washington State University, Laboratory of Anthropology, Reports of Investigations 47.

Shiner, Joel

Warren, Claude N.
PRELIMINARY REPORT ON THE WESTON CANYON ROCKSHELTER,
SOUTHEASTERN IDAHO: A BIG GAME HUNTING SITE
IN THE NORTHERN GREAT BASIN

by

Mario P. Delisio
Boise State College

The following is a report on the 1968 and 1969 excavations, and
to some extent on the 1970 summer's work at the Weston Canyon Rock-
schelter, carried out by the Idaho State University Museum archaeologi-
cal field school under the direction of myself and E. Robert Butler.

The rockshelter lies in the southern end of Weston Canyon, one
of the corridors in southeastern Idaho linking the Great Basin, the
Snake River Plain and the Northwestern Great Plains. The site is
approximately 65 miles south of Pocatello, Idaho, and 10 miles north
of the Idaho/Utah border (Fig. 1). Physiographically it is in the
Northern Great Basin (Penneman 1931).

Weston Canyon is of note historically in that Captain John C.
Fremont and his expedition, including Kit Carson, traversed the canyon
in 1843 (Fremont 1845). In his accounts Fremont describes the flora,
fauna and human occupants of the canyon and local area. Weston Canyon
Rockshelter or a shelter close to it was occupied even at that late
time.

The canyon is short and narrow, being only a little over two
miles in length, with canyon walls rising steeply from an elevation of
ca. 5200-5500 feet to over 6000 feet. Through the canyon flows Weston
Creek, a trickle of a stream averaging 4 to 5 feet in width and 6 to
12 inches in depth. The formations in the canyon consist principally
of limestones, shales and quartzites (Murdock 1961). The canyon it-
self is highly faulted. It is along one of these fault zones near the
mouth of the canyon that the site is located, a rockshelter which is
approximately 60 feet across at the mouth and 35 feet in breadth from
the drip line to the back wall. The shelter, which was carved out of
the limestone formation by Weston Creek at some time in the past, con-
sists of an exposed part and a buried section.

About a quarter mile to the south of the shelter, the canyon
opens into Cache Valley, part of the old bottom of Pleistocene Lake
Bonneville. This lake extended over 280 miles in length to the south
and at times filled a basin larger than that of Lake Michigan, with
Fig. 1. Lake Bonneville and Associated Features. Arrows point to: (1) Weston Canyon Rockshelter; (2) Danger Cave; (3) Promontory Point.
the waters rising to a level over a thousand feet higher than the present surface of the Great Salt Lake, which is its remnant. Either 30,000 or 18,000 years ago, depending on the dates accepted, that is, whether those of Malde (1968) or Bright (1963), the lake reached its highest point and subsequently broke through at Red Rock Pass, a divide about 20 miles northeast of Weston Canyon, causing a catastrophic flood down the Portneuf River and into the Snake River near Pocatello, Idaho. Malde reports that effects of this flood are evident in Hells Canyon, over 400 miles away.

After the downcutting ceased when a bedrock sill was reached, the water level stabilized to form the Bonneville shoreline. By approximately 13,500 years ago, overflow had gradually eroded Red Rock Pass down to its present level, with the water level stabilizing again to form the most pronounced of the shorelines, the Provo. Overflow then ceased, with climatic events subsequently causing the lake to gradually dry up. The Great Salt Lake is the end result of this dessication.

The Bonneville shoreline lies at the mouth of Weston Canyon at an altitude of about 5160 feet. The Weston Canyon Rockshelter itself is at an altitude of about 5215 feet. Thus there is a potential for 55 feet of fill to have accumulated in the shelter above the Bonneville gravels, representing 18,000 to 30,000 years of sedimentary accumulation. The site, then, should have recorded the antiquity of man in the region and the characteristics of his activities through time, which it indeed did.

The 1969 excavations reached to a depth of over 20 feet in places, and the 1970 excavations reached a depth of 30 feet (Figs. 2, 3, 4). At this depth a flow of water was encountered and the work was closed off. Cultural materials and carbon deposits had ceased to occur, however, about 3 feet above the water level. Thus the site holds about 27 feet, or 9 meters, of culture bearing fill.

The site is significant in three respects:

1) In the stratigraphic record
2) In the faunal remains
3) In the cultural remains.

The stratigraphic record is significant in that it provides a test of the degree to which Fryxell and Daugherty's regional climatic framework for the Columbia Plateau can be extended to other areas.

Commenting on their findings, Fryxell and Daugherty (1963: 13-15, and Fig. 2) note:
...stratigraphic records from archaeological excavations at more than 20 caves and rockshelters show that a general stratigraphic sequence, with modifications reflecting local conditions, is present from the Okanogan Highlands to north-central Oregon, and from western Idaho to the eastern foothills of the Cascade Range. Stratigraphy at these sites may be described in terms of three major types of sedimentation: (1) accumulation of rockfall from the cave ceiling; (2) deposition of eolian sediment; and (3) buildup of organic debris.

Alternate dominance or shift in relative importance of these processes, in the above order, are interpreted as reflecting control by regional climatic conditions. Thus coarse rockfall at the base of this sequence records a cool, moist environment accompanied by vigorous frost activity until about 8,000 years ago, next followed a time of relative aridity, lessened frost activity, and increased eolian sedimentation; beginning about 4000 to 2000 years ago conditions gradually shifted toward those of the present, resulting in moderately renewed frost-rockfall activity, moderating eolian deposition, and increasing accumulation of organic debris.

A post glacial period of minimum effective precipitation in the Columbia Intermontane Province, marked by decreased runoff, decreased frost activity, and possibly by higher mean temperatures, may be inferred from detailed physiographic and stratigraphic examination of post glacial deposits on and around the Columbia Plateau.

In a paper presented at the 1970 annual meeting of the Northwest Anthropological Conference I warned of limitations in applying this model to such areas outside the Columbia Plateau as the Snake River Plain, Idaho Rockies and Northwestern Great Plains, through comparisons of the stratigraphy of several sites in these areas. The findings at Weston Canyon reinforce this warning.

The Columbia Plateau three-fold stratigraphic succession of rockfall, eolian deposition and organic debris is not found at Weston. The major source of fill at the site, by contrast, is a continuous cone of colluvium extending from at least the 30 foot maximum depth of excavation to the surface. Colluvial debris is still being added to the cone and colluviation is still the major source of deposition in the site (Fig. 5).

What this means environmentally is not clear. Some may argue that this continuous colluvial cone demonstrates that the climate in the Great Basin or in southeastern Idaho has probably not changed
Fig. 3. The Weston Canyon Rockshelter

Fig. 4. View of Trenches Sectioning Buried and Exposed Parts of Shelter.
significantly since glacial times. Others, on the other hand, may argue that colluvium is not a good indicator of climatic changes and hence is relatively meaningless in interpreting significant environmental fluctuations.

The question, I believe, is still open, for we simply do not know enough about sedimentary processes and units in relation to past depositional environments to make strong environmental inferences. To be sure, colluvium is a product of mass-wasting, principally through the process of frost weathering, and is a function of temperature, moisture and slope. The process occurs when the temperature fluctuates around the freeze-thaw zone, that is, around 32°F, and when sufficient moisture is present to cause the breakdown of rocks as the result of freezing and consequent expansion of water in cracks and joints. Slope carries the debris away at varying rates to form colluvial cones or deposits thus allowing the frost weathering process to continue.

Beyond this not much can be said. The geological and archaeological sources are on the whole very limited in their reporting and evaluation of colluvium and the range of environmental conditions under which it forms. Colluviation does occur in the Idaho Rockies in Birch Creek Valley (Swanson and Sneed 1966: 10) and at the Weis Rockshelter in west central Idaho along the fringe of the Columbia Plateau (Butler 1962: 19, 23; Delisio 1970: 40). What is needed is intensive and extensive study of these major colluvial units, coupled with the reporting of related climatological, micro-faunal and pollen analyses.

Colluvium is not the only stratigraphic unit in the Weston Canyon shelter, however. In the upper eight feet of the deposits, between the apex of the colluvial cone and the back wall of the buried section of the shelter, there occur two layers of clayey silt, each about 4 inches thick; a layer of sandy silt, about 5 feet thick (Fig. 6); and a top layer of heavy angular rock, about a foot and a half thick.

The clayey silt layers probably were the result of local ponding, perhaps as a result of a slide or beaver activity down-canyon from the site. They do not extend throughout the site. The sandy silt could be eolian in origin although this is not certain since a similar unit at the same elevation occurs in the cutbank of Weston Creek across from the shelter. An eolian rather than stream laid origin is suggested because the space between the back wall of the shelter and the colluvial cone at its mouth would have served as a natural trap for wind-blown particles.

The heavy angular layer above the sandy silt is the result of a phenomenon peculiar to the buried section of the shelter. It does not occur outside that area. Observations made during thaw periods in the late winter and spring revealed that meltwater from the slopes
Fig. 5. Part of the Colluvial Cone in Blocks CIE-NBIE.

Fig. 6. Part of the Back Wall of Block NAIE Showing Carbon Lenses and the Sandy Silt Layers Behind the Colluvial Cone.
above flowed down the shelter face and into the buried area. There the water was refrozen, causing frost weathering of the buried section's ceiling. The heavy angular layer thus is not representative of a regional climatic pattern but only of local processes acting in response to the morphology of the shelter.

The value, then, of the stratigraphic record at Weston Canyon Rockshelter is that it points to the limitations of arbitrarily extending Fryxell and Daugherty's climatic model outside the Columbia Plateau, and that it calls to attention the existence of and need for study of a major kind of stratigraphic unit in mountainous areas, that is, colluvium; especially is such study needed with reference to the feasibility of drawing environmental inferences from such deposits.

Faunal Remains

The most notable fact concerning the faunal remains is that Bighorn sheep vastly predominate in numbers and extent over all other animals present at the site. Bighorn occur in every layer within the 27 feet of cultural fill. As with the remains of the other animals, the bones were essentially pulverized; a similar situation was reported by Mulloy (1954: 453) at the McKean site. Only one complete rib, probably of bison, was recovered. Numerous horn cores and multitudes of teeth occurred throughout. Besides Bighorn only a few other large mammals and very few small mammals occurred in the deposits. Significantly, no remains of antelope were recovered.

Based on the analysis of teeth, the following is the minimum number of animals found during the 1968-1969 excavations: Bighorn sheep, 125; elk, 5; bison, 4; bear, 2; marmot, 8; pocket gopher, 5; woodrat, 12; porcupine, 5; beaver, 5; coyote, 1; marten, 1; skunk, 1; weasel, 1; and possibly 1 domesticated dog. As for the rabbits, there occurred only 10 cottontail and 2 jackrabbits. In addition a few fragments of the freshwater bivalve Margaritifera were recovered. They appear to have been used for food.

The faunal evidence along with the cultural materials, which will be discussed shortly, make it clear that the shelter was a big game hunting site throughout its cultural history, with the hunting of Bighorn sheep being its primary economic mainstay. For an area located in the Great Basin the large quantity of Bighorn remains may seem somewhat anomalous, for a parsimonious existence verging at the threshold of subsistence is seen by some researchers as the rule not only in the Basin but also throughout the so-called Desert West. This view does not appear to hold in much of southeastern Idaho, where Bighorn were reported in large numbers not only in the mountains but also in the foothills and plains by the early explorers and pioneers.
Besides the Bighorn sheep, bison existed in numbers up to 1840 in this part of Idaho.

Climatically southeastern Idaho is much different from the areas to the south and north. Unlike other parts of the Great Basin to the south and the Snake River Plain to the north, where rainfall averages 7-10 inches or less, the communities around Weston Canyon record an average 15 inches of annual rainfall. Rain gauges in the mountains of Weston Canyon and surrounding areas record 20 to 30 inches of precipitation annually. Moreover, explorers such as Fremont, Hayden and Stansbury reported widespread grasslands throughout the region. Southeastern Idaho, particularly in the Weston Canyon area, appears to have been relatively lush, with big game existing in large numbers throughout a considerable span of time. Life there was far from marginal.

Cultural Remains

The majority of the artifacts from the Weston Canyon Rockshelter are of stone; a few are of bone, mainly awls. No artifacts of antler, shell or of other perishables such as wood, leather or cordage have been found. The 1968-1969 excavations recovered some 492 artifacts including worked and utilized flakes. This number was more than doubled by the 1970 work. About 90% of the stone tools are made of obsidian, the rest being made of chert, chalcedony and quartzite, among other materials.

The case for a hunting economy at the site is reinforced by the fact that the majority of artifacts are points, along with a large number of steep end-, thin end-, and side-scrapers. The 1969 excavations recovered only one definite mano, this on the surface, and no metates. One edge-battered cobble was recovered from one of the upper layers.

Two cultural complexes and an indication of a third have been identified thus far (Figs. 7, 8). The Early complex, which occurs in the lowest layers, consists almost exclusively of the large side-notched points termed Northern Side-notched by Gruhn (1961: 125-130) and Bitterroot Side-notched by Swanson and Bryan (1964: 10). The Late complex, which occurs in the upper layers, consists of stemmed, indented base

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Fig. 7 (opposite). Bitterroot or Northern Side-notched Points typical of the Early Complex, a-e; Stemmed, Indented Base Points of the McKeans Type typical of the Late Complex, f-n. Specimen o, from lowest point of 1969 Excavations, is perhaps part of a third and Earliest Complex.
points of the McKean type; Humboldt Concave Base A points; Elko Corner-notched and Elko Eared points; and medium to large lanceolate points. These various types of the Late complex occur dispersed throughout the upper layers in such a way that no particular distribution pattern of any type or types is evident. Moreover the points intergrade to a great extent, much as they do at Coyote Flat in southeastern Oregon (Butler 1970: 36-37). The most notable fact is that unlike the situation in Birch Creek Valley, where large side-notched points occurred throughout the stratigraphic sequence, at Weston they do not. The large side-notched points do not occur in the McKean-Humboldt-Elko-lanceolate point layers.

A third and perhaps earliest complex was suggested by the finding of a large stemmed, indented base point of the McKean type below the large side-notched points in the last shovelful of fill turned during the 1969 excavations (Fig. 7, o). This suggestion was reinforced during the 1970 excavations by the recovery of more such points. The relationship between these points and similar stemmed types in the upper layers is not clear at the moment. What is clear is that the large side-notched points, that is, the Northern or Bitterroot Side-notched, are bracketed by stemmed- and perhaps corner-notched points. Cross dating of the types in the two identified complexes with similar radiocarbon-dated types from nearby sites suggests dates of from 7200 B.P. to 3250 B.P. for the Early complex and from 3500 B.P. to 1350-800 B.P. for the Late complex.

There is a cultural gap between 800 B.P. and historic times because of the activities of collectors in the very upper layers of the exposed section of the shelter. This gap was partially filled by one such collection from the site. This collection included a few late point types, such as the type Desert Side-notched.

In summary, the Weston Canyon Rockshelter is a big game hunting site in which hunting of Bighorn sheep was the primary economic mainstay. Little evidence of the hunting of small game, or of dependence on seeds (in the form of grinding implements) was found. Two complexes, Early and Late, have been identified, and there is evidence of an earlier third complex. The Early complex consists almost exclusively of large side-notched points while the Late complex consists primarily of McKean, Humboldt, Elko and lanceolate type points. The third and earliest complex is evidenced by stemmed-indented base points of the McKean type and perhaps by corner-notched types.

Fig. 8 (opposite). Additional typical Points from Late Complex, a-k. Elko Eared, a, b; Elko Corner-notched, c, d; asymmetrical point, e; Humboldt Concave Base A, f-h; medium or large Lanceolates, i, j; blank/preform, k. Other artifacts found throughout the site, l-o. Crescentic knife or scraper, l; seam agate knife, m; bone tube possibly used in hand game, n; incised pebble, o.
Stratigraphically, the site deviates from the Columbia Plateau threefold sequence of large angular rockfall, eolian deposits, and organic debris, in that the shelter is filled principally by a single cone of colluvium at least 30 feet in depth. No changing regional climatic patterns can presently be discerned from the stratigraphic record.

References

Bright, Robert C.

Butler, B. Robert


Delisio, Mario P.

Fenneman, Nevin M.

Fremont, John C.
1845 The exploring expedition to the Rocky Mountains in the year 1842, and to Oregon and North California in the years 1843-44. Washington, D.C.: Gales and Seaton, Printers.

Fryxell, R. and Richard D. Daugherty

Gruhn, Ruth
Malde, Harold E.

Mulloy, William

Murdock, Clair N.

Swanson, Earl H., Jr. and Alan Lyle Bryan

Swanson, Earl H., Jr. and Paul G. Sneed
1966  Birch Creek papers no. 3: the archaeology of the Shoup Rockshelters in east central Idaho. Occasional Papers of the Idaho State University Museum 17.
Bucks Lake area of Plumas County is no exception. A survey of the area disclosed some dozen or so sites, one of which is the concern of the present report (Fig. 1).

The site, during its period of use, appears to have been situated above a meadow environment, just inside a climax conifer forest. An intermittent stream on the east border of the site may have accommodated a spring at one time. The fluctuating waters of the Bucks Lake Reservoir have washed most of the cultural deposit from the site and have left only the heavier materials. Revealed by the restless water were such features as house circles, food grinding implements, stone projectile points, chipping refuse, and coarse, percussion-chipped tools. Food refuse such as bone and shell were almost nonexistent, but the way of life of the site's occupants can be rather clearly defined by a review of the data and artifacts recovered.

Houses

The houses traditionally made by the aboriginal Maidu people in Plumas County were of two basic kinds: a domicile and a dance house. Only the more important villages could boast of the latter structure. Such a structure belonged to the headman of the area, the so-called "chief." It was semisubterranean, built on a circular plan, and covered with a bark roof supported by a single large center post from which a series of roof beams radiated to the edges of the excavated pit. This house usually had a diameter of some 40 feet.

The domicile which the average family called home was a conical structure having a pole framework covered with pine and/or cedar bark. The house had a circular plan with a diameter of 12 to 15 feet. A saucer-shaped shallow pit might be excavated for the floor, around the rim of which the poles for the frame were set. Earth and stones from the excavation often were piled up around the base of the bark cover to a depth of several feet to make the house snug and relatively weatherproof.

The only evidence of houses at the Rainbow Point site consisted of five rock circles grouped in a tight cluster (Figs. 2, 5c). Other houses may have been part of the village but no clear evidence was seen. The rock circles indicate the clearing (excavation?) of circular areas and (presumably) the erection of conical bark houses of the type made by the Maidu of the ethnographic period.
Fig. 1. Area Map of Northern California, a; Area Map of Bucks Lake and Site 4-Plu-S94 on Rainbow Point, b.
Fig. 2. Contour Map of Site 4-PLU-S94.
Use Areas

A close inspection of the water-washed surface of the village area revealed a pattern of artifact association which was more than just a random scattering. When the artifacts and chipping waste were plotted in relationship to the house circles it became apparent that certain areas within the village had specialized functions (Fig. 4). Probably most clearly represented were the stone-chipping areas exemplified by the clustering of basalt flakes and occasional cores (symbolized as Ba and Cs in Fig. 4). One workshop is indicated by a scattering of basalt and quartz flakes, several flake scrapers and a projectile point. This area is outside and directly south of House 3 (Fig. 4). Ten feet due west of this use area is another very distinct work area, revealed by a cluster of basalt flakes, a silicate flake and three basalt cores. This work area is in a cleared space which might have been a house circle. We did not record it as a house because the evidence was not sufficiently clear.

House 4, some 20 feet west of House 3 (Figs. 3 and 4), contained a series of basalt flakes, a core, and a plane in its eastern half. Another chipping area appears around the northern and western periphery of House 3.

The record shows, therefore, four reasonably distinct stone-knapping areas. The indications are that such activities were carried on not only outside the houses, but in one, possibly two instances, inside the houses.

Additional locational patterning of artifacts at the site is shown in Fig. 3. For example, projectile points (Symbol X) occurred away from the domicile cluster. The points were found a hundred or more feet south and west of the houses. Whether this distribution is spurious or real is somewhat in doubt as most of the points were found on a sandy surface and small objects such as points are readily visible for some distance in sand; in contrast the surface of the living area was quite rocky, which would make it difficult to spot small artifacts there. However, as can be seen in Fig. 4, we were able to plot concentrations of stone chips in the rocky areas, so presumably would have discovered areas in which points were heavily represented if they in fact existed.

A series of flake scrapers (Symbol F) noted east of Houses 1 and 2 suggest basket making, as flakes were used in the ethnographic period to scrape basketry material to size. Manos and metates do not seem to form a tight cluster as regards location in the site area. It can be observed in Fig. 3, however, that the heavy percussion-formed tools (cores, planes, choppers, and preforms), as well as manos, metates, and hammerstones are common in the northeast section of the site. It
would appear that several specialized activities took place in this area. Milling also took place 20 to 30 feet south of the house cluster. It is of considerable interest to note that no evidence of an earth-bound metate or mortar occurred within the floor area of any of the houses. This in contradistinction to the situation that pertained in the ethnographic period.

Two bedrock mortar areas were located which are presumed to have been in operation at the time the village was occupied. If so, it can be assumed they were used to reduce acorns to a fine flour for use in the preparation of soup and mush. Indicating that the acorn was of limited importance here is the fact that the mortar pits are neither very large nor numerous. A greater use of the mano and metate seems evident.

Ground and Pecked Stone Artifacts

Manos

Twenty-nine complete or fragmentary manos were removed from 4-PLU-S94. These implements do not constitute the total inventory of manos but represent a selected sample taken from all areas of the site. The descriptive classification that follows uses form, number and placement of grinding facets, angle of grinding, and condition of material as criteria.

Classificatory Terms

U. Uniface (One facet only).
B. Biface (Two facets, opposite each other).
Q. Quadriface (Four facets, equally placed).
M. Multiface (Two or more facets, randomly placed).
  O. Ovoid
  R. Rectangular
  I. Irregular
  E. Elongate
  S. Shaped (Sides and/or ends pecked and ground to desired form).
  C. Cobble (Natural form, cortex generally showing).
     r - Right-angle grinding to the long axis
     l - Lateral grinding
     t - Transverse grinding
     d - Diminutive size.
Fig. 3. Artifact Distribution on Surface of Site 4-Plu-S94.
Fig. 4. Detail of Artifact Distribution and Configuration of Sleeping Circles.
Basically, manos are hand-held implements used on a stable platform to process food resources in a limited variety of ways. It follows that the artifacts themselves will exhibit specific characteristics related to the kinds of resources processed. In other words, when we view a mano we should, to a high degree, be able to correlate the wear patterns exhibited on it with certain identifiable processes and, therefore, to infer the foods milled with it. With this in mind, the various types described below from 4-Plu-S94 take on greater meaning (Fig. 5). In the discussion to follow, type descriptions are coded, using the designators outlined above; the number of specimens and their catalog numbers are given in the parentheses immediately following.

**Type BRSr (2; P-115-25, 79).** The facets are flat to slightly convex and the overall weight of the stone is light. This suggests that these implements were used on fragile surfaces and were held by the fingers rather than in the palm of the hand, or at least held with a light touch. The stone used in both specimens was a soft metasandstone which is not suitable for heavy grinding. The character of the surface of the facets and the softness of the stone suggest limited use of these manos as mashing or fleshing implements for purposes such as seeding chokecherries through a basket or winnowing tray (Riddell 1960b: 36). They may possibly have been used to hull small, delicate seeds to separate the edible parts from the chaff prior to the winnowing process (Fig. 6).

**Type BOSr (1; P-115-176).** This is the classic loaf-shaped mano so common in many collections from California. The facets are deeply convex and the specimen is made from a granodiorite which is extremely hard and dense. Therefore, the use pattern is inferred to be one involving a heavy grinding action accomplished with considerable force. This kind of force would be needed for the cracking, smashing or pulverizing of hard seeds, dried bulbs, roots, nuts, and possibly acorns. Both hands were probably used, one over the other, to supply the necessary heavy downward pressure. The stone was moved over the metate in a back and forth motion (Fig. 6).

In both of the types above the action of the mano, as seen from striations on the grinding facet, is across and at right-angles to the long axis of the implement.

**Type BICr (4; P-115-21, 28, 136, 182).** These irregularly-shaped manos are bifacial, but on most specimens the facets are randomly placed and show little use. The facets are flat to slightly convex in profile. This mano type may represent an initial use stage. The amount and quality of wear on the facets reflect use of these implements with but slight downward force, though they probably were propelled with two hands. They are suitable for use in removing the hulls from small, hard seeds, or in cracking the husks of fragile seeds without damaging the small meats.
Fig. 5. Views of Site 4-Plu-S94. a, View East into Conifer Forest above High Water Line; b, View West across Reservoir—note rock debris from deflation of midden; c, Detail of Sleeping Circle No. 3, view Southeast.
**Type B**ECr (1; P-115-22). This specimen is the sole example in the collection of a mano which could have been used with two hands held side-by-side. The facets are deeply convex, with distinct striations. Inasmuch as the stone is of a dense, hard quartzite, a heavy downward pressure is suggested, with the stone occasionally breaking through the meal and striking the surface of the metate below. Both facets show sharpening by pecking and the ends are battered by pounding. The rounded and striated surface of the facets suggests use of this mano as a heavy grinder, smasher, or pulverizer to mill hard foodstuffs. Also, this specimen apparently was used occasionally as a pestle or hammerstone, presumably to crack acorns, or to otherwise reduce hard food materials into a suitable size for grinding on the metate.

**Type UOGt** (6; P-115-14, 81, 110, 135, 177, 183). These small, well-shaped manos all have domed tops that allow an easy grip for the hand. Light, transverse striations on the facets denote use by one hand (all are right-handed), and the deeply convex profile of the facets suggests that the manos were used with a heavy rocking motion, with the heel of the hand depressed sharply at the end of the stroke. The facets are highly polished and convex and the lack of deep striations suggests contact with metates made of fine-grained material. Convex facets, as noted before, denote vigor in grinding, and such facets reflect basined (concave) metate surfaces (Fig. 6).

**Type UICr** (3; P-115-24, 76, 179). Even though the grinding facets on these implements show slight use wear, a definite pattern is seen. All three manos are roughly triangular in cross section, thus allowing a good hand grip. This suggests a desire by the operator for good control in the placement and motion of the stone. The flat-profiled and highly-polished facets suggest light grinding processes such as might be used on fragile foods or for delicate tasks such as husking grass seeds (Figs. 6, 7).

**Special Purpose Manos**

**Type QESr-1** (2; P-115-80, 84). These completely shaped implements exhibit four grinding surfaces and evidence that both ends were used for pounding. On both specimens the facets alternate in direction of grinding, with the flatter facet at a right angle to the long axis of the tool and the more convex facet in a lateral direction. It is obvious that two different motor patterns are involved here. However, there is no way of clearly determining the function of these implements at this time. Whatever their use it would seem to have been rather specialized, or innovative.

**Type MCr-1** (2; P-115-105, 125). In both of these specimens the lateral grinding facets are dominant, both in size and definition, over
the right-angled facets. In other words, the lateral facets were produced by a deep, rocking action and denote a heavy grinding force, whereas the flat, right-angle facets are the result of simple back-and-forth motion. Both ends of these manos are battered and squared-off by use. Again, as in the Type QESr-1 manos, there are two distinct motor patterns indicated on the same specimen, but we are at present unaware of what the special use of these tools might have been (Fig. 7).

**Type ROCr**\(^d\) (3; P-115-82, 92, 184). These diminutive implements are similar in form to those of the larger type of the same designation, but were used in an entirely different fashion. They are well-formed bifacial tools with grinding facets that are marked by battered areas toward the ends. All these specimens are stained with red ochre and it seems likely that they were used exclusively to grind red pigment into a fine powder. The facets exhibit a high polish but are relatively flat. One specimen shows scars where the implement was used to reduce lumps of ore to a manageable grain size prior to grinding.

**Type UEGR**\(^d\) (2; P-115-71, 75). Except for shape and number of facets these tools were used in the same manner as the above specimens in the production of red paint. This is shown by the red stains and by the battered areas toward the ends.

**Fragmentary Manos** (3; P-115-55, 151, 181). These three specimens apparently were separated into halves longitudinally by blows which exceeded the strength of the implements. This again indicates that some manos served as battering tools, as well as for grinding. It is not possible to determine whether these three specimens were bifacial or not. Two are of granodiorite and are oval in outline, the other is a metaigneous stone which is elongate in outline. The latter was ca. 12.5 cm. long and 7.9 cm. wide. The smaller oval specimen measures 10.7 cm. long by 9.4 cm. wide, and the larger is ca. 11.5 cm. long by 9.5 cm. wide. All three are relatively large, heavy stones and a blow great enough to split them would indicate considerable force. Battering on these manos occurs on the ends and occasionally on the sides.

**Discussion**

There is little doubt that specific manos had specific grinding tasks to accomplish. This is not to say that the women who used them thought of the manos as single-purpose tools. On the contrary, there are implements that were used occasionally as hammerstones, and in many examples one facet might be used for one purpose and another facet on the same mano might be used for another purpose. The fact that a mano is bifacial or unifacial apparently has no real functional significance other than serving as a descriptive criterion. However, specific
Fig. 6. Manos; Types BRSr, BOSr, UOST, and UICr. a, P-115-25, Bifaced, Shaped; b, P-115-176, Bifaced, Leaf-shaped; c, P-115-177, Unifaced, Shaped; d, P-115-179, Bifaced, Irregularly Shaped.
Fig. 7. Manos, Types MICr-1, and UICr. a, P-115-105, Multifaceted; b, P-115-80, Multifaceted; c, P-115-175, Small, Bifaced (note ochre stains); d, P-115-82, Unifaced Mano and Hammerstone.
grinding facets do usually show traits that result from consistent use in a particular manner.

For example, hard-shelled but fragile grass seeds could not stand a heavy pulverizing process. A tool was needed that could lightly fracture the shell of the seed but not mash the soft interior. A considerable amount of touch control would be required to ensure that the tool did not press down too hard. Suitable for this would be a tool held in one hand, probably controlled by the fingers and not by the palm of the hand. The tool would be moved across a flat- or shallow-basined metate in a back-and-forth motion, so the direction of the striations, which are always present on the grinding facet in some degree, would tend to be at right angles to the long axis of the mano. Because the mano was held more in the fingers than in the palm, the torque of the lower arm would be reduced or arrested, and the result would be a facet tending to be flat rather than convex in profile.

Special adaptations of this type would be the manos used in the chokecherry seeding process described by Riddell (1960b: 36) for the Honey Lake Paiute. Here the berries are smashed and strained through the interstices of a basket sieve, leaving the seeds behind. Gayton (1948: 77) also states that the Wukchumni Yokuts used manos to mash juice from Manzanita berries through a winnowing tray in the making of cider. Obviously no considerable force would be applied against the soft baskets, and the facets resulting from such use would tend to be polished rather than striated.

In contradistinction to the above condition is the heavy milling process where hard, lumpy materials are reduced to meal. Considerable force is required and an entirely different set of conditions would result. First of all, the manos expectably are heavier and of a more dense material, resulting in a higher kinetic energy level, and requiring less muscular pressure than if a light stone were used. Secondly, both hands are used, either side-by-side or overlapping one another, to push the implement across the hard material to be ground. The combined forces of weight (mano) and pressure (arms), plus the motor force (torque) necessarily developed in the arms, would result in a grinding facet that is convex instead of flat. In other words, fine control of pressure and direction are exchanged for force and power. As the heavier mano is pushed across the metate it is rocked from the finger-tips to the heel of the hand and pressure is applied throughout the motion. Riddell (1960b: 49) observed a variation on this pattern when Kitty Joaquin, a Honey Lake Paiute, used a mano "...held with both hands (overlapped), and pushed back and forth with a snappy wrist action," i.e., with an outward rolling motion.

Considerable pressure and abrasive force are brought to bear upon the grinding surfaces of the mano and metate even though there is meal between. The results are striations and a convex profile of the
mano facet produced by the equalizing of the points of pressure (gradient is reached). The direction of the striations across the mano facet will be at right angles to its long axis because the hand-and-arm torque of one hand will cancel out that of the other.

Haury has given an excellent explanation of the development of "right or left-handed manos" (Haury 1950: 313). They are the result of the torque of the wrist and lower arm when one hand is pushed across a metate. The arm, because it does not come out of the center of the body, tends to move across in front of the body at an angle instead of straight back and forth. This produces a transverse grinding facet on the mano, usually 30 to 40 degrees off its long axis. Although only one hand is used, as seen by the transverse striations on the grinding surfaces, many of these manos have strongly developed convex facets. If one considers the range of foodstuffs processed it can be observed that there are a variety of items that are neither hard nor fragile but yet require a considerable amount of pressure to reduce them to meal.

Considering the milling stone complex at 4-Plu-S94 in light of the above hypothesized types we can generalize about some of the economic activities of the people of that site. First of all, there is no doubt that the five diminutive manos of both the B0Cr4 and UECr4 types were used to reduce lumps of red ochre into a powder for paint. All of the specimens have stains upon them from the ore and two of Type UECr4 (Fig. 7c) show scars from the battering of larger lumps of ore into smaller, more manageable pieces. The use of small mano-like implements for this purpose is known ethnographically from the Honey Lake Paiute (Riddell 1960a: 36). The suggestion made by Loud (1929: 138) that the extremely small manos were children's toys may be true but is not borne out at the Bucks Lake site.

The better-made manos in this collection are of Type BRSr. These implements are completely shaped and show a concern by the manufacturer for symmetry and balance. Again, there is little question as to their use. Loud and Harrington (1929: 138, Pl. 63 i-j) illustrate and discuss specimens from Lovelock Cave and the surrounding ethnographic area that are identical in size and shape to these specimens. They state that these manos were "shellers" that were used on flat baskets or winnowing trays to crush medicinal roots and to mash a small red berry called 'weyapue' (Riddell 1960a: 41). Analysis of the characteristics of the Bucks Lake tools suggests this same kind of function. The material is a soft metasedimentary that would not withstand heavy grinding. The tools are small and light in weight and the facets are flat with polished surfaces instead of striations. All these criteria reveal their use on a soft material, and the aesthetic quality of workmanship suggests a special concern for these tools.
The mano types UICr and BICr, represented by four and three specimens respectively, are closely associated with each other. They may well be stages in development, or more precisely, use-life of the particular implements. In either case, the facets are similar whether the tool is unifacial or bifacial. Many of the grinding facets are only slightly used, and all are poorly defined and randomly placed. In most cases the facets are polished instead of striated. They are made of a soft to medium-hard material and invariably the facets have flat profiles. The important criterion here is the flat, polished facets. The use of these manos was restricted to a highly controlled, light grinding process; they are "shellers," as Loud (1929: 138) or Riddell (1960a: 34) would call them. They were probably used to husk seeds or crack pine nuts, or to lightly fracture other delicate food-stuffs, as well as to grind such material.

Disregarding, for the moment, the special purpose manos (Types BRS, MIC, QES), and those used for grinding paint, the number of manos that exhibit a polished facet with a flat profile represents 40 per cent of the total number of manos recovered. Based upon this percentage we can suggest that a good portion of the plant food used by the Bucks Lake people consisted of small hard seeds that required a controlled and precise milling procedure.

Complementing the light grinding implements are heavy grinding tools, which comprise ca. 60 per cent of the total manos at 4-Plu-S94. These include mano types UOST, BOSr, and BECr. Loud (1929: 138) and Riddell (1960a: 34) called these kinds of specimens "grinders," and we find no evidence from the Bucks Lake collection to dispute this identification. The nine specimens of the three types are all made from a heavy, dense stone, and the facets are, for the most part, deeply convex and exhibit moderate to heavy striations as well as polish.

Types BOSr and BECr are similar to the very common 'loaf'-shaped manos found all over western North America. They are well shaped and the grinding facets are distinct; usually there is a well-developed shoulder at the juncture of the convex facet and the pecked or battered sides or ends of the mano. The facets are deeply convex and striated and are sometimes sharpened by pecking (especially Type BECr at 4-Plu-S94). In our opinion, based upon the above analysis of type traits and on ethnographic sources, these two types were both used to crush and grind the harder and coarser foods to a flour. This process generally requires heavy pressure, and on these two mano types both hands were used (Type BEC: side-by-side; Type BOS: hand-over-hand).

In addition to these, the UOST mano type is also a convex-faceted tool but the facets show polish instead of striations. They were used for heavy grinding but the lack of striations suggests use on fine-grained metates.
The combined inventory of these three heavy, convex-faceted mano types represents 57 per cent of the total mano count and from this we suggest that the majority of foods ground by the Bucks Lake people were foods which require vigorous processing. This interpretation fits well with the observed environment of the area and mirrors the ethnographic picture.

**Block Metates**

The majority (9 of 15) of the metates from Rainbow Point are block metates (Fig. 8b). These implements are simple blocks of granodiorite with one surface quite flat and polished by wear. There is no suggestion of basins or depressions on these metates, and the sharpening peck-marks suggest that a flat grinding surface was the desired configuration (the flattened surfaces are seen both in the centers and around the edges of the stones). Block metates, with their flat surfaces, can be correlated with manos having facets that are flat in profile.

In general, these metates are not as thick as the Basin metates described below (see also Table 1). In any case, both types are highly portable, although the Basin metates would probably have had to have been nestled partially into the ground for stability during use.

**Basin Metates**

Two large square-to-rectangular granodiorite blocks have shallow, basin-shaped depressions beginning at the outer edges of the blocks and dipping downward towards the centers (Fig. 8c, d). The specific measurements of these implements are seen in Table 1. The Basin metates are similar to the Block metates in that the grinding surfaces of both types are very smooth and are polished and show peck-marks as a result of sharpening. However, the surfaces of the Basin metates are quite concave and generally oval in outline. The long axes of the depressions are in line with the long axes of the blocks of stone. Wear patterns suggest that a quite strong rocking motion applied to the hand-held stone (mano) produced the observed basins in the metates. From this evidence it is clear that convex-faceted manos were used on these metates.
Fig. 8. Metates and Mortars. a, P-115-61, Block Mortar; b, P-115-46, Block Metate; c, P-115-76, Basin Metate; d, P-115-49, Basin Metate.
Portable Mortars

Four large, rectangular to square blocks of granodiorite were used as mortars. These specimens have centrally-located depressions (Fig. 8a) that could only have been produced by a pounding action. Even though pestles are scarce at the site the mortars provide evidence of their use. It is important to note that on several mortars the areas around the depressions also exhibit grinding and polishing. From this it might be inferred that the mortars were originally Block or Basin metates that were gradually deepened by use until the mano was replaced by the pestle, resulting in still further deepening of the central depressions.

Pestles

Three rough cobble pestles were found at 4-Plu-S94. Two are complete with both ends modified, and the third was broken in half. The ends were battered flat, and exhibit definite shouldering. They show no attempt at other shaping or modification. All are made of a dense, heavy granodiorite.

Bedrock Mortars

On the top surfaces of the small rock outcrop at the south end of the site (Fig. 2) five shallow bedrock mortar pits were found. In addition, a single pit was found on the upper surface of a boulder at the west edge of the creekbed to the east of the site. These six pits are all that are exposed above the present water level of the reservoir, although it is quite possible that more may exist on the rock outcrop below the modern water level. The mortar pits are small and shallow, measuring 15 cm. in diameter by 5 cm. or less in depth. These features are quite unlike the pits found at 4-Plu-S96 across the lake, which are much larger and more numerous.

It should be noted that the limited number of both pestles and mortar pits (even if more bedrock mortars are found beneath the reservoir surface) suggests that this milling complex was not as important at the site as the mano-metate complex. It is possible, although there is no direct evidence, that the pestles and mortar pits at the site may not be contemporary with the main assemblage.
Cobble Hammerstones

Two hard cobbles (P-115-152, 180), one of quartzite and the other of a metaigneous stone are battered from pecking or crushing, usually on or near the ends. These cobbles are not to be confused with pestles, but were possibly hammers used to strike flakes from the numerous cores found at the site.

Chipped Stone Artifacts

Planes

Definition of this artifact type is based on the fact that the rake-angle of the working edge to the plane is greater than 45° (Brott in Rogers 1969: 158). Step-flaking along the working edge gives the specimens a "pony-hoof" shape. The specimens placed in this category are variable as to shape but do tend to be domed (plano-convex), though irregular in plan outline. The larger specimens tend toward a circular form while the smaller ones are elongate. The plane surfaces are often poorly represented in the specimens, causing this artifact type to blend into the other heavy percussion-made artifact types.

The use to which these artifacts were put is not apparent. Their classification as planes is based more on form than on inferred function. Neither battering nor abrasion is evident, with the only evidence of use being that some edges exhibit use-fracture flaking. Use of the specimens as scrapers might have produced such fracturing along some edges. Several working edges and plane surfaces occur on most of the specimens. In a number of instances the artifacts might be classified as multi-purpose implements. It must be cautioned again, however, that in this category of artifacts we are basing identification primarily on form, and only secondarily on possible function. Any modest use would certainly leave abraded surfaces, fracturing, or wear of some sort. Except for possible limited use-fracturing noted above no such modification was evident.

Cobble Cores

Two specimens are placed in this category. The largest one (P-115-186) measures 13.5 by 11.4 by 5.5 cm. (Fig. 9d), while the smaller (P-115-99) measures 10 by 7.5 by 3.3 cm. The larger one is made of a metaquartzite while the smaller is of graphitic quartzite.
The large one is a portion of a large fractured cobble from which large flakes have been struck to reduce it to an angular core roughly triangular in shape. It would have served admirably as a pointed fist-axe or heavy chopper, but the specimen shows no clear evidence of use. Some small fractures occur at places along the edges but they are apparently not due to battering through use as a tool. The smaller specimen appears to have been subjected to some relatively light use, because the edge shows some wear. The use could not have been against stone or other hard material, but may have been on soft material, as the working edge is only slightly dulled. Possibly this smaller specimen was used as a scraper while the larger one was only a core from which flakes were struck. The smaller one also would have served well as a chopper, but apparently did not.

**Cores**

The specimens placed in this category are a motley accumulation of broken pieces seemingly resulting from the knapping of stones for various purposes. One specimen (P-115-18) is a circular, domed piece from which flakes have been struck in a relatively systematic manner. None of the edges show battering although some do show some small fractures, possibly the result of use. For the most part, however, the edges and projections are sharp, indicating that if this was a tool, it was only lightly used. The other specimens are angular pieces of broken stone from which flakes have been struck, or are pieces split off from other pieces, or both. Although the various edges of all the specimens could have served for scraping, planing, cutting, and battering, the evidence for such use is slight. Seemingly, these pieces are residue from the manufacture of stone tools.

**Choppers**

The two specimens that make up this category are elongate tools showing use primarily on their ends. One specimen (P-115-65) is quite well-made from a thick flake of graphitic quartzite (Fig. 9j). One side is not worked and exhibits two large flake scars which were on the stone before it was made into a tool. On the other side one end of the piece has been carefully flaked to form a clear-cut working edge. Use on this edge has been light, as if the tool were used to chop meat. A use-edge on one side is suitable for scraping. The specimen measures 9.5 by 6.6 by 3.2 cm.

The other specimen (P-115-150) is a tool with blunt ends (Fig. 9i). It shows both end and lateral battering, though not as if the blows had been against stone. It, too, may have been used for cutting
Fig. 9. Core Tools, Blanks and Preforms. a, P-115-236, Core tool; b, P-115-202, Bifaced Preform; c, P-115-102, Cortex Core tool; d, P-115-186, Core tool; e, P-115-224, Large Flake Knife; f, P-115-48, Large Flake Knife; g, P-115-74, Biface Preform; h, P-115-228, Uniface Preform; i, P-115-150, Biface Preform; j, P-115-65, Core tool.
Fig. 10. Percussion-Flaked Blades and Knives. a, P-115-199, Biface Blade; b, P-115-239, Biface Blade; c, P-115-121, Uniface Knife; d, P-115-3, Rounded Stem.
meat or wood, or something reasonably soft. It is of metavolcanic material and measures 8.9 by 6.3 by 3.1 cm.

Battering Tools

Of all the heavy percussion-formed specimens, these most clearly show their function. The heavy battering of the various edges of these specimens demonstrates their use as chopping and hammering tools. Probably their primary function was to sharpen grinding tools (compare Riddell 1960: 49). One can only speculate on their possible further use in crushing bone and chopping wood. On some of these specimens, however, some edges are still sharp, or only slightly worn, suggesting their use in cutting and scraping rather than battering. The artifacts in this category range from dome-shaped, oval forms to flat, elongate forms. Some specimens have been made from stream cobbles, as indicated by the cortex remaining.

Steep Angle Cortex Cores

Specimens in this category are closely allied in form and manufacture to the planes described above. The major difference lies in the fact that these specimens retain a considerable amount of the cortex of the original cobbles from which they were fashioned. The flaking is steep; the blows came from the cobble's surfaces and left step-flake scars like those found on the planes. Use-wear on these specimens is no more evident than on the planes. Possibly they were used as scraping and planing tools for soft materials, though the evidence is negligible.

Unifacial Preforms

Three elongate stone specimens, primary-flaked from one side, suggest a desire by the technician to produce a stone object from which more refined artifacts could be made; in short, they appear to be preforms. These pieces are, therefore, a step in the production of such tools as knives, scrapers, etc. Possibly because of the recalcitrant nature of the stone, or because of breakage during manufacture, these pieces never fulfilled their intended function (Fig. 10).
Bifacial Preforms

These ten specimens are essentially the same as the unifacial preforms except that they exhibit bifacial flaking. For the most part they are heavy flakes which were in the process of being shaped. However, because of poor fracturing qualities of the stone, or other reasons, these pieces were rejected. It can be pointed out, however, that although none appear to be finished they do have sharp edges suitable for scraping and cutting. Whether they may have been so used is speculative, however (Fig. 10).

In at least one specimen (P-115-134) a "knot" on one surface exhibits battering. It obviously represents an attempt by the fabricator to bring the piece under his will. However, in this instance the artisan did not succeed.

Large Flake Knives

Both thick and thin flakes struck from cores show one or more retouched edges suitable for cutting (Fig. 9e-f). These stone tools are well suited for cutting fish, as well as for skinning deer.

Large Flake Scrapers

These specimens are quite similar to the ones categorized as large flake knives. The primary difference is that the scrapers exhibit flaking along the edges from one side of the stone piece only. As can be noted in Table 8, both the scrapers and the knives are made from both thick and thin percussion-formed flakes. Both categories consist of rude stone tools, but nonetheless, tools fully capable of doing the job of cutting and/or scraping.

Small Flake Scrapers

Four scrapers may be differentiated from the large ones on the basis of lesser width and thickness as well as lesser length. This is arbitrary, as the two categories could have been merged to form a single category with a broader size range. However, on subjective grounds it seems defensible to separate out these four pieces. Three of them have lunate scraping edges; one has a convex edge; and on one specimen the lunate edge is opposed by a convex edge (Fig. 11g-i).
Fig. 11. Flake Scrapers and Prismatic Blades. a, P-115-15, Blade fragment; b, P-115-221, Flake Scraper; c, P-115-205, Flake Scraper; d, P-115-163, Prismatic Blade Scraper; e, P-115-34, Prismatic Blade Scraper; f, P-115-168, Prismatic Blade Scraper; g, P-115-193, Scraper tool; h, P-115-5, Thumbnail Scraper; i, P-115-10, Thumbnail Scraper.
Fig. 12. Projectile Points from 4-Plu-394 and Adjacent Area. a, P-116-2, Basalt. Informant indicated this point was made by Frog; b, P-116-1, Obsidian. Informant indicated this point was manufactured by Humans; c, P-115-166, Large Shouldered; d, P-115-162, Small Tapered Stem; e, P-115-165, Small Straight Stem; f, P-115-19, Small Straight Stem; g, P-115-204, Small Straight Stem; h, P-115-1, Small Side-notched; i, P-115-164, Small Straight Stem.
Knives

Four specimens have been singled out as knives, using size and shape as criteria. Two specimens (one broken) are stemmed, two are not. Two complete specimens show strong convex edges, while the third complete one (point only missing) is slightly convex along the edges. Three of the pieces are well-flaked overall, and one is made on a large stone flake with percussion flake scars showing on one surface. One of the non-stemmed pieces was probably hafted to a wooden handle as is also seemingly probable for the other three. These four sturdy stone pieces would have been, when hafted, very useful items in the tool kits of the aboriginal owners.

Projectile Points

Only a dozen projectile points, or fragments of them, were recovered from 4-Plu-S94. An additional seven found on other sites at or near Bucks Lake are included in this discussion. Out of the entire collection only one point (119-9) weighs less than 1 gram. The others, as shown in Table 10, for the most part weigh two grams or more. Non-obsidian materials are far more popular than is obsidian. Square-stemmed, shouldered types seem to have been popular, though corner-notched and side-notched specimens occur. One fragmentary obsidian specimen appears to have been a lanceolate piece with a concave base (115-4). A piece without base or point (115-47) is a near-translucent specimen of banded gray obsidian which shows considerable care in chipping. It has the best surface treatment of any of the projectile points discussed here. It is unfortunate that the base is broken, which prevents its being categorized as to type.

The single specimen weighing under 1.0 gram is a contracting-stem piece (from nearby 4-Plu-S95) made of obsidian (119-9). Its size, material and weight suggest that it is probably a recent piece. Two specimens (Fig. 12a, b) recovered from nearby 4-Plu-S99 evoked an interesting observation from a local Maidu informant (Tom Epperson). He looked at them and said that the large one (116-2) made of basalt had not been made by human beings; instead, it had been made by "Frog." The other one (116-1), however, had been made by man (it is of obsidian). This suggests that basalt and other non-obsidian stone was not used by the ethnographic Maidu in the fabrication of projectile points. This idea is substantiated, at least to a degree, at other places in California. The use of obsidian in quantity is relatively recent throughout much of California.

The limited number of points recovered suggests that hunting was of limited importance to the occupants of 4-Plu-S94. However, a
note of caution seems justified here. Although many features and specimens have been exposed by wave action and appear to be in approximately their original positions, it seems likely that local collectors have skewed the incidence of occurrence, as well as the location, of projectile points. Controlled excavation in the remaining midden might demonstrate that projectile points are more common to the site than indicated by the small number recovered from the washed surface.

If size and weight have any valid relationship to function it can be suggested that most of the projectile points were affixed to atlatl dart shafts rather than to arrows. This evidence of the atlatl and dart would suggest occupation of the site 1500 or more years ago, at a time before the introduction of the bow to California. The fact that no Desert side-notched points, or other small, late points were recovered at 4-Plu-894 substantiates the inference that the site is of some antiquity.

Summary

The archeological investigations at Rainbow Point reveal a pattern which corresponds well with the ethnographic picture for the Mountain Maidu. This is particularly true with respect to village location and interpreted function. It can be safely assumed that the village was not occupied during the winter because of the elevation (ca. 5100 feet) and the severity of the weather at that time of year. Tending to substantiate its summertime-only use is the fact that no ceremonial structure (round house) was noted. The site location is in consonance with the location of protohistoric (ethnographic) villages of the Mountain Maidu (Riddell 1968); that is to say, up out of the meadow and just into the forest fringe.

In answer to the question of why these people were here it can be pointed out that the high mountain meadows of the region provide a variety of plant foods, of which the "Indian potato" (Carum gairdneri) is abundant (McMillin 1956). These could be gathered in quantity, baked in earth ovens, made into patties, and stored for winter use at the permanent winter village (compare Riddell 1960b: 35). Other roots and bulbs were similarly treated. At this same time the deer herds would be in the upper elevations for the summer and the people would hunt them and dry at least some of their meat for winter use. The following is a listing of plants which could have been used for food:

Bracket fungi—all parts; Tule (Scirpus)—underground parts, stems; Golden brodiaea—underground parts; Purple brodiaea—underground parts, leaves; White brodiaea—underground parts; Buttercup—seeds; Balsam root—seeds; Western blueberry—berries; Blue camass—underground parts; Wild carrot (Lomatium sp.)—underground parts; Wild
carrot \( (Umbelliferae\_sp.)\)--leaves; Cat's breeches \( (Hydrophyllum\_captopum)\)--leaves; Cat-tail \( (Typha\_latifolia)\)--underground parts, leaves; Wild celery--stems; Chokecherry--berries; Bush chinquapin--seeds; Red columbine--underground parts, seeds, leaves; Blue currant--berries; Dandelion--leaves; Elderberry--berries; Fern--leaves; Fireweed--stems; Yellow fritillaria--underground parts; Gooseberry--berries; Blue grass--seeds; False hellebore--underground parts; Juniper--berries; Mariposa lily--underground parts; Tiger lily--underground parts; Larkspur--leaves; Miner's lettuce--leaves; Lichen--all parts; Lupine--leaves and stems; Ground manzanita--berries; Manzanita (black and red berries)--berries; Milkweed--stems; Mint--leaves and stems; Monkey flower--leaves and stems; Black moss--all parts; Mushroom--all parts; Mule-ear \( (Wyethia)\)--seeds, stems; Huckleberry oak--seeds; Pink and white onion--underground parts, leaves, stems; Indian paintbrush--flowers; Turkey pea--underground parts; Wild pea--seeds, leaves; Jeffrey pine--seeds; Ponderosa pine--seeds; Sugar pine--seeds; Sierra pufball--all parts; Wild raspberry--berries; Wild rose--rose hip; Indian rhubarb--stems; Service berry--berries; Skunkweed--seeds; Snow berry--berries; Snow brush--seeds; Squaw potato \( (Carum\_gairdneri)\)--underground parts; Strawberry--berries; Sweet cicely--leaves; Thimbleberry--berries; Buckwheat \( (Eriogonum)\)--leaves, stems; Obundum \( (Umbelliferae\_sp.)\)--seeds; Tosopen perwin \( (Umbelliferae\_sp.)\)--underground parts (after McMillin 1958).

If the preceding reconstruction of the function of the Rainbow Point site is correct, thus closely paralleling the ethnographic pattern, we have evidence of a way of life which was sufficiently successful to have remained stable for a period of centuries, possibly millenia.

Careful review and analysis of the food preparation tools, especially the grinding implements gives strong indication of the resources used at the site. The limited use of the bedrock mortar indicates that acorns were not an important item in the diet of the people while they were at the site. The use of heavy convex manos indicates, however, that heavy grinding was done, and it is suggested that seeds of several kinds were gathered in the area and ground into flour. Various grasses from the meadows, and pine nuts from the forested areas appear to be likely candidates. Hulling these products could be accomplished with the light-weight flat-faceted manos on a basket tray or flat metate. Producing flour from them would necessitate use of the heavy manos mentioned above. The several root and bulb types gathered were not reduced to a flour, but were probably roasted in earth ovens, mashed by hand, and made into patties which were sun dried and stored, also as noted earlier.

The village at Rainbow Point (4-Plu-394) seemingly was occupied by a half-dozen families during the summer months to take advantage of the plants and animals found at that time of year at that elevation in
a conifer forest-meadow environment. Not only were foodstuffs gathered for everyday use but a surplus was obtained for winter use back at the permanent village in a milder climatic zone. Such a pattern of activity was characteristic during the protohistoric period and it appears to have been established in the same form some 1500-2000 years ago at Bucks Lake.
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*Three Fragmentary Manos are not included in this analysis.

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*Type of Facet (Convex or Flat)

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*Reconstructed measurements.

Table 8 (Continued)

Table 9. Knives.
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*Measurements in millimeters
( ) = Estimated Measurements

**Weight in grams

Table 10. Projectile Points.
References

Gayton, A. H.

Greenwood, R. S.

Haury, E. W.

Kroeber, A. L.

Kurtz, P. L.

Loud, L. L. and M. R. Harrington

McMillin, J. H.

Mohr, Albert

Riddell, F. A.
1960a The archaeology of the Karlo site (Las-7), California. University of California Archaeological Survey Report 53.


1968 Ethnogeography of two Maidu groups: I and II. The Masterkey 42, 1 and 3.

Wheat, Margaret A.
SOME COMMENTS ON THE RELATIONSHIP OF GREAT BASIN TEXTILES TO TEXTILES FROM THE SOUTHWEST

by

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Youngstown State University

In an earlier paper (Adovasio 1970a), I defined and described three regional Archaic textile complexes within the Great Basin area of the western United States. In the present paper I intend to discuss the relationship of Great Basin textiles, as a unit, to materials in the Southwest.

Within the context of this discussion, the geographical boundaries of the Southwest are essentially those set forth by Reed (1964). He describes the Southwest as encompassing the territory lying between Durango, Colorado, on the north and Durango, Mexico, on the south, and between Las Vegas, New Mexico, on the east and Las Vegas, Nevada, on the west. This area includes most of the states of New Mexico and Arizona as well as portions of northern Mexico, southern Colorado, southern Utah, and extreme southern Nevada.

Within this fairly restricted area three major and more or less contemporary cultural traditions arose: the Mogollon, Anasazi, and Hohokam. Each dominated a particular area of the Southwest and each was, to varying degrees, influenced by its neighbors. Furthermore, all three traditions are assumed to have evolved from the Desert Archaic through stimulus from Mexico.

Prior to 1959, no textiles of an antiquity comparable to those from the Great Basin were known in the Southwest. However, archaeological researches in the Rainbow Plateau area of southern Utah and northern Arizona revealed an early pre-Basketmaker II occupation (Lindsay and others 1968). This occupation, called the Desha Complex, is dated about 5500-6000 B.C. and contains the earliest textiles in the Southwestern area as it is defined here. As these Desha Complex textiles were directly followed by textiles of distinctly Basketmaker II type, they have considerable importance in clarifying the history of textile developments in the Southwest.

From the Desha level at Sand Dune Cave, as well as the mixed Desha-Basketmaker II level immediately above, Lindsay recovered some eighteen pieces of closely coiled, one rod foundation basketry sewn with an interlocking stitch. In all particulars, this basketry is identical to the earliest one rod foundation coiling from northern
Utah, and it is my hypothesis that it diffused southward from the Utah area. In addition to the clearly eastern Great Basin-derived one rod foundation coiling, the Desha and mixed Desha-Basketmaker II levels also contained typical Southwestern basketry made by the two rod and bundle foundation coiling sewn with a noninterlocked or split stitch. As this technique has no early occurrence north of the Colorado River, it appears to be a local and early elaboration on the basic one rod foundation coiling technique. As is well known, once this technique arose, it became the standard coiling technique for much of the Southwest (Morris and Burgh 1941). In contrast basketry using the one rod foundation with an interlocking stitch becomes relatively rare. So rare in fact, that Morris and Burgh (1941), without knowledge of the Desha materials, questioned whether it was indigenous in the Southwest. Within both the Desha and mixed Desha-Basketmaker II levels at Sand Dune Cave were also recovered closely twined bags with stitches slanted down to the right on a flexible warp. This is further corroboration of a Great Basin origin for Southwestern textiles, as this technique is common in the northern and western Basin from 8000 B.C. on. Like two rod and bundle foundation coiling, it also becomes a standard Southwestern technique by Basketmaker II times.

While some of the Desha materials seem clearly to be of eastern Great Basin origin, and moreover, seem to provide the base of both twining and coiling techniques upon which subsequent Southwestern textile traditions were built, it should be noted with some emphasis that once the basic Great Basin twining and coiling techniques were established in the Southwest, local variations subsequently arose which showed little resemblance to contemporaneous Basin materials. Moreover, as will be shown below, later exchange between the Great Basin and the Southwest in textile techniques is slight.

Rather than attempt to list in detail subsequent developments in the three major Southwestern traditions, I shall discuss representative materials from each area which provide general indications of later developments. The earliest textiles in the Mogollon area were recovered from Tularosa and Cordova Caves (Martin 1952). These materials included both coiled, twilled, and twined pieces, as well as over-one-under-one woven cloth. The predominant coiling technique embodies a two rod and bundle foundation with noninterlocking or split stitches. Examination of the specimens shows that the technique is virtually indistinguishable from that of similarly made coiling from the Desha and mixed Desha-Basketmaker II layers at Sand Dune Cave (Lindsay and others 1968). Other coiling techniques are bundle foundation with rod core, bundle foundation, and half rod and bundle foundation-none of which ever attained much popularity. Twilling and twining are present though twining is relatively rare and twilling is not common until the later phases (Martin 1952). As has been noted elsewhere (Adovasio 1970d), twilling may represent a diffusion into the Southwest from Mexico.
In the Hohokam area the earliest textiles are from Ventana Cave (Haury 1950). The dating on these pieces probably falls in the vicinity of A.D. 800-1400; so they are, relatively speaking, quite recent. Nonetheless, I believe that they are indicative of basic Hohokam developments. As was the case in the Mogollon area, twining, though present, appears to be of little consequence, while coiling is extremely common. There is also a little twilling. However, the basic coiling techniques differ somewhat from those of the Mogollon area, and tend to include more varieties known from the eastern Great Basin. At Ventana, as in the Basin, the most popular techniques are one rod foundation variants, but the techniques (with one exception) are not similar to one rod foundation varieties found in the Great Basin. Ventana techniques include bundle foundation coiling, bundle with rod core foundation coiling, and one rod foundation coiling similar to that from the eastern Basin and, more importantly, to the one rod coiling from Sand Dune Cave, whence it may be derived. Other coiling foundation techniques present at Ventana include one rod and bundle, one rod and welt, two rod vertical, two rod and bundle, two rod and welt, and three rod bunched. All these last, with the exception of two rod and bundle, are uncommon.

The Ventana material indicates that in the Hohokam area, one rod foundation coiled varieties which emerged from basic one rod foundation coiling with interlocking stitch remained popular throughout the Hohokam sequence despite the elaboration of other techniques. Once again, it should be noted that the presence of bundle foundation coiling and twilling may indicate diffusion from areas of Mexico (Adovasio 1970d).

From the Basketmaker-Anasazi area a large number of twined and coiled textiles has been described by Kidder and Guernsey (1919), Guernsey and Kidder (1921), Morris (1919), Kidder (1932), Morris and Burgh (1941), and others. In this general area, twining reaches a high level of sophistication during Basketmaker II times, but afterward steadily declines, with a concomitant rise in popularity of coiling. Coiled basketry reaches its highest degree of elaboration in the Anasazi area and includes many close coiled varieties. The earliest and most well-developed spaced or open coiling technique also originates here and enjoys considerable popularity. Throughout this sequence, close-coiled two rod and bundle foundation basketry with a non-interlocking or split stitch is predominant and must have attained popularity very early, as indicated by its notable presence in the mixed Basketmaker-Desha levels at Sand Dune Cave. Some twilling and bundle foundation coiling is present, though rather late, and could mark the northern limits of the diffusion of these techniques from Mexico, at least in this period.

From the above admittedly brief summaries it becomes apparent that each subarea of the Southwest developed its own regional textile
manufacturing techniques. Moreover, it is also clear that all these areas shared a large number of techniques--specifically two rod and bundle foundation coiling, bundle foundation coiling, and twilling--although the popularity of each of these techniques is variable from area to area.

Taken as a unit, Southwestern textiles apparently represent basically local developments stimulated very early by diffusion from the eastern Great Basin and perhaps affected later by developments in Mexico; particularly the appearance of bundle foundation coiling and twilling may be due to Mexican inspiration.

The relationship of later Southwestern textiles to developments in the Great Basin remains to be discussed. Evidently no standard late Southwestern techniques ever appeared in significant numbers in the Great Basin at contemporaneous periods, or vice versa. As a result, no recognized textile-complex boundaries are as well defined as those which exist between the Fremont area and the northern borders of the Southwest. This does not mean that single techniques are not shared or that distinctly Southwestern varieties do not appear in the eastern Great Basin. In fact, spaced coiling or open coiling with an intricate stitch occurs sporadically and quite late in areas as far removed from the Southwest as Wyoming (Frison 1965-68), Idaho (Gruhn 1961), and Utah (Jennings 1957; Adovasio 1970b). As there is no history of development of this technique in the Great Basin, these pieces are presumed to represent trade wares and to be indicative of the limits of exchange between the Southwest and areas further north. Similarly, one or two pieces of bundle foundation coiling as well as bundle with rod core foundation coiling have been found in the Fremont area. These are also presumed to be intrusions from the Southwest.

I have already discussed the origin of Fremont textiles in another paper (Adovasio 1970c), in particular the origin of one rod and bundle foundation coiling, which is the standard Fremont technique and which appears in the Southwest long after its initial occurrence in the Great Basin. In summary, Fremont textiles are entirely Great Basin in origin and in only one small part of Utah, the Parowan Valley, do they tend to have any resemblance to Southwestern materials. In this particular area stitching patterns of Southwestern character (that is, very close noninterlocking stitches) appear at the very end of the Fremont sequence but this is presumed to be the effect of late and sustained contact only in that area. Conversely, the foundation pattern remains essentially eastern Great Basin in origin, and two rod and bundle wares seldom appear in Fremont sites despite Gunnerson's (1969) allusions to the contrary.
References

Adovasio, J. M.
1970a The origin and development of western Archaic textiles and basketry. Paper given at 35th annual meeting of the Society for American Archaeology, Mexico City.


1970c Fremont textiles. Paper given at 35th annual meeting of the Society for American Archaeology, Mexico City.


Frison, George C.


Gruhn, Ruth

Guernsey, S. J. and A. V. Kidder

Gunnerson, James H.

Kidder, A. V. and S. J. Guernsey

Haury, Emil W.
Jennings, Jesse D.

Lindsay, Alexander J., Jr., J. Richard Ambler, Mary Anne Stein, and Philip M. Hobler

Martin, Paul S., John B. Rinaldo, Elaine Bluhm, Hugh C. Cutler, and Roger Grange, Jr.
1952 Mogollon cultural continuity and change, a stratigraphic analysis of Tularosa and Cordoba caves. Fieldiana, Anthropology 40.

Morris, Earl H.

Morris, Earl H. and Robert F. Burgh
1941 Anasazi basketry, Basket Maker II through Pueblo III; a study based on specimens from the San Juan River country. Carnegie Institution of Washington Publication 533.
A STAGE ANALYSIS OF THE MANUFACTURE OF STONE TOOLS

by

Guy Roger Muto
Idaho State University Museum

Much recent archaeological discussion has centered on problems of technology, typology, and taxonomy; sadly enough, this discussion has tended to obscure rather than clarify the meanings of terms dealing with the early and middle stages of manufacture of chipped stone implements. Experimental lithic technology has drawn much interest, both popular and professional, and has introduced a new dimension and vocabulary for anthropologists. What is needed now is informed discussion, critical examination, and attempted application of the knowledge currently coming to light. Each site and concept mentioned in this report was chosen with these ends in mind. The concepts to be dealt with are those of the "blank-preform-product" continuum. The segments of this continuum are dealt with in terms of their contexts—archaeological, technological, and cultural.

The concept of the "blank" is at least as old as W. H. Holmes (1890); and although he never strictly defined it, Holmes used the concept to refer to the basic first form from which all lithic artifacts are derived (see Bryan 1950). Another widely used definition is that of H. M. Worthington (1957: 274): "A blank is a roughly shaped stone artifact, still in the process of manufacture, which has been blocked out to the approximate shape and thickness desired for a completed tool." Don E. Crabtree (personal communication) defines a blank as "A usable piece of lithic material of adequate size and form for making a lithic artifact—such as an unmodified flake of a size larger than the proposed artifact, bearing little or no waste material, and suitable for assorted lithic artifact styles. Not yet to the preform stage."

The term "preform" is relatively new, used generally by those who appreciate the experimental approach and who realize the purposive ends of a knapper's efforts. These efforts are directed by intentions which progress from first forms such as the blank to the final forms of the finished products. Intent is all important; it guides the manufacturing process and compensates minor errors in order to manipulate the material toward a final product. The concept of the preform, although used quite widely, is at present without a precise definition, although a preform is generally considered to be a more "finished" blank.
The contentions of this paper are that:

1) The purpose and intent of the knapper must be considered in any discussion of lithic technology, typology, or taxonomy.

2) A blank can be a finished form.

3) Use of the concept of a preform must be based on knowledge of the manufacturer's intent.

4) The concepts of blank and preform are useless, unless used with or as adjectives: e.g., "trade blank," "quarry blank," "burial blank," or "side-notched point preform," "Clovis preform," etc.

5) Analysis using the concept of a "blank-preform-product" continuum is relatively futile for single piece finds, but in a cache or other assemblage it may be possible to refer to stages of completion in the manufacture of lithic artifacts. This could provide us with a technological paradigm for correlating initial stages with later stages, and with end products.

Sites and Finds

The three sites chosen for this discussion are the Simon site on the Camas Prairie near Fairfield, Idaho (Butler 1963; Butler and Fitzwater 1969); the Braden burial site near Weiser, Idaho (excavated by Butler in 1968 but not yet published); and the Spring Creek cache near Fort Hall, Idaho (first reported here).

The Simon site, situated in the open, was apparently a cache. The original report identified two types of Clovis points, several asymmetrical knives, symmetrical knives, ovates, blanks, a spokeshave, a side scraper, and other miscellaneous points.

The Braden burial site showed an interesting group of lithic implements. The burial cache included: 150 complete blanks, 5 blank fragments, 2 complete side-notched points, 1 side-notched point (part of base missing), 1 corner-notched point (stem missing), 1 small pebble (1 cm. in length), 1 scoriaceous lava stone, 1 turkey tail end scraper, 1 turkey tail point, 1 drill or tanged point. This collection was definitely part of the funerary furniture associated with a burial and was concentrated in an area measuring 63 by 36 cm. across, buried 41 to 49 cm. below the surface.

The Spring Creek cache was found on the surface, near where Spring Creek debouches into the American Falls Reservoir, on the Fort
Hall Bottoms. The cache included a range of knives and blades. It was discovered by Mr. Ron Edgerly of Pocatello, Idaho, who reported that it was scattered over a circular area about 75 feet in diameter. Edgerly also reported that there were no associated flakes.

Description and Analysis

A reduction technology such as flint knapping by its nature produces a series of stages antecedent to the final form of each implement produced; in an extreme sense each flake removed from the piece of raw material is a stage of manufacture. With this fact in mind, it is possible through informed observation and experimentation to envision those stages which lead to given final types.

One example of how the "blank-preform-product" continuum has gone unrecognized is illustrated by the Simon site material. Based on the assumption that the artifacts found there were finished types, Butler (1963) originally identified a large broken biface as three separate tools. He later, through technological analysis, corrected this error in print (Butler and Fitzwater 1969). The concern here is not with the mistake but with the underlying assumption; with the fragmentary biface reconstructed only one error was rectified. A progression of preforms, showing a manufacturing sequence toward the large Clovis points, was hidden by the typological assumption which called for only finished types; the preforms were identified as knives.

The finds at the Simon site included the typical squat Clovis point (Fig. 1a), along with several very spectacular long, thin, finely worked lanceolate examples of lithic manufacture (Fig. 3d) similar morphologically but not in flake character to one Clovis specimen from Dent, Colorado (Wormington 1957: 45, Fig. 12). As mentioned above, the other objects in the Simon cache were variously described as asymmetrical knives, symmetrical knives, ovates, blanks, etc. It can be shown that technologically these forms exhibit a stage by stage progression toward one of the two Clovis point forms in evidence. The asymmetrical knives become symmetrical knives (Fig. 2), the large ovates become small ovates (Fig. 1b, c), and it takes very little imagination or daring to identify the symmetrical knives as preforms, with the long lanceolate type (Fig. 3d) representing the intended final product. This is easy to envision on purely morphological grounds, and is further substantiated by the flaking techniques seen in the items in the series:

1) The margins of the items are removed one at a time to gain outline as well as cross-sectional symmetry.

2) Basal thinning serves to prepare platforms for the removal of larger flakes from the obverse side of the form being worked.
3) Marginal retouch is used prior to final forming in order to present a regular edge.

4) Flake character is progressively more refined, better controlled, more consistently spaced, as production moves up the series from blank to preform to final product.

The Simon site data illustrate a typological problem that is quite general. The use of the artifact class termed "knives" as a classificatory catch-all obscures the "blank-preform-product" continuum.

The Spring Creek cache provides another example. It included symmetrical knives, bipointed knives, oval knives, and asymmetrical knives (Fig. 4); yet when these "knives" are viewed as a group there is a definite progression morphologically and technologically toward one symmetrical, bipointed type. Flaking is progressively more refined, extensive, and well controlled within this series, although all these pieces still show irregular faces, margins, and cross-sections, and would generally be considered unfinished. The possibility that such forms may be blanks roughed out to varying degrees of finish for trade or transportation must be considered. In the absence of archeological context to suggest otherwise, they might best be described as transport blanks or trade blanks, since we know that Danish flint blanks were roughed out for this very purpose and are concentrated along trade and travel routes throughout Europe (Bordaz 1970). Also in the Spring Creek cache was found a series of triangular artifacts which must similarly be identified as blanks (Fig. 5).

At the Braden site there occurred a series of triangular knives, squat lanceolates, rough points, and blanks, which essentially matches the triangular series from Spring Creek (Fig. 6). These all show primarily a triangular outline, though cross-sections vary from bi-convex, to plano-convex, to "S-shaped" concavo-convex. The surface flaking of the Braden artifacts is unpatterned and irregular and the edges are for the most part dull, with platform remnants and platform preparation both evident. A small percentage of artifacts in both the Spring Creek and Braden collections is more regularly flaked, bi-convex in cross section, with platform preparation by grinding over 90 per cent or more of the edge (Fig. 7c, d, g, h), and at a stage in the "blank-preform-product" continuum which could be ready for pressure flaking.

The triangular "knives" at the Braden burial site were associated with side and corner-notched points as part of the funerary furniture. They show a distinct seriation in size, shape, and care of workmanship (note cortex, Fig. 7a). In this context it would be proper to call all of them "notched point preforms," and to refer to them as finished for the purpose of burial; their association with the notched points suggests the ultimate form of the artifacts intended by the knapper,
Fig. 1. Simon Site. Classic Clovis Point, a; Ovates, b, c.

Fig. 2. Simon Site. Symmetrical and Asymmetrical Knives.

Fig. 3. Simon Site. Blank-Preform-Product Continuum of the Large Lanceolate Clovis Point.
Fig. 4. Spring Creek Cache. Bl-pointed Biface Progression.

Fig. 5. Spring Creek Cache. Triangular Biface Size Range.
and the purpose for which they were finished to this stage is made clear by their being placed with a person bound for the next world.

All these examples are presented by way of emphasizing the existence of serial stages of lithic manufacture. That there is a seriation from first to final forms is hard to deny; that we can know the intent of the manufacturer is more open to conversation, but that intent can sometimes be inferred from the context of the forms is suggested by the examples presented above. (The question of intent is also taken up by Painter /1965/.) The further removed from the supposed end product a piece is, the harder it becomes to draw a definite line for interpretation. Thus, forms such as the large broken biface from the Simon site, with which this section of the discussion was begun, may have to live with a purely descriptive term such as "biface," or one modified with relation to the context, such as "Clovis biface" or "bifacial blank."

Conclusions

In conclusion, it seems acceptable to use "blank" as a general term denoting an early stage of lithic manufacture, as defined by Crahtree (see above) and Worthington (1957). Where intent of the manufacturer can be established, the term "preform" should be tied to and used in conjunction with the term for the final type form. With assemblages of associated artifacts it may be possible to establish a techno-archaeological perspective in terms of intent of the knapper. We know that when a modern flintknapper uses the term "preform," he has a final form in mind, and his efforts are directed toward achieving that form. Contemporary experimental lithic technology as exhibited in the work of Don E. Cratree or Francois Bordes shows that the vision of a desired end product persists from the formative stages of manufacture to the final stages, and is guided by intent. Each flake removed in the process is designed intentionally, each mistake corrected in a purposive manner; each blow of the knapper's tool has meaning in a progression toward a purposive, intentional end product. Finally it should be cautioned that this perspective shows only progression toward an end point; the technological continuum from blank through preform to product does not preclude use of the evolving artifact at any stage.

Acknowledgements

I would like to extend a note of thanks to professors B. Robert Butler and Max G. Pavesic at Idaho State University for their comments and criticisms on the subject of this paper; they have been very helpful
Fig. 6. Spring Creek Cache, a, b, d. Braden Site, c, e, f.

Fig. 7. Braden Site. Progression of Side-Notched Point Production.
in clearing my thinking processes along the lines expressed above. Further thanks are extended to Don E. Crabtree, Idaho State University, for his contributions to my education in lithic technology; to Ron Edgerly, Pocatello, Idaho, for his loan of, and information about, the Spring Creek material; and to Malcolm F. Farmer, Whittier College, and C. Melvin Aikens, University of Oregon, for suggestions as to presentation. Finally, special thanks are due my wife for her many kinds of support and encouragement. Much of the value of this paper is due to those above mentioned; the shortcomings only I can claim.

References

Bordaz, Jacques

Bryan, Kirk
1950 Flint quarries--the sources of tools and, at the same time, the factories of the American Indian. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 17, 3.

Butler, B. Robert

Butler, B. Robert and R. J. Fitzwater

Holmes, William H.

Painter, Floyd

Wormington, H. M.
Suggested Additional Reading in Lithic Technology and Typology

Bordes, Francois

Bordes, Francois and Don E. Crabtree

Cook, Angel Garcia

Crabtree, Don E.


Crabtree, Don E. and B. Robert Butler

Pavesic, Max
A CYBERNETIC MODELING OF HISTORIC SHOSHONI ECONOMIC PATTERNS

by

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Julian Steward's original data on historical Shoshoni settlement patterns and seasonal round in central Nevada have been reworked in terms of a machine-compatible flow chart and systems model. The objective of this model is to provide a workable vehicle allowing particular ecological situations such as environmental fluctuations and historic White influences to be simulated statistically. Computer simulation also provides a predicted archaeological situation from which to test the applicability of Steward's model to extinct Great Basin societies. The data are strictly ethnographic, although relevant biological parameters can be utilized when properly quantified. The systemic model predicts artifact frequencies within the several microenvironments of the Reese River Valley. When the deductive ethnographic picture fails to suitably correspond to observed archaeological materials, we have concrete evidence for techno-ecological, technenvironmental change.

Introduction

My topic concerns a mathematical model of Great Basin economic patterns. To avoid as much pedantic jargon as possible, I shall briefly discuss what a cybernetic model is and how one such model functions in the service of archaeology and anthropology. This presentation is to be viewed as a programmatic progress report rather than as a finished product.

The word "cybernetic" derives from the Greek and means "the steersman or helmsman." Norbert Wiener coined the term in 1947 to designate that field of inquiry concerned with control systems and communication processes. Following more modern usage, I shall use the terms "cybernetics" and "systems analysis" as essentially interchangeable. In its simplest form, the cybernetic thesis is that a single body of theory can effectively deal with a plethora of systems. Most of us are familiar with the everyday usage of such prosaic terms as "feedback," "black box" and "decision models," these are popularized versions of cybernetic concepts. By its nature, a systems approach is gestalt, attempting to discover universals in systems of varying type.
If cybernetics studies systems, what then is a system? Formally, we can consider a system as a "set of objects together with relationships between the objects and between their attributes" (McMillan and Gonzalez 1968: 1). But in practice, a system boils down to simply those objects and relationships which the investigator wishes to study. Thus a thermostat forms a simple system, the reflex functions of the eye comprise a more complex system, and the production schedule of General Motors forms an even more intricate system. Yet all of these systems can be analyzed with the tool kit of cybernetics.

If a system is anything you want it to be, and cybernetics is simply the approach one uses to effectively deal with this system, then such tools become germane to archaeological situations. I wish to present the context and substance of a particular application of cybernetic modeling.

Theoretical Framework of the Reese River Ecological Project

The Reese River Ecological Project is a detailed archaeological investigation of a single valley system in central Nevada. The Reese River Valley is located in just about the center of the State of Nevada. The specific area of interest is the upper end of that valley, about 30 miles south of the town of Austin, in Lander County (Fig. 1). The study plot is limited to a chunk of land measuring about 20 by 60 miles. The criteria for selection and sampling methodology have been discussed elsewhere (Thomas 1969). This universe contains three primary biotic communities. The lower sagebrush-grass zone covers the valley floor and ranges in elevation from about 5000 to 6500 feet above sea level. Artemisia tridentata is the dominant species, sometimes occurring in pure stands. The invasion of Mediterranean grasses, and the overgrazing of native varieties, has apparently changed this life zone markedly from its condition in pre-contact times. The pinyon-juniper belt flourishes between 6000 and 8000 feet in the Toiyabe Mountains, which form the eastern flank of the Reese River Valley. This forest zone forms a fringe around the entire valley (Figs. 2, 3). Above 8000 feet, the upper sagebrush-grass zone is apparent. (The diminutive limber pine zone is excluded from discussion here.) A rain shadow effect displaces these zones approximately 1000 to 2000 feet upward in the Shoshone Mountains facing the west side of the Reese River. For present purposes, I recognize a fourth biotic community, the riparian life zone. On the flats, vegetation differs little from that of the surrounding sagebrush-grass zone. In the mountains, this riparian zone is characterized by lush stands of cottonwood and birch trees. This riparian microenvironment is recognized primarily because of its distinctive economic potential. For more detailed discussion of Reese River Valley biotic communities, see Billings (1951).
Fig. 1. Location of Reese River Ecological Project Study Area.
Fig. 2. Biotic Communities of the Reese River Valley. Riparian zone foreground; sagebrush-grass and pinyon-juniper zones, background.

Fig. 3. Archeologic Site in Pinyon-Juniper Zone.
Fieldwork in the Reese River Valley has been completed; the first year's research (1969) was conducted by a field school from the University of Nevada, Reno. A field crew from the University of California, Davis, spent the summer of 1970 working in the Reese River Valley. The collections are now under analysis in the laboratories of the University of California, Davis. The keynote of the Reese River Ecological Project is the application of established scientific methods in the study of culture history, the reconstruction of extinct lifeways, and the investigation of cultural processes in action.

John Kemeny's (1959) discussion of the scientific method, or more precisely, the scientific cycle, provides the structure in which the Reese River Ecological Project is grounded (Fig. 4). One begins with facts and through the process of induction, theories are formed. At this point, theories carry little information and even less credibility. Theories can be judged neither by their attendant factors nor by the reputations of their authors. Rather, theories (or hypotheses) are to be assessed only by their ability to predict phenomena. The second process in the scientific cycle is the deduction of testable propositions from the theories. Finally, these predictions must be verified with new facts. The phrase "scientific cycle" emphasizes Einstein's well-known dictum that science begins and ends with facts. Deduction and verification comprise the now-popular "testing" of hypotheses. An unverified hypothesis has the epistemological status of a daydream. From a scientific point of view, it makes no difference who framed the hypothesis, for professional reputation and experience are irrelevant to the truth value of an hypothesis. Theories, by themselves and untested, cannot compete for serious attention in the arena of modern science. Parenthetically, I wish to note the sterility of debate arguing the merits of "deduction versus induction" in the scientific process. In true scientific investigation, the techniques are complementary and entirely compatible (see Longacre 1970 for amplification of this point).

It is this logical framework which the Reese River Ecological Project seeks to deploy. The theory to be tested is Julian Steward's interpretation of Great Basin socioeconomic patterns. The initial facts are those which Steward himself collected in the 1930's and those from historic sources. These facts were induced by Steward into a consistent, articulate body of theory in "Basin-Plateau Aboriginal Sociopolitical Groups" (Steward 1938). Let me caution that there are two distinct issues here. One is the applicability of Steward's interpretation to the groups he observed in the field. That is, did the Shoshoni of this century behave as Steward tells us they did? To test this would require more ethnographic facts. This project has not been attempted. The other issue, and the one of interest here, is the relevance of the Stewardian theory to extinct groups, those of prehistoric and early historic times. Of especial interest is Jennings' use of Steward's model as the basis of the Desert Archaic concept (esp.
Jennings 1957). Although both situations involve Steward's interpretation, they are logically and methodological separate problems. The Reese River Ecological Project is equipped only to test Steward's model against the archaeological record.

The next step in the scientific process requires deduction of a set of verifiable propositions. These predictions can then be tested against unbiased data from the past. But, as Fig. 4 indicates, theories must be expressed in mathematical terms. The 1938 version of Steward's theory is obviously not in such a form. The purpose of this paper is to rework this corpus of theory into a form suitable for further examination. After such reformulation, it becomes possible to predict the archaeological outcomes of Steward's model. These predictions will refer to specific occurrences of archaeological artifacts and features in the study area, the upper Reese River Valley. By relying upon quasi-mathematical methodology, one can transcend simple presence-absence lists of items. The techniques of computer simulation enable one to forecast both (1) relative frequency of artifacts and features per unit area (density), and (2) the statistical distributions. Predictions must then be verified or rejected on the basis of the archaeological record. Presentation of this set of predictions is beyond the scope of the present paper; the immediate goal is to present an operational expression of the Stewardian theory. The current effort must be viewed as a single link in the continuous scientific cycle as described above.

**Flow Chart of the Shoshoni Economic Cycle**

Figure 6 presents the seasonal round of the Western Shoshoni of Reese River Valley. The data have been taken directly from Steward (1938: esp. 100-109). As few interpretations as possible have been injected; the attempt has been to array Steward's interpretation as faithfully as possible. In 1966, R. F. Heizer wrote:

I suggest that it might be helpful if someone would take Julian Steward's classic paper of 1938 and rework the data in order to show how many persons were involved in specific activities, how long such activities lasted, how many camps were visited in the course of a specified life span, how wide the range of exploration of each valley or mountain area, etc., etc. The information is there, but Steward handled it to demonstrate something he was interested in... no broad reanalysis of the data has ever been attempted (Heizer 1966: 240).

The flow chart shown in Fig. 6 can be viewed as a restricted attempt to do just this, but the scope is much more modest than Heizer has suggested. As Heizer correctly pointed out, the data are there, and they simply need to be put into an acceptable form for current research.
Fig. 4. The Scientific Cycle.

Fig. 5. Key to Flow Chart of the Shoshoni Economic Cycle.
Fig. 6. Flow Chart of the Shoshoni Economic Cycle.
A key to symbols is presented in Fig. 5. More or less standard flow charting symbols have been employed; conventions are primarily those of the FORTRAN computer language (see, for example, Veldman 1967). Construction of such a diagram is standard procedure prior to the actual programming of machine-readable statements. It allows the programmer, and any others, to visually grasp the particular algorithm in use. The white diamonds represent logical decision points, that is, those at which a proposition can be answered "yes" or "no." The upper diamond in Fig. 6 is thus read "Is pinyon pine area good?". There are two outlets to this decision, one negative and one positive. The progression through the flow chart is determined by the truth value of these logical decisions. There are three "Activity Box" types. "Female Activities" are denoted by a rectangle with excurvate sides, the oblique parallelogram indicates "Male Activities" and the rectangle represents activities involving both sexes. Inside each box is printed the activity; most activities involve distinctive tool kits, and it is these assemblages which are observed in the archaeological record. Activities are also coded by microenvironment; Fig. 5 indicates the types of shaded coding employed. The microenvironments or life zones there outlined are those of the upper Reese River Valley. The activity coded in the upper right of Fig. 6, for example, is read as "Rabbit drive involving both sexes and taking place in the lower sagebrush microenvironment." The activity code to the immediate left of this is read as "Pinyon harvest involving only females, taking place in the pinyon-juniper life zone." The small oval represents the "Go To" statement in FORTRAN. For our purposes, this symbol indicates a change in camp site locus. Go To statements are likewise coded by life zone into which camp is moved. The oval immediately below the "Harvest pinyon" activity is read as "Move base camp to festival locality situated out of the study area." The heavy black line denotes movement through time; the thin line indicates physical movement of people. When the logical priorities are uncertain, brackets indicate an ambiguous sequence.

The above symbols are integrated into Fig. 6 in the following fashion. The flow chart is roughly quartered to signify the four seasons of the year. The time line flows clockwise through the seasons, with logical branchings shunting movement into the proper seasonal activities. The logical decision point at the top of the time line is read as "Is T /time/ equal to Fall?". If so, then the positive branching is followed and fall activities commence. If T is equal to some other value than fall, one continues clockwise along the time line until the proper branching is taken. Once correctly diverted into one of the seasonal quadrants, one follows the operational connectors, the fine black lines. After all seasonal activities have been completed, and progress is channelled back to the time line, one proceeds to the next season; and so on. Note that no entrance is provided to the time line. It is a continuous cycle. This is to emphasize that Fig. 6 only attempts to display a functioning
system. There is no speculation as to its origin (see Collins 1965).

Fall activities center about the harvesting of pinyon pine nuts. The pinyon festival usually took place near Austin (Steward 1938: 106), so groups left the immediate study area. If local pine resources were satisfactory, groups then returned to their regular winter villages. Artifacts were at this season primarily deposited (lost or discarded) in the pinyon harvesting areas and in those zones connected with seed sowing and hunting. Harvesting, winter village, and rabbit driving implements would be expected to occur in clumped distributions, while hunting artifacts would tend to be randomly distributed over pinyon-juniper and upper sagebrush zones. These distributions can be simulated using a Poisson distribution, described below.

Winter was a time when families remained in the pinyon-oriented villages, such as the one depicted in Fig. 3. Task groups left these ridge-top sites only for ancillary trips to procure rabbits, roots, and fish. If fish resources proved more abundant than those provided by the pinyon, the winter village was often moved to the banks of the Reese River. Artifacts used during this season tend to reflect sedentary activities; only the hunting implements would be expected to be distributed in other than clumped fashion. Of particular interest is the final logical decision point in the Winter quadrant - "Is stored food gone?". If so, then activities branch to the Spring area of the flow chart, regardless of the season. Winter village activities could not continue once pinyon stores were depleted. On the other hand, if the stored foods were not exhausted in the winter, the village was not abandoned. Given an exceptionally abundant pinyon nut crop, camp would not have to be broken at all. Occupants would simply remain in the village until the next winter. The result is sedentary village living, a rather provocative thought, given the conventional wisdom concerning Great Basin settlement patterns.

When caches were emptied, families moved onto the flats in search of early-ripening seed and root crops. The best area for this seemed to be where snow melted first, near the river and streams. The "ambiguous sequence" brackets in Fig. 6 indicate that any course would be followed, depending upon the immediate availability of resources. Larvae were occasionally collected out of the study area.

Summer activities were exceeding varied; the flow chart distinguishes early from late summer activities. Most of these early activities seem to center about the riparian and lower sagebrush life zones. A temporary summer camp was often established near the river, although Steward notes that "the winter villages/ were conveniently located, for the mountains behind them afforded pine nuts, roots, and seeds, while the low and partly marshy valley floor provided seeds and roots, most of which grew within 4 to 5 miles of each camp" (Steward 1938: 101). In terms of the archaeological record, it is crucial whether
summer encampments were established along the Reese River, and if so, how often. If these villages were commonplace, then camp site artifacts (drills, gravers, grinding stones, beads, house pits, and so on) should be present. But if only temporary camps were established by task groups, we will find only refuse from specialized activities. Steward admits the possibility of people remaining in the pinyon-juniper zone winter village almost continually. It would seem that in good pinyon years, the winter village would be occupied all year if possible. In other times, river side sites were probably occupied. The exact importance of river side encampments is uncertain.

To repeat, the sequence of seasonal foraging described above is an attempt to mimic Steward's thesis. Although imperfect, the flow chart succeeds in translating Steward's statements into a form usable in this study. Personal bias has doubtless been interjected here and there, but the hope is that such effect is minimal.

Figure 6 represents the structure of a Shoshoni economic system and enables one to graphically follow the seasonal round. But we have yet to make this static model into a dynamic vehicle, one which provides useful predictions testable in the archaeological record. We need to predict the specific occurrences of artifacts resultant from these activities. A serviceable model should provide information regarding (1) form, (2) distribution, and (3) relative abundance of artifacts and cultural features. In discussing artifact formal variability, Longacre (1970: 132) noted three dimensions: (a) stylistic, (b) technological, and (c) variation resulting from design of the item for its projected use. The current model can only provide information regarding the last category of variation. Functional types, then, are of interest here, rather than historical-index types (Steward 1954). Discussion is based, for example, on functional groups such as "projectile points" rather than on historical-index types such as "Eastgate Expanding Stem projectile points."

The Poisson distribution is most appropriate for treating artifact and feature dispersion. To exhibit a Poisson distribution, an array of items must have two properties (Sokal and Rohlf 1969: 83-95): (1) the mean \( \bar{x} \) must be small relative to the maximum possible number of events per sampling unit, and (2) occurrence of events must be independent of prior occurrences within the sampling unit. Items occurring in a Poisson distribution are thus "rare and random events."

The Poisson distribution has seen service primarily in quantitative plant ecology, where data often take the form of measurements of density of items per sampling quadrat (Greig-Smith 1964). The research design of the Reese River Ecological Project is such as to provide data in this form and is thus amenable to rigorous analysis (Thomas 1969). Relative dispersion is determined by a coefficient of dispersion (Sokal and Rohlf 1969: 88)

\[
\text{C. D.} = \frac{s^2}{\bar{x}}
\]
in which \( s^2 \) is the sample variance and \( \bar{X} \) is the sample mean. A value of \( C, D \), much greater than 1 indicates a clumped sample and a value much less than 1 denotes repulsion. In these cases, items are not statistically independent and therefore not in a Poisson distribution. A winter village situation is an example of a clumped distribution, but an archaeological instance of a repulsed distribution does not come readily to mind. A value of \( C, D \), roughly equal to 1 verifies a Poisson (random) distribution. An archaeological example of the Poisson distribution would be artifacts lost during hunting in the upper sagebrush-grass zone. Incidentally, in a real situation, the values of \( C, D \) and goodness-of-fit are tested according to chi-square distribution.

Relative abundance of artifacts provides a more difficult problem. Weighting coefficients for tool kits, based upon time spent in the activity represented by each kit, will probably be necessary. These coefficients will be quite arbitrary, not unlike those of Winters (1968). Also necessary will be the estimation of approximate turnover rates. Stone knives, for example, are more fragile and expendable than grinding slabs, and therefore more often replaced and more abundant in the archaeological record. Such measures, though necessary for a successful simulation model, are beyond the scope of this programmatic paper.

To provide useful predictions, the model shown in Fig. 6 must be armed with functional artifact inventories. Fortunately, data from the Great Basin are among the best available, due to Steward's (1941) outstanding work on the Culture Element Distribution lists. By way of example, Table 1 lists expected tool assemblages for two activities, pinyon harvesting and communal rabbit driving, using data strictly for the Reese River Shoshoni. Distribution is considered either clumped (C) or random, that is, Poisson (P). Non-perishable items, those expected to be preserved in the archaeological record, are denoted by an \( X \) in the right-hand column. Numbers are those of Steward (1941).

As a result of pinyon harvesting activities, one would expect to find small stone circles, fire hearths, hullers, and cache pits, all in clumped distributions. This tool kit would occur only in the pinyon-juniper life zone, though the individual artifacts and features might occur elsewhere as well. Zonal stability through time is assumed. The only archaeological evidence likely to remain at the site of a communal rabbit drive would be projectile points and butchering knives. Distributions would probably tend to be clumped, since the events represented by these tools would occur only at the end of the drive area, near the rabbit net. These examples are presented only for heuristic purposes, to indicate the projected function of Fig. 6. A much more detailed analysis is necessary to provide completely serviceable definitions of functional tool kit assemblages.
Table 1. Functional Tool Kits

<table>
<thead>
<tr>
<th>Pinyon Harvesting (Pinyon-juniper zone)</th>
<th>Distribution</th>
<th>Non-Perishable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>443. Hooked pole.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450. Climbing stick.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>451. Store green, in stone circle</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>452. Whole cone in cache.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>453. Cooked seeds (Hearth).</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>454. Burn nuts from green cone</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>(Hearth).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>455. Stike nuts from ripe cone</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>(Huller).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>456. Cache.</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>466. Conical gathering basket.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (p. 231)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women's basketry hat.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rabbit Driving (Lower sagebrush-grass zone)</th>
<th>Distribution</th>
<th>Non-Perishable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>92a. Net.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>95. Bow and arrow.</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone knife.</td>
<td>(C)</td>
<td>X</td>
</tr>
<tr>
<td>Rabbit club.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When each activity in Fig. 6 is programmed with its respective tool kit, the entire model can then be translated into the FORTRAN computer language and punched on machine-readable cards. Simple runs through the seasonal cycle provide the predictions to be tested against independent archaeological data. After this, a further stage of modeling is possible. There are numerous environmental parameters which underlie the entire system, such as mean annual temperature, mean annual rainfall, seasonal distribution of rainfall, first frost, and so on. It can be determined from independent studies how each parameter effects the primary systemic components. What effect, for example would a five-inch increase in mean rainfall have upon the pinyon crop? On the rice grass crop? On the fish spawning runs? With this information, the entire model can be altered to simulate environmental change and systemic response. Drought conditions, for example, can be simulated on the computer and the aboriginal response predicted. This provides a set of consistent hypotheses to be tested in the field.

It is hoped that this holistic approach has demonstrated that modern, quantitative methods can answer some of the lingering questions of Great Basin culture history and can also explore some of the general aspects of ecological adaptation to arid environments. I wish, however, to end in a cautionary digression. In our zeal for quantitative archaeology, we all must assiduously avoid the temptation, however compelling, to apply new techniques indiscriminately. It is not enough to employ quantitative methods simply because they are quantitative or new techniques simply because they are new. Any theoretical approach which cannot justify its methods in terms of attendant research objectives is doomed to a fate of substantive sterility. Such pedantic procedures are to be roundly condemned by all.

Notes

1 This paper is Contribution No. 3 of the Reese River Ecological Project.

References

Billings, W.
Collins, P.

Greig-Smith, P.

Heizer, R.

Jennings, J.

Kemeny, J.

Longacre, W.

McMillan, C. and R. Gonzalez

Sokal, R. and F. Rohlf

Steward, J.


Thomas, D.
Veldman, D.

Winters, H.
LINGUISTIC RECONSTRUCTION OF PROTO WESTERN NUMIC
AND ITS ETHNOGRAPHIC IMPLICATIONS

by

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Since the Numic (Plateau Shoshonean) languages of the Great Basin area are very closely related, it is easy for the linguist to rough out the reconstruction of the parent or proto-language of all the Numic languages using the large number of identical or near-identical sound correspondences attested throughout the group. It is also possible to rough out the Numic subdivisions, i.e., to decide which languages are most closely related to each other. The finer details of the correspondences and relationships are sacrificed in order to obtain quickly an overview which serves both to guide further internal investigation and to facilitate wider comparisons with other overviews. However, it is precisely these finer details which are of most interest to the ethnologist, since they include words pertaining to the cultural or geographic changes of one dialect or language area which may not be typical of the whole group and are thus not reflected in the overview. On the other hand, relatively recent diffusion of terms which have come into the dialects as loan words may actually be reflected in the overview if they have spread widely. The overview also cannot cope with sound correspondences which are complex enough to be not immediately obvious, and words containing these sounds may thus be omitted from consideration. These limitations of the method can severely handicap an ethnologist attempting to discover facts about the people who spoke the proto-language through analysis of the words reconstructed.

Taking the overview as a guide, the linguist begins working from the other direction by combining the subdialects and dialects of a particular language into larger and larger units. At each stage in the combination reconstructions are made, and any changes in the sounds or grammar are expressed in strict rules. Apparently anomalous forms may have entered the language as loans after a rule ceased to operate. The rules can thus act as sieves to strain out loan words and insure that they are not reconstructed at the next stage. Tracing the sources of these loans can tell us a great deal about population movements and contacts in earlier periods. This method is not without its own hazards, since in a language family like Numic where the morphemes are very short, the chance of accidental resemblance is quite high. The sound changes are usually relatively uncomplicated,
and it is possible to initially assign a sound change to a level more recent than will actually turn out to be the case when all the languages have been compared; in fact, in the Numic languages traces of earlier stages are quite frequently noted even in the first stages of the reconstruction, and placing sound changes at the proper time depth is not always easy.

Hypotheses presented in this paper were suggested by a phonological reconstruction of the proto-language for the Western Numic subgroup, which consists of Northern Paiute and Mono. Certain linguistic observations which have added some ethnographic evidence to the record are discussed here: retrieval of lost medial consonants; a start on the problem of the velar nasal /ŋ/; and linguistic evidence for contacts with unrelated peoples to the north.

Intervocalic lenition, the weakening and eventual loss of a consonant in the position between two vowels, is still a productive process in all the Numic languages and seems to have been active as far back as these languages can be reconstructed. Not all weakened, or lenis, consonants in this position have been lost in all of the languages in the same words or at the same stage in time, so we have a fair chance to retrieve the missing consonants by comparing forms in the related languages. Even within a single language there are opportunities to recover some of these lost consonants, because often a semantically related term will have preserved the consonant intact or will show a corresponding strong, or fortis, consonant. In Western Numic, contrast in intervocalic consonant series is limited to lenis vs. fortis consonants, but the other Numic languages preserve evidence for other oppositions which must have coalesced in Western Numic. This is, in fact, one of the main reasons for considering Mono and Northern Paiute a separate subgroup.

Examining the Western Numic subgroup alone, we find evidence that no vowel clusters were permitted within a single morpheme. An overall glance at the Numic languages reveals so many vowel clusters that no extension of this generalization appears possible. However, in examining any one language it can be seen that most of the observed vowel clusters result either from the combination of two or more morphemes or from the loss of an earlier consonant. This juxtaposition of two vowels has often altered one or both vowels. Naturally, every effort should be made to recover the lost boundary or consonant before making wider comparisons, in order that these comparisons may serve as a check on the internal reconstruction.

In the Northern Paiute forms below we have an example of the loss of a medial consonant, preservation of the same consonant in a related word, and retention of the fortis counterpart of the same consonant in still another related word.
This abundance of evidence makes these terms fairly secure, but it is also possible to carry this process into less immediately obvious forms:

NP sakí tule boat
pUA(N) *saki ? tules
cf. pUA(S) *saki popcorn
(Miller 1967: no. 328)

pWN *sai- tules (Scirpus)
NP sáipy tules

NP sáipacð(h)u marsh hawk

Mn sáipa'kwi small fish sp. in Owens Lake
pWN *saja coot < *sai-a, cf. Ls ɣay-la (Bright 1968: 39)
NP sája coot, mudhen

Mn pa'sája mudhen

If we assume provisionally that no vowel clusters were permitted at an earlier stage, then in the element /sáí-/ tules a consonant may have been lost. We can trace this form in /sáí/a coot as well, and probably also in the recording /sahf'ty/ snipe by Stewart (1941; retranscription mine). This consonant must have been lost earlier than that in the word for earth since *sai occurs throughout Numic and in other Northern Uto-Aztecan without a medial consonant in the meaning tules and, if the Luiseno form is not a loan from Numic, as a partial in the term for coot as well. In a term limited so far to Northern Paiute we have a possibly related form with a fortis consonant in the word for a boat made from bundles of tule stems. If this comparison is valid, the lost lenis consonant in the word for tule is *k. If this etymology is correct, and if Miller's 'shorthand notation' for popcorn in a group of southern Uto-Aztecan languages is justified by linguistic reconstruction in those languages in the future, then we may have to deal with this additional meaning. This connection clearly has bearing on the question of the early Uto-Aztecs as possible agriculturalists. Certainly it may be only coincidental that the names for two economically important, tall, seed-bearing plants are apparently identical, but,
considering the similar forms of preparation of the seeds and the different geographical locations of the language groups, the idea of a semantic shift cannot be dismissed at this point in the investigation.

Although cognate vowels are usually identical in the Western Numic languages, reflexes of vowel clusters occasionally differ, complicating the task of reconstruction:

\[
\begin{align*}
\text{pWN} & \quad *\text{naw}^\prime \text{ma} & \text{to feel (intrans.)} \\
\text{NP} & \quad \text{n\text{\-'y}^\prime \text{ma}} \\
\text{Mn} & \quad \text{n\text{\-'d}^\prime \text{ma}} \\
\text{pN} & \quad *\text{paw}^- & \text{? blood} \\
\text{pWN} & \quad *\text{pay}'\text{pi} \\
\text{NP} & \quad \text{py\text{\-'y}^\prime \text{pi}} \\
\text{Mn} & \quad \text{p\text{\-'d}^\prime \text{pi}} \\
\end{align*}
\]

\(\text{cf. } \text{Sh-CN (CN)} \quad \text{pyy-} \quad \text{Pn (CN)} \quad \text{\[\text{pawu-7}\]} \quad \text{Ute (SN)} \quad \text{paa-} \quad \text{Ka (SN)} \quad \text{pyy-}\)

(Miller 1967: no. 455c; Davis 1966: no. 119)

The Northern Paiute word for \textit{feel} is transparently derived, through loss of \(\text{*w}\), from an earlier \(\text{*naw}^\prime \text{ma}\), analyzable as /na-/ , passive, plus /\text{wy}'ma/ to feel, the latter in turn analyzable into /\text{wy}'-/ , an instrumental prefix, and the root /\text{ma}/ , both common elements in verbs denoting physical activity. The Mono form is treated similarly, except that the intermediate form must be reconstructed as \(\text{*naw}^\prime \text{ma}\), the passive of /\text{wd}'ma/ . The same instrumental prefix in Mono is also /\text{wy}'-/ , however, and there seems to be no barrier to reconstructing an earlier Mono form \(\text{*wy}'\text{ma}\) for this verb: Numic languages have a strong tendency to harmonize vowels, and in the position after /\text{w}/ both languages often lose the distinction between /a/ and /y/, which frequently yields /\text{u}/ .

We now have a mechanism for correctly explaining the vowels, and perhaps the consonant as well, of the words for \textit{blood}, which show the same unusual vocalism. The *\text{ay} vocalism is supported by the evidence from the other Numic languages, and we thus have confirmation for the use in this word of the stem /\text{pa}-/ \textit{water} (a frequent partial in words for various liquids), which has often been suspected but was not previously provable. The occurrence of /\text{w}/ in the Panamint form (Miller 1967) suggests an even closer parallel to the word for feel, but because Panamint has not been completely analyzed we cannot be sure whether the /\text{w}/ is phonemic and derived from \(\text{*w}\), or predictably inserted between these vowels.
Words with the velar nasal /ŋ/ present one of the most complex problems involving the loss or mutation of an intervocalic consonant.

<table>
<thead>
<tr>
<th>NP</th>
<th>suŋa(ha) breathe</th>
<th>NP</th>
<th>soŋo lungs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mn</td>
<td>suwâ('ka) breathe</td>
<td>Mn</td>
<td>sóno lunge</td>
</tr>
<tr>
<td>ONP</td>
<td>poŋf'ča skunk</td>
<td>NP</td>
<td>wa'ŋa- younger brother</td>
</tr>
<tr>
<td>Mn</td>
<td>poŋf'ta skunk</td>
<td>Mn</td>
<td>wa'na- younger brother</td>
</tr>
<tr>
<td>NP</td>
<td>poŋâci mouse</td>
<td>ONP</td>
<td>jy'cynâ move, stir</td>
</tr>
<tr>
<td>Mn</td>
<td>puwâci mouse</td>
<td>Mn</td>
<td>jy'cynâ move, stir</td>
</tr>
<tr>
<td>cONP</td>
<td>oha- baby</td>
<td>cONP</td>
<td>uŋa- child</td>
</tr>
<tr>
<td>Mn</td>
<td>owââ- baby</td>
<td>eONP</td>
<td>uŋââ- baby</td>
</tr>
<tr>
<td>Ka(SN)owa (nazi)</td>
<td>Rock Baby</td>
<td>NNP</td>
<td>oŋa- baby</td>
</tr>
<tr>
<td></td>
<td>(mythol.)</td>
<td>Sh-CM(CN)</td>
<td>oħnaa- baby</td>
</tr>
<tr>
<td>owa</td>
<td>its cry</td>
<td>SP(SN)yŋa- baby</td>
<td></td>
</tr>
</tbody>
</table>

Northern Paiute has a phonemic lenis-fortis pair, /ŋ/ and /'ŋ/, but /ŋ/, unlike other plain consonants, does not occur initially. Although words in Northern Paiute with velar nasals are not uncommon, the number of these words for which we have Mono cognates is much smaller. The Northfork dialect of Mono which Lamb recorded has no velar nasals, but since earlier recordings of other Mono dialects (Steward 1933, 1941) show velar nasals corresponding to the Northern Paiute forms, we can be secure in reconstructing them for proto Western Numic. Working solely with the Northfork forms, we find that /ŋ/ in Northern Paiute apparently corresponds to a variety of different phonemes in Mono. Most, but not all, correspondences fall into one of two general patterns: NP /ŋ/, /'ŋ/; Mn /n/, /'ŋ/ or NP /ŋ/; Mn /h/ (the latter often replaced by /w/ after /u/ or /o/). In Northern Paiute, /h/ is often used to mark hiatus arising from a morpheme boundary or a lost consonant, and it is possible that the Mono /h/ is really a hiatus marker rather than the actual reflex of *ŋ. Words in the other Numic subgroups are not immediately helpful, since the reflexes of *ŋ in these subgroups are also irregular. Central Numic has no independent velar nasals, and the reflexes it shows in cognate terms include /hn/, /n/, and zero. Southern Numic shows /ŋ/, /n/, and zero. However, no one pattern emerges to link these reflexes into a coherent proto-Numic correspondence; although there are a few
cognate sets which behave somewhat alike, we are still left with four or five possible patterns, in addition to several unique correspondences.

In the words for baby and child (which appear to be at least partially onomatopoeic), central Oregon Northern Paiute shows a possible sound-symbolic pair of words probably based phonologically on an earlier lenis-fortis consonant opposition: the Mono and Kawaiisu forms and COMP baby reflect the old lenis form while COMP child, CN /h/n/, and SP /η/ reflect an old fortis. It seems most probable that, as with certain other consonants, some dialects retained the lenis phoneme and others the fortis for the base form of a given word. This process seems to have been a recurring one in Numic, and major dialect separations of the original Numic people might be expected to show the same variation. For the proto Western Numic forms I would reconstruct lenis *η unless both languages show fortis reflexes; presumably early Mono had differing stages in the loss of the lenis *η, and those words which in pre-Northfork still had */'η/ now show */'n/, while others, undoubtedly lost earlier, show only the hiatus marker. The effect of interdialectal borrowing in Mono is unknown, but should be considered as publications on other dialects are brought up to date.

The set of words for salt in the Western Numic languages has a unique correspondence not reflected in any other sets with /η/, yet this is the most frequently quoted set for *η since the distribution of this term spans nearly the whole Uto-Aztecan family. The eastern Oregon Northern Paiute form does not match that of its nearest relative, central Oregon Northern Paiute, as would be expected, but is instead the term common to the Central Numic languages. Even without taking into account the extra-linguistic fact that the eastern Oregon Northern Paiute (Bannock) live with a group of Central Numic speakers, the Fort Hall Shoshone, we would still have purely linguistic evidence of contact. Oregon Northern Paiute /η/ never reflects *η according to the rules established above; therefore the form for salt in eastern Oregon Northern Paiute is clearly anomalous and the central Oregon Northern Paiute form regular. Although the Mono form is also anomalous, we have no ready candidate for a source language since none of the recorded neighboring languages or other Numic languages has that form. It is not surprising that the term for salt should be subject to outside influences, since we already know that salt was a widely traded commodity throughout the area. In any event, the regular reflex of *η in Mono is not */m/.

In central Oregon Northern Paiute there are three other words for salt. One actually means alkali and need not concern us here. The others are /s’dòy/, from English salt by perfectly regular rules, and /cu’d’i/. Although the latter bears a faint resemblance to some of the Uto-Aztecan words for sour or salty and an Owens Valley Paiute (Mono) term for a plant growing near alkali, none of these is a very close match. My informants deny that /cu’d’i/ means anything other than table
salt, and they are well aware of their own words for these other meanings. The Chinook Jargon word for salt, /sul/, by regular rules yields the attested Northern Paiute form.

NP ko'só pig  
Mn ko'ci pig  
ONP cúdni salt

cf. CJ /koso/  Fr. cochon  
(via Penutian)  Sp. cochino  

cf. CJ /sul/  Fr. sel

The words for pig are superficially very similar, and if the referent were not a recently introduced animal one might be tempted to reconstruct a proto Western Numic word. The /o/ : /i/ correspondence, however, is unusual enough to suggest that the words are not cognate. The shape of the Mono word also suggests that this is one of the many Spanish loan words transmitted via the neighboring Penutian languages. The Northern Paiute form is problematical in that we cannot tell whether the word was borrowed directly from French or passed through Chinook Jargon, /cúdni/, however, could not have gotten its vocalism directly from French, and Chinook Jargon is a likely intermediary source which has the proper vowel. These two words underline the different orientations of the two Western Numic groups relative to their early mediated contact with white culture.

Aoki (1970) lists from various sources a common form meaning white man:

Sahaptin ( Sahaptian)  šuyápo
Nez Perce ( Sahaptian)  so'yápo
Columbian ( Salish)  suyápənux
Coeur d' Alene ( Salish)  suyẹpəms
Kalispel ( Salish)  suyápi

to which I can add NP /su:jápo/, phonetically /su:jápo/ ~ /suyápo/, which is felt by my informant to be a foreign word not analyzable to the Northern Paiute but recognized as a term for white man. The high degree of similarity among all of these terms virtually guarantees a common origin in borrowing, since Sahaptian and Salish are not related to each other or to Northern Paiute. Words shared by these three groups are all but nonexistent, and must date from after the time of white contact. Whether this term is native to Sahaptian or can be traced further remains to be seen, but it seems likely that both the Northern Paiute and the Salish groups received the term from the Sahaptians, since the Salish groups show different endings and because the Sahaptian tribes occupied the territory between the other two families astride some of the attested
post-contact trade routes, including those on which Chinook Jargon was used.

The possible affiliation of these three Northern Paiute words to Chinook Jargon and Sahaptian contradicts the majority of ethnographic accounts and the opinions of my informants to the effect that the Northern Paiute and their non-Numic neighbors hated each other and did not interact peacefully. If these words, which are the only possible loans found so far, prove to be correctly attributed, the arrival of the whites may have affected traditional culture patterns quite early in this area, since the next body of loan words is the result of permanent white settlement and cattle ranching at the end of the nineteenth century. It is possible that the early terms date from the temporary removal of the Northern Paiute from the vicinity of Burns, Oregon to the Yakima reservation following the Bannock War in the late 1870's, rather than from aboriginal contact; however, this would have been too late for the word for pig, since there is no other term in current usage and there were pigs in Burns prior to the time of removal to Yakima. These loan words have raised more questions than they have answered, but they indicate that further investigation of contacts to the north will prove interesting.

The linguistic and ethnographic material presented here stems almost entirely from purely linguistic investigation. The search for the missing consonants and the partial regularization of the rules for \( \eta \) were motivated by linguistic conclusions about the intolerance of vowel clusters and by the presence of almost certainly related words that differed only in the presence vs. absence of a particular lenis consonant. We often have an added clue to the presence of a loan word when there is more than one term for a single item with a very restricted meaning, as with the three central Oregon Northern Paiute terms for table salt, two of which have unresolvable vowel clusters and are thus suspicious. Even before using any outside information we are well on the way toward identifying the anomalies and either explaining them in terms of regular internal change or identifying them as loans. Linguistic research into these and other problems will certainly continue to increase our knowledge not only of the linguistic history but also of the ethnographic history of the Numic speakers.

Notes

1 Mono data are primarily from the materials on the Northfork Mono (Monachi) recorded by Lamb (1957, 1958). Northern Paiute materials are from my own field work at Burns, Oregon, Fort Hall, Idaho, and Susanville and Alameda, California, 1968-70, supported by the Survey of California and Other Indian Languages, University of California, Berkeley, directed by Mary R. Haas. Chinook Jargon forms are from Michael Silverstein
(personal communication), and the Kawaiisu forms from Maurice L. Zigmond
(personal communication). I am also grateful to Robert F. Heizer, who
has allowed me access to certain early Northern Paiute manuscripts in
his possession, and above all to Sven Liljeblad for his continuous en-
couragement of my work.

I follow the transcription system used by Liljeblad in his per-
sonal notes, which shares with the system used by Lamb the use of /y/
for /tʰ/, /j/ for /y/, /o/ for /ɔ/, and /c/ for /tʰ/. I have re-
analyzed the Mono data and have used the Liljeblad symbol '//' as a marker
for fortis articulation there as well. The /y/ of forms cited from other
Numic languages has been retranscribed to conform to this usage. The
reconstructed sound system of proto Western Numic is:

*p    *t    *c    *k    *kʰ    *ʔ
*ʔp  *'t  *'c  *'j  *'k  *'kʰ  *'w
*ʔm  *n  *s  *j  *ŋ  *w  *h
*ʔ'm  *'n  *'s  *'ŋ

Abbreviations used in the charts and text are:

P    proto-
pUA  proto Uto-Aztecan - (N) northern languages only
         (S) southern languages only
pN    proto-Numic
WN    Western Numic: Northern Paiute and Mono
CN    Central Numic: Shoshone-Comanche, Panamint/Kcsö
SN    Southern Numic: Southern Paiute, Ute, Kawaiisu
Nm    Northfork Mono (Monachi), from Lamb.
NP    Northern Paiute
ONP   The northern dialect group of Northern Paiute, comprising
         Oregon Northern Paiute and the Bannock
eONP  The eastern Oregon Northern Paiute subdialect of the Bannock
         of Fort Hall, Idaho
coNP  The central Oregon Northern Paiute of Burns, Oregon
Sh    Shoshone
Cm    Comanche
Pn    Panamint
SP    Southern Paiute
Ka    Kawaiisu
Ls    Luiseño
CJ    Chinook Jargon
Fr    French
Sp    Spanish
*saki (no. 157) as to parch, as corn; parched corn rather than popcorn,
but the analogy still holds.

Comanche resembles Western Numic but has a different base /sukaa-/ instead of /ma/: Cm nyy-sukaa- and wy-sukaa-. In the first Comanche form, as in Western Numic, the underlying prefix is /na-/ (Canonge 1958).

Bright (1968:2) notes that in unstressed syllables in Luiseno the height distinction in vowels is blurred by non-distinctive variation. I have also noted that both within Northern Paiute and between Northern Paiute and Mono, vowels will often differ in height. This is probably why the sets with /o/ and /u/ do not always agree, and probably also why /a/ and /y/ may shift, as in the sets for feel and blood. It is almost certainly the case that the roots in the words for lung and breathe originally had the same first vowel. This problem antedates the split of Numic.

For example, reflexes of pUA *woko pine tree, Ma /wo'ko/ and NP /woko/, are clearly cognate but the Mono medial consonant is fortis while that of Northern Paiute is lenis, for no discernible reason.

Northern Paiute regularly adds a vowel at the end of a borrowed word ending in a consonant, changes intervocalic /l/ to /n/, and lengthens stressed vowels. In Northern Paiute the non-distinctive Chinook Jargon stress would still probably be recognized. Cf. /sóóty/ from English salt, which has a similar treatment. The interchange of /s/ and /c/ that so well documented in Uto-Aztecan in general is also present in modern Northern Paiute.

Aoki (1970) suggests Fr. soldat soldier as a possible source.

References

Aoki, Haruo
1970 North Plateau linguistic diffusion area. Paper presented at the Fifth International Conference on Salish languages, Gonzaga University, Spokane.

Bright, William

Canonge, Elliot
Davis, Irvine

Lamb, Sydney M.
1957 Ms. Monachi dictionary.

Miller, Wick R.

Steward, Julian H.

Stewart, Omer C.

Voegelin, Charles F., Florence M. Voegelin, and Kenneth L. Hale
I attempted to determine from informants, first of all, the basis or bases for classification of native plants and animals as currently recognized. (This was done by using various formal techniques suggested in the literature as well as by contextual discussions). Secondly I sought to learn to what degree classification schemes are shared by speakers within any one language grouping or among the three languages tested, perhaps because of some cognate semantic structures in Numic; and thirdly, I attempted to discover whether there are any perceptible structural modifications in the system/systems for cultural or environmental reasons. Changes in more ancient systems might be expected as a result of the recent Numic expansion into the Great Basin (Lamb 1958a). I chose speakers from various areas within the Numic region not only for logistic reasons, but also to maximize the environmental diversity in their original habitats. The data have only been partially analyzed at this point, and I will outline only some of the results here.

First of all, there does seem to be a basic, but rather loose, system of classification for plants and animals common to all groups and represented in all three Numic languages tested. However, the scheme is also definitely affected by cultural and environmental differences, especially on the lower taxonomic levels. The overall scheme is based primarily on the concept of use, rather than on any necessary genetic connections among biotic species. All Numic groups see as their overriding concern in segregating plants and animals whether they can be and are eaten or whether they are not eaten. Data derived from informal discussions and formal eliciting techniques continually emphasize this point. Northern Paiute informants segregate the eaten from the not eaten categories by applying the terms /nadjad/ and /kad/, respectively "eaten" and "not eaten." Shoshoni informants use cognate terms, Southern Paiute informants offer related, but slightly different concepts. They use the labels /tikapi/ and /kati/tikapi/, "food" and "not food."

Within this broad dichotomy, distinctions as to whether what is eaten or not eaten is generally plant or animal are then made. The terms applied to these designates, however, do not clearly correspond to the terms "plant" or "animal" as used by English speakers. Northern Paiute informants use more than one term for plants, but the most common is /nadj/, literally "grower," implying things that grow in place. They oppose this to /yakinci/, "things that move," a designate for animals. Both of these terms can be used in other contexts. The feeling is almost for a distinction between animate and inanimate rather than specifically between plant and animal. Shoshoni informants offer the term /timsa//, said to mean "all plants together," I am not sure of the exact etymology of this term as yet. Shoshoni informants did not volunteer a term for "animal" even when formal eliciting techniques were used, although I am told by a linguist who has worked with Shoshoni that there is such a term (Sven Liljeblad, personal communication).
The Southern Paiute terms seem closest to the English plant/animal designations, although even their terms are not exact equivalents. Informants from different areas and different subcultural backgrounds differ as to the application of these terms. The term /maʔdbiʔ/ is most commonly volunteered as an equivalent to "plant," and is used to include "bushes" and in some cases "trees." However, Chemehuevi and Kaibab Southern Paiute informants who come from groups that practiced aboriginal horticulture use the term /maʔdbiʔ/ to mean specifically "wild plants" or "things that grow by themselves," to which they oppose /šdpój/, "things you plant," such as corn, beans and squash. Informants from Cedar City, who knew nothing of horticulture aboriginally, apply /maʔdbiʔ/ to all "wild plants" although they are hesitant to include certain "tall" trees, such as ponderosa pine, in this designation. For trees they prefer to use a descriptive phrase in textual discussion, such as /paʔxamé wínidí/, "by the water standing," or /maʔxwínidí/, "plant standing." One Chemehuevi informant applied /maʔdbiʔ/ only to trees and large bushes, such as cottonwood, mesquite and mesecraw, and supplied a separate term, /šisdbiʔ/, for smaller plants or herbs.

The term that Southern Paiutes use most commonly for "animals," /paʔdbiʔ/, also has some differing applications. Sapir (1931: 599) recorded the term in his dictionary of Kaibab Southern Paiute, defining it as "any living thing but man and plants." Some Southern Paiute informants, however, reserve it for small creatures, such as mice and "bugs" that are not commonly used as food, and use the term /pisabíbimáʔ/ for other animals, specifically the large game species that are hunted. Other informants, in keeping with Sapir's definition, use /paʔdbiʔ/, to quote one native definition, for "anything on the ground, including birds too."

Within the groupings of foods that are considered in some way "plants," "growers," or "things that grow by themselves," all informants, regardless of language and area, offer only one type of sub-classification, that based on the part of the plant used for food, for example, seeds, roots, greens, leaves, berries, etc. Most of these terms are cognates in all three Numic languages. Environmental differences in aboriginal and current habitats influence some of the sub-groupings of these materials as well as cultural "food" definitions and preferences. Northern Paiute informants group together "Indian asparagus," a native parasitic plant, and mushrooms, under the category "flesh." Chemehuevi Southern Paiute, who differentiate more than one type of mushroom in their environment, use a generic label for mushrooms and qualify the term for the subvarieties. So they have, for example, /řitádáji/, "mushroom" and /šagáhita/, "cottonwood mushroom," /kandhíta/, "willow mushroom," etc. According to Lamb (1958b), the North Fork Mono also have a class label for mushrooms and several named subvarieties. The Chemehuevi also have another category, in keeping with their environmental position, that of "sticker plants"
\[\text{man\textregistered}b\text{\textregistered}\text{ }\text{\textregistered},\text{ which includes various named varieties of cactus and yucca. This same term} \text{\textregistered}\text{\textregistered}\text{\textregistered} \text{is used by Cedar City Southern Paiute not as a class label, but as the name for prickly pear, the most common cactus in their area. In the northern Great Basin, the Shoshoni differentiate several species of currants by color under the class label} \text{\textregistered}\text{\textregistered}.\text{\textregistered},\text{ while the Southern Paiute use the cognate term for the only type of currant that grows in their area. There are numerous other examples of elaborations within categories for apparent environmental reasons.}

The general category "animal," whatever its specific designate in the three Numic languages, also displays some common features and some cases of elaboration. The idea that "animals" that are eaten must first be separated from those not eaten is important in all cases. Beyond this, and within either category, there are certain common features and others that reflect differences. Northern Paiute and Shoshoni informants segregate mountain sheep, antelope, moose, deer and elk with the designation "hoofed animals" \text{\textregistered}\text{\textregistered}.\text{\textregistered} (NP). The Southern Paiute make the same grouping, but call these animals "those with horns" \text{\textregistered}\text{\textregistered}\text{\textregistered}. Both descriptions, that is, hoofed and horned, fit the same list of species. Whether bison is added or not in spontaneous listing of the category members depends on its aboriginal distribution. All informants, when questioned specifically about bison, included them in the subset.

None of the groups tested has a clear class label comparable to "insects." However, flies, bees, and other flying insects are separated by speakers of all groups from other "bugs" that have different means of locomotion. Spiders have a separate designation and list of various types in all three languages, as do ants. There is a unit designation that includes specifically lizards and snakes in Southern Paiute, \text{\textregistered}\text{\textregistered}\text{\textregistered}, similar to our concept of "reptile." This designation is apparently not used by speakers of the other two languages, although in each, as well as in Southern Paiute, separate terms are given for lizard and snake, and varieties are listed. Frogs are seen by all groups as unique for their water habitat.

Birds are also recognized as a subgrouping by all informants. The Northern Paiute apply the term \text{\textregistered}\text{\textregistered}\text{\textregistered} to all birds, including ducks and other water species. They divide birds into two primary categories on the basis of flight habits, that is, into "high fliers" and "low fliers." "Low fliers" are those such as grouse, sage hen, mud hen, mountain quail and others that fly only short distances along the ground. "High fliers" are tree dwellers and soaring birds, such as hawks and eagles. The high flier/low flier distinction is also found in Southern Paiute and is known from Papago, a related Uto-Aztecan language (Mathiot 1962). Shoshoni informants did not volunteer this distinction, but admitted that it is a useful way of dividing the birds. The Southern Paiute also hesitate to apply their term for bird, \text{\textregistered}\text{\textregistered}, as freely as the Northern Paiute do their term, \text{\textregistered}. The term \text{\textregistered} is
used more commonly by the Southern Paiute for "little birds," while big birds are referred to by name, or collectively as /piawiçiçi/ or "big little birds." Whether bats are included as birds seems to depend on individual experience. Some informants say that they must be birds, because they fly, while others say that they must be related to mice because of their physical appearance.

In terms of modern biotaxonomy, the Numic classificatory scheme is not highly elaborate, but does have some interesting features. The focus of the terminology, especially the lexemes that name individual plants and animals, is on the generic level, that is, on the level of genera in the Linnaean binominal system. Cattail, cane, tule, mustard, strawberry, antelope, raccoon, jack rabbit and a host of others are all named individually and represent single genus/species designates. Certain higher taxonomic levels are also recognized by all groups, such as "toed" or "horned" animals, snakes, lizards, birds, fish, spiders, and others. These higher level distinctions are more common in animal categories than in those for plants. Maximal focus on the eaten-not eaten distinction rather than on the plant-animal dichotomy gives the scheme a somewhat unique character.

Beyond the generic emphasis and the basic upper level distinctions, all Numic groups also recognize certain species and variety distinctions. These differ from area to area, however, and are usually environmentally predictable. For example, Cedar City and St. George Southern Paiute recognize the species distinction between the single and double needled pinyon, which they label /tịbapí/ and /pàydábapí/, or "pinyon" and "water pinyon," respectively. The distribution of the two species overlaps in their area. Southern Paiute to the west of them use the term /tịbapí/ for Pinus monophylla; those to the east use the same term for Pinus edulis. The Cedar City Southern Paiute also recognize three species of juniper in their environment: the Utah juniper, labeled /waʔapi/; the one-seeded juniper, labeled /payʔwaʔapi/, "water juniper;" and the Rocky Mountain juniper, called /pádísapí/. Cognates of the "juniper" and "water juniper" terms occur in all parts of the Numic area, but plant species designated by the terms differ depending on local conditions. The terms "juniper" and "water juniper" are applied respectively to Utah juniper and tamarisk by the Chemehuevi, to Utah juniper and incense cedar by the Pyramid Lake Northern Paiute, and to the Utah juniper and Rocky Mountain juniper by the Owyhee Shoshoni.

Environmental influences are also seen in designations beyond species to varieties. Some of these are made on the basis of color distinctions, others on growth characteristics. Scrubby service berries are called "coyote's service berry" by the Owyhee Shoshoni. Both Northern Paiute and Southern Paiute recognize "mountain" and "regular" or "valley" types of big sage brush, Artemesia tridentata,
because of differences of color and size. Other variety distinctions are made for similar reasons. Occasionally upper level distinctions are also noted on these bases, or others, but are often not made specific. All groups, for example, feel that pinyon pine and juniper must be closely related, because they occur in the same stands, an ecological observation.

As can be seen from this brief outline of some of the classes and categories of Numic ethnobiology, there are some distinctions, often taxonomically the most general, that are made by all groups, and others that pertain only to particular groups often in particular areas. Environmental influences often affect not only the size but the shape of categories, especially on the most specific levels. Some cultural influences are also present, not only in the basic definitions of what is food and not food in the environment, but also in such examples as the differing uses of the label /maʔdbiʔ/, or "plant," by Southern Paiute horticultural and non-horticultural groups. Although many of the class designations are based on the concept of use, all Numic groups make certain genetic and environmental connections between categories, but do not necessarily systematize these into an overall scheme.

It is hoped that through continued analysis along these lines, the cultural, linguistic, environmental, and historical influences on the Numic ethnobiological systems can be differentiated and applied within the framework of general Numic prehistory.

Notes

1This work is part of a larger study of "Comparative Numic Ethnobiology," sponsored as my doctoral research by a National Institutes of Health Traineeship administered through the University of Pittsburgh. This assistance is gratefully acknowledged.

2See Fowler and Leland (1967) for discussion of Northern Paiute taxonomies and methodology. Transcription of native terms is broadly phonetic. Translations were supplied by informants.

References

Berlin, Brent and Paul Kay
1970 Basic color terms: their universality and evolution.
    Berkeley: University of California Press.
Berreman, Gerald D.

Bright, Jane O. and William Bright

Burling, Robbins

Colby, Benjamin N.

Fowler, Catherine S. and Joy Leland

Frake, Charles O.

Harris, Marvin

Lamb, Sydney


Mathiot, Madeline

Romney, A. Kimball
Sapir, Edward

Sturtevant, William C.

Tyler, Stephen A. (Ed.)
KAWAISU PLANT NAME CATEGORIES

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The aboriginal territory of the Kawaiisu straddled the southern end of the Sierra Nevada range of California. On the eastern side is the Mojave Desert, on the west the slopes leading to the San Joaquin Valley, and in between a mountainous region reaching an altitude of 8400 feet. Linguistically the closest affiliations of the Kawaiisu are to the east and northeast, with the Numic branch of Shoshonean centered in the Great Basin. The ethnobotany of the Kawaiisu reflects their varied environment. While the range, nomenclature and usage of much of their flora shows clearly their ethnobotanical orientation to the Great Basin, there are important instances in which an affiliation with the California culture area to the west is indicated. Thus typically central Californian are their basic vegetable food, the acorn, and their preferred tobacco, *Nicotiana bigelovii* var. *Wallacei* (despite the presence also within their range of the common Great Basin species, *N. attenuata*).

Plant segregates are obviously the indispensable basis of plant nomenclature. If a floral entity has a relatively restricted range, its designation cannot be expected to have a wide distribution unless the name itself has somehow been transferred to another plant form. The latter is then likely to be regarded as an "equivalent" in some significant way. A number of questions arise out of a botanical-lexical coordination. What happens to a name when the limits of a plant segregate is reached? What happens when a plant segregate persists across a major linguistic barrier? Or what if the terms for a plant segregate diverge when, for example, intensive use by different groups calls to their attention different characteristics of the plant? We must here confine ourselves to some of the categories into which plant designations may fall within a single tribal group.

On general diffusional principles it may be assumed that the wider the distribution of a root word through the divisions of a linguistic stock the older the word is apt to be. A plant name present in every Uto-Aztecan language from Aztec to Comanche is likely to belong to an early stratum while another designation limited to a localized usage would appear to reflect a later phase of linguistic development.

Kawaiisu plant names participate in extensive as well as restricted linguistic distributions. Yet informants evinced no awareness
of the existence in their language of any system of plant name categorization. If, as will be suggested in this paper, designations may be classified into several types, the idea emerges from the data, not from the speakers. The material seems to fall conveniently into three broad categories.

I.

The first grouping consists of those names found in more than one of the six divisions of the Shoshonean branch of Uto-Aztecan. The divisions will be indicated as follows: Southern California (C), Hopi (H), Túbatulabal (T), and the Numic languages; Southern Paiute--including Ute and Kawaiisu--(SP), Shoshone-Comanche (S), and Northern Paiute--including Mono--(NP). Since this study is centered on Kawaiisu, every illustrative example will involve SP, and the botanical determinations will refer to those plant segregates found in Kawaiisu territory. It is tempting to trace some basic roots through the Uto-Aztecan stock as a whole, but to do so would require a broader treatment than is possible here. Even within the area under review there are inevitable omissions due to lack of data.

The order of presentation in Category I is: Kawaiisu designation, taxonomic equivalent, common name, and the Shoshonean languages in which the key word is found.

wohody\(^5\) *Pinus sabini*ana D*ougl.* Digger pine. Distribution (involving other *Pinus* spp. but not pinyon): C, H, NP, S, SP, T.


tutupivy *Ephedra* (several spp. usually undifferentiated in Shoshonean terminology). Mormon tea et al. Distribution (both root word and reduplication): C, NP, S, SP, T.

to'ivy *Typha angustifolia* L. and *T. latifolia* L. (the two spp. usually undifferentiated). Cattail. Distribution: C, NP, S, SP, T.

we'evy *Oryzopsis hymenoides* R. and S. Ricker. Indian rice-grass et al. Distribution: NP, S, SP, possibly H.
Scirpus validus Vahl. Tule. Distribution (including other Scirpus spp.): NP, S, SP, T.


Amelanchier alnifolia Nutt. (and varieties). Western serviceberry. Distribution: H, NP, S, SP.


Mentzelia (several spp.). Stick-leaf et al. Distribution: NP, S, SP, T.

Perideridia pringlei C. and R., Nels. and Macbr. (The plant segregate includes other spp.—perhaps other genera.) Yampah, Indian "carrot," "potato" et al. Distribution: NP, S, SP, T.

Nicotiana bigelovii Wats. var. wallacei Gray. Indian tobacco. Distribution: C, NP, S, SP, T and non-Shoshonean Yokuts. Other Nicotiana spp. have other Shoshonean names.

To the second category are assigned those plant names which, on the one hand, give no evidence of any wide distribution among Shoshonean languages—at least so far as available data indicate—and, on the other, seem not to be susceptible to the kind of localized lexical analysis which forms the basis of Category III. The range of the species involved is not so restricted as to make them unknown to Shoshonean speakers outside the Kawaiisu area. Designations may, of course, be borrowed from neighboring non-Shoshoneans. What is needed is a detailed study of the ethnobotany of the entire region. In the meantime, these Kawaiisu plant names give every evidence of being well established in the aboriginal vocabulary. Resisting folk-etymological explanations, they must be accepted as local developments of Kawaiisu nomenclature until the discovery of cognates supports a contrary view.

Most of the names of the seven oak species used by the Kawaiisu as a food source seem to belong in this category. Since balonaphagy is a characteristic of central California rather than of the Great Basin, it may be that Shoshonean speakers to the east and northeast
had no incentive to distinguish between oak species. The Kawaiisu not only make such distinctions but evaluate the acorns of each species on the basis of taste and hence of desirability as food.

Wick R. Miller lists two Uto-Aztecan cognate sets meaning "acorn." He finds one, *kwi*, in four Shoshonean divisions (C, H, SP, T), and the other, *wi*, in three (C, SP, S). Assuming that these two proto-forms did not originate in one, we apparently have a Kawaiisu cognate for each: k'wija, Quercus kelloggii Newb. Black oak, and pawi'abi (apparently pa+w'i'a), Q. chrysophlepis Liebm. Canyon oak. The other five Kawaiisu species are:

ma'ahnidy Q. douglasii H. and A. Blue oak.

mucita Q. dumosa Nutt. Scrub oak.

saasi Q. wislizenii A., DC. Live oak.

'ividy Q. lobata Nees, Roble. Valley or White oak.

tuk'wa Q. breweri Engl. = Q. garryana var. breweri Engl. Oregon or Brewer's oak.

Aside from the oaks, the following plant segregates, among others, seem to qualify for inclusion in Category II. All of them have a place in Kawaiisu terminology and usage.

'tavaanaryby Rumex hymenosepalus Torr., Canaigre. Wild rhubarb.

'tuuparaby Fremontodendron californicum Cov. Slippery elm.

hu'upivy Lycium andersonii Gray. Water jacket or Desert thorn.

kayeezi Lomatium californicum Nutt., Math. and Const.

keeziwahntyby Cerococarpus ledifolius Nutt. Mountain mahogany. According to the Kawaiisu, Mountain Lion's forelegs were made out of the hard wood of this arborescent shrub.

kyyvyyzi Lomatium utriculatum Nutt., C. and R.


naara Melica imperfecta Trin. Melic grass.
pawiču'uvy  Alnus rhombifolia  Nutt.  White alder.

pyysivy  Artemisia dracunculus  L.  Tarragon or Sagewort.
    Also  Lythrum californicum  T.  and G.  California
    loosestrife.

puugysivy  Abies concolor  Lindl.  and Gord.  White fir.

In a sense Category II is a catch-all. In it are placed plant
designations which seem at present not to belong to Categories I or
III. As more information becomes accessible, the number of plant
segregates assigned to it will undoubtedly decrease. Whether the
category will disappear altogether is not currently predictable.

III.

Plant nomenclature at times yields clear meaning in the Kawai-
isu language. The names may arise out of folk-etymology or they may
be prompted by a striking similarity with other familiar things. A
plant may be called "tail" because it "looks like" a tail, and in this
instance, as we shall see, the image extends far beyond Kawaiisu. It
is often, however, difficult to determine whether a designation is
actually a name or a description. Is a plant "red-flowered" or is it
called "Red Flower"? An informant gave "rattlesnake-medicine" as the
name of a plant. "It is just a name," she said, and she did not know
whether it was used on snake bites. Another informant insisted that
it was "bad" because it attracts snakes. In any case, the distinction
between designation and description may not be precise in native
nomenclature.

Four types of what might be termed "meaningful designations"
are here differentiated though at no time did informants show any con-
sciousness of them.

1) Names derived from what, to the Kawaiisu, are the plants'
most conspicuous features.

caruwawagadyby  <caaruu, 'rattle,' hence 'characterized by
 rattling,'  Penstemon incertus  Brandg.  Also  P. laetus
 Gray.  Also  Argemone munita  Dur.  and Hilg., Chica-

cu'wa'nidyby  'stiff, rigid,'  Senecio douglasii  DC.
 Shrubby butterweed. "Quite woody." Also two spp.
 of  Cordylanthus, Bird's beak, one of which has the
 species name,  rigidus.
hopakidyby 'holey,' probably 'hollow,' Lonicera interrupta Benth. Honeysuckle. Hollow stem.


punuhodyby <punuhody (recording uncertain), 'odor,' hence 'odoriferous,' Trichostema lanceolatum Benth. Vinegar weed. "Strongly scented."

sanaco'ovi <sana- 'pitch, gum,' Haplopappus linearifolium DC. Stenotopsis. "Usually resinous."


2) Names which associate plants with animals because of an alleged similarity to some physical characteristic or behavior pattern, real or mythical.

The appearance of the flower-head or spike of various grasses has given rise in many languages to the designation "tail" or, specifically, reference to a certain animal's tail.

k'asijavy <k'asi- 'tail,' Hordeum jubatum L. Fox-tail or Squirrel-tail. Also Sitania jubatum J. C. Smith. Squirrel-tail.

kamynagavivi 'rabbit-ear,' Solidago californica Nutt. and S. confinis Gray. Goldenrod.

tyhyjanagavivi 'deer-ear' Wyethia ovata T. and G.

tyhyjago'opi 'deer-tobacco' (ko'opi), Turricula parryi Gray, Macbr. Coyote tobacco.

hu'ujugahnviv <'hu'uja '(a small bird) house,' Eriophyllum ambiguum Gray. Woolly daisy. Bird is said to make his nest from material of this plant.

čigypiwanavy 'lizard-net,' Cuscuta californica Choisy, Dodder. Web-like parasite growing on certain plants.


pog'ityna hy(g)apiina lit., 'grizzly bear, his trap,' Clematis ligusticifolia Nutt. Virgin's bower. A vine "climbing over bushes and in trees." Bear used the vine as a cord to catch small animals and birds.


3) Names which indicate an interrelationship between plants. Such association may be expressed through prefixes, suffixes or adjectival modifiers.

A) Prefixes:

mahagu'u maha- 'field,' i.e., open brush area, +ku'u (q.v. in Category I). Prefixed form refers to M. veatchiana Kell. and apparently to M. albicaulis Dougl. Stick-leaf or Blazing star.10

puhidu'u pahi- 'green'+tu'u Pholisma arenarium Nutt. Prefixed form refers to 'wild asparagus;'11 specimen not obtained, but see below under C), Adjectival Modifiers. Modern usage: Asparagus.

pa(a)'avaanary pa-/pa- 'water'+avaanary (q.v. in Category II above), Rumex salicifolius Weinn. Willow-leaved dock. "Grows in wet places."
B) Suffixes:

wa'adybyre'edy -re'edy, 'like'+wa'ady (q.v. in Category I above), *Cupressus macrocarpus* Hartw. Monterey cypress.


ma'ahnidybyrukutty -ruk/-ruk'wa, 'under'+ma'ahnidy (q.v. in Category II above), i.e., 'grows under the Blue oak,' *Achillea lanulosa* Nutt. Western yarrow.

pawi'abyrukutty 'under the Canyon oak,' *Osmorhiza brachypoda* Torr. Sweet Cicely.

C) Adjectival Modifiers:

An adjective, either preceding or following a plant name, identifies another plant and thus indicates a relationship between the two. Such modifiers are: 'akanuuipi'i and 'yv(e)'epii'i, 'small, short' (no clear difference in meaning); keewowady, 'mountainous' (i.e., growing at a higher elevation); yuwaava'adaaka, 'desert' (lit., 'its nothingness' yuwaaty--see Category 3) below).

puhidi'u keewowady 'mountain puhidi'u (see above), *Pterospora andromeda* Nutt. Pindrops. A root parasite.

kaaruukytyby keewowady 'mountain kaaruukytyby,' *Monardella odoratissima* Benth. Mountain monardella. Note common name. (kaaruukytyby is *M. viridis* Jeps. Green monardella.)

paako'oryby Yuwaava'adaaka 'desert paako'oryby,' *Eriogonum inflatum* Torr. and Frem. Desert trumpet. (paako'oryby is identified as two varieties of *E. nudum* Dougl.).

3) Names which indicate analogies with man or his culture.

'y'ysaaawuvv 'old men!' ('yssaazi, pl. 'y'ysaaawiw, 'old man'), *Elymus triticoides* Buckl. Rye-grass. Possibly the flower head is thought to resemble a beard. Cf. *Polemonium monspetiensis*, commonly called Beard-grass.

nygo'odyby <nygo'o-'cut,' Scirpus microcarpus Presl. Bulrush. Also Juncus xiphioides E. Meyer, Rush. Apparently so called because of the sharp edges of
the leaves.

tybikagivy 'rock-necklace' (or 'collar'), Euphorbia
albomarginata T. and G. Rattlesnake weed.

tybinawivy 'root-apron,' Cheilanthes covillei Maxon. Lip-fern. Also Pellaea mucronata D.C. Eaton, and
P. mucronata var. californica Munz and Jtn. Bird's-foot cliffbrake.

tyvaposonym by 'pinyon-needle,' Chrysothamnus nauseosus
Pallas, Britt. Rabbitbrush. Twigs used to pierce and 'thread' pinyon nuts, said to improve the taste.

wa'adybigidynyby 'juniper cake (pigivy),' Lotus purshianus
Benth., Clem. and Clem. Spanish clover. The juniper 'cake' is apparently placed upon a layer of the
leaves to harden.

In a negative sense, there belongs here:

yuwaatyby <yuwaaty, 'nothing' (i.e., good for nothing),
Rhus diversiloba T. and G. Poison oak.

The classification of Kawaiisu plant names into the above
categories is an artificial one since informants showed no aware-
ness of it. The arrangement suggested itself only after the
ethnobotanical material had been gathered. The result, however, is
to point out the variety of ways in which plant designations may have
been acquired. While some botanical terms belong to a basic level of
proto-Uto-Aztecan, proto-Shoshonean or proto-Nemic, others reflect
local ideology and mythology. As with most aspects of culture, the
line between diffusion and 'tribal' innovation can never be precise.
One thing is clear: the Kawaiisu never lacked for sources of botani-
cal nomenclature.

Notes

1 This paper is based upon data gathered in the field during the
summers of 1936 to 1940. A return visit in August, 1970, revealed that
my informants and interpreter had died. While a few Kawaiisu speakers
remain, the details of the aboriginal culture can no longer be compre-
hensively recorded.
2 A map of Kawaiisu territory was published in the American Anthropologist, vol. 40 (1938), p. 636. The boundary lines must be regarded as approximate.

3 While the Numic branch of Uto-Aztecans usually said to consist of four languages—Southern Paiute, Shoshone-Cayenne, Northern Paiute and Mono—I find it more practical, in view of the data at hand, to treat the last two as one. Thus Shoshonean in this paper comprises six divisions instead of seven.

4 The Kawaiisu ethnobotanical data in Category I, except material pertaining to the genera Scirpus, Descurainia and Perideridia, are taken from my doctoral dissertation submitted to Yale University (Zigmond 1941). The dissertation has recently (1970) been microfilmed and xeroxed. All other illustrative material in this paper is derived from an unpublished Kawaiisu Ethnobotany.

5 Most Kawaiisu plant names—and many other substantives—end in unstressed -by, -py, or -vy. The word thus terminated usually refers to the whole plant. Without the final syllable, the designation is apt to indicate the usable part (seed, nut, berry—though there is also a special suffix for the last named). Thus wohody-by, tyva-py, we'evy, etc.

6 Wick R. Miller (1967: 17).

7 Botanical comments in double quotation marks (" ) are taken from standard botanical manuals.

8 This word accounts for the first element in the plant designation. I was unable to obtain an analysis of the other elements.

9 ko'opi is the Kawaiisu designation for Nicotiana attenuata Torr. The stem is apparently limited to So. Paiute.

10 Cf. Northern Paiute kuha, "blazing star" (Fowler and Leland 1967: 384).


References

Fowler, Catherine S., and Joy Leland
Miller, Wick R.
1967 Uto-Aztecan cognate sets. University of California Publica-
tions in Linguistics 48.

Zigmond, Maurice L.
1941 Ethnobotanical studies among California and Great Basin
that only English is spoken in the home since they have more facility with this language.

Pregnancy and Childbirth

During aboriginal times pregnancy and childbirth were surrounded by a variety of behavioral restrictions for both parents in order to insure a safe delivery and a healthy infant. For instance, presence at the birth process with all its attendant rituals was restricted to women only. Today, Northern Paiute women attend prenatal clinics either on the reservation, at the nearest United States Public Health Service hospital or at a county hospital under contract to the USPHS. Generally babies are born at the county hospital or at the USPHS hospital, if the woman gets there in time. Both the clinics and the delivery rooms are attended by male physicians. The aboriginal practice of "cooking the milk" immediately following delivery is not attempted in the hospital. The traditional practice of keeping the neonate in a boat basket for the first five days of life is not feasible in the hospital setting. Only one woman on the reservation knows how to make the boat basket and has not made one for years. Mother and neonate usually remain in the hospital for three to five days prior to returning home unless there are post-partum complications.

Naming of infants is in distinct contrast to naming in aboriginal times, when an infant named himself by the first words he spoke. Today's infant is named either before birth or prior to leaving the hospital because a name is needed for the birth certificate. A fetus may receive a nickname and retain it after birth, unlike the aboriginal practice of nicknaming an individual in relation to some event in his life.

As these examples indicate, there are extensive changes in the behavior surrounding pregnancy and childbirth due to the introduction of western medical practices.

From Birth to Two Years

The Northern Paiute have retained bilateral kinship reckoning so that either grandmother of the first born child makes or buys the buckskin cradleboard, commonly called a hoop or baby basket. Succeeding children usually use the same hoop with only the worn out parts replaced, usually the shade (tso ko' no). As in aboriginal times the shade has a woven design that designates the sex of the infant but many of the mothers simply consider the design pretty without knowing what it means.

In general infants spend a great deal of time in the hoop during their early months. Use of the hoop is discontinued between the ages of
seven months to two and a half years, either when the child grows out of it or when he begins walking, whichever comes first. The making of a hoop is an arduous, time-consuming process so that the series of graduated hoops used in aboriginal times is no longer considered practical. Most of the mothers do not know how to make the hoop and must rely on their mothers or mothers-in-law to provide them with one. A purchased hoop is an expensive item and would be considered a luxury to buy. In aboriginal times an infant was kept in the hoop until he was walking, which was most suitable to a pedestrian semi-nomadic group.

The hoop, or cradleboard, remains a practical item, however, in baby care. Infants are easily carried with the mother wherever she goes. They may be placed under a table and allowed to sleep, leaving the mother free to attend to whatever she has to do. An infant cannot roll off a cradleboard or hurt himself if left alone. When riding in a car that comes to a sudden stop the infant is completely protected from injury if he falls or strikes the dashboard. The shade protects the baby from direct sunlight or sudden bumps. Also infants seem quite content in their hoops.

Although the navel cord is still being saved it is doubtful that this practice will be retained much longer. Most of the mothers interviewed had not heard of the reasons for saving the navel cord but only did so because their mother or mother-in-law asked them to. Only one mother, of those that saved the cords, knew where they were at the time of the interview. There was no attempt at burying the girls' cord to insure her being a good gatherer, or at placing the boys' cord in a juniper bush to insure his being a good hunter. The change from hunting and gathering to a cash economy seems to have offset this ritual and made it meaningless.

Only one mother stated that she breast fed her babies. Two mothers stated that they had tried to breast feed but had "dried up" too soon and so had switched to the bottle method. Other mothers stated that they had never tried breast feeding. Since the baby had been on the bottle in the hospital, they continued the practice. This contrasts with the aboriginal practice of breast feeding. Also grandmothers contend that since mothers are not "cooking their milk" they do not have enough milk for their infants.

Although half of the mothers interviewed stated that they tried to feed their babies on schedule, they admitted that they eventually fed their babies on demand. Whenever a baby cried, the first attempt to pacify him was by offering food. Failing results from this, if offering a pacifier such as the cord from the hoop, or if pushing about a toy did not stop the crying, then the infant was checked to see if it was wet. A crying infant who was not hungry, who was dry, and who could not be distracted, was considered sick. This same series of attempts to pacify a crying infant, in the same order, was used aboriginally.
Infants are not generally cuddled or held while being fed, since they are not removed from the cradleboard during feeding. Although the hoop minimizes holding and cuddling, even when the child is out of the cradleboard he is neither cuddled nor closely held. Close physical contact was never observed between adults of either sex and was seen only in elementary school girls holding hands, or boys fighting. (No questions were raised about this at the time of field work, but it may be speculated to have some relationship to beliefs about individuality and independence that are fostered early in childhood.) There is therefore no association with loss of holding when the infant is weaned. Weaning from the bottle to a cup begins at an age of six months to one year. The bottle is stopped completely anywhere between one to three years of age. The woman who breast fed her babies stated that she abruptly stopped when she knew she was pregnant with the next child.

Informants stated that the weaning process in aboriginal times was late and lenient. However, the practice of leaving the toddler at the campsite under the care of a grandmother while the mother was gone gathering all day leads to the speculation that weaning was abrupt in aboriginal times.

Although no infant was ever observed crawling or creeping, the possibility exists that in some homes infants were allowed to crawl on the floor or on the beds. Most infants of approximately one year were observed to be walking. An infant is placed on the floor and assisted to walk or is held in the lap of an adult and encouraged to walk there. A large fat baby is encouraged to walk sooner. Whether or not infants were encouraged to walk early during aboriginal times is not known.

Bowel training is started between the ages of six months and two years. The general attitude toward toilet training is said to be one of leniency. One mother stated that her ten months old child was trained in one week. Two mothers stated that training took three months. Two mothers stated that girls were trained by six months but boys took one and one half years to train regardless of the age at which training was begun. According to the public health nurse, enuresis among six year old boys is not unusual. This statement needs further investigation since it may be an indication that bowel and bladder training is not as lenient as is asserted.

Today's infants are clothed from diapers to pull-on jeans, in contrast to the nudity of children in aboriginal times, and this has probably had a great effect on toilet training practices. Also the use of indoor and outdoor toilets for elimination contrasts with practices in aboriginal times when these facilities were unavailable. Informants are vague about aboriginal toilet training practices, simply stating that children could "go" anywhere they wanted to but were taught by example or were "talked to" and shown that the house was not appropriate for bodily wastes.
From Two to Six Years

There is no definitely set time at which the infant is considered by the Northern Paiute to have become a child. Since infancy is defined for the purpose of this study as the period in which needs are met by others, and childhood is defined as the period of learning to meet one's own needs, a question was asked to determine at what age mothers generally considered that their children were capable of caring for themselves.

Beginning skills in self reliance develop between the ages of one to two and a half. At this time children are expected to explore their environment away from the mother, discover strengths and weaknesses in relation to skills, and spend more time with siblings and peers than with parents. Need gratification comes more through individual effort or sibling assistance than from the adult group. Learning to dress oneself is said to begin between the ages of two and three. Learning to feed oneself is said to begin between the ages of one and two. Playing out of doors without parental supervision is said to come between the ages of two and two and a half although one mother stated that she allowed her children outside without supervision at the age of one. In most cases the child is under the supervision of an older sibling. Children under four were never observed to stray outside the confines of their own yard.

Each of these areas contrasts with aboriginal self reliance training. Aboriginal child wore no clothing so that dressing was not a necessary skill. Today learning to feed oneself includes the proper use of eating utensils and sitting at a table, neither of which was necessary aboriginally. In aboriginal times parents did not supervise out-of-doors play, grandparents did, so that the contrast between aboriginal practices and those of today is in the present supervision by the eldest sibling. Aboriginal the grandparents taught most of the homemaking, hunting and craft skills to the children left at the campsite, which may have implications for the loss of skill in making the cradleboard that is seen among today's mothers.

Mothers agreed that parents alone have the right to punish children. The most common forms of punishment seen were: "talking to" the child and explaining that what he was doing was wrong, scolding, isolation in a corner or in a room away from the mother, a threatened spanking with a stick or belt (rarely followed through), ear pulling, and in more serious offenses, a shaking. In every case physical punishment is said to be the last resort and to be avoided as far as possible.

Although mothers admitted that their children became angry when punished they denied that their children ever retaliated by striking out. The most common form of retaliation described was that of "talking back" or name calling. In this case the mothers stated that they
"teased them back" or isolated the child till he was in a better humor. Informants state that these forms of punishment were used during "the old days" and that they are the right way to punish children. They deny, however, that children ever "talked back" aboriginally and said that only "bad children" did so.

The methods of punishment and the sanctions against aggressive and competitive behavior seem to be direct carryovers from aboriginal times, when cooperation was considered imperative for survival. Since the most common reason for punishment was fighting between siblings and the most common form of punishment was "talking to" a child or removal of a desired object, sanctions against aggressive behavior were reinforced through the method of punishment.

From Six to Twelve Years

The school-age child is given increasing responsibilities about the house. He is expected to run errands, supervise the play of younger siblings, and perform certain designated chores. Elder children are expected to be generous and patient with their younger siblings but are not expected to be "bossy" even if they are held responsible for supervision. Although mothers agreed that children should have tasks to do, there was little agreement on whether or not the child should be made to do the job well, if at all. Half of the mothers stated that they expected their children to obey right away but admitted that they rarely got an immediate response. A "good child" is described as one who is obedient, does his work well, does not tease or fight with siblings or peers, is not bossy, is neat and clean, and is not lazy.

The description of the "good child" is almost identical with that given for the aboriginal child. The major difference here is in the types of chores given to the contemporary Northern Paiute child. Today's child is expected to perform much the same types of chores as described by Ann and Jack Fisher for Orchard Town, U.S.A.4 On the other hand, the aboriginal child in the same age group was learning and practicing skills related to hunting and gathering and was made to feel that what he was doing was a contribution to the camp group as well as the household.

The major contrast however is in the fact that today's child spends most of his day in school. Children begin first grade during their sixth year and remain in the on-reservation public elementary school until they have completed the sixth grade. The school is a typical western rural school with three classrooms for the six grades. The school is staffed with three full time teachers, a visiting dentist, a school nurse and a music teacher.

The first and second grade teacher describes her students generally as "having a lack of self-discipline." They are unable to work
alone on a project or an assignment, but constantly seek assistance from either teacher or classmates. She does find the children willing to try to learn, eager to participate in class activities, and happy-go-lucky about everything.

The third and fourth grade teacher describes a different sort of class. These students are avid spellers but reading is a problem. Class participation remains at a fairly high level but with the fourth graders showing less enthusiasm than the third graders.

Compared to the other two classrooms, the fifth and sixth grades are quiet and subdued. The children are more involved in individual assignments than with group work and seem to enjoy the responsibility of working alone.

For many of the children, elementary school is their first consistent contact with non-Indians. Public school provides the Indian child with an exposure to the values of contemporary American society such as competitiveness, aggressiveness, leadership and individual achievement. During school hours these behaviors are rewarded. When the child returns home from school these same behaviors are punished. The difference in climate between the three classrooms seems to reflect a developing sense of awareness of the difference between Indian and White values and a choice between the two.

Aboriginally the purification rites which terminated childhood and signified adult status came when the child was approximately twelve. This was the time when the child had proven his ability to be a productive member of the group. Today the twelve year old simply continues on in school.

Summary and Conclusions

Directed change programs for the Northern Paiute have had repercussions on the child rearing practices. Few areas of Northern Paiute child life remain untouched by the effects of culture contact. Two areas of change, hospitalization for childbirth and public school education, have had major effects on other areas as well.

As a direct result of hospitalization for childbirth an entire series of beliefs and practices centering about childbirth has been virtually dropped. Isolation of men from the birth process is no longer required nor are the services of a midwife. Young women no longer "cook their milk" following delivery to insure an abundant milk supply and grandmothers state that this is the reason why babies are bottle fed today. No measures are taken with the afterbirth by hospital personnel to insure continued pregnancies. The infant is not kept in the traditional boat basket for the first five days of life, and the art of
making the boat basket is dying out. Post-partum restrictions on both parents are no longer adhered to; instead the mother takes her infant to well-baby clinic, sees to it that he has his shots, and welcomes the public health nurse into her home for follow-up care. In none of these areas can the grandmother assist since her beliefs and practices relating to baby care are in direct contrast to her daughters' practices. The grandmother, once the most significant person in guiding child rearing practices, now finds her wisdom and services obsolete.

Public school education is not new to the Northern Paiute but the many changes in educational policies over the last fifty years have met with some resistance. Having an elementary school on the reservation is considered a good thing, but the subjects that are taught are open to criticism. Many parents and grandparents would prefer vocational training to prepare their children for something rather than education for education's sake. The fact that elementary school prepares children for high school, which prepares children for college, strikes them as a ridiculous waste of time. They are interested in an education that would prepare children to work for a living. It is their belief that the American school system prepares people to be lazy since they don't learn to do anything useful in school. The high drop-out rate among Indian children in high school may be indicative of the fact that neither the parents nor the child see any advantage in continuing to attend a school that offers little vocational training. If there is no obvious usefulness to a project, the Paiute will not endorse it.

In addition to this, parents find public school education a threat to their teachings, since the values taught in school are in direct contrast to those taught at home. Public school education places a great deal of emphasis upon individualism and competitiveness, contrary to what is valued in the home. The conflicts engendered in children by these diametrically opposed views also may be reflected by the drop-out rate. Any child who is competitive, aggressive, and individualistic is considered by his peers to be non-Indian and becomes an outcast. Growing awareness by the students of conflict between Indian and White values may be the basis for the differences in behavior observed between the classes in the elementary school.

The aboriginal Northern Paiute were well adapted culturally for the environment in which they lived. It is therefore no surprise that they are equally as able to adapt themselves to the material advantages provided by a dominant culture. The major areas of change can be seen to have a direct relationship to the changes in material culture that have been adopted, as well as to changes directed by government agencies. It seems that the Northern Paiute are a pragmatic people; modern methods that prove themselves to be useful are more readily adopted than those whose usefulness is in question. If an aboriginal custom such as the saving of the navel cord no longer seems efficacious, it tends to die out. Any agency planning change for the Northern Paiute should first look to see whether or not the people would consider the change useful
for them and second should attempt to plan the change in such a way as to fit closely with their value system.

Notes

1 The research on which this paper is based was funded by United States Public Health Service grant number TI NU 5001, under the direction of Boston University Graduate School.

2 The Northern Paiutes discussed in this paper are the direct descendants of the aboriginal Kiyvi dokado band occupying the same territory. See Shaw (1965), Park (1938) and Wheat (1967).

3 For a more complete discussion of aboriginal child rearing practices see Brink (1969).

4 See Minturn and Lambert (1964) and Whiting (1963).

References

Brink, Pamela J.

Foster, George M.

Minturn, Leigh and William M. Lambert
1964 Mothers of six cultures: antecedents of child rearing. New York: John Wiley and Sons, Inc.

Park, Willard Z.

Shaw, Nellie Harner

Wheat, Margaret

Whiting, Beatrice B.
Currently, there are three identifiable categories of life styles among the Ute which approximate real groups in the social and political structure. They are: Mainstreamers, whose style is consistent with that considered "normal" in the dominant society; Working Families, a relatively stable, employed group, members of which prefer to base their social relationships among their relatives; and Poor Households, representing the families headed by females, who derive most of their income from public assistance.

The data on which this conceptualization is based were collected over the past two and one-half years through participant observation and the extensive interviewing of members of sixty-five reservation households. The research is part of a larger project designed to document Ute social process through time. For baseline data I have utilized information collected by Stewart (1942), Lang (1954), Jones (1955), Witherspoon (1961), and Jorgensen (1964) at different intervals over the past thirty years. In particular, I have relied heavily on Lang's account of the Utes just prior to the beginning of their economic development.

**Reservation Life Before Development**

In the early 1950's, Lang conceptualized the Ute society as having two distinct groups: the mixed-bloods and the full-bloods. For the most part the mixed-bloods controlled the reservation's formal political organization and bureaucratic structure without engaging in the full-blood's social structure. Many were active members of the Mormon Church and therefore maintained a life style considered "normal" for the White population in the region. It has been suggested by Lang (1954: 214) that many would have severed their tribal ties had it not been for the economic advantages they derived from employment by the tribe and from special tax exemptions. The mixed-bloods also believed they could help their full-blood counterparts achieve goals they could not achieve on their own. In a sense they played the role of reservation caretakers.

The full-bloods, on the other hand, were socially and economically isolated from the White society in spite of the fact that many White farmers lived on the reservation. Their poor standard of living reflected their low occupational status. Only a few full-blood families had managed to become financially solvent in private ranching operations or through unskilled jobs in the Agency or tribe. A majority of the full-bloods depended on casual labor, subsistence farming, grazing leases, and public assistance as means of support.

Generally, the lives of the full-bloods revolved about the extended family circle or household. This institution was marked by a system of sharing and leveling: those persons who enjoyed a windfall were expected to share their prosperity throughout the kin group.
Beyond this group an individual could gain status through participation in reservation institutions such as the Sun Dance or Peyote cult. The formal political structure was considered to be a White institution and, as other White institutions, was largely ignored.

Events of the past two decades changed this situation. The formerly fatalistic Ute full-bloods became politically active when the tribe first began receiving money. Ultimately they managed to legally remove the mixed-bloods from the tribe and secure a major portion of the money in individual payments. The remaining funds have been subsequently invested in such projects as a large cattle enterprise, a custom hunting enterprise, a small furniture factory, and a large recreation/motel complex. These tribal enterprises, and the many positions opened by the exodus of the mixed-bloods, created new employment opportunities for many Utes who had previously known only a life of welfare and tribal payments. The higher average income provided by these positions has led in part to the current differences in life styles among the three groups I now describe.

Mainstreamers

Perhaps the most visible effect this economic change has had is on the people I consider the Mainstreamers. Recall that some full-bloods' families had achieved solvency under the former conditions of economic deprivation. It was this same group or the children of this group which took over the high-paying, high-status positions in the tribal organization. In a sense, their new position is similar to that held formerly by the mixed-bloods, although their tribal status is less tenuous. Most members of the mainstream segment take care to maintain their "Indian-ness" (i.e., native language, attendance at pow-wows, peyote meetings, and the Sun Dance). While they profess to be openly hostile toward Whites and to involve themselves in defending and promoting Indian culture, they quietly identify with the dominant middle-class society. As one informant put it, "the people on top need the people on the bottom; we have to treat them right."

Generally these people identify with work success and job advancement. They see themselves as managers, decision-makers, and white-collar workers. One of the surest means to achieve this goal is through membership on the Tribal Council. Besides the fact that it pays a relatively high salary, membership usually leads to secure employment after a term is finished. Even with unemployment running over 60 per cent, it is common to see a Mainstreamer re-hired in another position as soon as his former position is terminated. Not infrequently is the wife employed in some tribal administrative committee or clerical position.

The Mainstreamers most closely resemble the White middle class in their family structure. Individuals are usually married and living in
stable nuclear families. Contact with close relatives is maintained, but it plays a secondary role to relationships within the immediate family. The males assume "normal" responsibility in the household and in the discipline of the children. Male-female relationships tend to be equalitarian, with both partners assuming an active role in reservation or community affairs. The Mainstreamers are relatively uninvolved with other reservation segments. In fact, the parents endeavor to keep their children out of the close-knit age groups formed by the other segments.

Excessive or public drinking is not condoned among the Mainstreamers. One arrest while under the influence of alcohol may result in the loss of one's political and economic positions. This is not to imply that many individuals in this group do not drink. But most often it is done away from the reservation.

Up until the past few years, the Mainstreamers did not represent what could be termed a viable political faction. However, as this group has become increasingly more identified with economic development, it now seeks to elect tribal councils which will promote its economic interest. At one time the Utes only voted for members of their extended families, but the Mainstreamers have broken with this tradition.

In sum, the Mainstreamers have achieved a life style comparable to that of the dominant White American society. However, this feat has only been possible because of the existence of the current reservation economic system. They, therefore, tend religiously to protect their "Indian-ness" while they quietly attempt to change the life styles of the other groups.

The Working Families

The people categorized as Working Families include most of those households with a male head who is steadily employed either in his own ranching operation or by the tribe in some unskilled or semi-skilled occupation. The jobs include such positions as ditch-riders, game wardens, custodians, heavy equipment operators, cowboys, and bus drivers. Although these males have had continuous employment for many years, they do not identify with work success or job advancement, as do the Mainstreamers. As one individual described his job in the tribe, "I could be doing the same thing at home, but up here I get paid for it." The jobs are frequently low in pay and status, but they provide the means of avoiding the extreme poverty of other Indians while allowing their holders to maximize the pleasures of life in their families and peer groups. It is very rare when any of the males in this category actively seek election to the Tribal Council or some administrative post.

The working males are usually married and maintain a relatively stable family. It is not uncommon to find the home occupied by married
children and grandchildren. Frequently additional children, related to some household member, are adopted or at least given temporary shelter. All members share equally in what resources the working male is able to obtain. However, this sharing does not include distant relatives.

The female maintains intense relationships with her mother and sisters. The male seeks out his own peer group to spend his leisure time drinking, hunting, or visiting. Many of these males are active participants in the Native American Church. The children of the Working Families form tightly structured peer groups of their own ages. To them the home is a place to sleep and pick up meals. It is not uncommon for a child, when not in school, to leave the home after breakfast and not return until the evening meal. Generally, child discipline is left solely to the female.

The Working Families resent the existing inequalities in distribution of reservation resources. In a sense, they are ambivalent about proceeding with economic development. They desire the jobs that development creates but are apprehensive about the change it might bring in their life style. They would rather have the immediate benefits of per capita payments than see the Council invest tribal funds in long-range programs that they think will benefit only the Mainstreamers. As one young married woman put it, "We want things now; we want to live modern. We can't have things if the Business Committee ties our money up in projects."

In this group, drinking and violence are identified as masculine activities. The working males drink heavily but usually on weekends. One male said, "There are days I will show up for work drunk or not show up at all, but I know just how much I can get away with before I get into trouble or lose my job." The wife will tolerate the drinking as long as the male can remain as breadwinner. However, once he is dismissed from his job, the marriage is often terminated.

Generally, the Working Families are quite stable. Due to their wage-earning capacity, the males carry a relatively high status within the family group. Although peer group pressure continues to segregate the family by age and sex, the immediate family tends to take precedence over the extended family group.

The Poor Households

The final category is composed of poor people living in female-based households, with marginal males. The household composition is unstable, and the marriage structure is relatively weak. The Poor Household can best be described as an aggregate of female relatives sharing limited resources. Most of the income of people in this category is derived from public assistance. If the female head is
married, the husband carries little status in the management of the household. Usually the home is owned by the female, and any income from public assistance is channeled through her. Thus, she is able to maintain authority over the members. She is in charge of discipline of the children, whether they are grandchildren or otherwise. She makes the final decisions as to which adults can maintain residence in the household.

The male in this category has had his role changed radically in the past two decades. Beginning in the 1950's with the first per capita payments, the male found his wife and children independent of what support he could provide. Previously, the male would run a few head of cattle or pick up seasonal labor as the family's needs dictated. This marginal activity was unnecessary during the eight years of relatively high individual payments. With his family or household financially solvent, the male was permitted to invest his time and new income to intensify his relationships with his male peer group. When the payments ended in 1959 and he had to seek again his former means of support, he found that they were no longer available to him. Seasonal labor has disappeared with the mechanization of local agriculture. The land he once used to run his cattle on has been taken over by the tribe for more efficient livestock production. Thus, the male has little alternative but to attach himself to a household that will accept his low productivity.

Offered his marginal status, the male now finds emotional satisfaction within his peer group: a social relationship that is frequently based on excessive drinking. One informant explained that the only time he felt like a man was when he was "out drinking with his buddies." All too often his drinking leads to conflict within his household, and ultimately he is turned out of the home. One male reported that he had lived in five different households in the past year. As one female described it, "I don't care who it is, when they come around my house drinking, I call the police to have them arrested; I don't want even my brothers drinking around my kids."

Providing these men with employment frequently solves their problems, particularly among those who have wives to encourage them to stay with a job. In some cases, however, the male finds his interaction within the peer group so significant that he does not wish to give it up. He does not see the benefits gained through secure employment as much of a bargain. Currently, he is able to fish or hunt whenever he desires, visit with relatives, or drink with close companions. There is an expressed belief that the tribe will eventually take care of his financial needs as soon as the situation becomes critical. As one individual described his attitude toward a job he had just quit, "It tied me down; you know, the summer is for Indians."

In summary, the most visible difference between the three categories discussed above is in the role of the male within the household structure. While the male has increased his status in the first two,
the male in the Poor Household has become increasingly more marginal. In all three segments, it is noteworthy that the adult female has become more aggressive, articulate, and politically active in the community.

Conclusion

It is evident that the increase in reservation opportunity through economic development in the past decade has accelerated the rate of Ute social change more than the direct payments of the 1950's. A number of traditional full-blood Utes have taken advantage of the new situation. The increase in income has provided them with the means to support a life style similar to that of the dominant middle-class society. The other segments of the reservation society have demonstrated that they do not share the same aspirations as their Mainstream counterparts. Although a large number have readily accepted secure employment, they have not identified with economic development to the same degree as the Mainstreamers. They do not view work as a means of mobility to higher reservation status. Rather, they have utilized the higher income to intensify the satisfaction they gain within their limited family and peer groups.

Continuing unemployment hampers the change process among the families included in the Poor Household category. As yet, the expanding opportunities of the reservation have not affected their life style. It is predictable that a number of the members of this segment will move into the other categories as their income increases. However, it is evident that some individuals will not change their life style to fit the demands of the other structures. Such individuals simply do not see the alternative as much of a bargain, hence they will continue to resist change.

References

Hannerz, Ulf

Jones, John

Jorgensen, Joseph
Lang, Gottfried
1954  The Ute development program: a study in culture change in an
under-developed area within the United States. Ph.D. disserta-
tion. Cornell University.

McFee, Malcolm
1968  The 150% man, a product of Blackfeet acculturation. American
Anthropologist 70: 1096-1103.

Stewart, Omer
1942  Culture element distributions XVIII. Ute-Southern Paiute. Univer-

Witherspoon, Younger
1961  Cultural influences on Ute learning. Ph.D. dissertation. Univer-
sity of Utah.