THE CURECANTI ARCHEOLOGICAL PROJECT: 
THE LATE PREHISTORIC COMPONENT 
AT PIONEER POINT

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Mitigative archeological investigations were conducted at 5GN41 in advance of visitor facility construction in the Pioneer Point Development Area, Curecanti National Recreation Area, Colorado. Block excavations in two areas of the site in 1982 exposed probable hearths within concentrations of lithics, brown ware ceramics, ground stone, and faunal remains. The radiocarbon dating of features, together with ceramic and projectile point comparisons, suggest that the site represents an occupation during the last part of the Late Prehistoric by a small group of Numic speakers related to the Historic Utes of Colorado. The Pioneer Point data suggest a temporary summer or early fall occupation(s) by a small group(s) practicing a mixed hunting and gathering economy. Subsistence related activities conducted on-site appear to have included the processing and consumption of large game animals, as well as the processing of Chenopodium and Gramineae seeds. The range of activities at the site which involved chipped stone material included tool manufacture, use, and maintenance. Analysis of the edge angles and bifacial/unifacial retouch on the numerous quartzite implements and resharpening flakes, together with their spatial distribution around one of the hearth features, suggest that relatively heavy cutting/chopping and scraping activities were conducted on-site. The cutting/chopping activities in particular were probably related to the processing of the large game animals mentioned above. The manufacture and/or repair of hafted tools is suggested by the presence of projectile points and other formerly hafted implements, a sandstone shaft smoother, and debitage which appears to have been produced during the retooling of hafted implements. Finally, the recovery of dog/wolf remains, interpreted as debris from the manufacture of a bone whistle or bead, suggests that craft activities occurred on-site at Pioneer Point. The data are consistent with a model of seasonal use of the Upper Gunnison Basin during the Late Prehistoric proposed by Kevin Black (1982:165-168, 1983:21-23). Site 5GN41 was nominated to the National Register of Historic Places in 1982 as part of the Curecanti Archeological District.
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Chapter 1

INTRODUCTION

Construction-related archeological investigations were conducted between 1980 and 1984 in Curecanti National Recreation Area west of Gunnison, Colorado, by the Midwest Archeological Center of the National Park Service. The Curecanti Archeological Project was necessitated by a multiyear program of park facility development funded by the Bureau of Reclamation under Section 8 of Public Law 485 (70 Stat. 105), which established the Colorado River Storage Project. This massive Federal undertaking included the construction of three dams, Crystal, Morrow Point, and Blue Mesa, along 37 miles of the Gunnison River above Black Canyon of the Gunnison National Monument. Following transfer of land around the three dams and resultant lakes to the National Park Service, the Bureau provided Section 8 funding for development and construction of numerous visitor facilities. Development at Pioneer Point under construction package 201 included construction of a new road, several trails, a picnic area, and a restroom facility.

The 1982 archeological field season at Curecanti involved both the evaluation of significance of archeological resources previously identified in the vicinity of proposed developments, and mitigation of construction and visitor use impact upon those resources (Jones 1986b:1). Archeological investigations were conducted at five sites in Curecanti during the 1982 field season. The 1982 investigations at 5GN204/205, 5GN222, 5GN247, and 5GN1664 have been reported elsewhere (Jones 1986b; Rossillon 1984). Mitigative excavations conducted at 5GN41 in the Pioneer Point Development Area are reported herein.

Site 5GN41 was identified by Center personnel in the Pioneer Point Development Area above Morrow Point Lake (Figure 1) at the end of the 1981 field season (Jones 1986a). It initially appeared as a light surface scatter of quartzite flaking debris, and was subsequently briefly tested. A red oval stain, designated Feature 1, was identified at a depth of approximately 18 cm, surrounded by a scatter of chipped stone tool fragments and debitage, bone, and charcoal (Jones 1986a:11-13). A radiocarbon age of 474 ± 70 years, A.D. 1476 (Jones 1984), was obtained by assay of a charcoal sample collected from the feature. Brown ware pottery was recovered from two contiguous test units placed approximately 15 m south of Feature 1, and the latter area became the focus of block excavation during the first portion of the 1982 field season (Area 811/821 in Figure 2). A total of 40 sq m was ultimately excavated within this block, exposing a shallow, basin-shaped unlined hearth, designated Feature 10, which was surrounded
Figure 1. Selected archeological sites in Curecanti National Recreation Area, Colorado.
Figure 2. Plan view of 1981 and 1982 excavations.
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by a scatter of lithics, pottery, ground stone, and burned and unburned bone. A radiocarbon age of 484 ± 80 years, A.D. 1466 (Jones 1984), was subsequently obtained from assay of a charcoal sample from Feature 10.

During the course of the work in Area 811/821, another scatter of cultural material was discovered a short distance downhill to the northwest (Area 822 in Figure 2). A shallow irregular lens of charcoal with an area of reddish burned soil along one edge, designated Feature 19, was ultimately exposed immediately beneath the surface within this second scatter. The feature appeared to represent the remains of a small, unprepared hearth and was associated with chipped stone artifacts, brown ware ceramics, and faunal remains.

The radiocarbon dating of features at Pioneer Point, together with ceramic and projectile point comparisons, suggest that the site represents an occupation during the last part of the Late Prehistoric by a small group of Numic-speakers related to the Historic Utes of Colorado. Prior to the identification of 5GN41, little was known about the Late Prehistoric or Historic period aboriginal presence in the area of the Park. As a consequence, the most recent episodes of Native American occupation of the region simply could not be addressed in detail during any of the previous Center investigations at Curecanti. Sites such as Pioneer Point, which contain well-defined archeological components which may be attributable to the immediate predecessors of the Historic Utes, are probably significant wherever they occur because of the rare glimpse which they provide of the little-known prehorse adaptations of these people. Site 5GN41 was nominated to the National Register of Historic Places as part of the Curecanti Archeological District in the summer of 1982.

The 1982 archeological investigations at Pioneer Point were begun on June 1st and concluded on June 25th. Center personnel involved in the field portion of the project included Bruce Jones, who directed the work; Janis Dial; Robert Blasing; Steve Baumann; Janet Matel; and Greg Risdahl. In addition, Park seasonal employee Joanne Vangenhen served as a volunteer on the project for a single day. The Curecanti staff provided excellent support during the field work portion of the project. The laboratory analysis of artifacts was undertaken by the author, and Bruce Jones drafted the maps, artifact illustrations, and other figures in this report. The report cover was designed and produced by Center Illustrator Carrol Moxham. Radiocarbon assays of charcoal samples collected during the project were conducted by Beta Analytic, Inc. Faunal analyses were conducted by B. Miles Gilbert and Sandra Olsen, and the macrofloral analysis was performed by Linda Scott of Palynological Analysts. A thin section analysis of ceramic samples was conducted by Patricia Dean of Prehistoric Ceramic Analysis. Bruce Jones served as an invaluable sounding board for the author during the entire process of analysis and report preparation, and he provided editorial comment on the manuscript. Carol Raish also served in an editorial capacity for the report. The report has also been strengthened as a result of modifications made in response to thoughtful review and comment provided by Kevin Black and Ann Johnson. Robert Nickel and F.A. Calabrese initially arranged for the author's participation in the Curecanti Archeological Project and provided continuing
support for that participation over a period of several years. A number of other individuals assisted with the Pioneer Point project in various capacities, and their contributions are greatly appreciated.

ENVIRONMENTAL SETTING

Site 5GN41 lies within the Upper Gunnison Basin in west central Colorado. The Upper Gunnison Basin is here defined as the watershed of the upper section of the Gunnison River from its headwaters to its confluence with the North Fork of the Gunnison River. The Upper Gunnison Basin extends from the Continental Divide in the Sawatch Range on the east to the western edge of the Gunnison Uplift several miles east of the town of Montrose, and from the Elk and West Elk Mountains on the north to the Continental Divide in the San Juan Mountains on the south. The Upper Gunnison Basin is a topographically diverse region of broad valleys, mesas, gorges, parklands, and mountain peaks which range up to 14,000 ft in elevation. The continental climate of the region is characterized by extreme seasonal variation. Topography also plays a significant role in the climatic variability of the region, with a reduction in temperatures and an increase in precipitation generally occurring with increased elevation (Hunter and Spears 1975:72-73, 81-83). Winter temperatures are particularly low in the vicinity of Gunnison and the mountain parks because of topographic barriers which prevent the drainage of cold air to lower elevations.

Recently, 5GN41 is located along the western edge of a prominent rocky overlook called Pioneer Point which stands on the north side of the Black Canyon of the Gunnison (Figure 3). The Black Canyon is a deep, narrow gorge which has been cut by the river through the Gunnison Uplift, a feature composed predominantly of metamorphic and igneous rock of Precambrian age overlain by Mesozoic sedimentary formations (Prather 1982:101-104). The Black Canyon extends a distance of approximately 50 mi (80 km) from Blue Mesa Dam within the Park downstream to
<table>
<thead>
<tr>
<th></th>
<th>Montrose</th>
<th>Gunnison</th>
<th>Crested Butte</th>
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<tr>
<td>Elevation (feet)</td>
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<tr>
<td>Length of annual freeze-free period (days)</td>
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<tr>
<td>Average minimum temperature (degrees Fahrenheit)</td>
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<tr>
<td>Length of period for calculation of averages (years)</td>
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<td>30</td>
<td>65</td>
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</tbody>
</table>
Figure 3. View southwest to Pioneer Point from Soap Mesa (5GN41 lies along the western edge of the point). The Black Canyon of the Gunnison extends across the photo, with the Curecanti Creek gorge at the lower right and the Blue Creek gorge at the upper left.
INTRODUCTION

the confluence of the Gunnison River and the North Fork of the Gunnison. Site 5GN41 is located roughly 4.5 mi (7 km) below or west of Blue Mesa Dam.

The site lies at an elevation of approximately 8,000 ft (2,450 m), over 950 ft (290 m) above the confluence of the Gunnison River and Curecanti Creek (Jones 1986a:10). It is situated in the NW ¼ of the NE ¼, Sec. 3, T. 48 N., R. 5 W., Gunnison County. The site area is illustrated on the Curecanti Needle Quadrangle of the U.S. Geological Survey 7.5 Minute topographic map series.

Sparse sagebrush covers most of the Pioneer Point promontory as well as the lower side slopes of Soap Mesa, which overlooks the site to the north. Small groves of aspen and a few scrub oak and juniper also grow on the overlook. Several species of pine grow either as isolated trees atop the point or in stands on the eastern side of the Curecanti Creek Valley below 5GN41 (Jones 1986a:10). Given the apparent stability of the major vegetation zones in the area of the Park during the past 6,000 years (L. Scott 1981, 1986:23), the vegetation on Pioneer Point during the prehistoric occupation of the site may have been very similar to that of today. The closest known water sources in the vicinity of the site consist of several seeps which currently flow from the east wall of the Curecanti Creek Valley several hundred meters north of 5GN41 (Jones 1986a:10). The exposure of the site is to the south and west.

PROBLEM STATEMENT

The primary anthropological problem addressed during the Pioneer Point investigations was a study of site function which addressed the nature of Late Prehistoric adaptations along the Upper Gunnison River and its tributaries. As a clearer picture of the terminal Late Prehistoric is obtained through study of sites such as Pioneer Point, future research will be better able to address two additional related problems which were not examined in depth by the present project. These two include the question of Ute culture change from the Late Prehistoric into the Protohistoric and Historic periods, and the hypothesized migration of Numic-speaking peoples into the Great Basin and adjacent areas within the past 1,000 years. More specifically with regard to the latter issue, future research needs to include an assessment of the relationship of the Utes to the previous occupants of the Colorado mountains. An evaluation of changes which may have occurred in subsistence-settlement strategies during the course of the Late Prehistoric period from A.D. 400 to the time of Ute contact with the Spanish is also much needed (Black 1986a:27; Guthrie et al. 1984:51).

Site Function

Data obtained from the brief episode of testing at Pioneer Point in 1981 suggested that the aboriginal occupations there were atypical for the Curecanti area in that they appeared to be few in number, of relatively short duration, and restricted in time depth (Jones 1986a:17, 214-215). A substantial number of the previously investigated sites in the Park have been large and complex, and the nature of the multiple, superimposed components at these locations has made it extremely difficult to isolate and study the cultural material produced by any single occupation (Jones
The initial impression of the character of the site at Pioneer Point was ultimately supported by several factors observed during the 1982 field work and in the subsequent analysis of the collected cultural materials. These factors included: 1) the relatively close correspondence of absolute dates obtained through radiocarbon assay of charcoal samples collected from Feature 1, a possible hearth identified during the 1981 investigations, and from Feature 10, a hearth exposed during the 1982 excavations; 2) the similarities between the lithics and ceramics recovered in Areas 811/821 and 822; and 3) the quantity and distribution of cultural materials.

Historic disturbance of the cultural deposits at Pioneer Point appeared to have been minimal, having resulted primarily from recreational use of the Pioneer Point area as an overlook. In addition, an initial evaluation of the spatial integrity of the cultural deposits surrounding Feature 10 suggested that natural processes such as frost heaving and downslope displacement of cultural material had only affected that portion of the site to a minor degree. As a consequence, the explicit assumption was made that the cultural deposits surrounding Feature 10 represented a single in situ archeological component deposited during the course of one occupation. Further, it was believed that this combination of site characteristics would facilitate the study of prehistoric activities performed on-site and might ultimately provide a basis for inferring the role of the site within a larger subsistence-settlement system.

Information relating to the aboriginal activities performed on-site at Pioneer Point was expected to derive from analyses of the different classes of recovered cultural material as well as from observation of patterns in their spatial distribution. The inferences ultimately drawn from the spatial patterning of artifacts within the cultural deposits were predicated upon a second explicit assumption that extensive "housecleaning" activities probably did not occur during the occupation. Such activities which would have resulted in redeposition of material from areas of use and original discard to secondary refuse areas (Schiffer 1972). However, it was also acknowledged that both primary site functions as well as incidental activities performed on-site might not be directly reflected in the material which had been incorporated into the archeological record and which was ultimately recovered during the excavation (e.g., Binford 1978).

In order to secure the necessary precision in spatial data, field methods employed at Pioneer Point in 1982 included block excavation in 2-m squares in order to facilitate the recognition of contextual relationships, together with the piece plotting of selected cultural materials.

In order to evaluate the appropriateness of spatial analysis in this particular instance, the vertical and horizontal distributions of selected artifacts in the deposit surrounding Feature 10 in Area 811/821 were examined for evidence of size-grading. The ground surface at the time of the prehistoric occupation appears to have been roughly 10 cm below the present surface, as the top of Feature 10 was most distinct at a depth of 10 cm. If the scatter of cultural material around Feature 10 had in fact originally been a single deposition on one ground surface, there had clearly been subsequent vertical displacement of that material on the order of 10-15 cm, since a
INTRODUCTION

Few artifacts were recovered from depths of up to 25 cm below the present ground surface. However, it was understood that if frost heaving had thoroughly reordered the artifacts in the deposit, artifact size could be expected to decrease with increasing depth as the larger artifacts were eventually displaced upward to the surface (Wood and Johnson 1978:338-343; Benedict and Olson 1978). The sizes of quartzite tools/tool fragments and debitage recovered from the vertical proveniences of 1981 test units X2 and X4 were compared for statistical evidence of such size-grading (Table 2). Very little surface material was present in either unit, and the bulk of the artifacts were recovered from just below the ground surface to 10 cm bs. While previous collection of artifacts from the surface of the site may have resulted in a bias in that portion of the sample, the mean artifact size in X2, reflected in the maximum dimension analytical attribute, was similar in all three vertical proveniences (Table 2), and the largest artifacts were recovered between the ground surface and 10 cm bs. Surface material in X4 was on the average slightly larger than subsurface material from that unit, but relatively large artifacts were also recovered from each vertical provenience. In conclusion, there was no clear evidence of vertical size-grading of quartzite artifacts in the deposits.

Finally, the horizontal distribution of quartzite material in the area surrounding Feature 10 was examined in order to determine whether size-sorting had occurred in the direction of the surface slope (approximately 3 degrees downslope to the northwest) as a result of downslope washing and displacement by gravity (Rick 1976). Small and large artifacts were found to be mixed in every excavation unit, and the average size of the material across the site varied by less than 1 cm (Table 3, Figure 4).

FIELD METHODOLOGY

The limited evaluative testing conducted at Pioneer Point in 1981 included the excavation of six 1-m squares which represented tests both of areas with a low density surface scatter of lithic artifacts and areas with no visible surface remains or material (Jones 1986a:4-5,10-17). In addition, a single .5-m extension of one of these units was ultimately excavated in order to expose the possible subsurface hearth designated Feature 1 (Figure 2).

The locations and methods of data recovery at Pioneer Point during the 1982 field season were in large part conditioned by the results of the testing conducted at the site in 1981. The 1981 work included excavation of two contiguous 1-m test squares (X2 and X4) placed within a small, low-density surface scatter of lithic flaking debris. These units ultimately produced slightly more than 200 brown ware sherds as well as lithics and bone. Because of this important discovery of the first ceramics to be identified in the Park, the area surrounding the above-mentioned two units was selected for mitigative block excavation in 1982.

An effort was made in 1982 to establish comparability with those aspects of the 1981 field methodology which were both appropriate for use in a more extensive excavation and which would facilitate the eventual laboratory analysis of the combined datasets from the two field seasons. For record-keeping purposes, that portion of the site atop the western edge of Pioneer Point (the initial focus of investigations
Table 2. Vertical Distribution of Quartzite Artifacts in X2 and X4. The Size of the Artifacts in Each Provenience is Indicated by the Minimum, Maximum, and Mean Maximum Dimension (Measured in mm).

<table>
<thead>
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<th>X4</th>
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Table 3. Horizontal Distribution of Quartzite Artifacts across Area 811/821. The Size of the Artifacts in Each Unit is Indicated by the Minimum, Maximum, and Mean Maximum Dimension (Measured in mm).

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INTRODUCTION

during the 1982 field season) was arbitrarily designated Area 821, the same areal definition as Area 811 from the 1981 field season (Figures 2 and 5). A combined designation of Area 811/821 has subsequently been employed to reference this portion of the site for analytical purposes.

A 2-m grid system was imposed over the area around X2 and X4 and aligned on magnetic north. Two-meter squares were selected as the basic unit of excavation, in order to maximize the visibility of soil changes of potential cultural significance and to facilitate the recognition of contextual relationships. Number designations were assigned sequentially as excavation units were opened, and excavation proceeded by arbitrary 10 cm levels. All excavated soil was dry screened through ¼-in hardware cloth. The 1982 methodology also included the piece plotting of selected cultural material exposed in situ, a procedure not employed during the brief 1981 testing at the site.

Different classes of cultural material and faunal remains exposed in situ were handled somewhat differently, depending upon the amount of variation represented in the material, coupled with a general consideration for project scheduling constraints. All chipped stone material 3 cm or larger in maximum dimension and all bone fragments were piece plotted using triangulated measurements from the northwest and southwest corners of the units under excavation. Depth within each unit was measured to the nearest cm below the ground surface at the highest corner of the unit. Each such lithic artifact and bone fragment found in situ was assigned a Field Specimen (FS) number and bagged separately in order to enable the eventual matching of individual specimens and associated provenience data. The horizontal positions of sherds exposed in situ were recorded using the same measurement scheme from the northwest and southwest corners of excavation units. However, vertical provenience control for ceramics was limited to the arbitrary 10 cm excavation levels, and individual sherds were not bagged separately.

Field records kept at Pioneer Point in 1982 included documentation on each excavation unit written by members of the crew, and periodic progress reports kept by the project director. Black-and-white prints and color slides were taken of horizontal excavations, vertical profiles, individual artifacts exposed in situ, and features, as well as of general excavation and data collection activities and the site locale. Feature designation was employed to collect detailed descriptions of a wide variety of phenomena. In addition to soil staining and associated materials of presumed cultural origin, feature numbers were given to spatial clusters of artifacts, to a few individual artifacts including diagnostic projectile points, and to descriptions of vertical profiles and areal divisions of the site.

Forty square meters were ultimately excavated within the block around X2 and X4, exposing a shallow unlined hearth (Feature 10) surrounded by a scatter of cultural debris roughly 6 m in diameter. The excavations were expanded until the limits of the cultural material were reached, resulting in the controlled excavation of several contiguous units including one 1-m-x-2-m unit and nine 2-m squares, and one non-contiguous 2-m square. Feature 10 was the focus of several special collection activities including the collection of
Figure 4. Quartzite artifact mean maximum dimensions and relative surface elevations across Area 811/821.

Figure 5. View northeast across excavations, Area 811/821. Soap Mesa stands at the left.
INTRODUCTION

Bulk soil samples for eventual macrofloral analysis, a charcoal sample for eventual radiocarbon assay, and an archeomagnetic dating sample. A trench was also excavated several meters southeast of the block excavation and outside the limits of the cultural deposit in order to record the natural stratigraphy of the area.

Limited 2-m interval shovel testing was conducted within Area 821 through the small aspen grove immediately east of the block excavation, in an attempt to identify any additional subsurface features. However, only two lithic artifacts were noted in the shovel tests, and no features were identified.

Because of a slight slope to the ground surface across Area 821, the method used to determine depth during excavation (i.e., measurement below the highest corner in each excavation unit) has subsequently served to limit the usefulness of the vertical provenience data from the site. The change in elevation across most 2-m squares ranged between 13 and 15 cm, with the greatest change of 25.5 cm occurring across X19. A total change of 44.5 cm (approximately 3 degrees of slope) occurred from the northwest to the southeast across the surface of the block excavation. Consequently, removal of the first 10-cm level in virtually every unit left a portion of the ground surface unexcavated. Fortunately, given the shallow nature of the cultural deposit (artifactual material was recovered to a depth of only 25 cm below the ground surface) and the amount and consistency of the recovered material, subsequent detailed study of the vertical distribution of artifacts was neither imperative in order to address the research objectives of the project nor necessarily appropriate.

Finally, during the course of the investigations in Area 821 at Pioneer Point, an additional scatter of cultural material was discovered a short distance downhill to the northwest which was designated Area 822 (Figures 2 and 6). Lithic flaking debris was observed both on a pronounced downslope with minimal soil cover and in a small saddle at the base of the slope which exhibited some soil development. Because the cultural material in Area 822 occurred in two different depositional contexts, a combination of data recovery procedures was used. Initially, cultural material exposed on the ground surface was flagged. An east-west baseline was established through the area, and a 2-m grid system with preassigned unit designations was established on either side of the line. For units containing surface material in locations with considerable slope (17 units in all), material from the surface and just below the surface (to a depth of 2-3 cm) was assigned FS numbers, plotted relative to the northwest and southwest corners of the units, and collected (Figure 7). In addition, a small separate lithic scatter (designated Feature 22) a few meters to the north was similarly plotted and collected.

Six and one-quarter of the units (25 sq m) within the saddle in Area 822 were actually excavated, to bedrock in most cases (Figure 7). A small hearth-like feature (Feature 19) exposed in this area was surrounded by a thin scatter of lithics, pottery, and bone. Excavation and field documentation procedures employed in the recovery of data in the saddle were identical with those used in the block excavations in Area 821, and bulk soil samples were collected from Feature 19 for eventual macrofloral analysis. A maximum elevational change
of 91.5 cm occurred across the surface of the excavated units in the saddle.

STRATIGRAPHY

The stratigraphy adjacent to the cultural deposits in Area 811/821 at Pioneer Point consisted of bedrock overlain by a natural soil profile (Figure 8). The bedrock at that location consists of Precambrian quartz monzonite and migmatitic gneiss, similar to the material exposed along the western edge of the Pioneer Point promontory immediately adjacent to the cultural deposits (Figure 2), and also distributed widely along and south of the upper reaches of the Black Canyon of the Gunnison (Hansen 1971). The soil at Pioneer Point is classified as Kubler loam (Hunter and Spears 1975).

While artifacts were recovered throughout the upper soil stratum in Area 811/821, the majority lay from just below the present ground surface to a depth of 10 cm (Figure 9). The upper stratum also contained charcoal which generally occurred as flecks but appeared as a distinct band together with charcoal-stained soil in localized areas just below the present humus layer in X14 and X15. The band of charcoal may have originated with a relatively recent grass fire, as several aspen trees in the immediate vicinity of the excavations appeared to have been killed by fire.

A dip in the contact between the upper two soil layers was observed to run southeast-northwest immediately south and west of Feature 10. The dip is illustrated in

Figure 6. View west to excavations, Area 822.
Figure 7. Plan view of excavated and surface-collected units, Area 822.
Figure 8. Vertical profile of natural stratigraphy, Area 811/821.
Figure 9. North-south vertical profile, Area 811/821.
INTRODUCTION

Figure 9 in vertical profile in the southern half of X11 and appears to represent a small gully which filled prior to the prehistoric occupation at Pioneer Point.

Cultural material in Area 822 occurred both on the pronounced downslope with minimal soil cover and in the small saddle between the slope and a projection of rock that overlooks the Curecanti Creek Canyon. The soil profile in the saddle consisted of an upper layer of pale brown sandy loam with gravel and pebble inclusions, underlain by a yellow brown sandy loam which generally lacked the small-sized rock inclusions of the upper stratum. Cultural material was recovered from the upper soil layer. Bedrock rubble occurred throughout the soil profile.

FEATURES

Feature 1

Feature 1 is interpreted as a possible hearth which was exposed at a depth of approximately 18 cm in X1 and X6 (Figure 2) during the 1981 evaluative testing at Pioneer Point (Jones 1986a:10-17). It initially appeared as a red oval stain surrounded by a scatter of chipped stone tool fragments and debitage, burned and unburned bone, and charcoal. The feature was approximately 50 cm in maximum dimension and extended to a depth of approximately 12 cm within a basin-shaped depression. A tree root extended through the center of the feature.

The feature fill consisted primarily of reddened soil which has been tentatively interpreted as fired earth. Light charcoal was also observed in the fill, and a radiocarbon age of 474 ± 70 years, A.D. 1476, was obtained by assay of a sample of the charcoal.

Feature 10

Feature 10 was initially identified at approximately 4 cm below the ground surface in Area 811/821. It appeared as an indistinct soil stain coincident with a concentration of lithic debris and bone. The top of the feature was most distinct at a depth of 10 cm, where it appeared as a black and red oval stain measuring 84 cm north-south and 68 cm east-west (Figure 10). It was ultimately found to extend to a depth of about 18 cm within a basin-shaped depression (Figure 11) and is interpreted as the remains of a hearth.

The fill of the feature was composed primarily of burned earth. Juniper wood charcoal and charred conifer needles were identified in the fill, as well as charred Chenopodium and Gramineae seeds (Scott 1986). A radiocarbon age of 484 ± 80 years, A.D. 1466, was subsequently obtained for a sample of the charcoal recovered from the feature. Approximately 30% of the faunal material found in the area of the block excavation around Feature 10 was recovered from the feature fill itself (Appendix VI). A portion of this faunal material is burned. The faunal remains from the feature include a phalanx fragment from a large dog or wolf which is believed to be debitage from manufacture of a bone whistle or bead. Chipped stone artifacts recovered from the feature include debitage and five complete or fragmentary tools (Implement Nos. 37, 38, 40, 41, 43). Two fragments of a projectile point (Implement #38) similar stylistically
Figure 10. Feature 10 outlined in plan view, Area 811/821.

Figure 11. Feature 10 in vertical profile, Area 811/821.
to the Desert Side-notched series were among the latter material.

**Feature 19**

Feature 19 was exposed immediately beneath the ground surface in Area 822 and appeared as an extremely thin, irregular lens of charcoal with an area of reddish burned soil along its northwestern edge (Figure 12). It appeared to represent the remains of a small unprepared hearth. The center of the feature appeared to have been disturbed by small animal activity.

The Feature 19 fill contained juniper wood charcoal, fragments of charred conifer needles, and charred *Chenopodium* seeds (Scott 1986). In addition, a small quantity of burned and unburned bone was recovered from the feature fill (Appendix VI). Chipped stone artifacts recovered from the feature include debitage and three complete or broken tools (Implement Nos. 252, 253, 254).

**DATING THE ABORIGINAL OCCUPATIONS**

Several lines of evidence bear upon the dating of the aboriginal occupations at Pioneer Point, including the recovery of brown ware ceramics and diagnostic projectile points, and radiocarbon assay of charcoal samples from two features at the site. The aboriginally manufactured ceramics recovered at Pioneer Point conform closely to the Plain Type of Uncompahgre Brown Ware defined by Buckles (1971). This type has been associated with the archeologically manifested Escalante Phase, dated to A.D. 1500-1880, and with Historic Ute occupations in the Uncompahgre Plateau and River Valley area approximately 20 mi (32 km) to the west of Pioneer Point. Buckles (1971:505, 533, 537) noted that the pottery manufactured by Historic Ute groups in the Uncompahgre was very similar and undoubtedly related to ceramics made by other Numic-speaking peoples, particularly the Paiute, and also by various Athabaskan-speaking groups. Therefore, pottery attributes cannot be considered to serve as ethnic group identifiers in this particular instance. However, Buckles inferred a Ute affiliation for Uncompahgre Brown Ware based upon the geographical location of the finds within the territory historically occupied by the Utes rather than upon specific morphological characteristics of the pottery itself. Paiutes who manufactured pottery and were in closest geographical proximity to the Uncompahgre during Historic times lived in south-central Utah (Kelly 1964:69; Stewart 1942:273).

Fragments of several projectile points were recovered from both excavated areas at Pioneer Point, and with one possible exception, they compare favorably with established point types and variants thereof which date from the Late Prehistoric through Historic time periods. First, three small side- and basal-notched projectile points are stylistically similar to a number of named point types associated primarily with Late Prehistoric through Historic occupations across much of North America. Two of the Pioneer Point artifacts were recovered in Area 811/821 in association with Feature 10, while another was recovered adjacent to Feature 19 in Area 822. From Area 811/821, two fragments of a point (Implement #38, Figure 13a) were recovered adjacent to each other in the uppermost fill of Feature 10. The point was apparently produced through bifacial reduction of a quartzite blank, and its deep basal notch is iden-
Figure 12. Horizontal and vertical profile, Feature 19, Area 822.
Figure 13. Complete and incomplete projectile points, Areas 811/821 and 822.
INTRODUCTION

tical in size and shape to its high side notches. Portions of the bases are missing from a second point from Area 811/821 which was manufactured from translucent agate (Implement #12, Figure 13b) and from a point manufactured from a quartzite flake recovered in Area 822 (Implement #212, Figure 13c). Two fragments of Implement #12 were recovered from adjacent test units X2 and X4 southwest of Feature 10. All three projectile points exhibit fine bifacial flaking.

Points of the above-discussed general configuration, usually described as Desert Side-notched in the Great Basin, first appeared by at least A.D. 1100-1200 (Heizer and Hester 1978:164-165) and have been linked with Shoshonean occupations via their frequent co-occurrence with Shoshoni ceramics (Holmer and Weder 1980:60, 67). However, an origin as early as 1,000 B.C. may be indicated at Hogup Cave (Aikens 1970:56). The Pioneer Point artifacts are also very similar to Type 2 points defined by Buckles (1971:115-116, 1252) in the Uncompahgre Plateau area, where the type is associated with the archeologically defined Escalante Phase and historically documented Ute occupations. Projectile points of this general description were recovered during archeological investigations conducted between 1977 and 1980 in the vicinity of the towns of Crested Butte and Gunnison in conjunction with the Mount Emmons Project of Amax, Inc.. They have been termed type MEPP 35 projectile points (Black 1986b:210-211). Most of the projectile points diagnostic of the terminal Late Prehistoric were found in surface contexts during the Mount Emmons project. Precise temporal assessments of these components were therefore not possible. However, Type MEPP 35 points are considered by Black as evidence of Ute occupation in the Mount Emmons Project area and are dated ca. A.D. 1500-1880.

A small, side-notched jasper point fragment with a slightly concave but unnotched basal edge was also recovered in Area 811/821 at Pioneer Point (Implement #24, Figure 13d). It is also similar stylistically to point types which, taken together, have a broad geographical distribution. Among them is Buckles' Type 1 (Buckles 1971:114-116) from the Uncompahgre Plateau. Although the type was not represented in Escalante Phase assemblages (Buckles 1971:1252), Type 1 and similar points have been associated with post-A.D. 1200 occupations on the Uncompahgre and elsewhere in west central Colorado (Reed and Scott 1982:386; Buckles 1971:531, 808, 1035). Projectile points of this general configuration were designated type MEPP 31 for the Mount Emmons Project, and were dated to ca. A.D. 1000-1880 (Black 1986b:202-203). The finely flaked specimen from Pioneer Point was manufactured on a flake, and exhibits a slight reddish hue along the margins which may indicate heat alteration of the raw material.

A long triangular point recovered in Area 822 (Implement #228, Figure 13e) has a slightly concave base and irregular blade edges and is stylistically somewhat similar to Buckles’ Type 10 points from the Uncompahgre (Buckles 1971:122, 1252). Type 10 points were recovered from Escalante Phase components and were therefore associated with Historic Ute occupations. The artifact from Pioneer Point has been manufactured on a jasper flake, and a slight blush along one edge may indicate heat alteration. The base of the point was found in situ just below the surface in X105
adjacent to Feature 19, while the tip was recovered during dry screening of fill from the same unit.

Additional small, thin projectile point fragments were recovered in both areas at Pioneer Point. The lower portion of an unnotched point manufactured on a quartzite flake (Implement #11, Figure 13f) was recovered in Area 811/821. The blade of the point is slightly contracted toward the base, and the basal edge is concave. A very small, unusually long and slender quartzite point (Implement #46, Figure 13g) from Area 811/821 is asymmetrical with one relatively high side notch. The other side of the artifact is unnotched. A corner of the base of the artifact is missing. A probable side-notched point fragment of jasper from Area 822 is broken toward the tip and across the top of the stem (Implement #242, Figure 13i). Consequently, the shape of the base is unknown. The artifact is deep red in color and exhibits potlid fracturing. Similar breakage has occurred on a small, probable side-notched quartzite point which was found in Area 822 (Implement #246, Figure 13h).

A somewhat thicker corner-notched point with a slightly expanding stem was also recovered in Area 811/821 (Implement #56, Figure 13j) which was produced through bifacial retouch of a deep red jasper flake. Both barbs project very slightly out from the blade edges, and the basal edge is sinuous but essentially straight. The upper portion of the blade and the tip are missing. A small, thick quartzite point recovered in Area 822 is relatively long and narrow with slightly serrated lower blade edges (Implement #241, Figure 13k). Because it is broken through the stem, the configuration of the base of this implement is unknown. It is consequently unclear whether the notches lay at the sides or corners of the point. Irregularities in the raw material appear to have contributed to the thickness of the artifact by making the thinning process difficult.

Finally, a medium-sized quartzite point (Implement #50, Figure 13l) was recovered from X18 north of Feature 10 within Area 811/821 which is entirely different in character from the other points in the Pioneer Point collection. It has low side notches, a short flaring stem, rounded base, and long straight blade edges which are slightly serrated. It has been made on a flake and has parallel diagonal flaking across one face of the blade. The upper portion of the blade and tip are missing. It compares favorably in appearance with Type MM 19 points associated with the Apex Complex and dating to the Late Archaic period (Irwin-Williams and Irwin 1966:81-82; Guthrie et al. 1984:23-24). It is also very similar stylistically to but considerably larger in size than a point recovered from 5OR182 in the Uncompahgre River drainage (Muceus and Lawrence 1986:88 Figure 6-21e, Cat #142). The point from 5OR182 is thought to date relatively recently (Muceus and Lawrence 1986:92). However, the artifact was associated with a charcoal sample with a radiocarbon age of 2030 ± 80 B.P. (Beta Analytic 1986:413).

In addition to artifactual evidence, radiometric dates obtained for two features of apparent aboriginal origin at Pioneer Point serve to date the occupations related to their use. A radiocarbon age of 474 ± 70 years, A.D. 1476 (Table 4), was obtained from assay of a sample of wood charcoal collected from Feature 1 during the 1981 testing of the site (Jones 1986a).
INTRODUCTION

When calibrated, the 474 B.P. age reflects an A.D. range of 1409-1468 (Stuiver and Pearson 1986:826). The feature consisted of a red oval stain identified at a depth of approximately 18 cm which was surrounded by a scatter of chipped stone tool fragments and debitage, bone, and charcoal.

A radiocarbon age of 484 ± 80 years, A.D. 1466 (Table 4), was obtained from assay of a wood charcoal sample recovered from Feature 10. The age of the sample may be associated with a calibrated A.D. range of 1403-1468 (Stuiver and Pearson 1986:826). The latter sample was collected after the feature was fully exposed at 10 cm below the present ground surface. Although Features 1 and 10 are separated by a distance of approximately 15 m, the two radiocarbon dates are nearly coincident.

Charcoal was widespread within the uppermost soil zone, the stratum which also contained the cultural deposit, throughout the area of excavation around Feature 10. The charcoal generally occurred as flecks but appeared as a distinct band together with charcoal-stained soil in localized areas just below the present layer of grass and thatch in X14 and X15. As was stated previously, this material may have originated with a fairly recent grass fire. It is unlikely that any recently produced charcoal contaminated the material in the two aboriginal features which were sampled for radiocarbon assay. However, if such contamination occurred, the assays would then indicate that the features were younger than they actually were.

In conclusion, the various lines of evidence for dating the cultural deposits at Pioneer Point, through radiocarbon assay and through diagnostic projectile point and brown ware ceramics comparisons, are reasonably consistent with one another. They suggest a Late Prehistoric occupation, most likely during the fifteenth century A.D. The similarities of some of the Pioneer Point artifacts to probable Protohistoric and Historic Ute material in the Uncompahgre Plateau area also lend support to the notion that the Pioneer Point locale was used by Numic-speaking prede-

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* Most of these data appear in Jones (1984).
** Calibrated AD ranges were obtained from Stuiver and Pearson (1986:826).
cessors of Historic Ute groups in western Colorado. The southernmost Utes began to acquire horses during the middle of the seventeenth century shortly after the Spanish became established in northern New Mexico (Haines 1938:117; Schroeder 1965:54). Therefore, the Pioneer Point occupation(s) occurred prior to this acquisition.

Reed (1988) has recently proposed a phase sequence for the Ute occupation of western Colorado and eastern Utah which acknowledges possible changes in Ute culture from the Late Prehistoric through the Historic period. The Pioneer Point occupation falls within Reed’s Canalla Phase which would extend from “the verifiable appearance of diagnostic Ute artifacts” in the archeological record of the region at about A.D. 1400 to the adoption of an equestrian lifestyle at about A.D. 1650.
Chapter 2

CERAMICS

INTRODUCTION

The aboriginally manufactured ceramics recovered at Pioneer Point conform closely to the Plain Type of Uncompahgre Brown Ware which Buckles (1971) has defined and associated with Historic Ute occupations in the Uncompahgre Plateau and River Valley area. Pottery is also diagnostic of Buckles' archeologically defined Escalante Phase, which he dated at A.D. 1500-1880. However, the radiocarbon dates from features at Pioneer Point indicate that the occupation(s) there occurred slightly prior to the latter time period, most likely during the fifteenth century.

Buckles (1971:505,533,537) noted that the pottery manufactured by Historic Ute groups was very similar to and undoubtedly related to ceramics made by other Numic-speaking peoples, particularly the Paiute, and by various Athabaskan-speaking groups. Therefore, he inferred a Ute affiliation for Uncompahgre Brown Ware based upon recovery of the pottery from Protohistoric or Historic archeological sites in a region which was apparently inhabited exclusively by Utes during the Historic period.

It is interesting to note that some ethnographic information on Ute pottery manufacture is not consistent with the archeological data from sites presumably occupied by Late Prehistoric or Historic Ute groups. For instance, on the basis of field work conducted in 1937 and 1938, Stewart (1942:273) suggested that the Utes in Utah were the only ones to manufacture fired pottery in the period prior to about 1850. In addition, Buckles (1971:528) noted that Southern Ute pottery described by Opler (1939) bears little resemblance to the ceramics found on the Uncompahgre Plateau and elsewhere in areas occupied historically by the Utes and Paiutes.

Nearly 700 sherds were recovered in Area 811/821 at Pioneer Point and an additional 80 sherds were recovered in Area 822. The ceramics from these two areas appear to represent the same pottery type. However, the two collections are distinct, most notably with regard to paste and temper materials, suggesting that multiple vessels and possibly separate occupations are represented. The substantially larger collection of ceramics from Area 811/821 exhibits variation which has been attributed both to the representation of different portions of one or more vessels and to post-depositional alteration of the pottery. In contrast, the relatively homogeneous Area 822 ceramic assemblage consists entirely of body sherds with little variation in attributes of color,
CERAMICS
degree of curvature, sherd thickness, and sherd size. The Area 811/821 collection therefore offered the greatest interpretive potential.

SPATIAL DISTRIBUTION OF CERAMICS

Ceramics recovered from both areas at Pioneer Point were spatially associated with probable hearth features (Features 10 and 19). The horizontal distribution of ceramics within the excavated portion of Area 811/821 was clearly more circumscribed than was that of the chipped stone material, and almost all of the sherds were recovered from an area roughly 4 to 5 m in diameter immediately west, southwest, and south of Feature 10 (Figure 14). Pottery was most densely concentrated near the center of the scatter in X2 and in the northeastern quadrant of X8. All rim sherds were recovered from this central zone and were consequently less dispersed than neck and body sherds (Table 5). There is also some evidence to suggest that sherds derived from different vessels or different portions of a single vessel were distributed somewhat differently within the general ceramic scatter, a matter which is discussed later. Ceramics were recovered from just below the ground surface to a depth of approximately 25 cm, coincident with the uppermost soil stratum at the site.

Ceramics within the excavated portion of Area 822 were confined to an area roughly 2 m in diameter both within and adjacent to Feature 19. They were recovered to a depth of 12 to 13 cm.

GENERAL DESCRIPTION

The techniques of construction and firing of the ceramic vessels represented at Pioneer Point appear to have been generally consistent with those used in the manufacture of brown wares recovered archeologically or described ethnographically elsewhere in western Colorado and the eastern Great Basin (Baldwin 1950:54; Buckles 1971:507-510, 519-520; Euler 1964: 379; Opler 1939:162; Smith 1974:84,86; Stewart 1942:273). Evidence for coiled construction of the vessels represented in the Pioneer Point collections was noted in the form of a few linear depressions on sherd surfaces, which seem to reflect incompletely obliterated coil junctures. These depressions are 1 to 2 mm wide and only 4 to 5 mm apart, and the single example observed on a rim sherd was oriented parallel to the rim. A slight undulating appearance to two exterior sherd surfaces may be a further reflection of vessel construction via coiling. The types of evidence for coiled construction which were observed by Buckles (1971:507-508) on Uncompahgre Brown Ware sherds were not present in the Pioneer Point collections. The evidence observed by Buckles included smooth-surfaced concave or convex sherd edge cross sections resulting from breakage between imperfectly joined coils, and a tendency for breakage along planes perpendicular to the vertical axes of vessels.

General surface finishing techniques may be inferred from the shallow striations present on the interior and exterior surfaces of more than half of the sherds from
Figure 14. Distribution of ceramics by excavation unit, Area 811/821.

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<th>X4</th>
<th>X11</th>
<th>X8</th>
<th>X10</th>
<th>X13</th>
<th>X14</th>
<th>X16</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rim</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>13</td>
<td>1.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>13</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td></td>
<td>29</td>
<td>4.2</td>
</tr>
<tr>
<td>Body</td>
<td>140</td>
<td>62</td>
<td>28</td>
<td>242</td>
<td>9</td>
<td>78</td>
<td>91</td>
<td>1</td>
<td>651</td>
<td>93.9</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>75</td>
<td>29</td>
<td>260</td>
<td>10</td>
<td>82</td>
<td>92</td>
<td>1</td>
<td>693</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5. Distribution of Rim, Neck, and Body Sherds by Excavation Unit, Area 811/821.
CERAMICS

Pioneer Point. The striations were probably produced by scraping and wiping while the vessel surfaces were moist, which both directly textured the clay itself and dislodged and rolled or dragged aplastic inclusions in the clay. Where striations occur on rim sections, they are oriented either parallel or diagonally to the rim. In addition, a number of grass or vegetal stem impressions were observed which range in width from 0.5 to 2 mm, some of which may represent voids left by the burning of organic material in the clay. The impressions were not sufficiently numerous to suggest that organic matter was purposefully added as temper. The gradual coincident termination of some parallel impressions of this type may indicate the use of a bundle of grass to brush vessel surfaces lightly during the final stages of manufacture. Many sherd surfaces exhibited neither striations nor linear impressions. No evidence for use of a paddle and anvil was recognized in the collections. The Pioneer Point ceramics are undecorated.

The colors of the larger sherds (at least 2 cm in the analytical attribute of maximum dimension) were recorded using the Munsell soil color charts and neutral value scale (Munsell Color Company 1970; Kollmorgen Corporation 1975). These colors are assumed to have been produced by a number of factors including the composition of the clay, firing, vessel use, and alteration subsequent to deposition in the ground. For the collection from Area 811/821, exterior surface colors were matched most closely with the darker values and low to medium chromas of the 7.5YR, 5YR, and 10YR series with two examples of neutral gray. Interior surface colors were dominated by the darker shades of neutral gray, with a few dark, low chroma speci-

mens in the 7.5YR, 10YR, and 5YR series. Exterior colors therefore include very dark grayish browns, browns, and reddish browns, and interior colors consist of dark shades of neutral gray, very dark gray browns, and browns. In general, interior colors were slightly darker and duller than were exterior colors.

The cores of sherds from Area 811/821 were largely dark shades of gray. Some sherds were split in color near the center of the core and were generally gray in the half adjacent to the interior sherd surface and brown adjacent to the exterior sherd surface. A few cores contained several layers of color. Sherd cores were generally darker than were sherd surfaces, and in many instances, temper particles in the core were coated with dark carbonaceous material.

Few color observations were made on the Area 822 collection because of the relatively small number of sherds involved. Surface hues fell largely in the 10YR or 7.5YR series (dark grayish browns, dark browns, and browns) with one interior surface of neutral gray. Once again, sherd interiors were slightly darker and duller than sherd exteriors. All sherd cores were gray. The high incidence of dark gray cores in both collections is a likely reflection of the incomplete oxidation of carbonaceous matter in the clay during the firing process, either because of poor draft, short firing time, and/or low firing temperature (Sheppard 1971:104; Rye 1981:115). In summary, firing probably occurred in the open.

Twenty-two examples of fire clouds were identified, primarily on the exterior surfaces of relatively large sherds. It seems likely that fire clouding may have occurred more widely on the original vessel surfaces...
than this small number of observations suggests, given the difficulty of recognizing it on small sherds and the heavy weathering of exterior sherd surfaces. In addition, patches of possible carbon deposits remain on several sherd exteriors, and a thin blackened layer of a possible food residue adheres to the interior surfaces of a number of sherds.

The temper and clay of three sherds in the collection (two from Area 811/821 and one from Area 822) were analyzed through thin sectioning (Dean 1987). The clay used in all three cases appears to have been derived from a poorly sorted volcanic tuff, and tuff fragments up to 1.25-1.50 mm in length were visible in thin section. However, the tuff represented in the sherd from Area 822 is slightly different in composition than that represented in at least one of the sherds from Area 811/821. Specifically, the sherd from Area 822 contains abundant pyroxene, in contrast to the sherd from Area 811/821 which contains none of that mineral (Sonnenthal 1987). In addition, the Area 822 sherd contains feldspar fragments which have been altered by water action, suggesting that the source of tuff in the clay was originally deposited in a lacustrine environment. Feldspar in the Area 811/821 sherd is not similarly altered.

The single sherd from Area 822 and one of those from Area 811/821 contain fragments of a siliceous volcanic rock, possibly rhyolite, as temper. The latter sherd from Area 811/821 also contains fragments of biotite. In contrast, temper in the second sherd from Area 811/821 consists primarily of fragments of a fine-grained cryptocrystalline silica, possibly a chalcedony, which is high in iron oxides. Despite the difference in primary temper material, the two sherds from Area 811/821 contain the same approximate amount of biotite (approximately 1% of the minerals represented in each case). However, the particles of biotite in the sherd with possible chalcedony temper are larger in size than those in the sherd with temper of rhyolite (.6 mm as opposed to .4 mm in maximum dimension).

Hill and Kane (1988) recently examined a small sample of ceramics from several sites in the Dolores River area, which are thought to have been manufactured by Utes during the Protohistoric period. A petrographic analysis of the sherds was undertaken in order to characterize the temper material and method of manufacture in each case, and the results were compared to ethnographic information on Ute pottery production. These data were then compared to archeological and ethnographic information pertaining to the manufacture of ceramics by the prehistoric Anasazi and Athabaskan populations in southwestern Colorado.

The Ute ceramics included in the study by Hill and Kane contained micaceous temper which was characterized as a gneissic granite grus. In addition, the petrographic analysis indicated that many temper particles in the paste of the Ute ceramics were oriented approximately parallel to the walls of the vessels, which suggests that the vessels were constructed using the paddle and anvil technique. In contrast, Hill and Kane indicated that temper particles in Navajo and Pueblo ceramics have no preferred orientation, and that finishing of vessel surfaces is accomplished by scraping. Therefore, they concluded that the ceramic traditions of the Utes, Athabaskans, and Anasazi may be distinguished by the method
which was used to complete the manufacture of ceramic vessels, either by the scraping of vessel surfaces or by the use of a paddle and anvil. They further suggested that the Ute pottery sample from the Dolores River area may be typical of Ute ceramics in general.

In a review of this work, Buckles (1988:221) suggested that the sample of Ute ceramics included in the Hill and Kane analysis is not representative of the full range of variation in temper and method of construction of Ute ceramics. Furthermore, he feels that some of the micaceous ceramics from archeological contexts which have been attributed to Ute manufacture may have been produced instead by other cultural groups. In this regard, the ceramic data from Pioneer Point contribute to a better understanding of the variability of probable Ute ceramics. For instance, the ceramics from Area 811/821 at Pioneer Point are micaceous, while those from Area 822 are consistently non-micaceous. The petrographic analysis performed on a sample of the Pioneer Point ceramics did not include the observation of temper alignment which was used by Hill and Kane to infer manufacturing method. However, as mentioned previously, the surfaces of the vessels represented at Pioneer Point appear to have been finished by wiping or scraping.

Much of the ceramic collection from both areas of Pioneer Point is in a poor state of preservation, and the exterior surfaces of most of the sherds are more pitted and eroded than the interior surfaces. It was initially believed that the apparent differential preservation of surfaces might reflect the position of many of the sherds concave surfaces down in the ground, and that the upper, convex surfaces of the sherds would consequently have been more exposed to the effects of percolating ground water, etc. However, although most of the actual erosion may have occurred subsequent to deposition of the material, the results of the analysis indicated that depositional attitude was not a significant factor in the differential preservation. Rim and neck sherds with concave exterior surfaces exhibited the same heavy exterior weathering as body sherds with flat to convex exterior surfaces. The poor condition of the exterior surfaces may instead be related to damage produced during vessel use or to differential treatment of exterior and interior surfaces during manufacture, the latter supported by the greater irregularity of exterior surfaces in those instances where both surfaces are still relatively intact.

The percentages of the number and weight of sherds recovered from each excavation unit in Area 811/821 (Table 6) are fairly comparable, and the ranking of units by either measure of quantity is identical. This suggests that the numerical frequencies are not biased by marked differences in the size of sherds across the site. Sherds in the Area 811/821 collection range in maximum dimension from 7 to 44 mm, with the lower size limit an obvious byproduct of the one-quarter inch screening procedures used at the site. Thickness of sherds ranges from 3 to 7.3 mm, and the largest thickness range on a single sherd or reconstructed segment is 2.2 mm.

The sherds collected within Area 822 range in maximum dimension from 8 to 31 mm, and the total ceramic count and weight data for the pertinent excavation units (Table 7) are remarkably similar, suggesting again
Table 6. Number and Weight of Sherds by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th>Unit</th>
<th># Sherds</th>
<th>Percent (count)</th>
<th>Weight in grams</th>
<th>Percent (weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>144</td>
<td>20.8</td>
<td>119.2</td>
<td>15.8</td>
</tr>
<tr>
<td>X4</td>
<td>75</td>
<td>10.8</td>
<td>63.1</td>
<td>8.4</td>
</tr>
<tr>
<td>X11</td>
<td>29</td>
<td>4.2</td>
<td>34.9</td>
<td>4.6</td>
</tr>
<tr>
<td>X8</td>
<td>260</td>
<td>37.5</td>
<td>327.5</td>
<td>43.4</td>
</tr>
<tr>
<td>X10</td>
<td>10</td>
<td>1.4</td>
<td>9.0</td>
<td>1.2</td>
</tr>
<tr>
<td>X13</td>
<td>82</td>
<td>11.8</td>
<td>85.3</td>
<td>11.3</td>
</tr>
<tr>
<td>X14</td>
<td>92</td>
<td>13.3</td>
<td>114.9</td>
<td>15.2</td>
</tr>
<tr>
<td>X16</td>
<td>1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>693</td>
<td>100.0</td>
<td>754.4</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 7. Number and Weight of Sherds by Excavation Unit, Area 822.

<table>
<thead>
<tr>
<th>Unit</th>
<th># Sherds</th>
<th>Percent (count)</th>
<th>Weight in grams</th>
<th>Percent (weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 1/4 X85</td>
<td>21</td>
<td>25.6</td>
<td>20.6</td>
<td>26.1</td>
</tr>
<tr>
<td>X86</td>
<td>37</td>
<td>45.1</td>
<td>35.6</td>
<td>45.0</td>
</tr>
<tr>
<td>X87</td>
<td>1</td>
<td>1.2</td>
<td>0.8</td>
<td>1.0</td>
</tr>
<tr>
<td>X105/X106</td>
<td>23</td>
<td>28.1</td>
<td>22.1</td>
<td>27.9</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>100.0</td>
<td>79.1</td>
<td>100.0</td>
</tr>
</tbody>
</table>
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that frequencies are not biased by fragmentation. Sherds in the Area 822 sample range in thickness from 3.9 to 6.4 mm.

Bettinger (1986) has proposed a method for classifying Great Basin brown ware ceramics which he feels may provide insight into the nature and regional distribution of these ceramic wares, and ultimately contribute to studies of culture history and prehistoric ethnolinguistic distributions. His classification provides a vehicle for much needed systematic collection of data on relatively subtle ceramic distinctions, presented in a standard format to facilitate the comparison of collections from different sites and regions. The basis of the Bettinger classification is variation in the surface finish of sherds. The data consist of the frequencies with which several modes of surface treatment occur on individual sherd interiors, exteriors, and jointly on the interior and exterior of the same sherd. The classification was applied to the Pioneer Point ceramic assemblage (below) simply as a contribution to the database which Bettinger has proposed.

<table>
<thead>
<tr>
<th>Area 811/821</th>
<th>INTERIOR</th>
<th>EXTERIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smooth</td>
<td>Rough</td>
</tr>
<tr>
<td>Smooth</td>
<td>67</td>
<td>133</td>
</tr>
<tr>
<td>Rough</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area 822</th>
<th>INTERIOR</th>
<th>EXTERIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smooth</td>
<td>Rough</td>
</tr>
<tr>
<td>Smooth</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Rough</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Sherds smaller than 15 mm in maximum dimension were excluded from classification, as were those with badly eroded or otherwise damaged surfaces. As a consequence, given the nature of the Pioneer Point collection, very few sherds could ultimately be classified. Reconstructed vessel segments were treated as single units for classification purposes.

Most of the sherds from both investigated areas at Pioneer Point had relatively smooth interior surfaces and rough exterior surfaces. A considerable number of sherds with smooth interior and smooth exterior surfaces were also recovered from Area 811/821. No sherds were characterized as ‘brushed’ or ‘tooled’, as defined by Bettinger (1986:99). The determination of ‘smooth’ and ‘rough’ in the Pioneer Point collection was subjective, and it was difficult to determine how much the surface erosion of sherds subsequent to deposition had contributed to the general roughening of sherd surfaces.

VESSEL SHAPE AND SIZE

All major portions or parts of vessels were recovered within Area 811/821 including rim, neck, and body sherds. The rim and neck sherds indicate that the intact vessels had short, slightly constricted necks and outward-flaring, rounded rims (Figure 15). One rim sherd appears to have a slight protuberance on the exterior surface, but this observation is inconclusive given the weathered condition of the sherd. Flat to slightly excursive body sherds suggest that the vessels lacked pronounced shoulders or other angular features, and this same gradual curvature suggests that the vessels were of medium size. The latter vessel size
estimate is supported by four rim diameter projections: one projection of a minimum of 12 cm, one of a minimum of 14 cm, and two projections of a minimum of 18 cm. However, each of the rim sections from which these projections were made constitutes 5% or less of a complete vessel rim.

No evidence for vessel base form was recognized in the Pioneer Point collection. However, Buckles' (1971:517,520,522) findings regarding the base form of Uncompahgre Brown Ware vessels are of interest here. Buckles contrasted the abundant evidence for conical bases on vessels of the Fingertip Impressed Type of Uncompahgre Brown Ware with the small amount of evidence for both conical and round bases on vessels of the Plain Type. He concluded that round bottoms were probably more prevalent on Plain Type vessels than the recognizable direct evidence suggested. He ultimately used this data in establishing a tentative sequence of ceramic changes on the Uncompahgre through time “from early conical base fingertip impressed vessels to late round based plain vessels with probably some occurrence of both surface treatments throughout time but in differing frequencies” (Buckles 1971:543).

In summary, the fragmentary ceramics from Area 811/821 have provided several kinds of data from which to draw inferences concerning the original size and shape of the represented vessels. This collection of sherds appears to have come from medium-capacity, medium-mouthed jars generally similar in configuration to Plain Type Brown Ware vessels described by Buckles (1971:514-518,522). One divergence from the extrapolated vessel forms illustrated by Buckles (1971:Figure 50) is a slightly more pronounced outward flaring rim form in the Pioneer Point assemblage, in combination with a relatively short neck.

NUMBER OF VESSELS IN THE AREA 811/821 COLLECTION

The most conclusive line of evidence regarding the number of vessels represented in the collection consists of differing rim sherd dimensions. Most of the variation observed in rim sherd thickness and proportions would probably occur on a single, somewhat irregular vessel. However, the rim sherds which anchor the ends of the thickness continuum in the Area 811/821 sample are sufficiently different from one another to suggest that portions of two vessels may be represented in the collection. These would include one relatively thick, robust vessel and a second slightly smaller and thinner vessel.

The rim sherd at the upper end of the continuum is approximately 25% thicker than the specimen at the lower end (7 mm as opposed to 5.2 mm) measured at the point of greatest curvature on each sherd where the interior surface begins to flare outward toward the rim. The location of this point on the two specimens, 13 mm below the rim of the larger specimen and 8 mm below the rim of the smaller specimen, is also an index to their differential proportions. Both sherds constitute 5% or less of a complete vessel rim, with intact rim segments only 31 mm and 24 mm long. While projected vessel rim diameter measurements from the two are somewhat tenuous given the fragmentary nature of the sherds and the undoubtedly irregular configuration of the original pots, a rim diameter of at least 18 cm is indicated in the thicker
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case, while a diameter of at least 14 cm is indicated in the thinner case.

However, efforts to use additional data on the collection to confirm this projected number of represented vessels proved largely unrewarding. For example, bimodal clustering in the thicknesses of sherds derived from different vessels was expected to occur, along with considerable thickness overlap due to similarities in vessel form and function. In order to evaluate this expectation regarding the collection, minimum and maximum thickness measurements to the nearest .1 mm were collected from sherds with intact remnants of interior and exterior surfaces (407 of the 693 sherds from Area 811/821). These data are presented in the histogram in Figure 16. The subtotals for each vertical bar reflect the frequency of the measured minimum and maximum values and the .1 mm increments between each paired set of values. There is clearly no evidence for grouping in the measurements.

In addition, temper differences within the Area 811/821 collection of rim, neck, and body sherds were tentatively ascribed to the presence of multiple vessels. The initial temper analysis was performed by the writer and involved observation of the relative amount of mica exposed on the surfaces of each sherd. Sherd surfaces were characterized as either 'slightly micaceous' or 'moderately micaceous', although the differences were not marked in every instance and the observations were undoubtedly affected by such factors as the size, color, surface treatment, and preservation of sherds. It was believed that the differences in quantities of mica observed on sherd surfaces might be an indication of other temper differences as well. If two types of crushed rock were ultimately found to be present as temper material, portions of two vessels might be represented. The existing sherd surfaces were washed prior to observation, but no new breaks were made for the purpose of this initial analysis. The surfaces were observed with the naked eye and under low magnification.

The spatial distribution of sherds assigned to the two temper categories was subsequently explored, based upon the assumption that sherds derived from a particular vessel might still be clustered if breakage occurred in the area where the materials were recovered. Because there are over six times as many 'slightly' micaceous sherds as there are 'moderately' micaceous, it was difficult to make a meaningful comparison of the two categories using raw frequency counts (Table 8). The frequency data for each excavation unit were therefore converted to percentages reflecting a proportion of the total number of sherds assigned to each temper category (Figure 17).

The two temper groups co-occurred in all but one excavation unit (X16), from which only one sherd was recovered. A relatively even percentage representation of the two groups occurred in excavation units 2, 10, and 11. However, it appears that some clustering of sherds occurred, based upon density of the two temper categories, with a higher proportion of 'moderately' micaceous sherds in X4 and X8 (the southwestern portion of the ceramic scatter) and a higher representation of 'slightly' micaceous sherds across the northern portion of the scatter in X13 and X14. Results of a chi-square test and subsequent calculation of Cramer's phi coefficient (Table 9) indicated a statistically significant but weak
Figure 15. Rim sherds (a-d), sandstone shaft smoother (e), and metate fragment (f), Area 811/821.

Figure 16. Thicknesses of sherds from Area 811/821. Subtotals for bars in the histogram reflect the frequency of measured minimum and maximum values and the 0.1 mm increments between each paired set of values.
Table 8. Distribution of Sherds Assigned to Micaceous Temper Categories by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th></th>
<th>X2</th>
<th>X4</th>
<th>X11</th>
<th>X8</th>
<th>X10</th>
<th>X13</th>
<th>X14</th>
<th>X16</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>126</td>
<td>56</td>
<td>25</td>
<td>214</td>
<td>9</td>
<td>78</td>
<td>90</td>
<td>1</td>
<td>599</td>
<td>86.4</td>
</tr>
<tr>
<td>Moderate</td>
<td>18</td>
<td>19</td>
<td>4</td>
<td>46</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>94</td>
<td>1</td>
<td>13.6</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>75</td>
<td>29</td>
<td>260</td>
<td>10</td>
<td>82</td>
<td>92</td>
<td>1</td>
<td>693</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 17. Percentage distribution of temper categories by excavation unit, Area 811/821.
Table 9. Calculation of Chi-square Test and Cramer’s Phi Coefficient on a Contingency Table of the Provenience of Sherds Assigned to Two Temper Categories, Area 811/821*.

\( H_0 \) : Amount of micaceous temper and sherd provenience (excavation unit) are independent (are not related).

\( H_1 \) : The two variables are related.

<table>
<thead>
<tr>
<th></th>
<th>( X_2 )</th>
<th>( X_4,X_{10},X_{11} )</th>
<th>( X_8 )</th>
<th>( X_{13} )</th>
<th>( X_{14},X_{16} )</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>126</td>
<td>90</td>
<td>214</td>
<td>78</td>
<td>91</td>
<td>599</td>
</tr>
<tr>
<td>Moderate</td>
<td>18</td>
<td>24</td>
<td>46</td>
<td>4</td>
<td>2</td>
<td>94</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>114</td>
<td>260</td>
<td>82</td>
<td>93</td>
<td>693</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
fo & \quad fe & \quad f_o-fe & \quad (fo-fe)^2 & \quad (fo-fe)^2 \\
126 & 124.47 & 1.53 & 2.34 & .02 \\
90 & 98.54 & -8.54 & 72.93 & .74 \\
214 & 224.73 & -10.73 & 115.13 & .51 \\
78 & 70.88 & 7.12 & 50.69 & .72 \\
91 & 80.39 & 10.61 & 112.57 & 1.40 \\
18 & 19.53 & -1.53 & 2.34 & .12 \\
24 & 15.46 & 8.54 & 72.93 & 4.72 \\
46 & 35.27 & 10.73 & 115.13 & 3.26 \\
4 & 11.12 & -7.12 & 50.69 & 4.56 \\
2 & 12.61 & -10.61 & 112.57 & 8.93 \\
\end{align*}
\]

\( f_o \) = observed frequency

\( f_e \) = expected frequency = \( \frac{(\text{row total})(\text{column total})}{N} \) under null hypothesis

\[
\chi^2 = \sum \frac{(f_o-fe)^2}{f_e} = 24.98
\]

\[\text{df} = (r-1)(c-1) = (2-1)(5-1) = 4\]

\[
\chi^2 = 24.98 \\
\text{df} = 4
\]

Since 24.98 > 18.47, null hypothesis is rejected.
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Table 9. Calculation of Chi-square Test and Cramer’s Phi Coefficient on a Contingency Table of the Provenience of Sherds Assigned to Two Temper Categories, Area 811/821 (continued).

\[
\text{Cramer’s phi coefficient } = \sqrt{\frac{X^2}{N(k-1)}} \quad \text{where } k = \text{the smaller of } r \text{ or } c
\]

\[
= \sqrt{\frac{24.98}{693(2-1)}}
\]

\[
= \sqrt{0.0360}
\]

\[
= 0.1899
\]

\[
= 0.19
\]


relationship between apparent quantity of micaceous inclusions and sherd provenience.

A thin section analysis was subsequently undertaken in order to determine whether possible mineralogical differences in temper observed through thin sectioning of sherds from the two temper categories would support the multiple vessel hypothesis (Dean 1987). The clay used in each case appears to have been derived from a poorly sorted volcanic tuff. Fragments of tuff in the two thin section samples from Area 811/821 ranged from clay-sized particles to fragments 1.5 mm in diameter. Temper in the two sherds was found to be different, the slightly micaceous sherd containing fragments of a siliceous volcanic rock, possibly rhyolite, and the moderately micaceous sherd containing fragments of a fine-grained cryptocrystalline silica, possibly a chalcedony. However, the amount of biotite present in each case was approximately the same (approximately 1% of the minerals represented). Biotite particles in the moderately micaceous sherd were simply larger in size than those in the slightly micaceous sherd (roughly 0.6 mm as opposed to 0.4 mm in maximum dimension). Clearly the original classification of the collection based upon the apparent quantity of micaceous inclusions is somewhat misleading.

In general, analysis suggests that there was little preparation of raw materials prior to manufacture of the vessel or vessels represented at Pioneer Point (Dean, personal communication 1987). While the variation in raw materials represented in a
complete vessel of this type is unknown, it may have been considerable. In addition, the information presented above regarding variation within the Pioneer Point ceramic assemblage is based upon thin section analysis of a very small sample of the collection. As a consequence, the issue of the number of vessels represented in the collection remains unresolved.

In summary, attributes of individual sherds, thin section analysis of selected sherds, and the spatial distribution of ceramics suggest that portions of two ceramic vessels may be represented in the assemblage from Area 811/821 at Pioneer Point. Admittedly, none of the avenues pursued in this area are overwhelmingly convincing, and the relationship between the various avenues is not completely clear. The slight spatial clustering of sherds discussed above might also be explained by the breakage of a single vessel in which the distribution of temper material was not uniform. Despite the large number of sherds in the collection, the individual sherds are relatively small (mean maximum dimension of 18 mm), and it is clear that substantial portions of the original vessel(s) are missing from the collection.

**NUMBER OF VESSELS IN THE AREA 822 COLLECTION**

As mentioned previously, the small ceramic assemblage from Area 822 is more homogeneous than that from Area 811/821 and consists entirely of body sherds with little or no curvature and little variation in thickness. In contrast to the ceramics from Area 811/821, gross examination of sherd surfaces in the Area 822 collection indicated that temper was consistently non-micaceous, and the lack of mica was confirmed during thin section analysis of a single sherd from the collection (Dean 1987). As has been discussed, thin section analysis suggested that the clay used to manufacture the pottery represented in both areas of the site was derived from poorly sorted volcanic tuff. However, the tuff represented in each case is slightly different in mineralogical composition and alteration of constituent feldspar due to differences in original depositional environment. Temper in the sherd from Area 822 consists of fragments of a siliceous volcanic rock tentatively identified as rhyolite. It therefore appears that a restricted portion of a single ceramic vessel is represented in the collection from Area 822 which is distinct from those in the Area 811/821 assemblage.

**VESSEL FUNCTION**

Several lines of evidence suggest that the functions of the vessels which are represented in the ceramic assemblage from Area 811/821 included cooking in or over a fire. What appear to be remnant patches of carbon deposits adhere to the exterior surfaces of 10 body sherds and a single rim sherd, and a thin blackened layer of a possible food residue is present on a number of sherd interiors. An attempt to identify the carbonized material on one interior sherd surface was unsuccessful (Dean 1987).

Extrapolated vessel shape is also informative of function. This is particularly true when it is reasonable to assume that the vessels in question were domestically produced for utilitarian purposes, although various culture-specific contextual factors may also significantly influence vessel morphology (Braun 1983:112; Smith 1983:304). In two instances in the Pioneer
CERAMICS

Point collection where slightly more than 5% of a complete neck has been reconstructed, the projected inside neck diameter falls between 14 and 16 cm. These projected neck diameters are consistent with a functional interpretation of temporary storage jars, water coolers, and cooking vessels for small- to moderate-sized groups of people (Braun 1980:182).

As mentioned previously, there is an unfortunate absence of concrete evidence for vessel base configuration in the Pioneer Point ceramic assemblage. Because the vessels represented are similar to the Plain Type vessels defined by Buckles for the Uncompahgre Plateau area, reference was made earlier to the data Buckles collected regarding base form and to his tentative temporal sequence of ceramic changes from early conical-based Fingertip Impressed Type vessels to late round-based Plain Type vessels (Buckles 1971:543). This proposed sequence would have involved not only a change in the method of surface finishing through the welding of clay coils and a change in vessel base form, but also an apparent decrease in vessel size and wall thickness through time (Buckles 1971:518,522). If these morphological observations and extrapolations by Buckles for the two Uncompahgre Brown Ware types are accurate, regardless of their potential temporal significance, they may have implications regarding dietary emphases and group mobility patterns (e.g., Braun 1983:118-122,125; Mills 1985:7-10; Smith 1983:124,270-271,273-274; Whallon 1969). Of note, although Buckles suggests the co-occurrence of types and base forms through a portion of time, the presence at Pioneer Point of relatively thin, plain vessels at an early time period does not appear to support Buckles’ suggested temporal sequence.

Ethnographic information on the Utes indicates that they manufactured and used pottery vessels for cooking food, both by stone-boiling and boiling over a fire, and for carrying and storing water (Smith 1974:69,87; J. Alden Mason personal communication in Smith 1974:84; Stewart 1942:254; Lowie 1924:226). The shapes of the vessels used for these purposes varied. Cooking vessels typically had wide, unrestricted orifices, and clay water jugs similar in design to basketry water jugs had relatively long constricted necks (Smith 1974:83,87,88,Plate 28b; Opler 1939:162; Lowie 1924:259, Figure 28b). Neither of these vessel shapes resembles that of the vessel(s) represented in Area 811/821 at Pioneer Point. There is also ethnographic documentation of the use of ceramic vessels by Ute groups for parching seeds and for storage of plant foods (Stewart 1942:252,254).

SUMMARY

Ceramics similar to the Plain Type of Uncompahgre Brown Ware (Buckles 1971) were recovered from two areas within 5GN41. It appears that portions of one or more vessels were represented in Area 811/821, and a portion of another vessel was recovered in Area 822. While inferences regarding the shape of the latter vessel are limited by the size and homogeneity of the sample from Area 822, the collection from Area 811/821 appears to represent medium-sized, medium-mouthed jar(s). The Pioneer Point vessels appear to have been used for cooking in or over a fire, although they may have functioned in other capacities as well. In both areas of the site, the ceramics were closely associated with a hearth feature.
LITHIC ARTIFACTS

INTRODUCTION

The results of an analysis of chipped stone artifacts from two lithic concentrations at Pioneer Point are presented below. Chipped stone from Area 811/821 included in the study was recovered from two test units (X2 and X4) excavated in 1981, and from the area immediately around the test units which was excavated during the 1982 field season at Curecanti. Together, these materials include over 2,500 pieces ofdebitage and 69 tools and tool fragments which have been refitted into 56 complete and partial implements. Most of the recovered artifacts are of quartzite (97% of the debitage and approximately 77% of the tools), but additional raw material types have been identified in the assemblage including jasper, agate, chert, and welded tuff (Tables 10-12). The quartzitic portion of the assemblage includes both patterned tools, most notably, medium to large biaxially flaked "knives" (Figure 18) and small projectile points (Figure 13 a,f,g,l), and less stylized medium- to large-sized implements (Figures 19 and 20e). Small- to medium-sized formal and informal tools of non-quartzitic raw material types were also recovered (Figures 13 b,d,j and 20 b-d,f-i). A large number of resharpening flakes are included in the debitage.

Cultural material recovered during the 1982 investigations within Area 822 at Pioneer Point includes nearly 2,000 pieces ofdebitage (95% quartzite) and 77 tools and tool fragments which have been refitted into 66 complete and incomplete tools (approximately 77% quartzite). All of the raw material types recovered from Area 811/821 are also represented in the Area 822 collection, with the addition of a few pieces of obsidian (Tables 13-15). The collections from the two areas of the site were analyzed separately, and the results were subsequently compared in order to develop a statement on the site as a whole. The following discussion is similarly organized, with separate sections on the area collections followed by a comparison of the two. Background information on the analytical approach which was taken is included in the initial section on chipped stone from Area 811/821.

The primary purpose of the chipped stone analysis was to obtain information regarding the kinds of activities which were conducted at Pioneer Point. Consequently, in addition to assembling data pertaining to the manufacture and maintenance of chipped stone implements, information was sought regarding actual on-site use of tools. As part of the latter effort, groups of arti-
Table 10. General Specimen Form for Debitage by Lithic Raw Material Type, Area 811/821.

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>RT</th>
<th>P</th>
<th>W</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>342</td>
<td>268</td>
<td>61</td>
<td>1775</td>
<td>2446</td>
</tr>
<tr>
<td>Agate</td>
<td>1</td>
<td>3</td>
<td></td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Jasper</td>
<td>3</td>
<td>9</td>
<td>7</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>Chert</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>286</td>
<td>69</td>
<td>1813</td>
<td>2514</td>
</tr>
</tbody>
</table>

R = resharpening flakes  
RT = resharpening/thinning flakes  
P = pressure flakes  
W = waste flakes/shatter

Table 11. Debitage and Implements by Lithic Raw Material Type, Area 811/821.

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>T</th>
<th>D/T</th>
<th>% D</th>
<th>% T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>2446</td>
<td>53</td>
<td>46.2</td>
<td>97.3</td>
<td>76.8</td>
</tr>
<tr>
<td>Agate</td>
<td>9</td>
<td>4</td>
<td>2.3</td>
<td>0.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Jasper</td>
<td>44</td>
<td>10</td>
<td>4.4</td>
<td>1.8</td>
<td>14.5</td>
</tr>
<tr>
<td>Chert</td>
<td>11</td>
<td>2</td>
<td>5.5</td>
<td>0.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>4</td>
<td></td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D = debitage pieces  
T = implements and implement fragments

Table 12. Tool Location for Refitted Implements and Implement Fragments by Lithic Raw Material Type, Area 811/821.

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>B</th>
<th>I</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>25</td>
<td>13</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>Agate</td>
<td>1</td>
<td>2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Jasper</td>
<td>7</td>
<td>2</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Chert</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>14</td>
<td>8</td>
<td>56</td>
</tr>
</tbody>
</table>

F = flake implements  
B = bifaces  
I = indeterminate
Figure 18. Selected quartzite chipped stone implements, Area 811/821.

Figure 19. Selected quartzite chipped stone implements, Area 811/821.
Figure 20. Miscellaneous chipped stone artifacts, Area 811/821: a. jasper core fragment; b. agate drill base; c. chert biface; d. agate notch; e. quartzite notch; f-h. jasper flake tools; i. chert flake tool.
Table 13. General Specimen Form for Debitage by Lithic Raw Material Type, Area 822.

<table>
<thead>
<tr>
<th>Material from excavated units</th>
<th>Material from surface-collected units</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>RT</td>
</tr>
<tr>
<td>Quartzite</td>
<td>147</td>
</tr>
<tr>
<td>Agate</td>
<td>1</td>
</tr>
<tr>
<td>Jasper</td>
<td>7</td>
</tr>
<tr>
<td>Chert</td>
<td>2</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
</tr>
<tr>
<td>W. tuff</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>155</td>
</tr>
</tbody>
</table>

Surface and Excavated Material Combined

| R   | RT | P | W | Total |
|-------------------------------|
| Quartzite  | 168 | 602 | 6 | 1114 | 1890 |
| Agate     | 2   | 4  | 6 | | |
| Jasper    | 7   | 28 | 3 | 36 | 74  | |
| Chert     | 1   | 2  | 1 | 4  | | |
| Obsidian  | 1   | 2  | 3 | | | |
| W. tuff   | 1   | 3  | 4 | | | |
| Total     | 177 | 635 | 9 | 1160 | 1981 | |

R = resharpening flakes  
RT = resharpening/thinning flakes  
P = pressure flakes  
W = waste flakes and shatter
Table 14. Debitage and Implements by Lithic Raw Material Type, Area 822.

<table>
<thead>
<tr>
<th>Material from Excavated units</th>
<th>Material from surface-collected units</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>T</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Quartzite 1673</td>
<td>51</td>
</tr>
<tr>
<td>Agate</td>
<td>5</td>
</tr>
<tr>
<td>Jasper</td>
<td>69</td>
</tr>
<tr>
<td>Chert</td>
<td>2</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>4</td>
</tr>
</tbody>
</table>

Surface and Excavated Material Combined

<table>
<thead>
<tr>
<th>D</th>
<th>T</th>
<th>D/T</th>
<th>% D</th>
<th>% T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite 1890</td>
<td>59</td>
<td>32.0</td>
<td>95.4</td>
<td>76.6</td>
</tr>
<tr>
<td>Agate</td>
<td>6</td>
<td>3</td>
<td>2.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Jasper</td>
<td>74</td>
<td>13</td>
<td>5.7</td>
<td>3.7</td>
</tr>
<tr>
<td>Chert</td>
<td>4</td>
<td>1</td>
<td>4.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Obsidian</td>
<td>3</td>
<td>1</td>
<td>3.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>4</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
</tbody>
</table>

D = debitage pieces  T = implements and implement fragments
LITHIC ARTIFACTS

Table 15. Tool Location for Refitted Implements and Implement Fragments by Lithic Raw Material Type, Area 822.

<table>
<thead>
<tr>
<th>Material from Excavated units</th>
<th>Material from surface-collected units</th>
<th>Combined surface and excavated units</th>
</tr>
</thead>
<tbody>
<tr>
<td>F B I Total</td>
<td>F B I Total</td>
<td>F B I Total</td>
</tr>
<tr>
<td>Quartzite</td>
<td>27 12 6 45 5</td>
<td>32 12 6 50</td>
</tr>
<tr>
<td>Agate</td>
<td>1 1 2 2</td>
<td>1 1 2 2</td>
</tr>
<tr>
<td>Jasper</td>
<td>8 1 9 2</td>
<td>10 2 12</td>
</tr>
<tr>
<td>Chert</td>
<td>1 1</td>
<td>1 1</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1 1 1 1</td>
<td>1 1</td>
</tr>
<tr>
<td>Total</td>
<td>37 12 8 57</td>
<td>8 1 9 10 2 1 1 1</td>
</tr>
</tbody>
</table>

F = flake implements  B = bifaces  I = indeterminate

facts which were considered most likely to have been used at the site were isolated for subsequent functional study. The study of function was limited to determining the general behavioral contexts of stone tool use at the site, and function was inferred through study of four attributes of chipped stone artifacts, stone tool edges, and remnant tool edges on resharpening flakes. The four attributes include edge angle, edge form, raw material type, and tool location (Appendix I). Observations on the entire assemblage of chipped stone tools and quartzite resharpening flakes from Pioneer Point were initially used to define what appear to be functionally significant categories of implements. The results were then selectively applied to those artifactual subsets previously determined most appropriate to examine, in order to study on-site tool use. The final phase of the lithic analysis involved an examination of the general spatial distribution of selected artifacts in light of the inferences which were made concerning activities in which tools may have been used at the site.

For purposes of the analysis, variables were defined for collecting and recording information on both the debitage and tools from Pioneer Point (Appendix I). All observations and measurements on the artifacts were made by the author, and the data were initially entered into the non-volatile RAM memory of either a TRS-80 Model 100 or Model 200 portable computer using data entry software developed at the Midwest Archeological Center. The data were then transferred electronically into an IBM PC and stored on magnetic disk using the PC-file database management program. Most statistical manipulations were performed on an IBM XT using the SPSS/PC commercial software package.
LITHIC ARTIFACTS

AREA 811/821

Tool Maintenance

The maintenance of chipped stone implements was a relatively important activity within Area 811/821 at Pioneer Point, as indicated by the presence of a significant number of resharpening flakes (Table 10). Tool maintenance is here defined as the reworking or reconfiguration of implements for purposes which may relate to their continued use to perform specific tasks. Resharpening flakes are therefore presumed to have been produced during the rejuvenation of the working edges of bifacial and unifacial chipped stone tools. Several specific criteria were employed to define resharpening flakes during the analysis (Appendix I), including the presence of macroscopically observable wear along the remnant of tool edge which now represents the intersection of the striking platform and resharpening flake exterior. Most of the resharpening flakes in the Area 811/821 assemblage (n = 342) were struck from implements manufactured from quartzite, but several of other raw material types were also recovered. The resharpening flakes in the collection range from extremely coarse, sinuous-edged pieces to small, finely flaked specimens, indicating that more than one form of tool was reworked at this locale.

An unknown but probably minimal number of the resharpening flakes may not reflect tool maintenance conducted at Pioneer Point itself. As shall be discussed in the following section, the preponderance of the Pioneer Point chipped stone implements were produced on resharpening and other flakes, raising the possibility that selected pieces of debitage were transported to Pioneer Point for use as or to manufacture into tools. In such cases, the maintenance activities which incidentally resulted in the production of the resharpening flakes would have occurred elsewhere.

Additional support for the idea that tool maintenance was conducted in the area surrounding Feature 10 at Pioneer Point may be drawn from the recovered tool assemblage itself, as well as from another form of the debitage. Six quartzite implement fragments which exhibit hafting abrasion most likely indicate that dysfunctional hafted tools were the focus of at least a portion of the maintenance activities. There is also dulling or wear on the ridges between flake scars on a few pieces of quartzite shatter, presumably resulting from the abrasion of hafts on the implements from which these pieces were subsequently removed. Portions of several projectile points lacking obvious signs of use, such as hafting abrasion or impact fractures, were also recovered near Feature 10 (Figure 13 a, b, d, f, g, j, l). The latter may be construed as evidence of either tool manufacturing or tool maintenance.

Although the various stages of tool manufacture which were performed within Area 811/821 will be discussed separately, there may be little discernible archeological distinction between maintenance and manufacture, particularly with regard to the bifacial implements. As will be discussed later, tool forms from both areas at Pioneer Point which may be identified technologically as biface "preforms" also exhibit evidence of use. In general, the form and function of such implements may
LITHIC ARTIFACTS

have changed through time with changing tool needs, until such point in the reduction process as commitments were made to particular “finished” tool types. Under such circumstances, it seems pointless to attempt to differentiate between the maintenance of an existing form and continued manufacture. Evidence for similar lithic reduction strategies has previously been observed at sites within the Park (Jones 1986a:212-213). This sequential modification of tools with a result that the original and final tool forms may be different has been termed by Jelinek (1976:22) as the “Frison effect,” based upon Frison’s classic study of the Piney Creek assemblage from northern Wyoming (1968).

Tool Manufacture

The disparity between the large quantity of recovered quartzite and the minimal amounts of the other raw material types is thought to be due in part to the range of tool manufacturing and maintenance activities performed at Pioneer Point. It appears that stages in the manufacture of quartzite tools ranged from primary reduction through finished tool production/resharpening. Activities involving most of the non-quartzitic tools were focused upon the later stages of tool manufacture and/or rejuvenation.

Observations on the presence/absence of cortex on both the debitage and tools provide part of the evidence in support of this contention. Small quantities of the quartzite debitage are cortical or partially cortical (Table 16). Much of this cortex is smooth and rounded, signifying primary reduction of water-worn and tumbled quartzite cobbles. Such material is available in gravel deposits along the Gunnison River and its current tributary streams and in source areas associated with former water courses, such as the exposure of cobbles near the base of the Pinnacles formation in the Park approximately 9 mi (14 km) east of Pioneer Point (Jones 1986a:52,56).

Quartzite obtained from bedrock exposures also appears to have been utilized. Although little information is presently available concerning the locations of raw material sources in the vicinity of Pioneer Point, there are no known quartzite quarries immediately adjacent to the cultural deposits. However, most of the quartzite debitage recovered within Area 811/821 is non-cortical, and it appears that most of the reduction of quartzite at Pioneer Point focused on the intermediate and final stages of tool production and/or tool maintenance. In this regard, two partially cortical quartzite flake tools were also recovered.

Partially cortical debitage of jasper and welded tuff was recovered in small quantities (Table 16), but a partially cortical flake tool of jasper was also recovered. All of the agate and chert debitage and flake tools were non-cortical. Of course, some of the observed difference in the presence/absence of cortex for the different raw materials may relate to the nature of the outcrops of material in source locations.

Pressure flakes of quartzite, jasper, and chert were recovered, further evidence that final tool manufacturing/tool resharpening activities occurred at Pioneer Point (Table 10). However, the numbers of pressure flakes and the absence of pressure flakes of certain raw material types cannot be considered meaningful in this instance.
LITHIC ARTIFACTS

because significant numbers of such small items are assumed to have been lost during the on-site screening of excavated soil. It is also recognized that pressure flaking was not essential to the production of several "completed" tool forms represented in the collection.

The sizes of the individual pieces of debitage also appear to support the inferred lithic reduction activities for the quartzitic and most of the non-quartzitic materials in the collection. However, the dimensions may as likely reflect the nature of the raw material outcrops and the size of nodules which could be effectively quarried and utilized, perhaps in combination with the careful conservation of certain raw materials. The quartzite debitage is slightly larger on the average than most of the non-quartzitic debitage, having a mean maximum dimension of approximately 17 mm (ranging 5 mm - 80 mm). The jasper (n = 44), agate (n = 9), and chert (n = 11) debitage is slightly smaller in size on the average, with mean maximum dimensions between approximately 11.5 mm and 13.5 mm (raw data values range 5 mm - 27 mm). Taking into consideration a very small sample size (n = 4), the recovered debitage of welded tuff is significantly different from the other non-quartzitic materials with respect to the size of artifacts, with a mean maximum dimension of approximately 32 mm (raw data values range 14 mm - 51 mm).

Debitage-to-tool ratios for the various raw material types represented in the Area 811/821 assemblage from Pioneer Point (Table 11) are particularly instructive regarding the stages of manufacture which occurred at the site and the apparent dichotomy between the quartzitic and several of the non-quartzitic materials. Excluding consideration of welded tuff, since no tools of this material were recovered, quartzite has by far the highest debitage-to-tool ratio. In contrast, there is proportionately much less agate, jasper, and chert debitage. Some of the rather marked difference in the ratios is undoubtedly due to the difficulty in retouch and use-wear recognition on the granular quartzite, as opposed to the fine-grained cryptocrystalline raw materials. As a consequence, some of the quartzite tools in the collection may not have been recognized as such. In addition, a higher percentage of the generally smaller non-quartzitic debitage was undoubtedly lost during the screening of excavated material. Nevertheless, the divergence in the above values suggests that the non-quartzitic implements arrived at Pioneer Point in finished or nearly finished form, while more actual manufacture of quartzite tools occurred on-site.

With regard to a separate aspect of tool manufacture, the collection of refitted complete and partial implements from Pioneer Point includes a high percentage of tools manufactured on flakes (Table 12). Over twice as many flake tools were identified as were tools produced through bifacial reduction, although such tool location in nearly 15% of the total number of cases was unclear. However, bifacial flaking of edges (on flakes as well as bifaces) was the most frequent edge form in the collection (Table 17). Almost all of the bifaces (13 of 14) were manufactured from quartzite, and yet the quartzite implements as a group are dominated by flake tools. All of the jasper and agate tool edges are located on flakes, and one flake tool (Figure 20i) and one biface (Figure 20c) of chert were also recovered. Also of relevance, a jasper core
Table 16. Amount of Cortex on Debitage by Lithic Raw Material Type, Area 811/821.

<table>
<thead>
<tr>
<th>Lithic Raw Material</th>
<th>N</th>
<th>PC</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>2294</td>
<td>127</td>
<td>25</td>
<td>2446</td>
</tr>
<tr>
<td>Agate</td>
<td>9</td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Jasper</td>
<td>40</td>
<td>4</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>Chert</td>
<td>11</td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>2357</td>
<td>132</td>
<td>25</td>
<td>2514</td>
</tr>
</tbody>
</table>

N = noncortical  PC = partially cortical  C = largely cortical

Table 17. Implement Edge Form Frequency for Lithic Material from Areas 811/821 and 822.

<table>
<thead>
<tr>
<th>Edge Form Frequency</th>
<th>A811/821</th>
<th>A822</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifacial retouch</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>Unifac. scraper retouch</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Unifac. denticulate retouch</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Unifac. notch retouch</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Unifac. borer retouch</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Alternating unifacial/</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>bifacial retouch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilized flake (bifacial)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Utilized flake (unifacial)</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Utilized flake (borer)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
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fragment (Figure 20a) was recovered during shovel testing across Area 811/821, and an isolated agate core was observed on the talus slope below Soap Mesa immediately north of Pioneer Point. There may actually have been a difference in the emphasis placed upon different tool production strategies for the various raw materials represented. However, such a suggestion is largely speculative given the few non-quartzitic implements which were recovered on which to base such an inference. In addition, as is later suggested, bifaces may have been more frequently curated than were tools produced on flakes. As a consequence, bifaces may be under-represented in the collection relative to their role in the technology (Binford 1973:242, 1977:34,36; Jelinek 1976:31).

In an effort to describe some of the variability in flaked stone tools from Pioneer Point, a combination of two variables was used during the analysis to place the recovered bifaces within a tentative "blank-preform-product" continuum. Muto (1971:109-110) has emphasized the importance of the "intent" of the knapper during the progressive stages of such a manufacturing continuum, and an attempt was made to apply this concept to the limited Pioneer Point biface collection. The product which was intended to be manufactured from a "blank" is unknown because the dimensions of the artifact are such that a variety of tool forms could subsequently be manufactured from it (Crabtree 1972:42; Thomas and Bierwirth 1983:213). At the preform stage, however, there is limited insight into the manufacturer's intent (Muto 1971:110) because a threshold has been crossed in the reduction process such that there is little flexibility in the form that the finished tool may ultimately take. Finally, a "product" is a tool in finished useable form.

However, the blank-preform-product continuum, as it was originally envisioned, does not imply that a clear distinction necessarily needs to exist between incomplete and completed tools. The following may be considered as basic tenets of the concept as described and applied by Muto (1971:110,115) and by Thomas and Bierwirth (1983:214).

1. The idea that an artifact may be used at any point along the continuum, and that

2. An artifact at any given point may in fact be a completed product.

An idea of the "intent" behind the Pioneer Point collection was derived from the kinds of "finished" tools represented in the assemblage. The assignment of artifacts to individual stages was also based upon expected thickness-to-width ratios (Sharrock 1966; Thomas and Bierwirth 1983:213). All of the bifaces from Area 811/821 were identified as one of three gross technological types (blank, preform, or finished implement). While no blanks were identified in the Area 811/821 collection, both preforms and finished tools were noted. A tool class was also specified for the preforms and finished tools (in this instance, the only applicable types were those of projectile point, knife, the unknown projectile point or knife, and drill). Although the latter labels customarily imply a function for tools, no such association was made during this descriptive stage of the Pioneer Point lithic analysis.

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Quick visual assessments of thickness-to-width ratios were used to assign specimens to technological categories. Actual measurement of the artifacts occurred subsequent to the assignments. Length, width, and thickness measurements and thickness-to-width values for individual bifaces are presented in Table 18, along with descriptive statistics for the combined preforms and finished tools. The sample size for both groups is very small. The preforms are illustrated in Figures 20c and 21g, and the completed tools are illustrated in Figures 13a,g and 18a.

It would seem that quartzite bifaces in various probable stages of manufacture were brought to Pioneer Point along with at least one quartzite cobble. Although a few of the more numerous quartzite flake tools may have been carried to the site as well, some of the coarser artifacts which have tentatively been labeled as biface tools may actually have served as cores from which a number of the flake tools were struck. Fully 25% of the flake tools were produced on resharpening flakes, making any distinction between biface tools and cores somewhat artificial. In contrast, flake tools of several non-quartzitic raw material types were either carried to the site or were struck on-site from cores.

**Tool Use - Selection of Artifacts for Study**

Information regarding on-site use of chipped stone tools was sought in the course of identifying the types of activities which were conducted at Pioneer Point. Several potentially productive avenues for investigation of tool use involved functional study of subsets of both the lithic tools and debitage. These artifactual subsets were those considered most likely to constitute "primary refuse" at the site (Schiffer 1972:161), or material discarded at the location of tool use. This material was isolated during the Pioneer Point analysis as much by the process of elimination of certain other groups of implements from consideration as by the identification of characteristics likely to be associated with the target tools themselves. While some of the excluded artifacts may actually have been used at the site, they were eliminated from study because of greater ambiguity in the circumstances surrounding their use and discard. Among the groups of artifacts which were excluded from the study of on-site tool use were most of the formerly hafted implements.

Lawrence Keeley (1982) has suggested that the hafting of stone tools has had important effects on the creation of the archaeological record. Of relevance here, he suggests that the hafted parts of such tools were generally discarded under circumstances which were different from that of hand-held implements, even when the two implement types were functionally equivalent. According to Keeley, the latter were most often abandoned at or near the location of tool use following the completion of a task, whereas the potentially time-consuming "retooling" of dysfunctional hafted implements may have been accomplished at some later point in time when it was more convenient to do so. Discard of hafted tools, then, may often have occurred both spatially and temporally outside the context of their use. The brief occupation at Pioneer Point would have provided such an opportunity for general equipment repair and rehabilitation, and it has already been suggested that retooling of hafted implements occurred in the area surrounding Feature 10, a probable hearth. There-
Table 18. Dimensional Data for Bifaces, Area 811/821.

<table>
<thead>
<tr>
<th></th>
<th>L (mm)</th>
<th>TH (mm)</th>
<th>W (mm)</th>
<th>TH/W</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preforms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>95.1</td>
<td>13.2</td>
<td>65.2</td>
<td>0.20</td>
<td>Knife (Fig. 21g)</td>
</tr>
<tr>
<td></td>
<td>32.7</td>
<td>6.7</td>
<td>19.3</td>
<td>0.35</td>
<td>Knife or projectile point (Fig. 20c)</td>
</tr>
<tr>
<td>Finished</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>implements</td>
<td>10.0</td>
<td>52.7</td>
<td>0.19</td>
<td></td>
<td>Knife (Fig. 18a)</td>
</tr>
<tr>
<td></td>
<td>2.9</td>
<td>14.4</td>
<td>0.20</td>
<td></td>
<td>Projectile point (Fig. 13a)</td>
</tr>
<tr>
<td></td>
<td>2.9</td>
<td>10.0</td>
<td>0.29</td>
<td></td>
<td>Projectile point (Fig. 13g)</td>
</tr>
</tbody>
</table>

Combined thickness/width

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>n</th>
<th>Min-max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preforms</td>
<td>0.28</td>
<td>2</td>
<td>0.20-0.35</td>
</tr>
<tr>
<td>Finished</td>
<td>0.23</td>
<td>3</td>
<td>0.19-0.29</td>
</tr>
</tbody>
</table>

L = length (mm)  
W = width (mm)  
TH = thickness (mm)  
TT = tool type
Figure 21. Selected quartzite chipped stone implements which may have been used in scraping activities (a-c) and heavy cutting or chopping activities (c-g), Area 811/821.
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fore, most of the formerly hafted implements and implement fragments in the Area 811/821 collection were excluded from the study of on-site use of tools.

Few hafted implements or implement fragments (n = 13) could be identified in the Pioneer Point collection with any confidence. Most of the tools in the collection are fragmentary, and some possess such potential hafting elements as bilateral notching but exhibit no evidence of actual use. Microwear studies might have eliminated some of the ambiguities in this regard. However, without such supplementary information, it could be suggested that the implements in question may have been manufactured at Pioneer Point and that the issue of hafted tool maintenance may not be applicable. In any event, speculation concerning the possible on-site use of these artifacts would have served no purpose during the Pioneer Point lithic analysis.

Of primary importance with regard to the issue of on-site tool use is the distinction between “expedient” and “curated” tools drawn by Lewis Binford (1973,1979) during the course of his ethnoarchaeological studies among the Nunamiut Eskimo. According to Binford, a curated tool “once produced or purchased is carefully curated and transported to and from locations in direct relationship to the anticipated performance of different activities” (Binford 1973:242). Other tools are produced expeditiously by the Nunamiut to meet specific and immediate needs, and these implements may be characterized as “responsive” to particular situations (Binford 1979:261). The distinction is important in the context of the Pioneer Point analysis because expedient tools, most often produced and discarded in the locations where they were used, may serve as an index to on-site activities involving tool use. Conversely, curated tools are not generally produced or abandoned in the context of their use (Binford 1973:242,244), but are typically manufactured and maintained in stages which are “embedded” in other activities (Binford 1979:268).

It should be noted that curational behavior in general may possess dimensions which are not directly related to the employment of tools in particular tasks, but which relate instead to possible stylistic preference or to the informational content of particular items (e.g., Jelinek 1976:31; Root 1983:210). Because the focus of the Pioneer Point lithic analysis was upon those aspects of tool function which relate most directly to the actual employment of tools in specific activities, the former kinds of perspectives on curation were not pursued. The specific aspects of curational behavior which were applied to the Pioneer Point lithic assemblage are discussed below.

First, Binford (1979:267) suggested that the various types of tools used by the Nunamiut which are highly curated should have more design features related to hafting, while tools used in situational contexts and which may be used to perform identical functions “may exhibit at most only minimal, and perhaps, technically different, hafting features.” While Keeley (1982:798-799, 801) has noted that the “archaeological effects of hafting and those of curational behavior (as defined by Binford [1973])” are not identical, curated tools are commonly hafted while expedient tools are generally hand-held. As discussed previously, there are difficulties with both the identification of hafted tools in the Pioneer
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Point collection and in the determination of hafted tools which may actually have been used on-site. Consequently, several tools which exhibit evidence of former hafting were excluded from this portion of the lithic analysis.

Second, gear which was highly curated among the Nunamiut was “much more likely to be manufactured according to quality considerations unaffected by constraints on time or immediate availability of appropriate material” (Binford 1979:267). In contrast, “Under situational conditions practically the only factor conditioning relative investment in maintenance, reuse, and recycling is the quantity of the immediately available material.” In a similar vein, Jelinek (1976:31) has also noted that “The stage at which a tool may be discarded is likely to be affected by the proximity, quantity, and quality of resources (environmental factors).” Bamforth (1986:40) has noted that tool maintenance and recycling “seem closely related to raw material availability, and ... that they are responses to raw material shortages.” Although all of the lithic raw material types represented in the Pioneer Point collection may be available at no great distance from Pioneer Point, the nature of known outcrops and gravel deposits in the Curecanti area suggests that quartzite was probably available in the largest quantity. Certainly, the inferred primary reduction of quartzite cobbles at Pioneer Point, as well as the substantial quantity of quartzite debitage and the high debitage-to-tool ratio for quartzite, would suggest that quartzite was probably the most abundant raw material type available in the general vicinity of the site.

Quartzites of excellent quality have been observed in the Curecanti area adjacent to geological faulting or in areas which have undergone volcanic activity (Liestman 1985). Because of their high degree of cementation, quartzites within the Junction Creek Member of the Wanakah Formation are highly suitable for the manufacture of stone tools and may, therefore, represent the most important source for quartzite utilized prehistorically within the area of the Park (Liestman 1985). Quartzite derived from such sources may have been widely available in the past. However, no studies directed toward the sourcing of the artifactual quartzite from Pioneer Point were undertaken.

Small nodules of such cryptocrystalline materials as jasper, agate, and chert have been observed within the present boundaries of the Park, primarily within brecciated gravels and alluviated gravel benches. However, despite their relatively widespread distribution, they occur in limited quantities at any single location (Liestman 1985). This situation may not characterize the availability of these raw materials in other areas of Colorado, and again, sourcing studies were not undertaken.

Welded tuffs form the resistant cap rock on the mesas on either side of the Gunnison River in the area of the Park, including Soap Mesa directly north of 5GN41 (Prather 1982; Olson et al. 1968). These formations date to an extensive period of volcanic activity in adjacent areas between 10 and 30 million years ago. Of course, erosion has resulted in the redeposition of some of this material at the bases of the mesas.

In general, the cryptocrystalline lithic raw materials recovered in Area 811/821 may be considered higher in quality than
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quartzite from the standpoint of ease and control of flaking. Of course, the suitability of various lithic raw materials for manufacture into tools of different function is also an important consideration here, and will be discussed later. However, following a somewhat conservative approach to the selection of artifacts for study of on-site tool use, the non-quartzitic implements in the Area 811/821 collection were excluded from that portion of the analysis.

Third, Binford has suggested the following with regard to tool design.

Under situational conditions, one need only be concerned with design characteristics which facilitate a specific, known and immediate task; therefore, the tool design may be quite specific or limited, in response to 'short term' considerations. Planning or designing a tool to be incorporated in [heavily curated] personal and household gear is very different since it will be seen in the context of long-term usage and the requirement that it meet many different types of tool needs [Binford 1979:268-269].

Although instances may be found in the archeological record in which expedient tools ultimately served multiple functions, such tools often reflect different instances of use which were apparently sequential and were accompanied by modifications in tool form (e.g., Frison 1968:154). Such use may have been typical of curated tools as well, particularly for generalized forms which were in the transition process of manufacture when specific expedient tool needs arose. However, the potential for curated tools to perform multiple functions may also have been manifested simultaneously in the form of implements which were manufactured with the expectation that they would be used in several kinds of tasks. The latter quality was sought in implements in the Pioneer Point collection in order that they might be excluded from the study of on-site use of tools. Of the 56 refitted tools and tool fragments in the Area 811/821 assemblage, six were identified as the best candidates for this type of multiple use. They are described individually in Appendix II. These implements were excluded from those portions of the analysis concerned with tool use at Pioneer Point.

Finally, it has been suggested (Binford 1979:268) that the type of "staged" reduction inferred for the largely quartzitic biface tools from Pioneer Point is most typical of curated technology. In contrast, expedient tool needs may typically be met through the production and use of flakes (Binford and O'Connell 1984). The Pioneer Point bifaces were thus originally excluded from the study on the basis of their tentative classification as curated implements. However, they were eventually returned to the study collection primarily on the basis of a postulated association between the bifaces and the large collection of probable bifacial resharpening flakes from the site. The latter association is discussed later in this section. In addition, as demonstrated later, several of the biface implement edges have characteristics similar to those of some of the implement edges produced on quartzite flakes. The two sets of edges may have been functionally equivalent, and there is no reason at this point to think that the occupants of the site would not have used whatever suitable implements were available in order to accomplish a given task.
One quartzite implement fragment (Implement #4) for which tool location was unclear was also included in the study.

The implements from Pioneer Point which were ultimately considered most likely to have been produced under situational conditions were the quartzite flake tools. Those flake tools which were identified as possible multiple function tools or which bore evidence of former hafting were eliminated from consideration, leaving a total of 16 flake implements and implement fragments for inclusion in the study (Implement Nos. 3, 6, 8, 10, 13, 19, 20, 22, 23, 26, 30, 37, 40, 42, 52, 54). Fully 35% (n = 6) of that number still retain evidence to identify that their manufacture/location occurred specifically on resharpening flakes. At least superficially, this would seem to substantiate the expedient nature of these tools, as it appears that whatever material was at hand was used in their manufacture. However, it should also be born in mind that some of the tools in the Pioneer Point collection which were clearly curated, such as finely flaked quartzite knives and projectile points, were also produced on flakes.

The categorization of quartzite tools as likely to be either expedient or curated implements is supported by the instances of breakage in the collection. If the quartzite bifaces were largely curated implements, one would expect few complete specimens to have been purposefully discarded, and, indeed, all of the quartzite bifaces recovered from the area surrounding Feature 10 at Pioneer Point were broken. If the quartzite flake tools were produced and used expeditiously at the site, then one might expect to find a higher relative percentage of complete tools in the group, since their discard should have accompanied the completion of the task in which they were used, regardless of whether or not they were in a reusuable or resharpenable condition at the time. Of the 16 tools in this category, 7 (approximately 44%) were broken and 9 (approximately 56%) were complete.

The incidence of breakage for the non-quartzitic implements is less conclusive with regard to their designation as curational gear. Ten (approximately 83%) were broken and only 2 (approximately 17%) were unbroken.

In summary, four criteria were used to identify tools in the Pioneer Point assemblage which were most likely curated.

1. Presence of hafting evidence (or identified as a projectile point),
2. Manufacture on non-quartzitic raw materials,
3. Evidence of use as “simultaneous” multiple function tools, and
4. Evidence of “staged” manufacture (suggested in this instance for implements produced through bifacial reduction).

A total of 35 complete and fragmentary implements met one or more of these criteria. Most of these tools, in turn, were eliminated from the study concerned with actual tool use at Pioneer Point because of greater ambiguity regarding the reasons for their presence at the site. However, the quartzite bifaces were ultimately included in the study collection. As indicated previously, 16 implements and implement fragments produced on quartzite flakes were also included in the study of on-site tool
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use. The latter are thought to represent largely hand-held expedient tools manufactured from a raw material which was available in considerable quantity within a distance of approximately 14 mi (22 km) of the site.

Examination of certain kinds of tool fragments may also produce useful information regarding on-site activities in which tools were used (Keeley 1982:807-808; Whallon 1978:34). These fragments include the distal portions of delicate tools as well as small broken edges of tools. The rationale behind this assertion suggests that the breakages which created such pieces may frequently have occurred during actual tool use, and the resulting fragments were left where they fell because they were small and no longer of use. However, the only artifact recovered within Area 811/821 which meets these specifications is a portion of a quartzite drill bit (Implement #45).

It is generally acknowledged that such by-products of activities as manufacturing and maintenance debris and faunal remains may serve as better sources of information on tool use at a site than most of the tool remains themselves (Binford 1973:242,244; Binford 1977:34; Frison 1968:154,155; Keeley 1982:807; Whallon 1978:34). Such a source at Pioneer Point is the relatively large collection of resharpening flakes created during working edge rejuvenation. The substantial number of quartzite resharpening flakes (n = 342) which were recovered at the site constitutes one of the most notable features of this particular lithic assemblage. One agate and three jasper resharpening flakes were also recovered. However, the usefulness of resharpening flakes in studying on-site tool use may be qualified in at least two respects.

1. Resharpening flakes are usually expected to have remained in the general location where they were struck because they were of no further use (Frison 1968:154). However, as has already been mentioned with regard to the Pioneer Point assemblage, a few resharpening flakes were recycled as tools themselves, albeit probably as expedient implements.

2. Resharpening flakes will also be struck from hafted implements which are retooled but not actually used on-site. This undoubtedly occurred at Pioneer Point.

Analysis indicates that a considerable number of the quartzite resharpening flakes may have been struck from some of the recovered quartzite bifaces. Evidence in support of this includes both characteristics of the raw material of the bifacial tools and resharpening flakes, as well as a general consideration of edge angle data (presented later). The amount of wear which was observed on the resharpening flakes suggests that the tools from which they came were utilized fairly intensively. This may simply indicate that a number of well-worn bifacially edged tools were reworked at Pioneer Point, or it may reflect the performance of on-site activities that necessitated several cycles of tool use and resharpening.

Unfortunately, those subsets of the assemblage which may be the most useful for generating information about activities in which tools were used at the site pose certain problems for functional interpretation. For example, expedient tools may
exhibit a somewhat looser fit between form and function than do curated tools simply by virtue of the circumstances surrounding their production (Binford 1979:267). On the other hand, expedient tools represent a response to a limited and specific need, and there may be a close correspondence between intended use through manufacture and actual use (Sheets 1975:370). In addition, there are problems associated with the functional interpretation of “non-functional” edges on exhausted tools.

In conclusion, both curational and expedient modes of tool production and use appear to be represented in the collection of chipped stone from Area 811/821 at Pioneer Point. In general, much of the quartzitic portion of the collection may have resulted from the use and resharpening of bifacial tools together with the production, either incidental (i.e., resharpening flakes) or intentional, of flake tools for expedient use. Subsets of the collection ultimately selected for a study of tool use at Pioneer Point include most of the flake tools and bifaces of quartzite, the quartzite resharpening flakes, and a single quartzite drill bit fragment.

Units of Analysis for Functional Study of Tools

Observations were made on up to three implement edges for each refitted tool or refitted tool fragment in the Pioneer Point assemblage (Appendices I and III). Edge angle, edge form, and amount of edge wear were recorded for each such edge, as well as additional information concerning the artifact on which the edge is located, such as raw material type. Individual implement edges thus represented the basic units of analysis for the purpose of investigating the function of chipped stone tools, rather than the refitted tools and tool fragments themselves. A similar approach to lithic analysis using “altered edges” as basic analytical units is described by White (1969:22-24; White and Thomas 1972:282-283). During the Pioneer Point analysis, implement edges were defined to include edges which were created or modified either through intentional flake removal, through use, or both. However, a distinction was made between “working” and “non-working” edges, and only those edges which exhibit macroscopic wear were considered to represent actual “working” edges.

The following four sections consider how the analysis of several attributes of tool edges including edge angle, raw material type, edge wear, and edge form may contribute to an understanding of the functional variability of chipped stone tools.

Use of Edge Angles to Infer Function

Edge angle measurements taken on the chipped stone tools and resharpening flakes recovered at Pioneer Point were the primary data used to infer functions for groups of implements. Edge angle research as well as other kinds of functional lithic studies are based upon the following general premise.

While the technical basis of tool modification is recognized, it is clear that modification was directed toward improving the functional qualities of tools and that, therefore, the specific character of this modification should provide insights into the actual functional role of any set of tools [Wilmsen 1968:160].
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By extension, it may be argued that flakes which were used without prior intentional edge modification were selected for use because they already exhibited certain desirable characteristics. The angle of the intended working edge, or bit, on such pieces would qualify as one such characteristic.

However, factors other than function also affect the size of edge angles measured by the archeologist and thereby impose constraints upon the functional interpretation of archeological collections. For instance, the use phase of tools when lost or discarded is one such factor. As implements are reused and resharpened, they will have progressively steeper edges (Ahler 1971:102,104; Crabtree and Davis 1968:428; Keeley 1982:801; Wilmsen 1968:159-160, 1970:71,73). Keeley (1982:801) also suggests that hafted versions of tools, as a consequence of their curation, will generally receive more resharpening than their hand-held functional counterparts, and are therefore likely to have steeper edges. Such increasing steepness may frequently have resulted in the recycling of tools for different uses rather than their discard (Frison 1968; Wilmsen 1970:73). Ultimately, the edges on exhausted tools pose an additional problem for functional interpretation. As Frison (1968:154) has noted, “It would appear that much time has been spent hypothesizing functions for tools that were in a nonfunctional condition when recovered from their archaeological context.”

One might attempt to test the relative importance of different factors affecting edge angles in a particular dataset by generating and subsequently evaluating a number of expectations. However, evaluation of test implications will produce no conclusive results without reference to an independent determination of tool function. For example, the distinction between curated and expedient tools may be a significant factor influencing the use phase of tools upon entry into the archeological record. Based upon Keeley (1982:801), the “average” expedient tool could be expected to have a more acute working edge angle than the “average” curated tool used for the same function. An independent determination of function was not available during the Pioneer Point analysis, such as might have been provided by a microwear study of the recovered material.

A number of previous edge angle studies were reviewed during the course of the present work, and a discussion of each of these studies is included in Appendix IV. The literature which was reviewed suggests that major functional distinctions are discernible through study of edge angles on tools. Gross distinctions, such as those made between cutting and scraping implements, have been proposed in several studies based upon the presence of multiple peaks in frequency distributions of edge angle data collected on archeological specimens. At least one ethnoarcheological study supports this approach to the identification of functionally distinct categories of tools.

Functional groups of tools have been identified relative to each other within particular datasets. Because of the considerable overlap expected in the ranges of edge angles for some functional categories, the differences between groups have been described using measures of central tendency, specifically mean edge angles and modal ranges. Differences in mode as
small as 10° (Frison 1970) and 20° (Wilsen 1968, 1970) have been considered to be significant in this regard. However, there is no consensus on absolute edge angle values which may have been optimal for different implement functions. Rather, it may be expected simply that “cutting” edges will be more acute than “shredding” or “scraping” edges, although edges steeper than 60° or 65° would make poor cutting tools, and edges more acute than 35° or 40° were probably too sharp for scraping. In addition, steeper edge angles were probably used to work harder or more resistant materials. Consequently, it seems that functional inferences to be drawn from edge angle data include both a general idea of how tools were used, and information on the types of materials which were worked. However, a relatively conservative approach to such functional interpretation is appropriate given the additional ambiguities arising from factors other than function which influence the size of edge angles.

**Raw Material Type, Heat Treatment, and Tool Function**

Lithic raw materials possess physical properties which make them more or less suitable for manufacture into implements intended for different uses. Crabtree has summarized the importance of raw material selection rather succinctly. Stone age man was very selective about his raw material, for his very survival depended on his knowledge of suitable stone for implements of specific function [Crabtree 1972:5].

However, Jelinek has observed that the process of raw material selection may involve a factor, namely style, which is unrelated to the anticipated physical performance of tools.

When a choice of raw materials is involved, it may relate to either function or style ... Although stylistically determined raw materials are difficult to demonstrate in an archaeological context, the documentation of such choices in contemporary societies (for example, Gould, Koster, and Sontz 1971:162) suggests an importance in prehistoric cultures which has only rarely been recognized [Jelinek 1976:23].

Although the potential stylistic significance of raw material preference is acknowledged, it was not pursued during the analysis of the Pioneer Point assemblage.

Much of the available information concerning the suitability of various raw material types for manufacture into specific kinds of tools has been generated during studies in experimental archeology (this discussion is limited to the raw material types recognized in the Pioneer Point assemblage). Working edges of obsidian may be characterized as extremely sharp but brittle, and they may be most useful for cutting relatively soft materials such as flesh, leather, soft woods, and cordage (Crabtree 1967:18,23; Crabtree 1972:5; Crabtree and Davis 1968). Tools of ignimbrite, a variety of welded tuff, may be considered similar to those of obsidian from the standpoint that the largely vitreous composition of the ignimbrite is conducive to the production of very sharp working edges (Crabtree and Davis 1968:427). The edges are also “subject to crushing” during use.
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On the other hand, quartzite is known for its tough, durable qualities. The working edges of quartzite tools employed in experimental studies have exhibited a notable resistance to damage during use, and they may consequently be used for longer periods of time without resharpening (Hester et al. 1973:95). They are particularly well suited for working such dense substances as hardwood, bone, and antler (Crabtree 1967:11,23; Crabtree and Davis 1968). However, the range of compositional variability generally subsumed under the designation of quartzite means that different quartzite edges may be expected to behave somewhat differently during use (Toll 1978:64).

The edges produced on the cryptocrystalline varieties of quartz identified in the Pioneer Point assemblage (agate, jasper, and chert) were undoubtedly stronger than those produced on the obsidian. Their suitability for use in particular tasks may be related to whether or not they were heat treated; these stone types are generally quite durable in their natural unaltered states, and a propensity for sharp edges may be enhanced by heat alteration (Crabtree 1967:23).

From the perspective of the knapper intent upon the production of flaked stone tools, there appear to be two primary advantages to the heat treatment of many lithic raw materials. One advantage is an improvement in the working qualities, or "flakeability," of the material (e.g., Crabtree and Butler 1964:1; Flenniken and Garrison 1975:128; Bleed and Meier 1980). A second benefit may be an improvement in the suitability of the material for manufacture into a tool with a sharp working edge (Crabtree 1967:23; Crabtree 1972:5).

However, the identification of heat altered specimens in the Pioneer Point assemblage is considered to be tentative only (see discussion under the definition for heat alteration in Appendix I). Although the intent of the analytical observations made during the Pioneer Point analysis was to identify the purposefully heat treated material, no definite inferences may be made concerning the circumstances surrounding the heat alteration. That is, the modification which was observed in a number of instances may be a consequence of deliberate heat treatment, unintentional alteration in a fire, or the result of natural events.

The previous statements suggest that fine-grained lithic raw materials made excellent cutting implements if employed on relatively soft materials. More durable lithic raw materials, which may be relatively granular in texture, were probably preferred for working harder substances (Crabtree 1967:11,23). Heat alteration may indicate a deliberate attempt to match the nature of the raw material to the intended function of the tool. However, various facets of implement design must be considered in combination in order to place such generalizations into a more realistic framework for use in interpreting actual archaeological datasets. A case in point is Crabtree's (1977:40) experimental demonstration that such "fragile" materials as obsidian may be used to shave dry bone when the working edge angle is obtuse.

Edge Wear and Tool Function

Based upon a macroscopic examination of all implement edges on refitted tools and tool fragments in the assemblage from Area 811/821, estimations were made of the amount of observed edge wear (none,
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light to moderate, or heavy). Thirty-one of the 81 implement edges in the assemblage exhibit such wear. In addition, the presence of wear was fundamental to the definition of resharpening flakes (n = 346). The kinds of edge alterations which were recognized as wear for purposes of this analysis and a few of the biases inherent in the definition of wear are discussed elsewhere (Appendix I).

Wear observations on the collection were made in an attempt to establish whether a tool had actually been used, to determine the "working" edges of tools, and to characterize in general terms the types of tool use which occurred at Pioneer Point. However, the amount and type of wear damage sustained by implement edges during use is clearly related to a variety of factors including the angle of the edge, raw material type, possible heat alteration, and the stage of utilization of a tool, as well as to the nature of the material which is worked (Tringham et al. 1974; Zier 1978; and others).

The subsets of the chipped stone assemblage which were studied for information regarding the on-site use of tools were all composed of quartzite, and as mentioned previously, they included a number of the quartzite flake tools, several quartzite bifaces, quartzite resharpening flakes, and a single quartzite drill bit fragment. Associations between specific damage patterns on quartzite and particular tool uses are somewhat elusive, even when systematic microscopic studies are conducted. For example, the results of an experimental study conducted by Toll (1978:64) involving the use of unmodified quartzite flakes to work a variety of substances indicated that "while some task-specific evi-

dences do exist they are subtle." He also observed that the most common form of wear, consisting of edge rounding and recession, was produced when working either hard or soft materials (Toll 1978:63). Likewise, Zier (1978:40) has indicated that the dulling of edges on a collection of quartzite projectile points from the area of Yellowjacket, Colorado "can probably be associated with more than one activity."

It has previously been noted that quartzite is an extremely durable substance which is not easily damaged through use. Given the smoothness and amount of macroscopically visible wear on the quartzite tool edges from Pioneer Point (on actual tools and resharpening flakes), it appears that the implements were used rather intensively on finely textured materials.

Edge Form and Tool Function

Nine categories of edge form were defined during the course of the analysis of implements from both areas at Pioneer Point (Appendix I). These edge form categories include the following.

1. Bifacial retouch
2. Unifacial scraper retouch
3. Unifacial denticulate retouch
4. Unifacial notch retouch
5. Unifacial borer retouch
6. Alternating unifacial/bifacial retouch
7. Utilized flake - bifacial
8. Utilized flake - unifacial
9. Utilized flake - borer

Most of the variation between the forms is attributable to three factors including 1) deliberate flake removal versus edges used without prior modification, 2) flake removal from a single face as opposed to both
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faces of an artifact, and 3) the shape of the edge, with distinctions made between relatively smooth (scraper), ragged or serrated (denticulate), markedly concave (notched), and projecting (boring) forms. Observations with respect to the third factor were recorded for unifacial edges only.

The edge form data collected on the Pioneer Point assemblage were analyzed at two scales in order to determine which was most meaningful in terms of function.

1. The tools were initially approached using the original nine-category edge form breakdown. Only seven forms were actually observed in the Area 811/821 collection; all nine forms were recorded for the Area 822 collection (Table 17).

2. Attempts were made to distinguish between cutting and scraping implements in general based upon conventional expectations regarding how such tools were designed and used. Bifacial retouch was frequently used to shape edges used primarily for cutting, and unifacial retouch was often used to create steeper bits for scraping. Thus, several of the original edge form categories were combined in order to examine the functional significance of bifacial and unifacial forms in general. Instances of deliberate bifacial flaking were compared to instances of deliberate unifacial flaking (unifacial scraper, unifacial denticulate, and unifacial notch categories combined). "Utilized" forms were not included at this level of analysis because too few of these artifacts were either recovered or recognized in the collection for adequate study.

Resharpening flakes were similarly studied for information on tool function. However, recognition of "edge form" on resharpening flakes was constrained by the short lengths of remnant tool edges generally present. As a limited variation on the approach described above, observations were made on the number of flakes which appear to have been removed along the remnant working edge from the portion of the original tool face now constituting the striking platform of the resharpening flake, and from the portion of the opposite face now constituting the resharpening flake exterior. By combining these data, tentative inferences were made as to the nature of the tools from which the flakes were removed (namely, bifacial or unifacial).

Use of this kind of edge form information for functional studies is obviously fraught with difficulty. For example, certain unifacial and bifacial tools may represent resharpened versions of what were, originally, unmodified flake tools. Edge modification was also suited to the peculiarities of the specimen at hand; in the Pioneer Point collection, there are instances where retouch which resulted in the classification of an implement edge as bifacial clearly served only to remove a bulb of percussion or to otherwise thin a portion of a largely unifacial implement. In the latter instances, the additional retouch does not appear to have contributed significantly to the functioning of the edge.

Functional Inferences for the Implements from Area 811/821

Several categories of tools which may have functional significance were ultimately identified in the Area 811/821 assemblage. Data collected on all of the recovered complete and fragmentary implements were used in the effort to define these catego-
ries, regardless of whether or not the tools are thought to have actually been used at Pioneer Point. The rationale for including all of the tools was to make the sample size for the study as large as possible.

This portion of the lithic analysis was conducted in two phases. Primary emphasis was placed upon an examination of those edges which exhibit macroscopic use-wear, based upon the contention that such edges were "working" edges which were actually used. The second phase of the analysis involved the additional consideration of implement edges which lack such wear. During both phases, it was necessary to adjust the focus of the study in keeping with the nature of the collection. For example, the analytical variable which dealt with evidence for heat alteration was ultimately not incorporated because of a lack of variability within any particular raw material type. Jasper represents the only heat altered raw material identified in the recovered tool assemblage from Area 811/821, and all of it exhibits some evidence of heat alteration. In addition, very few implements of non-quartzitic raw material types were recovered (Table 12). The sample sizes of jasper, agate, and chert are very small, particularly for edges which exhibit wear. Consequently, although a few conclusions were ultimately made regarding the use of these materials, the non-quartzitic tools were generally de-emphasized. In addition, only four unmodified edges which exhibit use-wear were identified in the Area 811/821 assemblage, a probable consequence of the difficulty in use-wear recognition on quartzite. Therefore, most of the results from this portion of the analysis concern tools produced through intentional retouch.

The data for the study were collected on four different attributes of implements and their edges: edge angle, edge form, raw material type, and tool location. It was anticipated that aspects of the underlying functional structure of the sample would be reflected in patterns in the occurrence of the attributes, particularly patterns corresponding to peaks in the frequency of edge angle measurements. As discussed in an earlier section, such peaks are thought to reflect general differences in tool function. The histogram in Figure 22 illustrates the frequency of the angles (in 5° intervals) of edges shaped through intentional retouch which also exhibit wear, and the histogram in Figure 23 illustrates the frequency of all implement edges angles in the collection of tools from Area 811/821 at Pioneer Point. Peaks in edge angle frequency are clearly evident in these histograms. The peaks range from 10° to 25° apart.

Twenty-seven worn implement edges (excluding the four "utilized" edges) from 22 complete and fragmentary tools were included in the first phase of the study. Data on the above four attributes of these edges were examined using a formal clustering routine, and were also studied informally using a series of histograms. The clustering method which was used was average linkage between groups (Anderberg 1973:140). The clustering was performed on matrices of Gower similarity coefficients (Gower 1971; Doran and Hodson 1975:142-143) representing the results of comparisons of the attributes of all pairs of implement edges. The primary recommendation for Gower's coefficient for this kind of study is that qualitative and quantitative attributes may be utilized
Figure 22. Angles of implement edges shaped through intentional retouch which also exhibit wear, Area 811/821.

Figure 23. All implement edge angles, Area 811/821.
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together. Additional information on the Gower coefficient and its application to the Pioneer Point lithic analysis is included in Appendix V.

The clustering routine was run on two different matrices of Gower coefficients which compared the worn implement edges using two slightly different sets of edge form codes.

1. Using the five edge form codes which were represented in this limited dataset out of the original nine category breakdown for the variable, and

2. Contrasting deliberate unifacial and bifacial flaking (i.e., original code 1 vs. combined codes 2, 3, 4).

Results were nearly identical in both cases, with the latter run yielding slightly more significant clustering. Thus, the results contrasting deliberately produced unifacial and bifacial edges in general are presented below.

Selected portions of the agglomeration schedule generated by SPSS/PC documenting the clustering process are reproduced in Table 19. The column labeled "Coefficient" indicates the average similarity between the two clusters which were combined at that stage in the clustering process. The first row in the table corresponds with the first merger that took place, resulting in a total of 26 rather than 27 individual clusters, and the last row corresponds with the last stage of clustering in which all of the edges were combined into a single large cluster. The fact that the first several mergers have associated coefficients of 1 indicates that identically coded edges were clustered together. The first considerable drop in the value of these coefficients occurs between the 10- and 9-cluster solutions, indicating a potentially significant change in the similarity of edges which were clustered at and beyond that point (Aldenderfer and Blashfield 1984:57). Further clustering involved the joining of increasingly dissimilar groups of edges.

At the 10-cluster solution, five of the clusters contain two or more implement edges and five consist of a single edge apiece. The raw data for the edges within these clusters are presented in Table 20. When interpreting the edge angle data presented in this report, it is important to keep in mind exactly how the data were collected. For example, measured values > 65° and ≤70° were coded to the 65° - 70° interval. The mean edge angles presented below for different clusters were calculated using an intermediate value within each interval. In the latter example interval, a value of 68° would be used to represent an edge measured to the > 65° - 70° interval. In addition, although the edge angle means are reported to the nearest one degree, they were calculated from data which are accurate only to the nearest five degrees. The following list includes the general composition, mean, modal interval, range, and minimum and maximum edge angle values for the three largest clusters.

1. Unifacial edges on quartzite flakes, Mean edge angle approx. 74°, modal interval > 75° - 80°, Range 25° (> 55° - 80°)
Table 19. Selected Portions of the Agglomeration Schedule for a Cluster Analysis of Implement Edge Data Using Average Linkage Between Groups, Area 811/821.

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<tr>
<th>Stage</th>
<th># of Clusters</th>
<th>Coefficient</th>
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<td>1</td>
<td>26</td>
<td>1.0000</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>1.0000</td>
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<tr>
<td>4</td>
<td>23</td>
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<td>6</td>
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<td>7</td>
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<td>19</td>
<td>1.0000</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>1.0000</td>
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<tr>
<td>10</td>
<td>17</td>
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<tr>
<td>11</td>
<td>16</td>
<td>0.9800</td>
</tr>
<tr>
<td>12</td>
<td>15</td>
<td>0.9600</td>
</tr>
<tr>
<td>13</td>
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<td>0.6432</td>
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<td>25</td>
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<td>0.6255</td>
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<tr>
<td>26</td>
<td>1</td>
<td>0.4569</td>
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Table 20. Ten Cluster Solution: Raw Data for Implement Edges within Clusters.

<table>
<thead>
<tr>
<th>Cluster #</th>
<th>Raw Material Type</th>
<th>Tool Location</th>
<th>Edge Form (retouch)</th>
<th>Edge Angle Interval (in degrees)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>55-60</td>
</tr>
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<td></td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>65-70</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>75-80</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>75-80</td>
</tr>
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<td>flake</td>
<td>unifacial</td>
<td>75-80</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>75-80</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>flake</td>
<td>unifacial</td>
<td>75-80</td>
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<tr>
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<td>75-80</td>
</tr>
<tr>
<td>2</td>
<td>Q</td>
<td>flake</td>
<td>bifacial</td>
<td>50-55</td>
</tr>
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<td></td>
<td>Q</td>
<td>flake</td>
<td>bifacial</td>
<td>50-55</td>
</tr>
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<td>Q</td>
<td>flake</td>
<td>bifacial</td>
<td>50-55</td>
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<td>flake</td>
<td>bifacial</td>
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<td>flake</td>
<td>bifacial</td>
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<td>Q</td>
<td>flake</td>
<td>bifacial</td>
<td>60-65</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>flake</td>
<td>bifacial</td>
<td>70-75</td>
</tr>
<tr>
<td>3</td>
<td>Q</td>
<td>biface</td>
<td>bifacial</td>
<td>50-55</td>
</tr>
<tr>
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<td>Q</td>
<td>biface</td>
<td>bifacial</td>
<td>60-65</td>
</tr>
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<td>biface</td>
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<td>60-65</td>
</tr>
<tr>
<td></td>
<td>Q</td>
<td>biface</td>
<td>bifacial</td>
<td>65-70</td>
</tr>
<tr>
<td>4</td>
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<td>indet.</td>
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<td>Q</td>
<td>indet.</td>
<td>bifacial</td>
<td>55-60</td>
</tr>
<tr>
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<td>A</td>
<td>flake</td>
<td>unifacial</td>
<td>50-55</td>
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<td></td>
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<td>flake</td>
<td>unifacial</td>
<td>65-70</td>
</tr>
<tr>
<td>6</td>
<td>Q</td>
<td>biface</td>
<td>alternating</td>
<td>60-65</td>
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<td></td>
<td></td>
<td></td>
<td>unifacial/bifacial</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>J</td>
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<td>unifacial</td>
<td>25-30</td>
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<td>flake</td>
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<td>J</td>
<td>flake</td>
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<td>10</td>
<td>CH</td>
<td>flake</td>
<td>unifacial</td>
<td>55-60</td>
</tr>
</tbody>
</table>

Q = quartzite    J = jasper    A = agate    CH = chert
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2. Bifacial edges on quartzite flakes, Mean edge angle approx. 59°, modal interval > 50° - 55°, Range 20° (> 50° - 75°)

3. Bifacial edges on quartzite tools produced through bifacial reduction, Mean edge angle approx. 62°, modal interval > 60° - 65°, Range 20° (> 50° - 70°)

The ranges for the three groups overlap in large measure, but the mean and mode of the first group are quite different from the same statistics for the other two groups. Anderberg (1973:15) indicates that the application of tests of significance to the differences in the means of groups discovered through cluster analysis is not appropriate because the whole purpose of such analysis is to produce a set of clusters which are well differentiated from each other. However, such tests were applied to the Pioneer Point dataset in order to determine which of the differences between the clusters are most likely to be important from a functional standpoint.

Results of a Kruskal-Wallis one-way analysis of variance (Siegel 1956) performed on the edge angle data for the three clusters listed above indicated that additional testing for significant differences between any two of the groups was justified (Figure 24). A Mann-Whitney U test (Siegel 1956) was then performed on the edge angle data for the second and third groups, and the results indicated that no significant difference exists with regard to their central tendencies (Figure 25). The only other difference between the second and third groups with regard to the four attributes used in the analysis was tool location (flake vs. biface), a factor unlikely to be as directly related to implement function as edge angle in this particular instance.

Based upon the latter result, clusters 2 and 3 were combined along with the fourth cluster which was isolated by the average linkage procedure (Table 20). The edge angles within this combined cluster were then compared to the angles in the first cluster listed above using the Mann-Whitney U test (Figure 26). Results indicated that the differences in edge angle between the unifacially flaked edges and the combined bifacially flaked edges are significant, and as a consequence, they may reflect a real functional distinction.

In summary, an examination of data collected on four attributes of worn tool edges resulted in the isolation of two subsets of edges on quartzite tools which may have been designed to serve different kinds of functions. Although the ranges of edge angles for the two groups overlap considerably, there is nearly a 15° separation between them with regard to mean edge angles.

1. Unifacial edges on quartzite flakes with edge angles averaging approximately 74° (modal interval > 75° - 80°), 7 edges on 7 implements (Nos. 3,6,25,26,42,53,54)

2. Bifacial edges on quartzite flakes and bifaces with edge angles averaging approximately 60° (bimodal at the > 50° - 55° and > 60° - 65° intervals), 13 edges on 12 implements (Nos. 1,4,15,18,19,22,31,51,52,53,54,55)

Given the relatively steep angles (principally 75° - 80°) and unifacial form of the first group of edges, it seems likely that they were used for scraping activities. Since six
H₀: There is no significant difference between the average edge angles of the three groups of implement edges.

H₁: The three groups of implement edges are significantly different in their average edge angles.

α = .05

<table>
<thead>
<tr>
<th>Mean Rank</th>
<th>No. of Cases</th>
<th>Composition of Group</th>
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<tr>
<td>13.86</td>
<td>7</td>
<td>Cluster 1: unifacial edges on quartzite flakes</td>
</tr>
<tr>
<td>6.14</td>
<td>7</td>
<td>Cluster 2: bifacial edges on quartzite flakes</td>
</tr>
<tr>
<td>7.75</td>
<td>4</td>
<td>Cluster 3: bifacial edges on quartzite bifaces</td>
</tr>
</tbody>
</table>

H (corrected for ties) = 8.2171

k (number of samples) = 3

df = (k-1) = 2

p = 0.0164

Since 0.0164 < .05, H₀ is rejected.

Figure 24. Results of a Kruskal-Wallis one-way analysis of variance by ranks performed on edge angle data for three groups of implement edges.
H₀: There is no significant difference between the average edge angles of the two groups of implement edges.

H₁: \( p(a > b) = 1/2 \). The two groups of implement edges are significantly different in their average edge angles.

\( \alpha = .05 \)

<table>
<thead>
<tr>
<th>Mean Rank</th>
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<th>Composition of Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.50</td>
<td>7</td>
<td>Cluster 2: bifacial edges on quartzite flakes</td>
</tr>
<tr>
<td>6.88</td>
<td>4</td>
<td>Cluster 3: bifacial edges on quartzite bifaces</td>
</tr>
</tbody>
</table>

\( U = 10.5 \)

Two-tailed p (corrected for ties) = 0.4879

Since 0.4879 > .05, \( H₀ \) is not rejected.

Figure 25. Results of a Mann-Whitney U test on edge angle data for two groups of implement edges.
H₀: There is no significant difference between the average edge angles of the two groups of implement edges.

H₁: p (a > b) = 1/2. The two groups of implement edges are significantly different in their average edge angles.

α = .05

<table>
<thead>
<tr>
<th>Mean Rank</th>
<th>No. of Cases</th>
<th>Composition of Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.71</td>
<td>7</td>
<td>Cluster 1: unifacial edges on quartzite flakes</td>
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<tr>
<td>7.69</td>
<td>13</td>
<td>Combined Clusters 2,3,4: bifacial edges of quartzite</td>
</tr>
</tbody>
</table>

U = 9.0

Two-tailed p (corrected for ties) = 0.0032

Since 0.0032 < .05, H₀ is rejected.

Figure 26. Results of a Mann-Whitney U test on edge angle data for two groups of implement edges.
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of the edges in this group were coded as "scraper" in form and only one was described as a unifacial "denticulate", shedding is probably not the primary function represented in the group. The angles of the bifacially flaked quartzite edges (primarily between 50° and 65°) fall at the upper end of the range for which cutting functions are generally attributed (Gould et al. 1971; Wilmsen 1968, 1970). The size of the edge angles in conjunction with the occurrence of the latter group of edges on a durable raw material type suggest that they may have been used for relatively heavy cutting or chopping. Most of both groups of edges were on medium- to large-sized implements.

Only one worn quartzite edge was not included in either of these groups, and this one is characterized by an alternating bifacial/unifacial form. No speculation will be made regarding the possible functions of the few worn agate (n = 2), jasper (n = 3), and chert (n = 1) implement edges which were identified in the collection.

Other patterns which seem to have functional significance are apparent within the larger collection of 81 implement edges for which edge angle measurements were obtained (including edges both with and without observed wear). In Figure 23, a histogram of the angles of edges within the entire collection, a separate group of values may be identified between 35° and 50° with a peak in frequency in the 35° - 40° interval. As it happens, a large number of the latter group of edges occur on projectile points. All six of the small projectile points in the Area 811/821 assemblage are represented in this group (Figure 13a, b, d, f, g, j), in contrast to the single medium-sized point which has blade edges in the 60° - 65° interval (Figure 13l). Given the delicate nature of the several small thin projectile points from Area 811/821, it is unlikely that they would have performed satisfactorily as knives, certainly not for heavy cutting tasks, even with a fairly strong hafting attachment (Frison 1978:333-337). These data therefore appear to provide a counterpoint to Thomas' (1971:46) assertion that such implements presumably designed for piercing may be expected to have somewhat more acute edge angles (< 20°) (see Appendix IV). The clustering of Pioneer Point edge angles in this instance also demonstrates the apparent functional significance of gross tool shape, an attribute not dealt with systematically during the Pioneer Point analysis.

It is possible that the medium-sized point with blade edges between 60° and 65° referred to in the preceding paragraph may not have served as a projectile tip. It has been manufactured from quartzite and has semi-serrated blade edges. Results of an analysis by Zier (1978) of projectile points collected near Yellowjacket, Colorado, seem to indicate a different functional emphasis for serration. Zier observed (1978:39-40) that "The consistent combination of serrated edges with durable quartzite and large size strongly suggests a particular function or group of functions." At Pioneer Point, however, small delicate points with smooth blade edges were also fashioned from quartzite. Ahler (1971:105-106,117-119) has associated serrated edges on projectile points recovered from Rodgers Shelter in southwestern Missouri with light-duty cutting, slicing, and sawing tasks, such as "the shredding of vegetal material, meat carving, hide stripping or fish scaling" (1971:104).
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A small group of edges with angles between 20° and 30° is also apparent in Figure 23, the histogram illustrating all 81 implement edges. The three edges in question occur on two small, heat altered jasper flakes (Figure 20 f,g), and their edge angles fall toward the lower end of the range generally ascribed to cutting functions (Gould et al. 1971; Wilmsen 1968, 1970).

Two unifacial notches were identified in the Area 811/821 collection. One notch on agate (Figure 20d) has an edge angle in the 65° - 70° interval, and a notch on quartzite (Figure 20e) has an edge angle in the 70° - 75° interval.

In addition to projectile points, the drill was a gross tool class recognized during the analysis, largely apart from the primary implement edge approach to function. Two pertinent implement fragments were recovered in Area 811/821: the base of an agate drill (Figure 20b) and a section of a quartzite drill bit. The former is characterized by alternating bifacial/unifacial flaking, and the latter has bifacially flaked edges with angles between 65° and 75°.

The ranges of edge angles for each raw material type represented in the collection of tools from Area 811/821 are listed below.

Quartzite > 35° - 85° (n = 63)
Jasper > 20° - 70° (n = 12)
Agate > 40° - 70° (n = 3)
Chert > 55° - 70° (n = 3)

There is a notable lack of edges on quartzite which fall within the most acute "cutting" mode (26° - 35°) identified by Wilmsen (1968, 1970). Wilmsen anticipates that most utilized flakes will have such acute edges with angles between about 20° and 40° (see Appendix IV). Only four edges used without prior modification were identified in the Area 811/821 assemblage from Pioneer Point.

1 Jasper edge (60° - 65°)
1 Chert edge (65° - 70°)
2 Quartzite edges (35° - 40° and 60° - 65°)

With regard specifically to the quartzite, as stated previously, the sample of utilized flakes is probably skewed because of difficulty in use-wear recognition on this granular material. In addition, the use of macroscopic inspection to determine the presence or absence of use-wear has probably biased the sample toward heavier or more intensive types of tool use which may have been performed with steeper-edged implements. Consequently, the absence of very acute implement edges on quartzite is not considered to be particularly meaningful in this instance.

One final observation on the collection concerns the potential functional significance of tool location. The implement edges which occur on flakes in general have a wider range of edge angles (> 20° - 85°) than those produced through bifacial reduction (> 35° - 75°). Viewed from a functional standpoint, this may indicate that flakes were used for a wider range of
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tool types. Conversely, it may instead reflect an underlying process, such as a more intensive curation of bifaces, such that the two samples of recovered tools, flakes and bifaces, may not accurately reflect the composition of the tool kits from which they came.

In summary, observations on a limited set of attributes were employed to ascertain the functional variability represented in this particular collection of complete and fragmentary chipped stone implements. It was not expected that all facets of tool function would be revealed during the analysis. Although definition of the qualitative attributes benefited from knowledge of the collection, the attributes nonetheless represent a largely imposed set of concepts. In addition, implement edges as units of analysis have limited interpretive potential. This point is well illustrated for the Pioneer Point assemblage by the edge angle data collected on projectile points. No microwear studies were performed.

The chipped stone implements from Area 811/821 at Pioneer Point were predominantly manufactured from quartzite. The analysis isolated two groups of worn quartzite edges based upon an association between edge angle, on the average, and edge form. Unifacial edges with relatively steep bits may have been used primarily for scraping, and bifacial edges with moderately steep edge angles may have been used for relatively heavy cutting or chopping. Within the larger collection of 81 implement edges, at least two additional subsets of edges are clearly apparent. A few fairly acute edges on heat-altered jasper flakes may have been produced to serve lighter duty cutting functions. Second, several small, thin projectile points have edge angles between about 35° and 50°.

Within the entire collection of edges from Area 811/821, the four peaks in edge angle frequency apparent in the histogram in Figure 23 are thought to have functional significance. A variety of functions are probably represented by the large number of values within and around the 55° - 65° range. The bifacially flaked quartzite edges with wear mentioned above are just one component of the latter group of edges. The other peaks in frequency in Figure 23 are composed largely of the other three groups of edges identified in the preceding paragraph.

Functional Inferences for the Resharpening Flakes

A total of 346 resharpening flakes has been identified in the recovered lithic assemblage from Area 811/821 at Pioneer Point. Most of these are quartzite, but one agate resharpening flake and three of jasper are included. Edge angle measurements were taken along the remnant sections of working tool edge on the resharpening flakes in order to provide a basis for inferring the general functions represented by the tools from which the flakes were removed. Edge angle measurements were obtained for approximately 85% (n = 293) of the resharpening flakes. Angles for the quartzite flakes range from 35° to 110°. The jasper flakes have angles between 60° and 70°, and the agate flake has an edge angle in the 75° - 80° interval.

As discussed in the preceding section, the average edge angles of worn unifacial and worn bifacial quartzite implement edges
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were found to be significantly different. These differences in edge angle and edge form may indicate a functional distinction between the two groups of edges. This line of investigation was extended to include the quartzite resharpening flakes recovered at the site, examined through two attributes observed on the resharpening flakes. One of these attributes dealt with the number of flakes which appear to have been removed along the remnant working edge from the portion of the original tool face now constituting the striking platform of the resharpening flake. The other attribute dealt with similar flake removal from what is now the resharpening flake exterior. Three categories were used to describe the number of scars present in both cases.

1. Single flake scar
2. Multiple flake scars (2-4)
3. Abundant flake scars (5+)

Using this information, judgments were then made regarding whether a resharpening flake represented a unifacial or a bifacial edge remnant. Resharpening flakes with a single scar on either the platform or flake exterior (multiple or abundant scars on the other face) may have originated from unifacial edges, while resharpening flakes with multiple, and particularly abundant, scarring on both faces probably originated from bifacially flaked implement edges. These associations are clearly tenuous because of the small amount of the original tool surface present on most of the resharpening flake platforms, and the usefulness of the data are therefore dependent in large measure upon the size of the individual pieces of debitage. In any event, however, the resharpening flake data were examined to attempt to determine the functions of tools represented by the resharpening flakes, and to potentially establish a connection between the recovered tools and the resharpening flakes from the site in the absence of appropriate refitting studies.

A histogram indicating the edge angles of the quartzite resharpening flakes is presented in Figure 27. A histogram of the edge angles of all implement edges shaped through intentional retouch which also exhibit wear and which occur on refitted quartzite tools and tool fragments is presented in Figure 28. The majority of the values in both cases fall between 50° and 80°. However, unlike the implement edge data, there are no obvious indications of grouping within the resharpening flake data.

Histograms illustrating the edge angles of the remnant tool edges on quartzite resharpening flakes with combinations of single, multiple or abundant scarring on the platform and resharpening flake exterior are presented in Figures 29-31.

1. Single scar on either the platform or flake exterior; multiple or abundant scars on the other face, Mean edge angle approx. 68°, Modal interval > 65° - 70°
2. Multiple scars on both the platform and flake exterior, or multiple scars on one and abundant scars on the other, Mean edge angle approx. 67°, Modal interval > 60° - 65°
3. Abundant scars on both the platform and flake exterior, Mean edge angle approx. 71°, Modal interval > 65° - 70°
Figure 27. Remnant tool edge angles measured on quartzite resharpening flakes, Area 811/821.

Figure 28. Angles of implement edges shaped through intentional retouch which also exhibit wear: refitted quartzite tools and tool fragments, Area 811/821.
Figure 29. Remnant tool edge angles measured on quartzite resharpening flakes with a single flake scar on either the striking platform or flake exterior, and multiple or abundant flake scars on the other face, Area 811/821.

Figure 30. Remnant tool edge angles measured on quartzite resharpening flakes which possess either multiple scars on both the striking platform and flake exterior, or multiple flake scars on one face and abundant scars on the other, Area 811/821.
The mean edge angle and modal interval for each of the three categories are nearly identical (the same stipulations apply to the calculation of mean edge angles for resharpening flakes as for implement edges on tools). Clearly, the grouping by unifacial/bifacial form evident in the tool data is not mirrored in the resharpening flake data. The central tendency of the edge angle data on resharpening flakes falls between the central tendencies for the two groups of worn quartzite implement edges described in the preceding section, as indicated again below.

1. Unifacial edges on quartzite flakes, Mean edge angle approx. 74°, Modal interval > 75° - 80°

2. Bifacial edges on both quartzite flakes and bifaces, Mean edge angle approx. 60°, Bimodal at the > 50° - 55° and > 60° - 65° intervals

An informal inspection of the colors of the quartzite tools and resharpening flakes was made with the intent of acquiring additional information bearing upon a potential relationship between these two classes of chipped stone artifacts. There are limitations to such uses of the color of quartzite, as illustrated by the refitting of tool fragments in the Pioneer Point collection with slightly different overall colors. Nevertheless, the colors of both the unifacial and bifacial implements match the colors which occur most frequently in the resharpening flakes (colorless to gray-white or yellow-white; medium purple- or gray-browns and tans; deep purple or reddish purple). This provides no evidence to refute a connection between the resharpening flakes and the tools in general. Additionally, the colorless and white resharpening flakes are the most numerous in the collection. Based upon color comparisons, most of the latter debitage may have been produced during the resharpening of implement edges in the bifacially flaked group located on several fairly large flake and biface fragments which came from at least four separate implements.

In conclusion, some of the resharpening flakes from Area 811/821 came from tools which were resharpened but appar-
ently not discarded at the site. However, based upon a comparison of color and a general consideration of edge angle data, it appears that the majority of the resharpening flakes could very easily have come from some of the tools represented in the recovered assemblage. In that event, the functions represented would be the same as those already inferred for the tools.

**Tool Use within Area 811/821**

As discussed previously, patterns were discovered in the data collected on worn quartzite tool edges which may indicate the presence of edges designed and used for two kinds of tasks. In addition, a relationship between these edges and the majority of the recovered resharpening flakes has been tentatively suggested. These intermediate analytical results were applied to those subsets of the chipped stone assemblage which had previously been identified as likely sources of information on tool use at Pioneer Point. The artifactual subsets isolated for study of on-site tool use include most of the complete and fragmentary flake tools and bifaces of quartzite, one quartzite implement fragment for which tool location was unclear, the quartzite resharpening flakes, and a single quartzite drill bit fragment.

Use-wear was noted on 16 implement edges which occur on the quartzite tools. These worn former “working” edges include the following:

1. Five unifacial edges with relatively steep bits which are among the larger group of edges tentatively inferred to have been used in scraping activities (Implement Nos. 3,6,26,42,54 [e.g., Figure 21a-c]),

2. Nine sharper bifacial edges which are among the group of edges tentatively ascribed such functions as heavy cutting or chopping (Implement Nos. 1,4,18,19,22,51, 52,54,55 [e.g., Figure 21c-g]),

3. One edge which was used without prior deliberate modification, and

4. One edge with alternating bifacial and unifacial flaking.

Thus, activities at Pioneer Point during the Late Prehistoric occupation may have involved the use of chipped stone tools in the capacities mentioned under the first two groups of edges listed above. The large number of quartzite resharpening flakes recovered and the heavy amount of wear on their remnant tool edges indicate that the above tool uses were fairly intensive.

The extent of the evidence for “drilling” activities at the site is limited to the nature of the drill fragment itself, i.e., a distal portion of a relatively delicate tool. No wear was observed on the fragment, which may have broken during manufacture or during resharpening unrelated to actual tool use at Pioneer Point.

Naturally, no suggestion is made that these tools were the only ones used at Pioneer Point, nor that the inferred activities are the only ones that took place in which chipped stone tools were used.

**Spatial Distribution of Chipped Stone**

A limited informal investigation was conducted into the spatial distribution of artifactual chipped stone in the excavated area surrounding Feature 10. The investi-
gation was organized around the three general topics addressed during the lithic analysis: possible employment, maintenance, and manufacture of chipped stone implements at Pioneer Point. As with all the attempts which were made to discern spatial structure within the scatter of cultural materials around Feature 10, severe limitations were imposed by the relatively gross provenience data combined with the small areal extent of the deposit. The provenience of all recovered debitage and tools is indicated in Table 21, and graphic representations of these data appear in Figures 32 and 33. Most of the chipped stone was recovered in an area 5 m in diameter around Feature 10. It was most densely concentrated immediately around, south, and southwest of the feature. Vertically, it was recovered from the surface to a depth of 16 cm.

Two groups of implement edges on quartzite flakes and bifaces which may have been used at the site were identified in the previous section, and it was suggested that they may have been designed and used to perform different tasks (scraping vs. cutting or chopping). Although the numbers of recovered pieces of stone which are involved is small (complete tools or fragments of tools), particularly for the possible scraping edges, the spatial distribution of these pieces for the two groups is somewhat different (Table 22, Figures 34 and 35).

Material from both groups was recovered from X2 and X4, the two 1-m test squares excavated in 1981. Their joint occurrence in X4 is due to the presence of one edge of each type on a single tool fragment (Figure 21c). The unifacial scraper edge on this piece has an angle between 55° and 60°, which is actually more acute than the bifacial edge of the artifact, which measured 60° - 65°. This scraper edge is in fact the most acute in the collection of unifacial quartzite implement edges, making it something of an outlier in the group. Additional scraper fragments were recovered in X14, the unit in which lay Feature 10, and in the southeastern quadrant of X13. The remainder of the possible cutting/chopping tool fragments were recovered from proveniences south of X2. In general, the scraping tools lay in closer proximity to the hearth. The more numerous cutting/chopping tools were more widely dispersed to the south.

These spatial data appear to be indirectly supportive of the original interpretation of the two groups of implement edges as different functional types based upon physical characteristics of the artifacts themselves. If the assumptions which have been made are correct concerning the integrity of the cultural deposits surrounding Feature 10, the use of certain tools on-site and their subsequent discard at the location of their use, then the artifactual distributions may reflect the locations where different activities were conducted. Relatively heavy cutting and/or chopping activities may have taken place a few meters south of Feature 10, and some sort of scraping activity may have been conducted immediately adjacent to the hearth. Given the similarity in size, as reflected in mean maximum dimension measurements, of the artifacts in each of the two functional implement categories (42 mm for the scraper fragments and 44 mm for the cutting/chopping fragments), the distribution of the artifacts relative to distance from the hearth.
Table 21. Distribution of Lithic Artifactual Material by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Debitage</th>
<th>Implements</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>428</td>
<td>11</td>
<td>439</td>
</tr>
<tr>
<td>X4</td>
<td>271</td>
<td>9</td>
<td>280</td>
</tr>
<tr>
<td>X11</td>
<td>288</td>
<td>5</td>
<td>293</td>
</tr>
<tr>
<td>X8</td>
<td>265</td>
<td>5</td>
<td>270</td>
</tr>
<tr>
<td>X10</td>
<td>26</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>X13</td>
<td>62</td>
<td>4</td>
<td>66</td>
</tr>
<tr>
<td>X14</td>
<td>1021</td>
<td>26</td>
<td>1047</td>
</tr>
<tr>
<td>X15</td>
<td>111</td>
<td></td>
<td>111</td>
</tr>
<tr>
<td>X16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X17</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>X18</td>
<td>32</td>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>X19</td>
<td>8</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>2514</td>
<td>69</td>
<td>2583</td>
</tr>
</tbody>
</table>

Table 22. Distribution of Selected Quartzite Tool Fragments by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Scraping Edges</th>
<th>Cutting/chopping Edges</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>X4</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>X11</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X8</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X10</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>X13</td>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>X14</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>X19</td>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>
Figure 32. Distribution of debitage, Area 811/821.

Figure 33. Distribution of tools and tool fragments, Area 811/821.
Figure 34. Distribution of tools and tool fragments with implement edges potentially used in scraping activities, Area 811/821.

Figure 35. Distribution of tools and tool fragments with implement edges potentially used in cutting/chopping activities, Area 811/821.
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is clearly not a result of size sorting during discard (e.g., Binford 1978:356).

The bulk of the debris which would have been produced during the manufacture and maintenance of tools, separately or in conjunction with the use of tools at the site, was concentrated in X14 and the 2-m square immediately south of X14 (consisting of X2, X4, and X11). Although artifactual remains indicative of tool maintenance were recovered from almost every excavation unit, many lay within or in close association with Feature 10. For example, a total of 141 quartzite resharpening flakes was recovered from X14, including 20 from the Feature 10 fill (Table 23). A total of 135 was recovered from the 2-m square to the south (69 from X2, 43 from X4, 23 from X11). Most of the 38 resharpening flakes recovered from X8 lay in the eastern half of that unit.

In addition, several projectile point fragments were recovered at the site (Table 23), including two fragments of one point from the Feature 10 fill (Figure 13a). Eight additional previously hafted implements and implement fragments were identified in the collection by the presence of wear on the ridges between flake scars on one or both faces of the artifacts, in conjunction with a notch or slight constriction in two cases. In contrast to most of the projectile points, these formerly hafted tools would have been of medium to large size. Provenience data for the latter group of artifacts are presented in Table 23. Several of them would conventionally be described as "knives." The provenience of manufacturing debris in the form of cortical quartzitedebitage is also presented in Table 23.

During the excavation, a small concentration of chipped stone, designated Fea-

Table 23. Distribution of Selected Lithic Artifactual Material by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th>X2</th>
<th>69</th>
<th>1</th>
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<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>X4</td>
<td>43</td>
<td>2</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>X11</td>
<td>23</td>
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<tr>
<td>X8</td>
<td>38</td>
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<td>2</td>
<td>1</td>
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<tr>
<td>X10</td>
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<tr>
<td>X13</td>
<td>7</td>
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<tr>
<td>X14</td>
<td>141</td>
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<td>X15</td>
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</tr>
<tr>
<td>X16</td>
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<tr>
<td>X17</td>
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<tr>
<td>X18</td>
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<td>1</td>
</tr>
<tr>
<td>X19</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>342</td>
<td>9</td>
<td>8</td>
<td>25</td>
</tr>
</tbody>
</table>
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Feature 5, consisting predominantly of gray-white quartzite debitage, was noted in the northwestern corner of X11 approximately 5 cm below ground surface. Recovered material includes three resharpening flakes, three resharpening/thinning flakes, 29 pieces of shatter, and one flake tool, all of quartzite. Although most of this stone, including the implement, is gray-white in color, several pieces are purplish in color. Several pieces of the white quartzite shatter retain smooth-surfaced cortex and represent debris from the reduction of a water-worn cobble.

In summary, chipped stone lay most densely within and around, south, and southwest of Feature 10. Debris from several kinds of activities, including manufacture, maintenance, and possible use of chipped stone implements, was generally mixed in this area. However, two separate locations of tool use may be indicated, as well as the location where a white quartzite cobble was reduced.

Summary

Chipped stone artifacts recovered within and around Feature 10 at Pioneer Point include over 2,500 pieces of debitage and 69 tools and tool fragments which have been refitted into 56 complete and partial implements. Most of this material is quartzite, although smaller quantities of jasper, agate, chert, and welded tuff have also been identified in the collection. Because the cultural deposit is not on or immediately adjacent to a known quarry location, it is likely that these lithic raw materials were brought to the site. Although several bifaces were recovered, the assemblage as a whole is dominated by flake tools. Both expedient and curational modes of tool production and use seem to be in evidence. Abundant resharpening flakes are thought to reflect activities which involved several cycles of tool use and subsequent edge rejuvenation.

The range of activities at Pioneer Point included the manufacture, maintenance, and actual use of chipped stone tools. The entire deposit is fairly circumscribed, and from that standpoint, all of the recovered material is grossly associated with Feature 10. Based upon coarse provenience data, it appears that most of the chipped stone generated during the various activities is mixed within the deposit. However, there is evidence to suggest that a task involving the use of fairly large quartzite cutting or chopping implements occurred south of Feature 10, while some type of scraping activity was conducted in closer proximity to the feature.

AREA 822

Tool Maintenance and Manufacture

The edges on a variety of tools were apparently rejuvenated within Area 822 as evidenced, once again, by a substantial number of resharpening flakes constituting approximately 9% of the recovered debitage. There are 168 quartzite resharpening flakes in the Area 822 collection, seven of jasper, and one each of chert and obsidian. Similar to the collection of such flakes from Area 811/821, the remnant tool edges range from coarse and sinuous to finely flaked, indicating that more than one type of implement was reworked.
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At least a portion of the latter implements appear to have been hafted. Dulling of the ridges between flakes scars away from actual implement edges, interpreted as hafting abrasion, was observed on several pieces of debitage and on two quartzite implement fragments. Five fragmentary projectile points were also recovered within Area 822 (Figure 13 c,e,h,i,k).

As with the chipped stone assemblage from Area 811/821, the disparity between the quantities of recovered quartzitic and non-quartzitic raw material types seems to be due in part to the range of tool manufacturing activities which were performed. Evidence suggests that stages in the manufacture of quartzite implements in Area 822 ranged from primary reduction through final tool production and resharpening. However, only the later stages of manufacture and resharpening of non-quartzitic tools seem to be indicated.

The wide divergence between the quartzitic and non-quartzitic fractions of the assemblage with respect to debitage-to-tool ratios (Table 14) suggests that the non-quartzitic tools arrived at the site in completed or nearly completed form, and that more actual manufacture of quartzite implements occurred within Area 822. Although the quartzite debitage is predominantly non-cortical, partially cortical and cortical quartzite are also present in the collection (Table 24). The nature of much of the cortex on both the quartzite debitage and tools indicates, once again, that a cobble source was exploited. One partially cortical resharpening/thinning flake of chert was recovered, but the remainder of the chert and all of the agate, jasper, obsidian, and welded tuff debitage are non-cortical. Regional sources for these raw materials were briefly reviewed in the discussion of the Area 811/821 assemblage, with the exception of obsidian. At present, there are no known sources of high quality obsidian within or immediately adjacent to the Park. However, a well documented source lies approximately 35 mi (56 km) to the southeast at Cochetopa Dome. No sourcing studies were performed for the obsidian from Pioneer Point.

The sizes of the individual pieces of debitage of the various raw material types recovered in excavated units are fairly similar to each other with respect to the average size of recovered material and the ranges of size, with the exception of quartzite; the quartzitic portion of the debitage includes some fairly large pieces. The mean maximum dimension for the quartzite is approximately 19 mm (range 5 mm - 83 mm). The average maximum dimension for agate is about 20 mm (range 6 mm - 30 mm). The average for jasper is about 14 mm (range 6 mm - 34 mm). The mean for chert is about 14 mm (range 6 mm - 22 mm). The mean for welded tuff is 15.5 mm (range 9 mm - 26 mm), and the obsidian resharpening flake has a maximum dimension of 14 mm. The lower size limits in all cases are considered a reflection of field screening procedures. Pressure flakes of quartzite and jasper are among the smallest material recovered.

With regard to general tool production strategies, the collection of complete, refitted, and partially refitted implements from Area 822 is dominated by flake tools of all raw material types (Table 15). Well over
three times as many complete or fragmentary flake tools were identified as tools produced through bifacial reduction, although tool location in almost 14% of the total number of cases was unclear. Although all of the identified bifaces are quartzite, there are two and one-half times as many quartzite flake tools as bifaces. Flake implements of agate (Figure 36h), jasper (e.g., Figures 13e and 36f), chert (Figure 36g), and obsidian (Figure 36i) were also recovered. However, bifacial flaking of edges on flakes as well as bifaces was the most frequent edge form (Table 17).

The blank-preform-product continuum described in the Area 811/821 section was also applied to the bifaces of quartzite recovered within Area 822. The assignment of individual artifacts to the arbitrary stages within the continuum was based upon the kinds of “finished” tools which were recognized in the collection as well as upon expected thickness-to-width ratios demonstrating progressive thinning from blanks to finished implements. With regard to the latter, the assignments were made following a quick visual inspection of the artifacts, while actual measurements were made subsequent to the assignments (Table 25). Thickness and width measurements were obtained on specimens which are believed to represent each stage in the continuum. These bifaces are illustrated in Figure 37. Of note, edge wear was observed on both of the artifacts which were classified as preforms, and one of the two additionally exhibits dulling of a long ridge between flake scars away from the edges of the artifact, which presumably resulted from haft abrasion.

Functional Inferences for the Implements from Area 822

The data collected on all identified implement edges were analyzed for the purpose of defining functional categories of tools. As with the Area 811/821 lithic analysis, certain adjustments in the scope of the investigation were necessary to accommodate the nature of the collection. First, the analytical variable which dealt with evidence for heat alteration was ultimately dropped. Two raw material types in the collection, agate and jasper, appear to have been heat altered. All of the agate was altered. Both altered and apparently unaltered jasper were recovered from Area 822, but no other recorded variability among implement edges was found to correlate with the distinction. For example, both groups of the jasper implements exhibit wide ranges of edge angles.

A second accommodation in the scope of the analysis involved observation of raw material type. Very few non-quartzitic tools were recovered in Area 822, other than those manufactured from jasper (Table 15). The greatest emphasis was consequently placed upon the more numerous quartzite implement edges. Finally, given the large quartzitic component in the collection and the nature of this particular lithic analysis, it is thought that many edges which were utilized without prior modification were not recognizable. Emphasis was therefore placed upon implement edges created through intentional retouch.

In the effort to define functional categories of implements in the collection, four attributes of implement edges were stud-
Table 24. Degree of Cortex Present on Debitage by Lithic Raw Material Type, Area 822.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>N</th>
<th>PC</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartzite</td>
<td>1691</td>
<td>179</td>
<td>20</td>
<td>1890</td>
</tr>
<tr>
<td>Agate</td>
<td>6</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Jasper</td>
<td>74</td>
<td>1</td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>Chert</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Obsidian</td>
<td>3</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Welded tuff</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1781</td>
<td>180</td>
<td>20</td>
<td>1981</td>
</tr>
</tbody>
</table>

N = noncortical  PC = partially cortical  C = largely cortical

Table 25. Dimensional Data for Bifaces, Area 822.

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>TH</th>
<th>W</th>
<th>TH/W</th>
<th>TT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanks</td>
<td>70.8</td>
<td>33.0</td>
<td>69.6</td>
<td>0.47</td>
<td>(Fig. 37a)</td>
</tr>
<tr>
<td></td>
<td>78.6</td>
<td>19.3</td>
<td>47.8</td>
<td>0.40</td>
<td>(Fig. 37b)</td>
</tr>
<tr>
<td>Preforms</td>
<td>52.9</td>
<td>12.0</td>
<td>35.0</td>
<td>0.34</td>
<td>Knife or projectile point (Fig. 37d)</td>
</tr>
<tr>
<td></td>
<td>10.2</td>
<td>34.0</td>
<td>0.30</td>
<td>Knife or projectile point (Fig. 37c)</td>
<td></td>
</tr>
<tr>
<td>Finished implements</td>
<td>8.8</td>
<td>39.0</td>
<td>0.23</td>
<td>Knife (Fig. 37e)</td>
<td></td>
</tr>
</tbody>
</table>

Combined thickness/width

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>n</th>
<th>Min-max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blanks</td>
<td>0.44</td>
<td>2</td>
<td>0.40-0.47</td>
</tr>
<tr>
<td>Preforms</td>
<td>0.32</td>
<td>2</td>
<td>0.30-0.34</td>
</tr>
<tr>
<td>Finished implements</td>
<td>0.23</td>
<td>1</td>
<td>0.23</td>
</tr>
</tbody>
</table>

L = length (mm)  W = width (mm)  TH = thickness (mm)  TT = tool type
Figure 36. Selected chipped stone implements, Area 822: a-c. quartzite denticulates; d-e. quartzite notches; f. jasper notch; g. chert drill base; h. agate flake tool; i. obsidian flake tool.
Figure 37. Quartzite bifaces, Area 822.
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ied, including edge angle, edge form, raw material type, and tool location. Patterns in the occurrence of these attributes were sought, particularly patterns corresponding to peaks in edge angle frequency. The edge forms recognized in the Area 822 assemblage are indicated in Table 17.

The first phase of the analysis focused upon those implement edges which bore macroscopic evidence of use, because they presumably represent completed working edges. The second phase involved the additional consideration of edges without such wear. Histograms indicating the edge angles (in 5° intervals) of the edges shaped by deliberate retouch which also exhibit wear (n = 21) and all implement edges (edge angle measurements were obtained for 94 of the total of 102 edges) appear in Figures 38 and 39.

The data collected on edges with wear were studied using a formal clustering procedure, average linkage between groups, and a series of histograms. Unfortunately, few useful results were obtained. The differences in edge angle for several clusters isolated during the average linkage procedure were tested using Kruskal-Wallis one-way analysis of variance and found not to be significant. This situation may ultimately be a consequence of the very small sample size (n = 13) of the quartzite edges; the sample size of comparable edges from Area 811/821 is 21. In general, the edge angles of quartzite implement edges which were produced through intentional retouch and which also exhibit wear range from 50° - 80° with a mean of 66°. The size of the implements upon which these edges were located ranged from small to large, probably indicating that several types of tools are represented.

During the second phase of the analysis, patterns were discovered which may have functional significance within the larger collection of implement edges. In the histogram for the 94 edges with angle measurements (Figure 39), peaks in edge angle frequency occur in the 35° - 40°, 45° - 50°, and 60° - 65° intervals. Most of the collection consists of edges on quartzite (n = 69) and jasper (n = 20). Histograms of the edge angles of the latter two subsets appear in Figures 40 and 41. By comparing the three histograms, it is apparent that the large cluster of values around the 60° - 65° interval for the entire collection is composed primarily of quartzite. The primary edge forms of the quartzite edges in the 60° - 70° range are “bifacial” and “unifacial denticulate.”

A comparison between the Area 811/821 and Area 822 assemblages reveals an interesting difference with respect to the proportions of bifacial, unifacial scraper, and unifacial denticulate edges of quartzite. Roughly one-half of each collection of edges is bifacially flaked (Area 811/821: 35 of 63 edges, 56%; Area 822: 32 of 69 edges, 46%). However, the Area 811/821 collection contains a higher proportion of unifacial scraper edges (21 of 63, 33%) than the Area 822 collection (10 of 69, 15%). On the other hand, only two unifacial denticulate edges were identified on tools recovered from Area 811/821 (3%), while 18 (26%) were identified in the Area 822 collection (e.g., Figures 36a-c and 37b). While the denticulate edges on quartzite implements from Area 822 have edge angles which range from 45° to 100°, most fall between 60° and 70°. Because macroscopic wear was observed on only one of the latter group of 18 edges, it seems highly likely
Figure 38. Angles of implement edges shaped through intentional retouch which also exhibit wear, Area 822.

Figure 39. All implement edge angles, Area 822.
Figure 40. Angles of implement edges manufactured on quartzite, Area 822.

Figure 41. Angles of implement edges manufactured on jasper, Area 822.
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that many of them represent unfinished tool edges.

Many of the edges with edge angles which occur around the peak in frequency in the 35° - 40° interval (Figure 39) are located on projectile points. The four small, thin projectile points which were recovered in Area 822 (Figure 13 c,e,h,i) have edge angles between 30° and 50°. Comparable points from Area 811/821 have edge angles between 35° and 50°. One anomalous small, but particularly thick, semi-serrated point from Area 822 (Figure 13k) has blade edges with angles between 60° and 70°. Irregularities in the raw material may have contributed to the steeper edges on this artifact.

The edges with angles which appear to cluster around the 45° - 50° interval (Figure 39) are a highly variable group with respect to raw material type, edge form, and tool location.

Five unifacial notches were identified in the collection, four of quartzite (e.g., Figure 36 d,e) and one of jasper (Figure 36f). Only one of these exhibits macroscopic use-wear. Edge angles for the group range from 75° - 90°. These edges are slightly steeper than the notches from Area 811/821, which have edge angles between 65° and 75°. Perhaps these edges were intended for use in shaping wooden arrow shafts or hafts for other kinds of tools, a suggestion consistent with other evidence of hafted implement retooling such as projectile points and other hafted implement fragments.

Edge angle ranges for each raw material type represented in the collection of implement edges from Area 822 are listed below.

- Quartzite > 35° - 100° (n = 69)
- Jasper > 25° - 90° (n = 20)
- Agate > 45° - 65° (n = 3)
- Obsidian > 75° - 85° (n = 2)

Only thirteen edges were identified in the collection which were apparently used without prior deliberate modification. Edge angle measurements were obtained on eleven of these (7 of jasper, 3 of quartzite, 1 of obsidian). A wide range of angles is represented (> 25° - 85°) with the following distribution.

\[
\begin{align*}
&\leq 40° \ n = 2 \\
&> 40° \ n = 9
\end{align*}
\]

The majority of these edges are unexpectedly steep in light of Wilmsen’s (1970:74) suggestion that most such edges will have angles less than 40°. However, the recognized samples of utilized flakes from both areas at Pioneer Point are thought to be skewed, given the difficulty in use-wear recognition on quartzite and the macroscopic analysis of edges which was performed.

In summary, the first phase of the analysis failed to produce the type of results obtained during study of a comparable subset of artifacts from Area 811/821. Worn edges on implements of quartzite recovered within Area 822 have edge angles which fall within a 30° range and a mean edge angle of 66°. Within the collection of
implement edges both with and without macroscopic use-wear which was studied during the second phase, at least one of the three peaks in edge angle frequency appears to reflect the presence of a functionally significant group of edges; four small, thin projectile points have edge angles between 30° and 50°. In addition, five unifacial notches have edge angles between 75° and 90°. Although the latter edges may have been designed for shaping wooden hafts of various kinds, actual wear was observed in only one instance. The large group of values around the peak in edge angle frequency between 60° and 70° is composed largely of measurements taken on quartzite edges. A variety of functions may be represented, and many of the edges may not be in completed form.

**Functional Inferences for the Resharpening Flakes and Tool Use within Area 822**

A total of 177 resharpening flakes was recovered within Area 822, including 168 of quartzite, seven of jasper, and one each of chert and obsidian. Edge angle measurements were taken along the remnant sections of tool edge on the resharpening flakes to provide a basis for inferring the functions of the tools from which the flakes were removed. Such edge angle measurements were obtained for 94% of the collection (n = 167). The edge angles for quartzite resharpening flakes range from 45° - 130°, and the edge angles for jasper resharpening flakes range from 60° - 95°. The specimen of chert has an edge angle in the 70° - 75° interval, and the one of obsidian has an edge angle in the 55° - 60° interval.

A histogram showing the frequency of edge angle measurements on the quartzite resharpening flakes appears in Figure 42. The mean edge angle for this group is 74°. Given the durability of quartzite in general, the amounts of wear visible on the remnant tool edge sections on the resharpening flakes, and the moderate steepness of those edges, it may be concluded that some of the tools from which the flakes were removed were used for fairly heavy work.

The quartzite resharpening flakes may be reflective of tool use at the site. As previously indicated, tool repair and maintenance were clearly conducted within Area 822, and much of this activity may have been conducted apart from actual tool use; the short-term camp situation may have offered an opportunity for general upkeep of equipment. However, much of the quartzite resharpening debris may have been generated as a result of intensive tool use, i.e., several cycles of implement use and edge rejuvenation may have been necessary in order to complete a task.

**Spatial Distribution of Chipped Stone**

Given the geographical setting of Area 822 and the considerable potential for movement of the cultural materials deposited there over time, only a brief and general statement is appropriate concerning the spatial distribution of the recovered chipped stone artifacts. As indicated earlier, a vertical change in the ground surface of approximately 90 cm occurred across the six contiguous 2-m units which were actually excavated, with the largest eleva-
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Figure 42. Remnant tool edge angles measured on quartzite resharpening flakes, Area 822.

Tional change of 56 cm for any one unit occurring across X87. The smallest change of 16 cm occurred across X106.

Chipped stone was most densely concentrated within 2 to 3 m of Feature 19, although material was scattered over the ground surface for a short distance to the north and northeast. The provenience of the recovered debitage and tools is presented in Tables 26 and 27. Within the excavated units immediately around the feature, the largest quantity of material was recovered from X106 (Figures 43 and 44). This unit encompassed the most level ground within the saddle as well as a portion of the feature itself. The second largest amount of material was recovered from X87, the unit with the greatest differential in surface elevation. Chipped stone along with the other classes of material were recovered from the surface to a depth of 12 - 13 cm. Provenience data indicate that debris from the manufacture, maintenance, and possible use of chipped stone tools was apparently mixed within the deposit.

A small, separate lithic scatter (designated Feature 22) was identified a short distance north of the block excavations. All visible surface material was collected and was composed of either deep reddish purple quartzite or off-white quartzite with dark speckles. Four resharpening flakes in the Feature 22 material exhibit slightly rougher edge wear than occurs on the other chipped stone from the site. Seven resharpening/thinning flakes and six pieces of shatter were also recovered from Feature 22.

Summary

Nearly 2,000 pieces of debitage were recovered within Area 822, together with
Table 26. Distribution of Lithic Artifactual Material by Excavation Unit, Area 822.

<table>
<thead>
<tr>
<th>Unit</th>
<th>D</th>
<th>T</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 1/4 X85</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>X86</td>
<td>128</td>
<td>10</td>
<td>138</td>
</tr>
<tr>
<td>X87</td>
<td>270</td>
<td>14</td>
<td>284</td>
</tr>
<tr>
<td>X105</td>
<td>186</td>
<td>12</td>
<td>198</td>
</tr>
<tr>
<td>X106</td>
<td>995</td>
<td>18</td>
<td>1013</td>
</tr>
<tr>
<td>X105/106 (F19)</td>
<td>23</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>X107</td>
<td>136</td>
<td>4</td>
<td>140</td>
</tr>
<tr>
<td>X126</td>
<td>10</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1754</td>
<td>65</td>
<td>1819</td>
</tr>
</tbody>
</table>

D = debitage pieces    T = implements and implement fragments

Table 27. Distribution of Lithic Artifactual Material from Surface-Collected Units, Area 822.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Debitage</th>
<th>Implements</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>X68</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X88</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>X92</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X104</td>
<td>18</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>X111</td>
<td>14</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>X125</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>X130</td>
<td>8</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>X131</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>X132</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>X148</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X149</td>
<td>27</td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td>X150</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X151</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X169</td>
<td>76</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>X170</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>X171</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>X189</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>X190</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>F22</td>
<td>17</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td><strong>General surface</strong></td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>227</td>
<td>12</td>
<td>239</td>
</tr>
</tbody>
</table>
Figure 43. Distribution of debitage, Area 822.

Figure 44. Distribution of tools and tool fragments, Area 822.
77 tools and tool fragments which have been refitted into 66 complete and partial implements. Although a number of quartzite bifaces were recovered, most of the tool assemblage is comprised of implements fashioned from flakes of various raw materials. The predominant raw material type is quartzite, but agate, jasper, chert, welded tuff, and obsidian are also present in the collection.

Although artifactual chipped stone was scattered over the ground surface for a short distance north and east of Feature 19, it was most densely concentrated within 2-3 m of the feature itself. Within the latter area, debris from the manufacture and maintenance of chipped stone tools was apparently mixed. All stages in the manufacture of quartzite tools may have been performed within Area 822, while activities involving non-quartzitic raw materials were apparently limited to the later stages of manufacture and tool edge rejuvenation. Hafted tools including projectiles were the focus of at least a portion of these activities. The edge angles on most of the recovered projectile point fragments were remarkably consistent, both within the group and with comparable points recovered in Area 811/821, thus confirming that they constitute a highly stylized tool form. The large number of quartzite resharpening flakes in the collection may, in part, reflect tool use at the site from the following standpoint. Their considerable numbers, together with characteristics of the remnant tool edges on them, may constitute evidence of intensive use of chipped stone tools for fairly heavy work which ultimately required several episodes of edge rejuvenation to complete.

The assemblages of chipped stone from the two areas at Pioneer Point are remarkably similar in several respects. First, the chipped stone material from the two areas was recovered in similar contexts from the standpoint that all of the chipped stone from Area 811/821 and most of that from Area 822 was associated with a probable hearth. Second, the raw material types which were recovered in each area and the relative representation of the types are comparable. Quartzite is the predominant raw material type in each case, constituting from 95% - 97% of the debitage and 77% of the recovered complete and fragmentary implements. Quartzite cobble sources were exploited for at least a portion of this material. Evidence for utilization of cobbles occurs at other sites in the Park, but the extensive quartzite bedrock exposures along the Gunnison River in the present area of Blue Mesa Lake were clearly the primary prehistoric sources of quartzite in the general vicinity of Pioneer Point. Jasper constitutes the second largest raw material component in each collection. Small quantities of agate, chert, and welded tuff were also recovered in each area, and a few pieces of obsidian were found within Area 822.

Resharpening flakes make up approximately 14% of the debitage from Area 811/821 and approximately 9% of the debitage from Area 822. The vast majority of the resharpening flakes in each collection were struck from quartzite implements, the latter possessing a range of edge types...
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from relatively coarse to fine and smooth. While several of the tools from which these flakes were struck may simply have been repaired or otherwise reworked at the site, a large number of the quartzite resharpening flakes may have been generated during tool maintenance performed in conjunction with on-site tool use. In other words, tasks may have been performed which ultimately required several cycles of tool use and edge rejuvenation to complete. Edge angle data for the quartzite resharpening flakes from the two areas are presented below.

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area 811/821</td>
<td>&gt; 35°-110° 68°</td>
</tr>
<tr>
<td>Area 822</td>
<td>&gt; 45°-130° 74°</td>
</tr>
</tbody>
</table>

A dichotomy in debitage-to-tool ratios for the quartzitic and non-quartzitic raw material types from both areas is largely a reflection of the different ranges of activities related to tool manufacture/maintenance which were performed at the site. The manufacture of quartzite implements from inferred primary reduction of cobbles onward apparently occurred in both areas. However, the initial stages of reduction for the quartzite were clearly limited in scope. There are no known quarries of any lithic raw materials in close proximity to Pioneer Point, and it is therefore probable that such materials were brought to the site by the prehistoric occupants. The proportions of recovered quartzite debitage retaining differing amounts of cortex are very similar for the two areas of the site.

On the other hand, activities involving non-quartzitic raw materials were apparently confined to the later stages of manufacture/tool resharpening. Hafted tools were the focus of at least a portion of the implement manufacture and maintenance conducted in each area.

Finished tool types from both areas include well-executed stylized forms, most notably small projectile points, medium to large bifacially flaked knives, and drills. The stylistic comparability of the projectile points is discussed elsewhere. A variety of informal expedient tools was also recovered in each case. Both assemblages are dominated by flake tools possessing a variety of edge forms. All or most of the implements produced through bifacial reduction are quartzite, yet most of the recovered quartzite tools are produced on flakes.

Several remarks concerning the possible functions of implements recovered in the two areas are presented in the Area 822 discussion. In both cases, a large number of implement edges on quartzite (both with

<table>
<thead>
<tr>
<th>Percentage of Debitage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A811/ A822 821</td>
</tr>
<tr>
<td>Non-cortical</td>
</tr>
<tr>
<td>Partially cortical</td>
</tr>
<tr>
<td>Largely cortical</td>
</tr>
</tbody>
</table>
and without macroscopic edge wear) have edge angles between 55° and 70°. In the Area 811/821 collection, there is also a clear expression of a steeper group of quartzite edges with angles between 75° and 85°. Two groups of worn quartzite implement edges from Area 811/821, which generally parallel and thus contribute to these two peaks in edge angle frequency, may have functional significance; no comparable grouping was identified in the smaller collection of such edges from Area 822. However, the edge angle data for the two areas are very similar overall. Worn quartzite edges produced through intentional retouch have edge angles which range in both cases from 50° - 80°. The mean for all such edges from Area 822 is 66°, while the two groups of worn edges from Area 811/821 have mean edge angles of 60° and 74°.

Within the larger collection of quartzite edges (both with and without wear) from each area, there seems to be a difference in emphasis in the edge forms on quartzite. Specifically, there is a higher proportion of "unifacial scraper" edges from Area 811/821 and a higher proportion of "unifacial denticulate" edges from Area 822. Since only one of the eighteen denticulate edges of quartzite from Area 822 was clearly worn, most of the group may represent unfinished implement edges. In addition, the edge angles for small thin projectile points are almost identical for the two collections, with values ranging from 30° - 50°.

In conclusion, the two cultural deposits at Pioneer Point investigated in this analysis seem to be by-products of similar human behavioral responses to the same approximate set of environmental variation. Use of the site and the region's lithic resources appear to be similar in each case. It thus appears that the same group of people or groups with similar economic adaptations were responsible for the two areal deposits.

GROUND STONE ARTIFACTS

Very little ground stone was recovered at Pioneer Point. Investigations in Area 811/821 resulted in the recovery of three mano fragments, a simple slab metate fragment, and a sandstone shaft smoother. No ground stone artifacts were recovered in Area 822.

The metate section was represented by a fine-grained natural sandstone slab recovered from the surface of X20 a short distance east of the block excavation in Area 811/821 (Figure 2). The artifact had been incorporated into a partial ring of rock lying on the ground surface, which was designated Feature 16. This feature was investigated as a possible hearth. However, excavation revealed neither soil staining nor charcoal within or around the rocks, although one rock in the ring may have been charred. Rusted bicycle spokes were found in association with the ring. The rocks have been interpreted as a feature of probable recent origin into which the metate fragment was incidentally incorporated.

Evidence of abrasion occurs over roughly 190 sq cm of one face of the metate fragment (Figure 15f). Use of this face of the
LITHIC ARTIFACTS

implement created a slightly dished depression, and the surface appears to have been pecked and subsequently reused. Possible abrasion occurs on a much smaller area of the opposite face (approximately 20 sq cm). The intact portion of the outer edge of the metate is battered, which may have resulted from a rough shaping of the implement.

Two small mano fragments were recovered from the north and west balk walls of X11. They exhibit a light sheen presumably resulting from use of the parent implement(s) made from a quartzite cobble. Light abrasion also occurs on the cortical surface of a quartzite cobble fragment recovered from the surface of X4.

Two fragments of a coarse-grained sandstone shaft smoother were exposed in situ approximately 90 cm apart just below the ground surface in X14. Both fragments were recovered near the eastern edge of Feature 10 but slightly above the associated soil stain. The original artifact was probably rectangular in plan view, and is H-shaped in transverse cross-section as a consequence of wear within two opposing rounded grooves (Figure 15e). The objects abraded by the implement appear to have been 5-6 mm in diameter. Although a particular type of shaft smoother employed by many Native American groups consisted of two pieces of stone used in combination, the implement from Pioneer Point appears to have consisted of a single piece of sandstone. This is evidenced both by the fact that the channels or grooves are deeper at one end of the tool than the other, and by the slightly irregular wavy surface along the top of the abrader. The latter surface would presumably have been ground flat through use with a second stone. Stewart (1942:268) noted differences in similar tools used by Historic bands of Utes, with the Tabehuache alone employing the one-piece versions.
Chapter 4

FAUNAL AND MACROFLORAL REMAINS

FAUNAL REMAINS

Limited testing at Pioneer Point in 1981 resulted in the recovery of identifiable long bone fragments of mule deer and elk in X1 and X6 in association with Feature 1, and long bone fragments of mule deer in X2 (Gilbert 1986). As a result of the 1982 investigations at the site, the faunal remains from X2 were ultimately determined to have lain in proximity to Feature 10. A total of 62 pieces of bone was recovered from X2, and approximately 30 pieces were recovered from the adjacent X4.

A total of 330 bone fragments was recovered during the 1982 investigations at Pioneer Point, two-thirds of which came from the Area 821 excavations within and around Feature 10, and one-third of which came from Area 822 within and around Feature 19 (Appendix VI). Fully 86% of the total recovered material was too fragmentary for element identification and was therefore assigned only to Class Mammalia. All of the faunal remains which were identified more specifically were from large mammals.

Almost 80% of the faunal material recovered at Pioneer Point in 1982 was burned and calcined (Olsen and Jones Appendix VI), indicating... a pattern of bone discard onto a fire rather than directly reflective of aboriginal cooking practices ... While it is reasonable to hypothesize that many of the bones in the Pioneer Point collection were derived from portions of meat which were roasted and eaten, butchering marks on the material represent the only concrete evidence of such activity.

Butchering marks are present on only two bone fragments in the collection. Bone fractures are typically longitudinal or transverse rather than spiral. Since calcined bone is susceptible to such breakage, most of the breakage probably occurred after the bone was discarded and is therefore not supportive of bone grease production or marrow extraction activities on-site.

Domesticated animals may possibly also be represented in the collection. Historic ranching activities in the area of Pioneer Point could conceivably have resulted in the introduction of elements from either cow or domestic sheep into the shallow cultural deposit, and taxonomic identifications were often limited to very general levels because of the fragmentary nature of the collection. A conservative approach to the faunal identifications was taken, partially because of the proximity in time of
the aboriginal occupation at Pioneer Point to the early Spanish contact period in the region. However, it seems extremely unlikely that domesticated animals may be represented at Pioneer Point which were ultimately derived from a Spanish source. Radiocarbon dating of two hearth-like features at Pioneer Point suggests that the aboriginal occupation took place during the 1400s, and the Spanish province of New Mexico was not founded until 1598 (Bolton 1950:1).

The faunal material from the block excavations in Area 811/821 includes elements of mule deer, bison and/or domestic cow, bighorn sheep and/or domestic sheep or goat, and a large dog or wolf (Appendix VI, Table 30). Most of the bone was recovered within and around Feature 10 in X14, and in the adjacent 2 m square to the south (consisting of X2, X4, and X11 [Figure 45]). Faunal remains were also recovered in X8, X10, X13, and X15, but none were found in X16, X17, X18, or X19. The remains were thus clustered within and around the hearth and were not widely dispersed.

Approximately 30% of the faunal material from Area 811/821 was recovered from the Feature 10 fill. This material includes elements of mule deer, dog or wolf, bison/bos, and unspecified artiodactyl. A heavily calcined right occipital condyle of a mule deer skull was recovered from the feature fill. The large dog/wolf remains consist of a burned grooved and fractured distal condyle of a proximal phalanx which has been interpreted as debitage from manufacture of a bone whistle or bead. Twelve of the 13 fragments of bison or cow bone from Area 811/821 were found within Feature 10; seven of the 12 are burned. They consist primarily of foot and long bone fragments, but one premolar fragment was also identified. Olsen (Olsen and Jones Appendix VI) noted the following with regard to the Bison/Bos identification:

... the morphological characteristics required to distinguish between osteological remains from the two genera were not present ... Based upon size alone (among those specimens sufficiently complete for evaluation), the faunal remains may well represent domestic cattle.

Additionally, two fragments of bison or cow bone exhibit evidence of weathering which may indicate their exposure on the ground surface for a considerable period of time. Transverse and diagonal cut marks were noted on two fragments of Bison/Bos bone in the collection, one from within and one from outside Feature 10 in X14.

Early historic accounts place bison throughout most of Colorado, including the mountain parks and valleys, and in northern Utah, and in New Mexico primarily east of the Rio Grande (Roe 1970:36-37, 260, 264-265, 269, 274-278; Beidleman 1955; Armstrong 1972:308; Seton 1929:647; Skinner and Kaisen 1947:157-158). Bison may have been absent from the southwestern part of Colorado during historic times. If bison were available locally prehistorically, it would probably have been in extremely small numbers. The radiocarbon dates for features at Pioneer Point indicate an aboriginal occupation prior to the Spanish contact period. Given that a portion of the Bison/Bos material recovered from Feature 10 itself was burned, it would not appear to represent a recent addition of
domestic cow to the deposit. Consequently, an identification as bison is favored.

Twenty-six premolar or molar fragments from bighorn sheep, domestic sheep, or domestic goat were also recovered in 1982 at Pioneer Point. None of this material is burned, and none was recovered from the Feature 10 fill. Over one-half of this material (14 fragments) was recovered from X8, with the remainder divided between X10, X11, X13, and X14 (Figure 46). Based upon wear attrition, Olsen (Olsen and Jones Appendix VI) indicates that the teeth fragments may have come from a single individual. This material may represent a relatively recent introduction into the deposit.

Within Area 822, faunal remains were recovered primarily within 1-2 m of Feature 19 (Appendix VI, Table 30). Only 9% of the faunal material was recovered from the feature fill. Identifiable bone includes two fragments of bison or cow bone, one burned and one unburned, and a burned distal condyle from a metapodial of either a bighorn sheep or mule deer.

In summary, faunal remains recovered in both areas at Pioneer Point suggest that on-site activities included the processing and consumption of large game animals which were most likely procured locally. These animals appear to have included mule deer, elk, and bison. Deer are currently seen in the vicinity of the site, and game trails have been observed on the slopes of the Curecanti Creek Valley below Soap Mesa (Jones 1986a:17). The faunal evidence from Pioneer Point is consistent with the limited faunal assemblages from most other sites in the Park, which document a primary focus upon the exploitation of large game animals such as deer and elk over thousands of years. However, there is a possibility that the archeological samples may be biased by the differential preservation of bone from small as opposed to robust species (Jones 1986a:208). The recovery of the dog/wolf remains which appear to represent debris from the manufacture of a bone whistle or bead is supportive of an interpretation for the site as a short-term camp at which a variety of activities were performed.

MACROFLORAL REMAINS

Bulk soil samples from Features 10 and 19 at Pioneer Point were analyzed for macrofloral content (Scott 1986). The scant macrofloral remains identified in the samples are indicated in Table 28. A number of charred Chenopodium seeds (25 complete, 10 fragmentary) and three fragments of charred Gramineae seeds were identified in the sample of processed fill from Feature 10. Charred Chenopodium seeds (9 complete) were also identified in the sample of fill from Feature 19 in Area 822. Both the seeds and the greens of plants in these two groups are known to have been used for food by Native Americans (Chamberlin 1964; Gallagher 1977; Gilmore 1977; Harrington 1967; Rogers 1980, cited in Scott 1986:19-20). The macrofloral record at Pioneer Point therefore suggests that Chenopodium seeds in particular may have been processed as food at the site. This is consistent with the recovery of processing implements adjacent to Feature 10 which include both mano and metate fragments.

Seed production by the chenopod and grass families is controlled by seasonal temperature constraints (Gary Farnsworth, Agricultural Agent, Extension Office,
Figure 45. Distribution of faunal remains by excavation unit, Area 811/821.

Figure 46. Distribution of premolar/molar fragments from bighorn sheep, domestic sheep, or domestic goat by excavation unit, Area 811/821.
Gunnison County, Colorado, personal communication 1987). Current information suggests that annual chenopod species will not produce seeds when the temperature drops below a threshold of 32° F. The perennial species are slightly more tolerant, with a temperature threshold for production of 28° F. In both cases, seed production is limited to the relatively short growing season in the Gunnison area, which currently averages 63 days and extends from approximately July 1st to September 1st. Depending upon yearly fluctuation, the season may extend to as late as the 15th of September. Therefore, Chenopodium and Gramineae seeds would be available locally between July 1st and September 15th. The occupation at Pioneer Point probably took place during this same time period, assuming that the seeds recovered in the prehistoric features were collected locally and had not previously been placed in storage.

Wood charcoal from Juniperus and fragments of charred conifer needles were also identified in the fill samples from Features 10 and 19 (Table 28). This material is interpreted as the remains of locally collected fuel which was burned in the two features. Both junipers and conifers grow in the immediate vicinity of the site today. Given the relative stability of the major vegetation zones in the area of the Park during the past 6,000 years (L. Scott 1981, 1986:23), the distribution of these species during the Late Prehistoric occupation at Pioneer Point may have been similar to that of today.

In summary, the macrofloral remains from Pioneer Point, in conjunction with

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Provenience</th>
<th>Flotation Charred Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB10</td>
<td>Feature 10</td>
<td>Conifer needle 2 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chenopodium 25, 10 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gramineae 3 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eriogonum 1*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unknown 3, 1 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Juniperus charcoal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bone 9 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lithics 10</td>
</tr>
<tr>
<td>MB19</td>
<td>Feature 19</td>
<td>Chenopodium 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Penstemon 3*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conifer needle 1 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Juniperus charcoal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bone 5 fr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lithics 4</td>
</tr>
</tbody>
</table>

* indicates uncharred remains
FAUNAL AND MACROFLORAL REMAINS

several ground stone artifacts recovered in Area 811/821, suggest that processing of locally available vegetal foods occurred at the site. Assuming that the seasonal cycle 400-500 years ago was similar to that of today, these same materials also suggest that the site was occupied sometime during the summer or early fall. In addition, mixed local fire wood sources were exploited during the occupation.
Chapter 5

SUMMARY AND CONCLUSION

SITE SUMMARY

The Late Prehistoric site at Pioneer Point was identified in 1981 during the archeological survey and testing which was conducted in advance of Park development of the area (Jones 1986a:10-17,214-215). The site was immediately deemed significant for two primary reasons. First, a substantial quantity of brown ware ceramics was recovered in association with chipped stone artifacts and faunal remains. These were the only such ceramics that had ever been identified within the Park. In light of the otherwise scant archeological evidence of Late Prehistoric, Protohistoric, and Historic aboriginal occupations within Curecanti, 5GN41 clearly had considerable potential to contribute to an understanding of recent aboriginal adaptations in the Upper Gunnison Basin. Second, the occupation(s) at the site appeared to be few in number, of relatively short duration, and restricted in the time period(s) which they represented. An opportunity was thus provided at Pioneer Point to assess information pertaining to single-component site structure, which might subsequently be applied to the analysis of other more complex multiple component sites of greater antiquity elsewhere within the Park (Jones 1986a:112).

As a result, mitigative archeological investigations were conducted at Pioneer Point in 1982 which included block excavations in two areas of the site. During the course of the preliminary work in 1981 and the mitigation in 1982, three probable hearths were exposed within concentrations of cultural material. The scatter of lithics, ceramics, faunal remains, and ground stone within and around one of the hearths, designated Feature 10, became the primary focus of the 1982 field investigations and subsequent laboratory analysis.

The several lines of evidence for dating the cultural deposits at Pioneer Point included radiocarbon assay, and diagnostic projectile point and brown ware ceramics comparisons. These lines of evidence yield results that are reasonably consistent with one another. The calibrated date ranges obtained from radiocarbon assay of charcoal from Features 1 and 10 are A.D. 1409-1468 and A.D. 1403-1468, respectively. Numerous similarities between the artifactual and ecofactual materials associated with Features 10 and 19, the latter from Area 822, also suggest that the group or groups responsible for those two deposits made similar use of the site itself and of local lithic, floral, and faunal resources. It thus appears that in each case the occu-
of hafted tools is suggested by the presence of projectile points and other formerly hafted implements, a sandstone shaft smoother, and debitage which appears to have been produced during the retooling of hafted implements. The somewhat different spatial distributions of two groups of chipped stone implements may indicate the locations where relatively heavy cutting and/or chopping activities and scraping activities were conducted. The cutting/chopping activities in particular were probably related to the processing of the large game animals mentioned above. Several cycles of tool use and subsequent edge rejuvenation were apparently necessary in order to complete the task. Finally, the recovery of dog/wolf remains, interpreted as debris from the manufacture of a bone whistle or bead, in combination with chipped stone drill bit and base fragments suggest that craft activities occurred on-site at Pioneer Point.

A number of assumptions were made as a necessary prerequisite to the study of spatial structure within the cultural deposits surrounding Feature 10 in Area 811/821. First, an explicit assumption was made that those deposits represented a single in situ archeological component deposited during the course of one occupation. A second explicit assumption was made that extensive “housecleaning” activities probably did not occur during the aboriginal occupation, activities which would have resulted in redeposition of cultural material from areas of use and original discard to secondary refuse areas (Schiffer 1972). Because of limitations imposed by the nature of relatively gross artifact provenience data for the site and the small areal extent of the deposits, the spatial studies were ultimately limited and informal. The general dis-
SUMMARY AND CONCLUSION

Approximately 87% of the faunal material was recovered from the 8-sq m area which included X14 and the adjacent 2-m square to the south (Table 29). As with the distribution of the lithics, most of the faunal remains from the latter southern unit were recovered from its western half. In contrast to the spatial distribution of chipped stone, however, faunal remains were most densely concentrated within and immediately adjacent to Feature 10 in X14, with a relatively lesser amount of material scattered to the south. This distribution for the faunal remains is consistent with the burned and calcined nature of nearly 80% of the material, indicating a pattern of bone discard onto a fire (Appendix VI).

The distribution of ceramics was notably different from that of either the chipped stone tools, tool fragments, and debitage were distributed similarly within the cultural deposits surrounding Feature 10 (Table 29). The 8-sq m area including X14, X2, X4, and X11 contained approximately 74% of the chipped stone tools and tool fragments, and approximately 80% of the debitage. For each of these datasets, nearly equal percentages of material were recovered from X14 (the unit encompassing Feature 10), and the adjacent 2-m square to the south (consisting of X2, X4, and X11). Within the latter 2-m square area, most of both the debitage and tools lay within the western half, encompassed by X2 and X4.

Table 29. Percentage Distribution of Cultural Material Types by Excavation Unit, Area 811/821.

<table>
<thead>
<tr>
<th>Excavation Unit</th>
<th>Chipped Stone Tools</th>
<th>Chipped Stone Debitage</th>
<th>Faunal Remains</th>
<th>Ceramics</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>16</td>
<td>17</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>X4</td>
<td>13</td>
<td>11</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>X11</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total of X2, X4, X11</strong></td>
<td><strong>36</strong></td>
<td><strong>39</strong></td>
<td><strong>37</strong></td>
<td><strong>36</strong></td>
</tr>
<tr>
<td>X8</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>38</td>
</tr>
<tr>
<td>X10</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>X13</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>X14</td>
<td>38</td>
<td>41</td>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>X15</td>
<td></td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>X18</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X19</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>99%</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

tributional patterns of the different classes of cultural material recovered in Area 811/821 are described and compared below.
SUMMARY AND CONCLUSION

stone artifacts or faunal remains, in that 74% of the ceramics lay southwest of Feature 10 in X8 and in the combined 2-m square represented by X2, X4, and X11 (Table 29). Within the latter area, pottery was most densely concentrated in X2 and in the northeastern quadrant of X8. Only 13% of the ceramics was recovered from X14, the unit which contained the hearth.

Ground stone artifacts recovered from subsurface contexts were limited to two mano fragments which lay in X11, south of the hearth.

The bulk of the cultural material found in Area 811/821 was thus recovered from the Feature 10 fill and from an area which extended roughly 2 m south, southwest, and west of the feature. Among the Nunamiut Eskimo, Binford (1978:Fig.4 339,349) observed that the distribution of cultural debris around a hearth was related to the direction of the wind during the occupation. Specifically, cultural material was primarily deposited upwind from the hearth. While there is clearly variation in wind direction during any given season of the year at Pioneer Point, the current prevailing wind directions are from the west and southwest during the summer, and from the north in winter. The distribution of cultural remains in Area 811/821 may thus provide additional support for the warm season occupation of the site suggested by the macrofloral evidence.

THE LATE PREHISTORIC AT CURECANTI

There exists considerable evidence within the Park for relatively late aboriginal occupations which date between A.D. 400, when small corner-notched arrow points first appear in the Colorado archaeological record, and A.D. 1881, the date of official removal of Historic Colorado Ute groups to reservations. However, most of this evidence dates to the time period prior to the Pioneer Point occupation. In addition to the features at Pioneer Point, probable hearths at three other sites in the Park have been dated to the post-A.D. 400 period. However, each of these features dates prior to the occupation(s) at Pioneer Point.

Two prehistoric hearths exposed at 5GN1664 on the Lake Fork of the Gunnison River (Figure 1) have associated calibrated date ranges of A.D. 888-1006 (1090 ± 60 B.P.) and A.D. 967-1035 (1020 ± 70 B.P. [Rossillon 1984:16; Stuiver and Pearson 1986:830]). Two charcoal samples submitted for assay from a single hearth (Feature 21) at 5GN212 in the Iola Development Area on the south side of Blue Mesa Lake (Figure 1) have associated calibrated date ranges of A.D. 788-975 (1050 ± 70 B.P.) and A.D. 979-1028 (1020 ± 50 B.P. [Jones 1984, 1986a:111; Stuiver and Pearson 1986:830]). A shallow charcoal-and rock-filled basin at 5GN1668, adjacent to Dillon Gulch on the north side of the Gunnison River (Figure 1), produced a calibrated date range of A.D. 1047-1093 (840 ± 80 B.P. [Jones 1984, 1986a:199; Stuiver and Pearson 1986:828]). No cultural material was recovered from the fill of the latter feature. However, a scarred Ponderosa pine growing in the vicinity of 5GN1668 may provide evidence of relatively recent aboriginal collection of tree bark at the site (Anderson 1987). Native American groups are known to have used tree bark for a variety of purposes, and Martorano (1981:113-114, 1988a:3,
SUMMARY AND CONCLUSION

1988b:13-15) suggests that bark was often utilized by the Historic Utes in Colorado as an emergency food source.

The evidence for the post-A.D. 400 occupation of the Curecanti area also includes a number of projectile points which compare favorably with point types such as those of the Rose Spring series which have been dated elsewhere to that time period. Such points have been recovered in the Park at 5GN53, 5GN57, 5GN66, 5GN69, 5GN191, 5GN203, 5GN210, 5GN222, 5GN247, and 5GN1664 (Jones 1982, 1986a; Rossillon 1984). These sites are shown in Figure 1. Most of these are relatively thick, corner-notched varieties which do not compare stylistically with the artifacts from Pioneer Point. In addition, large corner-notched projectile points similar to certain long-lived types have been recovered at 5GN212 and 5GN1664 (Figure 1) which may date into the Historic period (Jones 1982; Rossillon 1984).

The Pioneer Point collection most notably includes several small thin projectile points with high side notches, and notched or slightly concave bases. Small side-notched projectile points appear in the Colorado archeological record at approximately A.D. 700-1000, and small side- and basal-notched points appear ca. A.D. 1300-1500 (Black 1982:19; Black 1986b: 202-203, 210-211). Similar projectile points have been recovered at only two other sites in Curecanti. The base of a small side-notched point was found on the surface of 5GN42 (Figure 1), a multiple component site on the west side of the Soap Creek Valley (Jones 1986a:20), and a nearly complete point of this general description was recovered from the surface of 5GN222 (Figure 1), a large multiple component site overlooking the confluence of Dry Creek and the Gunnison River (Dial 1986; Jones 1986a:113).

The only other archeological evidence recovered to date from the Park which is possibly associated with the most recent aboriginal occupations is a conical tin bangle or tinkler which was found on the surface of 5GN222 (Jones 1986a:132-133,135). While the tinkler cannot be positively identified as an Indian artifact, it probably documents the post-contact presence of Utes in the area of the Park. A 3-m-x-7-m block excavation opened at the location where the tinkler was found produced no additional materials diagnostic of the Protohistoric or Historic periods, but only exposed lithic debris similar to that recovered from other areas of the site. The late side-notched projectile point found at 5GN222 was recovered roughly 450 m away from the tinkler.

In summary, archeological evidence collected in the Park which is clearly associated with the last portion of the Late Prehistoric period or the Historic period consists solely of the features and associated cultural material at Pioneer Point, three artifacts recovered from the surface of two other sites, and a scarred Ponderosa Pine. Of this evidence, at least one of the artifacts and possibly the scarred tree date to the Historic era.

UTE OCCUPATION OF THE UPPER GUNNISON BASIN

A number of archeological sites in the Upper Gunnison Basin outside the Park may be comparable to Pioneer Point with respect to dating and/or cultural affili-
SUMMARY AND CONCLUSION

These sites have been identified primarily through projectile point and ceramic comparisons, radiometric dating, and the presence of standing wickiup remains. However, the fact that certain wickiup remains still exist is probably an indication that these features date into the Historic period and may be associated with an Historic adaptive strategy which was significantly different from that which operated during the Late Prehistoric. This issue is discussed briefly in the following section.

The remains of several wickiups elsewhere in western Colorado have been dated through tree-ring analysis to the period extending from the middle of the eighteenth century into the early nineteenth century (Scott 1988:50). Most of the latter sites may be associated with the Historic Ute occupation of the region through the combined factors of dating and geographical location within the known Historic Ute range. In addition, the only Native American burials identified to date in the Upper Gunnison Basin appear to relate to the Historic Ute occupations.

Three sites with possible Ute components were identified and tested in 1981 along Colorado Forest Highway 59 near Taylor Park Reservoir (Black 1982). The small collection of cultural material from 5GN1617 included two projectile points, a stemmed dart point fragment of possible Middle Archaic age recovered from the surface of the site, and a small basal- and side-notched point dating to the Late Prehistoric or Protohistoric periods which was recovered from the upper 10 cm of the deposit (1982:61-68). The latter artifact (1982:Figure 19b 61) is nearly identical in size and style to several of the Pioneer Point projectiles. It was recovered in association with nine thinning and reshaping flakes and three bone fragments.

A probable Ute component was also identified at 5GN1618, approximately 125 m southeast of 5GN1617 (Black 1982:68-76). The evidence for this Late Prehistoric or Historic component consists of seven pottery fragments recovered from the uppermost 10 cm of soil in a single shovel test. The ceramics compare favorably with the Plain Type of Uncompahgre Brown Ware defined by Buckles (1971). In addition, 5GN1618 may contain Late Archaic and Late Paleo-Indian components.

Given the proximity of 5GN1617 and 5GN1618, Black (1982:74-76) has raised the possibility that the Late Prehistoric/Protohistoric/Historic components at each site may actually represent contemporaneous activity areas within a single site. The limited amount of information presently available on these sites suggests that hunting and tool maintenance activities were conducted during the late occupation at 5GN1617, and cooking/processing activities may be associated with the sherds from 5GN1618 (Black 1982:68,74). Both collections were recovered from hilltop settings within 175 m of a permanent water source (1982:160). Site 5GN1617 occurs within a sagebrush-pine ecotone, while the vegetative cover at 5GN1618 is predominantly sagebrush. Site 5GN1617 lies at an elevation of 9,520 ft, while 5GN1618 lies at an elevation of 9,500 ft.

A very small side-notched projectile point (Black 1982:Figure 19d 64) and six additional chipped stone artifacts were recovered from 5GN1619, on a sagebrush-covered slope overlooking Willow Creek.
near Taylor Park Reservoir at an elevation of 9,400 ft (1982:76-81). On the basis of projectile point comparisons, Black has suggested that the site was occupied sometime after A.D. 900. The occupation therefore cannot be linked to the Historic Utes or their immediate predecessors.

An extensive program of archeological investigations was conducted between 1977 and 1980 by Centuries Research in portions of the Upper Gunnison drainage in the vicinity of the towns of Gunnison and Crested Butte in conjunction with a molybdenum mine development, the Mount Emmons Project of Amax, Inc. Three historic aboriginal sites were identified during archeological survey of the zones of anticipated direct impact from the project (Black, Horvath and Baker 1980). Site 5GN407 in the Cabin Creek Study Area, approximately 7 mi (11.5 km) east of the town of Gunnison, consisted of the standing remains of a probable Ute wickiup made of aspen logs (Black, Horvath and Baker 1980:105-106,110). The wickiup remains were approximately 3 m in diameter and nearly 2 m in height. They were located in a dense grove of aspen trees on a ridgetop at an elevation of 9,100 ft. No artifacts were found in association with the feature.

Artifacts recovered from the surface of 5GN159 in the Ruby/Anthracite Creek Study Area, roughly 6 mi (10 km) west of the town of Crested Butte, include a small side- and basal-notched projectile point and a glass scraper (Black, Horvath and Baker 1980:131,135; Black 1986b:Figure 7.11b 137). The site occurs on a knoll near Ruby/Anthracite Creek at an elevation of 8,880 ft. Finally, 5GN448 in the Antelope Creek Study Area, approximately 3 mi (5 km) northwest of Gunnison, consisted of a small circle of stone and wood which may have served as a hunting blind (Black, Horvath and Baker 1980:119,122,125). No artifacts were found in association with the latter feature.

The remains of a second possible hunting blind (5GN441) were identified approximately 1.3 mi (2 km) west-northwest of 5GN448 (Black, Horvath and Baker 1980:115,119,122,125). The feature at 5GN441 was constructed entirely of stone, but again, no associated artifacts were observed. Consequently, the association of the hunting blinds with aboriginal populations is tentative. Both 5GN441 and 5GN448 occur on ridgetops at elevations of 8,320 ft and 8,430 ft respectively. In addition, a private citizen provided Centuries Research with three ceramic sherds of probable Ute affiliation which were reported to have been collected within the Ruby/Anthracite Creek area (Black, Horvath and Baker 1980:131).

Projectile points which may be associated with Late Prehistoric or Historic period Ute occupations in the Upper Gunnison Basin were recovered from seven sites (in addition to 5GN159 discussed above) and five isolated finds in the direct and indirect impact zones of the Mount Emmons Project (Black 1986b: 202-203, 206-211). Small side- and basal-notched points (designated type MEPP 35 for the Mount Emmons Project) were recovered at sites 5GN159, 5GN318, and 5GN442, and included isolated finds 5GN521-F, 5GN539-F, and 5GN609-F. Black (1986b:210-211) suggests that this projectile point type dates ca. A.D. 1500-1880 and is considered evidence of Ute occupation in the Mount Emmons Project area.
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Test excavations at 5GN318 revealed a deeply stratified cultural deposit which contained components dating from the Middle Archaic through the early twentieth century (Black, Horvath and Baker 1980:86; Black, Baker and Horvath 1980:138-143,148; Black, Horvath and Baker 1981:18,22; Black and Horvath 1981:40,44-51). The site is located approximately 100 m from Alkali Creek on the valley floor at an elevation of 8,840 ft, and approximately 5 mi (8 km) north of the town of Almont. Vegetation at the site is a typical sagebrush community. Prehistoric cultural material recovered at 5GN318 included lithic tools and debitage. A radiocarbon age of 1105 ± 145 years was obtained for a charcoal sample collected from the cultural fill. However, no actual aboriginal features were identified during the test excavations. In addition to the side- and basal-notched projectile point mentioned earlier (Black 1986b:Figure 7.11c 137; Black and Horvath 1981:Figure 21g 49), two small side-notched points of a type termed MEPP 31 were recovered at the site (Black 1986b:Figure 7.10f,g 136; Black and Horvath 1981:Figure 21e,f 49). Black (1986b:202-203) indicates that points of this style may date ca. A.D. 1000-1880.

A small side- and basal-notched projectile point (type MEPP 35) was also recovered from the surface of 5GN442 in the Antelope Creek drainage (Black 1986b:Figure 7.11d 137,210; Black, Horvath and Baker 1980:125). The site is located on a ridgetop at an elevation of 8,780 ft and has been interpreted as a habitation. Surface material at 5GN442 included lithic tools, debitage, and a single core (Kvamme 1986:263). A single type MEPP 33 projectile point was recovered at 5GN319, an extensive habitation site adjacent to Alkali Creek (Black 1986b:Figure 7.10j 136,206; Black, Horvath and Baker 1980:86; Black, Baker and Horvath 1980:143,148; Black and Horvath 1981:40,51-55). However, Black and Horvath (1981:55) suggest a site occupation between A.D. 450 and 1250 based upon the recovery of two corner-notched points diagnostic of the early portion of the Late Prehistoric period, in addition to the small unnotched biface.

A single type MEPP 33 projectile point was also recovered at 5GN373 and 5GN446, and at isolated finds 5GN533-F and 5GN750-F (Black 1986b:Figure 7.10k 136,206). Site 5GN373 is a sparse but extensive lithic scatter which was identified at an elevation of 9,540 ft on a terrace in the Keystone Mine Portal Development Area, approximately 2 mi (3.5 km) west of the town of Crested Butte (Black, Horvath and
Baker 1980:134-135). The site is tentatively interpreted as a habitation which dates to the Late Prehistoric or Historic periods. Site 5GN446 was identified on a ridgetop between Antelope Creek and West Antelope Creek at an elevation of 8,620 ft (Black, Horvath and Baker 1980:115,125). Projectile points diagnostic to the Archaic and Late Prehistoric/Historic periods were recovered at 5GN446.

Finally, the single diagnostic artifact recovered from the surface of 5GN396 in the Cabin Creek drainage is a small projectile point with serrated blade edges and a bifurcated or notched base (Black 1986b:Figure 7.11a 137). This projectile point was classified as a type MEPP 34 and may date ca. A.D. 900-1880 (Black 1986b:208-209; Kvamme 1986:263; Black, Horvath and Baker 1980:110). Several additional lithic tools, debitage, and a core were included in the collection of cultural material from the site. The site lies on an alluvial fan and adjacent ridgetop at an elevation of about 8,100 ft.

The Whinnery Ranch site (5GN1697) was identified in 1983 during archeological survey in advance of the proposed realignment of Colorado State Highway 149 approximately 12 mi (19 km) north of Lake City (Kelly and Muennig 1984:1). This multicomponent site lies on upper and lower terraces of the Lake Fork of the Gunnison River, and has a mean site elevation of 8,300 ft. A triangular unnotched biface recovered during test excavations at the site in 1983 has been compared to projectile points classified as Cottonwood Triangular in the Great Basin (Kelly and Muennig 1984:15, Figure 6a 17). While Cottonwood points frequently co-occur with points of the Desert Side-notched series, the Cottonwood Series may have appeared prior to A.D. 1300 in the Great Basin (Heizer and Hester 1978:165-166).

During an archeological survey of Black Canyon of the Gunnison National Monument in 1973 and 1974 (Breternitz et al. 1974; Stiger and Carpenter 1980), small side-notched projectile points were recovered from the surface of three sites along the north rim (5MN208 [Breternitz et al. 1974:110 Figure 19-1], 5MN178 [Stiger and Carpenter 1980:24 Figure 2B], 5MN182 [Breternitz et al. 1974:100 Figure 8-1]). The three sites are located between 7,600 and 7,680 ft in elevation within areas of mixed scrub vegetation including sagebrush, mountain mahogany, scrub oak, serviceberry, scrub juniper, and low pinon pine. Site 5MN208 lies on a prominent bedrock exposure adjacent to Grizzly Gulch. Site 5MN178 is situated on a gently sloping bench, and 5MN182 lies on a slope below a ridgetop which parallels the north rim of the canyon. Because of the association of chipped stone artifacts and ground stone on the surface of each site, all were tentatively classified as camps.

Site 5MN184 was also identified on the north rim of the Black Canyon. It contained the remains of a possible wickiup of uncut pinon and juniper branches in association with twenty chipped stone surface artifacts (Breternitz et al. 1974:40,99). The site is located on a slope above a deep drainage at an elevation of 7,800 ft, in an area of scrub oak within a pinon- juniper forest. The structural remains were 5 m x 1.75 m in horizontal extent.

Two small sherds were recovered during test excavations in 1978 at 5GN246, the Soderquist Ranch site, located 6 mi (10
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km) east of Cimarron and adjacent to U.S. Highway 50 (Chambellan 1984). While the fragmentary nature of the sherds did not permit a positive identification of the ceramic type represented, Chambellan suggests that they may represent Uncompahgre Brown Ware as defined by Buckles (1971:505). However, the stratum from which the ceramics were recovered (Level 1, 0-20 cm bs, Test Pit 10) was apparently mixed, because a Late Paleo-Indian projectile point was also recovered from this level. The Soderquist Ranch site was initially described as an extensive lithic scatter which covered approximately 50 acres. The site is adjacent to a cliff edge at an elevation of 7,848 ft and overlooks the valleys of the Little Cimarron River and Stumpy Creek. The undisturbed portions of the site have a mixed sagebrush and grass cover. The site was briefly reexamined in 1987 (Liestman and Gilmore 1988).

A small petroglyph panel which may date between A.D. 1 and 1650 has been identified at the Sheep Spring site (5GN1275) approximately 6 mi (10 km) northeast of Gunnison (D. Scott 1981). The panel was incised on a sandstone outcrop in a sagebrush flat, within 10 m of the once-flowing Sheep Spring. The outcrop is surrounded by a lithic scatter which was devoid of diagnostic artifacts. The panel consists of fourteen distinct elements which appear to include representations of one elk, one deer, two mountain sheep, three ungulate hoof prints, one possible paw print, five vertical lines with some possible cross-hatching, and one possible hand print. Stylistically, the panel is most similar to rock art found on the Uncompahgre Plateau.

Two Ute burials have been reported within the Upper Gunnison Basin which appear to date to the Protohistoric or Historic periods (Nickens 1984:109). The remains of a 30-40 year old male were exposed in 1981 on the western side of Cochetopa Dome near the headwaters of Cochetopa Creek (Scott et al. 1984). The burial appeared to date between 1830 and 1881. The remains of an adult male were identified in the 1930s at Black Canyon of the Gunnison National Monument, in association with scattered horse bones (Huscher and Huscher 1939:142-143, cited in Nickens 1984:109).

Finally, archeological excavations were conducted in 1986 by Centuries Research at an apparent Historic Ute hunting camp at 5DT271, the Rotacap Game Trail site, on the southeastern flank of Grand Mesa on a bench adjacent to a tributary of the North Fork of the Gunnison River (Baker 1987). While not located within the Upper Gunnison Basin as defined by this study, the investigations at 5DT271 are nevertheless relevant because of the proximity of the site to the present study area and the important contribution which has been made by that project to our understanding of the Historic Utes in western Colorado and the archeological record that they left behind.

Three spatially and temporally distinct aboriginal components were identified which dated to the Historic era, the Formative Period, and the Archaic/Formative interface. The Historic component (designated Component 1) consisted of a slab-lined hearth surrounded by four apparent butchering loci containing the remains of several deer and elk and a single bison.
Cultural materials were scattered over an area less than 100 sq m in extent but were recovered to a depth of 30 cm. Artifacts recovered from this component included 22 chipped stone artifacts, 10 brown ware sherds bearing evidence of fingertip impressions, a milling stone, a mano, two probable hammerstones, and a single bone implement fragment. A Desert Side-notched projectile point fragment (Baker 1987:Figure 33a 96) was recovered from the hearth. A radiocarbon age of 140 ± 50 years was obtained through assay of charcoal found in apparent association with the hearth. The sparse lithic assemblage was characterized by a lack of bifacial implements and a relatively high proportion (37%) of utilized flakes. There was no evidence for lithic reduction activities at Component 1.

The component lies at an elevation of 6,900 ft in a dense stand of scrub oak near the intersection of several modern game trails. Component 1 has been interpreted as a late summer/early fall hunting camp of a single Ute household of the Sabuagana band. It was further suggested that the consistent absence of certain faunal elements of deer, elk, and bison may reflect a system of food distribution which was operative between the residents of the site and other households which together comprised a traditional Ute deme, a matrilineal matrilocal family group (Service 1966:17, cited in Baker 1987:109). In addition, Baker (1987:110) suggests that the types of activities conducted at the site are those typically performed by women in hunting and gathering societies.

The preceding review of sites which may be comparable to Pioneer Point with respect to dating and/or cultural affiliation is not intended to be an exhaustive listing of such sites which are known to occur in the Upper Gunnison Basin. Rather, the review is intended to provide a general idea of the number and variety of archaeological remains which have been attributed to the Late Prehistoric or Historic aboriginal occupants of the area, and to give an indication of the interpretive potential in each case. An apparent pattern in the distribution of the sites which have been discussed here is that roughly half of them occur on hilltops, ridgetops, or in other similar settings which may have provided a vantage point for observation of game. However, many of the sites are presently known only through a relatively few artifacts and features exposed at the ground surface, which limits the amount of information available at this time for studies of site setting and function. In addition, several of the sites clearly date to the Historic era, and it is unknown whether most of the remaining sites are Late Prehistoric or Historic in age. A number of significant changes took place in the Ute way of life during the Historic period, triggered initially by their acquisition of horses from the Spanish in New Mexico (see Discussion section). It is therefore most appropriate to distinguish between sites of these two eras prior to a consideration of settlement pattern.

DISCUSSION

A number of factors combine to indicate a pre-contact pre-horse Ute cultural affiliation for the site at Pioneer Point. This assignment is based upon the radiocarbon dating of two hearth-like features there, together with the recovery of brown ware ceramics and small side- and basal-
notched projectile points which compare favorably with probable Historic Ute archeological materials from the Uncompahgre Plateau (Buckles 1971). Only the Utes appear to have occupied and utilized the Pioneer Point locale during the Historic period (Stewart 1966a). More specifically, the earliest first-hand historical account of the Indians in present-day western Colorado, written in 1776, appears to place the Upper Gunnison Basin within the territories of the Tabehuache and/or Sabuagana bands (Velez de Escalante 1776).

However, while certain projectile point styles, ceramics, and basketry are considered to be characteristic of many Numic-speakers (Adovasio 1986; Holmer and Weder 1980:60,67; Madsen 1975), this is not to suggest that an exclusive one-to-one correspondence necessarily exists between the Pioneer Point artifactual material and a Numic-speaking ethnic group. For example, the small side- and basal-notched projectile points which are called Desert Side-notched (Holmer and Weder 1980) in the Great Basin are morphologically similar to named point types which occur in late archeological contexts across much of North America.

The migration of Numic-speaking peoples from a homeland in southeastern California into the Great Basin and adjacent areas within the past 1,000 years was originally proposed on the basis of the historic distribution of Numic-speakers and glottochronological projections of language divergence (Lamb 1958; Miller 1966). Modifications to the original migration hypothesis have addressed certain inconsistencies in Great Basin archeological and linguistic data which bear upon this issue (e.g., Aikens and Witherspoon 1986). However, Great Basin scholars continue to debate whether or not such a migration actually occurred, questioning the mechanisms by which one hunting and gathering people could have replaced another, and by which a hunting and gathering people could have replaced horticulturalists. In any event, Reed (1984:43) has suggested that the hypothesized Numic spread may have reached west-central Colorado with the arrival of the predecessors of the Numic-speaking Historic Utes sometime between A.D. 1200 and 1400.

The chronometric dating of the Pioneer Point occupation to the period of the A.D. 1400s is generally consistent with that of several other sites elsewhere in Colorado which have also produced brown ware ceramics (Reed 1988:81-82). One exception is the portion of an Intermountain Ware vessel which was recovered from Graeber Cave southwest of Denver which has been associated with a Shoshoni occupation (Nelson and Graeber 1966, 1984). While characterized by a slightly different ceramic tradition than that of the Utes, the Shoshoni nevertheless are thought to represent another component of the Numic expansion. The Graeber Cave vessel fragment is notable because of the radiocarbon age of 630 ± 75 years which was obtained from an associated charcoal sample. When calibrated, the 630 B.P. age reflects an A.D. range of 1277-1403 (Stuiver and Pearson 1986:827). However, Benedict (1985:141) has reported that a thermoluminescence age of less than ca. 100 years has subsequently been obtained for one of the sherds from Graeber Cave. As a consequence, the dating of the Graeber Cave materials remains unresolved.
A number of models have been proposed by anthropologists and archeologists which address the nature of the pre-contact adaptations of Numic-speaking groups in the Great Basin and adjacent areas. Much of the primary information used to develop these models was derived from written historic accounts and ethnographic field work and has been applied to the prehistoric past through ethnographic analogy. The earliest surviving first-hand account of the Utes in southwestern Colorado is that of Fray Silvestre Velez de Escalante and was written in 1776 (Velez de Escalante 1776). The earliest ethnographic field work among the Utes was conducted by John Wesley Powell between 1868 and 1877 (Fowler and Fowler 1971). Since the Utes in southern Colorado acquired horses from the Spanish sometime during the middle of the seventeenth century (Schroeder 1965:54; Haines 1938:117), virtually all of the detailed historical information available on the Colorado Utes was thus collected after they had been in possession of horses for at least a century and, furthermore, after they had acquired them in considerable numbers. For instance, Escalante met a group of about eighty mounted Sabuaganas near a river which Bolton (1950:45) has identified as the North Fork of the Gunnison River. Spanish documents dating from the earliest years of Plains exploration and New Mexico colonization suggest that the Utes may have acquired some Plains culture traits prior to acquisition of the horse (e.g., Kayser 1965:86-89; Stewart 1966a:170-171; Tyler 1951:163). However, most scholars agree that the ultimate effect of the horse complex upon Ute lifeways was profound (e.g., Fowler 1966:63; Opler 1963; Steward 1942:236; Steward 1966b:50). Most notably, acquisition of the horse permitted some Colorado Utes to consolidate into large, warlike bands under the control of centralized leadership.

Some of the changes in Ute culture which may have occurred with the transition to horse nomadism are relatively subtle but remain significant in terms of subsistence and the seasonal round. For instance, Petersen (1977) suggests that the mounted Utes of western Colorado followed the pattern which Powell observed in the Northern and Pahvant Utes and termed a “grand circuit” (Fowler and Fowler 1971:7,38-39). This pattern included a movement to higher elevations or to the buffalo country during the summer with a return each winter to lower elevations. Petersen further suggests that the mounted Ute bands “cross-utilized” the territories of one another.

The historic pattern of Ute seasonal transhumance described by Petersen may ultimately be found to represent a continuation of certain prehistoric patterns. However, the timing of residential moves, the selection of winter village sites, the size of the Ute home range, and the relative importance of various subsistence resources may have been markedly affected by the acquisition of the horse (e.g., Osborn 1983; Fowler 1966:63; Buckles 1971:649). In view of this, any assertion (Smith 1974:20-21) that the horse complex was merely a “veneer” over the Great Basin type culture of the Utes needs to be more clearly demonstrated. There will be a continuing need to reevaluate and refine the models of Late Prehistoric adaptation derived from information provided by Powell, Escalante, and others as archeological data become available from sites such as Pioneer Point.
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Great Basin Models

Julian Steward's (1970) synthetic study of aboriginal sociopolitical organization and ecology in the Great Basin and adjacent plateau areas has served as the foundation for a great deal of subsequent anthropological research in the region. This study was based primarily upon ethnological field work which Steward conducted in 1935 and 1936. Information regarding pre-horse Ute organization was not available to Steward. However, he suggested that the Ute social and economic structure may have been similar to that of the Western Shoshoni and Southern Paiute, with the single exception of the Southern Paiute economic pursuits, which included a limited amount of horticulture in addition to hunting and gathering (Steward 1970:223,234,236).

Steward (1970:232,236,260) suggested that the biological family constituted the basic social, political, and economic unit for the Western Shoshoni, and probably for the Southern Paiute as well. He further suggested (Steward 1970:230-231) that this organization evolved largely in response to the number of individuals most efficient to harvest the seeds which constituted the primary food base of these groups. Throughout most of the year, according to Steward's data, individual families or small groups of families traveled over large areas in order to harvest seeds. The most permanent association of Western Shoshoni and Southern Paiute families occurred in the winter villages (Steward 1970:232, 236, 247, 257). Although the families in each village were often related, Steward noted that frequent changes occurred in the composition of winter villages, partially in response to yearly fluctuation in the availability of food resources in different localities. Winter villages were typically small and were situated with respect to the accessibility of stored seeds, water, and wood, and were situated in areas where low temperatures were not extreme. Other temporary gatherings of families or villages occurred for such economic pursuits as rabbit or antelope drives, and for social purposes at festivals.

Steward suggested that no band organization existed among the Western Shoshoni and Southern Paiute. However, both Omer Stewart (1942:236) and Elman Service (1962:94-99) subsequently took exception to this assertion, and Service cited certain kinship terminology in Shoshonean languages to postulate the previous existence of a patrilocal band organization.

David Hurst Thomas (1972,1973) ultimately devised an archeological test of Steward's model of the prehistoric Western Shoshoni subsistence system. Thomas selected the Reese River Valley in central Nevada as the study area for the project and ultimately concluded that the system appeared to have been operative there prehistorically. He readily acknowledged that the Reese River project results may not be considered a definitive test of the model. However, archeological data from the central section of the Great Basin which became available subsequent to completion of the Reese River project are also consistent with the Steward model (Thomas 1982:163). However, research in other localities within the Great Basin has fostered an appreciation for the environmental and cultural diversity of the region as a whole through both time and space.

Other recent research in Great Basin prehistory has focused upon the so-called
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Numic issue, the hypothesized migration of Numic groups out of California. Robert Bettinger and Martin Baumhoff (1982) have proposed a model of the hypothesized Numic spread which hinges upon the contrasting adaptive strategies of Numic and Prenumic populations in the Great Basin. Bettinger and Baumhoff characterize Prenumic groups as "travellers" who were largely dependent upon large game for food, and who spent considerable time in the search for these animals. Conversely, they characterize the Numic-speaking peoples as "processors" who placed more dietary emphasis upon such resources as small edible seeds. While the Numic peoples would have spent less time in the search for food, they presumably spent more time extracting and processing resources for consumption than did the "traveller" groups (Bettinger and Baumhoff 1982:492).

Bettinger and Baumhoff (1982:487) further suggest that when population density increased, as might occur during an ethnic spread, processor strategies would have had a competitive advantage over traveller strategies. Because of the increased number of consumers under such circumstances, there would be a corresponding increase in the procurement of such important food resources as large game animals, possibly resulting in depletion of those resources. In the Great Basin, the Numic diffusion may in fact have been accelerated by such special circumstances as a deterioration of climate, or by a general reduction in the availability of large game due to overexploitation following the introduction of the bow and arrow or decimation by disease (1982:498). In any event, the Prenumic groups would have found it necessary to spend ever-increasing amounts of time in the search for food. With its emphasis upon a more balanced diet of plant foods and animals, the adaptive strategy of the Numic "processors" would have represented a distinct advantage over the increasingly costly strategy of the Prenumic "travellers." According to the Bettinger and Baumhoff model, Numic groups were therefore able to consistently displace the existing populations.

Kevin Black (Metcalf-Zier 1984:8, cited in Black 1986a:18) has questioned the applicability of Bettinger and Baumhoff's Great Basin model of Numic population replacement to the Colorado mountains. Black's reservations relate to basic differences between the two regions in the abundance of the two types of economic resources which the model contrasts, namely small edible seeds and game animals. Because both economic resources are concentrated in high altitude areas, Black has suggested that adaptive strategies in the mountains may have represented a combination of both the traveller and processor strategies. While strategies in the mountains may have been characterized by considerable mobility, they may also have maximized the procurement of all economic resources because there was no need to spend extended periods of time in the search for large game.

**Colorado Models**

In 1940, Marvin Opler (1963:123-128,133,153-155) proposed a model of the seasonal round of Ute groups south of the Gunnison River prior to their acquisition of the horse. Based primarily upon Southern Ute ethnological data and information obtained from early Spanish documents, Opler's model emphasizes an annual circuit which contrasts with the Shoshonean
model proposed by Steward (1970) with regard to the seasonal congregation and dispersal of family units (Opler 1963:154). According to Opler, individual extended families would typically scatter over the plateaus of present northern New Mexico and adjacent states during the winter. However, families would occasionally gather during the winter for communal rabbit hunts or trading expeditions to the pueblos. The families constituting a loose band would meet each spring for the annual bear dance, after which they would disperse to mountainous areas for the summer. The camps established in the mountains would typically include one or more extended families. In Opler’s model, families migrated southward again during the fall to exploit the seasonal congregation of antelope in the foothills, thus obtaining a winter meat supply. This general pattern of dispersal in winter and retreat to the mountains in summer was viewed by Opler as a response both to the distribution of food resources and to pressure upon the Utes by Plains enemies.

As a result of archeological investigations on the eastern slope of the Uncompahgre Plateau in the early 1960s, William Buckles (1971) assessed both existing and new evidence for the sequence of aboriginal occupations in the area and ultimately redefined the concept of the Uncompahgre Complex which had originally been proposed by Wormington and Lister (1956:78-92). Buckles (1971:1163-1164) interpreted the apparent continuity of aboriginal material culture on the Plateau, particularly chipped stone assemblages and rock art from the earliest prehistoric components through historic materials, as a reflection of similar adaptations to the diverse environments of the region. He further defined the Escalante Phase as the terminal development of the sequence and associated this archeological manifestation with the Historic Ute Indian occupation of the area. Buckles (1971:1210,1230,1251) suggested that a shift in the Historic Ute economy toward increased emphasis upon hunting may be reflected in the lithic assemblages of the Escalante Phase which contain increased numbers of hide preparation implements, particularly formal end scrapers, in comparison to earlier phases of the Complex. However, the extremely small sample of end scrapers recovered from components of the preceding Camel Back Phase (Buckles 1971:Table 63), which Buckles tentatively dated to the period A.D. 1300-1500, precludes any meaningful comparison of these two phases. Escalante Phase components also appeared to reflect occupations by larger groups of people than were indicated for earlier sites (Buckles 1971:1201). Buckles found that brown ware ceramics were also associated with the Escalante Phase.

Buckles (1971:19-20) suggested that parallels to Ute pre-horse adaptations could be found in those Numic-speaking groups elsewhere which did not adopt horse nomadism. His review of historical descriptions of these latter peoples suggested that their yearly cycle involved vertical movement to exploit the resources of different environments as they became available. The basic unit of social organization for these people was probably the family (1971:1201).

Elsewhere, James Grady (1980:240-245) has proposed a model of the annual economic cycle of aboriginal populations in the Piceance Basin in western Colorado. Developed from an assessment of modern
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environmental data on the Piceance Basin, Grady’s approach utilized archeological survey data including information on site location and surface artifact inventories, together with ethnographic descriptions of Ute lifeways. Grady suggests that a pattern of aboriginal seasonal movement was established between low and high elevations in the Basin during the Archaic period which continued into the Historic era. Winter camps were established in sheltered lowland valleys, where foods stored for winter consumption were supplemented by occasional fresh deer meat. The time of greatest hardship for these groups would have occurred in early spring, when stored food supplies were exhausted and new plant foods were not yet available. Lowland marshes would have provided the first such plant foods during the spring. According to Grady’s model, the aboriginal groups would have moved to areas of high elevation (over 8,000 ft) in summer following the migratory herds of mule deer. Deer would have been intensively hunted at this time, and the meat would have been prepared for winter storage. Collection of plant foods would presumably have been de-emphasized during the summer. However, fall subsistence activities would have focused primarily upon the collection of pinon nuts and juniper berries available in the lowlands. With the onset of winter, the Piceance Basin groups retreated once again to sheltered valleys.

Most recently, Kevin Black (1982:165-168,1983:21-23) has constructed a model of prehistoric adaptations in the Upper Gunnison Basin which is based upon both archeological and ethnographic data, including that of Steward (1970). Of note, Black (1980:15; 1983:2) has defined the Upper Gunnison Basin to include a more restrictive geographical area than has been used in this report (see Environmental Setting), extending only to the Curecanti Basin on the west. Recent palynological research suggests that the Upper Gunnison as defined by Black has been characterized by climatic and vegetational stability during the past 4,000 years (Markgraf and Scott 1981:233). Black has suggested that aboriginal subsistence-settlement patterns during this time period may have been characterized by considerable mobility, as exemplified in ethnographic descriptions of the local Ute occupation (e.g., Stewart 1966b, 1973; Smith 1974; Petersen 1977). During the late spring and summer, small hunter-gatherer bands would have moved to the higher elevations following migratory animals and ripening plant foods. Return to the warmer valleys to the west and east would have occurred prior to the onset of winter. Fall activities would have included the collection of food resources to be cached for consumption in the winter camps. The leanest time of the year would typically have occurred during the early spring when winter stores were depleted, game animals were lean, and new plant foods were not yet available. However, Black (1983:23) notes that prehistoric and historic Ute economic patterns may not be directly comparable because acquisition of the horse allowed the Utes to store more food to support larger winter villages (e.g., Smith 1974:121-124). In contrast to this pattern of seasonal use during the past 4,000 years, Black has also suggested that a more sedentary winter occupancy occurred in the Upper Gunnison Basin during the millennia prior to 4,000 B.P., particularly during the Early and Middle Archaic.

In developing his model of prehistoric adaptations in the central Colorado Rock-
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ies, Black (1982:165,1983:22) applied some of the ideas proposed by Binford (1980) in a general model to account for variability in hunter-gatherer subsistence-settlement systems. Binford's model pivots upon his characterizations of "forager" and "collector" strategies. According to Binford, foragers typically make frequent residential moves in order to gather foods for daily consumption. As a consequence, the amount of food typically procured during any single resource extraction episode would be limited, a situation that Binford (1980:9) refers to as low-bulk extraction. Depending upon the distribution of critical resources within the environment either in a series of "patches" or in undifferentiated areas, forager strategies may involve either reoccupation of the same locations year after year (i.e., high redundancy in use of particular locations) or occupation of different locations (i.e., low redundancy). In either case, however, all of the critical resources would typically lie within the foraging range of a residential base. In situations of low land use redundancy in combination with high residential mobility and low-bulk resource extraction, the resultant archeological record would be relatively ephemeral.

According to Binford, in situations of spatial and/or temporal incongruity of critical resources, collectors would typically implement logistical strategies in which foods are gathered by specially organized task groups and will be either transported for consumption by a larger group living elsewhere or stored for future consumption. In general, as the length of the growing season decreases (with greater temporal incongruity in the availability of critical resources), there would normally be an increased dependence upon stored foods and a reduction in residential mobility (Binford 1980:15). While the amount of cultural debris which accumulates at different sites will vary, logistical strategies typically produce residential and resource extraction sites with high archeological visibility.

Other groups may have utilized a combined pattern in which certain seasonal differentiation existed in the relative predominance of residential and logistical mobility (Binford 1980:18). A foraging strategy characterized by high residential mobility might provide "optimal" security during the growing season, while a collector strategy might provide better security during the winter. This combination may be applicable to Black's model for the Upper Gunnison Basin during the past 4,000 years. Binford suggests that evidence of this combined pattern should be detectable at the regional archeological level, with individual winter residential sites characterized by internal complexity, but as a group exhibiting little intersite variability. Summer sites would be comparatively simple in structure and would exhibit greater artifactual variability as a group than the winter sites. However, Black (1983:21) has proposed that Archaic populations in the Gunnison Basin may have exploited certain floral resources, such as grass seeds, which were available at various elevations during the course of the growing season. If such a pattern of exploitation was typical of Late Prehistoric groups in central Colorado, then the archeological record of Late Prehistoric warm season sites in the Gunnison Basin may be less varied than Binford has predicted. In addition, if Opler's model of winter dispersal of families in the
SUMMARY AND CONCLUSION

The absence of small animal remains in the Pioneer Point collection is noteworthy because of the documented importance of small animals in the diet of many Great Basin Shoshonean groups. A similar contrast in the meat diet of Historic Utes in Colorado and Utah has been attributed to regional environmental differences and to the differential availability of large and small game (Callaway et al. 1986:338,340; Smith 1974:51). Small game available today in the Gunnison Basin include cotton-tail rabbit and white-tailed jack rabbit, yellow-bellied marmot, porcupine, muskrat, and beaver (Woodbury 1962). The possibility also exists that differential preservation of the skeletal remains of small and large animals may have biased the Pioneer Point sample (Jones 1986a:208).

Three probable hearths related to the prehistoric aboriginal occupation were identified at Pioneer Point, including Features 1, 10, and 19. As noted previously, the various lines of evidence for dating these cultural deposits through radiocarbon assay and diagnostic artifact comparisons are reasonably consistent with one another. Several factors combine to suggest that the group or groups responsible for these deposits made similar use of the site itself and of the local lithic, floral, and faunal resources. These factors include similarities in the ceramic and lithic assemblages from the areas of block excavation surrounding Features 10 and 19, and similarities in the physical evidence of subsistence activities recovered in association with each of the three features. These features may represent either the by-products of a single episode of occupation or repeated occupation within a restricted period of time by the same group or groups with similar subsistence adaptations.

The Pioneer Point data are consistent with that portion of each of the above models which proposes a seasonal occupation of moderate to high altitude areas in order to exploit the available economic resources. Specifically, the Pioneer Point data suggest temporary summer or early fall occupation(s) by a small group(s) practicing a mixed hunting-and-gathering economy. Plant foods processed at the site appear to have included Chenopodium and Gramineae seeds. Hunting activities were probably directed toward procurement of such large game animals as mule deer, elk, and bison. The Pioneer Point data are therefore consistent with a general model of seasonal use of the Upper Gunnison Basin during the Late Prehistoric. Furthermore, the macrofloral and faunal remains from the site support the concept of a mixed economy which included large game and small seeds.

Pioneer Point

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SUMMARY AND CONCLUSION

In terms of the Binford (1980) model, the site at Pioneer Point may have played one of the following roles within a larger subsistence-settlement system:

1. A brief summer camp occupied by a small group which practiced foraging on a seasonal basis. Food processed and presumably consumed at 5GN41 would have included both meat and seeds; or

2. The campsite of a party collecting and processing food for winter storage. No storage pits were identified within the areas excavated at Pioneer Point. While food processed at the site would probably have been transported down the valley for storage near a winter village location, it may alternately have been cached near Pioneer Point in an undiscovered location (e.g., Kelly 1964:18, cited in Fowler 1982:127,130).

Prior to the identification of 5GN41, almost nothing was known about the Late Prehistoric or Historic period aboriginal presence in the area of the Park. Thus, the archeological investigation of the site has provided an important opportunity to study the most recent episodes of Native American occupation of the Upper Gunnison Basin. Any late sites, such as Pioneer Point, which contain well-defined archeological components will remain significant wherever they occur because they permit evaluation of those prehistoric subsistence-settlement system models which are based in large part upon local ethnographic analogy.
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SELECTED ANALYTICAL OBSERVATIONS ON CHIPPED STONE ARTIFACTS

REFITTED CHIPPED STONE TOOLS AND TOOL FRAGMENTS

Raw Material Type

Six raw material types were identified in the Pioneer Point chipped stone assemblage including quartzite, agate, jasper, chert, obsidian, and welded tuff.

Quartzite. No attempt was made to distinguish between the two varieties of quartzite, metamorphosed and sedimentary silicified. However, observations which were made regarding the possible heat alteration of a few quartzite artifacts in the Pioneer Point collection may relate to that distinction (see Heat Alteration). A considerable amount of variation in grain size and proportion of granular inclusions to silica matrix is represented in the quartzitic portion of the collection. A wide range of color is also represented (predominantly white, tans, grays, browns, and purples), but color combinations on individual artifacts and in the known outcrops of quartzite within the Park suggested that color would not be a particularly useful attribute for purposes of this analysis.

Agate, Jasper, Chert. These cryocrystalline varieties of quartz are represented in smaller quantities than the quartzite in the Pioneer Point collection. Nevertheless, a fair amount of variation was observed within each group. The agate ranges from transparent to opaque, depending upon the thickness of individual artifacts and the presence of impurities in the rock. Some of the agate is almost colorless or milky in appearance, while several pieces of a tan moss agate and a marbled gray and white agate are also present in the collection. The surfaces of the agate artifacts are either dull or waxy with one exception, a bluish-gray piece with a shiny surface which was coded as heat altered. Jasper ranges from translucent to opaque, and is yellow, yellow-brown, or red in color. All material identified as chert is opaque. The two primary varieties of chert represented in the collection include a distinctive mottled gray and tan material and a solid gray-brown chert. Single artifacts were recovered of a gray and white banded chert, a white chert with red speckling, and a heterogeneous white lithic raw material which probably represents a weathered rind.

Obsidian. Several artifacts of shiny black volcanic glass are included in the Pioneer Point collection.

Welded Tuff. This extremely hard rock is formed by the “welding” of volcanic ash deposits. The artifacts of welded tuff in the
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Pioneer Point assemblage are gray-tan in color and contain sparse crystalline inclusions.

Heat Alteration

Decisions regarding the possible heat alteration of chipped stone in the Pioneer Point assemblage were based upon the presence/absence of the following four heat alteration criteria (Crabtree and Butler 1964; Olausson and Larsson 1982; Purdy 1974; Toll 1978:62).

1. Color change,
2. Potlid fracturing,
3. Waxy surface luster, and

The application of these criteria was dependent upon the raw material type, as discussed below. Because of ambiguities arising from the identification of heat altered materials by simple visual inspection, the identifications for the Pioneer Point assemblage are considered to be tentative. Although the intent of the observations was to identify materials which had been purposefully heat treated, no definite inferences may actually be made concerning the circumstances surrounding the alteration; it may be a consequence of deliberate heat treatment, unintentional alteration in a fire, or the result of natural events.

Quartzite. A range of color is represented on individual quartzite artifacts in the collections from a number of sites at Curecanti, including Pioneer Point, and in the outcrops of quartzite within the Park which were quarried prehistorically. Therefore, color was not considered to be a reliable index to heat alteration for purposes of this analysis. No potlid fracturing or crazing was observed on the quartzite in the Pioneer Point collection. However, a number of artifacts exhibit a waxy surface luster. Because identification of the luster was very subjective and situational, initial efforts to formally record it were abandoned. The luster may or may not be related to changes produced by heat, and if it was produced by heat, the heat source may well have been a natural one. For example, fine grained superior quality lustrous quartzites have been observed within the Park adjacent to locations of geologic faulting or adjacent to volcanic vents (Liestman 1985). The degree of cementation and the luster of these quartzites may thus be related to their proximity to natural thermal activity. The waxy quartzite from Pioneer Point may be derived from such a source.

Agate. A few artifacts of agate have a waxy surface luster but no other indication of possible heat alteration. One specimen which exhibits both a bluish hue and a shiny surface luster was coded as heat altered.

Jasper. The most useful criteria for identification of heat altered jasper included a presumed color change in combination with potlid fracturing. The colors which were considered to be unaltered were yellows and yellow-browns. The colors defined as indicative of heat alteration were reds and red-browns. All evidence of potlid fracturing occurred on jasper of the latter colors.

Chert, Welded Tuff, Obsidian. None of the four heat alteration criteria listed above were identified on artifacts of these raw material types.
Tool Location

This variable was used to record whether the chipped stone tools represented in the Pioneer Point assemblage were produced through bifacial reduction, or were manufactured on resharpening or other flakes. These determinations were made conservatively, with the result that tool location was considered indeterminant for a substantial part of the collection (14%). The criteria which were used for the identification of tools on flakes are listed below. For additional criteria used to identify resharpening flakes, see remarks under Chipped Stone Debitage, General Specimen Form.

Primary criteria:
1. Features of a flake interior (presence of a bulb, platform, etc.), and
2. Plano-convex transverse cross-section.

Secondary criterion:
3. Longitudinal asymmetry (not diagnostic alone).

Flake Cortex

The amount of remnant cortex on exterior flake surfaces on debitage and flake implements was recorded using three categories: largely cortical (90%-100% coverage), partially cortical (10%-90%), or largely non-cortical (10% or less).

Number of Implement Edges

Implement edges lie along the perimeter of chipped stone tools or tools in the process of manufacture, and are believed to have been created or modified through deliberate flake removal, use, or both. Up to three implement edges were coded for each refitted tool and tool fragment in the Pioneer Point assemblage, and observations on edge form, edge angle, and amount of edge wear were recorded for each such edge. Implement edges represented the basic units of analysis for the purpose of investigating the function of chipped stone tools, rather than the refitted tools themselves. An intermediate analytical goal of the project involved the identification of actual "working" edges. The latter were defined as those implement edges on which macroscopic use-wear was observed. The following criteria were used to define the limits of individual implement edges.

1. A change in edge form,
2. For unifacial edges only, a change in the direction of flake removal,
3. An unmodified, unutilized section of the perimeter of an implement,
4. The platform of a resharpening flake, and
5. A broken, missing section of the perimeter of an implement.

However, notches on projectile points, constrictions on "knives", and indications of wear on the ridges between flake scars on the faces of implements away from the edges were not coded as implement edges, because they are assumed to have been related to the hafting of the implement on which they occurred.

Implement Edge Form

The nine categories of edge form which were observed during the analysis are defined below.
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Bifacial retouch - the result of deliber­ate flake removal from both surfaces of an implement along the same section of the perimeter.

Unifacial retouch - the result of the deliberate removal of contiguous flakes from one surface of an implement along its perimeter, producing a smooth or rela­tively smooth edge.

Unifacial denticulate retouch - the re­sult of the deliberate removal of flakes from one surface of an implement along its perimeter, producing a ragged or serrated edge (scraper and denticulate retouch differ in degree only, and assignments were subjective).

Unifacial notch retouch - the result of deliberate flake removal from one surface of an implement along its perimeter, result­ing in a single marked concavity.

Unifacial borer retouch - the result of deliberate flake removal from one surface of an implement along its perimeter, result­ing in an isolated projection of the edge.

Alternating unifacial/bifacial retouch - the result of multiple alternation between deliberate flake removal from both surfaces of an implement and flake removal from a single surface.

Utilized flake-bifacial - macroscopically observable wear in the form of small, irregular flake scars on both surfaces of an implement along its perimeter, unac­companied by deliberate flake removal from the same edge.

Utilized flake-unifacial - macroscopically observable wear on one surface of an implement along its perimeter, which is not accompanied by deliberate flake removal from the same edge.

Utilized flake-borer - macroscopically observable wear on an isolated projection located on the perimeter of an implement, unaccompanied by deliberate flake removal from the same edge.

**Edge Wear**

Observations were made regarding the amount of wear present on implement edges on refitted tools and tool fragments, and on the remnant tool edges on resharpening flakes. These wear observations were used to define the “working” edges of tools, and to characterize the general types of tool use which occurred at the site. Evidence of wear was also observed on ridges between flake scars and on relatively flat surfaces away from the perimeter of artifacts. The latter variety of wear was attributed to abrasion from a haft. Because of its location away from the edges of tools, it was not recorded under this variable. Some of the edge wear which was recorded may also have been produced by haft abrasion. Indeed, there are several implements in the collection with edge wear and wear on a flat surface away from the edge which are coincident in their longitudinal location on the artifact. Given the fragmentary nature of many of the tools and the size of remnant tool edges represented on resharpening flakes, there was no systematic means to control for this factor during the analysis.

The presence of wear was determined by macroscopic inspection and by touch. Three admittedly subjective categories were used to characterize the amount present: no apparent wear, light to moderate wear,
APPENDIX I

and heavy wear. Most of the damage which was recognized as wear had produced a flattened or rounded cross-section of the edge. The texture of the wear was smooth, and the resultant finish of the edge in the area of wear was dull or matte. This form of wear was prevalent and easily recognizable on the resharpening flakes and most of the tools in the collection, but additional forms of wear were recognized on a few of the utilized flakes of quartzite and the non-quartzitic implements. The latter forms of wear generally consisted of small, irregularly spaced flake scars. Since a microwear analysis was not performed, there is a greater possibility of having misconstrued the cause of this type of damage as opposed to the smoothly worn variety previously described. In addition, striations observed on one obsidian artifact were recorded as wear. In general, wear was heaviest on the protruding portions of edges.

The amount and type of damage which is sustained by edges during their use is related to a variety of factors including the angle of the edge, raw material type, heat alteration of raw material, the stage of utilization, and the nature of the material which is worked (Tringham et al. 1974; Zier 1978; and others). This is most apparent in the Pioneer Point collection with regard to raw material type. Because of the granularity and durability of the quartzite, evidence for some retouch as well as use-wear was probably missed, and observations on the quartzite therefore are assumed to contain a bias toward longer term, more intensive, or heavy duty tool uses. The non-quartzitic raw materials would have been more easily damaged during use, and display a wider range of damage types. The nature of the present analysis undoubtedly resulted in the introduction of a different and more complex set of biases into the edge wear data collected on implements of these raw material types.

Edge Angle

For purposes of this study, edge angle was defined as the angle between the interior surface, or the platform on resharpening flakes and resharpening/thinning flakes, and the exterior surface of an artifact immediately adjacent to the edge. This definition is comparable to that used by Wilmsen (1970:14-15,21), with emphasis placed upon measurement of the actual retouched “bit” of the tool (following Jelinek 1976:29). Since no attempt was made during the Pioneer Point analysis to identify and measure the angles resulting from use damage, our definition of edge angle is at variance with that used in some microwear analyses, such as that reported by Tringham et al. (1974:178-179).

Edge angle measurements were taken on the retouched edges of chipped stone tools, the remnant tool edges on resharpening flakes and resharpening/thinning flakes, and the exterior surface of an artifact immediately adjacent to the edge. These measurements were made in order to study the working edges of the tools, and in the case of resharpening and resharpening/thinning flakes, to collect information regarding the edges of the parent tools from which the flakes were removed. When it was known how particular tools were employed, as in the case of drill or projectile point fragments, it was easy to differentiate between working and non-working portions of edges for angle measurement purposes. For most of the
tools and debitage, however, such a distinction was not clear, and measurement of retouched non-working edges therefore undoubtedly occurred. Measurements were taken in or adjacent to areas of macroscopically observable wear, if such was present.

Edge angle measurements were not obtained for many of the resharpening and resharpening/thinning flakes because of limitations imposed by the method of angle measurement, so that edge angles were generally obtained for the larger pieces of debitage. Several measurements were made along each edge using a goniometer, and the mean of the measurements was calculated. The means were recorded in $5^\circ$ intervals as follows. For example, mean values $> 65^\circ$ and $\leq 70^\circ$ were computer coded as $70^\circ$. A considerable range of measured values was often obtained for individual edges, a problem which was more prevalent with increased specimen size.

**Hafting**

Keeley (1982) has specified a number of criteria which may be used to identify tools which were formerly hafted, or were intended to be hafted. The two criteria applicable to the Pioneer Point assemblage are listed below.

1. Morphological or technological features that are related to hafting, such as bilateral or basal notching, stems, etc. (Keeley 1982:805,807), and
2. Traces of contact with a haft resulting from friction or impact (Keeley 1982:807).

**CHIPPED STONE DEBITAGE**

**Maximum Dimension**

Maximum dimension is the distance between those two points on an artifact which are the farthest apart. These measurements were recorded to the nearest whole mm. This variable provides a general indication of the size of each artifact.

**General Specimen Form**

**Resharpening Flake.** This is a complete or broken flake which was removed from a bifacial or unifacial tool, presumably to rejuvenate the working edge of the implement. The only criterion which distinguishes a resharpening flake from a resharpening/thinning flake is the presence of edge wear along the remnant tool edge. The presence of a lip and a reduced bulb of percussion are attributed to the presumed use of soft hammer percussion techniques to remove the flakes.

**Primary criteria:**
1. Edge wear,
2. Flake scarring on the flake exterior,
3. Flake scarring on the platform, and
4. The presence of a lip on the flake interior at its juncture with the platform.

**Secondary criteria:**
5. Obtuse angle between the platform and the flake interior, and
6. Reduced bulb of percussion.

**Resharpening/Thinning Flake.** This is a flake which was presumably removed for one of the following reasons.
a. It was removed from a bifacial or unifacial implement during rejuvenation of the working edge or during general re-tooling. There is no apparent wear along the remnant section of tool edge either because the wear was not recognized during the analysis, the wear is only visible microscopically, or the flake was removed from a non-working portion of the edge of the parent tool.

b. It was removed in order to thin an incipient tool during the process of manufacture.

Primary criteria:
1. Flake scarring on the flake exterior,
2. Flake scarring on the platform, and
3. The presence of a lip on the flake interior at its juncture with the platform.

Secondary criteria:
4. Obtuse angle between the platform and the flake interior, and
5. Reduced bulb of percussion.

**Pressure Flake.** This is a flake removed by pressure flaking techniques, and they were identified during the Pioneer Point analysis using the following criteria.

1. Relatively flat (reduced bulb of percussion),
2. Relatively thin, and
3. Relatively small.

**Waste Flakes and Shatter.** This category includes all rejectage from lithic reduction which is not subsumed under the previous debitage categories of resharpening flake, resharpening/thinning flake, and pressure flake.

**Character of the Flake Exterior at the Platform Edge**

This variable was recorded for resharpening flakes and resharpening/thinning flakes which were recovered from Area 811/821 and for resharpening flakes from Area 822. It indicates the number of flakes which appear to have been removed from the flake exterior along the edge adjacent to the platform. The following categories were used to record this information.

1. Single scar,
2. Multiple scars (2-4), or
3. Abundant scars (5+).

**Character of the Platform**

This variable was recorded for resharpening flakes and resharpening/thinning flakes which were recovered from Area 811/821 and for resharpening flakes recovered from Area 822. It indicates the number of flakes which appear to have been removed along the former implement edge from the portion of the tool now constituting the platform of the flake. Although the categories which were used for recording the data are identical to those of the previously described variable, the data for the two variables are not directly comparable because of the general size difference between platforms and flake exteriors. In other words, for any given flake, more flake scars are likely to be present on the flake exterior than on the platform because the former is generally the larger of the two surfaces.

See previous section on Refitted
APPENDIX I

Chipped Stone Tools and Tool Fragments for information on raw material type, heat alteration, edge wear, edge angle, and flake cortex.
MULTIPLE FUNCTION CHIPPED STONE TOOLS
FROM AREA 811/821

Several refitted chipped stone tools and tool fragments in the Area 811/821 collection may represent multiple function tools in the sense suggested by Binford (1979:268-269), i.e., that they were manufactured with the expectation that they would be used in the performance of several kinds of tasks. It was assumed during the Pioneer Point lithic analysis that these types of tools could be identified by the presence of multiple, functionally distinct implement edges on a single implement. One weakness in this approach to the identification of such tools is related to the fact that some implement edges do not exhibit macroscopic use-wear, leading to the possibility that retouched but non-working edges were evaluated as working edges. The individual implements which were nevertheless identified as the best candidates for multiple function tools are described below.

Three of the total of six tools have been manufactured from quartzite (Implement Nos. 25, 29, 53). Two implement edges were identified on Implement #25 (Figure 19c), an intentionally produced unifacial scraper edge and an edge with unifacial flake scarring which conversely appears to have resulted from use of the edge rather than from deliberate retouch. Scarring along the two edges occurs on opposite faces of the artifact; the plan view shape of one edge is slightly concave and the other convex. There is a difference of 40° in the edge angles of the two edges (one has an edge in the 35° - 40° interval, and the other in the 75° - 80° interval). The edge produced through utilization is quite ragged in comparison to the scraper edge, which may be attributed to both the origin of the scarring on the former edge and the greater vulnerability of that edge to damage because of its acute edge angle. The amount of edge wear on the scraper edge was coded as light to moderate, while use-wear on the second edge was heavy. Implement #29 (Figure 19a) exhibits three noncontiguous unifacial scraper edges, none of which bear macroscopic use-wear. One of the edges was considered to be too short to permit meaningful observation. However, the two remaining edges exhibit both similarities to each other and differences. Both are unifacial scraper in form with similar edge angles (measurements fall into the 70° - 75° and 75° - 80° intervals). One is characterized by regular flake removal and is slightly concave in plan view. Flake scarring on the second edge is slightly irregular, but the edge as a unit is straight. Implement #53 (Figure 19b) has implement edges of three forms, bifacial, unifacial scraper, and unifacial denticulate. The heaviest wear oc-
APPENDIX II

curs in two locations on the tool, around a corner of the tool with bifacial retouch, and along a section of the denticulate edge. Edge angle measurements fall primarily into the 60° - 65° interval (bifacial edge) and in the 75° - 80° interval (denticulate).

One possible multiple function tool is manufactured from jasper (Implement #35, Figure 20h). Three edge forms were observed on this tool (deliberate bifacial, utilized bifacial, and deliberate unifacial scraper), but overlap occurs in the ranges of the edge angle measurements which were obtained along the three edges. All three edges exhibit light to moderate wear.

Implement #5 (Figure 20d) has been manufactured from agate and has edges of two forms, a unifacial scraper and a unifacial notch. Both edges exhibit light to moderate wear. Edge angle measurements for the two edges fall into the 50° - 55° (scraper) and 65° - 70° (notch) intervals.

Implement #16 (Figure 20i) has been manufactured from a distinctive gray and tan chert. Implement edges on opposite sides of the artifact include a unifacial scraper edge and a utilized edge exhibiting bifacial damage. Both edges exhibit heavy wear. The bifacial edge is generally steeper than the scraper edge.
Appendix III

RAW DATA ON CHIPPED STONE IMPLEMENTS

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<tr>
<th>Implement No.</th>
<th>Excavation Unit</th>
<th>Raw Material Type 1</th>
<th>Tool Location 2</th>
<th>No. of Refitted Pieces</th>
<th>Hafting Evidence 3</th>
<th>No. of Implement Edges</th>
<th>Edge Form 4</th>
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Area 811/821
### APPENDIX III

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APPENDIX III

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Area 822

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## APPENDIX III

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APPENDIX III

1 Raw material type.

Q = quartzite  A = agate  J = jasper
C = chert  O = obsidian

2 Tool location.

F = flake  R = resharp. flake  B = biface
I = indeterminate

3 Hafting evidence. Evidence of former hafting of tools is discussed in Appendix I. The presence of such evidence on individual tools in the above dataset is indicated by a P.

4 Edge form category.

1. Bifacial retouch
2. Unifacial scraper retouch
3. Unifacial denticulate retouch
4. Unifacial notch retouch
5. Unifacial borer retouch
6. Alternating unifacial/bifacial retouch
7. Utilized flake - bifacial
8. Utilized flake - unifacial
9. Utilized flake - borer

The following information is included in parentheses for each recorded edge:

1. edge angle interval measured in degrees.
2. amount of visible wear:  n = none
   l-m = light to moderate
   h = heavy

* Side- and basal-notched projectile point similar to Desert Side-notched and Type MEPP 35.

** Side-notched projectile point similar to Type MEPP 31.

*** Similar to Type MM 19 projectile points associated with the Apex Complex.

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Appendix IV

SELECTED EDGE ANGLE STUDIES

The idea that the angles of the working edges of tools are reflective of tool function was put forth in the writings of S. A. Semenov (1964) and was explored by application to North American archeological data in the 1960s by Edwin Wilmsen (1968, 1970). In his study of nearly 1,500 implements recovered from eight Paleo-Indian sites, Wilmsen found that the distribution of edge angle values for the sample exhibited peaks in frequency between 26° and 35°, 46° and 55°, and 66° and 75°. He wrote:

While it would certainly be an oversimplification to equate each mode with some specific functional operation, general categories of functional effectiveness may be suggested for each mode [Wilmsen 1970:70].

Wilmsen inferred that “cutting operations” were associated with the most acute mode (26° - 35°). Suggested functions for tools with angles between 46° and 55° included (1) skinning and hide scraping, (2) sinew and plant fiber shredding, (3) heavy cutting of wood, bone, or horn, and (4) tool back blunting (Wilmsen 1970:70). Functions which were suggested for edges with angles between 66° and 75° included (1) wood working, (2) bone working, and (3) heavy shredding (Wilmsen 1970:71). It is interesting to note that Wilmsen made provision for non-working edges in his interpretive scheme by the inclusion of “tool back blunting.”

Simple unmodified flakes may have been preferred for certain tasks (e.g., Gould et al. 1971:149; Walker 1978). In this regard, Wilmsen (1970:70,74) observed that utilized flakes tend to be most heavily represented in the lower end of the functional edge angle range (20° - 40°), and that most such edges were probably used to cut meat and skins. However, he has also suggested that flakes with unmodified edges around 50° may have been preferred for cutting bone. Lawrence Keeley (1980:114) has noted that such tasks as sawing and whittling wood, and cutting meat may be “more efficiently accomplished with an unretouched edge.” These functions were inferred by Keeley for implements with fairly acute edge angles (< 49°) from the British Lower Paleolithic Golf Course site at Clacton-on-Sea.

George Frison has also suggested that the functional dichotomy between cutting and scraping implements will be manifested in the angles of the working edges of such tools. According to Frison,

Working edges must be right for the task at hand. Scraping edges must be different from cutting edges. An
APPENDIX IV

edge that is too thin will cut fast but will also nick easily, and then time and material are wasted in restoring the tool to a functional condition. Scraping edges must not be too sharp or they will cut and ruin the hide or other material being worked. In other words, there are strong forces that cause certain attributes of tools to cluster around a central tendency in order to maximize their utility [Frison 1968:152].

Results of Frison’s (1970) analysis of chipped stone tools recovered from the Glenrock Buffalo Jump, a Late Prehistoric site in central Wyoming, indicated that two groups of edge angles were present. Edges with angles which clustered around the 37° - 42° range were interpreted as cutting edges, while edges with angles which clustered around the 48° - 53° range may have been used for scraping. Among the debitage recovered from the Late Prehistoric Piney Creek site in northern Wyoming (Frison 1968) were resharpening or retouch flakes derived from a number of bifaces, as well as side scrapers made on percussion flakes. The tools themselves were either lenticular in transverse cross section (bifaces) or plano-convex in cross section (side scrapers). Consequently, the remnant of working edge present on the retouch flakes formed an acute angle on the bifacial specimens and an approximate right angle on the specimens deriving from side scrapers.

David Hurst Thomas (1971:46) has suggested that tools such as projectile points which are designed to pierce materials will have edge angles less than about 20°. Contrary to Thomas’ reference to Semenov’s suggestion that similar edge angles will be used for whittling, Semenov (1964:20) suggested instead that bone and wood whittling tools will have edges which average between 35° and 40°.

J.B. Sollberger (1969) and a number of others have observed that steeper edge angles are in general less susceptible to damage during use and are, therefore, more effective for working relatively hard substances such as wood and bone. Sollberger further concluded from his experimental studies that naturally steep edges without retouch (i.e., steep-edged unmodified flakes) perform better when working hard materials than do steep edges created through deliberate retouch.

It is often assumed that extremely steeply (obtuse) angled edges are non-functional. However, Don Crabtree (1977) has discussed the use of obtuse angled edges on experimental tools modeled on archeological specimens, and the probable intentional production of such edges prehistorically. The analytical methodology used during the Pioneer Point analysis to determine the working edges of tools was not amenable to the identification of many such obtuse-angled edges as they were described by Crabtree. For example, he suggested that obtuse-angled ridges between flake scars on the backs of lithic tools may have served as working edges. During the Pioneer Point analysis, such ridges were not considered to be functional in the sense suggested by Crabtree. Indications of wear which were observed on ridges of this sort were generally attributed to abrasion from hafts. However, Crabtree’s discussion of obtuse angles is relevant to the functional interpretation of those implement edges which were identified in the Pioneer Point sample.
For purposes of his work, Crabtree (1977:40) defined "obtuse" angles to be those greater than 90° and less than 130°, noting that angles greater than 130° had so far proven to be too flat to have functional value. With regard to the possible functions of these edges, his experiments indicated that they were well-suited to the carving or shaving of such resistant materials as hardwoods, bone, horn, and antler because they were stronger and more durable than acute-angled edges. Crabtree's results clearly represent a broadening of the concept of the suitability of various edge angles for working materials of different hardness.

Keeley (1980) has reported results indicating a relationship between the angle of the working edges of tools and tool function as determined through microwear analysis for implements from two British Lower Paleolithic assemblages. For implements from the Golf Course site at Clacton-on-Sea, he found the following associations (Keeley 1980:110, 115-116).

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<tr>
<td>Wood whittling</td>
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<tr>
<td>Meat cutting/butchery</td>
<td>35° - 49°</td>
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<tr>
<td>Wood scraping</td>
<td>&gt; 60°</td>
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<tr>
<td>Wood planing</td>
<td>&gt; 72°</td>
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<tr>
<td>Hide scraping</td>
<td>&gt; 72°</td>
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</table>

The edge angle data collected on implements with inferred meat cutting/butchery functions from the Lower Industry levels at Hoxne were consistent with those from Clacton. Edges with angles less than 40° which were apparently used for cutting plants were also identified in the Hoxne collection. Notably, the Hoxne hide scraping data are somewhat different than the Clacton data on hide scraping, with actual implement edge angles ranging from 35° - 79°.

In general, the sources which were reviewed during the Pioneer Point analysis present conflicting information on the steepness of edges which may have been used for scraping hides. Moderate edge angles (45° - 55°) have been associated with skinning and hide scraping by Wilmsen (1968:156) and Frison (1970:36). However, Frison (1968:150) has also reported edge angles of nearly 90° for the remnant tool edge sections on retouch flakes from side scrapers which were presumably used for similar tasks.

Ethnoarchaeological studies have also generated useful information concerning edge angles and tool function. For example, Aborigines of the Western Desert of Australia (Gould et al. 1971) classified their stone tools into two categories based upon the shape of the cross section of the working edges. Thick flakes retouched to produce a steep working edge (purpunpa) were considered to be suitable for the adzing or scraping of wood. Flakes with thin, sharp edges (tjimari) were used for slicing or cutting (Gould et al. 1971:149). Most of the latter category of tools were unmodified flakes. A sample of these two types of stone tools was collected by Gould for subsequent study, and results indicated that the angles of the working edges correlated with the native classification and the differences in function. The mean working edge angle for the cutting implements was 39.5° (ranging between 19° and 59°), and the mean angle for adzes was 67° (ranging between 40° and 89°). A smaller sample of
tools made by the Wongkonguru Aborigines of eastern South Australia collected during the 1920s was also studied by Gould with similar tentative results (Gould et al. 1971:151-152).

Peter White and D.H. Thomas (1972) have described two classes of unretouched flake tools (are and are kou) which were used by Central Highlands populations of New Guinea. The primary uses for these implements included fiber shredding and drilling (Thomas 1971:46). Mean working edge angles of these tools fell between 50° and 60°.
THE GOWER SIMILARITY COEFFICIENT AND ITS APPLICATION TO THE PIONEER POINT LITHIC ANALYSIS

A BASIC computer program was written by the author to facilitate the analysis of chipped stone implements from Pioneer Point using the Gower similarity coefficient (Gower 1971). The program constructs a matrix of Gower similarity coefficients based upon a comparison of all pairs of computer records containing artifact information (one record per artifact) in a previously constructed computer data file. The artifact information consists of data on a set of observations or attributes, and the computer records containing this information are compared for any subset of the attributes specified by the program user. The Gower coefficient expresses the degree of similarity between each pair of records as a single number between 0 and 1. The matrices which were constructed for the Pioneer Point analysis were then manipulated using the SPSS/PC commercial software package.

The similarity of any two cases (i and j), which were chipped stone implements during the Pioneer Point analysis, is defined as the average score taken over all comparisons between the two cases using a set of variables (k) (Gower 1971:859).

\[
S_{ij} = \sum s_{ik} / \sum \delta_{jk}
\]

\[
v \quad v
\]

In calculating the Gower coefficient for any pair of cases, dichotomous, qualitative, and quantitative attributes are treated somewhat differently, although the results are comparable. No dichotomous variables were included in the Pioneer Point analysis, so Gower's suggested treatment of this class of variables will not be discussed here.

For qualitative attributes, \( s_{ik} = 1 \) if the two cases are coded the same for the kth variable, and \( s_{ik} = 0 \) if they are coded differently. For quantitative attributes with values \( x_i, x_j \) through \( x_m, s_{ik} = 1 - |x_i - x_j| / R_k \). The value of \( R_k \) is the range of values for variable k in either the sample (which was the option selected during the Pioneer Point analysis) or the target population. For both qualitative and quantitative attributes, \( \delta_{ik} = 1 \) if the comparison between the two cases on a variable is possible (i.e., no missing data values) or \( \delta_{ik} = 0 \) if the comparison is not possible (i.e., one or both values is missing). During the construction
APPENDIX V

of matrices of Gower coefficients for the Pioneer Point analysis, edge form, raw material type and tool location were treated as qualitative attributes and edge angle was treated as a quantitative attribute. All values for Gower’s coefficient range from 0 to 1. A coefficient of 0 indicates that two cases are as different as they can be, given the variability within the sample or population. At the other extreme, a value of 1 indicates that two cases are coded identically.

There was no formal differential weighing of attributes in the calculation of Gower coefficients during the Pioneer Point analysis. Although edge angles were considered to be the most important index to function used during the study, an adverse effect of not using weights was that edge angles were slightly underrepresented in the calculation of the coefficient relative to the other attributes. This is apparent in view of the scale at which edge angle data may be considered functionally significant. To illustrate, the contribution to the numerator of Gower’s coefficient calculated for two edges with angles measured 10° apart would be some value less than 1 dependent on the magnitude of the range of edge angles for the sample. However, such a difference in angles may not reflect an important functional distinction between the two edges. If both implement edges were on quartzite, the contribution of the raw material comparison to the coefficient would be the maximum possible similarity value of 1.
FAUNAL ANALYSIS OF THE 1982 CURECANTI MATERIAL

by
Sandra L. Olsen and Bruce A. Jones

INTRODUCTION

The faunal material recovered from the 1982 Center investigations at 5GN41, 5GN222, 5GN247, and 5GN1664 was analyzed using the National Park Service modern comparative collection housed in the Arizona State Museum at University of Arizona in Tucson. Each archaeological fragment in the Curecanti collection was compared to a wide range of elements and taxa in the comparative collection to minimize the possibility of error in identification. In those cases in which an element could not be identified, the fragment was only assigned to the taxonomic level of class.

Only mammals were identified in the 1982 collection from Curecanti. Most of the material represents the remains of large animals, and no rodents or lagomorphs were positively identified in the 1982 material. Those taxa identified in the collections from the four sites presently have expansive geographic ranges and occur in the Curecanti area today. Consequently, little environmental interpretation may be made based upon the 1982 faunal material recovered from sites in the park.

Features at 5GN41 have produced radiocarbon ages of 474 ± 70 B.P. and 470 ± 80 B.P., and the site probably represents a single late aboriginal occupation. The late dates from the site fall near the time of early Spanish contact with aboriginal populations in the region, and introduce the possibility that the remains of domestic cattle, sheep, and goats may be present in the faunal collection from the site. This situation is complicated by the large quantity of small bone fragments in the archeological collection, and unfortunately resulted in very general levels of taxon identification. Of the 330 bones and bone fragments collected at 5GN41, 283 (85.8%) could only be identified as Class Mammalia, order indeterminate because of their extremely comminuted state. Table 30 illustrates the distribution of the various taxa within the site.

Charring occurred in 261 (79.1%) bone fragments from Pioneer Point. The majority of the burned bones in the site collection are fairly well calcined and are light gray or
APPENDIX VI

powdery white in color. This is indicative of a pattern of bone discard onto a fire rather than directly reflective of aboriginal cooking practices. Bone heated in the process of cooking typically may show no change in color, or it may turn brown or black around the edges which were exposed to the heat source. While it is reasonable to hypothesize that many of the bones in the Pioneer Point collection were derived from portions of meat which were roasted and eaten, butchering marks on the material represent the only concrete evidence of such activity. Most of the unburned elements in the collection are fragments of cheek teeth from sheep or goat(s) which, based upon wear attrition, may represent the remains of one individual.

Two bone fragments recovered from Feature 10 in X14, Area 821, represent the left mesial and the ungual phalanges of a cow (Bos taurus) or bison (Bison bison) and exhibit surficial alteration characteristic of weathering. Probable exposure to ultraviolet radiation and desiccation over a period of months or even years has rendered these particular elements friable and chalky. Root etching, the solution of the surface of bone in vermicular patterns caused by acids produced by rootlets in the soil (Pei 1938:12; Binford 1981: 49-51), was observed on a left cow or bison humerus from the same feature as well as on a cow-sized large mammal bone fragment from elsewhere in the same excavation unit (X14, 0-10 cm below surface).

Butchering marks were observed on only two bone fragments from 5GN41. The left humerus of a cow or bison recovered from fill of F10 has fine diagonal cut marks across the mid-diaphysis which may have been made when the muscles were removed. Elsewhere in the fill of the same unit (X14, 0-10 cm below surface), a long bone fragment from a large cow-sized mammal exhibits four fine transverse butchering cut marks.

Another element, the distal condyle of a proximal phalanx of a dog (Canis familiaris) or wolf (Canis lupus) recovered from the fill of F10, appears to represent bone debitage. The fragment was probably produced during manufacture of a tubular bead or small bird whistle. The diaphysis of the bone was probably grooved and snapped through immediately adjacent to the proximal articular surface.

Spiral fractures were very uncommon in the material from 5GN41. Calcined bone is very susceptible to transverse and longitudinal cracking, and most of the breakage in the collection probably occurred after the bone was discarded. There is thus little evidence in the fragmentary faunal remains from Pioneer Point to suggest that the bones were being exploited for bone marrow or grease.

Canis, Species indeterminate

The only example of canid remains from 5GN41 is the fragment of the proximal phalanx found in the fill of F10 in X14. The distal articular end of this bone is similar in size to that of a wolf, Canis lupus, but the epicondylar region of the diaphysis appears to be more flattened antero-posteriorly and more gracile, as in a domestic dog, C. familiaris. Wolves presently occur throughout Colorado (Hall and Kelson 1959:849), although they are much less common today than in the past. Wolves are extremely rare in archeological contexts in
the Southwest, and the phalanx, which was used to produce a bone tube, may well have been derived from a large breed of dog.

**Order Artiodactyla, Family indeterminate**

Three burned bone fragments from 5GN41 were identified only as artiodactyl remains. The fill from F10 contained a sheep- or deer-sized femoral shaft fragment and the centrum of a thoracic vertebra. The other small artiodactyl bone fragment is a piece of either the caudal border of a scapula or the posterior surface of a deer metatarsal.

**Bos taurus/Bison bison**

Fifteen pieces of bone from Pioneer Point were identified as the remains of either domestic cattle or bison. Unfortunately, however, the morphological characteristics required to distinguish between osteological remains from the two genera were not present in the material from 5GN41. Based upon size alone (among those specimens sufficiently complete for evaluation), the faunal remains may well represent domestic cattle. The late radiocarbon dates from features in the site together with the shallowness of the archeological deposits at Pioneer Point certainly present the opportunity for the presence of cattle. However, bison would presumably also have been in the area during the occupation of the site.

**Ovis, Species indeterminate/Capra hirca**

Twenty-six pieces of premolars or molars from either bighorn sheep (*Ovis canadensis*), domestic sheep (*Ovis aries*), or domestic goat (*Capra hirca*) were dispersed over the site (Table 30). Those pieces which retained the occlusal surface indicated wear below the tooth enamel. Although tooth wear is dependent both upon grit in the diet as well as upon age, the individual or individuals from which these teeth came must have been fully adult and possibly senile. None of the tooth fragments are burned.

**Ovis canadensis/Odocoileus hemionus**

A burned distal condyle from a metapodial found in the fill in X85, Area 822, represents the remains of either a bighorn sheep or a mule deer. The fragment did not include the metaphysis of the metapodial, and the state of fusion consequently could not be determined.

**Odocoileus hemionus**

Finally, the F10 fill in X14 contained the right occipital condyle of a mule deer skull. This small piece is heavily calcined and is white in color.....

**CONCLUSIONS**

The comminuted condition of the osteological material from the four Curecanti sites makes specific taxonomic assignments difficult. No identification below the level of class was attempted if the particular element represented by a given bone fragment could not be determined, except in the case of a single artiodactyl bone which had been reduced to two possible elements. No small mammals such as rodents or rabbits could be positively identified in the 1982 Curecanti collection, and no class of animals other than mammals appeared to be represented. Dietary reliance upon large mammals, predominantly if not exclusively
APPENDIX VI

artiodactyls, is clearly suggested by these collections. However, the sample sizes from the four Curecanti sites are all relatively small, so interpretations regarding subsistence must be cautious and tentative.

* This analysis was conducted under the terms of Purchase Order No. PX-6115-3-0031 between the National Park Service and Stanley J. Olsen, Department of Anthropology, University of Arizona. The report of this work was presented in its complete form as Appendix B in Jones (1986a). It has been excerpted here to include only the faunal data from 5GN41.
### Table 30. Faunal Material from 5GN41.

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A = Class Mammalia, Order indeterminate  
B = Canis, Species indeterminate  
C = Order Artiodactyla  
D = Bos taurus/Bison bison  
E = Ovis, Species indeterminate/Capra hirca  
F = Ovis canadensis/Odocoileus hemionus  
G = Odocoileus hemionus
Table 30. Faunal Material from 5GN41 (continued).

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