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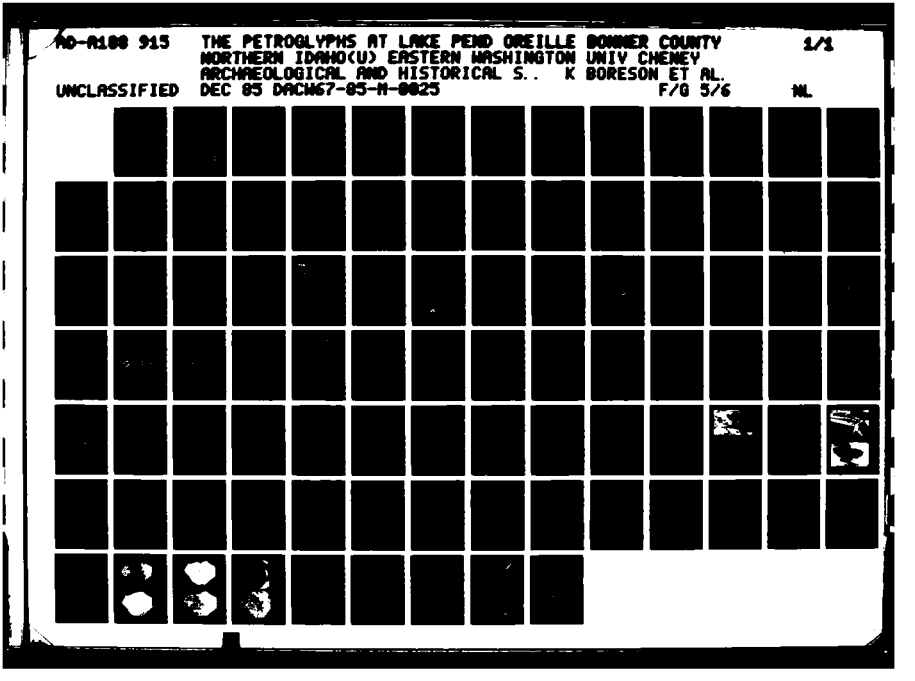

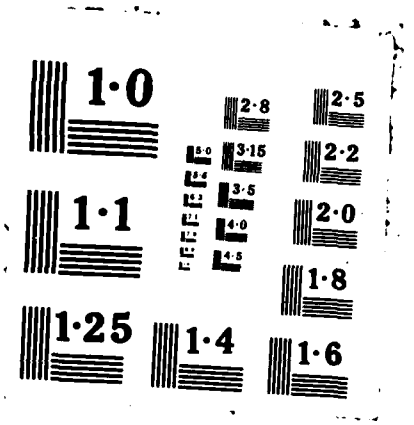
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TECHNICAL REPORT

THE PETROGLYPHS AT LAKE PEND OREILLE

BONNER COUNTY, NORTHERN IDAHO

US Army Corps
of Engineers
Seattle District

North Pacific Division

DECEMBER 1985

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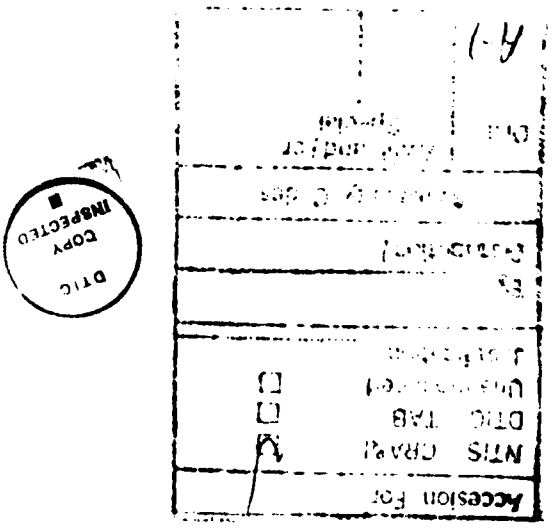
ABSTRACT

Archaeological and Historical Services conducted a rock art reconnaissance for the Seattle District of the U.S. Army Corps of Engineers to record the known and reported rock art sites within the Albeni Falls project area. Seven sites, all petroglyphs, were identified in the northern and eastern areas of Lake Pend Oreille.

Various sizes and styles of bear paws and intersected circles dominate the assemblage of figures. A few examples of other motifs are present, including anthropomorphic figures, quadrupeds, curvilinear and abstract figures, and many unidentified forms. The techniques used to create the figures were primarily pecking and connected pecking, with a few instances of incising.

Several causes of deterioration were observed. Lichen and moss growth obscured the rock surfaces, water percolation combined with freeze and thaw cycles caused spalling, wave action eroded the rock surfaces and erased the figures, and gravel covered portions of the petroglyphs.



THE PETROGLYPHS AT LAKE PEND OREILLE, BONNER COUNTY, NORTHERN IDAHO

By

Keo Boreson

and

Warren R. Peterson

Report prepared for the
U.S. Army Corps of Engineers, Seattle District

by

Archaeological and Historical Services
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The authors wish to thank several individuals for their involvement with this project. Dr. David G. Rice was a capable and helpful link to the contracting agency; Sherrill Pratt and Larry Fredin assisted with fieldwork, and Larry located a previously unrecorded rock art site on the north end of the lake. May Peterson and Joe Randolph have endured and supported many years of data gathering, and Cort Sims of the Idaho Panhandle National Forest generously provided a photogrammetric map of the petroglyphs at 10BR5.

Dr. Jerry Galm, Joe Randolph, and archaeologists from the Seattle District Corps of Engineers read the draft report and made pertinent recommendations. Pam Rutan prepared the report maps and the artifact illustrations in Appendix 3, and Priscilla Wopat edited the draft and saw the report through the various stage of production. Marsha Krebs, Diane Starbuck, Mary Condon, and Vivian Harvey managed the budget, travel, and administrative details.

We particularly appreciate the interest and cooperation of private landowners. Because of their awareness of the importance of these prehistoric resources, most of the rock art in the Lake Pend Oreille area has been protected from human disturbance and vandalism.

ABSTRACT

Archaeological and Historical Services conducted a rock art reconnaissance for the Seattle District of the U.S. Army Corps of Engineers to record the known and reported rock art sites within the Albeni Falls project area. Seven sites, all petroglyphs, were identified in the northern and eastern areas of Lake Pend Oreille.

Various sizes and styles of bear paws and intersected circles dominate the assemblage of figures. A few examples of other motifs are present, including anthropomorphic figures, quadrupeds, curvilinear and abstract figures, and many unidentified forms. The techniques used to create the figures were primarily pecking and connected pecking, with a few instances of incising.

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1. INTRODUCTION

An on-the-ground visual inspection of all known and reported rock art sites within the Albeni Falls project area was conducted by Archaeological and Historical Services (AHS) for the Seattle District of the U.S. Army Corps of Engineers. The project involved the rock art sites located on Lake Pend Oreille, an area affected by a rise in the water level from 625 to 629 m (2050 to 2062.5 ft) above mean sea level after completion of Albeni Falls Dam in 1957. Since the reported rock art sites in the Lake Pend Oreille area are below or very near the present high-water level, the necessity of locating, describing, and evaluating the condition of these sites was apparent. The fieldwork was conducted in the spring of 1985 in order to take advantage of low water, since some figures are above water for only a short period each year.

Environmental Considerations

The seven rock art sites described in this report are located in Bonner County, Idaho, in the northern and eastern areas of Lake Pend Oreille (Figure 1). Four of the sites are on islands and the remaining three are on the mainland. Although all the sites are now very near or beneath the waters of Lake Pend Oreille, prior to the 1957 rise in the lake level 10BR5 and 10BR225 were about 0.8 km (0.5 mile) northeast of the lake (Packsaddle Mountain quadrangle) and 10BR621 was on the mainland rather than on an island (U.S. Geological Survey 1927).

A review of the weathering effects on rock art in Canada indicates that, by a variety of mechanisms, the combined actions of moisture and temperature changes are the major causes of the natural deterioration of the sites and that moisture is by far the more damaging agent (Taylor et al. 1979:301). It comes as no surprise that the 4 m (12.5 ft) rise in Lake Pend Oreille has adversely affected the condition of the known local petroglyphs.

The rock exposures in the Lake Pend Oreille area are glacially scoured outcrops trending north-south. The rocks from five of the sites were petrographically analyzed as argillite and one sample was analyzed as sandstone (Appendix A). An exterior orange weathering rind on many of the rock faces was initially considered of possible use in relative dating techniques. The petrographic analysis, however, indicated this was an unlikely possibility.

> It may be possible to determine relative ages (i.e., ages of exposure to the atmosphere) of rocks as a function of the thickness of their weathering rind. I would be cautious about comparing rind thicknesses between different rock types. Specifically the natural acid in rainwater might leach the calcite out of 10BR25 faster (therefore developing a thicker rind) than it would alter smectite to limonite in [the sample from 10BR4A] in the same amount of time (Koehler, Appendix A, this report).

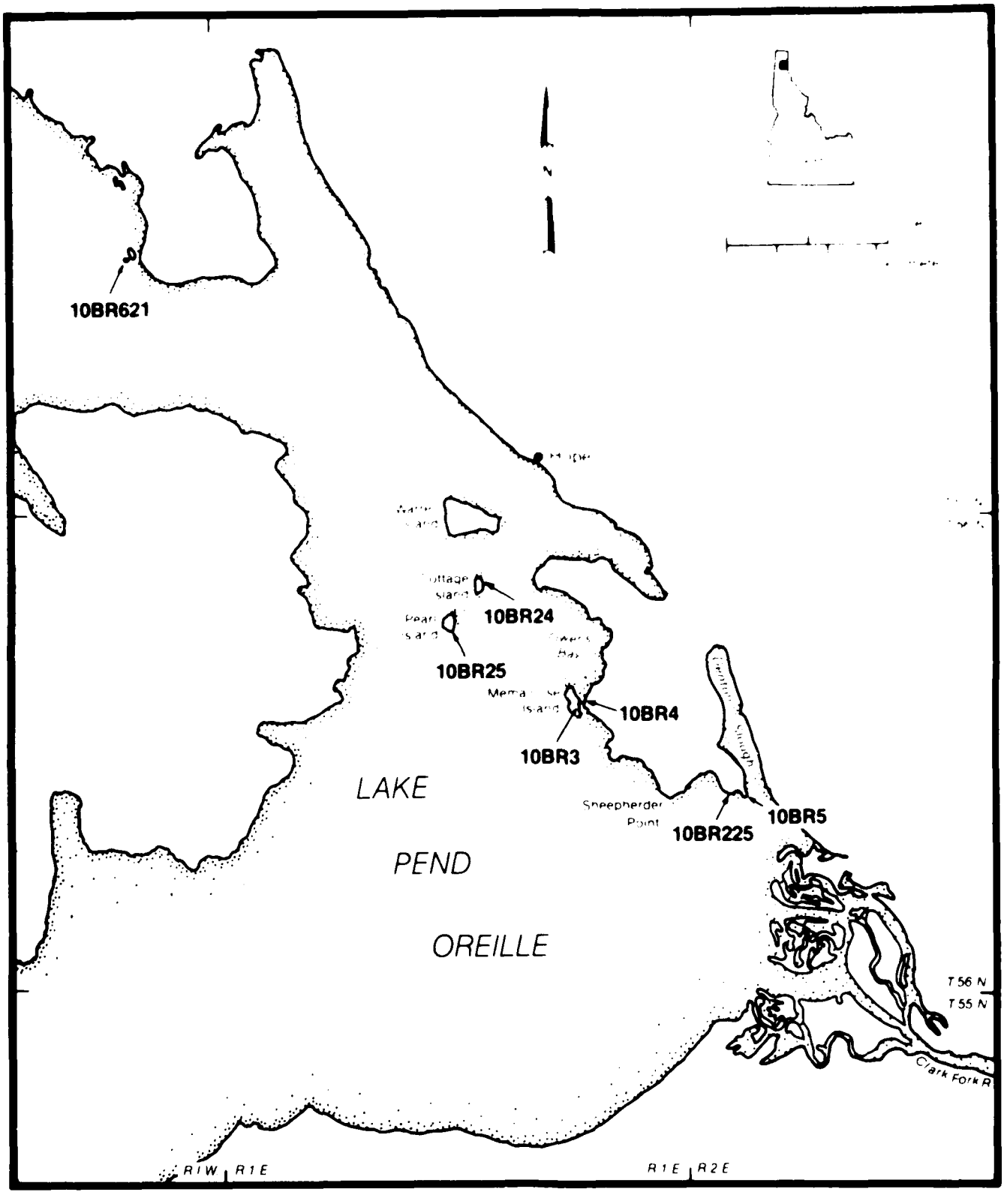


Figure 1. Locations of recorded rock art sites in the Lake Pend Oreille area.

The local vegetation is predominantly Douglas fir and ponderosa pine. Lichen and moss grow abundantly on the rock surfaces above the high-water line. This thick growth may be in part due to the increased humidity from the raised lake level. The role of lichens in the disintegration of rock, and therefore the destruction of petroglyphs, is not clear. Several studies indicate that chemical and mineralogical changes do occur in the composition of the rock beneath lichen thalli. A review of the effects of lichen on their substrates concludes that "lichen can be important agents in the biogeophysical and biochemical weathering of minerals and rocks" (Syers and Iskandar 1973:243).

The presence of lichen is of particular relevance to rock art studies. Their very slow growth rate can be measured and hypothetically used to date the age of the petroglyphs beneath the lichen. A number of factors affect the growth rate of lichens, including moisture, light, temperature, and the availability of nutrients. "Past work in lichen growth has shown that most species in temperate areas grow 0.5-8mm a year and that both seasonal and annual variation is large. Availability of moisture and temperature have the greatest effect on growth" (Hale 1973:490). One study concluded that "when a thallus is wetted, as by rain, it attains saturation quickly and begins to metabolize almost at once....Increments of up to 0.10mm without subsequent shrinkage [were noted] as the result of a single one-day long rainstorm" (Hale 1973:475). Various aspects of this dating technique as it applies to rock art are discussed in detail by Taylor et al. (1979:301-307).

Previous Regional Rock Art Studies

As early as 1893, reference was made to the presence of rock carvings in northern Idaho when John Leiberg described and illustrated the figures at 10BR5. This site and others in the Lake Pend Oreille area were identified in Erwin's survey of Indian rock writing in Idaho published in 1930. It was not until 1966, however, that the rock art sites on Lake Pend Oreille were entered into the state inventory files by Paul Sneed and Cort Sims of Idaho State University. Other rock art sites in northern Idaho have been documented by Keo Boreson as part of a statewide inventory effort begun in 1973. These sites include 10BR7, consisting of a few pictographs on the west side of Priest Lake, and 10KA59, a cluster of abstract petroglyphs on the west shore of Lake Coeur d'Alene. Additional sites have been reported southeast of St. Maries and near Chatcolet, Idaho.

For the past 20 years, Warren Peterson has conducted an ongoing rock art study that includes monitoring, recording, and photodocumentation of the Lake Pend Oreille sites. He updated the site records in 1979 and added a new site to the state site files in 1980. Peterson has also experimented with various methods of documenting rock art, including photography under controlled light conditions (see Appendix B, this report).

A rock art site with considerable similarity to those in the Lake Pend Oreille area was the focus of a project conducted in 1979 and 1980 by Barbara Kennedy and Steve Cassidy from the Conservation Division of the British Columbia Provincial Museum. The Cranbrook Petroglyph site (DIPw1) is about 145 air km (90 air miles) north of Lake Pend Oreille at Cranbrook, British

Columbia. The micro-exfoliation of the rock face and vandalism had caused significant loss of the rock art. The project included protecting and casting the rock face, recording and photographing the panels, preparing the surface with a protective coating, and covering the site with 15 cm (4.5 in) of sand and 1 m (3.3 ft) of earth (Kennedy and Cassidy 1981:6).

Other regional rock art studies have been conducted at Slocan Lake, British Columbia (Bell 1979); Zephyr Creek, southern Alberta (Keyser 1977); and Flathead Lake, western Montana (Elrod 1908; Malouf 1953). Rock art reports describing sites within a broader geographical area are available for British Columbia (Corner 1968; Lundy 1979), Washington (Cain 1950; McClure 1978), and western Montana (Keyser and Knight 1976; Knight 1975; Malouf 1961). On a still-larger scale is a distribution study of the rock art in the Pacific Northwest discussed by Boreson (1976).

2. PROCEDURES

The primary objective of the Albeni Falls Rock Art Reconnaissance project was to update and present, in report form, several years of data collected by Peterson. In addition to the compilation of existing data, the project was to provide descriptions of figures, sites, and causes of deterioration, and to evaluate each site's condition. It was assumed that:

1. The locations, descriptions, and perimeters of the sites, and the locations of individual figures, were known;

2. The lake level would be low enough to expose the petroglyphs, the weather and light conditions would permit visual identification of the figures, and the time allotted for fieldwork would be adequate for recording the sites; and,

3. The existing photographs, notes, site maps, and slides would be available as an aid in preparing the site descriptions and illustrations.

Methodology

Upon arriving at each site, the rock art panels were relocated and flagged using the numbers previously used by Peterson in his site descriptions. Several unrecorded figures were identified during this phase of the project.

Maps of three sites with widespread features (10BR3, 10BR4, and 10BR225) were made using a transit and stadia rod or metric tape and/or Peterson's site maps. All map features are based on magnetic north and were measured using metric units. Individual rock art panels were plotted on the site maps along with high-water marks and other distinguishing characteristics such as docks, rock outcrops, and other areas of the site.

The rock art panels and figures were photographed, sketched, measured, and described. A photographic record was completed in the field to record the site number, description (panel number), view, photographer, and date of each exposure. The photographs were taken with black-and-white (Plus X) and color slide (Kodachrome 64) film using a tripod when possible. The lenses used were one 50 mm lens, one 50 mm lens with macro capabilities, and one 80-200 mm zoom lens which also had macro capabilities. In order to avoid spatial distortion, wide-angle lenses were not used. Individual figures, panels, and general views of the site area were photographed, most of them with a scale.

The sketches were freehand drawings of the rock faces and petroglyphs and were primarily used as an aid in identifying the photographs and in providing points of reference for indicating measurements. Measurements included the dimensions of the figures, the depths of the petroglyphs as taken with a depth gauge on calipers, and the slope of the rock face as determined

with a protractor and a line level attached to an adjustable frame. The descriptive information included the direction the panel faced, techniques of production, condition, and causes of attrition.

Finally, rock samples were collected from six of the sites and were submitted for petrographic analyis in order to identify the type of rock upon which the petroglyphs were located. The U.S. Army Corps of Engineers site form (NPS Form 54) and a rock art site form were completed for each site.

The most time-consuming aspect of this project involved illustrating the rock art figures. Accurate reproduction was a high priority and to achieve this goal, every slide with discernable petroglyphs was projected and traced. Many slides from Boreson's and Peterson's personal collections were also projected and drawn in order to define vague, incomplete, and missing figures. The tracings of approximately 380 slides were sorted and labeled by site and panel. It was then a matter of comparing the drawings, contact sheets, and field sketches, and compiling the illustrations. This was done by projecting selected slides and tracing those rock panels with figures, sometimes with additions or deletions. Sites such as 10BR5 and 10BR24, which are situated on large single rock outcrops, were illustrated by piecing together the black-and-white prints of the rock face, highlighting the petroglyphs, and then tracing the entire faee and figures onto acetate.

Problems

Weather, limited recording time, poor light conditions, and lichen and moss growth were the major problems encountered during the investigations. Although only a few days were too rainy or windy for recording, the fieldwork period was short and therefore restricted investigations of the unknown areas of several sites.

Although light conditions varied during the fieldwork, most of the figures were recorded with satisfactory results. However, some sites or areas of sites were recorded when figures could not be relocated, sketched, and/or photographed due to the intensity of the sunlight or, conversely, a cloud cover. This was particularly true at 10BR4 where the rock art panels have various slopes and face different directions.

The relocation of figures at some sites was also hindered by lichen and moss covering the petroglyphs. Without removing this vegetation, the total numbers and types of figures could not be determined, and many figures could only be partially illustrated.

The identified problems generally indicate the shortcomings of the project. In summary, lichen and moss obscured many petroglyphs, resulting in incomplete recording. Time and light limitations prevented an intensive site survey to locate additional rock art sites and all figures within sites, and to verify the accuracy of report illustrations with a final field check.

3. THE SITES

Seven rock art sites were recorded during the Albeni Falls rock art reconnaissance. One site, 10BR621, is a new addition to the Idaho State Site Inventory; the remainder are sites that had previously been recorded. Two sites consist of more than one area of rock art, i.e., 10BR3 has three (A, B, and C), and 10BR4 has four (A, B, C, and D). These areas of rock art are separated by substantial distances and normally would be given separate site numbers; however, to maintain continuity with existing records, the original designations were retained. Since measurements at the sites were taken in metric units, the following site descriptions will not contain English equivalents.

One additional rock art site, 10BR245, was previously recorded in the Lake Pend Oreille area. This site consists of red pictographs which were painted in the early 1970s by a local resident. The site was not visited during this reconnaissance.

Three methods of producing petroglyphs were observed at the seven sites recorded on Lake Pend Oreille. They are "connected pecked," "pecked," and "incised." Peck marks are small individual concave depressions created by a hammer or chisel, presumably a rock, striking the rock surface. Connected pecking refers to peck marks that are attached either by grooving or by a continuous chain of pecking. Incised figures are straight or slightly curved lines ranging from shallow scratches to narrow V- or U-shaped grooves.

10BR3 - Memaloose Island

Site 10BR3 is located on Memaloose Island, about 183 m west of the western edge of the mainland. The island is privately owned. It is composed of gravel beaches, rock cliffs, and glacially scoured rock outcrops oriented north-south. One sample of rock was petrographically analyzed as a compact fine-grained brownish-gray argillite that splits irregularly along the bedding.

The local vegetation includes ponderosa pine, Douglas fir, juniper, and an abundance of moss and lichen growing on most rocks. In an effort to stabilize the east beach of the island, the U.S. Army Corps of Engineers built a rock retaining wall north of 10BR3A. This wall may have covered some petroglyphs. Frame structures and boat ramps have been constructed on the island, and it has been logged at least once. The channel between the island and the mainland was used as a log holding area from the early 1900s to the 1930s.

Although Memaloose Island is within the area ethnographically identified as Kalispel territory, Smith indicated that the name "Memaloose" is a Chinook jargon term meaning "burial locality" (1985:152). This evidence is supported by early newspaper articles relating the digging up of Indian graves at this popular Sunday excursion point. In 1809, David Thompson men-

tioned the use of an island near Kullyspel House, which may possibly have been Memaloose Island, as an Indian campsite (Elliott 1920:100).

When Memaloose Island was first recorded as a site in 1966 by Sneed and Sims, they noted 14 small (0.4 x 1 m) depressions and three large (0.5 x 1 x 2 m) depressions in addition to four areas of petroglyphs. In 1979, Peterson re-recorded the site and decribed three areas of rock art. The petroglyphs had previously been noted in publications from 1930 (Erwin 1930:48-49) and 1943 (Bailey 1943:277). The later reference indicated that "the rocks on the north side of the island [were] literally covered with Indian writing, most of them some form of a bear's paw." If there are petroglyphs on the north side of Memaloose Island, their location remains unknown.

Other cultural items reported from the island include projectile points, scrapers, and exotic artifacts such as jadeite celts, a steatite pipe fragment, and a tapered cobble having a quadruped painted in red-brown pigment and unifacial modification on one end.

In this report, three areas of petroglyphs on Memaloose Island are defined. These areas are designated as Area A on the east side, Area B in the northwest corner, and Area C on the west side (Figure 2). The site elevation ranges from 628 to 632 m.

10BR3A

The 15 panels at 10BR3A are scattered along or beneath the high-water mark for a distance of 58 m (Figure 2). Some of the figures, particularly panels 1, 2, 3, and 4, are under water for part of the year. Several petroglyphs are covered by beach gravel and/or water-deposited silt. Other panels are cracked and spalled from freeze-thaw cycles and many figures are partially or entirely covered by moss and lichen.

The datum from which all location information was made is 2.8 m south-southeast of panel 8, and was marked by a steel spike driven into a crack in the rock near the ground surface. All the panels in Area A face east.

Panels 1 and 2 were relocated in the field from Peterson's notes but the light was inadequate to identify the petroglyphs for sketches or photographs at the time of the reconnaissance.

Panel 3 is a single figure that appears to be a large intersected circle. It is water worn and partially buried by beach gravel (Figure 3).

Panel 4 is located on a rock with a 40° slope. A possible human figure measuring 10 x 28 cm consists of four vertically connected circles with three vertical lines extending down from the lowest circle. Several less distinct figures as well as others which may be buried in gravel are scattered over the rock face. The rock has cracked and a large chunk has slumped (Figure 3).

Panel 5 includes a circle intersected by a line 15 x 18.5 cm long by 0.13 cm deep, an incomplete circle intersected by a line 9 x 11 cm long by 0.06 cm deep, a 30 x 50 cm area covered by peck marks partially covered by gravel, and some indistinct figures (Figure 4). The panel is located on a

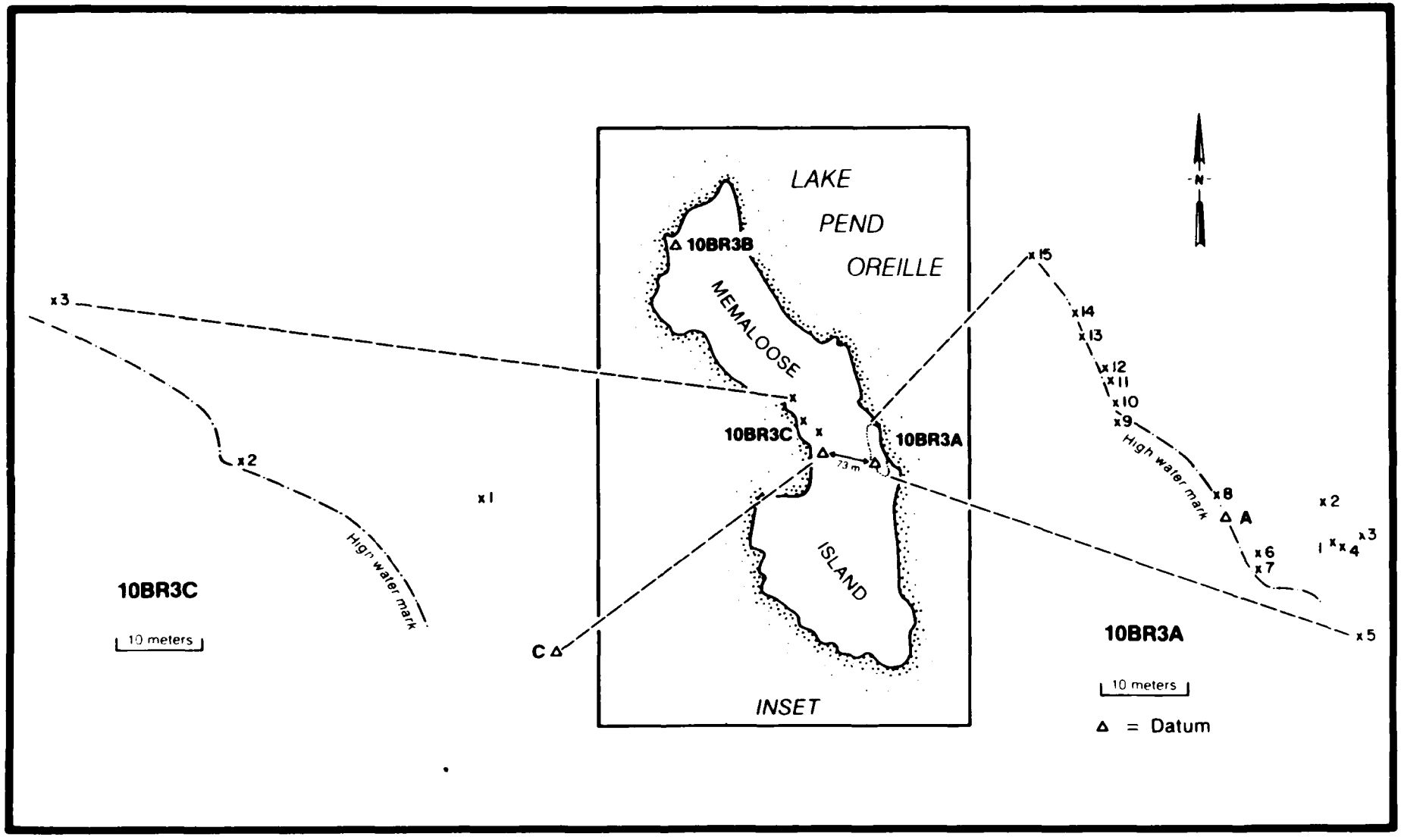
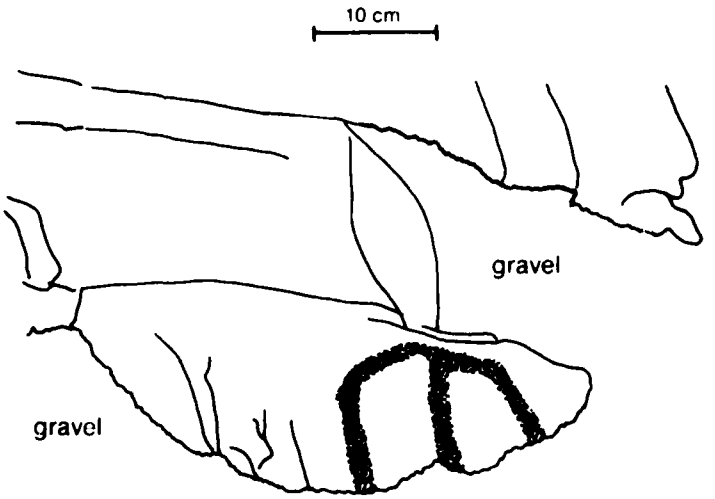


Figure 2. Location of Areas A, B, and C, and rock art panels in Areas A and C at 10BR3.

Panel 3



Panel 4

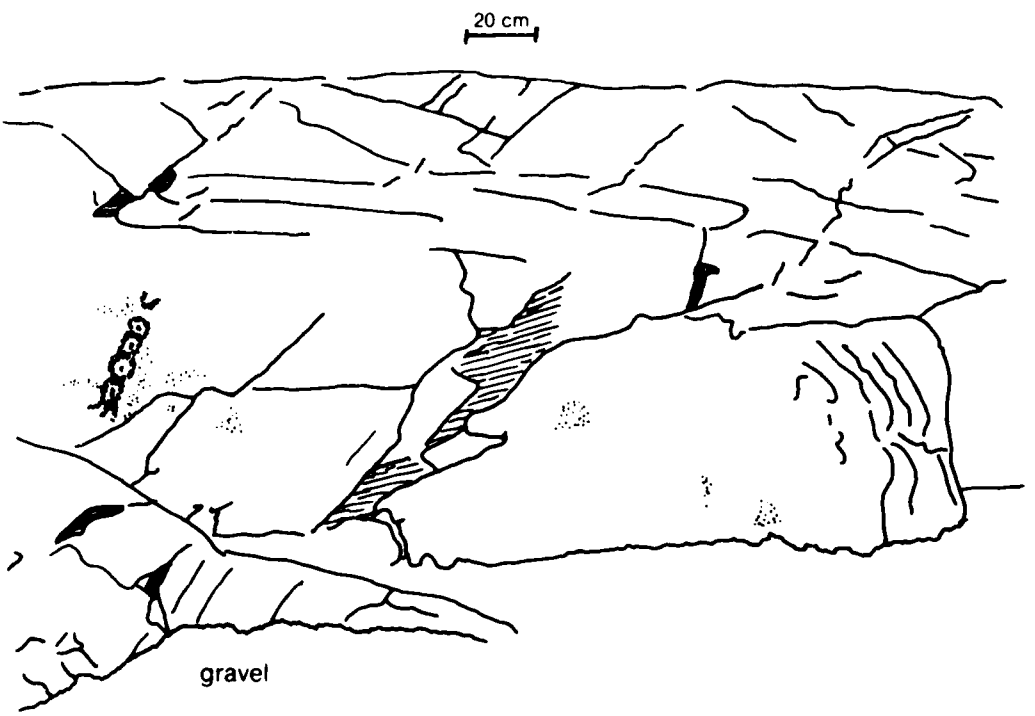
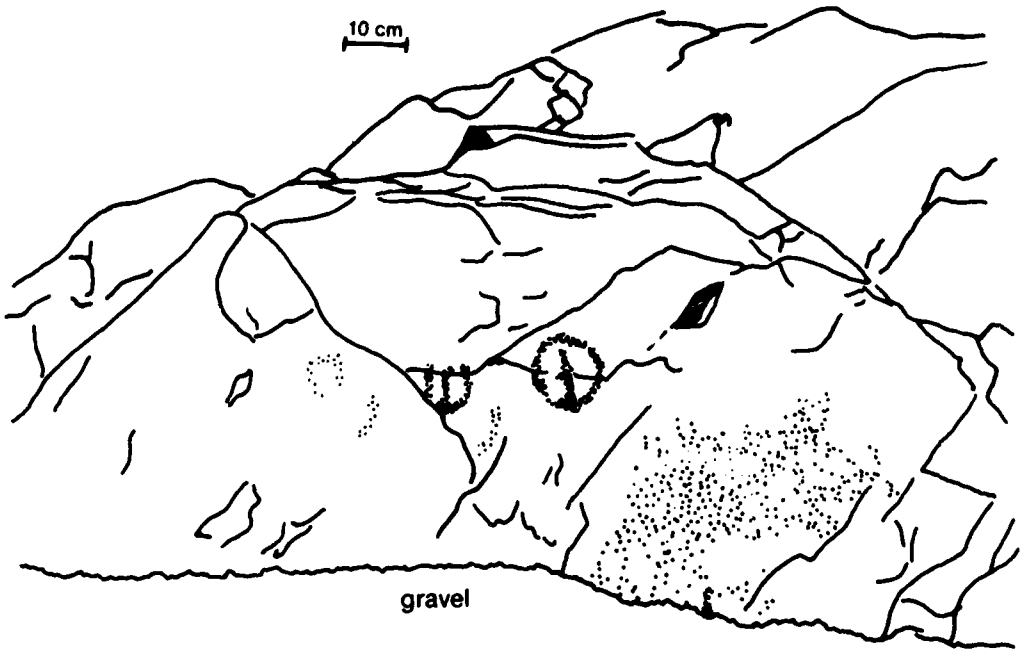


Figure 3. Panels 3 and 4 at 10BR3A.

Panel 5



Panel 6

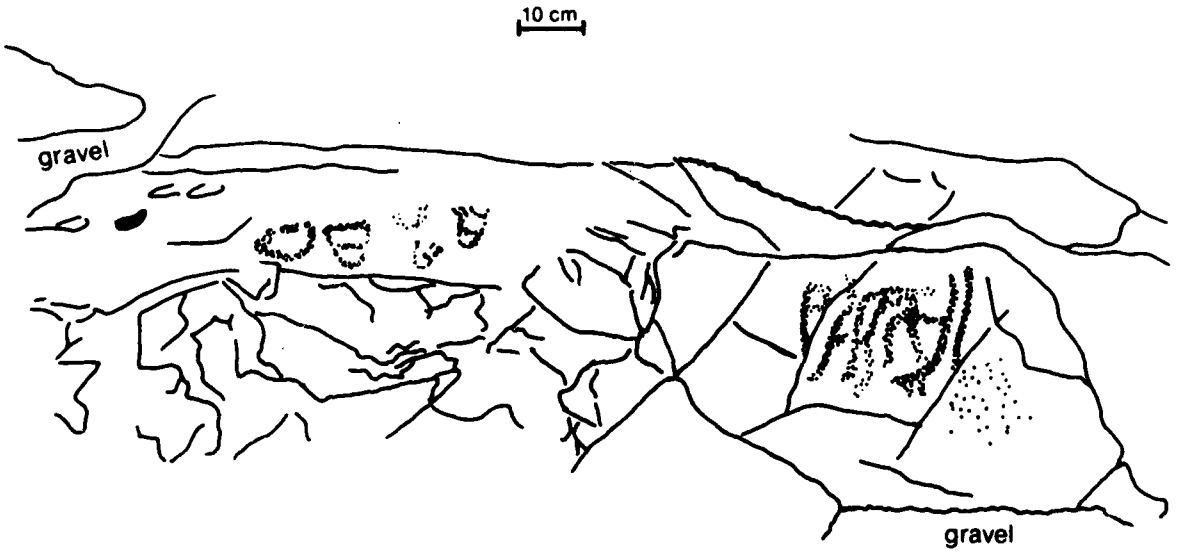


Figure 4. Panels 5 and 6 at 10BR3A.

37° rock slope. Peterson's slides from 1979 and 1982 and the photodocumentation from this project were used to illustrate this panel.

Panel 6 includes several possible bear paws, the smallest of which is 3.5 x 5.5 cm. There is also an area of peck marks and a very faint, water-eroded design about 0.08 cm deep covering a 22 x 31 cm area (Figure 4). Lichen has probably obscured some figures in this panel. The petroglyphs are on a 40° slope and were illustrated using Peterson's slides from 1982 and the photographic information generated by this project.

Panel 7, just south of panel 6, is on a 32° rock slope. Gravel covers portions of a few of the petroglyphs and lichen and moss probably obscure many more. Possible bear paws and other figures are on the rock face (Figure 5). The northernmost portion of this panel was illustrated using one of Peterson's 1979 slides.

Panel 8 has two parts. The southern rock, with an 11° slope, has a circle intersectd by a line, and several peck marks extend for 20 cm on the upper surface of a low rock about 15 cm above the sand and gravel beach. The northern part of panel 8 is on a spalled and cracked rock with a 31° slope. It consists of several figures, including possible bear paws, an intersected triangle, and other unidentified figures (Figure 5).

Panels 9, 10, 11, and 12 are all on the same rock outcrop (Figure 6). The rock face is 8.3 m long, averages 1 m high, and has a 42° slope. The petroglyphs are primarily bear paws, the largest of which is 15.5 x 31 cm long and 0.16 cm deep. Intersected ovals, a large triangle intersected by several lines, a vertical line with radiating horizontal lines, and other unidentified figures are also present. Some of the figures are buried in gravel and there are spalls and cracks on the rock face. Extensive lichen and moss obscure many of the figures.

The rock faces for panels 13, 14, and 15 were relocated in the field but the petroglyphs were too vague or not visible in the existing light conditions to permit sketching or photographing.

One additional figure from 10BR3A was removed from the site many years ago and is now part of a Sandpoint fireplace. The petroglyph is about 35 cm long and is an abstract figure with unknown orientation (Figure 6). The illustration is from a slide taken by Peterson in 1985.

10BR3B

Site 10BR3B is located on a single rock outcrop about 6 m south of a small bay on the northwest end of the island. The rock faces west, has a 42° slope, and measures 1.21 x 3.05 m. The petroglyphs appear to have been pecked through the red exterior of the rock face into the underlying yellow-brown rock. The upper and lower portions of the rock face have extensive lichen growth which covers some figures. The more exposed middle area also has lichen growing in the depressions of the petroglyphs.

The figures are quite faint but appear to represent bear paws as well as a few abstract or unidentified petroglyphs (Figure 7). A few of the figures are defined by individual pecks, but most were formed by connected

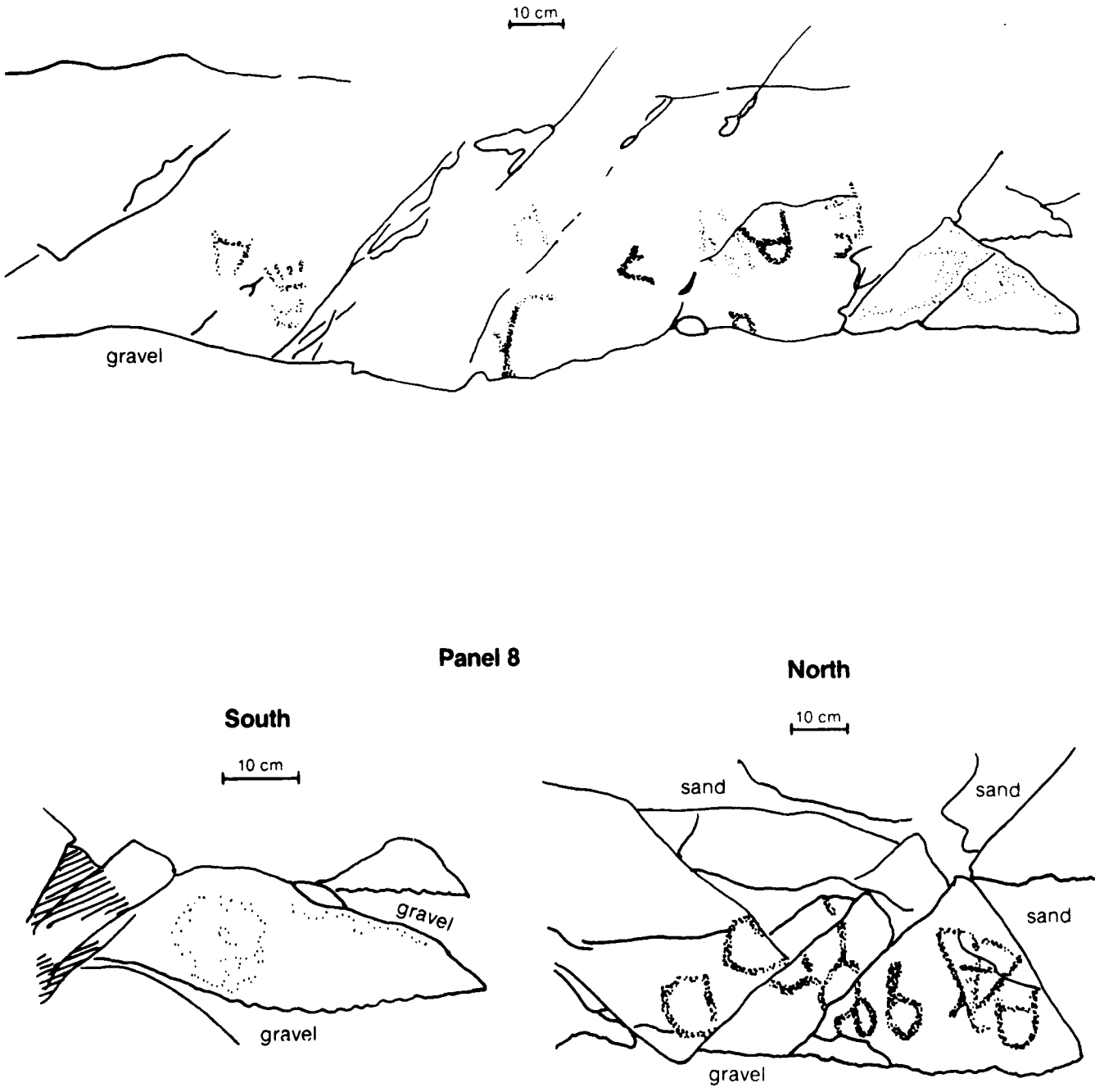
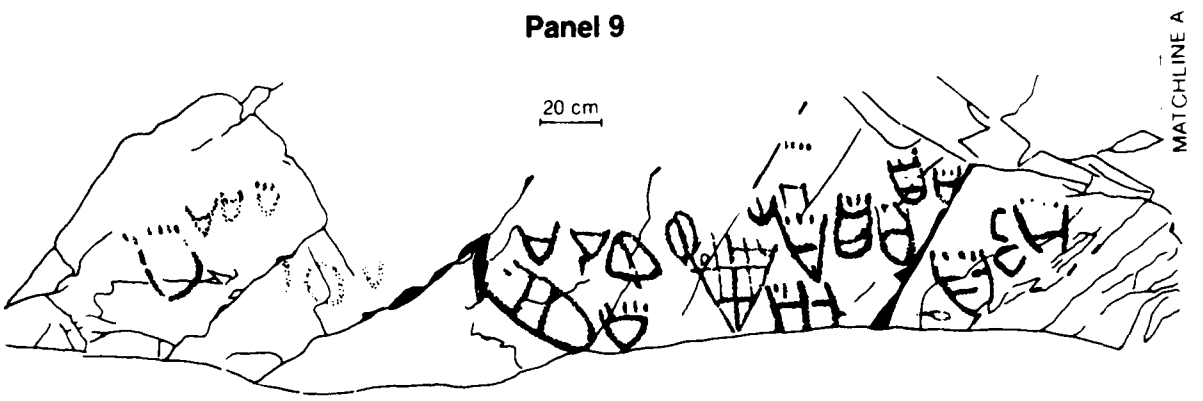
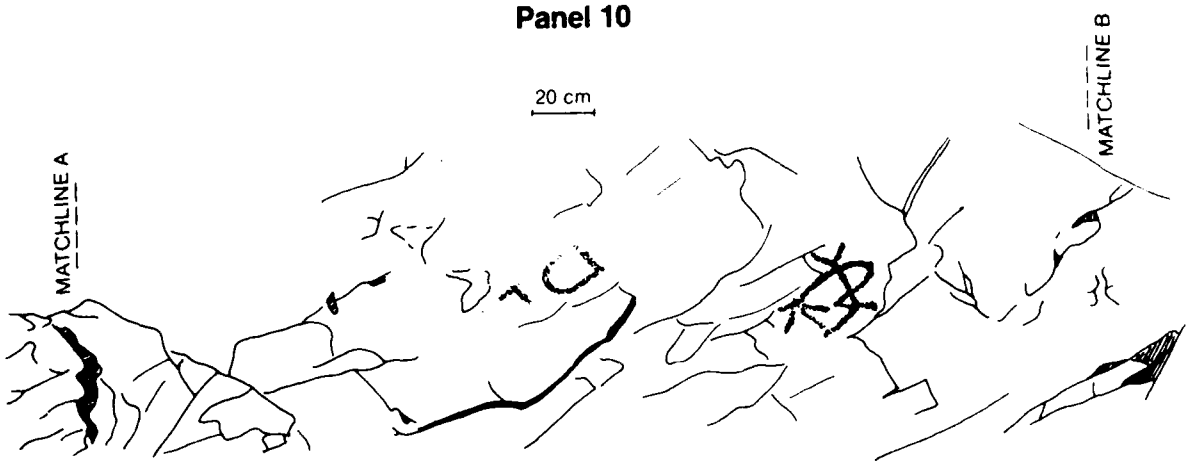
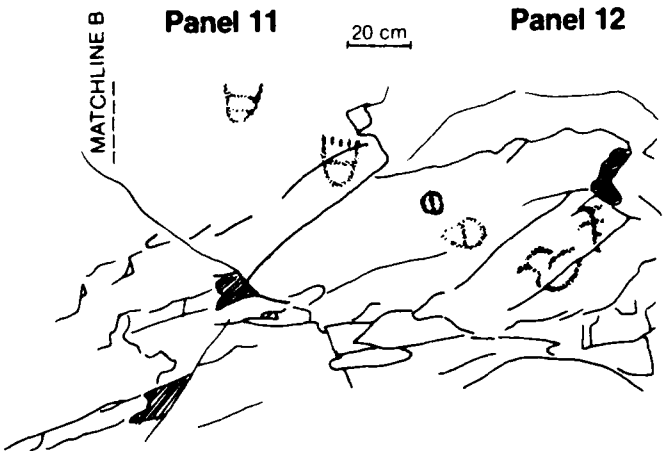


Figure 5. Panels 7 and 8 at 10BR3.







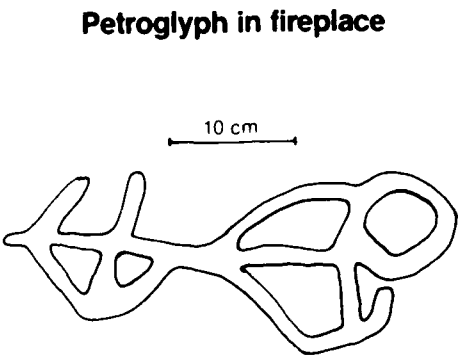


Figure 6. Panels 9, 10, 11, and 12, and the petroglyph removed from site 10BR3A.

Figure 7. Petroglyphs at 10BR3B.

pecks. A five-toed bear paw near the middle of the panel has two horizontal lines and a small tail on the lower end. This petroglyph is 12 x 16 cm long and 0.04 cm deep. The illustration was compiled from the photodocumentation from this project as well as Peterson's slides from 1979, 1982, 1983, and 1985.

10BR3C

Site 10BR3C is situated at a small bay on the west side of Memaloose Island. It consists of three panels of very faint petroglyphs, all of which face west (Figures 8 and 9).

Panel 1 appears to be an array of bear paws on a rock outcrop about 3 m high and 6 m long (Figure 8). The slope of the rock face ranges from 36° to 54°. Moss and various types of lichen obscure many figures on this rock, which several years ago was reported to have been covered with bear paws. The depth of the petroglyphs ranges from 0.06 to 0.25 cm. Some of the peck marks are eroding and spalling from moisture, thereby distorting the original figures. The panel is well above the high-water mark.

Panel 2 is located on a water-rounded rock outcrop about 28 m west-northwest of panel 1 (Figure 9). The two clusters of peck marks on this panel are about 1.5 m above the high-water mark; however, the rock and figures are exposed to the prevailing southwest wind and to wave action from 13 km of open lake water. The peck marks of the figures are elongated and distorted from this water erosion.

Panel 3 is found on a rock outcrop on the northern edge of the bay and south of a small cove and a steep rock outcrop. The figures appear to represent bear paws and an intersected circle (Figure 9). The petroglyph on the right side of the panel is on a 39° slope, the upper middle figures are on a 16° slope, and the lower bear paws on the left are on a 50° to 78° slope. Although the figures were sketched in the field, the extensive lichen cover and light conditions did not permit photodocumentation.

10BR4

Site 10BR4 is located on the west shore of the peninsula south of Hope, Idaho, on the mainland east of Memaloose Island. Four areas of petroglyphs have been identified over a 440 x 20 m area on the beach. The site extends over several privately owned land parcels. Vegetation on the site includes ponderosa pine, juniper, Douglas fir, extensive lichen and moss, and introduced lawn grasses and ornamentals.

The area is characterized by low, subrounded rock outcrops interspersed with gravel and sand. More prominent angular outcrops are at the southern end. The rock was petrographically analyzed as an argillite with poorly defined bedding. The sample from 10BR4A, panel 13, has a dark gray core with an intermediate 0.15-cm-thick, light gray weathering band, and an outer 0.05-cm-thick, orange-brown rind. The orange-brown rind is due to the oxidation of smectite to limonite.

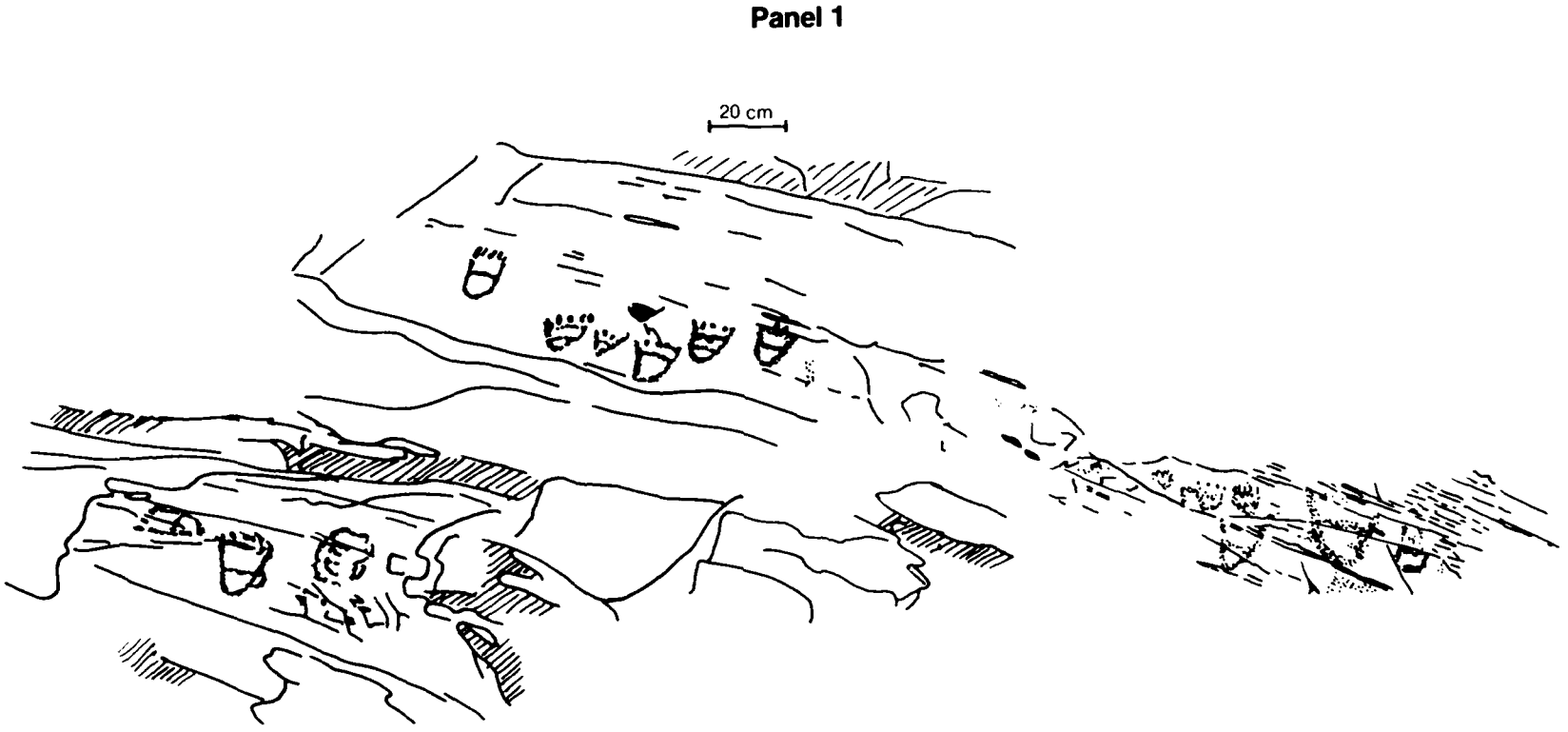
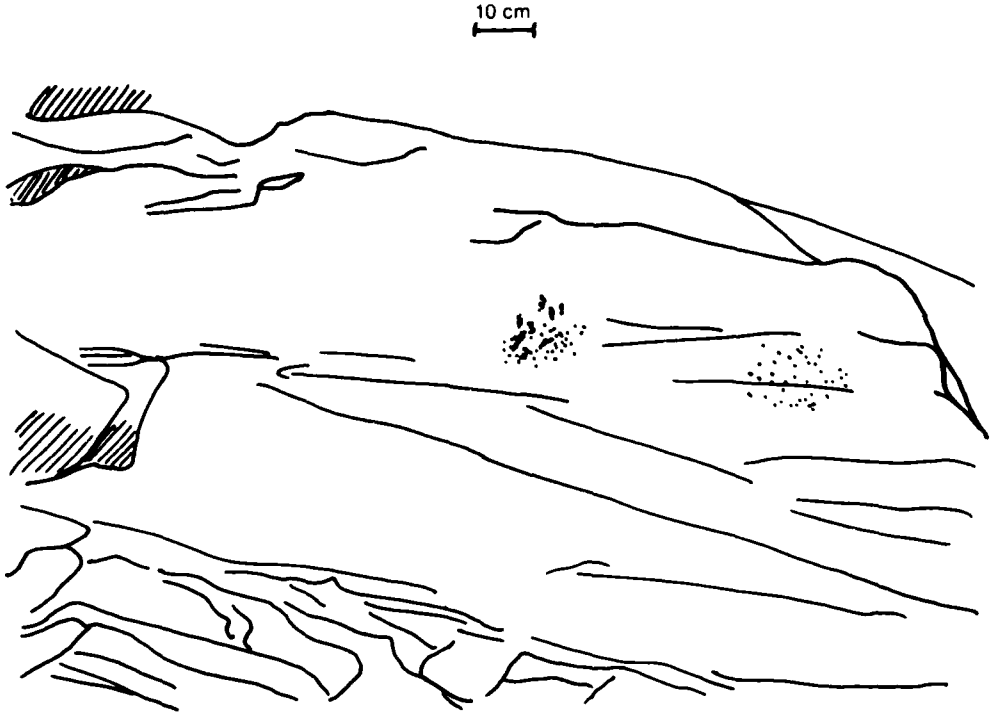


Figure 8. Panel 1 at 10BR3C.

Panel 2



Panel 3

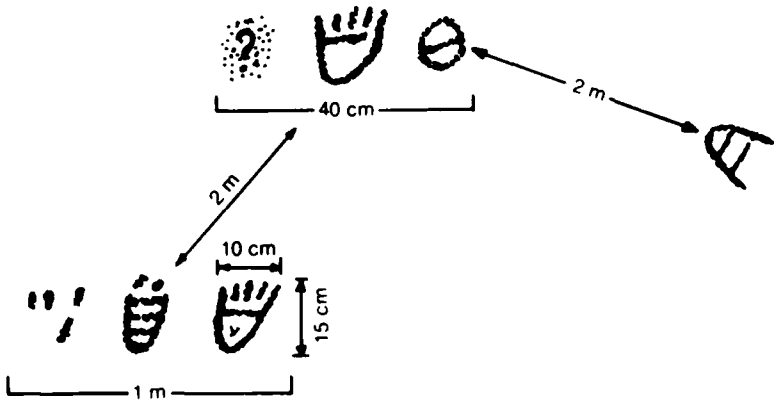


Figure 9. Panels 2 and 3 at 10BR3C. Panel 3 is illustrated from a field sketch.

The area was the focus of some of the earliest historic activity in the Pacific Northwest. Although not absolutely determined, the remains of David Thompson's Kullyspel House, built in 1809, appear to be within the area of 10BR4 (Bailey 1943:276-278; Smith 1985:155-157). Regardless of the location of Kullyspel House, it is certain that early fur trading operations did take place in the vicinity.

A report from the 1930s mentions the petroglyphs at 10BR4, which were said to include a great many Indian inscriptions, including a large bear paw (Erwin 1930:49). A later reference mentions "a huge outcrop of rock on the mainland directly across from Memaloose Island. He [Old Aleck] described the rock pile as marked with Indian writings, with bear paws dominating... many of the bear paw signs were with the claws folded within the palm" (Bailey 1943:277).

In 1966, 10BR4 was recorded by Sneed and Sims as consisting of two rock outcrops with petroglyphs, two circular depressions ca. 2 m in diameter, and the foundation of Kullyspel House. Peterson re-recorded the site in 1979 and described two areas of rock art. He later added two more areas to the 10BR4 site complex. Other indications of prehistoric activity have also been noted in the area, including fire-cracked rock and a wide variety of flaked and ground stone.

The four areas of petroglyphs begin at the southernmost edge of Owens Bay with Area A. Area C is 168 m south, Area D is on a rock outcrop 158 m further south, and Area B is on a smaller rock outcrop 111 m south of Area C, or 437 m south of Area A (Figure 10).

10BR4A

The northernmost area of petroglyphs consists of 21 panels, many of which are single figures, located over a 30 x 35 m area (Figure 10). The panels face various directions. Curiously, panels 2 through 10 are located in an almost straight north-south line.

All but panels 1 and 13 are near or below the high-water mark and have been affected adversely by lichen growth, wave erosion, masking by water-deposited silt, and cracking and spalling from freezing and thawing. Construction of a dock has damaged some of the figures. There is no doubt that there are additional petroglyphs in Area A which were not visible during the fieldwork because of poor light conditions. The datum of 10BR4A is located on panel 1.

Panel 1 is on a west-facing rock with a 7° slope. The three figures include an intersected circle, a short line, and two connected convex arcs 28 cm high having an intersecting line 18 cm long extending out of the left (north) side. The figures were made by connecting peck marks, resulting in lines about 1 cm wide and 0.22 cm deep. The panel is cracked and spalled (Figure 11).

Panel 2 includes several figures facing west on a rock with a 48° slope in the northern third and a 12° slope in the remainder of the panel. The figures include an intersected circle, a faint bear paw, several curved lines, and other indistinct figures (Figure 11). The panel extends over a

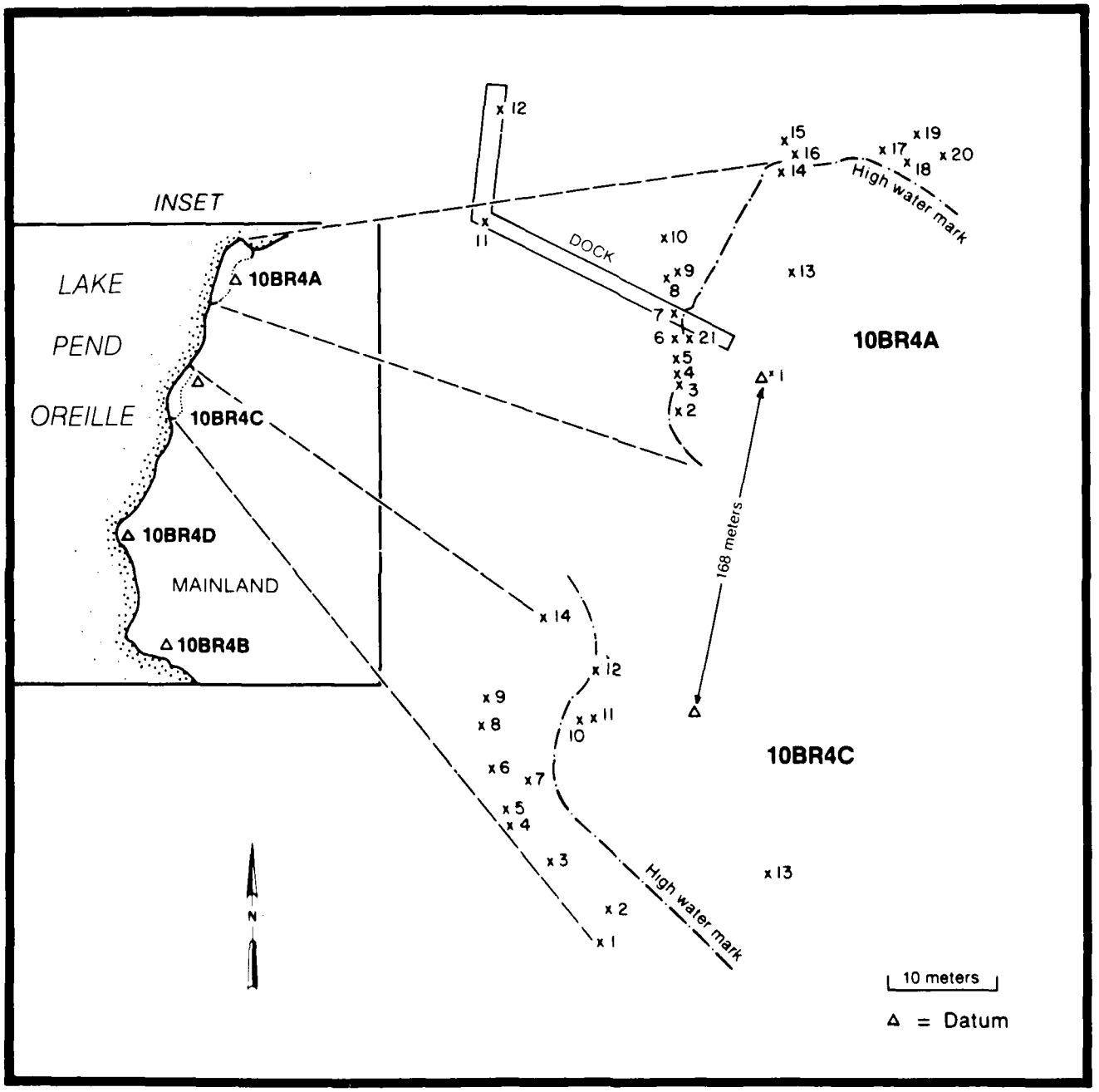


Figure 10. Location of Areas A, B, C, and D, and rock art panels in Areas A and C at 10BR4.

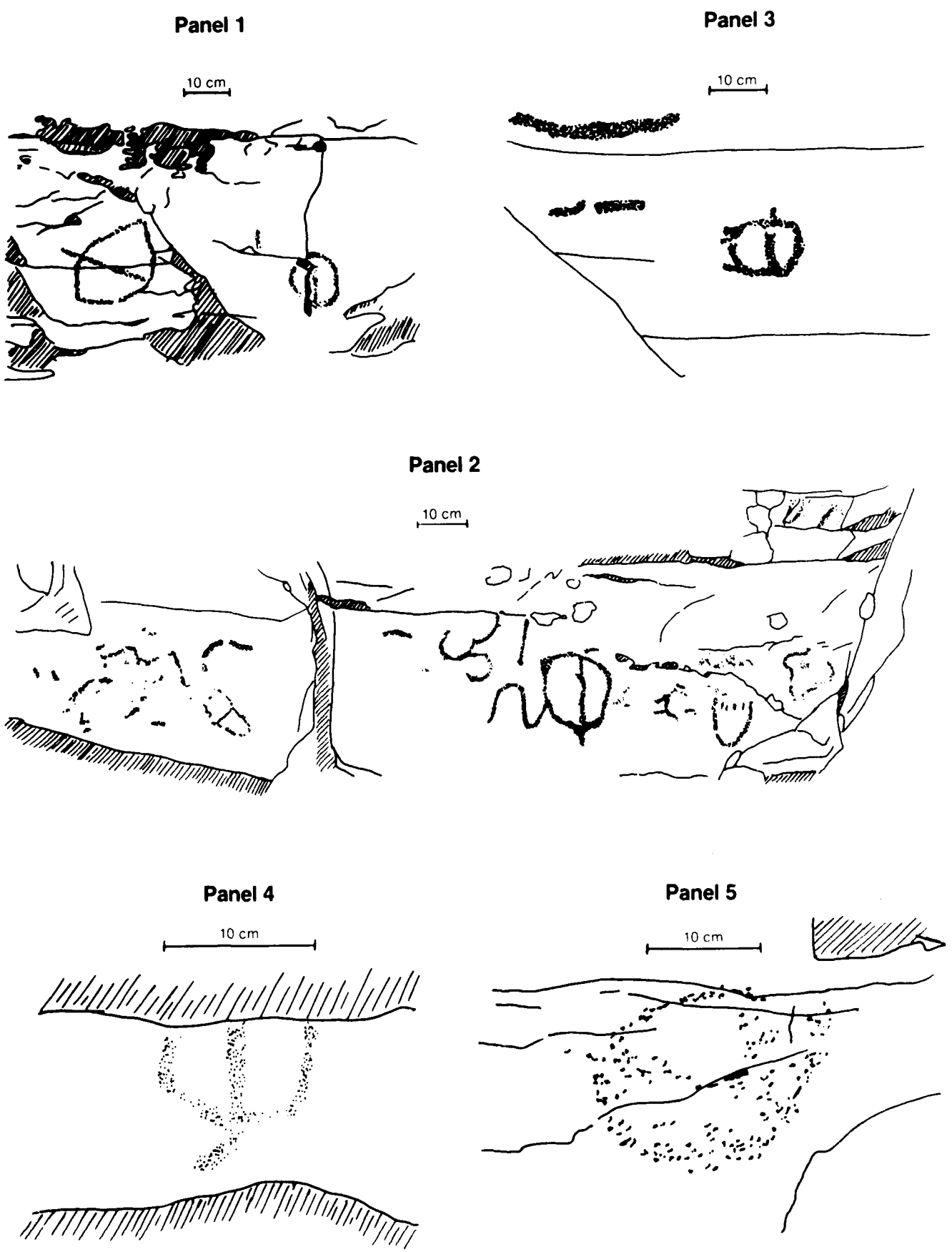


Figure 11. Panels 1, 2, 3, 4, and 5 at 10BR4A.

30 x 180 cm area. In addition to the photodocumentation from this project, Peterson's slides from 1981 and Boreson's slides from 1979 were used to illustrate panel 2. Lichen obscures many of the figures in this panel.

Panel 3 is located on a level rock surface (0° slope). The petroglyphs represent a circle intersected by a vertical line, a horizontal line, and a slightly curved line 29 cm long having a groove that is 1.5 cm wide and 0.22 cm deep (Figure 11). There is extensive lichen growth on this rock.

Panel 4 slopes 15° toward the west. The petroglyphs consist of part of a circle intersected by a vertical line extending out from the lower end of the arc (Figure 11). The upper third of the petroglyph is apparently spalled off.

Panel 5 is a single figure facing north on a rock with a 5° slope. The petroglyph, which is pecked to a depth of 0.06 cm, appears to be a horizontally intersected oval 18 x 23 cm.

Panel 6 is on a horizontal surface and includes two intersected arcs, an intersected circle, and other faint unidentified figures (Figure 12). Two additonal intersected circles which were not photographed or illustrated were sketched. These are located 76 and 120 cm left (north) of the illustrated figures. Peterson's slides from 1982, Boreson's slides from 1979, and the slides and sketches from this project were used to illustrate panel 6.

Panel 7 consists of a circular arrangement of peck marks on a horizontal rock surface under a dock. There also appears to be an intersecting line and a smaller interior circle (Figure 12).

Panel 8 is found on a rock surface sloping 32° toward the east. It includes a circle 0.1 cm deep at the center intersected by vertical and horizontal lines and another possible circle (Figure 12).

Panel 9 is a single figure situated on a north-facing rock with an 8° slope. The petroglyph is a horizontally intersected oval 16 x 20 cm with peck marks that are 0.3 cm deep (Figure 12). There may be an area of peck marks to the right of the illustrated figure.

Panel 10 is facing northwest on a rock surface with a 7° slope. The figure appears to be a circle that is vertically and possible horizontally intersected (Figure 12). The petroglyph was made by a rather blunt object with a striking area ca. 0.5 cm across. This implement created concave depressions ca. 0.04 cm deep. An area of peck marks was sketched but not photographed below the one illustrated in Figure 12.

The figure on Panel 11 is an intersected circle on a west-facing rock with a 10° slope (Figure 13). The panel is located under a dock. Slides of Peterson's from 1981 were used to illustrate this panel.

Panel 12 is about 1.4 m under water at high water. The rock faces east but the area with the petroglyphs is horizontal. Six circles, five of which appear to be intersected, some with extended lines, and other nondescript figures are on the rock face. The rock has broken in two areas, removing

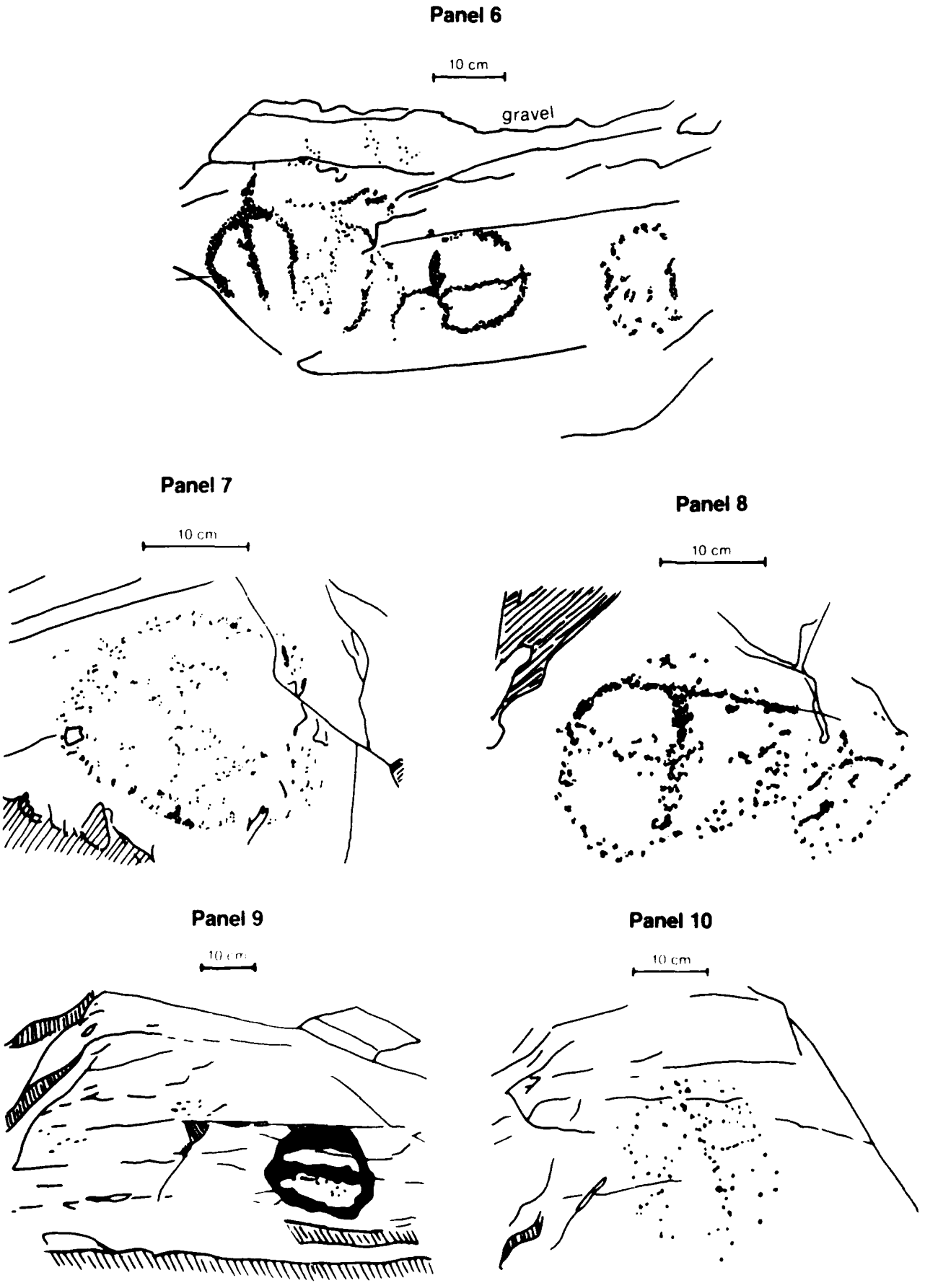


Figure 17. Panels 6, 7, 8, 9, and 10 at 10BR4A.

part of at least two figures (Figure 13). Peterson's slides from 1981 and the slides from this project were used to illustrate the panel.

Panel 13 is located on a broken rock that had one spalled section nearby (Figure 13). The broken and incomplete figures are on a west-facing rock with a 30° slope. The figures, about 0.04 cm deep, are pecked through the red cortex of the outer layer of rock. A 1979 slide of Boreson's was used to illustrate the panel.

Panel 14 is a diagonally intersected circle located on a rock sloping to the north. The connected pecks range from 0.04 to 0.08 cm deep (Figure 13).

Panel 15 is on a west-facing rock that slopes 32°. This faint, vague figure appears to be a diagonally intersected circle produced through pecking (Figure 14). Another petroglyph 82 cm to the right (south) of the illustrated figure was sketched.

Panel 16 is on an east-facing rock with a 45° slope. It is composed of a circle with vertical and horizontal intersecting lines pecked to a depth of 0.08 cm and another nondescript figure (Figure 14).

The figures in panel 17 could not be photographed due to poor light conditions and therefore are not illustrated. The notes and sketch indicate this panel is on a rock with a 47° slope that faces east and consists of two circles that are horizontally intersected.

Panel 18 is a nondescript, curvilinear figure about 0.16 cm deep covering a 23 x 30 cm area (Figure 14). The petroglyph is on a rock with a 38° slope facing east.

Panel 19 is an arc that terminates at the broken edge of the rock (Figure 14). The petroglyph is 0.06 cm deep and is on a 40° sloping rock that faces east.

Panel 20 is on an east-facting rock with a 35° slope. The figure is an arc or half-circle (Figure 14).

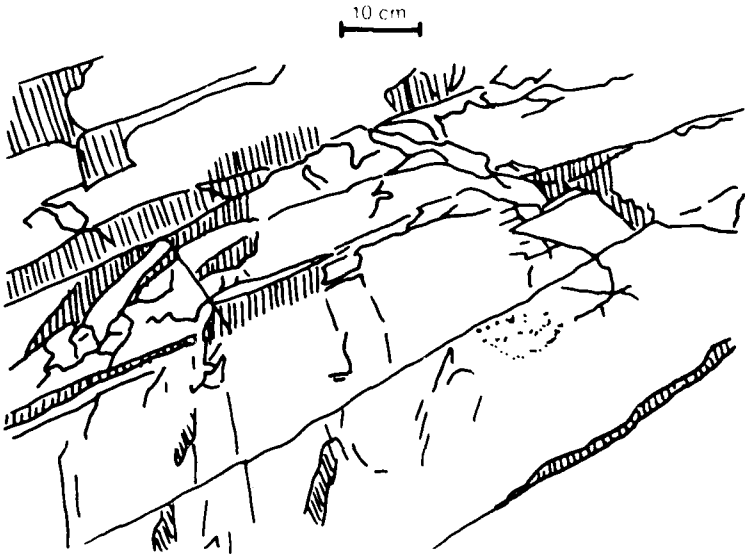
Panel 21 is located on a horizontal rock surface and contains an unidentified figure. There are no slides depicting this petroglyph, but a black-and-white print provided the information necessary for the illustration (Figure 14).

10BR4B

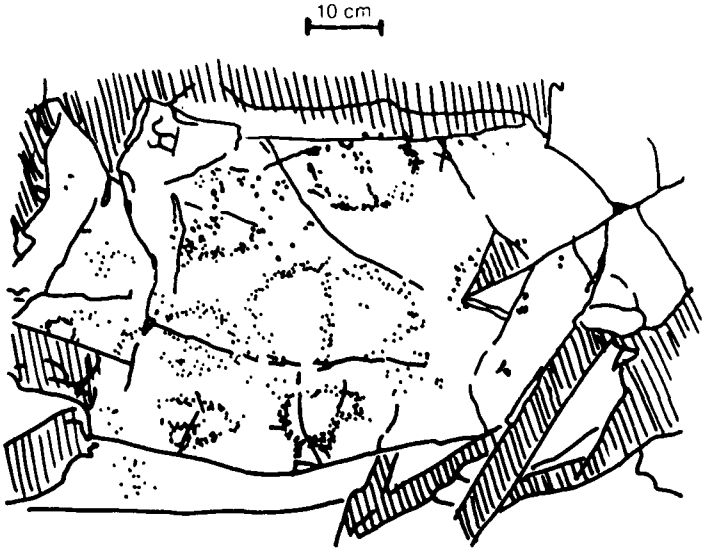
Site 10BR4B is located on a rock outcrop situated in a protected area well above the high-water mark of Lake Pend Oreille. The rock face upon which the petroglyphs were pecked is facing east and has a 40° slope. The very faint figures are about 30 cm above the ground. They appear to represent three bear paws. The middle figure is 15 x 20 cm and has lines that are 2.5 cm wide and 0.3 cm deep (Figure 15).

Several years ago, heat from a campfire in front of the rock apparently spalled off a section of the face which included two bear paws. These petro-

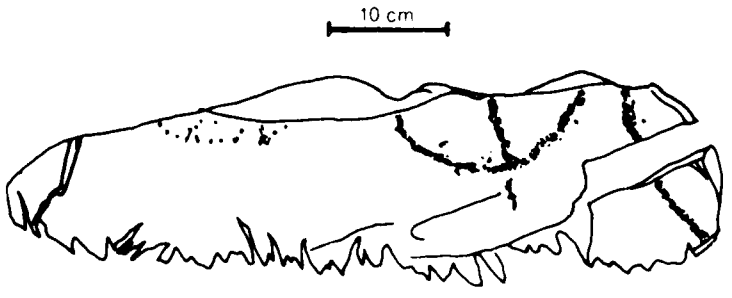
Panel 11



Panel 12



Panel 13



Panel 14

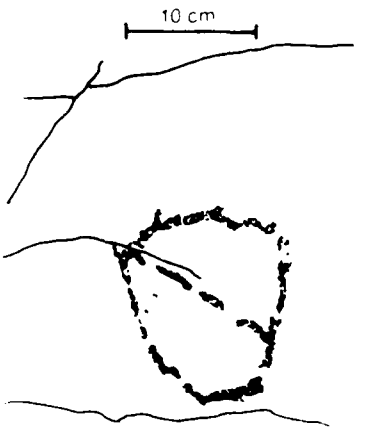


Figure 13. Panels 11, 12, 13, and 14 at 10BR4A.

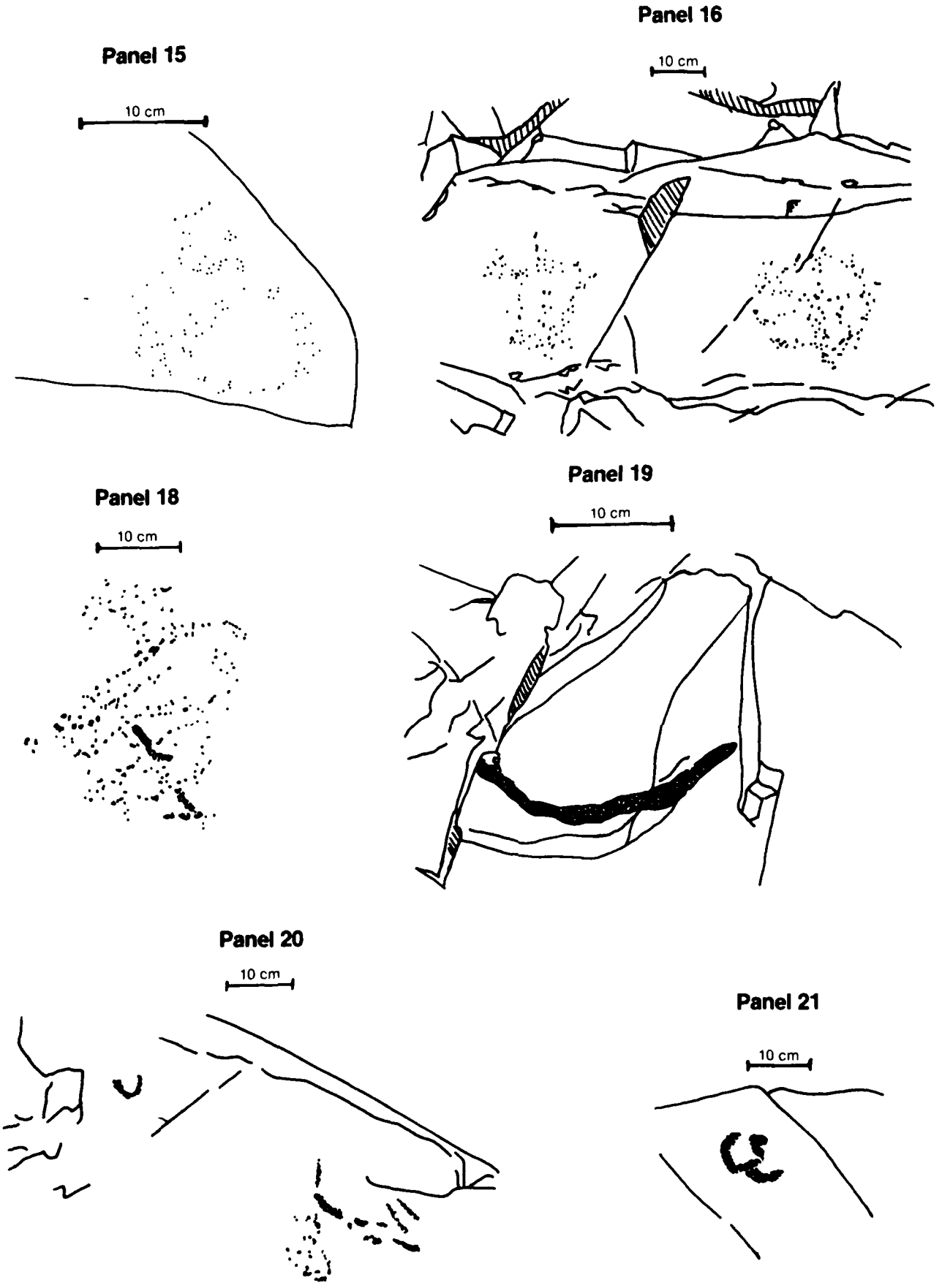
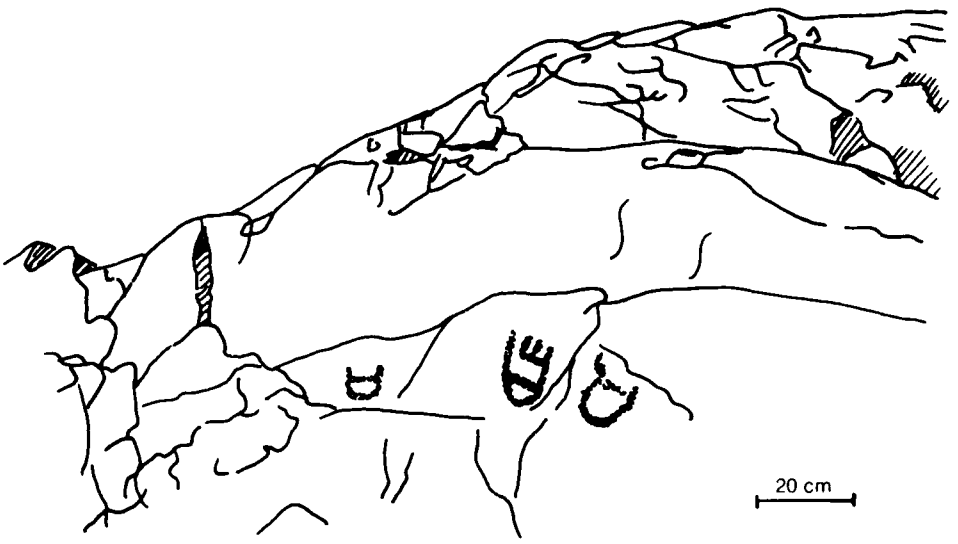


Figure 14. Panels 15, 16, 18, 19, 20, and 21 at 10BR4A.



Petroglyphs in gatepost

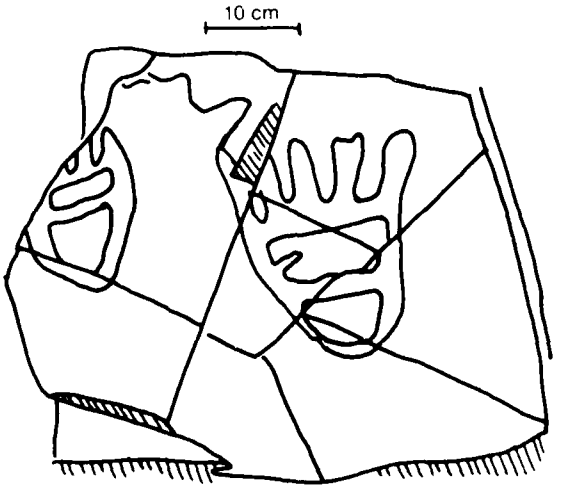


Figure 15. Petroglyphs at 10BR48.

glyphs were subsequently cemented into a gatepost at a local residence. The largest bear paw is 17 x 22 cm and the lines are 2 cm wide. This may be the same figure depicted in a photograph published in 1943 by Bailey (1943:277).

10BR4C

Site 10BR4C includes 14 panels which are located over a 32 x 37 m area. All but panel 13, which may not be a petroglyph, are below or near the high-water mark. The panels all face west.

This area of petroglyphs resembles Area A in many respects, including the placement of figures on low, subrounded rock outcrops near the high-water mark, the dimensions of the area, the frequent occurrence of one figure per panel, and the preponderance of intersected circles.

The deterioration of the petroglyphs in Area C is primarily due to water erosion, which is gradually erasing the figures, and from the effects of freeze-thaw cycles. There are undoubtedly more figures in this area that have not yet been identified.

The datum for Area C is just west of an isolated juniper tree, and was marked by a spike driven into the ground.

Panel 1 is located on a rock with a 50° slope. The very faint pecked figures represent two vertically intersected circles (Figure 16). The illustration was made from a 1979 slide of Peterson's.

Panel 2 consists of a single figure that appears to be a circle with a straight base about 15 cm wide (Figure 16).

Panel 3 is found on a 30° slope on a rock that measures 33 x 76 cm. The two petroglyphs (Figure 16) each consist of two intersecting lines, 4 x 6 cm and 6 x 6.5 cm. The rock was covered with water-deposited silt.

Panel 4 includes a pecked, horizontally intersected 20 x 23 cm oval with a crack through the middle, a smaller circle, and two possible bear paws (Figure 16). An additional circle to the right of the illustrated figures was identified in the field but was not visible in the slides.

Panel 5 consists of four circles, one intersected horizontally, two intersected vertically, and one intersected both ways. The upper circle also has connected peck marks in the lower right quarter (Figure 17).

To the left (north) of panel 5 is panel 6. The figures include one or possibly two intersected half-circles with a line extending vertically out of the circle. Another unidentified figure is on the broken, cracked rock face (Figure 17). The photographs from this project and Peterson's slides from 1981 and 1982 were used to prepare the illustration.

Panel 7 is a scatter of apparently random peck marks (Figure 17). Some of the peck marks may be from natural causes.

Panels 8 and 9 contain clusters of peck marks forming a circular pattern (Figure 18). The pecks in panel 9 are elongated, either from water

erosion or from the method of manufacture (i.e., striking the rock surface with a chisel at an angle less than 90°).

Panel 10 consists of a single circle of connected pecks. This panel is spalled in the upper right corner (Figure 18).

Panel 11 includes two figures, neither of which could be identified (Figure 18). A crack in the rock may have altered the form of the petroglyphs.

Panel 12 is an area of faint peck marks (Figure 18); these could be natural flaws in the rock.

Panel 13 is not illustrated. The grooves on this panel could be the result of driftwood grating against the rock surface.

Panel 14 is a single figure consisting of a diagonal line with three lines extending off the left side (Figure 18).

10BR4D

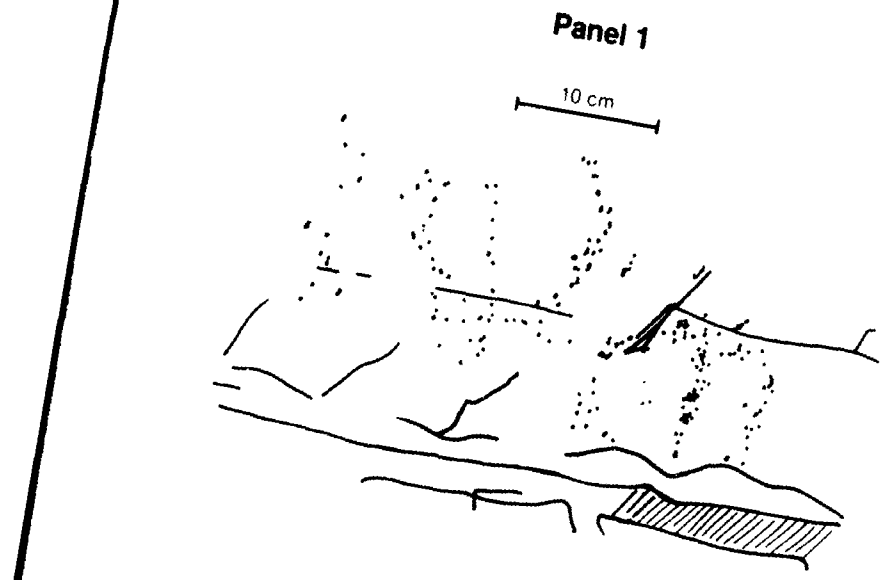
Site 10BR4D is next to and above Lake Pend Oreille on a prominent rock outcrop at the south end of a sand and gravel beach. The petroglyphs extend over a 50 x 60 cm area on a west-facing rock surface with a 20° slope. Lichen and moss grow on the cracked rock face.

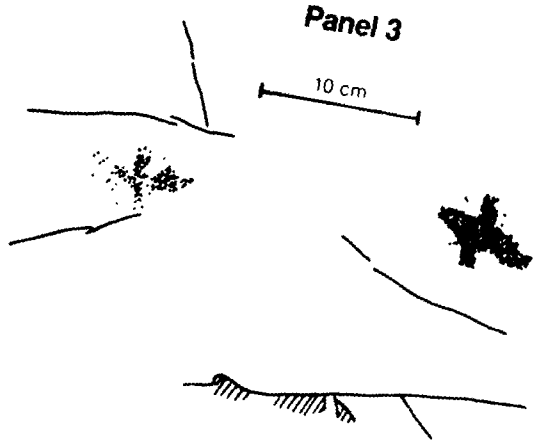
The petroglyphs include a large bear paw (9 x 12 cm), one or two smaller bear paws, and an unidentified figure (Figure 19). Slides from Peterson's collection from 1981, 1982, and 1985 were used to prepare the illustration. The datum for this panel is 37 cm left (north) of the large bear paw, and was marked by a spike driven into a crack in the rock.

10BR5 - Bearpaw Rock

Site 10BR5 is located on land administered by the Idaho Panhandle National Forests. A 1981 Forest Service map identified the site on a point of land on the west side of Denton Slough, about 1.6 km east of Sheepherder Point. Prior to the rise in the lake level behind Albeni Falls Dam, the North Fork of the Clark Fork River flowed ca. 0.5 km south of the site, emptying into Lake Pend Oreille about 0.8 to 1.2 km southwest. A creek apparently draining from the southern end of Denton Slough was within 0.2 km of the site. Today the site is about 6 m north and 2 m above the present high-water mark of the lake. A line across the rock face suggests an earlier episode of high water.

The petroglyphs are on a rock outcrop with a 58° slope that faces east. The site is situated in a V-shaped gapamong numerous other rocky projections. The rock was petrographically analyzed as a compact, fine-grained arkosic sandstone. Layering was seen as weakly defined tan and gray bands 0.1-0.2 cm thick.





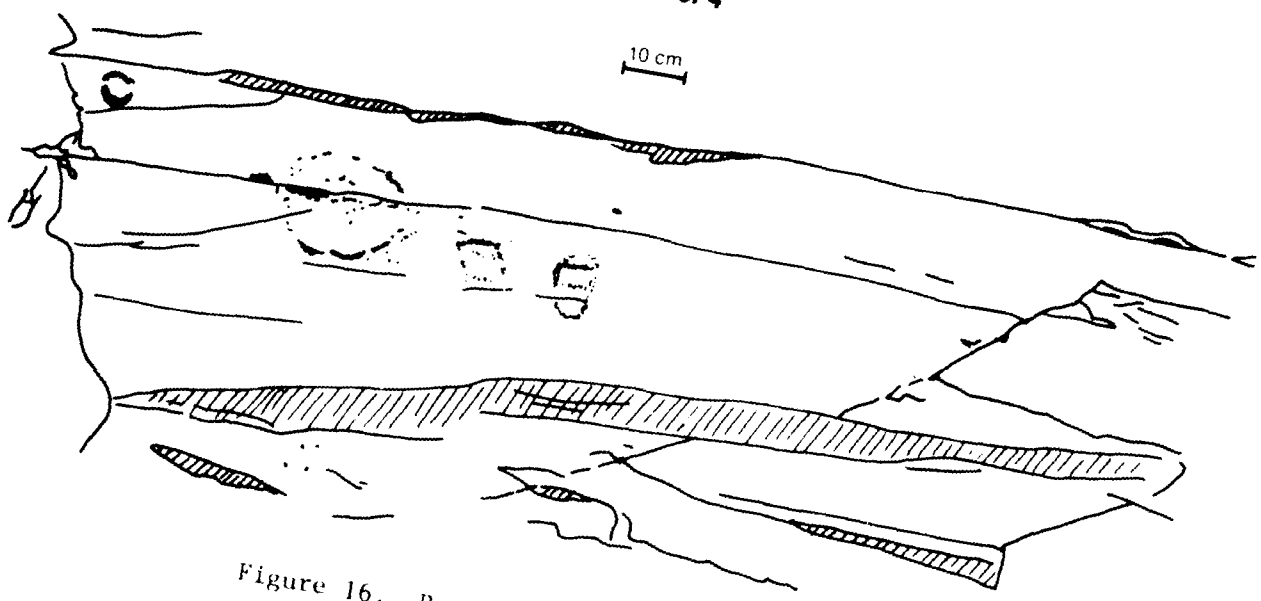
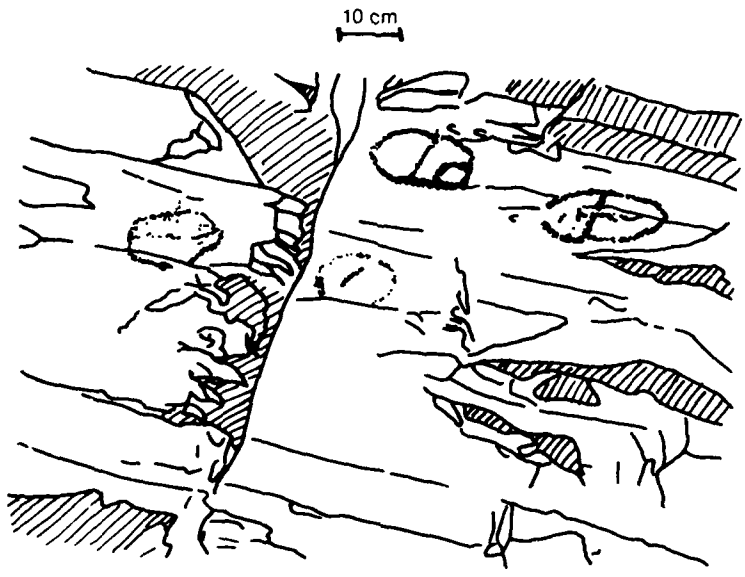
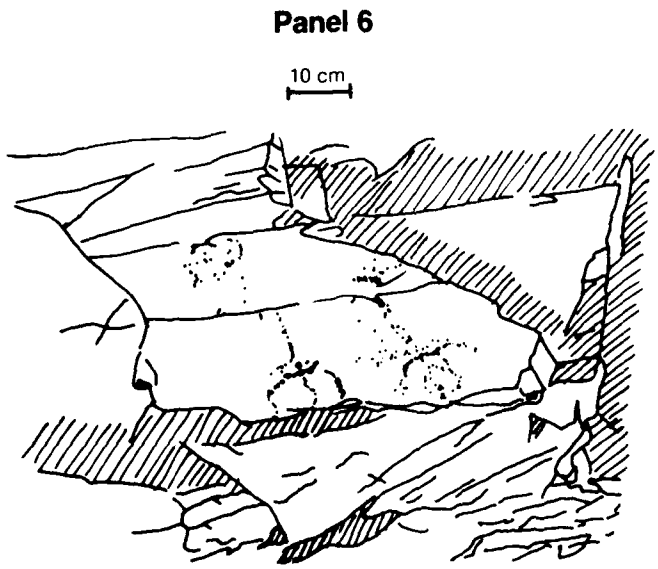


Figure 16. Panels 1, 2, 3, and 4 at 10BR4C.





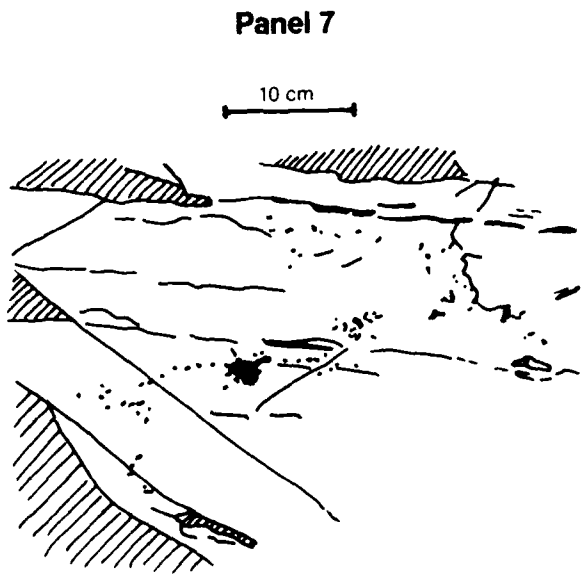


Figure 17. Panels 5, 6, and 7 at 10BR4C.

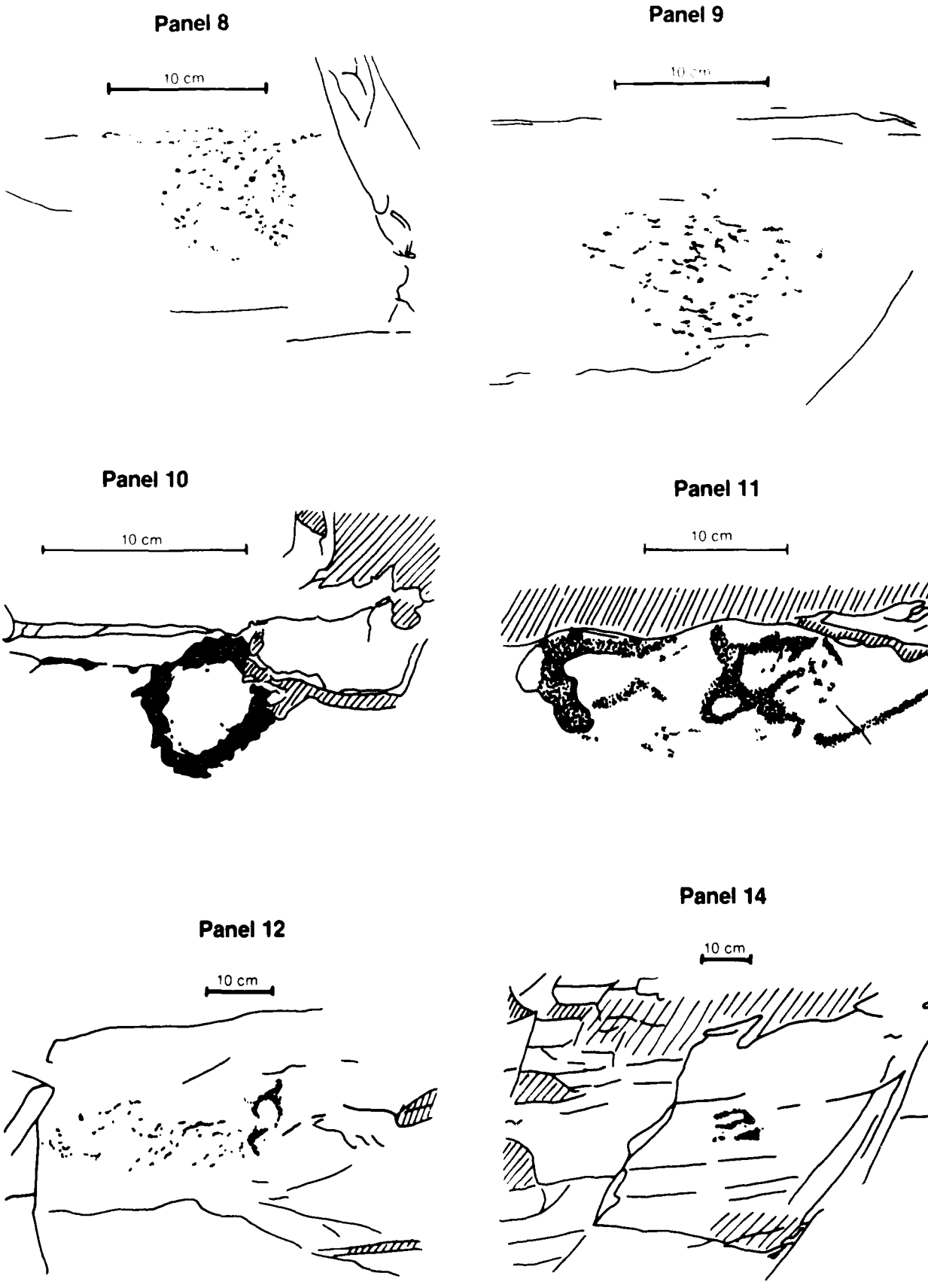


Figure 18. Panels 8, 9, 10, 11, 12, and 14 at 10BR4C.

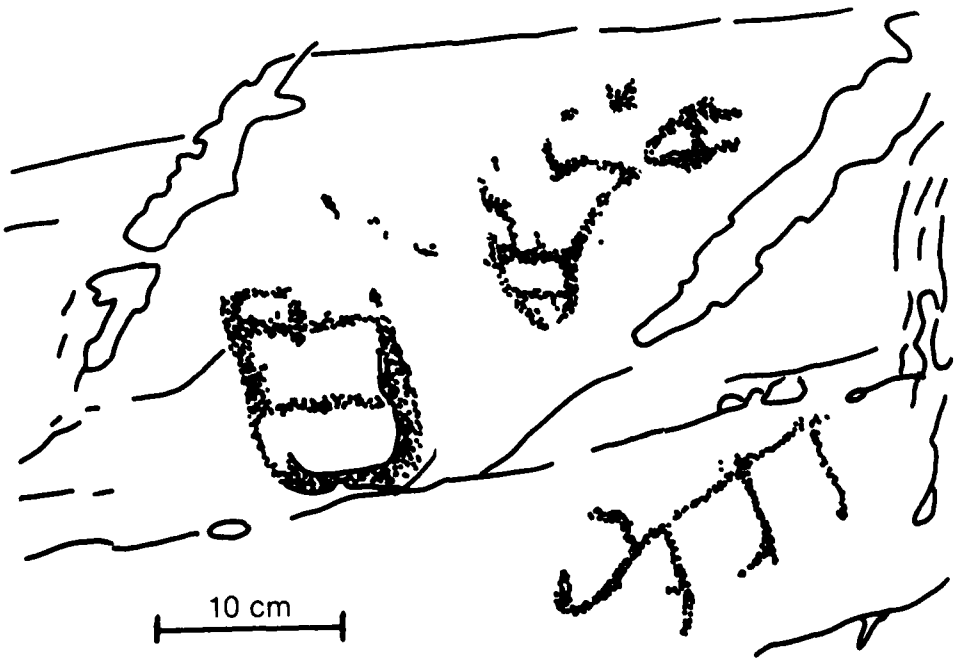


Figure 19. Petroglyphs at 10BR4D.

This area of Lake Pend Oreille was apparently the focus of considerable prehistoric activity. Ray (1936:129) indicates a permanent Kalispel settlement with 300-400 people was located at the mouth of the Clark Fork River, an area noted for its fishing grounds. Smith (1985:212, 214) also relates the popularity of the Clark Fork River as a fishing area and mentions people camped here in late summer and sometimes through the winter.

Peterson (1979) notes that the Indians camped on a sandbar along the North Fork of the Clark Fork River until the 1930s. The campsite, 60-90 m wide and 2.4 km long, was situated about 0.4 km south and southwest of 10BR5. Pow-wows and horseraces were held in the meadow between the campsite and the petroglyphs. By 1977, ca. 1.5 m of the upper surface of the campsite had washed away.

Many flaked and ground stone artifacts have been found in the vicinity. Eighteen modified cobble fragments, described in Appendix C, were found in front of 10BR5 within the sediment accumulated between the rock outcrops. These artifacts were collected in 1969 and may represent the tools used to create the petroglyphs.

The petroglyphs at Bearpaw Rock were first described and illustrated in 1893 by John Leiberg. A photocopy of the illustration is included in Figure 20 and this early description of the petroglyphs is provided below.

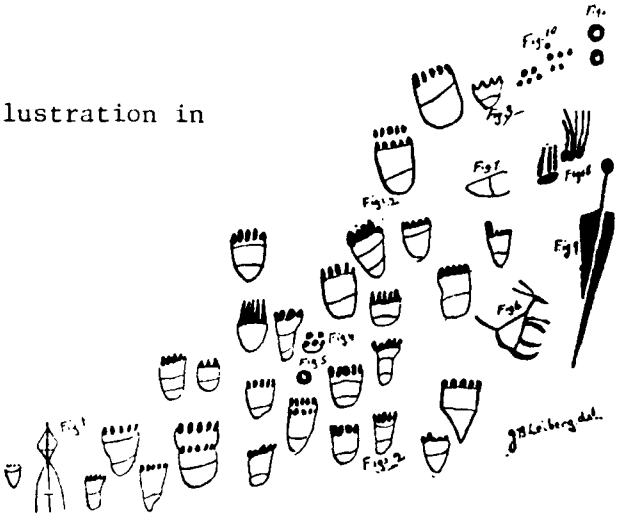
> There are twenty-eight figures evidently representing the footprints of the bear, three of the tracks with double sets of toes, three with but four toes, and one with but three toes. Three figures which may represent tracks of the cougar. One arrow head. Three points within circles. One mountain goat. Two sets of circles composed of five and six respectively, and three large figures of unknown meaning. Besides these figures there are evidences of many light scratches, but the lines are too dim to be traced with certainty....Figs. 2 are 3.2 cm. in width and 1.2 cm in depth, while the cutting forming fig. 3 is, in its broadest portion, 5.5 cm. wide and 2.5 cm. deep (1893:156).

The site is again mentioned in 1903 in The Illustrated History of North Idaho. The article is based on Leiberg's observations but adds that the site is located "near what is known as Steamboat Landing....a settlement at the extreme southern point of Lake Pend Oreille" (1903:754, 815). The misplaced location may be due to the existence of more than one Steamboat Landing (what is now Denton Slough was a steamboat stop), or may be a publishing error.

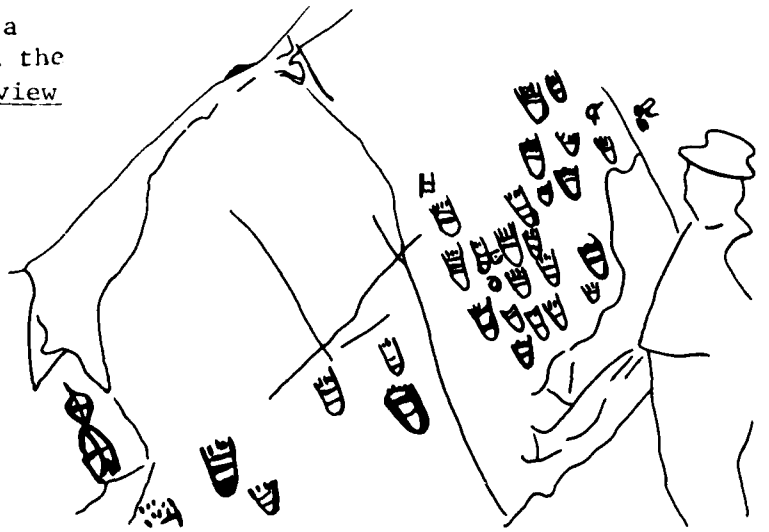
A 1906 edition of the Spokesman Review published an indistinct photograph of the petroglyphs at 10BR5 (illustrated in Figure 20) with the following article by Leiberg.

> There is but one locality in this region with true rock carvings and it is one of the most interesting to be found in the great northwest. It is located on the shores of Lake Pend d'Oreille, easily accessible from Solitare, on the south side of the lake. A rocky point of land rises abruptly to a height of 250 or 300 feet above the surface of the lake (Spokesman Review 1906:3).

Photocopy of an illustration in Leiberg 1893.



Tracing from a photograph in the Spokesman -Review 1906



Tracing from a reproduction of a postcard of the 1940s

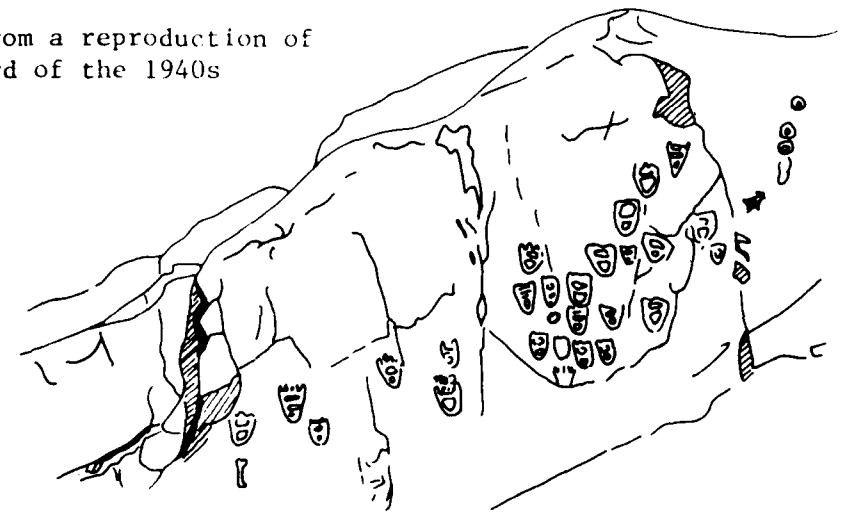


Figure 20. Reproductions of petroglyphs at 10BR5.

In the remainder of the article, Leiberg repeats what he described in 1893 almost verbatum. The reference to the south side of the lake might account for the confusion noted in the 1903 article. The same reference contains another point of possible dispute, that of the rocky point of land rising 250-300 feet above the lake. In the immendiate area of 10BR5, there is no 250-foot-high cliff. If the location of Solitare could be determined, these conflicting statements might be resolved.

A description of the site in Erwin's summary of rock art in Idaho (1930:48-49) also reproduced Leiberg's 1893 article and the 1906 Spokesman Review photograph, or a very similar view. Site 10BR5 was also the subject of a postcard photographed in the early 1940s entitled "'Petroglyphs' on the shore of Lake Pend Oreille between Hope and Clark Fork, Idaho," photographed by Ross Hall Studio of Sandpoint. A reproduction of this card, with some very indistinct petroglyphs, was traced for Figure 20.

Bearpaw Rock was given a state site number in 1966 when Sneed and Sims recorded the site. Delisio (1974) later recorded petroglyphs of large paw prints on Sheepherder's Point, which was given the state site number of 10BR121. A comparison of Delisio's photographs with those from 10BR5 indicates that 10BR121 and 10BR5 are the same site (Munsell 1980). Cynthia Cox, from the University of Idaho, also recorded the site in 1979, as did Peterson, who described, photographed, and illustrated the figures.

In 1980, a rubber mold was taken of an area near the center of the rock panel and a cast was made which is now at the Bonner County Historical Society Museum in Sandpoint. The procedure left a distinct color difference on the rock face, although this is gradually becoming less apparent. The Idaho Panhandle National Forests also documented the rock face in 1984 using photogrammetric techniques.

Lichen is abundant on Bearpaw Rock today, appearing in pink, gray, and various shades of green. On the upper two-thirds of the rock face is a pale green type growing in most of the petroglyph grooves. Below the old high-water line in the lower third of the panel, the lichen is primarily a darker green, thereby creating a distinct horizontal color change on the rock face. This variation in color may represent a localized "lichen succession." Previous high-water levels killed the lichen beneath the high-water line and the regrowth is a different color, and perhaps species, than that on the remainder of the rock face. This variation in lichen presents some interesting possibilities in dating the panel.

There are patches of bare rock in some of the petroglyphs caused by the removal of the lichen. The extent of previous cleaning of the figures cannot be accurately determined, however, since photographs from 1906 and the 1940s suggest the figures were painted in white by the photographers. This paint could have been applied over bare rock or the close-growing lichen. Leiberg did mention in 1893 that "nearly all the figures are thickly overgrown with close-clinging rock-lichen, rendering the whole quite inconspicuous" (1893:156). The "white paint" apparently used to highlight the figures for photographic purposes remains on the figures in a few patches.

At least one figure has been removed from 10BR5. A large petroglyph illustrated in 1893 and 1906 on the lower left (south) side of the rock face is missing in the 1940's photograph, along with a large chunk of rock. Other figures illustrated on the right side of the rock in 1893 are either natural irregularities in the rock or are now also missing.

There are 28 distinct bear paws and several less visible representations with varying numbers of toes (claws) and intersecting lines. There are three or four other (dog, coyote, cat?) tracks, four circles, a quadruped (deer?), and a vertical line capped by a horizontal line. An "M" and "O," which appear to be recent, are on the right (north) side of the panel (Figure 21). The photodocumentation from this project, in addition to the photogrammetric map produced by the Idaho Panhandle National Forests and Boreson's and Peterson's slides from 1979, were used to illustrate the panel.

10BR24 - Cottage Island

Site 10BR24 is located on Cottage Island west of Hope Point and south of Warren Island on Lake Pend Oreille. The petroglyphs at this site are situated on a rock outcrop that is 1.4 m below (northeast) a U.S. Coast and Geodetic Survey elevation brass cap. The panel is facing northeast at a 26° slope and occupies a 3.5 x 4 m area. The rock was petrographically analyzed as argillite with poorly defined bedding.

In the late 1800s, a resort and boat works were located on the island (Peterson 1979), and today there are modern structures in the area. Prior to the Euro-American habitations "the Kalispel stored dried berries, meat, and fish for winter on Cottage Island....they were cached here to keep them safe from animals, especially from grizzly bears" (Smith 1985:148).

A variety of artifacts, including fire-cracked rock, projectile points, scrapers, and ground stone, have been found on the beach adjacent to the site. Two modified cobble fragments, possibly used in making the petroglyphs, were recovered from the gravel below the figures (see Appendix C).

Erwin's summary of rock art mentions Cottage Island as being "locally known as Child's Island with five bear paws on the rocks on the north shore" (Erwin 1930:50). The site was first recorded in 1966 by Sneed and Sims as consisting of three large mounds (1 x 1 x 6 m, 1 x 1.5 x 5 m, and 1 x 2 x 15 m) and four small mounds (0.5 x 0.75 x 1 m) in addition to petroglyphs. Peterson described the site in detail in 1979.

More than 60 figures, most of them representing bear paws, are documented at this site. There are also a few possible anthropomorphs, incised lines, and unidentified figures (Figure 22). Additional unrecorded figures are probably also present on the rock face. These petroglyphs were formed by pecking, connected pecking, and incising.

Many of the figures are partly covered by lichen and moss. The rock face is cracked and spalled, and geese have left long vertical scratches on

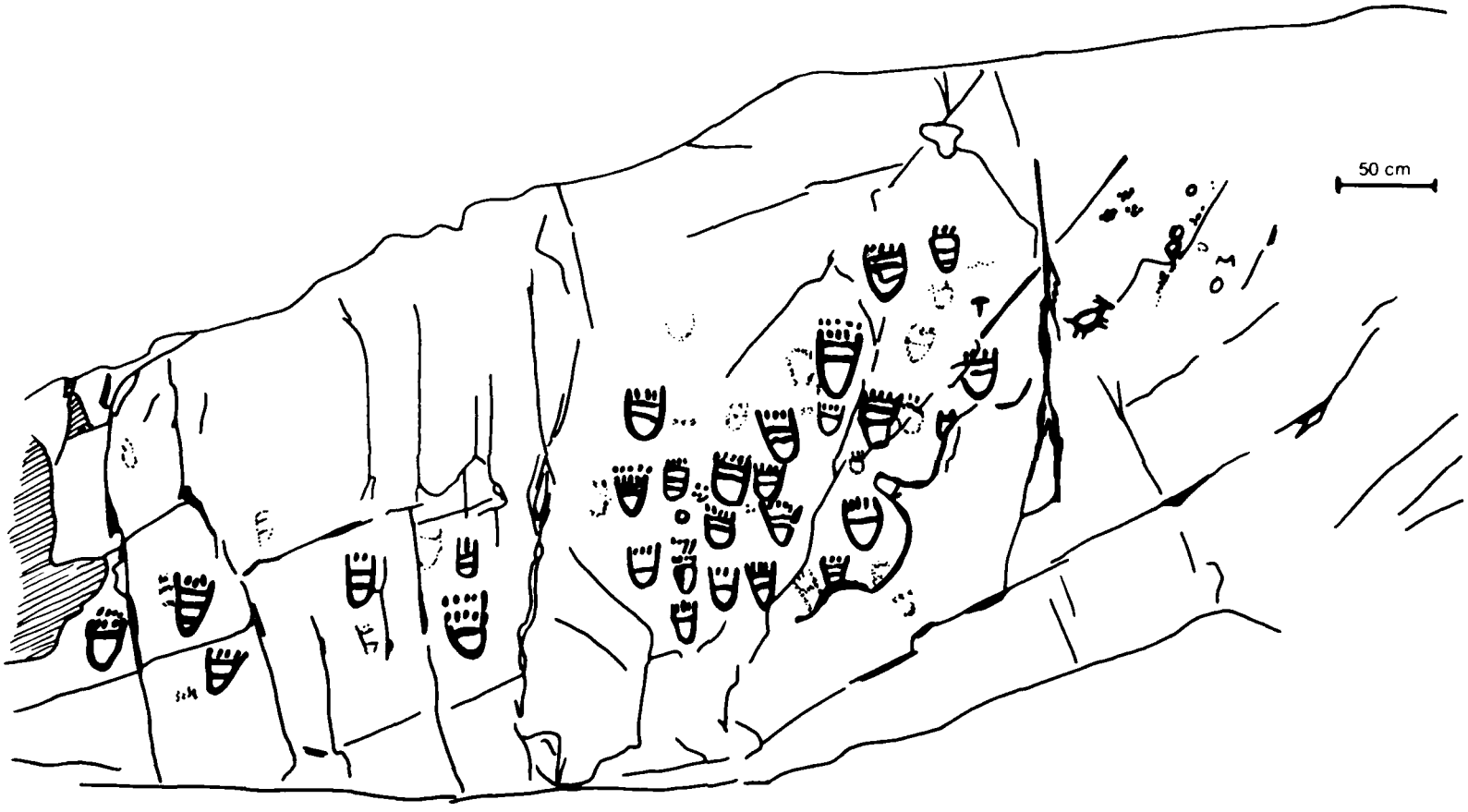


Figure 21. Petroglyphs at 10BR5.

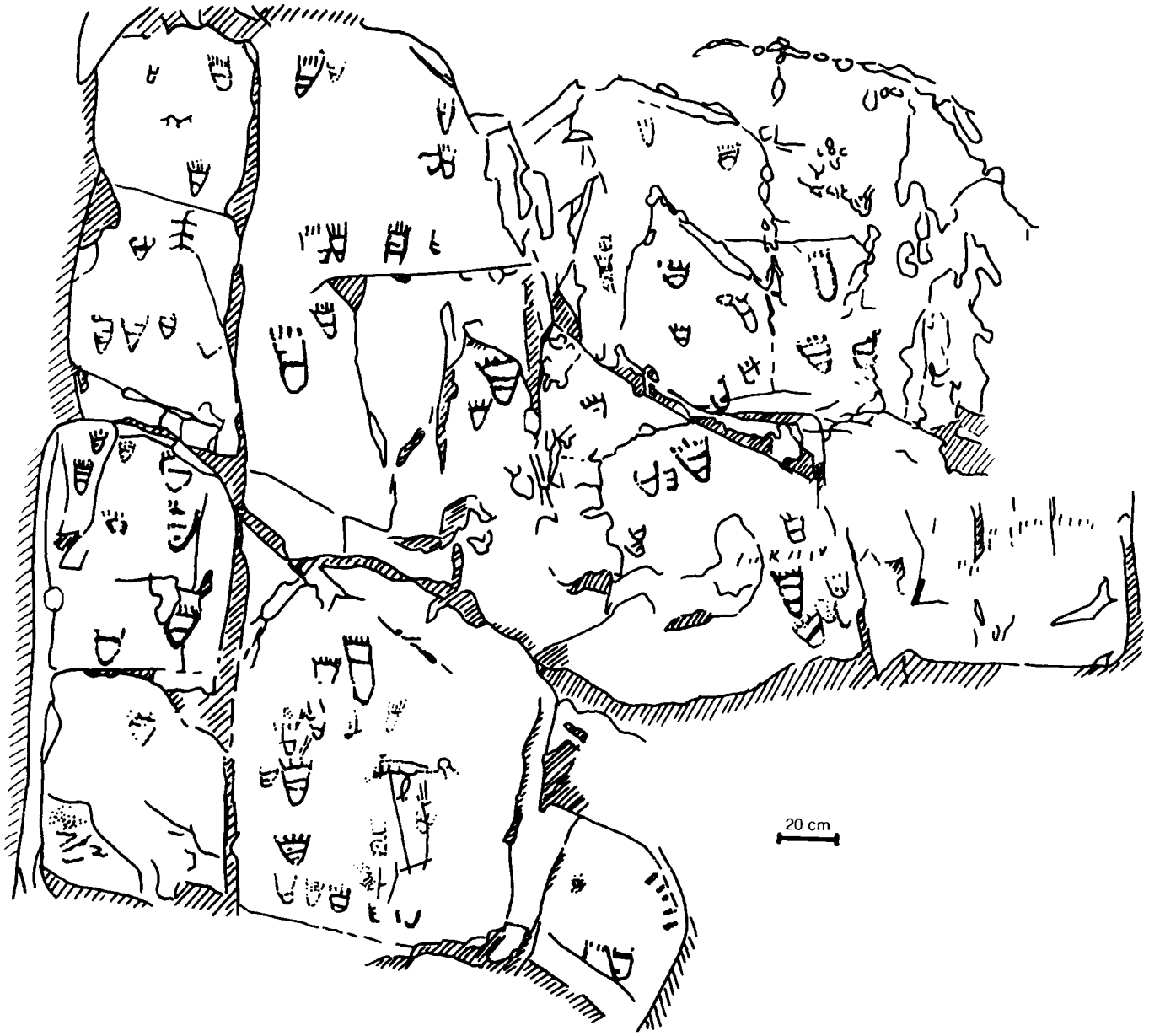


Figure 22. Petroglyphs at 10BR24.

the rock. The position of the high-water mark indicates that a third of the panel is below water for part of the year.

The slides and black-and-white prints from this project, Boreson's 1979 slides, Peterson's 1979 slides, and Peterson's slides and color prints from 1981 were used to compile Figure 22.

10BR25 - Pearl Island

Site 10BR25 is located on one of the many low, bedrock outcrops on the southernmost end of Pearl Island, 30-40 m south of a large metal tower. The rock face slopes 10° to the east and is extensively cracked and spalled. The site is under water for part of the year. The rock was petrographically analyzed as an argillite with weak layering. The rock is compact and gray with a 0.1-0.2-cm-thick tan weathering rind.

Historically, the island was the site of an Upper Kalispel camp for a short time in early spring. When the chub began to ascend a creek called nx"ex"ewi to spawn, the Kalispel left Pearl Island for a camp on this creek (Smith 1985:150). A few projectile points, scrapers, and fire-cracked rock have been noted on the north end of the island.

The site, which is privately owned, was issued a state site number in 1966 when Sneed and Sims recorded "a display of petroglyphs." Peterson has also visited and photographed the site. The petroglyphs are very difficult to find without favorable light conditions.

The four figures illustrated in Figure 23 extend over a 1 x 2 m area. They are extremely distorted by waves eroding and spalling the petroglyph peck marks and/or grooves, which has resulted in the almost complete obliteration of the original figures. One possible bear paw was identified on the strength of its U shape.

10BR225 - Scraper Bay

Site 10BR225 is located on land managed by the U.S. Forest Service on the south end of the peninsula west of Denton Slough and east of Sheepherder Point. Prior to the rise in the lake level behind Albeni Falls Dam, the site was about 0.4 km north of the Clark Fork River. The area was a grassy meadow prior to innundation and a creek, apparently draining from Denton Slough, is shown on a 1949 USGS map as being south of the site.

The sediments at 10BR225 have been extensively eroded vertically and horizontally, creating a small bay. A gravel beach overlying loamy clay is intersected by rock outcrops upon which the petroglyphs are located. The rock has been petrographically analyzed as a compact gray argillite with irregular bedding.

Eleven panels have been identified at 10BR225 (Figure 24), most of which are under water for part of the year. Datum A is at a large pine tree

Figure 23. Petroglyphs at 10BR25.

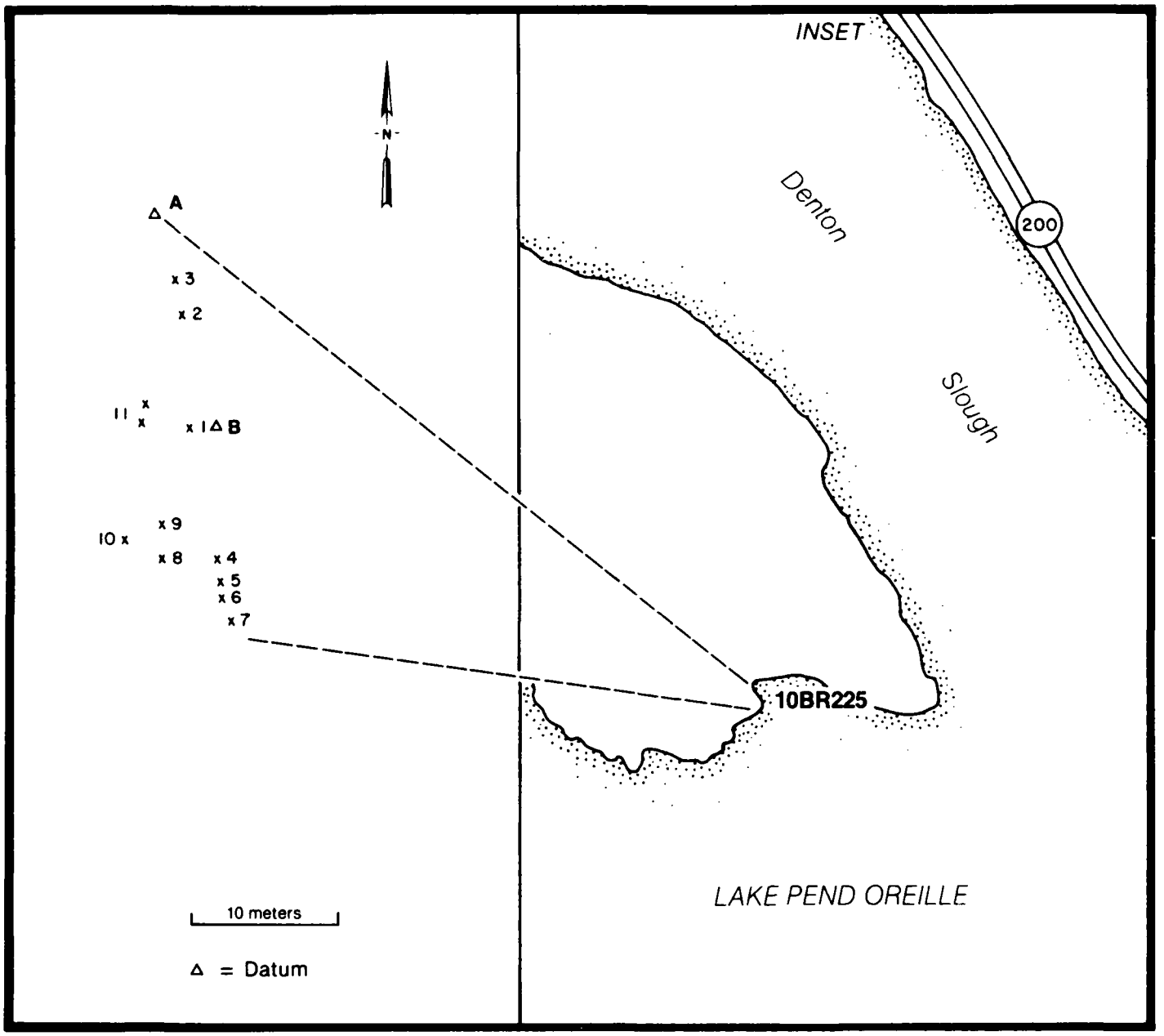


Figure 24. Location of rock art panels at 10BR225.

north of the petroglyphs and Datum B is located on panel 1. The site has been affected by freeze- and thaw-induced cracking and spalling, and water has contributed to the obliteration of the figures by smoothing the surfaces and by spalling and elongating the peck marks and grooves. Lichen, moss, and water-deposited silt cover many petroglyphs.

The site was first recorded in 1980 by Peterson, who also noted the presence of fire-cracked rock and flaked and ground stone artifacts. The presence of 10BR5 about 150 m east and the use of the Clark Fork River for fishing and occupation suggest this was an area extensively used by Native Americans.

Panels 1, 2, and 3 are located on a rock outcrop oriented north-south, the upper surface of which is exposed for at least 12 m. Panel 1 is found on the southern end of this bedrock exposure on a rock face that slopes 10° toward the east. The figures appear to be curvilinear designs (Figure 25), but lichen and moss and cracks in the rock obscure the outlines. The illustration was made from a slide of Peterson's taken in 1981.

Panel 2 is about 8 m north of panel 1 on a 10° to 16° rock slope facing east. Parts of two figures were identified, an arc and two horizontal lines connected by a vertical line (Figure 25). These figures are partially overgrown by lichen and are therefore incomplete. Other figures on this panel could not be illustrated.

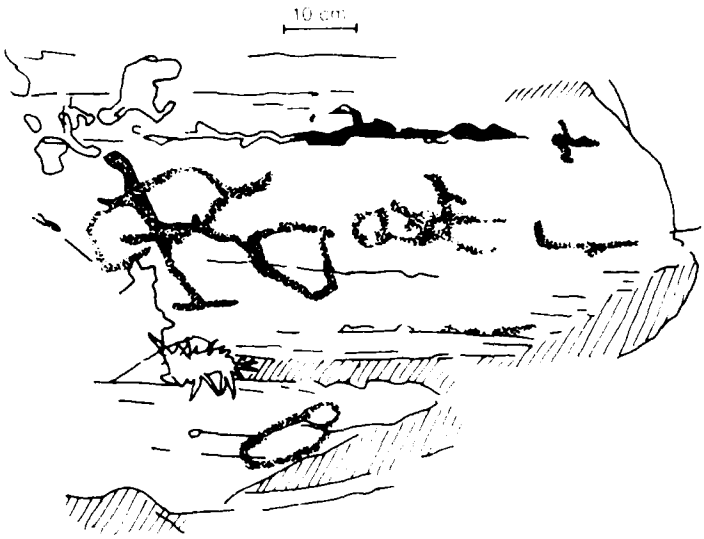
Panel 3 is located at the northern end of this exposed rock outcrop on a rock face with a 13° slope toward the east. The identified figures include two nearly complete circles, an arc, and a line of peck marks (Figure 26). It is highly likely that other figures are covered by the abundant lichen and moss growing on this panel.

Panel 4 is located on an extensively eroded rock which has cracked and spalled. The petroglyphs are found on a rock with a 13° slope facing southeast. A circle with an intersecting line is at the south end of the panel. The figure has been eroded by water, creating grooves that are now 0.1 to 0.25 cm deep. Other petroglyphs on this panel include a circle in the lower center and unidentified figures consisting of connected pecked and pecked lines. A cluster of incised lines radiating out from a hub intersects some of the pecked figures (Figure 26). A spalled portion of this panel, which could not be found in the adjacent area, probably contained additional petroglyphs.

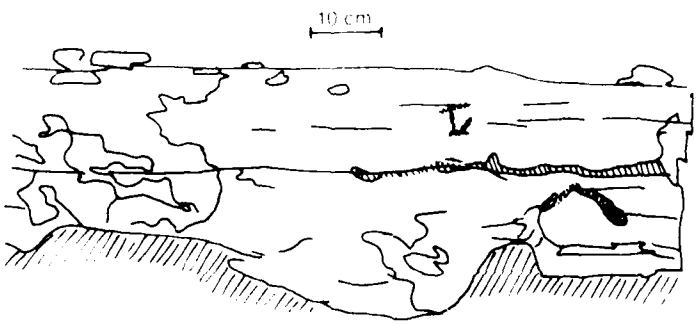
Panel 5 consists of several large slabs of rock which have spalled off the parent rock, probably from panel 4. Three spalls were identified with curvilinear figures (Figure 26). The original petroglyphs apparently had lines about 1 cm wide and 0.04 cm deep. These lines have eroded into grooves which are now from 2 to 2.5 cm wide and 0.16 to 0.25 cm deep.

Panel 6 is a single curvilinear figure on a east-facing rock with a 14° slope (Figure 26). The petroglyph is just south of panel 5 and, judging from the spalled and cracked areas on the face, is part of the water-eroded series of rocks in panels 4 and 5.

Panel 1



Panel 2



Panel 3

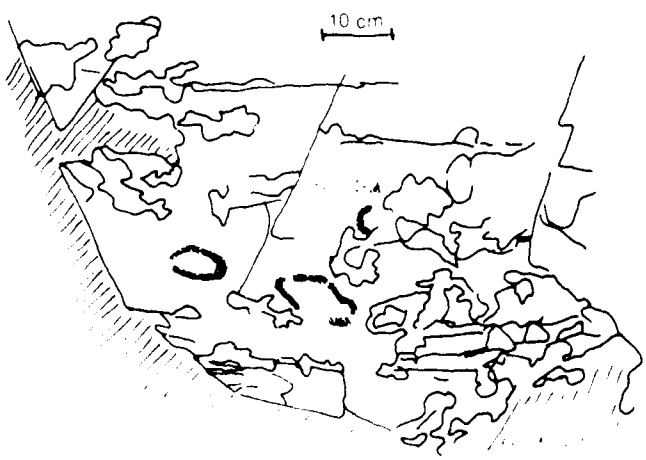


Figure 25. Panels 1, 2, and 3 at 10BR225.

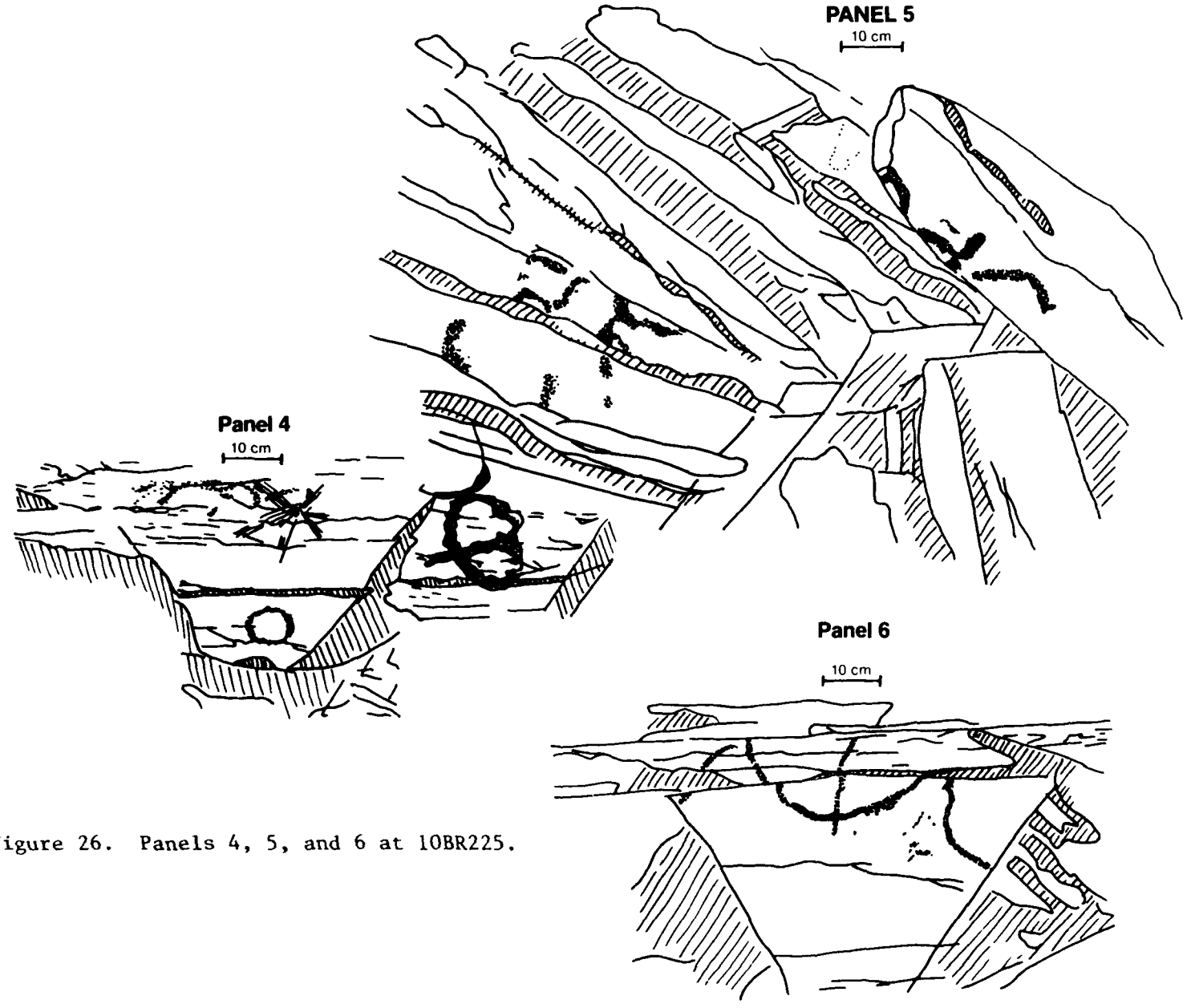


Figure 26. Panels 4, 5, and 6 at 10BR225.

Panel 7, which was previously mapped in 1980, could not be relocated, possibly because of inadequate light conditions.

Panel 8 is a group of figures which is primarily located on a horizontal rock surface. Water-deposited silt was removed to identify the figures. These included six or more bear paws, two with lines extending from the lower end; a 43-cm-long anthromorphic figure having grooves 0.13 cm deep with three lines extending from the lower end and two lines from the sides; an abstract figure made of connected arcs, lines, and a curved "arrow"; and several other vague figures. The unidentified petroglyphs on the right side of the panel are on a sloping face on the southern end of the rock (Figure 27). The photodocumentation from this project and Peterson's slides from 1981 were used to illustrate this panel.

Panels 9 and 10 consist of fragments of arcs and unrecognizeable figures (Figure 27). Better light conditions will probably improve the identification of the figures on this panel.

Panel 11 is located on two rock faces about 93 cm apart which are facing west-southwest at a 45° slope. The petroglyphs on the left (north) side include a possible bear paw with a short protruding line 7.5 x 11 cm long and at least five incised lines 0.13-0.16 cm deep by 0.2-0.25 cm wide. The figures on the right (south) half consist entirely of intersecting incised lines 0.22-0.41 cm deep and 0.5 cm wide. Many of these deep lines have a number of adjacent parallel scratches. There appears to be two "teepee-shaped" figures on this rock face, one intersected by a horizontal line and the other with a horizontal and vertical line (Figure 28).

10BR621 - Fisherman Island

Site 10BR621 was located and recorded by Larry Fredin of AHS in April, 1985, during the Albeni Falls Cultural Resources Reconnaissance project. This project was also conducted for the Seattle District of the U.S. Army Corps of Engineers. The site was then revisited by Boreson and Peterson and again by Peterson to photograph and sketch the figures.

The site is situated on Corps land on the southwest side of Fisherman Island in an area cut off from the larger island during high water. Fire-cracked rock, flaked artifacts, and historic debris have been recorded at site 10BR34 nearby. The petroglyphs are innundated for part of the year and are located on a rock face sloping to the west. Two, very faint bear paws are 16.8 cm apart and measure 12.2 x 21.3 and 9.2 x 12.3 cm (Figure 29). Light conditions did not permit good photodocumentation of the figures and the illustration is based primarily on Peterson's sketch.

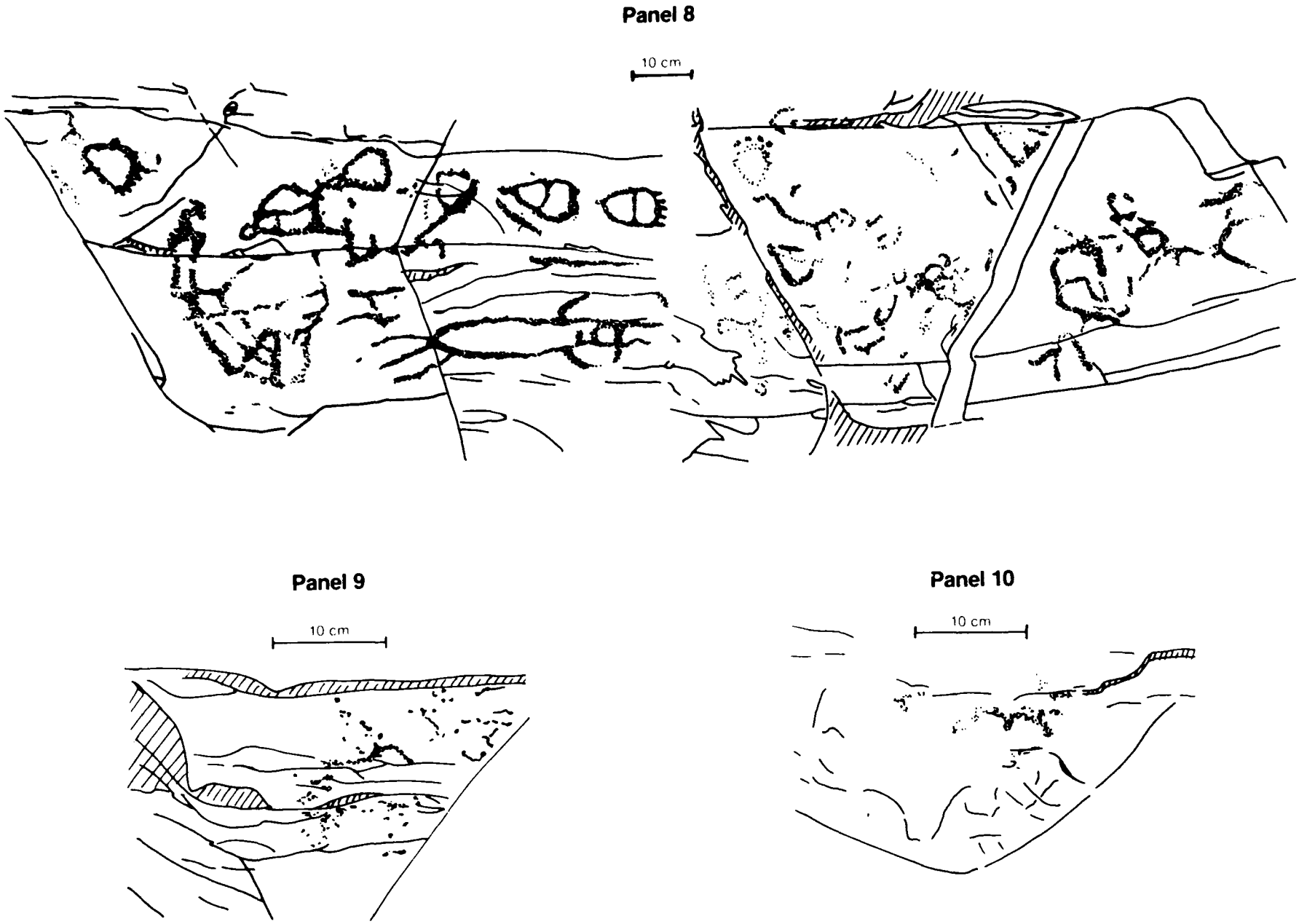


Figure 27. Panels 8, 9, and 10 at 10BR225.

Panel 11

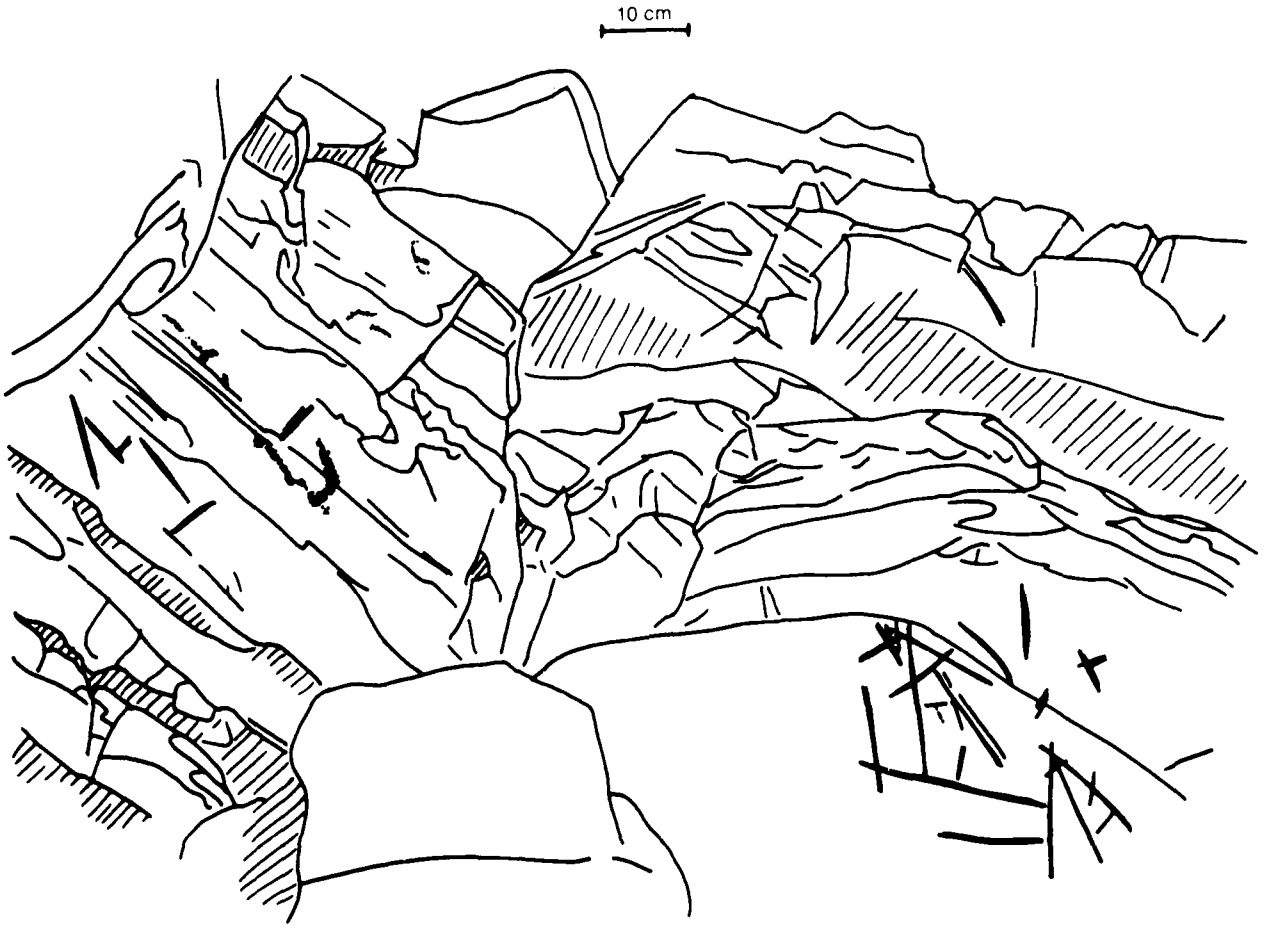


Figure 28. Panel 11 at 10BR225.

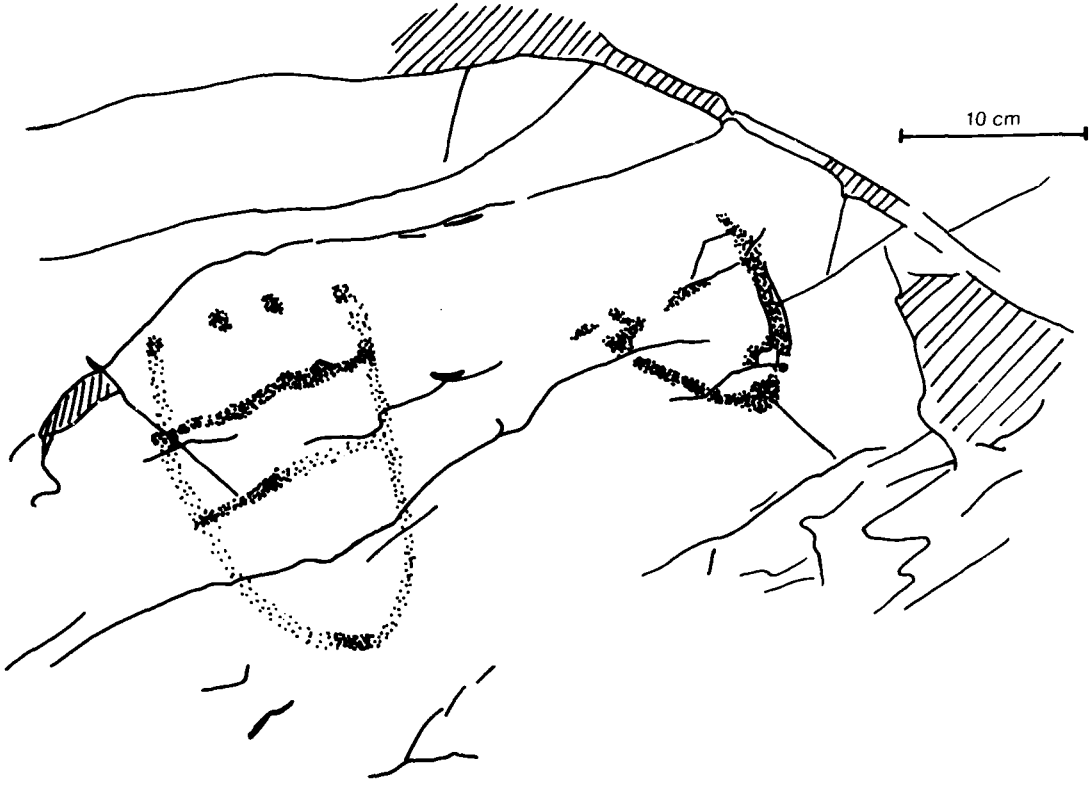


Figure 29. Petroglyphs at 10BR621.

4. SUMMARY

Motifs and Production Techniques

The stylistic motifs and techniques of production are summarized in Table 1. This information was compiled from the illustrations and represents the figures that were the most well defined. Petroglyphs that were indistinct or incomplete were sometimes omitted or were listed as part of those headings reflecting a faint or partial design, such as arcs, lines, or abstract figures.

The most frequently occurring figures are bear paws, followed by intersected circles and arcs; however, the distribution of these figures varies widely. For example, bear paw petroglyphs are very common on Memaloose Island in all three areas of 10BR3. On the mainland, about 180 m east, intersected circles and arcs are by far the most common motif. Bear paws are predominant only in Areas B and D, at the south end of the site.

A similar variation in distribution is found between 10BR5 and 10BR225, which are about 150 m apart. Site 10BR5 consists primarily of bear paws and a few other animal tracks, while 10BR225 has only one panel with bear paws but includes many curvilinear designs. Future research may indicate a gender or political identity represented by the figures or the figures may reflect changes in motifs through time.

Bear paws are present at petroglyph and pictograph sites throughout western North America, as are circles and curvilinear designs. In the Interior of British Columbia, "the bear track, or paw, sign is perhaps one of the more typical rock art designs" (Lundy 1979:62). Motifs of a design similar to those on Lake Pend Oreille, including bear paws and other animal tracks, are found at the Cranbrook Petroglyph site (Kennedy and Cassidy 1981:6).

Three methods of creating petroglyphs were observed at the seven sites recorded on Lake Pend Oreille. The most frequently used method was by connected pecking, followed by pecking, and, in a few instances, incising. Peck marks are small individual concave depressions created by a hammer or chisel, presumably a rock, striking the rock face, generally at a 90° angle. In a few panels, the pecking appears as an elongated depression made by a blow at less than 90°. Some of the pecked figures consist of an apparently random cluster of peck marks, such as those at 10BR3A, panels 5 and 6; 10BR3C, panel 2; and 10BR4C, panel 9. It would be interesting to experiment with a shotgun and a muzzleloader to see if the pattern made by the shot is similar to these peck mark clusters. Other peck marks may be the result of natural processes such as driftwood or rocks grating against the rock face.

Connected pecking refers to peck marks that are attached, either by grooving or by a continuous chain of pecking. The petroglyphs at 10BR5 are grooved to a depth where there is no indication of the original peck marks. The figures at other sites are not as deep as those at 10BR5 and many of the peck marks still remain.

Table 1. Summary of Petroglyph Motifs and Techniques of Production.

Site	Bear Paw	Intersected Circle	Intersected Arc	Circle	Arc	Triangle	Crossed Lines	Anthropomorph	Quadruped Fig.	Track	Pecks Line	Pecks Cluster	Curvilinear & Abstract	Techniques Connected Pecked	Pecked	Incised
10BR3A																
Panel 3			1											X		
Panel 4				4	1			?						X		
Panel 5		1	1									1		X	X	
Panel 6	4											1	1	X	X	
Panel 7	4			1							1		1	X	X	
Panel 8	1	1		1		1					1		1	X	X	
Panel 9	17	2	1			1								X		
Panel 10	1												1	X		
Panel 11	2	1												X		
Panel 12								1					1	X		
In fireplace													1	X		
10BR3B	12													X	X	
10BR3C																
Panel 1	12													X		
Panel 2												2			X	
Panel 3	4	1												X		
10BR4A																
Panel 1		1	1											X		
Panel 2	1	1			1								2	X		
Panel 3		1			1									X		
Panel 4			1											X		
Panel 5		1													X	
Panel 6		1	2	1										X	X	
Panel 7				1											X	
Panel 8		1													X	
Panel 9		1												X		
Panel 10		1													X	
Panel 11		1													X	
Panel 12		6												X	X	
Panel 13			1		1									X		

Table 1. (Continued)

Site	Bear Paw	Intersected Circle	Intersected Arc	Circle	Arc	Triangle	Crossed Lines	Anthropomorph	Quadruped Fig.	Track	Pecks Line	Pecks Cluster	Curvilinear & Abstract	Techniques Connected Pecked	Techniques Pecked	Techniques Incised
10BR4A (Continued)																
Panel 14		1												X		
Panel 15		1													X	
Panel 16		2													X	
Panel 18													1	X	X	
Panel 19					1									X		
Panel 20					1									X	X	
Panel 21													1	X		
10BR4B	5													X		
10BR4C																
Panel 1		1	1												X	
Panel 2				1										X		
Panel 3							1							X		
Panel 4	2	1		1										X	X	
Panel 5		4												X		
Panel 6			2											X		
Panel 7											1				X	
Panel 8		1													X	
Panel 9												1			X	
Panel 10				1										X		
Panel 11					1									X		
Panel 12												1		X	X	
Panel 14													1	X		
10BR4D	3												1	X		
10BR5	28			4			1		1	4				X (Grooved)		
10BR24	47							1	1			1	2	X		X
10BR25	?													X		

Table 1. (Continued)

Site	Bear Paw	Intersected Circle	Intersected Arc	Circle	Arc	Triangle	Crossed Lines	Anthropomorph	Quadruped Fig.	Track	Pecks Line	Pecks Cluster	Curvilinear & Abstract	Techniques Connected Pecked	Pecked	Incised
10BR225																
Panel 1				1	1								1	X		
Panel 2					1		1							X		
Panel 3				2	1						1			X		
Panel 4		1		1			1							X		X
Panel 5					1								1	X		
Panel 6			1		1									X		
Panel 8	6							1					2	X		
Panel 9												1			X	
Panel 10					1									X		
Panel 11					1		1							X		X
10BR621	2													X		
Total	151	33	12	19	14	2	5	3	2	4	4	8	18			

Incised figures are straight or slightly curved lines ranging from shallow scratches to narrow V- or U-shaped grooves. There are incised figures at 10BR24 and 10BR225, panels 4 and 11, some of which are intentionally formed designs. These designs include lines radiating out from a hub, teepee-shaped figures, and a square.

In British Columbia, V-shaped grooves are described as having been incidentally produced in the course of abraiding rock surfaces during tool sharpening or tool making. "Sites with 'V-shaped' grooves are directly associated with tool-making activities, and indirectly, at least along the Middle Fraser, with fishing camps and fishing places" (Lundy 1979:65). Other incised figures, thought to represent a Plains style of rock art, are found in southern Alberta (Jones 1979:72-73).

Recommendations

The combined effects of weathering from years of exposure to the elements have resulted in the deterioration and erosion of the rock surfaces of virtually all recorded petroglyphs. It is apparent that all the sites are disintegrating and for this reason further work should be initiated at the earliest opportunity.

Using the data derived from the present study as a starting point, it is recommended that:

1. The accuracy of the illustrated petroglyphs should be field checked;

2. The site areas should be examined for additional petroglyphs; and

3. Other likely areas should be closely inspected for rock art sites.

The experience gained from this project suggests that using a controlled light source (see Appendix B) would be the most effective method of identifying and documenting petroglyphs that are otherwise not discernable.

Table 2 summarizes the causes of attrition at each site and evaluates the condition of the sites. Lichen and moss growth is a problem that affects virtually all the petroglyphs to some extent, excepting those that are under water for part of the year. Lichen and moss cover all or parts of many petroglyphs and may aid in the disintegration of rock (Figure 30). Removing the lichen cover would allow more complete and detailed recording of the petroglyphs and perhaps would retard the deterioration of the rock. However, the advantages of leaving the lichen intact are that lichen growth rates may eventually serve as a method of dating the petrographs, and the masking of rock art sites by lichen is an obvious deterrent to vandalism.

Canadian studies in rock art conservation conclude that "since lichen obscure pictographs and petroglyphs and contribute to their deterioration, and since dating using lichenometry [lichen dating] is of dubious value, it can be concluded that safe removal of lichens should take precedent over their potential use in dating" (Taylor et al. 1979:305).

Table 2. Summary of Site Condition and Causes of Deterioration.

Site	Condition				Causes of Attrition					Other
	Destroyed	Poor	Fair	Good	Lichen/Moss Cover	Freeze/Thaw Spalling Rock Figure		Water Erosion	Gravel Cover	Silt Cover	
10BR3											
A		x	x		x	x		x	x	x	1 figure in a fireplace
B		x			x						
C		x	x		x		x	x			
10BR4											
A		x			x	x	x	x		x	Dock construction
B		x				x					2 figures in a gatepost
C		x				x	x	x		x	
D		x			x						
10BR5			x	x	x	x					1 figure missing. Paint on figures. Recent figures added.
10BR24		x	x		x	x		x			Goose scratches
10BR25	x					x	x			x	
10BR225		x	x		x	x	x	x		x	Large rock slabs spalled off
10BR621		x				x		x			

Figure 30. Lichen covered rock with petroglyphs at 10BR225.

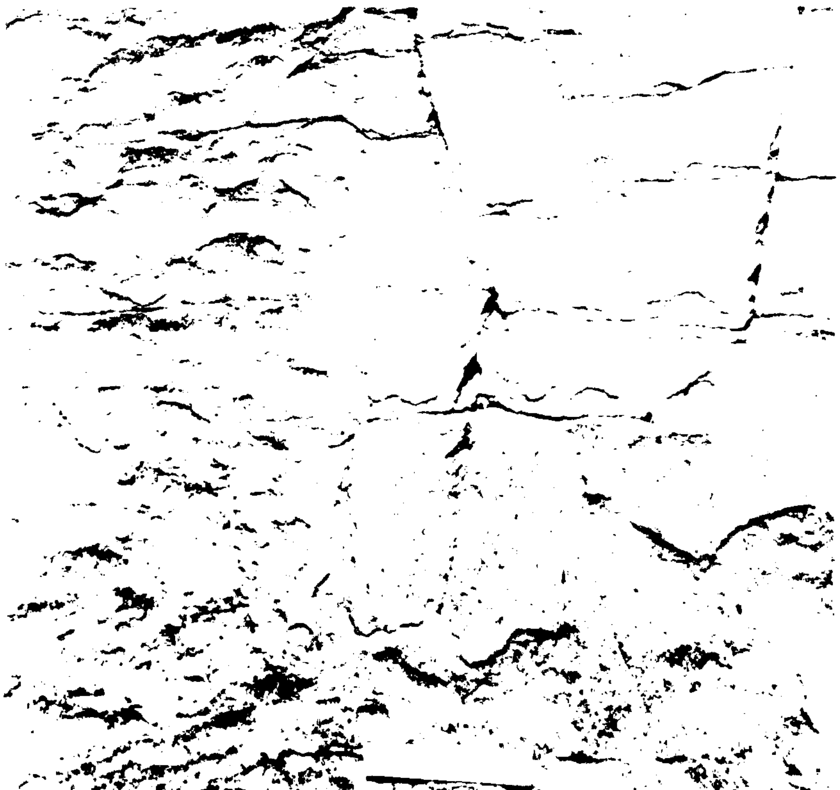


Figure 31. [illegible]

In the case of the Lake Pend Oreille petroglyphs, it would be prudent to remove the lichen from areas in one or two sites and monitor the effects for a period of time in addition to initiating a lichenometry study. Sites suitable for this would include 10BR3C and 10BR225.

The combined effects of moisture and heat, and freezing and thawing are major causes of attrition to rock art sites.

> A situation of periodic submersion together with freezing and thawing cycles is one of the worst imaginable for any rock art site. On top of that, argillite is an inherently unstable rock and it is not surprising that it is disintegrating in chunks. Argillites are composed of layer silicates (clay minerals) which, as they absorb and desorb water, result in considerable expansion and contraction. This, coupled with frost, will have the inevitable consequences [described] (Wainwright 1985).

There is no doubt that the higher lake level created by Albeni Falls Dam has significantly increased the deterioration of the petroglyph sites on Lake Pend Oreille during the past 28 years. This attrition has resulted in

1. The alteration of individual peck marks, i.e., they have been lengthened and deepened;

2. The exfoliation of the rock faces;

3. The erosion of the rock faces, which have been lowered and worn away; and

4. The spalling of large slabs of rock along the bedding planes.

The most effective way to reduce the destruction is to remove the cause, but this is clearly not a practical recommendation. The possibility of protecting rock art by coating it with synthetic materials, such as epozy resins, has little chance of success. Sealing a rock surface with a relatively impermeable barrier will accelerate deterioration by prohibiting the exchange of moisture between substrate and atmosphere. However, the use of perfluoropolyther water repellents, which are reported to be stable, colorless, transparent, and permeable to water vapor, is regarded as a treatment that has promise (Wainwright n.d.:7). This material should be used experimentally on the surfaces of a few petroglyph rocks in the Lake Pend Oreille area and the effects monitored to determine the results. It is important to reiterate that "all treatments must be carefully studied in the context of the particular rock to be treated, the polymer to be used, and the method of application" (n.d.:7).

Another alternative is to shield the sites from destructive processes, such as wave action. This has several disadvantages, among them being:

1. The additional attention which would be focused on the sites and the resultant increased possibility for vandalism;

2. The cost;

Figure 32. Soil with petrocalcic horizon.

Figure 33. Soil with petrocalcic horizon.

3. The "protection" afforded sometimes creates secondary areas of deterioration, such as that caused by the "greenhouse effect" of protective roofs or walls; and

4. Alterations in the natural setting caused by fences, shelters, dikes, and other protective enclosures.

Thus, complete documentation appears to be the most reasonable and viable measure to ensure the life of these rock art sites.

An example of extreme deterioration can be seen at 10BR25, which has been almost completely erased by wave-induced spalling (Figure 31). Because of the almost total obliteration of the rock art, experimentation with molds and casts is recommended. The use of latex and silicone rubber molds has frequently been utilized as a method of recording petroglyph sites by duplicating the figures. This process is known to accelerate the disintegration of the rock faces, particularly by exfoliation, and is discouraged except in instances where destruction is imminent (Lundy 1985; Wainwright 1985). By experimenting with various molding materials and release agents at 10BR25, the effects of this process upon the local argillite can be evaluated before the technique is used at other, less deteriorated sites.

Another form of attrition by water can be seen in the large spalled slabs of rock at 10BR225 (Figure 32). These chunks of rock have petroglyphs on them, and appear to have spalled off one large rock outcrop. An effort to locate the displaced rock slabs, transport them to a secure location such as the Bonner County Historical Society Museum, and reassemble the pieces should be a priority action at this site.

Additional recording efforts should include comparing old aerial photographs with the present spalled areas to see if it is possible to determine the rates and dates of the spalling. Site stablilization should also be initiated in the form of pinning, grouting, or cementing the eroding bedding planes. Initially, this should be done on rocks without petroglyphs and monitored for a few years prior to stabilizing the rock art panels.

Several of the petroglyphs at 10BR3A have been partially covered by gravel (Figure 33), probably the result of storms on the lake. Before further recording takes place, the gravel should be removed from the rock faces to expose the petroglyphs completely. There is also lake-deposited silt covering petroglyphs at 10BR3A, 10BR4A, 10BR4C, 10BR25, and 10BR225. Prior to recording, this cover should be removed with water and a soft brush.

The U.S. Army Corps of Engineers should notify private landowners of the locations of rock art panels on their properties. Projects such as the construction of docks or other alterations to the beaches could be coordinated with the Corps' permitting system and the destruction of petroglyphs from construction could be prevented through active participation in such a program.

A narrative in an 1853-1855 field report relates

a superstition respecting a point of painted rock in Pend d'Oreille lake, situated near the place now occupied by Michel Ogden. The Indians, he says, do not venture to pass this point, fearing that the Great Spirit may, as related in the legends, create a commotion in the water and cause them to be swallowed up in the waves. The painted rocks are very high and contain effigies of men and beasts, and other characters, made, as the Indians believe, by a race of men who preceded them as inhabitants of the land (Stevens 1860:150).

It is not yet known where the painted men and beasts mentioned in this account were located. A possible site is 10BR5 which has areas of white paint in the petroglyph grooves. Early photographs indicate the paint was present in the 1940s and may have been applied prior to 1906. This pigment should be analyzed to determine if it is of Euro-American origin and whether there is an underlying area of prehistoric paint. The identification of the mineral and organic composition of the pigment could answer these questions.

Finally, several artifacts were recovered which are believed to have been tools used to make petroglyphs (Appendix C). These artifacts were found at 10BR5 and 10BR24. Test excavations should be conducted at these sites to locate additional tools in datable contexts.

National Register Eligibility

The criteria for evaluating site eligibility for inclusion in the National Register of Historic Places are listed in 36 CFR Part 60.4, which states:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

To be listed in the National Register, a property must meet Criterion A, B, C, or D, and must possess integrity. Using guidelines prepared by the National Park Service (1982), the Lake Pend Oreille rock art sites were evaluated for eligibility for inclusion in the National Register (Table 3).

The application of Criterion A (association with significant events) and Criterion B (association with significant persons) to these prehistoric rock art sites cannot be evaluated. The possession of high artistic values, as listed in Criterion C, is more clearly defined. "A property may qualify for high artistic values if it is an important representative of the aesthetic values of a cultural group, such as petroglyphs" (National Park Service [NPS] 1982:24). Of the Lake Pend Oreille petroglyphs, only 10BR25 does not appear to have high artistic value because of the extremely deteriorated condition of the motifs. The petroglyphs at 10BR621 are quite faint and need further evaluation.

There is also little doubt that Criterion D applies to the sites in that they have yielded or may be likely to yield information important in prehistory. Although there is limited local comparative information with which to evaluate the importance of the information to be gained, the sites will provide data necessary to fill that gap. This information will be useful in broader contexts on regional, national, and international levels. Of the seven sites listed in Table 3, the application of Criterion D to two of them is unknown. The deteriorated condition of 10BR25 and 10BR621 suggests the scientific or research value of the motifs may be negligible, but the sites may be important sources of information regarding the effects of water-induced erosion on petroglyphs.

Finally the sites were evaluated for integrity.

> A significant property is eligible if is exists today essentially as it did during its period of significance....the majority of the property must be intact or undisturbed....the retention of integrity depends upon the nature and degree of alteration or change. It is not necessary for a property to retain all the physical features or characteristics that it had during its period of significance. However, the property must retain the essential physical features that enable it to convey its past identity or character and therefore its significance (NPS 1982:37-38, 40).

Although all of the rock art sites in the Lake Pend Oreille area have undergone various forms of deterioration, five of the sites appear to retain the integrity necessary for National Register eligibility. Site 10BR25 is almost obliterated and therefore does not appear to meet the integrity requirements, and the degree of alteration at 10BR621 has not yet been determined.

Four of the sites discussed in this report (10BR3, 10BR4, 10BR5, 10BR6, and 10BR7) are recommended as being eligible for inclusion in the National Register of Historic Places. The site (10BR25) does not appear to meet National Register requirements, and the status of the site at 10BR621 is unknown.

Table 3. Evaluation of Sites for Inclusion in the National Register of Historic Places.

Site	Criteria		Site	Recommended National
	C	D	Integrity	Register Eligibility
10BR3	+	+	+	Yes
10BR4	+	+	+	Yes
10BR5	+	+	+	Yes
10BR24	+	+	+	Yes
10BR25	-	?	-	No
10BR225	+	+	+	Yes
10BR621	?	?	?	Unknown

Criterion C = High artistic value
Criterion D = has yielded or may be likely to yield information important to prehistory

Conclusions

The rock art sites in the Lake Pend Oreille area are all in the vicinity of other prehistoric cultural remains. Cultural debris representing occupation and/or procurement and processing activities is either directly associated with or near all the petroglyph sites, and at least one site is known to be near burials. The prehistoric inhabitants probably occupied the area on a seasonal basis and were in close, everyday contact with the rock art locales.

Since there is as yet no way to date the figures, little can be said about the intended function or the creators of the petroglyphs. The recovery of several artifacts, possibly the tools used to make the petroglyphs, is encouraging, however, since the possibility exists for controlled excavations designed to recover additional tools from datable contexts.

This report has presented a detailed review of the locations, descriptions, and conditions of the rock art sites recorded in the Lake Pend Oreille area, and has made several recommendations involving future recordation and conservation efforts. The information presented represents an initial phase of recordation and cannot be regarded as complete documentation of the rock art in this area.

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APPENDIX A

PETROGRAPHIC ANALYSIS OF SIX ROCK FRAGMENTS FROM VARIOUS PETROGLYPH SITES IN THE LAKE PEND OREILLE AREA OF NORTHERN IDAHO

By

S. W. Koehler Co.
Grangeville, Idaho

10BR25 Potassium + Calcium Stain

An argillite consisting of 70% quartz, 10% clay, 5% calcite, 5% sericite, 5% chlorite, and 5% accessory minerals. Accessory minerals include plagioclase, rutile, tourmaline, and limonite. Rutile occurs as irregular lacelike clots (altered ilmenite?) commonly .04 mm across. Limonite occurs as clots up to ½ mm across and along fractures. Most quartz grains are silt size being .02 - .06 mm across. A weak layering is defined by the parallel alignment of sericite grains.

In hand sample the rock is compact and gray with a 1 - 2 mm thick tan weathering rind. In thin section, the most striking feature about the weathering rind is that the calcite has been leached from the rock in this outer layer. I don't know how to assign an absolute age to this weathering feature but there would seem to be the possibility of constructing a relative age dating scheme.

10BR5 Potassium + Calcium Stain

A compact fine grained arkosic sandstone consisting of 60% quartz, 20% plagioclase, 15% K-feldspar, 4% sericite plus clay, and 1% accessory minerals. The accessory minerals include opaque Fe-Ti oxides, zircon, rutile, and limonite. Some rutile occurs as spheres of radial crystals, like the form of a sea urchin. Such an occurrence of rutile suggests secondary in situ growth, possibly from former ilmenite. Layering is defined by elongate quartz and feldspar grains as well as oriented sericite grains. A ¼ mm wide fracture transverse to layering is filled with quartz.

In hand sample layering can be seen as weakly defined tan and gray bands 1 - 2 mm thick. The rocks splits cleaning parallel to this bedding, a surface which may show a concentration of sericite and limonite.

10BR3C#3

An argillite consisting of 93% clay and sericite, 5% quartz plus feldspar, 2% magnetite, and accessory pyrite. Clay and sericite grains generally are less than .01 mm across but some relatively large sericite grains are up to .05 mm long. Quartz and feldspar grains mostly are less than .04 mm across. Magnetite grains are .005 - .18 mm across and show partial to complete oxidation to limonite. In that the magnetite grains are subhedral to euhedral, I suspect they are secondary, having crystallized after deposition of the silicate minerals.

In hand sample the rock is a compact fine grained brownish gray rock that splits irregularly along bedding. Clay, sericite, and elongate quartz and feldspar grains show parallel alignment in thin section. The rock is magnetic.

10BR225 Potassium + Calcium Stain

A compact gray argillite consisting of 55% colorless clay and sericite, 43% quartz and subordinate plagioclase, 1% smectite, and 1% accessory minerals. The smectite is pleochroic in shades of brownish green. Accessory minerals include zircon, rutile, carbonate, and limonite. Carbonate occurs as rhombs up to 3/4 mm across intergrown with limonite and containing inclusions of sedimentary quartz. Quartz and plagioclase grains generally are .02 - .07 mm across. Lenses of clay plus sericite ½ mm to at least 1 cm long contribute to the irregular bedding of the rock. In hand sample the gray rock breaks unevenly along bedding planes which may be coated with orange limonite stains.

10BR24 Potassium + Calcium Stain

An argillite consisting of 58% clay and sericite, 40% quartz with subordinate plagioclase, and 2% accessory minerals. The accessory minerals include leucoxene, limonite, and tourmaline. Some of the leucoxene and limonite appear to come from altered opaque Fe-Ti oxide grains. Bedding is poorly defined, partly due to the distinctive irregular lens-like pockets commonly up to 1 cm long. The pockets are stained with limonite and contain quartz grains somewhat larger than the remainder of the rock. Quartz grains in the pockets are roughly .03 - .08 mm across. Quartz grains in the bulk of the rock generally are .02 - .04 mm across. Some clay minerals are pale green.

In hand sample the rock is mottled in shades of tan and greenish gray.

10BR4A#13 Potassium + Calcium Stain

An argillite consisting of 56% clay and sericite, 37% quartz, 2% plagioclase, 1% K-feldspar, 2% brownish green smectite, and 2% accessory minerals. Accessory minerals include aggregates of hematite granules, zircon, tourmaline, and magnetite as euhedral crystals up to ¼ mm across. Most quartz grains are .02 - .07 mm across. Bedding is poorly defined by parallel alignment of larger sericite grains.

In hand sample, the core of the rock is dark gray, with an intermediate 1½ mm thick light gray weathering band, and an outer ½ mm thick orange-brown rind. The orange-brown rind is due to the oxidation of smectite to limonite.

It may be possible to determine relative ages (i.e. ages of exposure to the atmosphere) of rocks as a function of the thickness of their weathering rind. I would be cautious about comparing rind thicknesses between different rock types. Specifically, the natural acid in rainwater might leach the calcite out of 10BR25 faster (therefore developing a thicker rind) than it would alter smectite to limonite in this sample, in the same amount of time.

APPENDIX B

CONTROLLED LIGHT PHOTOGRAPHY: A METHOD OF RECORDING PETROGLYPHS

By

Warren R. Peterson

Lake Pend Oreille in northern Idaho is a large natural lake where the water level is controlled by Albeni Falls Dam. The summer water level averages 629 m (2062 ft) from May to October. A low pool level of approximately 625 m (2050 ft) is usually maintained during the winter. Rock art sites around the lake are approximately half above and half below the high pool level.

Many of the petroglyphs in the Lake Pend Oreille area are almost invisible, even when their exact locations are known, unless direct light strikes them at the correct angle. When the weather is clear, the sun will be at the correct angle for about 30 minutes each day, depending on the slope and exposure of the rock surface. On the other hand, under the following conditions, petroglyphs are difficult or impossible to see: (a) when an obstruction blocks the sun during the period the light is at the correct angle, (b) when the rock surface has a north exposure, or (c) when the rock is under water.

During the summer when the weather is favorable for finding and recording petroglyphs, the water level is high and many are under water and cannot be reached. When the water is low during the winter, the petroglyphs are accessible, but there are only a few clear days when they are not covered by snow. Those figures which are innundated for six months each year are difficult to see during the drawdown period because the water deposits a grey silt on the rocks which makes the figures blend in with the rest of the rock surface. Tight-growing lichen and moss cover many figures figures above the high-water level.

Many of the figures are found on light grey rock which weathers to pink or red when exposed to the air for a long period of time. By pecking through the surface color, the light grey color of the rock is exposed, making the figures very obvious at that time. Time and the elements have caused the figures to become the same color as the adjacent rock surface, making them very difficult to see.

Under these conditions, I located and recorded as many figures as possible using sunlight. Progress was slow, and when I realized how many figures were being missed, I knew a better method had to be found.

Experiments for photographing petroglyphs on the Skeena River at night were conducted by Walker et al. in 1977. This technique used artificial light striking the rock surface at a low angle. With this technique in mind, I revisited the Lake Pend Oreille rock art sites at night. Using a large flashlight held at arm's length, I found many more figures at the known sites and one previously unrecorded site. The figures were marked with flagging as they were found so they could be mapped during daylight.

I then tried taking photos of the figures at night using a 35 mm single-lens reflex camera, a detached flash on a PC extension cord, and a flashlight for a modeling and focusing light. Some satisfactory photos were obtained, and the figures were very distinct when the flash was held at an angle of from 5° to 10° to the rock surface. Correct exposure was difficult to determine, however, and I wasted much film on bracketing exposures until I obtained a MK10A Soligor Trysistor flash unit with a detachable automatic sensor. The sensor was attached to the camera hotshoe while the flash could

be detached but connected to the sensor by a cord. This allowed the sensor at the camera to measure the light reflected from the rock surface to the camera and so regulate the amount of light from the flash unit. This system allowed correct exposures regardless of the texture, color of the rock, or the angle at which the light struck the rock surface.

It soon became apparent that the 5° to 10° light angle recommended by Walker et al. (1977) was best for black-and-white photos, but the amount of deep shadows at this low angle caused a loss of color in color photos. I have found that a fill light at the camera of 1:2X the main light source, or a light angle of 15° to 20°, produced better color and still cast good shadows in the depressions.

Recording sites in the spring of 1985, Keo Boreson and I were frustrated by bad weather and poor natural light so we tried covering the rock faces and ourselves with a large piece of black opaque plastic. Using a flashlight held at a low angle, we were able to find and sketch figures that were otherwise impossible to see. Later I tried photographing a figure using the plastic cover and the results were good. Two people are required--one to hold the modeling light and flash while the other takes the photo. Also it takes two people to hold the plastic if the wind is blowing. A frame of fiberglass rods like those used in dome tents would work well and give the photographers working room. A skirt of loose plastic around the bottom of the frame would keep daylight from entering around the bottom. An ideal camera for this work would be one with a dedicated automatic flash. This would allow the flash to be detached from the camera but connected by a PC cord, which would allow the camera to control the amount of light produced for a correct exposure. A flash with a modeling light incorporated in it would also be ideal.

The following six photographs (Figure 34) are of a 22 x 26 cm rock fragment with peck marks from site 10BR4A. The camera was stationed at a 90° angle to the rock surface and was set at 1/60 of a second at F-11. The flash was held at 90°, 67°, 45°, 22°, 10°, and 5° angles to the rock surface at a distance of 1.2 m and had an automatic sensor on the hotshoe.

The lighting techniques presented in this discussion offer an efficient and effective method of locating and photographing petroglyphs when natural light conditions are inadequate.

APPENDIX C

MODIFIED COBBLE FRAGMENTS FROM PETROGLYPH SITES 10BR5 AND 10BR24

By

Keo Boreson

In 1969, 20 modified cobble fragments were recovered from sites 10BR5 and 10BR24 by Warren Peterson. The 18 artifacts from 10BR5 were found within the sediment accumulation between outcrops in a 2 x 1 x 0.5 m area. Two tools from 10BR24 were found in the beach gravel adjacent to the petroglyphs.

Many of the cobble fragments are minimally altered. The cross sections range from rectangular to triangular with several irregular shapes produced through modification or use. The artifacts range from preforms to almost exhausted tools.

The measurements and characteristics of the assemblage are included in Table 4, and a few examples are shown in Figure 35. Many of the artifacts had been bifacially altered to a tapering point, forming an area that had subsequently been rounded and blunted from use. In many cases, the opposite end appears to have been a strking surface with edges rounded from use. A few items have two (or more) modified, blunted ends indicating bipolar use. These tools were apparently used as chisels or direct hammers in petroglyph production.

Several artifacts had been unifacially or bifacially modified on one or more edges from intentional flaking or use and resemble large scrapers with rounded or blunted edges. They appear to have been used as grinding or incising tools, again possibly in connection with the production of petroglyphs.

Table 4. Measurements and Characteristics of Artifacts from 10BR5 and 10BR24.

Artifact Number	Measurements (cm) Length x Width x Thickness			Striking Surface	Bifacially Modified	Unifacially Modified	Pointed	Rounded Edge	Other
10BR5									
1	7.80	5.13	2.05	x	x		x		
2	6.53	6.45	2.90		x				
3	10.17	7.91	2.52			x	x		
4	9.01	5.09	1.82	x		x	x	x	
5	14.00	10.06	4.55	x	x		x		
6	12.82	9.23	3.01	x	x		x		
7	15.00	7.55	2.82		x		x		Bipolar
8	7.91	7.40	1.09						Platform
9	12.54	10.29	5.53		x		x		Bipolar
10	8.82	8.02	5.10						Platform
11	8.38	6.09	2.68	x			x		
12	9.46	7.43	3.96	x	x		x	x	
13	11.95	9.92	3.02	x	x	x	x		
14	9.69	5.43	2.41	x					
15	9.05	7.10	3.82	x		x	x		
16	9.45	6.02	1.71	?	x			x	
17	11.66	4.66	4.49	x	x		x		
18	6.19	2.76	2.23				x		
10BR24									
1	16.50	5.91	2.32	x			x		
2	8.45	5.07	1.73	x	x		x		

Artifact No. 2

Artifact No. 3

Artifact No. 5

Artifact No. 7

Figure 35. Examples of modified cobble fragments from 10BR5.

END

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MARCH, 1988

DTIC