

RELATIVE DATING AND THE
ROCK ART OF LAVA BEDS NATIONAL MONUMENT

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ABSTRACT

Dating rock art has long been a serious impediment to its use in archaeological research. Two rock art sites in Lava Beds National Monument present an unusual opportunity for the establishment of a relative dating scheme tied to external environmental events. In the case of Petroglyph Point, extended wet and dry climatic cycles produced changes in the levels of Tule Lake that successively covered, eroded, and then exposed the petroglyph bearing surfaces. Similarly, wet periods would have precluded painting at the nearby Fern Cave as the cave walls would have been too wet for paint to bond to the wall. The study of past climatic conditions, coupled with other archaeological evidence, allows us to present a model from which a relative chronology for Modoc rock art of Northeastern California covering the past 5,000 years can be constructed.

INTRODUCTION

Lava Beds National Monument is located in northeastern California, south of Klamath Falls, Oregon. Aside from a very interesting history that encompasses the Modoc Indians (and their predecessors) and the famous Modoc Wars of 1872-73, the Monument has numerous natural geological features of interest, as well as some outstanding rock art sites. It is also on the migratory bird flyway, making it a popular area for hunters and bird watchers alike. During World War II a Japanese internment camp was located nearby. These various attractions serve to draw a number of visitors to the Monument throughout the year. For many of them, the Monument affords their first and only exposure to Native California rock art.

We were contracted by the Lava Beds National Monument to document the rock art of Petroglyph Point and Fern Cave. As part of the project, we were to address problems of dating the art and make management recommendations for the sites. This paper focuses on our efforts to establish a relative chronology for the Monument rock art sites.

DATING CALIFORNIA ROCK ART

Rock art has long been ignored by archaeologists or relegated to a second class status among other types of archaeological data.

With the exception of Dorn's (cf. Whitley and Dorn 1987) experimental attempts to directly date rock varnish, most chronological sequences for California rock art rely on superpositioning and the appearance of items such as the bow and arrow or horse and rider motifs to establish relative dates. Dating rock art is important to establishing its place within local culture histories, but it can also be useful to addressing more interesting questions related to cultural change and ethnicity.

Archaeological sequences in the Modoc area, for example, postulate apparent cultural changes about 5,500 B.P. (Sampson 1985:511) and again around 2,000 B.P. following the introduction of the bow and arrow (Sampson 1985:514). The appearance of shell beads from the coast at about the same time, along with the appearance of obsidian ceremonial blades and points from the interior on the coast, indicates the establishment of a long distance trade network along the Klamath River (Hughes 1978). It would be interesting to know what changes, if any, were occurring in the rock art as the trade networks were expanding. We often assume that rock art styles reflect a culture's ideology and, therefore, styles will change in concert with other cultural changes. This is an assumption we should be able to test archaeologically with better chronological controls.

Another example of a testable hypothesis can be derived from Aikens' (1985) proposal that the Modocs descended from Penutian speakers who moved into the area about 2,000 years ago. As with the proposed Numic spread, Aikens builds a model wherein the Penutians were better adapted to the lacustrine environment than the indigenous population. If it is possible to isolate panels that are likely to date to this time period, then Aikens's proposal could be tested by comparing them with central California rock art styles. Whether or not the rock art data reflect these cultural changes is a topic for further research.

RESEARCH AREA

The Modoc territory includes the southern portion of the Klamath Basin, straddling the California-Oregon border immediately southeast of Crater Lake. The Klamath Basin was formerly covered by what Dicken (1980) calls pluvial Lake Modoc. A complex series of northwest-southeast trending fault blocks coupled with innumerable basaltic lava flows and down warping combined to create the lake basin. The lake was fed by the eastern drainages of the Cascades and runoff from the Modoc Plateau (Dicken 1980; Pease 1965). The antiquity of the lake can be inferred from the estimated dates of phreatomagmatic explosions of basaltic lava in the lake several hundred thousand years ago that formed calderas such as Prisoners Rock and Juniper Butte in the Lava Beds National Monument (Macdonald 1966; Donnelly-Nolan and Champion 1987).

The Modoc Plateau to the south of the Klamath Basin is marked by the Devils Garden lava platform and the Medicine Lake Highlands. The Highlands comprise numerous volcanic cones, basalt

flows, and obsidian flows that form the larger Medicine Lake volcanic mountain. The area is covered by a Great Basin shrub-grass plant community dominated by *Artemisia* species with pine and fir forests at higher elevations (Pease 1965:38-44). Annual temperatures range from 20° to 90° F and rainfall averages between 12 and 17 inches (Sampson 1985:7; Pease 1965:173).

The area was inhabited by the Modocs at the time of white contact. The Modocs wintered in semi-permanent villages along the lake shores and moved into the highlands to fish and gather roots and bulbs in the spring and summer (Ray 1963:180-182). According to Ray (1963), hunting continued throughout the year, but it was most important from October through December, when the winter villages were being readied for reoccupation. In addition to deer, elk, and antelope, the Modoc hunted bear, mountain sheep, rabbits, and a variety of rodents. Along with the Klamath, the Modoc form an isolated linguistic group, speaking a divergent form of Sahaptin (Ray 1963:xiv) possibly related to the Columbia Plateau region. Archaeological evidence shows long-term occupation in the Modoc region extending back for thousands of years with little change in subsistence patterns (Sampson 1985).

Two sites are examined here in detail, Petroglyph Point (Mod-1) and Fern Cave (Mod-17). Petroglyph Point is one of California's largest rock art sites; it is also one of the most accessible and publicized. The site is situated at the base of the cliffs on either side of an eroded volcanic caldera that once formed part of a narrow peninsula extending into the southeast corner of the former Tule Lake. In contrast to the exposed cliffs of Petroglyph Point, Fern Cave is a dark, damp, fairly lush lava tube. Luxuriant growths of ferns, lichens, and mosses give the cave its name. The rock paintings extend along both walls of the cave into the darker reaches of the lava tube. Temperatures inside range from cool to cold, in contrast to the atmosphere above ground.

LAKEBED EVIDENCE AND RELATIVE DATING

In their report to the National Park Service, Squier and Grosscup (1952) first recommended that future studies in Lava Beds National Monument should consider the problem of fluctuations in the level of Tule Lake. Cleghorn (1959:Fig. 1) first noted the presence of a wave cut notch at 4,076 ft. at Prisoners Rock that could only have been formed after the Tule Basin was separated from the larger Lake Modoc and the newly formed Tule Lake stabilized in area. We are assuming that this event took place sometime near or after the end of the Pleistocene in concert with similar changes occurring in the other pluvial lakes of the region. If this assumption is correct, then we should be able to correlate later fluctuations in the level of Tule Lake with similar fluctuations observed in geological studies of the pluvial lakebeds to the northeast and east.

Fluctuations in lake levels varied in concert with changing climatic conditions in the Klamath Basin. When rainfall exceeded

the average without an accompanying increase in average temperature, lake levels could be expected rise. Cool and moist climatic conditions, therefore, are generally correlated with high lake levels, warm and moist conditions may or may not affect lake levels, and warm or cool dry conditions are correlated with dropping lake levels. Our premise is simple. Wave action during extended periods of high lake levels is expected to have cut notches in the Petroglyph Point cliff face, thereby erasing any rock art that might have been present. Extended periods of low lake levels are likely times for petroglyphs to have been carved as the site would have been most accessible. Otherwise, annual fluctuations may or may not have precluded the carving of petroglyphs. At the time of the Modoc War, for example, most of the carved surfaces at Petroglyph Point were under water (Cleghorn 1959: Fig. 1).

Ideally, we would find former lakebed terraces for dating, however, Tule Lake is a poor candidate for the direct dating of terraces. The northern shore is too flat and sandy for terraces to survive and the southern shore is formed by basaltic lava flows (Cleghorn 1959:4). Sampson's (1985) Nightfire Island study offered one model for studying changing lake levels in the basin using the LaMarche (1973,1974) White Mountain bristlecone pine temperature and moisture curves for the period 3,400 B.C. to A.D. 1900. The model (see Figure 1) predicts high lake stands prior to 6,500 B.P., around 5,000 B.P., 2,500 B.P., 1,500 B.P., and 500 B.P. (Sampson 1985:22). Periods of extremely low lake stands were predicted for 6,500 B.P., 3,000 B.P., and 1,000 B.P.

Archaeological evidence from Nightfire Island supports the predicted model somewhat, but not precisely. Sampson's model also proved to be too fine for our purposes as we felt that some of the fluctuations important for his subsistence studies were of too short a duration to substantially effect the petroglyphs. Therefore we refined Sampson's model by looking to evidence for dated shorelines from adjacent pluvial lake basins that are subject to similar climatic conditions as Tule Lake.

The geologic history of the pluvial lakes can be divided into the Pleistocene or earlier and the Holocene. While our primary interest is in the events of the Holocene following the arrival of humans, the Pleistocene lake histories help resolve questions about the timing of the drop in water levels at pluvial Lake Modoc. Two lakes in particular, Fort Rock and Chewaucan, provided direct dates for prehistoric shorelines. The pluvial Fort Rock Lake lies to the northeast of the Klamath Basin and is similarly formed by deep faults, fault-block mountains, and lava flows (Allison 1979:3). To the southeast is Pluvial Lake Chewaucan, better known today as Summer and Abert Lakes. In addition to the dates of immediate post-Pleistocene lake levels, recent work on the shore of Lake Abert (Pettigrew 1985) provides direct evidence for dating fluctuating lake levels in relation to archaeological sites.

	Antevs' (1955) Climatic Ages	Sampson's (1985) Predicted Lake Levels for Lower Klamath Lake	Predicted Levels of Tule Lake in Relation to the Petroglyphs
500 B.P.	Medithermal (moderate)	Average	Average
1,000 B.P.		High	High
1,500 B.P.		Low	Low (with periodic inundations)
2,000 B.P.		High	
2,500 B.P.		Low	
3,000 B.P.		High	High
3,500 B.P.		Low	Low (with periodic inundations)
4,000 B.P.		Average	
4,500 B.P.		Low	
5,000 B.P.	Altitheermal (warm/dry)	High	High
5,500 B.P.		Low	Low
6,000 B.P.		Low	
6,500 B.P.			----- ? -----
7,000 B.P.	Anathermal (cool/moist)	High	High
7,500 B.P.		High	High
8,000 B.P.		High	High
8,500 B.P.		High	High
9,000 B.P.		High	High

FIGURE 1. Antevs' Holocene climatic ages, Sampson's Nightfire Island predicted lake levels, and the predicted high lake stands for Tule Lake used in the current study.

After correlating the data from the Fort Rock Basin, the Chewaucan Basin, and the Klamath Basin, we produced an alternative sequence to that offered by Sampson. Between 6,400 and 5,700 B.P. it appears that a drying trend may have caused lake levels to retreat. They recover about 5,500 B.P. along with apparent cultural changes in the Klamath Basin (Sampson 1985:511). To the extent that people throughout the pluvial basins had to adapt to drier conditions for 200 years or more, it may be that we are seeing the effects of a broadening of the subsistence base rather than the effects of population replacement.

By 4,500 B.P. Nightfire Island, Lake Abert, and perhaps the other basins show evidence of another drought. Despite a brief wet period, the climate continued to be dry and the lakes again shrank in size. Nightfire Island was abandoned during this climatic episode and then reoccupied around 2,600 B.P. with evidence of major cultural changes. The site was apparently abandoned again during a drought about 2,000 years ago. Most aspects of the material culture remain unchanged following reoccupation with the exception of the previously mentioned addition of the bow and arrow and long distance trade networks. The latest changes in lake levels are adapted from Sampson's model for want of better data.

ESTIMATED DATES FOR PETROGLYPH POINT

Based on the preceding discussion of fluctuating lake levels in the pluvial basins, we propose that the uppermost notch, as well as the caves on either end of Petroglyph Point, were cut at the end of the Pleistocene as Tule Lake slowly fell (see Figure 2). Several other notches were possibly created as the lake fell and stabilized in successive stages. The cliff face probably was not exposed until the dry period between 6,400 and 5,700 B.P. This is the earliest that any petroglyphs could have been carved. Although it is risky to assume that any of the rock art was created at this time, likely surviving candidates include panels 38 and 39 on the west side and panel 6 on the east. Panels 38 and 6 are too high to have been carved from boats after 6,400 B.P. (see Lee, Hyder, and Benson 1988 for panel documentation). Panel 6 on the east side of Petroglyph Point was probably carved from a rock ledge which later collapsed. Panel 38 may have been carved from a bank left by the receding lake that later eroded away.

An extended period of higher lake levels again prevailed about 5,000 years ago. If we assume that the 4,076 foot notch was cut at the end of the Pleistocene and that lake levels did not reach that point again, then at least one of the lower petroglyph-bearing notches was cut at this time. It is unlikely, therefore, that much of the rock art could predate 5,000 B.P. The drought at 4,500 B.P. would be the next likely time for the creation of petroglyphs, and Petroglyph Point probably was accessible for the next 2,000 years. This does not preclude periodic inundations related to short-term climatic fluctuations. Assuming that petroglyphs were produced during this period, likely candidates would include panels 20, 21, 22, and 23 on the west side of

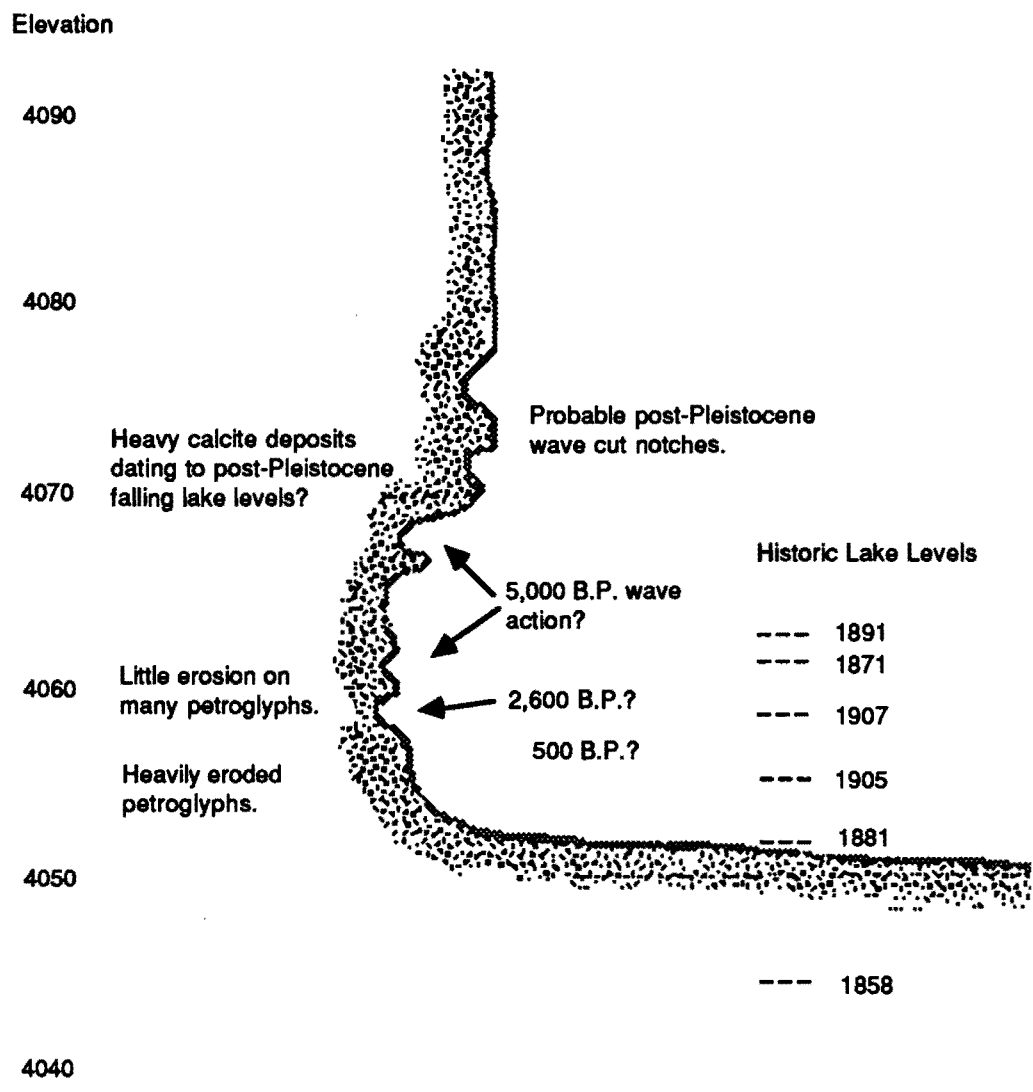


FIGURE 2. Elevations of wave cut notches (after Cleghorn 1959) and their relationship to changing lake levels and petroglyphs.

Petroglyph Point. The cliff face in this area is not as deeply cut, perhaps owing to its exposed location and wave patterns on the lake. These panels have nearly eroded away, but they appear to postdate the eroded notch in which they are found.

Later changes become more difficult to identify. The boulders that comprise panel 26B show definite wave cut notches that could only have formed while both boulders were standing upright and apart. The southern boulder has now shifted so that its upper notch is angled upward, and it has neatly eroded into the side of the northern boulder. The petroglyphs inside the small cave formed by the two boulders could only have been carved when they were upright. While we do not know when they fell, the fact that they lack multiple notches and the wall behind them is notched implies that they fell later rather than earlier. If we assume that the lowest, undisturbed notch was cut at the last extended period of higher lake levels 500 years ago, then the boulders probably shifted sometime in the preceding 2,000 years. The petroglyphs then were carved prior to the cool/moist period 2,600 years ago or at the time of the drought about 2,000 years ago. The earlier date seems more likely.

The latest petroglyphs are most likely those nearer the southern end of the west side of Petroglyph Point. The area is interesting as it sits in a pocket somewhat protected from wave action and it is situated at the only place of access to or from the top of the caldera along the west face of Petroglyph Point. Many of the figures have been eroded in a manner that has acted to widen and deepen the grooves of the petroglyphs. This action makes them appear somewhat newer and somewhat less refined than other petroglyphs at the point. Either these figures were not eroded heavily by the extended high water levels 500 years ago, or many of the petroglyphs in this area were carved within the past 500 years.

A recalcified Anglo name, Kib Green, below Panel 9 demonstrates the rapidity with which even short-term higher lake levels would interact with the rock. While we do not know when or how deeply the name was carved (the lines are broad, smooth, and shallow), we are guessing that it was carved about the time of lower lake levels in 1881. A Major John Green was involved in the Modoc Indian Wars and an H.E. Green surveyed in the area for the Bureau of Reclamation in 1903. Unfortunately, both of these men were in the area at times when the petroglyphs were under water, although it is possible that the lake level fell while Major Green was still in the area.

DATING FERN CAVE

Fern Cave presents a separate problem for dating. It is unique in that it is the most extensive painted site in the monument and one of only two caves with habitation debris, yet it is stylistically similar to other painted sites in the region. A cross-shaped trench was excavated in the cave floor in 1935 by then Chief Ranger J. Carlisle Crouch (1936). His report is barely

adequate by today's standards, but it appears that the artifacts recovered generally date to the past 2,000 years. Fortunately, only a sample of the midden was excavated and it appears from his report that sufficient charcoal should be present in the remaining deposits for radiocarbon dating. Until more work is done in the cave, two contrary pieces of evidence might better fix the age of the paintings depending on one's perspective.

Over the course of the past year, we had the opportunity to observe the cave walls under extremely damp and extremely dry conditions. Based on our recording of painted panels, we can attest to the fact that several of them could not have been painted when the climate was wetter than at present. The paint simply could not have bonded with the damp walls. That would suggest that they were painted prior to the last wet period about 500 years ago. On the other hand, no water is readily available in the general vicinity in dry years. The presence of several nearby house pits and the midden deposits in the cave suggest possible extended periods of occupation. Either water was being carried in from some distance, or the site was more likely to have been occupied in the wetter period of the past 500 years. In this latter case, it may have been that fires in the cave kept moisture levels down and the walls relatively dry. Again, more archaeological work is needed to resolve this question.

A second piece of evidence further confuses the issue. Red pigment apparently did not come into use in the Modoc area until they began trading with the Paiutes (Ray 1963:174-176) about 1,000 years ago. However, no red pigment is present in the paintings at Fern Cave, although it does appear in the art at other sites. For example, one small eroded ochre painting can be found on the east side of Petroglyph Point. It appears in conjunction with a petroglyph panel. The adjacent petroglyph panel shares some motif types in common with Fern Cave. It may be possible that this panel is indeed late and may be evidence that painting also entered the local tradition rather late in time, although it seems not to have replaced the manufacture of petroglyphs.

CONCLUSIONS

Petroglyph Point's unusual geological features and petroglyphs, when coupled with our knowledge of past lake fluctuations, provide us with an excellent opportunity to postulate relative dates for the art of the Modoc region. Our recording efforts produced a database of thousands of elements that have yet to be coded and fully analyzed. In the future, these data will afford the opportunity for a comparison of motif compositions and stylistic changes between presumed early and late panels to test the proposition that change has occurred. Similar comparisons can be made between the petroglyphs and the paintings from sites such as Fern Cave. Although not a part of our study, the data generated could be coupled with data from California's Central Valley to test Aikens' proposition of population movements from the Penutian areas into the Klamath Basin. It is through the pursuit of these and similar questions that the study of

California rock art will begin to make a bigger contribution to the study of California archaeology.

NOTES

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