BONES, STONES, AND CULTURAL MARKINGS: A CONTEXTUAL APPROACH THROUGH TESTING PROVIDED BY THE BENNYHOFF AWARD

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What can be learned about the prehistoric peoples who left evidence of their early rituals on boulders throughout the Coast Ranges of California? This study utilizes an existing collection of artifacts, with testing provided by the 2007 Bennyhoff Award, and focuses on lithic and faunal material recovered at the University of California Hopland Research and Extension Center (HREC). Results garnered from obsidian hydration, EDXRF sourcing, and faunal analysis provide information that will inform an understanding of how these early people were utilizing the landscape, as well as provide a temporal framework for human transit and occupation in the area.

SIGNIFICANCE OF STUDY

My dissertation research investigates how prehistoric peoples were moving around and utilizing the landscape: how they created cultural places and spaces. It seeks to determine and evaluate if it was feasible that the people who produced the artifact assemblage are the same people who placed the cultural markings (PCNs or Pecked Curvilinear Nucleated elements) on several boulders in the study area, which are believed to be the result of ritual. The artifacts that are the subject of current testing will serve to identify temporal periods of occupation or transit, and indicate how prehistoric people were utilizing the landscape. It is important to realize that the marked boulders are more than cultural phenomena to be placed in a temporal/spatial context. Not just relics or epiphenomena of the prehistoric/historic past, they are representations of meaningful social and cultural practices (rituals). Even today, they are material manifestations that evoke history, memory, and meanings. They are phenomena with life histories and biographies. In particular, they can perhaps be better understood as vital to a dynamic landscape of symbols and meanings as "players" or "participants" in the multiple ways in which relationships among people, places, spirits, histories, groups, and practice may have been brought into being, reinforced, changed, or forgotten or rejected. This paper or report will provide the archaeological context to better place a face on the prehistoric past.

Access to an existing artifact collection has provided an opportunity to place the PCN tradition within this cultural context with a minimum amount of invasive excavation. It is my objective that my dissertation research will contribute additional knowledge concerning the phenomena, and will move beyond a "rock art study" to a contribution to the field of California archaeology that will answer greater questions about the prehistoric movement of cultures across the landscape, and to further understand the prehistoric peoples.

HISTORY OF PCN RESEARCH

The marks themselves were identified as cultural on several boulders by Julian Steward as early as his 1929 publication on California petroglyph sites (Steward 1929). Interestingly, nearly all of the nine petroglyph sites that Steward published in his section on the Northwestern California style area have PCNs present on the boulders. His 2 Pt. is CA-TRI-1, 3 Pt. is MEN-433 (Bell Springs), and 4 Pt. is MEN-434. Steward's 5 Pt. may be the same as his 4 Pt. Recently, Bryan Much had an opportunity to visit an unrecorded site that may have relocated Steward's 6 Pt., SON-265 (Roche La Motte) (Bryan Much, personal communication 2007). The Old Blair Ranch Site SON-373, Steward's 7 Pt., has not been documented as a PCN site, but by being classified as a "Pomo Baby Rock," may also contain PCNs as on

similar boulders. This site needs to be visited for identification. The Cazadero site, Steward's 6 Pt., SON-268, contains PCN markings as does his 9 Pt., SON-269, the Porter Creek site.

Research into the PCN tradition began in 1970 when its type-site, Ring Mountain (MRN-442), was first noted by geologist Salem Rice (Miller 1977:8) and was first published by Hotz and Clewlow (1974). While Kroeber (1925) and later Heizer and Clewlow (1973) had deemed Marin County void of rock art, in 1972 Virginia Hotz was shown the site on Ring Mountain that identified the cultural markings, and was the impetus for research by Teresa Miller that culminated in her M.A. thesis (1977) that identified and named the tradition (Pecked Curvilinear Nucleated) and offered a predictive model for locating PCN sites, and thus identified a plethora of 68 additional sites in Marin and Sonoma counties. The model was based on the hypothesis that the lithology of the marked boulders (known by geologists as "knockers") was a blue/green chlorite or glaucophane schist, which is metamorphic and a part of the Franciscan formation. It is believed that these boulders appeared in geologically unstable regions, such as fault zones (Miller 1977:13-14). Subsequent research (Fentress 1999; Gillette 1998, 2003; Miller 1977; Parkman 1991; Rushing 2004) has added to the corpus of knowledge concerning the tradition.

My 1998 M.A. thesis (Gillette 1998) assembled a geographical distribution of similar sites which has subsequently grown to more than 120 presently identified sites that span the length of the Coast Ranges of California, into Oregon, and into the Transverse Ranges to the south. New sites continue to be identified. The PCNs, or Pecked Curvilinear Nucleated elements, that had been defined by Miller (1977:44) as "circles and ovals, which have nuclei, that appear raised," have been the subject of my research for approximately the last 15 years.

RESEARCH AREA

While PCN marked boulders occur throughout the Coast Ranges, the setting for my dissertation research is restricted to the University of California-owned Hopland Research and Extension Center (or HREC) located in the southeast corner of Mendocino County, just east of the Russian River, in the Mayacamas Mountains of the North Coast Range of California, and the surrounding area that may provide additional clues concerning prehistoric use and movement on the landscape. There are four boulders or clusters of marked boulders in the study area. The HREC consists of nearly 5,400 acres that has seen minimal development and has served as an agricultural- and science-related study station since the 1950s. Prior to that time, it was ranch land. Just to the east, less than 20 mi. distant, is Clear Lake and the site of the two major obsidian flows -- Mt. Konocti and Borax Lake -- that have been documented as obsidian sources for at least 12,000 years. Several chert quarries have been identified on the HREC. Ethnographically and traditionally, the region lies within the Central Pomo territory and specifically that of the Hopland Rancheria, whose historic reservation lies in close proximity to the HREC (Figure 1).

THE ARTIFACT COLLECTION

I am very appreciative to have been granted access to an extensive collection of artifacts (with over 2,200 catalog numbers) that were the result of 18 weeks of excavation on the HREC by field schools from 2000 to 2002 directed by a former graduate student at UC Davis. While no analysis was made of this collection, it has been generously made available to me for my research. I have benefited greatly from this access, and it provides a model for utilizing existing collections in place of additional extensive excavation to understand the archaeological context of a region. Artifacts from this collection (UC Davis #504) are the materials that were submitted for the testing provided by the Bennyhoff Award.

SAMPLE SELECTION

My selection of samples for analyses was chosen with the assistance of Lisa Deitz and Liz Guerra of the Davis Archaeology Lab staff and UC Davis students David Rudduck and Cassandra Manning, with faunal analysis assistance from Dr. Christine Darwent of the Davis Anthropology Department. During

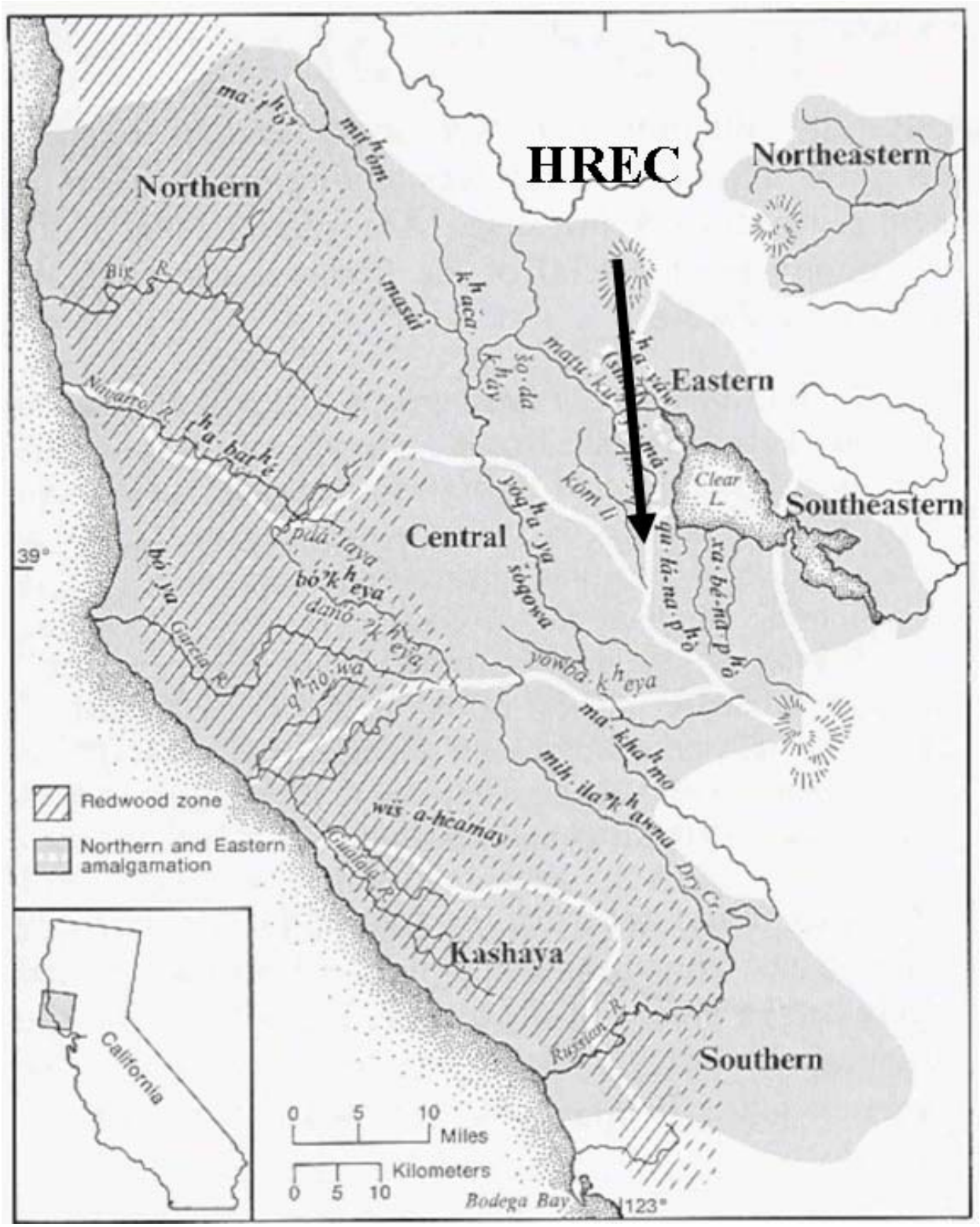

Figure 1. Map showing the location of the HREC.

the Davis Field Schools, nine separate identified archaeological sites on the HREC were excavated. Additional portions of the artifact assemblage were from STPs (shovel test pits) and auger samples that were taken from the lowest level of many of the excavated units. After careful study of the excavation notes (from student field books) and the artifact catalog of the collections, five of these sites were selected as the source of material for the procedures, based on the probability that these sites were habitation sites (more likely seasonal campsites), and the suggestion that they might provide samples that would be appropriate for analysis and enlighten my research. The five sites are summarized below (Figure 2).

Prior to the 2000 UC Davis field school session, MEN-852 (Rockpile) had been identified in a 1974 site report as a large midden site located on the south side of a large rock outcrop, containing chert, obsidian, and groundstone (Orlins 1974). There was a sag pond with water year-round reported just to the southwest of the midden (Figure 3). A sag pond is a body of water which forms as water collects in the lowest parts of the depression that forms between two strands of an active strike-slip fault, in this case the Mayacamas fault that runs through the site. Rounded cobbles and formed net-sinkers have been found around the pond, making it an archaeological sensitive area as well. Possible house pit features had been identified along the base of the rock outcrop (Orlins 1977). Many obsidian and chert flakes and tools, and bone fragments have been observed (and some collected and curated by HREC staff). This is the only site that was originally identified as a habitation site based on the observable midden. The site was mapped and surveyed in 2000 and excavated in 2000 and 2001. Excavations included 10 auger tests to determine the extent and depth of the deposit and 14 (50-by-50-cm) STPs to verify the extent. Seven 1-by-1-m excavation units (numbered Units 1-7) were placed according to the richness of deposits as indicated from the results of the surface survey, augers, and STPs, and were excavated to sterile. One 6-by-.5-m trench, excavated in six 1-m sections, was placed across a circular depression to determine its content. Unit #1 was excavated to a depth of 160 cm, Unit #2 to a depth of 148 cm, Unit #3 to a depth of 140 cm, Unit #4 to a depth of 150 cm, Unit #5 to a depth of 150 cm, Unit #6 to a depth of 150 cm, and Unit #7 to a depth of 150 cm. The trench was excavated to a depth of 100 cm, and was placed over an area that had been identified by Robert Orlins (1977) as a possible house pit (which may also have been the result of rock quarrying by the HREC).

The Middle Pond site, or HREC-9 (site report yet to be submitted to the Northwest Information Center), has been identified as a lithic scatter along the west side of a sag pond. The pond holds water all year. The scatter includes chert, obsidian, and some rounded cobbles. There is a noted mix of oak and madrone trees present. Two units were excavated in 2001 at HREC-9 to depths of 170 and 180 cm. Large quantities of bone and debitage, exceeding that of the other excavated sites on the HREC, were catalogued from these units. Field school students had suggested that the site might be much larger, and believed it was a seasonal hunting camp based on the faunal assemblage.

The site report for the site known as Parson's Creek Narrows or MEN-3357 (HREC-8) (Sjordal et al. 1999) indicated that it contains a midden with a metate, obsidian points, obsidian debitage, fire-affected rock, historic debris, and some shell. The site covers an area that is 60 m (N/S) by 15 m (E/W), and is divided into two parts by a drainage (Parson's Creek) that is approximately 6 m wide. The one unit that was excavated was taken down to a level of 150 cm. Charcoal and an ash lens were revealed at Level 12 (120 cm) of MEN-3357. No STPs were performed at this site. It is my understanding that, because of the difficult rocky conditions for excavation and the history of flooding of the nearby creek, just the one unit was excavated.

Madrone Grove or MEN-2216 (Gary et al. 1988a) is the fourth site from which artifacts were selected for testing. The site report listed a moderate lithic scatter with groundstone tools. These were observed located on a flat area adjacent to Parson's Creek. In 2001, Unit 1 was excavated to a depth of 70 cm and Unit 2 to a depth 110 cm. There were no STPs. The site is located just north of MEN-852.

The final site that provided artifacts for testing was MEN-2223, the Buck Springs site (Gary et al. 1988b). The 1988 site report indicated a sparse lithic scatter and a pestle fragment at the head of a spring, surrounded by various kinds of oak trees. This site was a short distance to the east of MEN-852. In 2001, five units were excavated: Units 1 and 2 to a depth of 100 cm, Unit 3 to a depth of 80 cm, Unit 4 to a

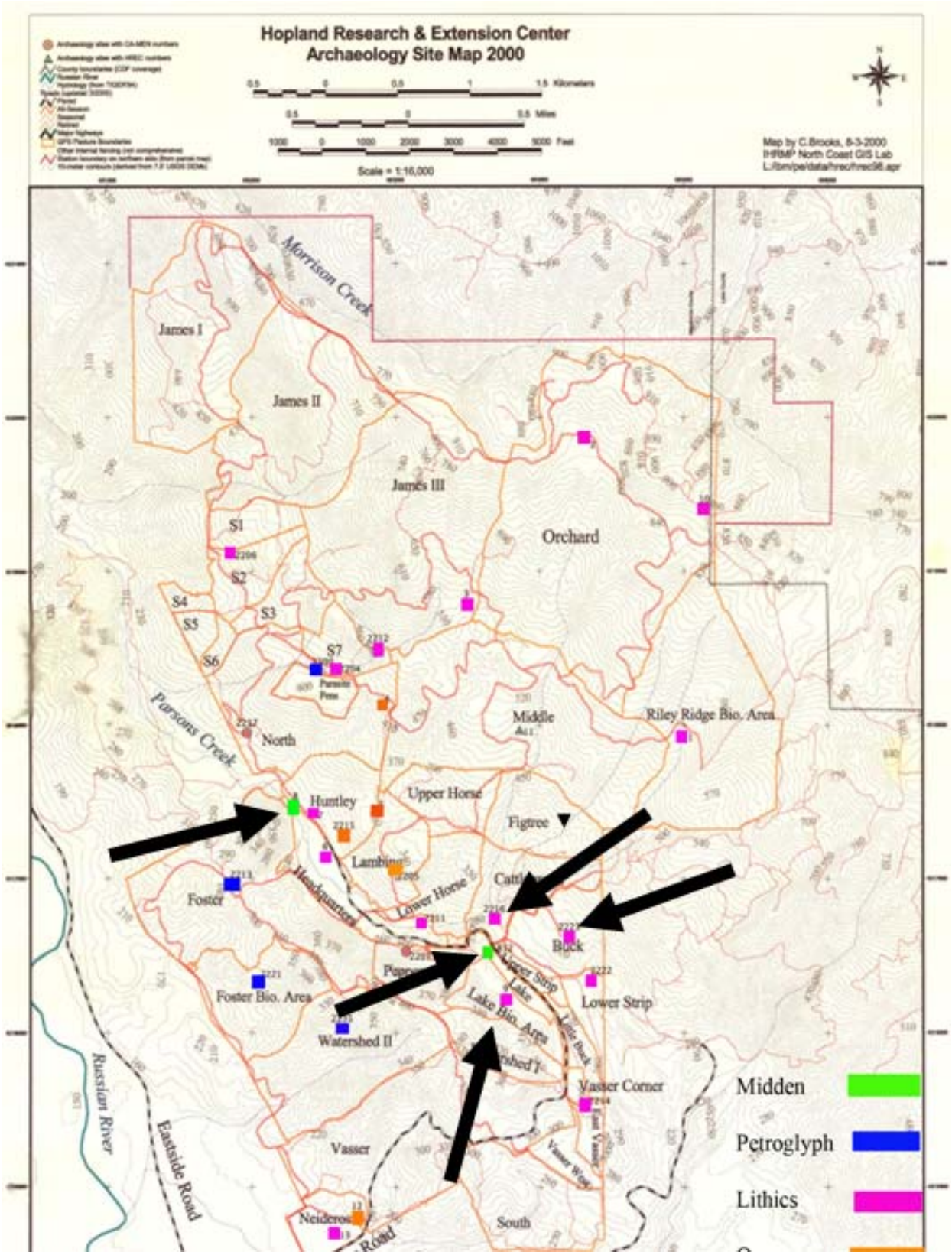

Figure 2. Map showing archaeological sites identified on the HREC with arrows indicating sites where specimens were selected for faunal analysis, EDXRF testing, and obsidian hydration.

Figure 3. Photo of MEN-852 habitation site with sag pond in the background. Photo by D. Gillette.

depth of 110 cm, and Unit 5 to a depth of 80 cm. There were also 75 STPs performed at the site, probably to determine the extent of the site.

FAUNAL ANALYSIS

The faunal analysis was prepared by UC Davis student Cassandra Manning (2008). Faunal analysis of all specimens identified accounted for 8,118 individual faunal fragments from the assemblages present at five of the excavated sites, MEN-2216, MEN-2223, MEN-852, HREC-8, and HREC-9. A limited amount of faunal material was recovered from three additional sites, HREC-6 (19 fragments), MEN-2206 (103 fragments), and HREC-12 (one fragment), but was not included in the analysis (Table 1).

Results

Of the 8,118 faunal fragments that were analyzed, 6,088 fragments were categorized "vertebrate species indeterminate" and 4,470 specimens (or 55 percent) exhibited modification (4,435 were burned, and 35 showed cut marks) (Figure 4). Of the NISP (number of identified specimens present), 4 were identified as reptiles, 28 fish, 9 invertebrates, 1,990 mammals, and 0 birds. Twenty-one of the specimens could be identified as to taxa, and 10 could be identified to the species level (Figure 5). Of the 8,118 recovered specimens, the greatest number of faunal specimens were excavated from MEN-852 and HREC-9.

Table 1. Hopland Fauna, Number of Identified Specimens (NISP), and Relative Frequency of Identified Specimens from All Units Combined (Manning 2008).

Taxa		**NISP**	**%NISP**
Freshwater clam	freshwater clam species indeterminate	6	.30
Saxidomus nuttalli	California butterclam/Washington clam	1	.05
Land snail	land snail species indeterminate	2	.10
Castotomus occidentalis	Sacramento sucker	4	.20
Lavinia exilicauda	hitch	2	.10
Minnow	Cyprinidae species indeterminate	12	.59
Fish	fish species indeterminate	10	.49
Clemmys marmorata	Pacific pond turtle	4	.20
Eutamias spp.	chipmunk	1	.05
Thomomys bottae	pocket gopher	12	.59
Lepus spp.	jackrabbits	2	.10
Sciuridae	squirrels	0	0
Bird	Bird species indeterminate	0	0
Microtus spp.	voles	0	0
Rodent	rodent species indeterminate	2	.10
Small mammal	lagomorph-rodent size mammal	8	.39
Canis cf. *latrans*	coyote	1	.05
Antilocapra americana	pronghorn antelope	1	.05
Odocoileus sp.	deer	29	1.43
Cervus elaphus (canadensis)	elk (wapiti)	30	1.48
Artiodactyl	cloven-hoofed mammal	45	2.22
Large mammal	deer-size or larger mammal	473	23.29
Mammal	mammal species indeterminate	1386	68.24
Total		**2031**	**100**
Unidentified bone	vertebrate species indeterminate	6088	

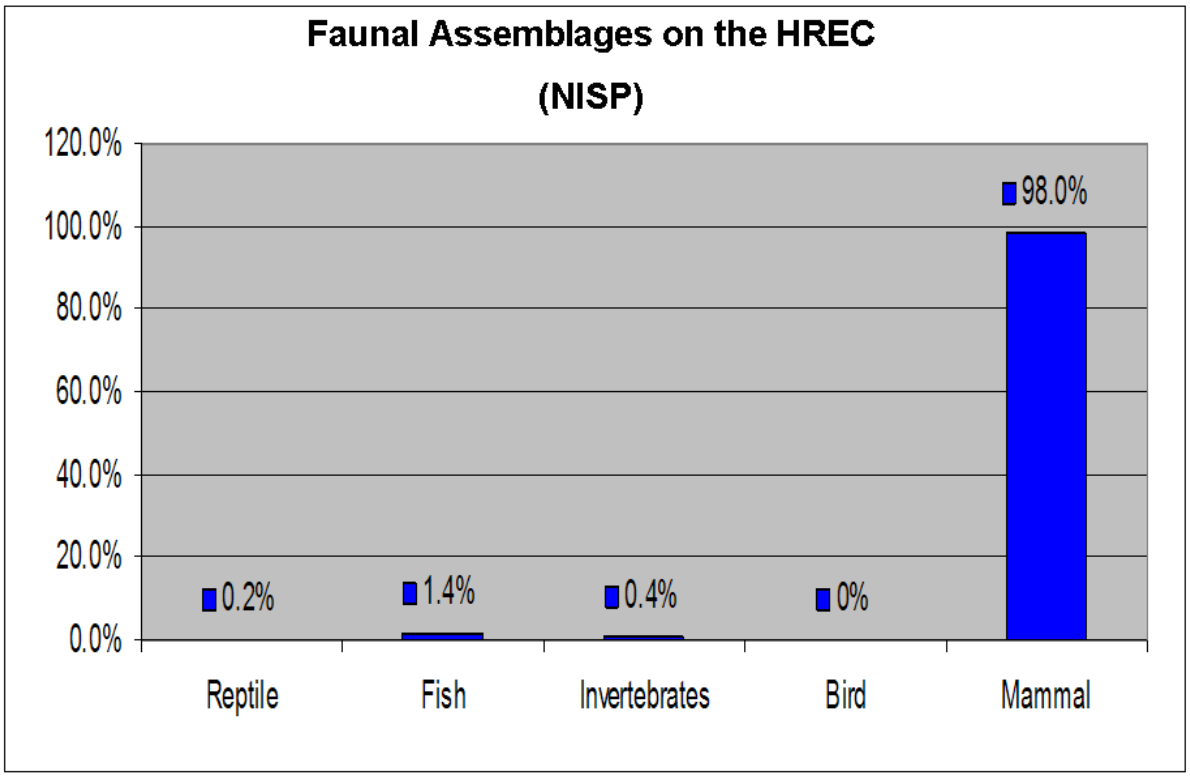

Figure 4. Chart of faunal assemblages found on the HREC (NISP) (Manning 2008).

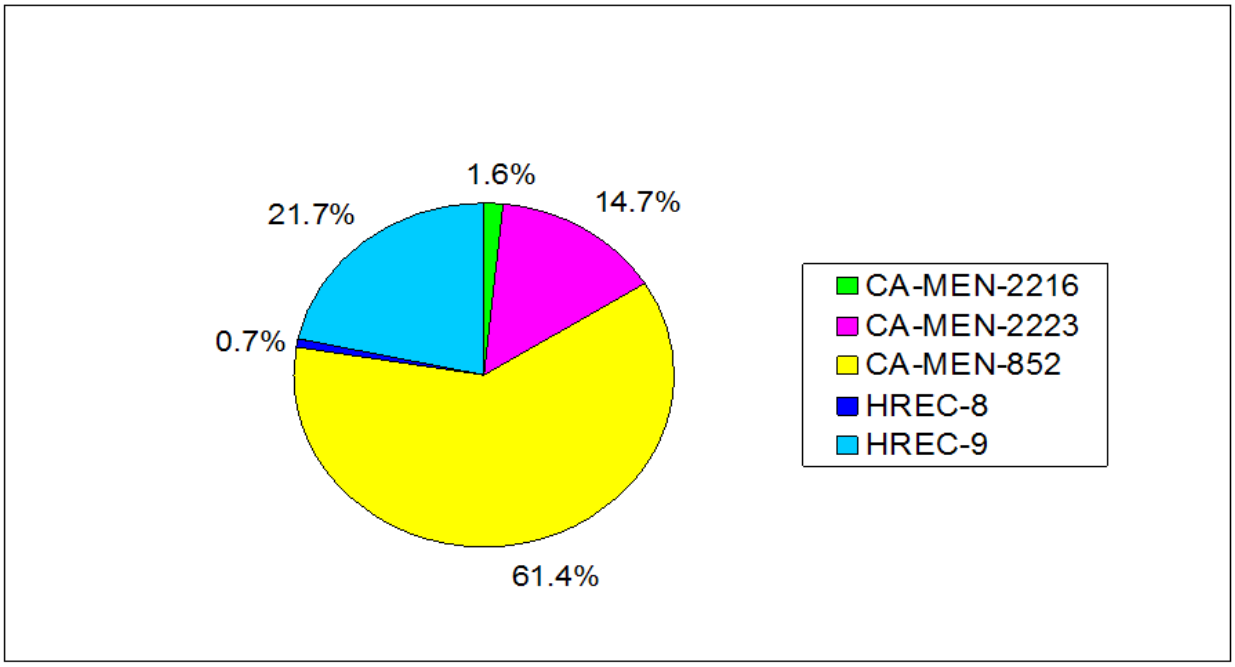

Figure 5. Chart indicating the percentage of burned bone by site.

EDXRF

Nondestructive XRF or energy dispersive x-ray fluorescence (EDXRF) analysis was made of 50 obsidian artifacts recovered from two of the archaeological sites, MEN-852 (42 specimens), and HREC-9 (eight specimens), by Richard Hughes (2008). The samples for XRF processing were sent to Richard E. Hughes, Ph.D, RPA, and Director of the Geochemical Research Laboratory, Portola Valley. The EDXRF process is a nondestructive analytical technique used for the elemental analysis or chemical characterization of a sample. By applying this technique to an obsidian sample, a distinctive spectral "footprint" is produced that allows chemical sourcing to a specific identified obsidian source or quarry.

Of the 50 specimens submitted for EDXRF processing, half were selected from debitage and half were worked flakes (mostly biface fragments). All lithic materials from MEN-852 were from Unit 4, represented samples taken from Levels 2-15, and were spread between late, middle, and early levels. All samples were chosen from one unit in an attempt to elicit as much temporal information as possible for one specific area, and to determine possible obsidian source preference or change over time. The eight lithic specimens selected from HREC-9 were from Levels 12-14.

Results

Forty-six of the specimens were of adequate physical size to generate quantitative composition estimates. When combining the results from both quantitative and semi-quantitative techniques, Hughes determined that 46 (or 92 percent) of the lithic specimens were sourced to Mt. Konocti, and four (or 8 percent) were sourced to Borax Lake. One biface tip specimen had some trace element values that plotted outside the range of Mt. Konocti geologic reference samples, but did fall within the range that is reported by some to have originated at Mt. Konocti, and was provisionally assigned by Hughes to this source (Figure 6). At the time of this paper, arrangements have been made to submit additional lithic material to be examined through the EDXRF process at the UC Berkeley EDXRF lab facility to expand the sample.

OBSIDIAN HYDRATION

The lithic material selected for obsidian hydration studies represented three of the sites, MEN-852, HREC-8, and HREC-9, with the greatest number of specimens (48) selected from MEN-852, and excavated from seven units. Unit 4 included the largest concentration of tools, according to the Davis collection catalogue. Eighteen were selected from HREC-8, and 34 lithic specimens came from the two excavated units at HREC-9. The lithic material represented samples taken from Levels 2-15, and was spread between late, middle, and early levels across the sites, as were the samples that were submitted for EDXRF.

Results

Preliminary analysis based on hydration band measurements ranged from .9 to 6 microns, and, when adjusted for hydration rates based on sources of the specimens, indicates that these sites on the HREC represented activity from approximately 2800 BP to 150 BP. This points out that activity continued to take place on the landscape into the onset of the contact period. Several of the bands failed to produce useful hydration band measurements, often because of weathering. Visual sourcing of the 100 submitted lithic specimens showed that 80 percent could be sourced to Mt. Konocti, 17 percent to the Borax Lake quarry, 2 percent to Napa Valley, and 1 percent was identified as possible Anadel. The visual sourcing affirmed a similar ratio of Mt. Konocti to the Borax Lake obsidian samples that were sourced with EDXRF.

AMS RADIOCARBON DATING

One sample of charcoal was submitted to Lawrence Livermore Labs for AMS (Accelerated Mass Spectrometry) carbon-14 dating. The sample was selected from HREC-8, based on its depth (Level 12),

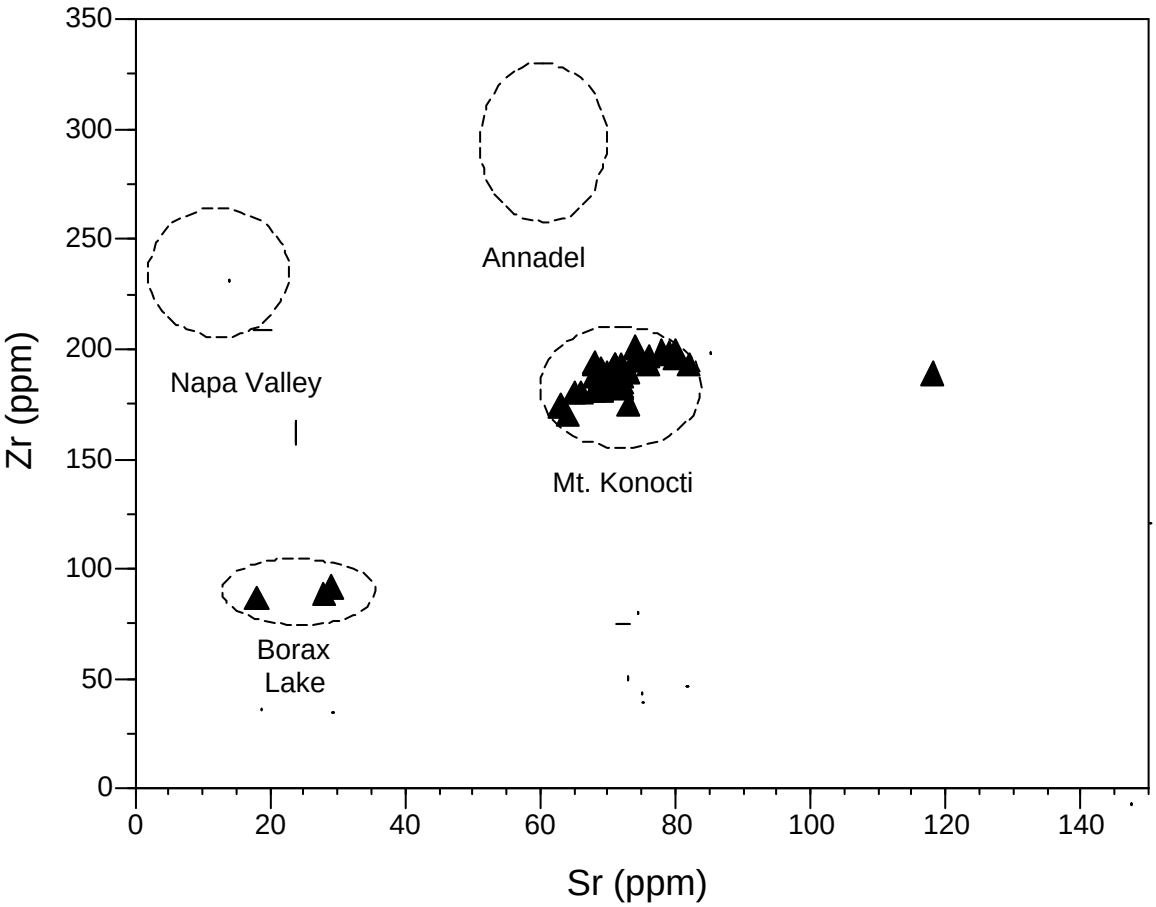

Figure 6. Graph with dashed lines to represent the range of variation in obsidian sources based on Zr vs. Sr composition of artifacts from MEN-852 and HREC-9 (Hughes 2008:2).

that it was excavated within a cultural context, and its location as being the nearest (possible) habitation site to the PCN boulders at MEN-2213. It was also in situ with additional charcoal, and adjacent to a partially exposed ash lens. At the time of the writing of this paper, several faunal specimens (some exhibiting modification, including one with a cut mark, one with a spiral fracture, and two that have been burned), have been selected for impending processing and AMS dating by Lawrence Livermore Labs.

Results

The one specimen that was submitted to date to the Lawrence Livermore Labs was reported with a carbon-14 date of 680 ± 40 B.P.

ADDITIONAL EXCAVATION ON THE HREC

When this paper was presented, I reported on additional limited fieldwork that I intended to accomplish during this past summer. My limited excavations included work at two sites. The MEN-2221 or Hidden Hill site presents a very interesting opportunity. The boulder appears very weathered, as do the other marked boulders on the HREC. At some point after the boulder was marked, it split into two pieces that are now separated to nearly 1 m apart at the widest point, leaving a portion of a single PCN element on each side (Figure 7). It is not known how this separation occurred, or if it was sudden. With a fault line nearby, earthquake activity may have played a role in the movement that has resulted in the current

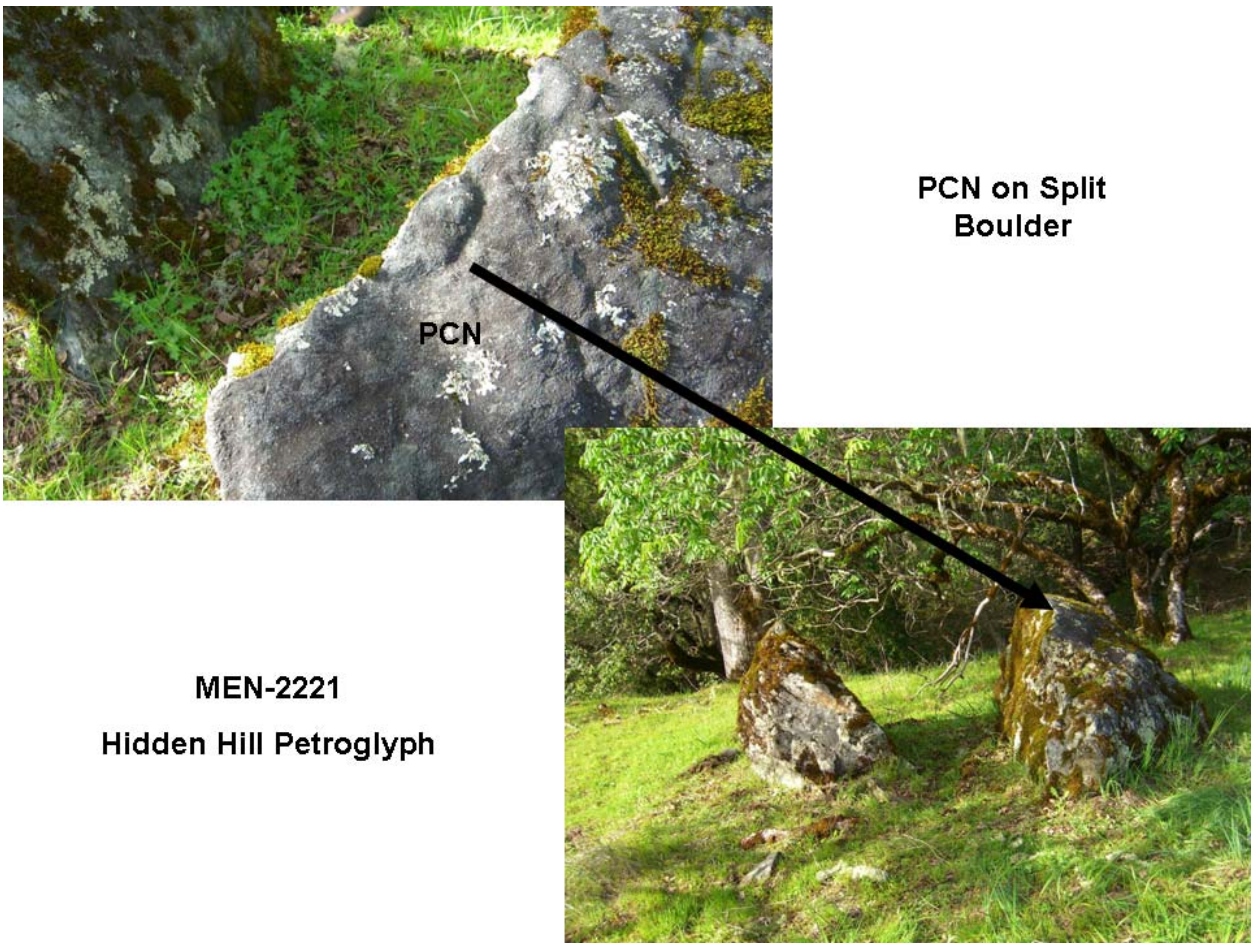

Figure 7. MEN-2221 showing the split boulder and a close-up of the bisected PCN element, indicating its placement on the boulder.

placement of the pieces of the boulder. Fieldwork this past summer indicated that the bottom of the boulder rested at 50 cm below the current soil level. Several soil samples were collected and submitted for OCR (Oxidizable Carbon Ratio) dating, and additional samples will be removed shortly from the unit for analysis by OSL (Optically Stimulated Luminescence). When results from both testing procedures are available, they will be compared and presented at a future date. A portion of this boulder was excavated underneath where the split took place, and it is anticipated that dating of soil samples taken from the soil that has accumulated between the sections of the boulder may indicate a relative date for the split, and, thus, a youngest possible date for the markings. Several test units placed within 4 m of the split boulder identified only two small pieces of chert debitage. One piece of lithic material was recovered from Unit 33 (located between the split boulder), Level 1, and an additional chert piece was recovered from Unit 24, adjacent to the eastern side of the boulder.

Limited excavation was also conducted at MEN-2213, Locus #3 (Huntley Peak Petroglyph site) to determine if any tools were associated with the marking of the boulders, and to establish if the markings extended below the current ground level. Due to the high compaction of the clay soil, limited success was achieved. No artifacts were recovered. It has not been decided at this point whether additional excavation will be conducted.

CONCLUSIONS AND QUESTIONS RAISED

The artifact assemblages that were identified by the UC Davis excavations provided insight into the activities that have taken place on the landscape for the past several millenniums. Of the 8,118 faunal bones and fragments from five sites on the HREC that were examined, 4,470 exhibited some form of modification, with the majority having been burned, and the remainder (35), exhibited either cut or impact marks, or spirals due to the removal of bone marrow. The fragments with cut marks were recovered from three of the sites (MEN-852, MEN-2223, and HREC-9). These same sites also produced the largest number of burned bones in the collection. This may indicate that these three sites were for seasonal camping, where food preparation and consumption took place. Future study of the faunal analysis may also give clues to the diet and possible hunting practices of the prehistoric peoples. The lack of bird bones included in the faunal assemblage raises some questions. With two of the sites (MEN-852 and HREC-9) adjacent to sag ponds, why are no duck specimens in the recovered material? Possibly this indicates a seasonal use of the sites that did not correspond with a seasonal presence of the fowl.

The lithic sourcing through both the EDXRF and visual sourcing could possibly indicate that the sites on the HREC may also represent camping sites on a trade route where obsidian was procured from Borax Lake (less than 20 km from the HREC). All sourcing indicated a preference for the Mt. Konocti obsidian over the Borax Lake source, which was a little further away but of better quality. Future examination of the debitage may give an indication of the type of sites that are evident by lithic scatter. Chert samples are being collected from the five quarries identified on the HREC and will be compared with chert artifacts from the Davis collection, the HREC collection, and a nearby site that has been dated at over 7000 B.P., to see if it is possible to visually source lithic material to specific quarries.

The results of the obsidian hydration studies have indicated the MEN-852 site was in use between 151 B.P. to 2802 B.P., and, with the dates spread in a continuum in this period, a near continuous long-term use is suggested for this site. Additional analysis may identify temporal periods of procurement from specific quarries. Shortly, the samples sent for EDXRF will also be submitted for the obsidian hydration procedure.

From the 30+ archaeological sites identified on the 5,358-acre research facility, it is obvious that the landscape was the site of much modification by prehistoric activity for both technological and ritual purposes. Five chert quarries have been identified along, with four PCN boulders or clusters of boulders, and a glittering rock (high quartz content) with cupules. The many lithic scatters identify areas that may indicate lithic reduction processes and early hunting activities. Some of these identified lithic scatters will be reevaluated and labeled habitation or camp sites, based on the results of the UC Davis field schools. Testing made possible through the Bennyhoff Award has provided much data to direct questions and may provide answers to questions about what specific activities took place on the landscape and the temporal period they represent. This will provide a better understanding of the prehistoric people that lived, camped, performed rituals, or even just traveled through the landscape for thousands of years.

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