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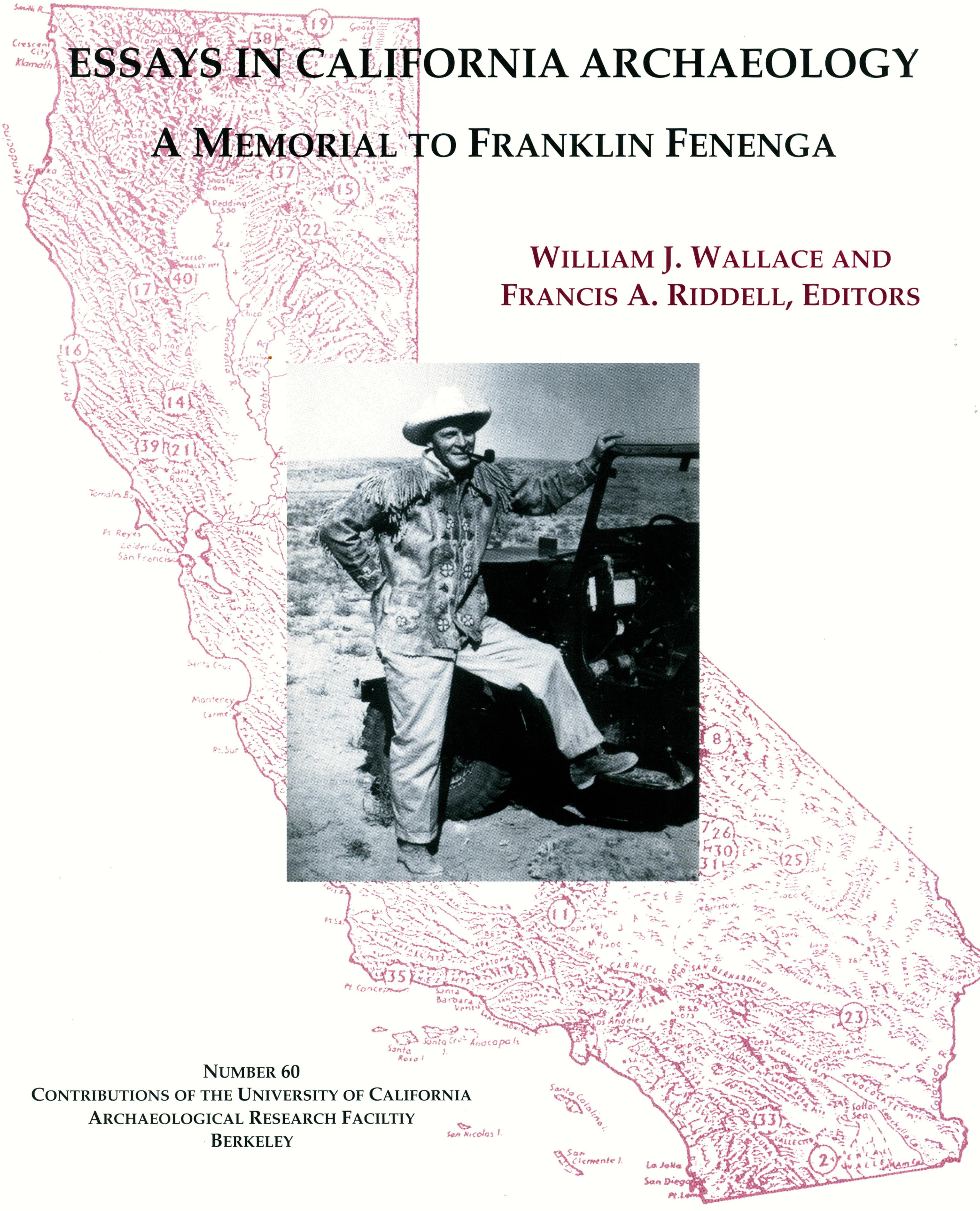
ESSAYS IN CALIFORNIA ARCHAEOLOGY

A MEMORIAL TO FRANKLIN FENENGA

WILLIAM J. WALLACE AND
FRANCIS A. RIDDELL, EDITORS



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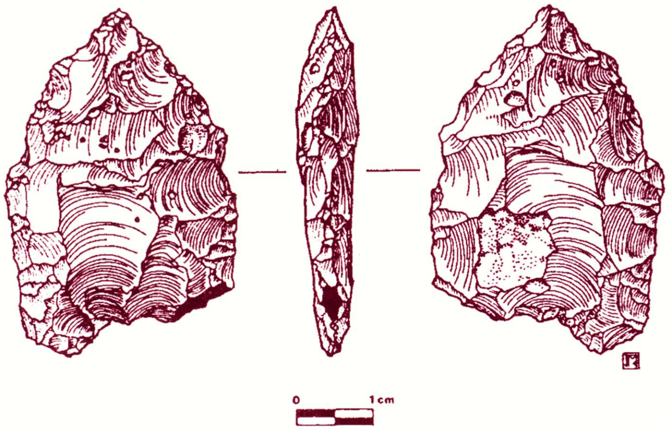

Illustration of fluted projectile point from chapter 8 by Brian D. Dillon. Drawing by John McCammon.

Cover photo: Frank Fenenga conducting an archaeological survey for a pipeline project in New Mexico circa 1950. Photo courtesy of Gerrit Fenenga.

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ESSAYS IN CALIFORNIA ARCHAEOLOGY

A MEMORIAL TO FRANKLIN FENENGA

William J. Wallace and Francis A. Riddell

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Contributions of the University of California
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Frank Fenenga conducting inspections of archaeological sites in western Fresno County in 1987 during an expedition of the Coalinga Archaeological Research Group (COALARG). Photo by Dan Foster.

CONTENTS

ACKNOWLEDGEMENTS

Covering a variety of subjects dealing with California archaeology, the following twelve essays were prepared by colleagues and long-term associates of Franklin Fenenga. A brief evaluation of Fenenga's contributions to the study of the state's prehistoric human past opens the collection.

A good many individuals assisted in one way or another in the assembling and publishing of this volume. The eleven colleagues and friends of Franklin Fenenga, who shared their time and knowledge in writing the essays, top the list. Three members of the review committee—John Foster, L. Kyle Napton and the late Albert Elsasser—carefully read the volume and offered insightful suggestions for its improvement.

The volume could not have been published without donations to help defray the costs of its publication. The following individuals contributed to the funding of this volume: Gwyn Alcock, Barbara Baker, Eleanor Bates, California State University, Bakersfield (various individuals), Joyce Clevenger, Brian Dillon, Dorothy Fleagle, Daniel Foster, John Foster, David and Vera Mae Fredrickson, George Kritzman, Donald McGeein, Fred Reinman, Frances Riddell, Phillip Silverman, William and Edith Wallace and Claude Warren. Michael Moratto made a more than generous contribution, as did Thomas Origer. Kent Lightfoot of the University of California Archaeological Research Facility arranged for the publication of the volume and for the additional funding for its printing.

Daniel G. Foster of the California State Department of Forestry and Fire Protection gave aid of a different kind; he took over and got the project off the ground when it was languishing. A special word of thanks is due to Linda Sandelin and Jennifer Souza, also of the California State Department of Forestry and Fire Protection, for taking on the time-consuming job of preparing the final draft of the volume for publication.

A great debt of gratitude is owed to all these individuals for their support and assistance. The editors express their deep appreciation to the various contributors and apologize for the lengthy delay in publishing their papers. They also warmly thank those individuals who donated funds toward the cost of this publication.

William J. Wallace
Francis A. Riddell

FRANKLIN FENENGA AND CALIFORNIA ARCHAEOLOGY

William J. Wallace

Franklin Fenenga's involvement in archaeology began early in life. Interested in relic hunting, he had a couple of years experience in fieldwork in the Middle West while still a high school student. As one of a group of high school students assembled to talk about potential careers, he spoke on archaeology before a meeting of the National Educational Association. Present in the audience was Jeremiah B. Lillard, president of Sacramento Junior College. Anxious to build an archaeological program at the college, Lillard began a correspondence with Fenenga, urging him to come to Sacramento, which Fenenga eventually did. During his stay at Sacramento Junior College, Fenenga helped to direct archaeological crews in excavating Indian mounds in the Sacramento Valley on Saturdays and Sundays. It was here that he began a long and close friendship with Robert F. Heizer, who had also been recruited by Lillard. The end result of the archaeological work was the publication in 1939 of *An Introduction to the Archaeology of Central California* by Lillard, Heizer and Fenenga and published by the college's Department of Anthropology. This volume outlined the first clear-cut cultural sequence for the Sacramento Valley. In the same year, a summary article "Archaeological Horizons in Central California" co-authored by Heizer and Fenenga appeared in *American Anthropologist.*

Following several years at the junior college, Franklin Fenenga enrolled as an anthropology major at the University of California, Berkeley. At the university, he renewed his association with Heizer, who was now a member of the faculty.

When the Smithsonian Institution extended its program of River Basin Surveys to the Far West, Fenenga was hired to survey four proposed reservoir areas—Pine Flat, Isabella and Success in the San Joaquin Valley; Coyote in Mendocino County. Brief reports on each of the investigations were prepared.

With the founding of the University of California Archaeological Survey, Fenenga was enlisted as the first archaeologist, a post he held for two years, 1948 to 1950. This was a busy and productive period for him. In addition to conducting surveys and excavations in central and northern California, he prepared two useful guides—*Methods of Recording and Present Status of Knowledge Concerning Petroglyphs in California* and *Methods of Site Survey in California*—both printed as UC Archaeological Survey Reports.

Drawing upon information collected in the field during this period, Fenenga published "Artifacts from the Excavations of Sutter's Sawmill" (1947), "Survey of Building Structures of the Sierran Gold Belt, 1848-70" (with R. F. Heizer, 1948) and "The Archaeology of Slick Rock Village, Tulare County, California" (1952). Additionally, he compiled reports on archaeological resources of five proposed reservoir areas, four in the San Joaquin Valley and one in Mendocino County. These papers did not appear in print.

After a long absence from the state, Fenenga returned to California in 1965 to teach in the Department of Anthropology at California State University, Long Beach. There he developed an active archaeological program and won the respect and admiration of students, not only as a teacher but also as a friend and confidant. A major research activity, carried out between 1969 and 1975, included five profitable field sessions at Hidden Reservoir in Madera County. Following his retirement from teaching in 1987, Fenenga remained active in the field of California archaeology as consultant, advisor and participant in various projects. Finding it hard to give up contacts with former students, he kept in close touch with many of them.

In 1985, as recognition for his numerous contributions to the profession, Franklin Fenenga received the Society for California Archaeology's Lifetime Achievement Award.

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SLAKAIYA ROCK (CA-TRI-1): A REDISCOVERED PETROGLYPH SITE NEAR THE EEL RIVER, TRINITY COUNTY, CALIFORNIA

Daniel G. Foster and John W. Foster

An outstanding petroglyph site (CA-TRI-1) recently was rediscovered by an archaeologically trained CDF forester during his inspection of a timber-harvesting project along the Eel River in Trinity County, California. Subsequent archaeological survey of the area by the authors resulted in the identification of a major archaeological site containing two panels of petroglyphs, which display elaborate, multiple, superimposed elements representing six discrete styles. Three housepits, a midden deposit, and an abundant scatter of chipped and ground stone artifacts were also recorded. The site had first been discovered in 1913 by a U.S. Government engineer, but its exact location remained obscure for over 80 years until the recent rediscovery. This paper reviews the history of the site, describes its rock art panels, and interprets their styles and cultural affinities through comparison with other petroglyph sites in northwestern California.

Introduction

Every California archaeologist can recall a dozen instances when the "system" broke down, where a valuable site was mangled because a small step in the planning flow chart was bypassed or forgotten, or where, because of lack of time or funds, research failed to be conducted before an important archaeological site was damaged or destroyed. For those of us who work in public agency archaeology, this is an all too common occurrence, and we are numbed by a series of regular "losses."

Occasionally, however, public agency archaeologists report a success - a rare example where vigilance, training, sound environmental planning, and individual effort combine to produce gratifying results. It is also a rare thing to report the rediscovery of a site that has been lost to science for 80 years, but the finding of the ***Slakaiya Rock*** petroglyphs is one such example. In this paper we describe the site's environmental and ethnographic setting, its unique history and early recording, and account for its disappearance from the archaeological record. Finally, we summarize its rediscovery and present a complete documentation of the site, its rock art panels, and propose a classification of six distinctive styles.

Environmental Setting

The ***Slakaiya Rock*** petroglyph site (CA-TRI-1) is located in a cluster of boulders on a stream terrace above the east bank of the Main Fork of the Eel River in southernmost Trinity County. The site lies in extremely rugged and isolated terrain, in a deep canyon, a few miles north of the Mendocino county line (Figure 1). The site is reached by a two-hour drive from Garberville; the last twenty miles or so being traversed on private roads.

This portion of the Eel River canyon is deeply carved and spectacular. In early November, after a dry fall, the main course of the Eel is only 18 inches deep at the site. Scour marks on the nearby banks, however, reveal a height of nearly 20 feet during peak flows. The riverbed is studded with highly polished boulders including sandstone, shale, schist, and serpentine. These are derived from blocks within the Franciscan assemblage (Strand 1962). The schist boulders, on which the petroglyphs are found, appear to be rich in glaucophane, chlorite, and talc, and are of variable hardness. The steep banks are broken only by small tributaries that cascade into the larger stream. Aside from the river itself, the terrain is dominated by Moose Peak (1787 feet amsl) and Little Moose Peak (1650 feet). The latter is the prominent feature to the east and only a half-mile distant. Site CA-TRI-1 lies at about 520 feet elevation.

An oak-woodland vegetation community surrounds the site. Dominant trees are Oregon white oak, (*Quercus garryana*), black oak (*Q. kelloggii*), live oak (*Q. wislizenii*), California buckeye (*Aesculus californica*), pepperwood (*Umbellularia californica*), madrone (*Arbutus menziesii*), and scattered conifers.

The understory is composed of manzanita (*Arctostaphylos* sp.), poison oak (*Toxicodenendron diversiloba*), and elderberry (*Sambucus* sp.). This area is particularly rich in native foods. These include abundant anadromous fish including salmon and steelhead trout, and diverse terrestrial resources including deer, quail, acorns, pine nuts, grasshoppers, elderberries, buckeye nuts, and a variety of grass seeds.

Ethnographic Setting

Slakaiya Rock is situated in the territory of the Eel River Wailaki, one of the three major tribelets of the Wailaki people (Elsasser 1978:190-191). The Wailaki, until the mid-nineteenth century, occupied a series of villages along the upper Main Fork of the Eel River, Kekawaka Creek, and most of the Eel's North Fork. The Wailaki were southern Athabaskans who controlled the uppermost Eel drainage to Big Bend, the recognized boundary of Yuki territory (Kroeber 1925). Wailaki economy centered around salmon fishing during winter and hunting and foraging during the other seasons. They had intimate knowledge of their homeland, making abundant use of its rich resources. Powers (1877:117) noted their particular prowess in hunting deer by running them down; this was accomplished by a relay team who alternated hunters chasing their prey until it could be dispatched by clubbing.

In his detailed study of the Wailaki, Goddard (1923:108) was able to account for eighteen separate political units within the group. Each had its own chief, defined territory, hunting and fishing grounds, and capital winter village. The river formed a boundary between groups who held lands to the ridge tops on opposite sides. A total of sixty-six winter villages were still remembered into the second decade of the twentieth century, and the names of many smaller hamlets and places were also recorded.

Slakaiya Rock is located within the tribelet territory inhabited by the Slakaiya (or Seyadankaiya). Their upstream neighbors were the Baskaiya; downstream were the Chiskokaiya. The Setakaiya held the west side of the river to the ridgeline forming the west margin of the Eel River canyon. Unfortunately, while Slakaiya tribelet village locations were not precisely pinpointed by Goddard, he does provide their sequence (1923:104) along the east bank (from the upstream boundary):

akyank'at — "right here on (?)" a village some distance north of the boundary creek on the river. The Baskaiya tribelet occupied the area upstream.

natallininki — "step over creek trail" a village taking its name from the creek immediately north of it.

tcolattcebannan — "graveyard hillside" about a half mile north of the above creek, near the river.

taggaskotan — "cottonwood trail down" some half mile down the river.

tosekyok'at — a large village a quarter of a mile downstream.

t'otcallackyoki — "grass sour large tail" a village on the north side of a tributary creek.

sketeclkascanan — "mush throw away sunny place" a large village a little ways downstream situated at the top of a bank of rock. "The name refers to a place where Panther, in mythical times, threw away mush he had carried on a hunt until he was tired. The mush-like substance appearing on the face of the rock each spring indicates by its thickness the abundance of the year's acorn crop. This substance was washed away during the winter. The rock where this happens is sandstone, and the mush-like substance appeared to contain iron, probably soluble in the winter rains."

lekk'at — "smoke on" a village an eighth of a mile downstream.

kaslenkyobi — "spring large in" a good rock shelter where a family used to spend the winter. This is on the east side of the river and close to *lekk'at*. Captain Jim, Goddard's informant, was forced to leave his father-in-law to die there when being pursued by white men years earlier.

kaslenkyodan — "spring large place" a nearby village on the bank of the river.

kaitcdantadan — "Christmas berries place" a village situated a short distance north near the bend of the river towards the west. This is the most northerly of the Slakaiya hamlets. There was a graveyard about a quarter of a mile north of this small village. The northern boundary is marked by a tributary creek, *tciskot*.

In summary, the Slakaiya tribelet was one of 18 autonomous Wailaki groups who occupied both sides of the Eel, fished from small winter villages, and ranged up to the ridge crest during other seasons. Goddard estimates a population of 15 to 30 persons per village throughout the drainage, and an overall population of 1000 to 2000 (1923:108). While Goddard was able to identify specific named village sites, use areas and topographic features for neighboring tribelets, this could not be done for the Slakaiya. We do have the geographic sequence of villages, but no confirmation of their exact position or number. A trail along the east bank of the Eel River connected these villages, graveyards and use areas. The upstream and downstream boundaries were marked by specific tributary creeks (Goddard 1923).

Given Goddard's (1923:104) references to Slakaiya hamlets such as *kaslenkyobi*, a place with "a good rock shelter" and *sketeclkascanan*, a village with a large ceremonial rock, the occurrence of an important petroglyph site in a rock shelter setting should not be a surprise. It would appear that important ceremonial activity occurred in the immediate vicinity, and while rock art was not specifically mentioned by either Powers (1877) or Goddard (1923), the Slakaiya maintained a mythological connection between Panther and an important rock feature near the ***Slakaiya Rock*** petroglyph site.

Site Description

Slakaiya Rock (CA-TRI-1) is a major hamlet on the east side of the Eel River north of its confluence with a small tributary stream. It covers an area some 105 by 55 meters (m) in an open forest setting with numerous large schist, serpentine and sandstone boulders. Three probable housepits are visible on a narrow terrace above the tributary; they average some 3m in diameter and 60 centimeters (cm) deep and seem to be intact. A single midden deposit was noted at the base of a high rock. This area contains dark ashy soil, lithic debris and thermally altered rock, and is located midway between the housepits and the boulders displaying the petroglyphs.

A light scatter of lithics covers the entire site area. Most artifacts seen were chert flakes, although many formed tools were also observed. Artifacts were exposed in game trails, in erosional gullies, and on much of the exposed surface of the site. A green chert projectile point of the Gunther series, several chert biface fragments and projectile point tips, and a wide array of scraping tools and debris were observed. The midsection of a large sandstone pestle was also found. Distinguishing this site from the many other Late Prehistoric Eel River sites, and setting it apart, is the presence of two extensive rock art panels. During the second decade of the twentieth century, one of these panels attracted the attention of an employee of the U.S. government.

History of Site Documentation

The largest rock art panel (Panel 1) at ***Slakaiya Rock*** was first discovered in 1913 by Mr. O. W. Degen, a civil engineer employed by the U.S. War Department. Degen made his discovery while surveying along the Eel River for construction of the Northwestern Pacific Railroad and the mile-long Island Mountain Tunnel, which was completed the following year, in 1914 (Carranco and Beard 1981:312). He reported his find in two letters to Dr. A. L. Kroeber of the University of California during October, 1913 (Connick 1973). With the exception of the deletion of specific Section numbers (to avoid disclosing confidential site locations), Degen's two letters are quoted verbatim as follows:

> Dear Sir: Enclosed you will find a photograph of hieroglyphic writings on a large granite rock near the entrance to some caves found in Trinity County. As near as I've been able to find out, this rock has never been examined by scientists, or its location been known except to one lone settler. The rock in question had to be cleaned of moss before the inscription could be brought out clear. The inscription seems to depict the mythology of the Wailaki Indians. The upper lines represent two snakes, the other figures representing man in dead and life position, deer, trees, other snakes and various other subjects. I also found the remains of a large Indian village with lots of caves formed by boulders and large rocks hollowed out for grinding acorn flour. I would like to find if this rock is known by the University or if it has ever been explored.

> Dear Sir: In reply to your letter of Oct. 23 in regards to the photo I sent you of the inscribed rock in Trinity County, the rock is located in T[ ]S, R[ ]E, Section[ ] on the north side of the Eel River on the 30,000-acre ranch of Mr. Spring, the Oakland banker. The rock is about sixty yards from the bank of the river amongst a large lot of boulders; right here was a large Indian village. The Eel River is very wide at this place and must have been alive with fish; close by are three large boulder caves formed by large number of boulders where I found all kinds of arrow heads and remains of deer horns, etc., also a large number of mounts. About 1/2 mile north of this rock is the largest of these caves where a horse can be driven in. The boulder with the hieroglyphic inscription is about 16 feet wide and 12 feet high with a very hard polished face. The inscription takes up nearly the entire face. There seems to be a small piece of rock split off in the right hand corner. I enclose

> an enlarged photo of this rock for record in the museum. The scratches near the bottom of the center were made by Indians sharpening arrowheads, etc. The inscription is made many hundreds of years ago. If the rock was cleaned by acid all the inscriptions would be brought out clear. The second photo I enclose is of a large Indian acorn flourmill with 2 holes cut into the rock and a large roasting space between. This rock I found in amongst the remains of a large Indian village on the north bank of the North Eel River in T[ ]S, R[ ]E, Section [ ] adjoining [ ]. Here once a large settlement of Indians existed—what accounts for the large number of mounts and rock caves. This section is very interesting, besides here where natural fastness of large perpendicular rocks easy to defend when attacked. Near here is a large open field where arrowheads could be picked up by the dozens. I am naturally interested in these relics as I have a large Indian collection myself. Hoping this will interest you (Connick 1973).

Kroeber was indeed interested in Degen's information. He transmitted the material to Pliny Earle Goddard, who at that time was one of Kroeber's graduate students, and who was studying the Wailaki. Goddard shared Degen's information with Julian H. Steward, who was compiling his pioneering inventory of rock art sites in California and adjoining states. ***Slakaiya Rock*** was listed in Steward's (1929) landmark inventory as site PT.2; one of Degen's photographs is included as Plate 22a.

The University of California Archaeological Survey was created in July, 1948 under the direction of Robert Heizer; Franklin Fenenga and Francis Riddell served as archaeologists. The initial objective of the inventory was to compile site record forms and assign designations to archaeological sites identified in existing literature. One such site was Steward's PT.2. Although the archaeological site record form for CA-TRI-1 lists Goddard as the recorder and November 8, 1913 as the date it was recorded, the form was actually prepared by Fenenga and Riddell in 1948 without having revisited the site (Francis Riddell: personal communication). The November 8, 1913 date was documented by Steward (1929: 57) as the date of Goddard's letter, which transmitted to him Degen's information and photographs. Of course, all this came about before there were accurate USGS topographic quadrangles to plot site locations, and when such maps did become available, the exact position of CA-TRI-1 on a USGS quadrangle was unclear.

In 1973, Robert Connick, a chemistry professor at the University of California at Berkeley and an active rock art enthusiast, relocated the site using Steward's information and Degen's letters. Professor Connick took color slides of Panel 1 and compiled field notes during his survey. Although Professor Connick did not find the moss-covered petroglyphs now identified as Panel 2, he did discover a cupule boulder on the edge of the river a short distance below the site. Professor Connick, however, did not transmit his information to the California Archaeological Inventory, and the exact location of site CA-TRI-1 remained uncertain for another twenty years.

From 1980 to 1993, Dave Drennan, a Registered Professional Forester (RPF) with the California Department of Forestry and Fire Protection (CDF) with an active interest in local archaeology, and who has received archaeological training from CDF, searched for the site during his reviews of numerous CDF projects in the area northeast of Island Mountain. Unfortunately, without accurate site location information, he could not relocate Degen's petroglyphs. The reason Drennan failed to find CA-TRI-1 is that he was searching in an area some five miles northeast of its actual location. Inaccurate "corrections" made to the site record subsequent to its first recording erroneously placed the site in the wrong Section. Finally, in October, 1993, Drennan rediscovered the main petroglyph panel during an inspection of a timber-harvesting plan along the Eel River. He organized an archaeological survey team including the authors to conduct a reconnaissance of the site area and to prepare a complete record of the site and its petroglyphs. This task was completed in November, 1993 (Foster et al. 1993). We named the site ***Slakaiya Rock*** in honor of the Wailaki tribelet that inhabited this section of the Eel River canyon. Photographs confirm that ***Slakaiya Rock*** is the same site discovered by Degen in 1913, reported by Steward (1929:57) as PT.2, and formally designated as CA-TRI-1 by Fenenga and Riddell in 1948.

Recording Methods

On November 9, 1993, a survey party consisting of Drennan, the authors, and CDF Forester Ernie Rohl, waded across the Eel River to evaluate the site. An intensive reconnaissance of the immediate area was conducted as well as a brief search for the pitted boulder petroglyph reported by Professor Connick to occur nearby. Approximately six hours were spent surveying and recording the site; its location was accurately plotted on a USGS topographic map, and a detailed site map was prepared. Diagnostic artifacts were examined and illustrated but not collected. A careful inspection was made of both rock art panels and numerous photographs (color slides, color prints, and black and white prints) were taken. Finally, a detailed recording of the petroglyphs was made using large 3-millimeter (mm) plastic sheets and felt markers (Figure 2). A tracing of both panels was made, maintaining accurate scale and groupings of elements. The plastic sheets were later reduced to 8 1/2 by 11-inch size at an engineering blueprint laboratory to produce a complete, highly accurate, scaled illustration of both petroglyph panels (Figures 3 and 4).

Description Of Rock Art Panels

Two separate rock art panels were found at the ***Slakaiya Rock*** site and both appear to be in nearly pristine condition. The only evidence of either natural or cultural deterioration was the presence of modern letters "RA" and "A" carved into Panel 1 above the prehistoric carvings. This graffiti does not appear in either of Degen's two photographs but does appear in one of Connick's photographs so it must have been created between 1913 and 1973.

Slakaiya Rock Panel 1

The largest and most elaborate rock art panel at ***Slakaiya Rock*** (Panel 1) occurs on a vertical surface of a large schist boulder at the north end of the site. Part of the panel is located within a rock shelter, although it also extends outside on a fully exposed vertical rock surface. Panel 1 measures 253 cm from side to side and 150 cm from ground level up to its top. The panel contains a complex grouping of pecked abstract curvilinear figures overlain by a multitude of both shallow and deeply cut incised lines. Numerous examples of superimposition indicate that the two styles of incised line petroglyphs were carved into the rock after the pecked designs were created. The panel is dominated by numerous large, pecked, abstract curvilinear motifs formed by tightly clustered pecking, probably made by punch and hammer stone. These figures include long wavy lines, "zigzags", circles, linked circles, linked diamonds, "tally mark" designs and other more abstract shapes (Figures 5, 6 and 7).

A total of 39 "dot" or small circular elements are pecked into Panel 1. These range in size from 1.0 to 2.4 cm in diameter but most are smaller than 2.0 cm and are about 0.4 cm deep. These are linear arrangements of small pecked dots, different from the cupule petroglyphs found at Panel 2 and other cupule sites in northwestern California, as they differ in size, spatial patterning, and method of creation. Many of these dots are clustered to form orderly rows forming zigzag motifs. The individual dots appear to have been created by 10-16 impacts by punch and hammer (Figure 8).

In addition to the controlled pecking which formed dots and abstract curvilinear elements and motifs described above, Panel 1 also contains areas of extensive pecking, which did not produce designs. Hundreds of individual dints occur, sometimes clustered into groups, but often, the appearance is given that the aboriginal artist made no attempt to form an element or motif. The tight clustering of peck marks indicates that some of the elements at Panel 1 were made with a punch (possibly an antler tip) struck with a stone or bone hammer. This left a small, sharp individual peck-mark. Other elements appear to have been pecked "free hand" without the aid of a punch. Some of the peck marks have a small "tail" as though they were made with a glancing blow to the punch tool that caused it to be deflected horizontally. One grouping of these marks clearly indicates this was deliberately done, perhaps for artistic effect (Figure 9).

A multitude of fine scratched lines occurs on Panel 1. These appear to have been formed by a single stroke or scratch made with a sharp-edged stone tool, perhaps a chert flake or biface (Figure 10). Like the deeply incised lines, which sometimes occur in the same groupings, these line figures occur in tight parallel clusters and are vertical; oriented perpendicular to the ground surface. They differ, however, in method of manufacture: only a single scratch is made, not the repeated cuttings executed to form the deeply incised lines. They also differ in that oblique orientation of clustered lines occurs. Also, there are locations at Panel 1 where only fine lines exist with no other motifs. These clues suggest that the fine line petroglyphs could represent a style distinctive from the deeply incised line petroglyphs.

Dozens of deeply incised lines occur at Panel 1 (Figure 11). These are nearly identical to the incised

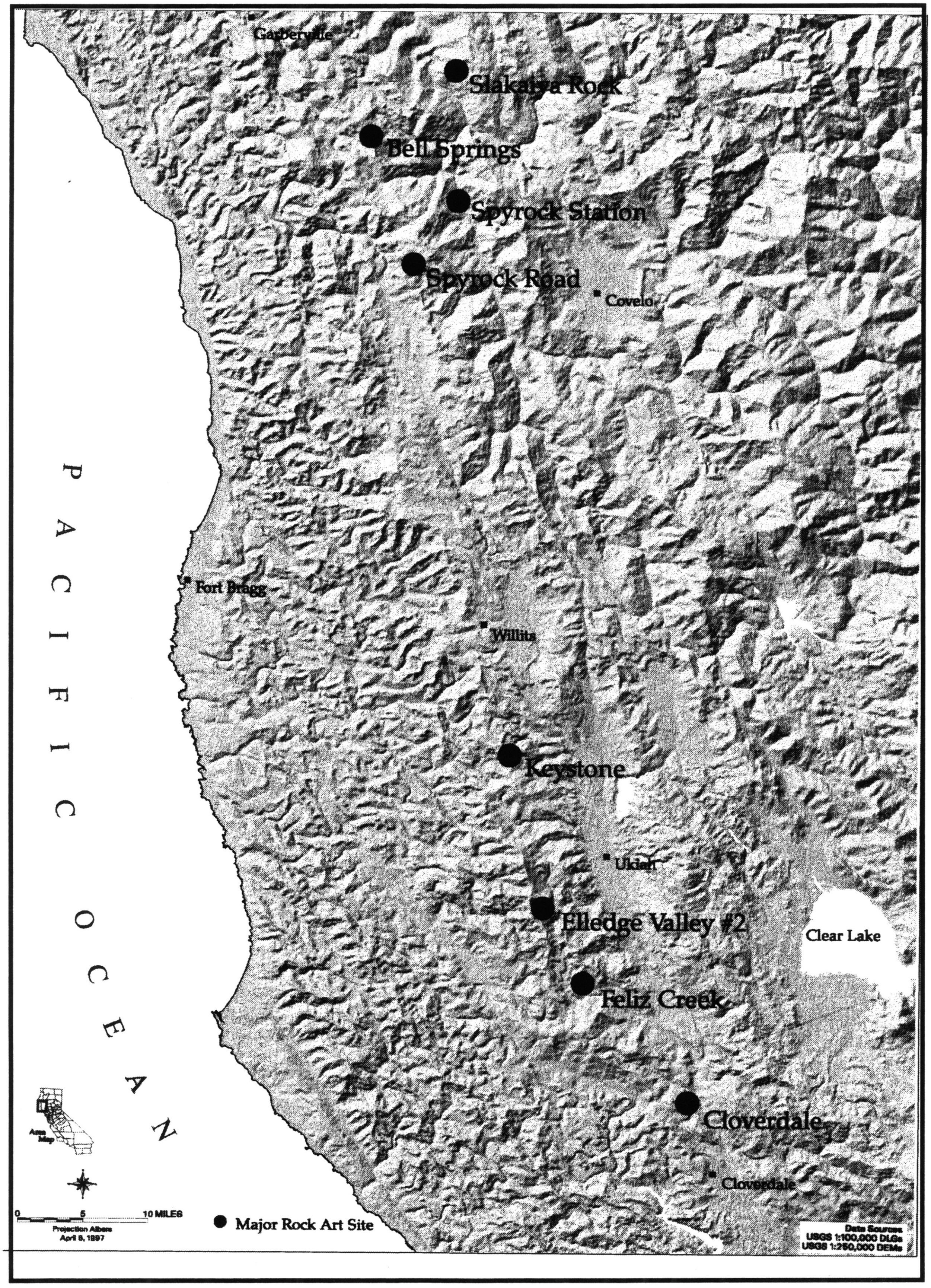

Figure 1: Discussed site locations.

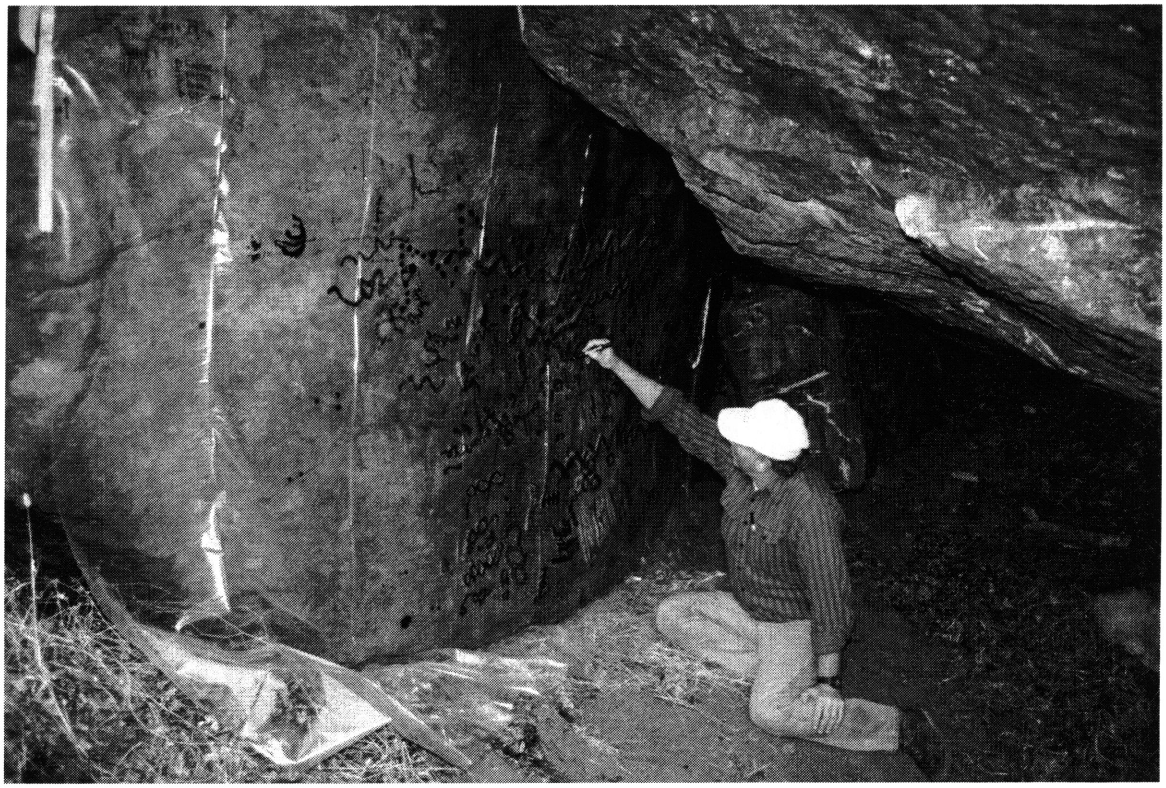

Figure 2: Recording procedure used at Panel 1. The petroglyphs were traced onto a 3 mm plastic sheet using felt markers.

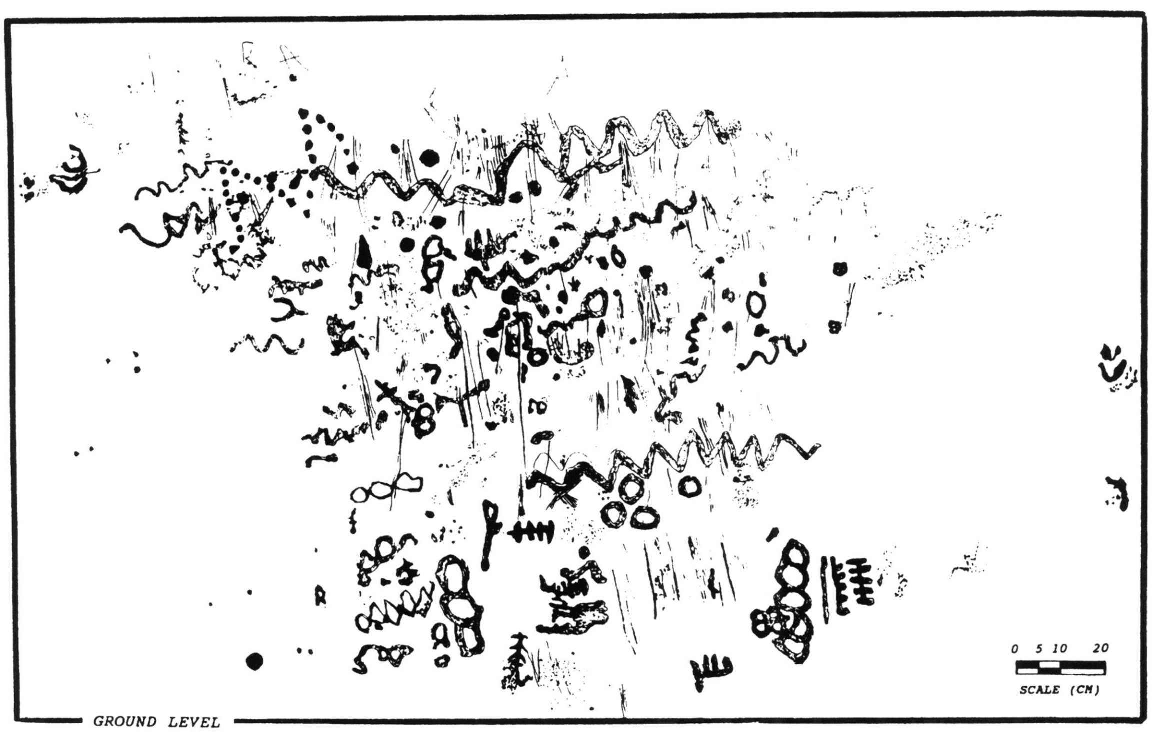

Figure 3: Illustration of petroglyphs at Slakaiya Rock, Panel 1.

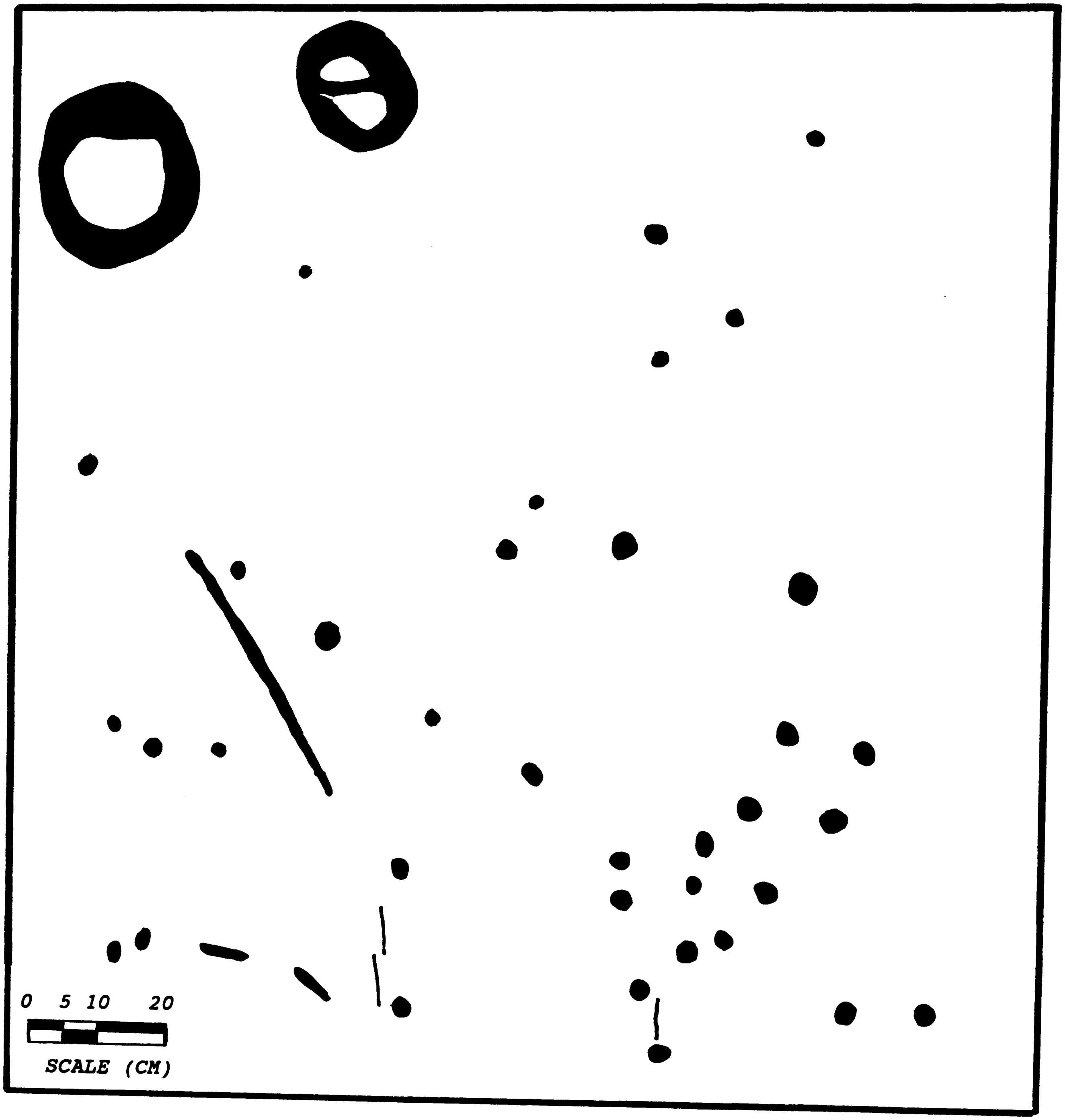

Figure 4: Illustration of petroglyphs at Slakaiya Rock, Panel 2.

Figure 5: Pecked abstract curvilinear petroglyphs (SR Style 4) at the top of Panel 1. Note the wavy lines, rows of dots and abstract shapes.

Figure 6: Pecked abstract curvilinear petroglyphs (SR Style 4) in the center of Panel 1. Motifs include "zigzags," circles, linked circles and extensive pecked areas.

Figure 7: Pecked abstract curvilinear petroglyphs (SR Style 4) in the lower left Portion of Panel 1. Motifs include more linked circles, linked diamonds, "tally marks" and abstract shapes.

Figure 8: Rows of pecked dots (SR Style 4) at the top of Panel 1. These dots are arranged to form a large "zigzag" motif.

line petroglyphs found at numerous sites in northwestern California, especially farther south in Mendocino and Sonoma counties (Heizer and Clewlow 1973; Clewlow 1978). These are deeply cut lines, probably made with a chert biface, and consistently oriented perpendicular to the ground surface. One prominent line is 71 cm long, 1.5 cm wide, and 1.0 cm deep, forming a sharp, "V-shaped" profile. These figures often cut through earlier petroglyphs, the superimposition suggesting at least two episodes of petroglyph making by Native Americans.

Slakaiya Rock Panel 2

Panel 2 is a small, moss-covered grouping of deeply abraded petroglyphs. It occurs on the opposite side of the same complex of boulders at the northeast end of the stream terrace and is markedly different from Panel 1. The pecked abstract curvilinear art, deeply incised lines, and fine scratched lines common at the larger panel are completely absent. Differences in subject matter, relative repatination, and method of execution are also readily apparent. Prior to its discovery this panel was completely concealed by a 2 cm-thick layer of moist green moss. The rock revealed a grouping of cupules, grooved circles, and grooved lines. The panel containing the petroglyphs measures 147 by 135 cm on a gently sloping, nearly vertical surface of a large schist boulder. It extends 16 cm below the present ground surface.

Two large circular elements, situated side by side on the upper portion of the panel, have been deeply abraded into the boulder (Figure 12). One of the elements is formed by a deep, wide circular groove, which encompasses a bulbous center. The largest of these two petroglyphs measures 27 by 24 cm; the groove is 5 to 8 cm wide and 3 to 5 cm deep. Its center measures 13 by 15 cm. As is the case with many of these distinctive grooved carvings, the center of the large one at Panel 2 appears to have been partially hollowed (quarried) in a manner similar to that described at Swallow Rock (Foster and Betts 1994) and several similar sites in northwestern California (Parkman 1993). The smaller example is 20 cm away from the larger one. It measures 19 by 16 cm, with a groove ranging from 3.5 cm to 5.5 cm wide and 3 to 4 cm deep. Its center measures 11 by 7 cm. Although it has not been hollowed, it exhibits an unusual grooved line, which bisects the raised center.

Thirty-six cupules are found at the Panel 2, occurring in a randomly scattered grouping extending from the pair of grooved circles down to and even slightly below the present ground surface. Like all of the petroglyphs on this panel, they are highly weathered and completely repatinated, giving the appearance of being quite old (Figure 13). Most are abraded or chiseled into the boulder and most of the cupules are ground smooth. If they were initially pecked, they were later abraded as individual peck-marks are absent. This trait sets them apart from the dot figures at Panel 1. These cupules range in size from 2.5 to 5 cm in diameter, and from 1.5 to 3.5 cm deep.

Six linear grooved elements are deeply carved into Panel 2, including one very large example which measures 42 cm long, 1.5 to 2.2 cm wide, and 1.0 to 2.0 cm deep (Figure 14). It is abraded and has a smooth polished surface. Like the cupules, individual peck-marks are absent. The other five linear grooves are shorter and are situated near the base of the panel (at or slightly below ground level), and measure approximately 6 to 8 cm long, 0.2 to 0.4 cm wide and 0.2 cm deep. Although quite narrow, these five grooved, linear petroglyphs should not be confused with the deeply incised line figures at Panel 1. The linear elements here were not cut into the rock, but were abraded, or pecked and abraded to finished shape. They are much broader and exhibit a "U-shaped", not a "V-shaped" profile when examined in cross-section.

Stylistic Classification

We believe that at least six different petroglyph styles are present at ***Slakaiya Rock***. These separate styles can be identified by the following attributes: (1) method of creation; (2) subject matter; (3) repatination; and (4) evidence of superimposition. For the purpose of this paper they are designated Slakaiya Rock Styles 1-6. These stylistic designations are not intended to imply a formal relationship with similarly designated California rock art styles although possible associations with nearby sites are reviewed.

Several previous studies including Clewlow (1978), Heizer and Baumhoff (1962), Heizer and Clewlow (1973) and Steward (1929) have classified known petroglyph sites in northwestern California into a single "style" such as the so-called *North Coast Petroglyph Style* proposed by Clewlow (1978:622), whose only common denominator seems to be geography regardless of stylistic content. The validity of a single petroglyph style for all of northwestern California was first questioned by Foster (1983) in his description of the Spyrock Road petroglyphs (CA-MEN-1912), a site dominated by ancient concentric-circle motifs carved in *bas-relief*. A possible explanation for this misinterpretation was also suggested:

> Since the *North Coast Petroglyph Style* area was proposed based upon only eight recorded sites, the identification seems premature because very few surveys have been conducted in the region. The Spyrock Road site is a complex petroglyph assemblage, which sharply contrasts with the tentative identification of a *North Coast Petroglyph Style* as defined by Clewlow (1978:622). Since the Spyrock Road site is not likely to be aberrant example, several unique styles could also be recognized within this area if additional site data were available. It is hoped that future research in northwestern California will test this possibility and that more meaningful interpretations will be presented (Foster 1983:53).

Rock art surveys during the past decade have indeed demonstrated that northwestern California is far more complex and infinitely more variable than can be accommodated into a single-style classification. A total of 178 petroglyph sites have now been documented from within the Pomo, Yuki, and Coast Miwok ethnographic territories alone (Leigh Jordan: personal communication). Several major rock art sites such as ***Slakaiya Rock***, Spyrock Road, Spyrock Station, Bell Springs (CA-MEN-433), Feliz Creek (CA-MEN-793), Cloverdale (CA-MEN-1800), and Keystone (CA-MEN-2200) contain petroglyph assemblages which are inconsistent with the originally proposed single-style and support the view that the region contains multiple, distinctive styles. Superimposition of elements at these complex petroglyph sites, combined with documentation of difference in repatination, may provide researchers with the initial inventory of elements needed for the identification and organization of the different styles found in the region. The following six discrete styles are found at ***Slakaiya Rock*** and are designated Slakaiya Rock (SR) Styles 1-6.

SR Style 1

"Pecked Curvilinear Nucleates" (PCNs): The two grooved circle figures at Panel 2 are similar to numerous rock art features originally described by Miller and Haslam (1976) and more completely by Miller (1977) as "Pecked Curvilinear Nucleates." Parkman (1993) has recently presented a thorough discussion of the distribution and function of this group, which he terms "PCN-Style Petroglyphs" or PCNs. Although implied in its name, this style of petroglyph does not always give the appearance of having been created by pecking. If they were initially pecked, the elements often appear to have been later abraded to form deep grooves, which removed evidence of pecking. It is equally possible that most PCNs, including these two at ***Slakaiya Rock***, were not pecked at all but were created entirely by deep abrasion. While this distinction may seem insignificant, it is important to recognize that evidence of a truly pecked style does exist at this site. ***Slakaiya Rock*** is one of the nor-thern-most examples yet reported for this group, although Drennan (personal communication) recently reported discovery of a PCN petroglyph site in southern Humboldt County, which extends their range even further north. There is a concentration of PCN petroglyph sites in Mendocino, Sonoma, and the Bay Area counties (Parkman 1993: Table 1). This distinctive style has also been recently reported as far south as western Fresno County (Foster and Betts 1994). Like many of the grooved circular elements at other PCN-Style petroglyph sites, one of the examples at Panel 2 appears to have been quarried to remove its soft, schist center. Reed Haslam (1986) has suggested that quarried centers removed from PCN petroglyphs have been used as blanks for the creation of carvable artifacts. Examination of carved artifacts recovered near PCN sites has revealed that schist pendants (Foster 1990:7), charmstones or small ornaments (Parkman 1993) or shaft straighteners (Foster and Betts 1994), are the most common objects, which may have been created from them.

SR Style 2

Cupules: The grouping of 36 cupules at Panel 2 is thought to represent another distinctive style at ***Slakaiya Rock***. Cupule petroglyphs are extremely common in northwestern California. Recent rock art surveys have suggested these petroglyphs may be associated with both Archaic and Late-Prehistoric/Historic cultural traditions in the region. Some of these cupules appear to be quite old, others seem to date to a middle period (Gary and McLear-Gary 1988), and others appear to have been created in the historic period (Barrett 1952). Although this assessment is preliminary, the cupule petroglyphs at Panel 2 appear to be very old, perhaps early Holocene age.

Many researchers have interpreted all cupule-bearing rock outcrops in northwestern California to be either "Baby Rocks" in Pomo territory (Barrett 1952:387) or "Rain Rocks" in the Klamath River region (Heizer 1953) based upon presumed associations to the type-sites. Recent studies have demonstrated, however, that such broad functional interpretations should be applied carefully. Hedges (1983a), to cite one example, has shown that in spite of the terms "pits" and "cuppings" recorded in ethnographic accounts describing the Pomo fertility ritual (which suggests cupules), known Pomo "Baby Rocks" he visited always contain deeply incised line petroglyphs, but at one site (Elledge Valley Baby Rock No. 2), only a single cupule was present. This may indicate that deeply incised line petroglyphs are more likely associated with the fertility ritual described in ethnographic accounts than are cupules. Hedges (1983a:20) provides this assessment:

> Judging from the baby rocks so far examined, cupules are not essential to the function of a site as a baby rock. Incised grooves, sometimes very deep, are found in all of the sites examined so far, and are consistent with the described activity of grinding powder from the rock to make a paste.

The "Rain-Rock" interpretation for SR Style 2 petroglyphs seems unlikely when, upon careful examination of the Gottville boulder (CA-SIS-183), the type-site for "Rain-Rocks" (Heizer 1953), revealed the presence of numerous bear-track motifs along with remarkably large cupules, which are dissimilar to the cupules, recorded at ***Slakaiya Rock***. Neither bear-track motifs nor huge cupules occur at site CA-TRI-1; hence, little evidence exists to suggest that it is a "Rain-Rock".

SR Style 3

Grooved Lines: The six grooved linear figures at Panel 2 are considered to represent another distinctive style of art at ***Slakaiya Rock***, although, in fact, SR Styles 1-3 may be culturally-linked — that is, made by the same group of people during the same time period. The fact that all three groupings are clustered on the same remote panel, are fully repatinated, and are of similar manufacture (abraded, not pecked, scratched or incised) suggests that they are of similar age. Grooved linear petroglyphs (which are not incised or scratched) are extremely uncommon in northwestern California although they have been seen at three sites: CA-MRN-193 located within Olompali State Historic Park, along Ward Creek near Cazadero, and in Napa Valley (Parkman: personal communication).

SR Style 4

Pecked Abstract Curvilinear: This assemblage consists of all forms of the pecked rock art at Panel 1, such as the rows of dots, wavy lines, circles, linked-circles, diamonds, and other abstract curvilinear designs. This style includes the extensive pecked motifs not shaped into elements or motifs. There appear to be two different ages of pecked designs: some are completely repatinated, while other pecked elements, (sometimes part of the same motif) appear vividly fresh, exposing the white-colored schist subsurface. This observation may indicate a pattern of renewing ancient petroglyphs by later peoples. If SR Style 4 elements were renewed or "re-pecked," this must have occurred prior to 1913, as no change is noted since the photographs taken by Degen in that year. It probably also occurred prior to 1900 since Goddard's informants seemed to not know about the site. It could be argued that Goddard's Wailaki informants chose not to disclose information about sacred places such as this petroglyph site. We believe this explanation to be unlikely. Goddard's informants did provide detailed information about *sketeclkascanan*, and other ceremonial sites known to surviving Slakaiya elders (Goddard 1923:104). Apparently they were unaware of the petroglyphs. It seems more likely that re-pecking of SR Style 4 petroglyphs occurred in the earliest historic period (circa 1850-1900), which would explain the difference in repatination of stylistic elements on the same panel.

The possibility should be considered that some of the pecked designs were made with a square nail used as a punch. Several very small elements appear to have a "star-shaped" peck. This may be the result of impact from an iron nail or some other metal tool. Perhaps the artists at ***Slakaiya Rock*** acquired a star drill from one of the old mining camps in Trinity County. Star drills were typically made of tough steel and designed to be hammered into the rock to make holes for explosive charges. They were most commonly used in remote areas where heavy mechanized drilling equipment could not be delivered. The name derives from the cruciform or star-shaped bit face. The star-shaped and whitish-colored peck marks at Panel 1 could have been made in historic times with such a tool. Other peck-marks exhibit a round impact scar and are often fully repatinated.

Sites containing SR Style 4 petroglyphs are extremely rare in the region, however, a few others are known. One of these is the Spyrock Station site, which contains many examples of SR Style 4 pecked abstract designs (Connick 1960). Located 10 miles upstream on the Eel River, this petroglyph site exhibits pecked wavy lines, linked circles, zigzags, and abstract figures, as well as dozens of cupules. On one panel, it appears that many cupules have been placed over, and therefore must be later than, the SR Style 4 petroglyphs (Figure 15). The difference in their ages is confirmed by a distinctive difference in the degree of repatination. Another site possibly containing SR Style 4 petroglyphs is the Klamath River site (Steward's PT.1) that appears to contain pecked wavy lines and pecked dots (Steward 1929:57, Plate 22b).

SR Style 5

Fine Scratched Lines: Hundreds of fine scratched lines occur at Panel 1 and are thought to represent a discrete style in northwestern California. Published rock art literature for this region does not often describe this group separately from deeply incised line petroglyphs, but we believe this style is well represented in the region. The Cloverdale boulder (CA-MEN-1800), to cite one example, contains similar scratched lines as well as complex groupings of deeply incised lines and cupules (Hedges 1983b).

SR Style 6

Deeply Incised Lines: This grouping includes dozens of deeply incised lines, all occurring on Panel 1, and is possibly the most common style of rock art found in northwestern California. The style has been unfairly characterized by an oversimplified description that the group is made up of "...artistically unconnected angular lines..." "which"... "appear as random scratches"... "forming"... "no particular pattern"... (Heizer and Clewlow 1973:29), but as Hedges (1983b:58) reports in his description of the Cloverdale petroglyphs, this is not accurate. Deeply incised line petroglyphs often do occur in complex, patterned groupings in northwestern California.

Stratigraphic analysis at ***Slakaiya Rock*** reveals the deeply incised line petroglyphs are cut through groupings of fine scratched lines, and thought to be a separate and later style. At Swallow Rock (CA-FRE-2485), a major petroglyph site in the southern Diablo Range, two separate styles of incised lines were also recorded. These are fine scratched, and deeply incised lines. Stratigraphic analysis revealed that the fine lines are older than the deeply incised ones (Foster and Betts 1994). This is consistent with the stratigraphic relationship of these two groupings found at ***Slakaiya Rock***.

As mentioned earlier, deeply incised line petroglyphs are linked to female fertility rituals in Pomo territory to the south, and it seems reasonable to propose a similar functional interpretation for the ***Slakaiya Rock*** examples, especially if these were made by the Wailaki. Elsasser (1978:190) provides the following description of the cultural relationship between the southern Athabaskans and the Pomo:

> Although the Cahto of the upper South Fork Eel River region, south of the Sinkyone and Wailaki, spoke another dialect of the Nongatl-Sinkyone-Lassik-Wailaki language, culturally they were not typical of the southern Athabaskan enclave but were more closely allied to Central California (specifically the Pomo) than to Northwestern California, with which the five components of the enclave are usually associated.

Elsasser's comments suggest that the cultural tradition of rituals designed to cure female infertility linked with incised line petroglyphs may have spread from the Pomo through the Cahto to the Eel River Wailaki. Regardless of their function, these petroglyphs must be very late in age. Superimposition of styles at Panel 1 reveals these to be the most recent petroglyphs at ***Slakaiya Rock***. Parkman (1993:351) suggests that this style dates to circa 350 B.P., and Barrett's observations of the Pomo (1952) indicate that the tradition of deeply incising lines onto schist boulders continued into historic times. The following description of the Pomo fertility ritual was provided by Barrett (1952:386-387):

> The sterile pair went to one of these rocks and there a prayer for fertility was made. Then, by means of a pecking stone, some small fragments were chipped from the sides of one of the grooves or cuppings in its surface. These were then ground into a very fine powder, which was wrapped in some green leaves and taken to some secluded spot. Here this powder was made into a paste and with it the woman's abdomen was painted with two lines, one running from the top of the sternum to the pubes, the other transversely across the middle of the abdomen. Some of this paste was also inserted into the female. Intercourse at this time positively assured fertility, due to the magic properties of this rock.

We suggest that the frequently observed pattern of deeply incised lines oriented perpendicular to the ground surface results from repeated cuttings with a chert biface with a cupped hand held below the line to catch schist powder used in the fertility rituals. This functional interpretation of the SR Style 6 petroglyphs is supported by Loeb's description of the Pomo "Baby Rock" ritual where he reported the use of a "flint knife" in repeated "cuttings" upon the rock. His graphic account, which illustrates the importance Pomo cultures places on the number four, is as follows:

> If a woman wants a child she fasts for four days, taking only a little mush after dark. On the fifth day she goes alone to the rock at daybreak, taking with her a small flint knife. She walks around the rock counter-clockwise four times, then clockwise four times. Then she stops, facing the carved surface of the rock. She raises both hands and extends them before her, the finger tips level with her eyes, then draws them in and lays them on her breast, finger tips meeting. This is done four times. Then four times she bends her knees. The fifth time she sits back on her heels. With the flint knife she makes four motions as though to cut the rock. Then four times she really cuts it and with the dust she has ground from it she marks upon her body two long lines from lower lip to navel, from left armpit to right, and then a circle upon the forehead where the parting of the hair begins. Then she speaks to the rock, asking for a child. There are no set prayers for this. She rises, and beginning again with the lifting of her hands, goes through her ritual four times. Then four times she walks about the rock counter-clockwise, then clockwise four times. She stops where she has been crouching, turns her head to the left four times and then goes home. Four times on the way she stops and turns her head to the left, but on no account must she look back. All this must be kept secret from every one (Loeb 1926:247).

Conclusion

Based upon our observations of the horizontal and vertical positions of groupings at the site, the subject matter, evidence of repatination, and comparisons with other sites in the region, we propose the following relative ages for the six styles. SR Styles 1-3 are probably the oldest of the six, and probably of similar age, but their temporal relationship to SR Style 4 is unclear. Many of the SR Style 4 petroglyphs also give the appearance of being quite old (Figure 16). We know that SR Style 4 is older than SR Style 5 and both are older than SR Style 6 petroglyphs. This sequence is clearly revealed by superpositioning of styles at ***Slakaiya Rock*** Panel 1. The Spyrock Station site contributes another style to this sequence by revealing a pattern of cupules placed over SR Style 4 elements. We believe the Spyrock Station cupules to be younger and of a different style than the fully-repatinated cupules at ***Slakaiya Rock*** Panel 2 designated SR Style 2. This age difference is proposed not only from the superpositioning but also by a noticeable difference in repatination. We propose the following sequence: SR Styles 1-3, followed by SR Style 4, followed by Spyrock Station cupules, followed by SR Style 5, and finally, SR Style 6. A final episode of renewing earlier petroglyphs during the early historic period is also possible. The sequence proposed here is remarkably consistent with the sequence of styles proposed by Gary and McLear-Gary (1988:3) from their investigation of the Keystone petroglyphs in central Mendocino County. They report a sequence of 1) abstract curvilinear petroglyphs grids, concentric-circles, parallel wavy lines, and parallel zigzag elements,

Figure 9: Clustered peck marks at Panel 1. Some of these have a "tail" as if created with a glancing blow to the punch tool.

Figure 10: Fine scratched lines (SR Style 5) at Panel 1.

Figure 11: Deeply incised lines (SR Style 6) at Panel 1. Thse are thought to be associated with female fertility rituals.

Figure 12: PCN-Style petroglyphs (SR Style 1) at Panel 2. The one on the right has a grooved line bisecting its nucleated center.

Figure 13: Arrows point to two PCN petroglyphs (SR Style 1) at Panel 2 with a coin placed on their raised centers. Below them, 36 cupules (SR Style 2) were found.

Figure 14: Arrow points to the largest grooved line petroglyph (SR Style 3) found at Panel 2.

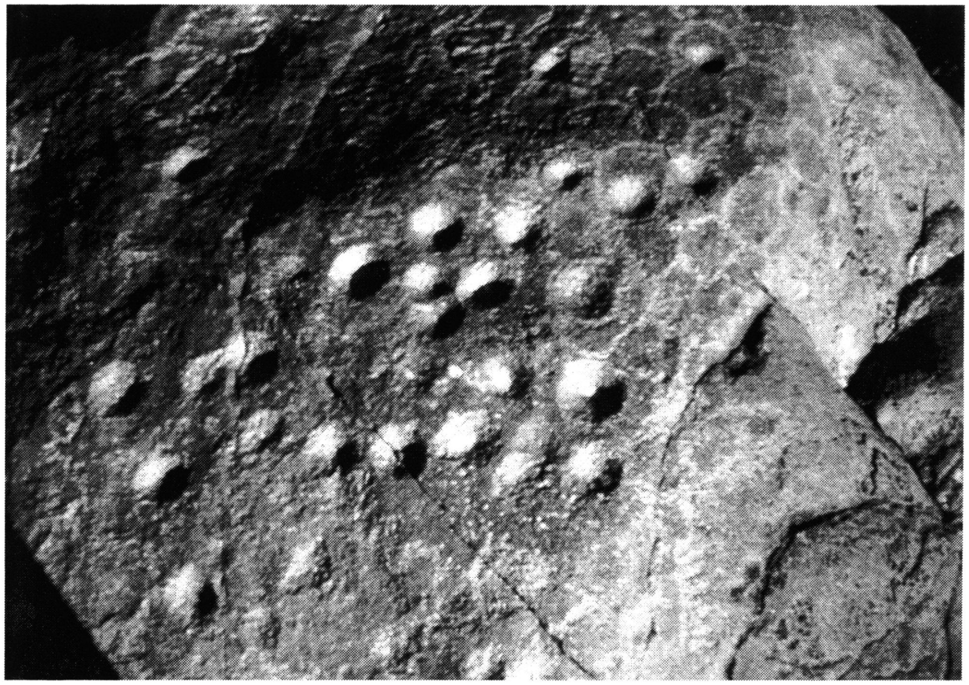

Figure 15: Petroglyphs at the Spyrock Station site revealing two distinctive styles. The cupules appear to be superimposed over the pecked curvilinear elements. There is a noticeable difference in repatination as well. Photo by Robert Connick, 1960.

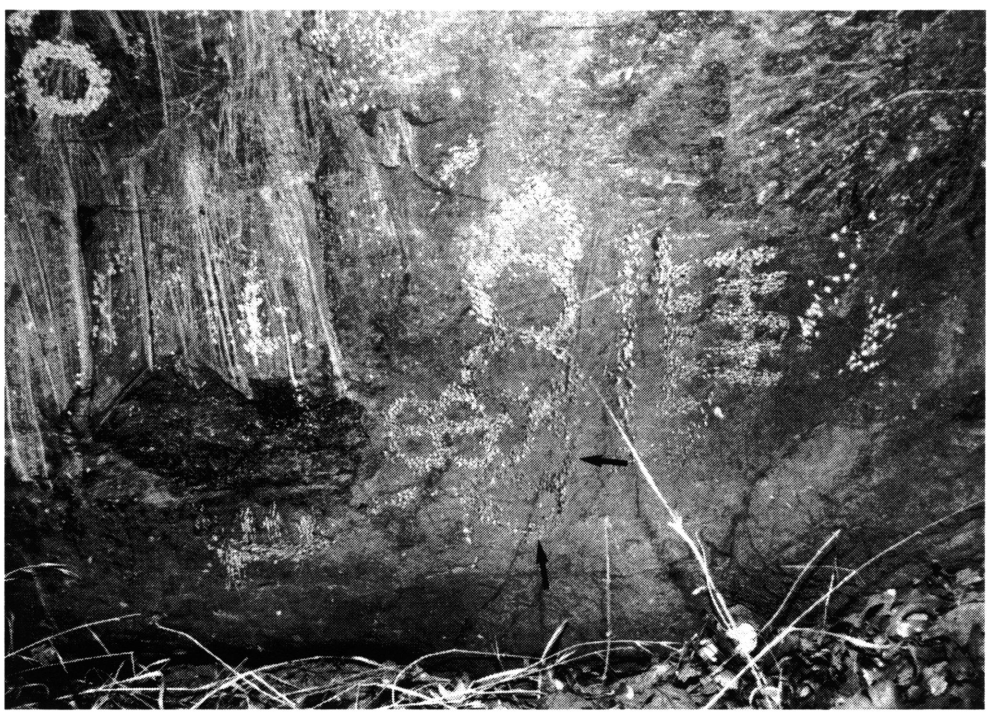

Figure 16: Differences in repatination of pecked elements at Panel 1. Arrows point to section of linked circle motif which reveals fully repatinated peck-marks. The top two circles on the same motif reveal whitish colored peck-marks showing no repatination. This could indicate that SR Style 4 petroglyphs were renewed (repecked) by historic Wailaki groups.

2) cupules, small circles, and ovals (PCNs) and 3) incised lines. To quote from their report:

> More than 100 instances were observed of incised lines occurring over everything. This is strong evidence that incised lines are the latest motif to be applied. The remaining superimposition is mainly cupules placed on shields, circles, and concentric circles (Gary and McLear-Gary 1988:3).

Slakaiya Rock reveals similar superpositioning and suggests that the temporal patterns proposed at Keystone also occur in the upper Eel River. A significant difference is that the concentric-circle motifs found at Keystone, Spyrock Road, and Feliz Creek, from Mendocino County, thought to be one of the county's oldest styles, seem to be absent. Another difference is that ***Slakaiya Rock*** appears to contain a panel of PCNs and cupules, which may be older than those, found at Keystone. In the Eel River region, the oldest petroglyphs appear to be PCNs, SR Style 2 cupules, grooved lines, and pecked abstract curvilinear elements. These are followed by fine scratched lines (SR Style 5), and lastly, deeply incised lines (SR Style 6). The Late Prehistoric - Historic pattern of deeply incised line petroglyphs, thought to be related to female fertility rituals, extends into Trinity County, and into Wailaki territory.

Slakaiya Rock is a remarkable site in nearly pristine condition. Its two petroglyph panels display multiple styles, some of which are superimposed on earlier styles. With six distinctive styles present and outstanding evidence of superimposition, this site presents unique opportunities to investigate the relative chronology of prehistoric rock art of northwestern California. Further studies may also contribute to our understanding of the Slakaiya tribelet of Athabaskan-speaking Wailaki who inhabited this remote section of the Eel River.

Acknowledgments

The authors are grateful for the opportunity to submit this paper in memory of Professor Franklin Fenenga who was instrumental in guiding both of our careers in California archaeology. John received his M.A. degree from California State University, Long Beach under Franklin, and Dan received his first exposure to archaeology from him as a participant in the Hidden Reservoir project during the summer of 1971. We are fortunate to have learned much about California archaeology from him during the past 25 years. This study of the ***Slakaiya Rock*** petroglyphs is dedicated to Franklin, who had originally given the site its permanent designation (CA-TRI-1) in 1948, the first year of the University of California Archaeological Survey. Its methods are those prescribed by Fenenga in his 1949 report "Methods of Recording and Present Status of Knowledge Concerning Petroglyphs in California."

Many colleagues provided assistance during this study. Robert Connick sent us copies of his slides and field notes and duplicates of Degen's original photographs. The reproduced photographs were provided by Eugene Prince of the Hearst Museum of Anthropology. Since Degen's original letters to Kroeber are now missing from the files at the University of California, Connick's transcriptions of them, recorded in 1973, represent a now irreplaceable source of information about ***Slakaiya Rock*** and nearby sites. Professor Connick also provided the photo of the Spyrock Station site (Figure 15) and one of the photos of ***Slakaiya Rock*** used in this paper (Figure 11). Mark Gary provided us with his data on the Keystone site and Deborah McLear-Gary sent slides of other Mendocino county rock art sites used during this research. Albert Elsasser and Clement Meighan made important contributions to the initial recording. Francis Riddell, William Wallace, L. Kyle Napton, and Brian Dillon helped us trace the earliest years of the University of California Archaeological Survey and the initial recording of site CA-TRI-1. Leigh Jordan provided information on the number of known rock art sites within northwestern California compiled from her Masters thesis research. Mark Fleming loaned us his copy of *Genocide and Vendetta*, which is out-of-print and hard to find. Stephen Ellen of the U.S. Geological Survey provided helpful information concerning the geology of the Eel River canyon. Mark Gary, Breck Parkman, and John Betts offered suggestions concerning the stylistic classification proposed herein. Ernie Rohl discovered the petroglyphs at Panel 2 and without his keen observations, this report would have been missing Styles 1-3. He also helped prepare the site map included in the site record. Brian Dillon, L. Kyle Napton, Breck Parkman, and Michael Moratto took the time to carefully review and edit the manuscript and each made numerous improvements to it.

Dave Drennan deserves special recognition. Not only did he rediscover the site but also obtained permission from the private landowners for us to revisit the area in order to carry out this research. As those of us who have conducted research on private land know, this permission is sometimes difficult to obtain, and without it, the site would be completely inaccessible. Lacking Dave's extraordinary efforts, this paper could not have been written, and we would still be searching for ***Slakaiya Rock*** in a remote area five miles distant from its actual location. The authors assume full responsibility for any errors or misinterpretations.

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CULTURE HISTORY OF THE NEW MELONES RESERVOIR AREA, CALAVERAS AND TUOLUMNE COUNTIES, CALIFORNIA

Michael J. Moratto

Summarized here are the results of archaeological studies (1948-1988) in the Stanislaus River locality of the central Sierra Nevada. A local sequence of cultural phases, spanning nearly 10,000 years, is defined in terms of land use/settlement, subsistence, resource procurement, and technology. In the prehistoric record, three phases in particular—Clarks Flat (ca. 7650-4500 B.C.), Sierra (ca. 1000 B.C.-A.D. 500), and Horseshoe Bend (ca. A.D. 1300-1848)—reflect intensive occupation. The sequence concludes with the Peoria Basin Phase (A.D. 1849-1910), representing historic transformations of Central Sierra Miwok lifeways in the study area.

Introduction

As a young graduate student during the late 1960s, I was awed by the prospect of meeting Franklin Fenenga - a major deity in the pantheon of California archaeology. After all, he was one of the Holy Trinity who had handed down (what was then believed to be) the basic culture sequence in central California prehistory (Heizer and Fenenga 1939; Lillard, Heizer, and Fenenga 1939). He was the first archaeologist (1948-1950) of the University of California Archaeological Survey (UCAS) (Heizer 1972:37), and a pioneer in archaeological surveys and excavations throughout central and southern Sierra Nevada, the San Joaquin Valley, and elsewhere in California on behalf of the Smithsonian Institution as well as the UCAS (Fenenga 1947a, 1947b, 1948a, 1948b, 1949, 1952; Fenenga and Riddell 1949; Heizer and Fenenga 1948). Thus, it was with the trepidation of an acolyte approaching the Pope that I first met Frank at his field camp on the Fresno River, not far from my own excavations on the Chowchilla River, in the foothills of Madera County.

My timidity proved unwarranted. Frank was a gracious host, who spent hours acquainting me with various sites in the Hidden Reservoir (Hensley Lake) project area. I found him to be a skilled teacher, obviously at ease with his students, and a man who involved his family in the work to which he was so devoted. He patiently discussed his investigations of large prehistoric midden sites, historic-era Indian settlements, and James Savage's trading post (see Fenenga 1973, 1975; Kelly 1974; Muñoz 1980b). During this and subsequent trips to the Fresno River, and during Frank's visits to my project, I learned a great deal about field methods, historical archaeology, and the prehistory and ethnohistory of the Sierra Nevada foothills. I remember, too, with deep appreciation, that Frank treated me with respect and as a fellow professional, even though I was many years his junior and probably knew less altogether than he was apt to forget on any given day. Looking back over the past three decades, I am sure that Frank Fenenga's warm welcome to Sierran archaeology influenced my own commitment to this fascinating region.

Some years later, after working at Buchanan Reservoir, Lake Don Pedro, and on the Stanislaus National Forest (Moratto 1971, 1972, 1981), I was privileged to direct fieldwork, and later to synthesize the results of nearly 40 years of archaeological research, in the New Melones Reservoir area on the Stanislaus River. Highlights of that research are summarized in the following pages. The purpose of this paper is to review the Holocene archaeological record of Indian activity in the study area. Cultural phases and periods are defined, with emphasis on diachronic changes in land use, subsistence, resource procurement, and technology between ca. 8000 B.C. and A.D. 1910. The proposed sequence is offered as a model to be tested and refined in the course of future archaeological investigations.

Project Location and Setting

New Melones Reservoir lies in the Stanislaus River basin of the central Sierra Nevada foothills, approximately 160 km (100 mi) east of San Francisco (Figure 1.) The project area encompasses roughly 10,250 ha (25,000 ac), including the reservoir pool (<5122 ha, or <12,500 ac), recreation areas, wildlife habitat, and administrative facilities. At maximum gross pool, the impounded waters (913 million m^3, or 2.4 million ac-ft) extend upriver 38 km (24 mi), creating a shoreline of more than 150 km (95 mi). Local elevations range between ~150 and 760 m (~500 and 2500 ft) amsl; most of the project area falls below 455 m (1500 ft) amsl (Moratto and Goldberg 1982).

Natural Environment

This part of the Stanislaus River watershed features diverse landforms. Prominent among these are rolling hills, steep-walled river canyons, alluvial "flats," and segments of latite-capped Tuolumne Table Mountain (Moratto 1976b). The study locality exemplifies the Mediterranean Warm Summer (Csa) climatic type. Temperatures recorded historically at New Melones Dam have ranged from a summer high of 45°C (113°F) to a winter low of -10°C (14°F). In nearby Sonora (Figure 1), mean temperatures are arrayed between 10°C (50°F) in January and 28.3°C (83°F) in July; the mean annual temperature is 18.3°C (65°F) (Corps of Engineers 1972:12). Precipitation occurs mainly between October and March, with the heaviest rainfall normally in December and January. Summer rainfall is minimal. Normal annual precipitation averages about 686 mm (27.0 in) at New Melones Dam and 1189 mm (46.8 in) in the drainage basin upstream. At Sonora, mean annual precipitation during a 95-year period beginning in 1887-88 was 826 mm (32.5 in) (*The Union Democrat* 1982:9).

As a northeast-southwest transect across the central Sierran foothills, this segment of the Stanislaus River drainage represents chiefly the Upper Sonoran life zone, although marker species of the Transition and Lower Sonoran zones (Merriam 1898) are also present, respectively, in the northeastern and southwestern parts of the study area. Five plant communities or vegetation types (Munz 1968:11) are common at New Melones Reservoir: Yellow Pine Forest, Chaparral, Foothill Oak Woodland, Grassland, and Riparian. Of these, the most extensive are Chaparral and Woodland-Grass savanna (Moratto and Goldberg 1982: 57-72).

Cultural Background

The study area lies within the traditional homeland of the Central Sierra Miwok (Aginsky 1943; Barrett and Gifford 1933; Kroeber 1925; Levy 1978; Powers 1976). While sharing a common language, the Miwok did not think of themselves as an inclusive tribal entity. Rather, political cohesion was limited to smaller, corporate land-holding groups consisting of a main or "royal" village and several tributary communities (Kroeber 1954; Merriam 1967). Each settlement within a tribelet was named, and appears to have been occupied by a localized patrilineage (Levy 1978:410). The province of the Central Sierra Miwok included the foothill and mountain drainages of the Stanislaus and Tuolumne rivers, except that the Washo had hunting and camping rights down the western slope almost as far as Big Trees (in the Stanislaus watershed) in Calaveras County (Kroeber 1925: 442-443). Miwok concepts of territory were conditioned by the nature of their land use and social relations with other groups. Because land tenure was communal and intermarriage with other peoples common, boundaries were often indistinct and subject to change. Although the Indians of the study area were not profoundly affected by mission-era Spanish expeditions and later Mexican expansion into east-central California (see Cook 1960), they were devastated by the Gold Rush and its aftermath (Castillo 1978; Cook 1976; Heizer 1974; Hurtado 1988; Rawls 1976).

Situated at the heart of the Mother Lode gold belt, the Stanislaus River area was a major center of Gold Rush activity beginning in 1848 (Borthwick 1917; Carson 1952; Jackson and Mikesell 1979a; Jenkins 1948; Meyer 1938; Shoup and Greenwood 1984). Many immigrant groups sought their fortunes in the central Sierra during the mid-nineteenth century. Some of these people departed when the goldfields were depleted, but others settled as ranchers, farmers, and businessmen. They and their descendants have been responsible for local economic and social development. The history of the central Sierra Nevada has been strongly influenced by environmental conditions.

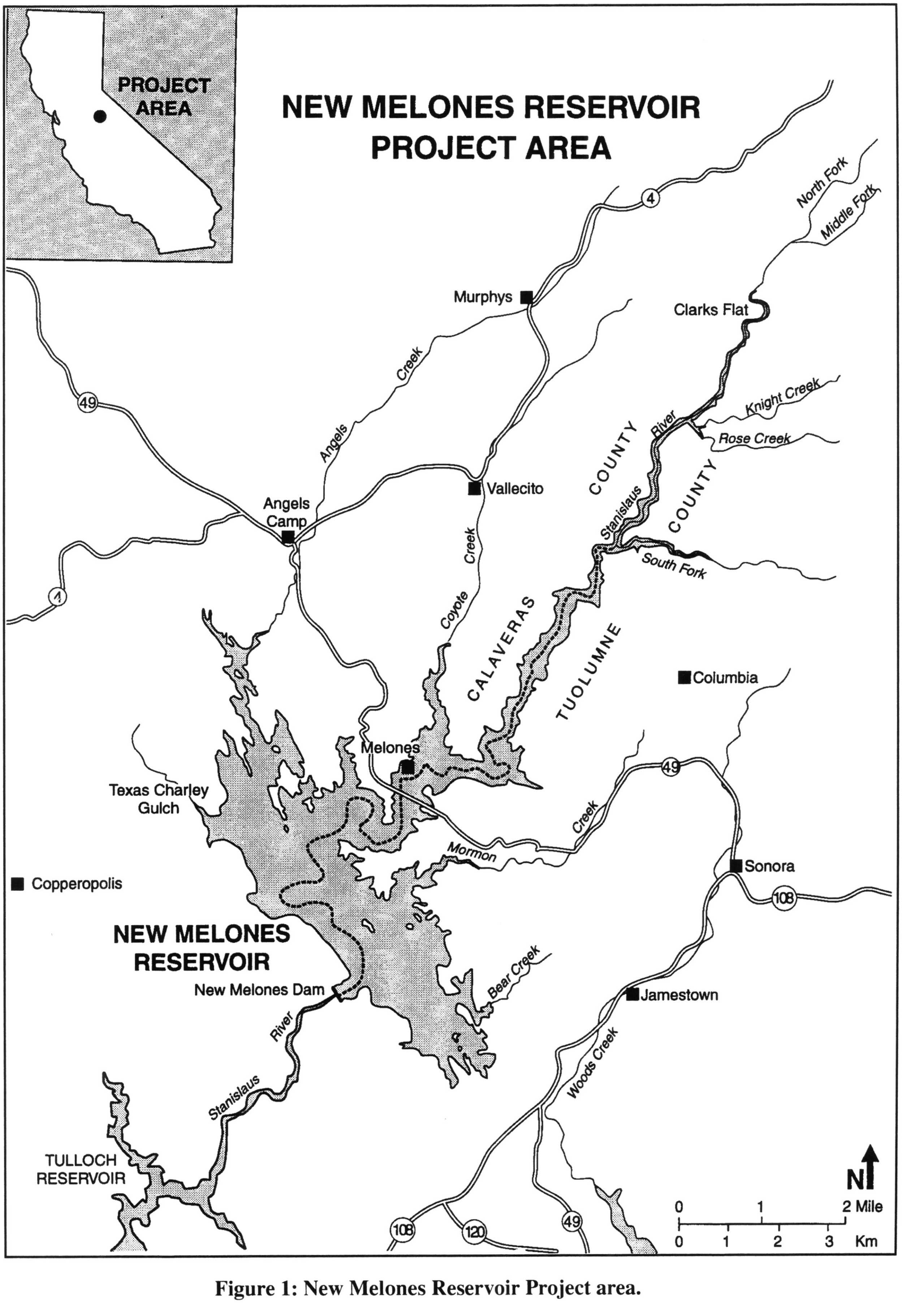

Figure 1: New Melones Reservoir Project area.

Terrain, climate, water, mineral resources, and vegetation all have shaped the patterns of enterprise and settlement. Accordingly, the regional economy has been dominated by mining, logging, ranching, water projects, and recreation (Jackson 1976; Shoup 1986). Concomitantly, shallow soils, mountainous terrain, and poor transportation routes have limited some kinds of agricultural and industrial ventures. Abundant stream flows and high topographic relief along the Stanislaus River, however, have created ideal conditions for water projects (Jackson and Mikesell 1979b). The largest of these is New Melones Reservoir.

Synopsis of the New Melones Archeological Project

Over a period of 30 years, beginning with a reconnaissance in 1948 (Fredrickson 1949), more than 700 archeological sites were documented in the course of numerous surveys within the New Melones Reservoir study area. In 1968 the Central California Archaeological Foundation (CCAF) discovered 112 sites (Payen et al. 1969). Between 1969 and 1972 the CCAF and the Foundation for Archaeological Research (FAR) completed additional surveys and posted 68 more sites to the inventory, for a total of 180 (Gage 1969, 1970; Kenton 1973a, 1973b; Johnson 1973; Peak 1973). Concurrently, a listing of archeological and other caves was prepared (Squire 1972). A systematic survey of the entire project area, performed in 1974-1975 by San Francisco State University (SFSU), resulted in the documentation of 474 "new" and 155 previously-recorded sites. Adding 25 known sites that were then inundated, otherwise inaccessible, or outside of project boundaries, 654 prehistoric and historic sites were known by 1975 (Moratto 1974a, 1974b, 1976c). The register of archeological caves was also expanded at that time (Squire 1975).

During 1976 and 1977 Greenwood and Associates evaluated 168 previously recorded historic sites, surveyed lands newly acquired by the project, and discovered 36 sites (Greenwood 1976, 1977a, 1977b). Subsequently, J. M. McEachern and M. A. Grady (1977, 1978) prepared an inventory and assessment of 25 caves in the study area (see also McEachern 1986); Science Applications, Inc. (SAI) encountered 20 previously-unknown sites in the course of 1978-1979 fieldwork throughout the project area (Fitting et al. 1979); and INFOTEC Development, Inc. (IDI) added two sites in 1981. This brought to 737 the grand total of archeological sites—including 442 historic non-Indian properties and 295 Indian sites—recorded between 1948 and 1981 at New Melones Reservoir (Moratto et al. 1987; Oman 1982), excluding cultural resources in the downriver segment of the project near Knight's Ferry (Orlins 1977a, 1977b; Swernoff 1982).

The New Melones Archaeological Project (NMAP) involved many episodes of fieldwork and other studies. Subsurface testing was initiated by the CCAF at four sites in 1968 (Payen et al. 1969). Thereafter, sampling was performed: in 1969 and 1970 by the CCAF at 18 sites (Gage 1970; Johns 1970; Peak 1973; Pritchard 1973); in 1972 by the FAR at six sites (P. Johnson 1973) and by the University of California, Davis at three sites (Richards 1973); by SFSU in 1975 at four sites (Moratto 1976d); and in 1975 by M. J. Moratto (1976a) at one site (see Moratto et al. 1988: Tables 9.1, 9.2). Between 1976 and 1978 several research proposals and cultural resources management plans were developed (cf. Greenwood 1977a, 1977c; Iroquois Research Institute 1978; Moratto 1976e, 1976f, 1977a, 1977b). During this same interval, studies of ethnography, history, and ethnohistory in the project area also were completed (A. Hall 1976, 1978; W. T. Jackson 1976; Theodoratus 1976). Four other works on local history and ethnohistory appeared soon thereafter (Jackson and Mikesell 1979a, 1979b, 1979c; Muñoz 1980a).

Beginning in August, 1978 SAI undertook a large-scale program of archeological testing ("Stage I") and "mitigation" ("Stage II") at New Melones Reservoir (SAI 1979; Singleton 1986b). By April, 1979 SAI had sampled 56 "prehistoric" (i.e., Indian) sites and 15 "historic" (non-Indian) sites. During Stage II, which lasted until April, 1980, SAI excavated 20 Indian sites, 19 of which had been tested during the first stage of fieldwork, and seven historic sites. Altogether, within a span of 21 months, SAI tested or excavated 57 Indian sites and 22 historic non-Indian sites (Cooley-Reynolds 1980; Costello 1981, 1983; Crew 1980; Fitting et al. 1979).

Following SAI's investigations, IDI undertook a program of fieldwork and analytic studies between 1981 and 1987 (Moratto and Greenwood 1982). In 1981 IDI excavated: the prehistoric/protohistoric Texas Charley Gulch site (Moratto and Arguelles 1984); the prehistoric Redbud site (O'Brien 1984);

the protohistoric Albany Flat site (Goldberg 1984); the Vonich Gulch historic site cluster, and nine additional historic sites with remains of early mining and residential activities (Greenwood 1982). Subsequently, IDI analyzed and reported data collected by the NMAP between 1948 and 1980 at Indian sites (Moratto and Singleton 1986) and non-Indian sites (Greenwood and Shoup 1983; Shoup and Greenwood 1984). A ten-volume final report of the NMAP culminated in a summary and synthesis of *Culture Change in the Central Sierra Nevada, 8000 B.C.-A.D. 1950* (Moratto et al. 1988).

A related study by Professional Analysts, Inc. (ProLysts) involved geological, biological, and archeological research at Coral Cave in the Stanislaus River Canyon (Gehr et al. 1983). ProLysts also conducted archival research, field survey, and subsurface testing at 16 proposed recreation areas along the lower Stanislaus River, from Goodwin Dam downstream to the San Joaquin River confluence (Swernoff 1982). Lastly, J. G. Costello prepared overviews of historical archeology in the project area (1981) and of the town of Melones (1983), and T. M. Van Bueren (1983) examined the archaeological record of the historic Central Sierra Miwok.

In sum, taking into account all of the NMAP investigations except those at cave sites and along the lower Stanislaus River, 34 historic (non-Indian) sites and 68 Indian sites were sampled. Nearly all of the historical archeology was performed during the late 1970s and early 1980s (Greenwood 1982; Greenwood and Shoup 1983). Previous sampling of historic sites had exposed four features at two sites (Peak 1973). SAI's (1978-1979) work involved clearing 40 features and excavating an areal sample of 115.4 m_ at a total of 22 sites. IDI investigated 16 features and excavated units covering a total of 279.2 m^2 at 10 sites during 1981. Altogether, the fieldwork at historic sites resulted in the excavation of 60 features and 394.6 m^2 (Moratto et al. 1988: Table 9.1).

Subsurface samples at the Indian sites range from 1.0 to 182 m^2 per site (849 m^2 total), with a mean of 12.5 m^2 per site, and from 0.3 to 134 m^3 (544.7 m^3 total), with a mean of 8.01 m^3 per site (Moratto et al. 1988: Table 9.2). The grand totals of areal and volumetric samples would rise to 1163 m^2 and 858.7 m^3, respectively, if the 314 m^2/est. 314 m^3 trench at 04-Cal-S-286 were added. At 40 of the sites, test units covered 1-9 m^2. Sampled areas covered 20 m^2 or more at 19 sites. The excavated volume exceeded 15 m^3 at 11 sites; six were sampled at 10.0-14.9 m^3, 14 at 5.0-9.9 m^3, and all the rest (37 sites or 54.4%) were sampled at levels below 4.9 m^3 each. With several exceptions (04-Cal-S-276/344, 04-Cal- S-286, 04-Tuo-S-313, and 04-Tuo-S-444/449), the excavated volumes were too small to reveal site structure or to provide representative samples of site contents. Also, with few exceptions, the small samples preclude reliable definitions of intra- and inter-site archeological patterning. Knowledge of local prehistory thus is limited by the nature and size of the available archeological samples.

Archaeological Units: Time, Space, Form

An archeological sequence, tracing cultural developments from the first evidence of early Holocene hunter-gatherers to the Gold Rush and its aftermath, can be outlined for the middle Stanislaus River locality. The following pages review significant cultural patterns, trends, and changes through time. Arbitrary time periods provide a broad organizational structure, while cultural manifestations within periods are discussed in terms of phases, components, and assemblages (defined below). Topical foci include land-use and settlement, occupational intensity, subsistence, resource procurement, and technology. Locations of sites representing various periods are shown in the accompanying maps (Figures 2-6).

Organizing the archeological record by temporal *periods* is a useful approach insofar as it allows inter-site comparisons and highlights cultural change through time. Like any organizational structure, however, periods entail certain biases and limitations. One of these is the inherent perception of cultural homogeneity in each temporal block; another is the implication of rather abrupt cultural shifts at period boundaries. In reality, cultural evolution is a continuous process, albeit one punctuated by episodes of rapid change; moreover, there is no reason to think that, for each time period, a single, monolithic culture prevailed throughout the entire NMAP area. A more realistic model would allow for occupation of the study area at any point in time by one or more sociocultural entities. Archeological remains in the project area thus might evince significant formal variation in space or time, or both, within a given period.

Another way to organize archeological data is by cultural or formal, rather than temporal, units. Three such units — phase, component, and assemblage — are employed here to represent local culture history and to provide a framework for regional comparisons. A *phase* is a distinctive formal unit including one or more components, spatially limited to a locality or region, and chronologically limited to a relatively brief interval of time (Willey and Phillips 1958:22). When ordered chronologically, phases comprise a local or regional sequence. Phase may be viewed as the archeological manifestation of community or society, with each component representing a settlement or special-activity site used by members of a defined sociocultural group. A *component*, then, is the expression of a phase at a single site. While a site may contain multiple components, each component represents one or more occupations ascribable to a single phase. The term *assemblage* refers to a discrete, contemporaneous group or class of artifacts (e.g., a functional toolkit or technologically related set of items) from a single component.

Described below are phases and other cultural units identifiable in the New Melones archeological record. To the extent feasible, each such unit is defined formally, delimited in space and time, and discussed relative to other units in the project area. As data permit, the issue of continuity vs. replacement is examined for each sequential unit. Comparisons with local and regional sequences elsewhere in central California are presented in Moratto et al. (1988:541-562). The local chronology proposed for the NMAP area is summarized in Figure 7.

Culture History of the Project Area

Pre-6000 B.C.

Flaked-stone assemblages from NMAP excavations at 04-Cal-S-276/344, 04-Cal-S-321/ 418, 04-Cal-S-347, and 04-Tuo-S-505 (Figure 2) include a total of seven Lanceolate Stemmed and Large Square-stemmed bifaces (Singleton 1984a, 1986a). A much larger sample of stemmed bifaces was obtained in 1985 by Peak & Associates, mostly at 04-Cal-S-342 but also at 04-Cal-S-275, on Clarks Flat (Peak 1987; Peak and Crew 1990). Typically, these specimens are large, percussion-flaked, lanceolate-bladed bifaces with long, broad, parallel-sided to slightly contracting stems and square to semi-excurvate bases. Chert is the preferred material, examples of obsidian being rare; heat-pretreatment is evident on some specimens. These bifaces are comparable to projectile points of the Hell Gap, Lind Coulee, Lake Mojave, and Parman types, variously dated to ca. 6000-8000 B.C. (Daugherty 1956, 1962; Frison 1974, 1978; Layton 1979; Warren 1984; Warren and DeCosta 1964). Closer to the NMAP area, "Parman points" have been found at 04-Pla-23 near the Truckee River, northwest of Lake Tahoe; these have been assigned to a provisional Tahoe Reach Phase, tentatively dated at ca. 6000 B.C. (Elston et al. 1977:169, 171). In the upper Stanislaus River watershed, similar bifaces, likened to "Cougar Mountain points" (cf. Cowles 1960), were recovered in 1986 from early Holocene archeological contexts (Peak and Neuenschwander 1991). An early Holocene component typified by numerous large, stemmed, "Lake Mojave-like" points also has been excavated at the Skyrocket site near Copperopolis (Figure 1), a few kilometers west of the NMAP area (J. Pryor, personal communications 1989, 1993, 1995). These discoveries indicate fairly widespread occupation of the central Sierra during early Holocene times.

The *Clarks Flat Phase* is here proposed as the cultural unit subsuming all components distinguished by large, stemmed bifaces of early Holocene age, in the NMAP locality (Figure 7). Minimal expressions of the Clarks Flat Phase are recognized at 04-Cal-S-275 and 04-Cal-S-276/ 344, with unconfirmed evidence of related occupations at 04-Cal-S-321/418, 04-Cal-S-347, and 04-Tuo-S-505. It is possible that large side scrapers of basalt and Great Basin Transverse point (Moratto et al. 1988: Figures 4.4, 4.5) from Zone 4 at 04-Cal-S-276/344 also belong to the Clarks Flat Phase component, or they might register some different, largely unknown occupation(s).

The lower levels of 04-Cal-S-342 on Clarks Flat (Figure 2) provide the type component of the Clarks Flat Phase. Occupation beginning ca. 7650 B.C., or possibly earlier, is evidenced by a "low density" and "restricted variety" of artifacts, notably 13 types of stemmed and foliate projectile points, five kinds of scrapers, notched tools, "discoidals," and beaked gravers; this assemblage marks an Early Clarks Flat subphase (Peak and Crew 1990:227). A Late Clarks Flat subphase (post ca. 4800 B.C.) is distinguished by the addition of scraper-gravers, five more types of scrapers, and four varieties of Western Stemmed Series points as well as by increases in artifact density (Peak and Crew 1990:228). These findings suggest

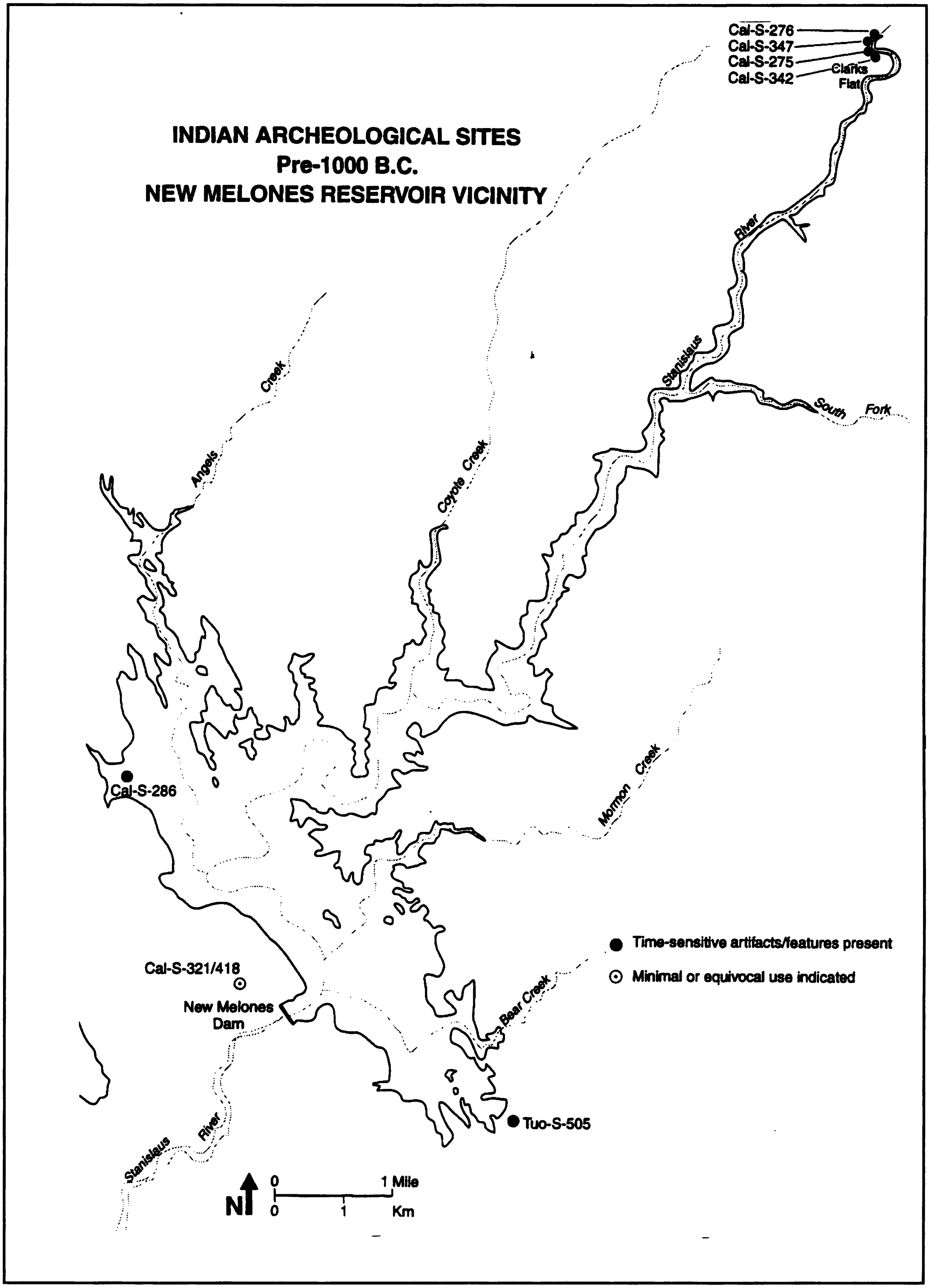

Figure 2: Map of New Melones Reservoir Vicinity Indian Archaeological Sites, Pre-1000 B.C.

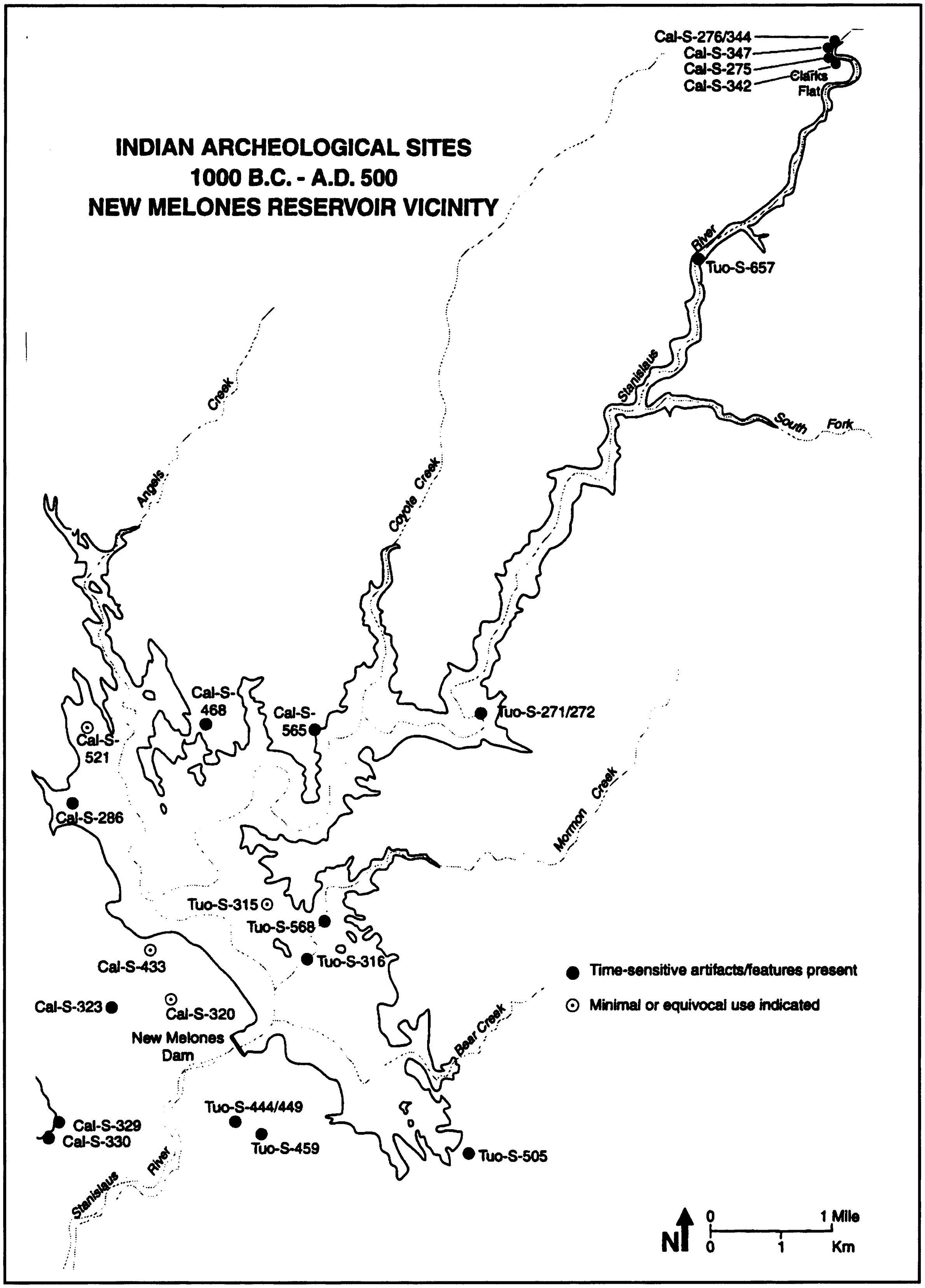

Figure 3: Map of New Melones Reservoir Vicinity Indian Archaeological Sites, 1000 B.C. to A.D. 500.

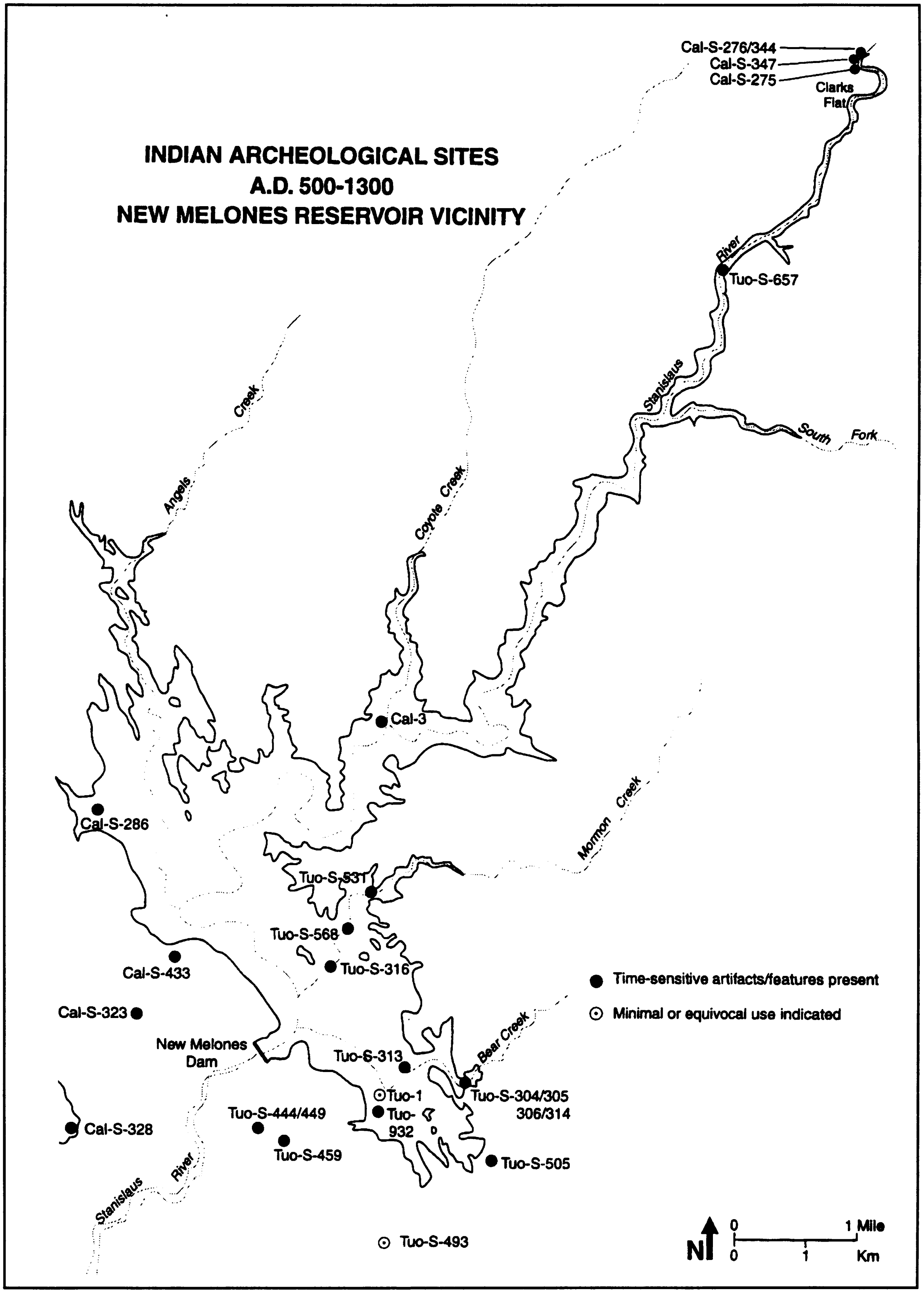

Figure 4: Map of New Melones Reservoir Vicinity Indian Archaeological Sites, A.D. 500 to 1300.

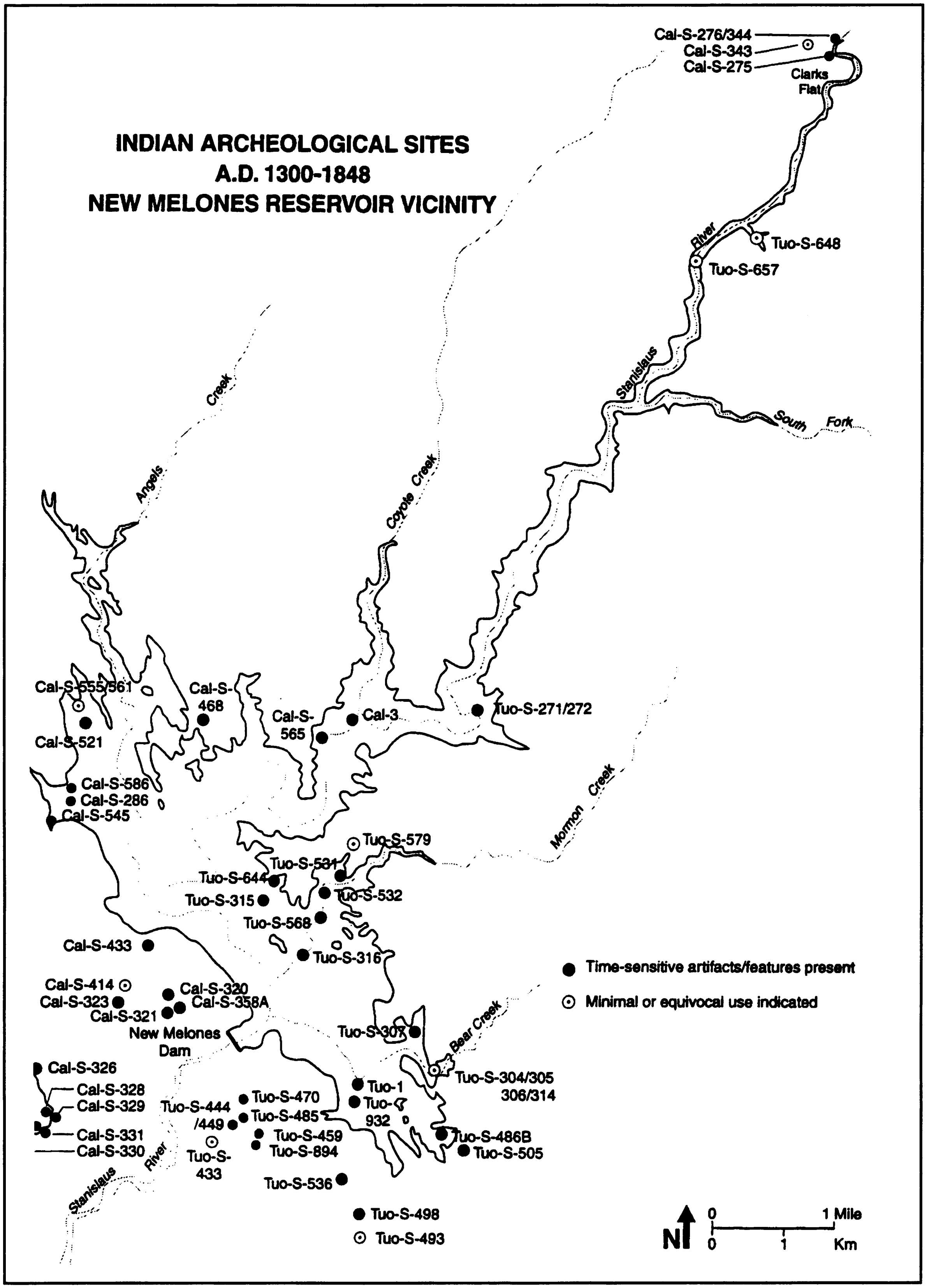

Figure 5: Map of New Melones Reservoir Vicinity Indian Archaeological Sites, A.D. 1300 to 1848.

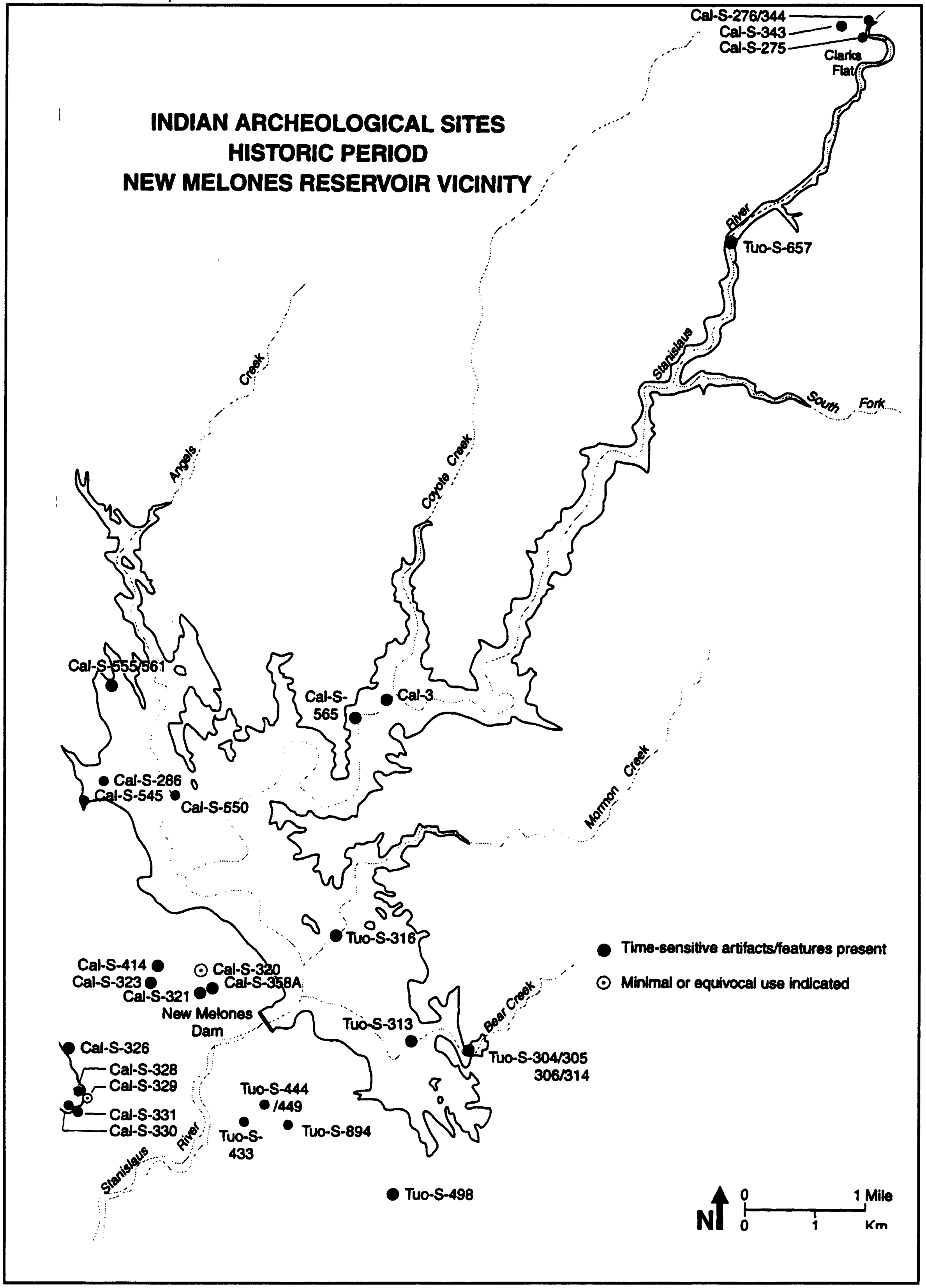

Figure 6: Map of New Melones Reservoir Vicinity Indian Archaeological Sites, Historic Period.

Temporal and Formal Units in NMAP Culture History

Periods	Time Markers*	Cultural Units	Comments
		CENTRAL SIERRA MIWOK	
1910	Glass beads; DSN, CT points.	PEORIA BASIN PHASE	Historic Miwok; village community pattern; acculturation; depopulation.
1848 – DESERT – 1500	SS, CT, DSN, GB projectile points; *Olivella* E, K, M beads.	HORSESHOE BEND PHASE	Large populations; intensive occupation; acorn-based economy; year-round settlements; 54 sites.
ROSE-GATE – 1000 – 500	Rosegate series projectile points; *Olivella* D, K, M beads.	Other Phases? REDBUD PHASE	Ephemeral site use; small populations; minimal trade. Of 21 sites, only 3 have anthrosols.
ELKO – A.D. 0 B.C. 500	Bowl mortar; cylindrical pestle; SCB, SSN, Elko series points; *Olivella* F, G series beads.	SIERRA PHASE	Large populations; intensive occupation; houses, middens, cemeteries; extensive trade; 24 sites are known. Economic diversity; acorn use. Use of mortuary caves; abundant funerary artifacts
1000 – 1500 – 2000 – 2500 – 3000 (PINTO/HUMBOLDT)	Pinto and Humboldt series projectile points; milling stones. Large Lanceolate Bifaces.	Other Phases? CALAVERAS PHASE ? TEXAS CHARLEY PHASE	Poorly known; traces of minimal, temporary habitation at 9 sites. --HIATUS?-- Distinctive scrapers and Large Lanceolate Bifaces.
3500 – 4000	Pinto and Humboldt series projectile points.	Undesignated Components	Increasing artifact densities and assemblage diversity in the Late Clarks Flat through Stanislaus Phase sequence at 04-Cal-S-342 reflect diversification of economic pursuits (notably expanding use of vegetal resources) and occupational intensification. Elsewhere i the project area, poorly known assemblages marked by Pinto and Humboldt points seem unrelated to the Clarks Flat-Stanislaus continuum.
4000 – 4500	Late Clarks Flat types continue, but with the addition of Stanislaus Broad Stemmed points and abundant milling tools.	"STANISLAUS PHASE" (Peak and Crew 1990)	
5000 – 5500 (STEMMED SERIES)	Early Clarks Flat types continue, but with the addition of milling slabs, manos, many types of scrapers, and Western Stemmed Series Points.	LATE CLARKS FLAT SUBPHASE (Peak and Crew 1990)	
6000 – 6500 – 7000 – 7500	Bipointed, foliate, and stemmed points; scrapers; notched tools; beaked gravers. Great Basin Transverse points may be ascribed to this or possibly an earlier, undesignated phase.	EARLY CLARKS FLAT SUBPHASE (Peak and Crew 1990)	Several sites, most notably 04-Cal-S-34 functioned as hunting camps as early as 7650 B.C. Low assemblage diversity and artifact densities suggest limited, temporary use of sites.
8000	?	?	?

Figure 7: Table of Temporal and Formal Units in NMAP Culture History.

intensive use of the Clarks Flat vicinity: "Hunting and Game Processing was still the economic emphasis, although the presence of milling stone bases and unshaped manos suggests the addition of vegetal food" (Peak and Crew 1990: 228).

6000-3500 B.C.

Cultural materials older than 5500 years have been recognized at 04-Cal-S-276/344, 04-Cal-S-342, and possibly at 04-Cal-S-347—all on Clarks Flat (Figure 2). The case for cultural activity at 04-Cal-S-347 prior to 3500 B.C. is tenuous; the few biface fragments and pieces of debitage from Stratum D (ca. 6000-4000 B.C.) may be coeval with the deposition of that stratum by the Stanislaus River, or possibly the artifacts were intruded from overlying anthrosols (O'Brien 1984:152). Another site, 04-Cal-S-286 on Texas Charley Gulch in the Angels Creek drainage (Figure 2), also might have been occupied prior to 3500 B.C. Evidence of cultural activity soon after this date, however, is more definitive (see 3500-1000 B.C., below).

The 6000-3500 B.C. period is better represented by Zone 4 at 04-Cal-S-276/344 (Figure 2), characterized by: a paucity of groundstone items (Riley and Moratto 1986); few bifaces but many backed scrapers, scraper-planes, backed bladelets, choppers, and hammerstones; a lower density of tools and debitage than in any other zone at the site; and an emphasis on chert as the primary toolstone. Obsidian tools are present but account for only 45% of the Zone 4 flaked stone assemblage (Singleton 1986a). The low density and remarkable variety of artifacts at 04-Cal-S-276/344 indicate a wide range of activities—hunting, flaked stone tool production, scraping, pulping, and limited milling—but probably not intensive occupation. In fact, the Zone-4 ensemble may reflect brief visits by diverse groups at various times over a span of centuries. Multiple components may be documented, albeit sparsely, in this zone. The evident degree of mixing and the absence of clearly definable components within Zone 4 preclude definition of represented phases.

The best-known archaeological record of the 6000-3500 B.C. interval in the study area is from 04-Cal-S-342, where Peak and Crew (1990) recovered ample evidence of early (ca. 7650-4800 B.C.) and late (ca. 4800-? B.C.) expressions of the Clarks Flat Phase (*supra*). Peak and Crew (1990:229-230) also defined a <u>Stanislaus Phase</u> (ca.? 4250 B.C.), characterized by the addition of Stanislaus Broad-stemmed projectile points and a marked increase in the use of ground stone tools, "to constitute the dominant tool category by the end of the phase" (Peak and Crew 1990:229). One may question the definition of a separate Stanislaus Phase, given its shared sedimentary context ("Spit B") with the Late Clarks Flat materials, the unclear temporal distinction between Late Clarks Flat and Stanislaus assemblages, and given that "during the Stanislaus Phase, the entire tool inventory of the preceding Clark Phase (sic) was retained and the newer tools appeared as an overlay on the older assemblage" (Peak and Crew 1990:229). Nonetheless, the diachronic changes in relative frequencies of various kinds of implements would seem to evince an adaptive shift:

> The steadily increasing numbers of ground stone tools with a corresponding diversity in types may reflect a change in the botanical resources of the locale. Hunting persisted as an economic pursuit.... In short, although direct evidence is lacking, the changes observed in the artifact record may well indicate an environmental shift with a corresponding change in the interactive responses of the residents (Peak and Crew 1990:279).

Except for these findings at 04-Cal-S-342, the 6000-3500 B.C. period remains poorly known archaeologically. Occupation is registered by mixed assemblages reflecting brief visits by diverse, small groups. Hunting, flaked-stone tool production and maintenance, and milling with manos and mealing slabs are inferred, but elucidation of occupational intensity must await further study. The paucity of information for this and earlier periods, however, should not be interpreted as evidence of either small populations or limited site use in the project area. Paleoenvironmental surveys have not been undertaken to inventory the relict landforms and paleosols most likely to harbor early and middle Holocene archeological remains. All of the known cultural materials of such antiquity in the study area were discovered fortuitously (i.e., they occurred below younger, more visible archeological deposits). The apparent number and distribution of early components thus are more the products of coincidence than of systematic research, and they might not accurately represent the patterns of prehistoric land use.

3500-1000 B.C.

Archeological deposits at 04-Cal-S-275, -276/344, -286, -347, and 04-Tuo-S-271/272 and -505 (Figure 2) have produced cultural materials ascribable to this period. Pinto and Humboldt series points from these sites (see Moratto et al. 1988) are thought to register times before ca. 1000 B.C. and possibly as early as 5000 B.C. (Hester 1973; Singleton 1984a, 1986a; Warren 1984:410-414). Minimal archeological data from the 3500-1000 B.C. period was obtained at 04-Tuo-S-505 and 04-Cal-S-347 (Figure 2). At 04-Tuo-S-505, east of upper Long Gulch, SAI recovered a Humboldt Concave Base point, a core, a stepped biface, a drill, and debitage at depths below 100 cm in sub-midden gravelly clay; no millingstones were found below 90 cm at 04-Tuo-S-505, despite their abundance in the overlying midden deposits. Unfortunately, the excavated sample at this site is very small (5.1 m^3), and the nature of the sub-midden component is not well understood. Similarly, the small assemblage from Stratum E (ca. 5320-2600 B.C.) at 04-Cal-S-347 is poorly defined. Included are manos, scrapers, retouched pieces, bifaces, choppers, and a hammerstone fragment. Among the bifaces are a contracting-stem point fragment and two Large Lanceolate Bifaces comparable to specimens from the middle-Holocene yellow clay deposits at 04-Cal-S-286 (O'Brien 1984; Singleton 1984a). Similar assemblages might be discovered at 04-Tuo-S-313, -531, and -567, if ever their known sub-midden deposits are excavated.

Occupation at ca. 3500 B.C., or possibly earlier, is clearly evidenced at the Texas Charley Gulch site, 04-Cal-S-286 (Figure 2). The oldest recognized archeological component at this site occurs in sub-midden, alluvial over bank sediments and in old residual soils (Haltenhoff 1984). These deposits exhibit no charcoal, little if any bone or shell, almost no detectable phosphates, approximately neutral pH, and minimal (11.6-19.3 kg/m^3) fire-altered rock, much of which may be intrusive. In short, the matrix is developed only weakly, or not at all, as an anthrosol. Best known from Strata D and E of the Eastern zone but also from Stratum D of the Central zone and Stratum C in the Western zone (Moratto and Arguelles 1984: Figure 1.2.4), the occupation is recognized by:

> a percussion-flaked tool industry (pressure flaking is not represented); distinctive backed scrapers and Large Lanceolate Bifaces of chert..., cores, choppers, and scraper-planes; and abundant debitage (more than 7450 pieces in the Eastern zone sample alone), of which chert represents a much higher frequency (398.5m^3) than do obsidian (84.2/m^3) and other lithic materials (161.2/m^3). The selection, heat pretreatment, and skillful percussion- flaking of exotic cherts reflect systems of lithic procurement and technology not replicated in later components. Finally, the Texas Charley component has produced several pestle-like implements, a pecked but apparently unfinished "charmstone," and several other groundstone artifacts; the association of manos with this component remains equivocal (Moratto et al. 1984:102-103).

These materials from the sub-midden clays at 04-Cal-S-286 comprise the type component of the *Texas Charley Phase* (Figure 7). The entailed specimens show that the production of chert and greenstone tools was an important activity in Texas Charley Gulch some 5500 years ago. The lack of anthrosols, coupled with the absence of recognized features and low density of artifacts other than debitage, suggests that occupation was not intensive. Unfortunately, nothing is known about the subsistence economy, land-use patterns, shelters, mortuary practices, or ethnic identity of the people who left the Texas Charley Phase component. Nor does this component seem to have known antecedents or successors at the type-site. The phase, however, is well represented at the Skyrocket site near Copperopolis (J. Pryor, personal communication 1995).

At 04-Cal-S-286 erosion seems to have removed any deposits representing the 3500-2500 B.C. period. Whether the site was inhabited at any time during this interval is unknown. Occupation after ca. 2500 B.C. is evidenced by a few square and rectangular manos, millingslabs, and Pinto Sloping Shoulder and Sierra Side-notched points in the lower levels of Stratum B in the Western and Eastern zones (Moratto and Arguelles 1984). This component does not appear to be extensive at the site, implying minimal cultural activity there between ca. 2500 and 1000 B.C.

Aside from the assumed general contemporaneity of the Pinto-series points, none of the assemblages assigned to the 3500-1000 B.C. period is necessarily coeval with any other. Indeed, the variety of bifaces (Humboldt Concave Base, Pinto Sloping Shoulder, Pinto Square Shoulder, and Large Lanceolate) and variable occurrences of millingstones may signal cultural diversity as well as temporal separation. Certainly, the lithic technology expressed in the Texas Charley Phase component at 04-Cal-S-286 is very different than the technology evinced by the Humboldt/Pinto assemblages. The latter thus seem to represent a distinct occupation, or occupations, to which the name Calaveras Phase is applied provisionally. Otherwise, current data provide little information about the economy and land-use strategies of the evidently small, mobile groups who inhabited several sites in the NMAP locality at various times between ca. 3500 and 1000 B.C.

1000 B.C. - A.D. 500

This is the first period for which available evidence shows widespread, relatively intensive occupation of the study area. Archeological materials at 24 sites (Figure 3) are attributed, with varying levels of confidence, to this interval. Additional components may remain undetected; some sites may have been lost to erosion or buried by sediments; others likely were destroyed by placer mining during the Gold Rush; and yet other sites, particularly those along the Stanislaus River below Coyote Creek, may have been inundated by old Melones Reservoir. Consequently, the known components must be viewed as a very incomplete record of land use and settlement during the 1000 B.C.-A.D. 500 time span.

Sites 04-Cal-S-320, -323, -329, -433, -468, -521, -565, and 04-Tuo-S-271/272, -315, -459, and -568 have produced only minimal or equivocal evidence of cultural activity during this period. The collections from each of these sites include from one to several time markers, notably bifaces of the Elko Eared, Elko Corner-notched, Sierra Concave Base, and Eared Concave Base types; *Olivella* G series beads; and *Haliotis* H3c2 beads. Anthrosols or archaeological features (implying longterm or intensive occupation) definitely related to the 1000 B.C.-A.D. 500 interval have not been detected at these sites.

The record is more substantial at 12 sites: 04-Cal-S-275, -276/344, -286, -330, -342, -347, and 04-Tuo-S-316, -444/449, -505, and -657 (Figure 3). Pre-A.D. 500 occupations at these sites are marked by brown midden soils (often stratigraphically below darker-colored, later prehistoric midden deposits); buried, earthen housefloors; numerous millingslabs and manos; infrequent cobble mortars and shaped pestles; conical pipes; *Haliotis* H2 and H3 beads; *Olivella* C and G series beads; atlatl weights; medium-to-large bifaces of Elko Eared, Elko Corner-notched, Sierra Concave Base, Triangular Contracting Stem, Medium Triangular Contracting Stem, Medium Corner-notched, Bipoint, and Sierra Side-notched types; abundant debitage, of which obsidian is the predominant material; and flexed burials, often under stone cairns and sometimes furnished with *Olivella* and/or *Haliotis* ornaments. These traits characterize the Sierra Phase (Figure 7).

The well-developed midden deposits at these sites attest to repeated or long-term habitation. Housefloors and burials likewise indicate that the sites were residential bases. Subsistence practices seem to have included hunting mostly deer, rabbits, and squirrels with atlatl and dart, and gathering vegetal foods, of which some were processed in mortars and on millingslabs. Although no acorns have been found among recovered plant macrofossils, the combination of mortars and pestles, ashy midden soil, and fire-altered rock makes a good circumstantial case for their use by the Sierra Phase people. While shell beads and ornaments, along with obsidian from the North Coast Ranges, signal trade relationships with peoples to the west, biface types and the large quantities of obsidian from Bodie Hills and Casa Diablo evince strong economic ties with groups to the east. In the aggregate, these findings attest to levels of economic activity, sedentism, and occupational intensity apparently not documented by earlier components in the study area. For example, Zone 3 at 04-Cal-S-276/344 contains the deepest cultural deposits, highest densities of debitage and both flaked and ground stone tools, highest proportion of obsidian among both tools and debitage, and greatest variety of artifact classes and types found at the site (Moratto and Singleton 1986:141-142). The Sierra Phase components at 04-Cal-S-275, -330, and 04-Tuo-S-316, -444/449, -505, and -657 (Moratto and Singleton 1986) are comparable.

Stratum B at 04-Cal-S-286 is consistent with the type component of the Sierra Phase. The extensive, deep midden deposits of Stratum B are dark, organic loams with neutral to basic pH, high phosphate levels, moderate quantities of faunal remains, and considerable amounts (26.8-124.0 kg/m^3) of fire-altered rock, showing that cooking with heated rocks was an important activity. Culturally, the Sierra Phase component is marked by *Haliotis* H3b Flat Disc beads; *Olivella* beads of the F2 Saddle, G1 Round Saucer, G2a Small Saucer, and G2b Large Saucer types; Elko Corner-notched, Medium Triangular Contracting Stem, Medium Corner-notched/removed, Medium Expanding Stem, and Sierra Concave Base points; stepped bifaces; various scrapers and other flaked stone tools (Riley 1984a, 1984b; Singleton 1984a: Tables 2.6.104, 2.6.110, 2.6.116); quartz and chrysotile crystals, manuports, and ochre; occasional pointed bone implements; manos, millingslabs, shaped and possibly unshaped pestles, and cobble, boulder, and slab mortars (but not bedrock mortars); and hammerstones. Lithic debitage is generally abundant (244-472 pieces/m^3), and obsidian achieves its highest density (88-144 pieces/m^3) in the Sierra Phase component.

Although artifactual cross-dating, reinforced by radiocarbon assays at 04-Cal-S-286 and 04-Cal-S-347 (Moratto et al. 1988: Table 5.1), would assign all of the components discussed in this section to the 1000 B.C.-A.D. 500 period, temporal control is poor at most of the sites and synchroneity of occupation cannot be assumed. Thus, settlement patterns in the sense of population distribution at a given point in time cannot be reconstructed on the basis of current information. Nonetheless, it is interesting that the known Sierra Phase midden sites in the foothill portion of the study area (namely, 04-Cal-S-286, -329/330, -468, possibly -565, and 04-Tuo-S-271/272, -316, -444/449 together with -459, and -505) are approximately equidistant at ~3 km from one another (Figure 3). Perhaps this distribution of sites reflects some proxemic reality, such as settlement spacing and the mutual circumscription of primary catchments, in prehistory. Given the nature and limited extent of excavations at most of these sites, however, the apparent pattern might as well be an artifact of sampling bias. In either case, additional data will be required to reconstruct Sierra Phase settlement patterns in the New Melones project area.

Aside from the habitation sites, numerous caves in the study area evidently were used as mortuary chambers during a time span beginning ca. 1000-500 B.C. and ending ca. A.D. 500-700 (McEachern 1968; Moratto 1984: 304-308). These funerary caverns contain secondary burials and, rarely, cremations together with stone pipes, bone daggers, large side-notched projectile points, fish vertebra beads, turtle bone artifacts, quartz crystals, basketry, *Haliotis* ornaments, and a profusion of *Olivella* beads (Beck 1970; Danehy 1951; Gonsalves 1955; McEachern 1968; McEachern and Grady 1977; Orr 1952; Payen 1964; Payen and Johnson 1965; Wallace 1951a, 1951b; Whitney 1867). In quantity and range of types, the artifact assemblages from the mortuary caves are different than those from the habitation sites. This may reflect differential preservation, formal distinctions between funerary and economic assemblages, or, possibly, the use of the mortuary caves by cultural groups other than those who lived and interred their dead at the nearby midden sites. On present evidence, it would seem most likely that the caves were used by local groups, and that the funerary offerings found in the caves elucidate a range of artifact forms and inferred sociotechnic behaviors not fully represented in the assemblages from open sites.

A.D. 500-1300

Unlike the relatively sedentary and intensive occupations of 1000 B.C.-A.D. 500, the subsequent period evidently witnessed sparse populations and limited site use by small, presumably mobile groups. Moreover, all of the known Sierra Phase sites (Figure 3) in the project area seem to have been abandoned, or inhabited only minimally, during the A.D. 500-1300 interval. The archeological record apparently indicates cultural discontinuity from the preceding phase. The cessation of cave burial at ca. A.D. 500-700 supports this reconstruction. A few time-sensitive artifacts typically one to several Rosegate series bifaces and/or *Olivella* B, D, K, or M series beads attest to minimal activity during this period at 21 sites: 04-Cal-3, 04-Cal-S-275, -276/344, -323, -328, -347, -433, and 04-Tuo-1, 04-Tuo-S-304/305/ 306/314, -316, -444/449, -459, -505, -531, -568, and -932 (Figure 4). One other site, 04-Tuo-S-493, produced a radiocarbon date of 910 ± 60 B.P.: A.D. 1040, but no diagnostic artifacts. Cultural deposits, features, or other indications of significant occupation during the A.D. 500-1300 time span have not been recognized at any of these 22 sites.

At three sites—04-Cal-S-286, 04-Tuo-S-313, and 04-Tuo-S-657—the known records of activity between ca. A.D. 500 and 1300 are more appreciable. The Redbud Phase type component at 04-Cal-S-286, for example, includes definite midden deposits with mammal bone, fragments of *M. margaritifera* shell, and moderate amounts of fire-altered rock. Found in this midden were two broad, shallow pits of unknown function and an apparent housefloor of compacted earth associated with ash and charcoal. At least two interments also seem related to this component (Moratto and Arguelles 1984:105-106). Faunal remains document the hunting of deer and small game as well as the collecting of freshwater mussels. Vegetal foods, perhaps including acorns, were gathered and processed in portable mortars and millingslabs.

Hallmarks of the Redbud Phase at 04-Cal-S-286 include: *Olivella* beads of B2 End-ground, C3 Split Oval Drilled, K2 Cupped, and M1a Plain Thin Rectangular types; projectile points of the "Rosegate" series (i.e., Rose Spring and Eastgate types [Thomas 1981]), and, late in the period, Gunther Barbed type; flaked stone scrapers and other lithic tools of various types (Singleton 1984a: Table 2.6.112); pestles of unshaped cobbles, cobble mortars, manos and millingslabs; and red ochre, together with quartz and chrysotile crystals. Like their predecessors, the Redbud Phase residents of 04-Cal-S-286 continued to acquire Bodie Hills obsidian. However, "the quantities of obsidian reaching the site or at least the obsidian densities in the midden were smaller than in earlier and later phases of prehistory. Indeed, the overall densities of all kinds of lithic debitage tend to be low ($245/m^3$) relative to those of the earlier...component or later protohistoric and historic components at the site" (Moratto and Arguelles 1984:106). Together, the comparatively low debitage frequencies, small quantities of fire-altered rock, and paucity of Rosegate artifacts and midden imply that the Redbud Phase occupation of 04-Cal-S-286 was spatially limited and of small scale.

The A.D. 500-1300 period is also documented at 04-Tuo-S-313 near Bear Creek (Figure 4) in strata for which temporal control is supplied only by three Rosegate-series bifaces, a single *Olivella* C1 bead, and hydration measurements of 5.7/7.1 and 4.1 microns, respectively, on pieces of Bodie Hills and Casa Diablo obsidian. Two charcoal samples from "random" test units, and not associated with any of the 30 features excavated at this site, provided modern radiocarbon dates (i.e., <300 B.P.) and thus contribute no useful information. The A.D. 500-1300 period at 04-Tuo-S-313 witnessed the procurement and reduction of local slate, manufacture and use of slate choppers and scraper-planes (function unknown), limited production of small tools of chert, hunting with the bow and arrow, food processing with millingslabs/manos and portable mortars/pestles, and cooking in steatite vessels (Moratto and Singleton 1986).

At 04-Tuo-S-657, in the Stanislaus River canyon (Figure 4), occupation is registered by a dark brown midden radiocarbon-dated between 850 ± 80 B.P.: A.D. 1225 and 415 ± 80: A.D. 1450. This component is marked by triangular arrow points and a profusion of mano fragments. Biface preforms and abundant debitage confirm that lithic reduction was a major activity at this site. Remarkably, obsidian pieces accounted for only about 24 percent of the otherwise silicate (mostly chalcedonic) debitage. Hunting is attested by numerous bones of deer, lagomorphs, and squirrels; fishing, too, is indicated. Given its canyon-bottom setting next to the river, 04-Tuo-S-657 perhaps served as summer hunting/gathering/fishing camp between A.D. 1200 and 1450 (Moratto and Singleton 1986).

Aside from the modest evidence of habitation at 04-Cal-S-286, 04-Tuo-S-313, and 04-Tuo-657, the archeology of the A.D. 500-1300 period is poorly known. Even the assignment of 04-Tuo-S-313 and -657 to the Redbud Phase is tenuous, given their peculiar assemblages. The fact that they share with the type component such traits as Rosegate points, abundant manos and millingslabs, and low frequencies of obsidian tend to justify their place in the Redbud Phase. The variability among the three components may reflect different environmental settings, site functions, and/or economic specializations. Nonetheless, the possibility of more than one phase cannot be discounted for the A.D. 500-1300 period. By every indication, the study area was sparsely populated and minimally used during much of this period. Older (Sierra Phase) villages were abandoned, their sites used occasionally for ephemeral camps and perhaps as sources of obsidian to be reworked. Cultural continuity from the Sierra Phase is not implied by the meager archeological remains of the subsequent Redbud and other phases.

A.D. 1300-1848

Late prehistoric occupation of the middle Stanislaus River locality was both extensive and intensive, especially as compared with that of the A.D. 500-1300 period. Fifty-four of the 68 sampled Indian sites in the project area can be assigned, definitely (43) or probably (11), to the A.D. 1300-1848 period (Figure 5; Moratto et al. 1988: Table 5.17); 42 of these sites feature middens, bedrock mortars, and other evidence of substantial, long-term and/or repeated, occupations as compared with only three such components recognized for the preceding period and 12 for the 1000 B.C.-A.D. 500 period. The overall impression derived from the sampled components is that late prehistoric times witnessed larger populations, more sedentism, tighter spatial clustering of settlements, and higher levels of both intra- and inter-site organization than in any earlier period.

Late prehistory in the NMAP area coincides with the *Horseshoe Bend Phase* (Figure 7), of which the type component is strongly registered in Stratum A at 04-Cal-S-286 (Figure 5). This stratum is a deep, very dark, ashy loam midden with weakly basic pH, high phosphate and total organic content, abundant charcoal and other plant macrofossils, numerous faunal remains, and high densities (mean=212 kg/m^3) of fire-altered rock. Horseshoe Bend Phase activities at 04-Cal-S-286 are further attested by numerous hearth, cairn, pit, and earthen-floor features, as well as cremations and burials (Moratto and Arguelles 1984: Goldberg 1984). Typical artifacts are *Olivella* El Thin Lipped beads; *Saxidomus* A1 and A2 disc beads; Desert Side-notched, Cottonwood Triangular, and Gunther Barbed points; inferred use of the bow and arrow; hammerstones, cores, choppers, and abundant flake tools of diverse types (Singleton 1984a); a steatite industry featuring disc beads, cooking vessels, ear ornaments, and other forms; manos, millingstones, unshaped (and possibly some shaped) pestles, and bedrock mortars; battered stones; and fairly high densities of debitage, ranging from 245 pieces/m^3 in the Western Zone to 500/m^3 in the Central Zone. The frequency of late prehistoric obsidian (120-165/m^3) is greater than that of the underlying Redbud Phase component (68/m^3) at this site (Moratto and Arguelles 1984).

Several clusters of Horseshoe Bend Phase components can be defined. Some of these such as the groups of sites at Clarks Flat (04-Cal-S-275, -276/344, and -343), Bowie Flat (04-Cal-S-326, -328, -329, -330, and -331) and on the southern flank of Bostick Mountain (04-Cal-S-320, -321, -323, and -358A) _ reflect the constraints of topography. Perhaps these components are absolutely contemporaneous and do reflect some measure of intersite organization, but the data are equivocal on this point. Other apparent clusters, such as 04-Cal-S-286 and -586 at Texas Charley Gulch and 04-Tuo-S-304/305/306/314 on Bear Creek, are in fact nothing more than nearly contiguous loci of single sites. Other settlement clusters, however, seem to include synchronous components reflecting intersite organization. The best example of this pattern is the cluster focused upon 04-Tuo-S-444/449 (Cooley-Reynolds 1980) near Peoria Mountain (Figure 5; Moratto et al. 1988: 299-314).

Considering the extent of midden, number of bedrock mortars, presence of a large structure (communal dance house?), number of smaller structures (dwellings?), abundance of sociotechnic artifacts, and evident cemetery, 04-Tuo-S-449 probably functioned in late prehistoric and early historic times as the center of a village community (cf. Merriam 1967:340). If this inference is valid, 04-Tuo-S-449 might have been the social and political center for a community of hamlets in the Peoria Basin-Peoria Mountain vicinity. In terms of propinquity and contemporaneity, this community might have encompassed 04-Tuo-S-444, -449, -470, -485, -433, -459, and -894 (Figures 5, 6). Village communities probably also were centered at 04-Cal-S-565 and 04-Tuo-S-271/272, and possibly near the confluences of Angels and Bear creeks with the Stanislaus River (both inundated by old Melones Reservoir); unfortunately, these impressions cannot be verified with available data. By A.D. 1848, however, named villages existed at Horseshoe Bend (*Tipotoya* [04-Tuo-S-271/272?]), Robinsons Ferry/Melones (*Wüyü* [04-Cal-S-565 and 04-Cal-3?]), on Mormon Creek (*Pokto-no*), and on Bear Creek (*Suchumumu* [04-Tuo-1? or 04-Tuo-S-304/305/ 306/ 314?]) (cf. Kroeber 1925). Some or all of these centers might have emerged from late prehistoric antecedents.

The strong similarities between Horseshoe Bend Phase assemblages and the ethnographic material culture of the Central Sierra Miwok (cf. Barrett and Gifford 1933), together with models of California linguistic prehistory (see Moratto 1984: Chapter 11), indicate that the post-A.D. 1300 occupants of the project area were, predominantly, the ancestors of the Central Sierra Miwok. Cultural discontinuities between Redbud and Horseshoe Bend Phase components imply that the ancestral Miwok did not come to occupy the study area until ca. A.D. 1300. Subsequently, their population spread seems to have been rapid and by ca. A.D. 1500-1600, complete. While it would be nice to know the ethnolinguistic identity of the people(s) supplanted by the Miwok, it would be even more interesting to learn about the mechanisms of replacement. The archeological record is taciturn on both counts, although, as discussed above, a significant factor might have been the minimal occupation of the middle Stanislaus River locality prior to ca. A.D. 1300. In turn, both the limited Redbud Phase activity and the intensive late-prehistoric (Miwok) occupation may reflect paleoenvironmental conditions and changes (see Moratto et al. 1988: 39-86, 535-541).

The subsistence economy of the Horseshoe Bend Phase involved hunting, fishing, collecting, and gathering, doubtless supplemented by trade (*supra*). Faunal remains show that deer, rabbits, squirrels, and various birds were hunted regularly; other animals among them, black bear, coyote, tule elk, antelope, and turtles also were taken, at least occasionally. While the bow and arrow served as the principal weapon, one may assume (based upon ethnographic information [Barrett and Gifford 1933]) that various traps, snares, deadfalls, nets, and other devices also were employed. The technology for processing vegetal foods changed significantly from that of earlier periods. Millingslabs and manos evidently were used less frequently than before, and portable mortars were replaced almost entirely by bedrock mortars (BRMs). While not conclusive, the absence of BRMs in Redbud Phase components and their ubiquitous correlation with Horseshoe Bend Phase occupations imply that bedrock milling technology spread within the project area sometime after ca. A.D. 1300. It is probably significant, too, that the proliferation of fire-altered, clastic rocks in midden deposits largely coincided with the advent of BRMs. Both are thought to reflect an emphasis on acorns as a staple food, the mortars of course being used as mills and the rocks attesting to stone-boiling. The increased reliance on acorns an abundant, nutritious, and storable food resource would have facilitated year-round occupation and allowed for population expansion.

Trade was also an important aspect of the late prehistoric economy. *Olivella* E1a, E1b, and H1a beads, *Saxidomus* and *Tresus* disc beads, and *Haliotis* ornaments came ultimately from coastal groups, probably through the intermediacy of Valley peoples. Stockton Serrated points, while infrequent in the project area, also signal contacts with the west _ an inference sustained not only by typologic similarities with points in the Stockton locality, but also by the distribution of these points at sites (04-Tuo-S-307, 04-Tuo-932, and 04-Cal-S-328) in the western part of the NMAP area, and by the fact that at least one of the four recovered Stockton Serrated points is made of Napa Glass Mountain obsidian. Obsidian, chiefly from the Bodie Hills source, was acquired through trade with higher Sierran and/or Great Basin peoples. Debitage from the post-A.D. 1300 components at New Melones typically includes a larger proportion of obsidian than is found in Redbud Phase debitage but less than in the Sierra Phase components. The widespread occurrence of Desert Side-notched and Cottonwood Triangular points throughout late prehistory further attests to sustained influences from the Great Basin. Nonetheless, the dominant cultural ties during this period were with the central California area, as indicated by the acorn-based economy, settlement pattern, degree of sedentism, community organization, complex of sociotechnic artifacts, and participation in religious cults. By A.D. 1848, the peoples of the middle Stanislaus River locality had become well integrated into the economic, social, and religious systems of central California.

A.D. 1848-1910

The ethnohistory and historical archeology of this period are reviewed elsewhere in considerable detail (Goldberg et al. 1986; Greenwood 1982; Greenwood and Shoup 1983; Hall 1978; Jackson 1976; Theodoratus 1976; Tordoff 1988a, 1988b; Van Bueren 1983). Essentially, this was the time of the Gold Rush and its aftermath, when Miwok culture and society were devastated. The early years of this period were characterized by environmental destruction, intercultural violence, decimation of Native populations, the incursion of non-local Indians, forced abandonment of traditional villages and short-term occupation of new sites that would have been judged marginal or unsuitable by earlier settlement criteria. The historic period further witnessed the demise of Miwok social and political institutions; collapse of obsidian trade;

adoption of Euro-American clothing, tools, weapons, musical instruments, and ornaments—all of which are attested archeologically; significant dietary changes; and even a change in mortuary practices, from a preference for cremation to a general pattern of coffin burial. By the end of this period, following more than 100 centuries of adaptation to the local environments, Indian populations ceased to live in the New Melones project area.

Archeologically, these profound changes are reflected in Peoria Basin Phase components, most of which trace ephemeral occupation or use, at 33 sites (Figure 6; Moratto et al. 1988: Tables 5.16, 5.17; Moratto and Singleton 1986; Van Bueren 1983). The Peoria Basin type component at 04-Cal-S-286 exhibits flaked glass tools (e.g., Desert Side-notched and Cottonwood Triangular points and scrapers) of traditional form; *Saxidomus* disc, and *Olivella* series H Ground and Rough Disc beads; glass beads of many types; cobble pestles and bedrock mortars; coiled baskets of varied forms; textile fragments, buttons, buckles, and shoe parts; rings, brooches, and other jewelry of metal and glass; metal tableware; steel knives, shovels, and picks; iron nails; pane, bottle, and lamp-chimney glass; stoneware, porcelain, and other ceramics; and parts of musical instruments (Furnis 1984; Isaacs 1984; Van Bueren 1983). This component also features both cremations and burials, together with the persistence of ceremonial structures (Moratto and Arguelles 1984).

In brief, the Peoria Basin Phase documents sweeping cultural changes from Gold Rush times until the early twentieth century. During this period, traditional economic patterns, domestic architecture, clothing, and most technology rapidly gave way to those of the dominant culture, while aspects of social organization, ceremonial architecture, ritual, and many native foods—together with their processing technology—were retained by the historic Miwok.

The middle Stanislaus River country, transecting perhaps the richest segment of the Mother Lode belt, was at the very heart of the Gold Rush. Beginning in 1848, waves of foreigners: Anglo-Americans, Italians, Chinese, Mexicans, Chileans, as well as Californios swept into the southern mines to seek their fortunes. The resulting population growth was phenomenal: "At the eve of the Gold Rush [California's] population [excluding Indians] had grown to about twenty-six thousand. By mid-summer of 1849 it reached fifty thousand, and by the year's end it was probably near 115,000. By 1860 the number had more than tripled to 380,000" (MacKinnon 1967:3-4). The early miners created a dependent economy (see Shoup 1988), and an ephemeral one at that. By 1860, having exhausted the easily-worked placers, most of the '49ers had left the Stanislaus. In their wake remained countless abandoned camps and prospects, and vast areas of despoiled land.

But not all of the Argonauts pulled up stakes. Some stayed on, making their living by ranching, hard-rock mining, or commercial enterprises in the foothill towns. Between the 1860s and 1890s, gold mining declined and agriculture emerged as dominate in the local economy. Thereafter, the economic base was broadened to include: corporate industrial mining; logging, aided by the Sierra Railroad; and hydroelectric developments, notably the Camp Nine Powerhouse and old Melones Dam. These varied activities, ranging from the placer mining of Gold Rush days to twentieth-century hydroelectric projects, are recorded by at least 442 historic archeological sites in the NMAP area (Tordoff 1988a). Grouped by function, these sites related to mining, agriculture, residential activities, water systems, transportation, stone ovens, miscellaneous functions, and various combinations of these. Together, these sites represent the (undesignated) historic phases of the New Melones cultural sequence.

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THE STATUS OF SAN JOAQUIN VALLEY ARCHAEOLOGY

Francis A. Riddell

The San Joaquin Valley consists of the southern half of the great Central Valley of California. The northern half of the basin, the Sacramento Valley, is drained by the Sacramento River and its tributaries, the southern half by the San Joaquin River and its tributaries. These two rivers flow toward one another and join in the Sacramento-San Joaquin delta to find a common outlet to the ocean through the Golden Gate on San Francisco Bay.

The San Joaquin River rises at the crest of the Sierra Nevada northeast of Fresno, flows down the western slope until it reaches the main valley, and then turns northwesterly down the trough of the lower San Joaquin Valley. Several main tributaries enter the valley from the Sierra and include the Fresno, Chowchilla, Merced, Tuolumne, and the Stanislaus rivers. The Calaveras, Mokelumne and Cosumnes rivers enter the Sacramento-San Joaquin delta directly. There are no important streams, at least ones that consistently carry a significant annual volume of water, entering the lower San Joaquin valley from the west.

> The upper or southern portion of the San Joaquin Valley, south of the San Joaquin River, has no surface water outlet, [the] Kings River, which carries eroded material from the Sierra Nevada, —built up a low broad ridge across the trough of the valley. Under natural conditions there was a lake above, or south, of this barrier ridge, maintained by inflow from [the] Kings, Kaweah, Tule, and Kern Rivers. Prior to the extensive irrigation development of the area, this lake, known as Tulare Lake, flowed over the confining ridge into [the] San Joaquin River at intervals, but the last such spill occurred in 1878 [USDI 1949:83].

The foregoing broadly delimits the San Joaquin Valley by reference to the watercourses found there. It can be further delimited by reference to elevation, for as soon as the foothills are reached on the three borders of the valley one is removed into another geographic and ecologic environment. The climate of the San Joaquin Valley is classed as Mediterranean, that is, with its greatest precipitation during the winter. The summers are hot and dry, and the west side of the valley suffers from a rain shadow effect limiting stream flow generally to an intermittent nature.

The valley floor proper is characterized by oak parklands, vast areas of tules, and sycamore groves interspersed with cottonwoods and willows. The arid west side, except for stream courses, consists of grasslands until oaks and buckeyes take over at the higher elevations.

The Indians occupying the San Joaquin Valley at contact were the diversified groups of the Yokuts. They held the entire valley except for a portion of the lower, or northern end. This region, including a portion of the delta area of the San Joaquin and Sacramento Rivers, was occupied by the Miwok. Occupation of the San Joaquin Valley in aboriginal times was dense with some villages numbering their inhabitants in the hundreds.

Mission recruitment and disease made heavy inroads on the native population, and what they did not do the American occupation did. The decimation of the native population in portions of the San Joaquin Valley was so complete and done so early that many groups, especially on the west side, are almost totally unrecorded ethnographically.

As a result of heavy population in the valley archaeological sites are, or were, numerous. Hewes (1941:125) notes, "The densest populations clustered in tule marsh areas and in areas where oaks abound."

The following (Table 1) is a site distributions listing by county of the approximate number of sites recorded for the San Joaquin Valley (personal communication, William Seidel, State Office of Historic Preservation, Sacramento, 12/14/94; Southern San Joaquin Valley Information Center, Bakersfield, 12/14/94; Central California Information Center, Turlock, 12/20/94):

Table 1

County	OHP	Center	Sites below 500' (OHP)
Fresno	2480	2933	111
Kern	2984	4161	170
Kings	55	65	43
Madera	1833	2114	134
Merced	303	343	166
San Joaquin	210	258	163
Stanislaus	248	386	187
Tulare	1544	2094	33
Total	9657	12354	1007

These raw numbers, however, say nothing about the condition, size, age, cultural affinity, or likelihood of preservation of these sites. In 1965, I asked a local collector who had intimate knowledge of all archaeological sites in the Tulare Lake - Porterville area of the valley what percentage of sites have been destroyed. His answer was 90 percent! (Witt, personal communication 1985). One can assume with reasonable certainty that this includes most of the large, significant and important village sites.

Agriculture in the San Joaquin Valley has been the leading factor in the destruction of archaeological sites. One large landowner, several decades ago, had a crew engaged in land leveling operations around the clock for at least five years. An uncounted number of major sites were destroyed, with their loss noted only by a private collector who kept a schedule of the approach of the heavy equipment toward a doomed site (Roehr, personal communication 19__?). This is not an isolated report but constitutes a portion of a dominant pattern for the loss to farming of archaeological sites in the San Joaquin Valley.

Should we, as archaeologists, be concerned with this loss of a non-renewable resource? Is it possible that we have about all the data we need to reconstruct the culture history, socioeconomic, religious, and other aspects of prehistoric native life in the San Joaquin Valley? Are the losses here any greater than for the rest of California? Possibly a review of the published literature will assist in answering some of these, and other, questions on the current status of archaeology in the San Joaquin Valley.

One of the most recent and encompassing efforts made to cover the written record of archaeological work in the San Joaquin Valley (as well as for all of California) has been made by Moratto (1984) some ten years ago. Since that time, however, a great deal of contract archaeology has taken place with countless numbers of reports prepared by the archaeologists for their clients, but not published. These reports are normally collected and filed with the Information Center, which has dominion over each of the respective projects. This does not, however, necessarily include reports prepared for Federal and other public agencies. Combined, these unpublished and uncounted reports number into the hundreds. For this reason it is not easy to get a firm idea of just what is known of the prehistory of the subject region of the state, or for that matter, for any portion of the state.

Let's take a look at the published literature and see what sort of coverage we have for this region of California. One of the more significant archaeological reports was done for sites at Buena Vista Lake located at the upper (southern) end of the valley. This is the classic work by Waldo Wedel (1941) and involves fieldwork done by Works Project Administration crews during the Great Depression of the 1930's. Wedel's Buena Vista Lake data was augmented later by work done by Fredrickson and Grossman (1977), and by Hartzell (1992) in her unpublished dissertation. Earlier a survey was made by Gifford and Schenck (1926), which was extensive and particularly illuminating in view of the fact that little or nothing was previously known regarding the prehistory of the region. Gordon Hewes' (1941) survey in 1939 is of major importance as a survey, but encompassed no comprehensive site work or compilation of archaeological data. His short report on the ancient site at Tranquillity (1946) is tantalizing in its briefness. Walker's (1947) work in a Yokuts cemetery at Buena Vista Lake is, in published form, quite limited with respect to usable data. My report on Ker-74 (1951) gleaned from private collections made at destroyed site gives another tantalizing glimpse of what was being lost to agricultural development. Paleo-Indian evidence at Tulare Lake was illuminated by Riddell and Olsen (1969). Moratto (1984) lists reports on work done at protohistoric and historic cemeteries in the southern San Joaquin Valley; the list includes Anonymous (1938); Estep (1933); Latta (1977); von Werlhof (in Schiffman and Garfinkel 1981). Warren and McKusick (1959) investigated prehistoric burials.

In the northern San Joaquin Valley Moratto (1984) notes the archaeological work done by McAlexander and Upson (1969); McGeein (1950); Mohr (1948); Nissley (1975); Olsen and Payen (1968, 1969); Pritchard (1967, 1970); Riddell and Olsen (1965); Treganza (1960); and Wildesen (1969).

With respect to the archaeology of the northern San Joaquin Valley is Napton's *Seven Counties: An Archaeological Overview of Alpine, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne Counties, California* (1981). This very useful and important work was done under contract with the State Office of Historic Preservation. Although it was prepared before Moratto's opus (1984) it was not cited because of time lags in the preparation of both projects overlapped to such a degree that apparently it was not feasible to do so. The single most significant drawback to Napton's work is that at this time it is about 15 years out of date. This is not a reflection on the author, but it is an appeal to the State Office of Historic Preservation to find the funds to update this and similar efforts, and get them out in published form. I say this with the full realization that funding for such efforts are not readily available, but as funds can be found an updating of these regional overviews is, to my way of thinking, of the highest priority.

In his introduction, Napton makes the following statement, which rather succinctly typifies the status of archaeological research in both the northern and southern portions of the San Joaquin Valley:

> This endeavor opened a Pandora's box of unwritten, unpublished, or unknown site investigations—sites that someone tested on a forgotten Saturday many springs ago, reports that were to be written during some distant winter which came and went to wherever old winters and good intentions go to die, this dig or that test which was going to be written up "one of these days"—or have we heard that one before? At any rate, a great deal of what has been accomplished in Central California archeology has yet to be written. It is true that many sites have been destroyed, but it is also true that a very considerable amount of work has been completed, but has never been written or published. Particularly vexing, of course, is the Xeroxed manuscript or thesis, a few copies of which seem to be "around" somewhere but are difficult to acquire. And when a project report or thesis is available it may contain descriptions of excavations or tests of numerous sites, and to achieve a reasonable job of review we should extract the information and present it in a standard, organized format. Time, the enemy of all human endeavor, precludes doing anything like a comprehensive job for the first edition, or approximation, of the seven-county over-view (Napton 1981:2).

Napton's effort, of course, covers an area beyond the valley floor as it also addresses the Sierran portion of each county as applicable.

In 1965, I presented a paper titled "Urgent Problems in San Joaquin Valley Archeology" to the Kroeber Anthropological Society annual meeting in Berkeley. This present effort is designed to see if any of the urgent problems facing the archaeology of the San Joaquin Valley have been met (Riddell 1965). In my paper I warn of the great loss to the archaeological database through agricultural and urban development, and by all those land-modifying activities associated. I state that

> One of the most urgent problems facing the archeology of the San Joaquin Valley is one, which is basic. It is concerned with the necessity for a series of surveys of the order made by Hewes twenty-five years ago. Such work is imperative and must be of a detailed nature to discover what has been lost, as well as what remains. Excavation, however, should not be held up for such a definitive survey but should be carried out as soon as possible in order to get useful samples from those sites that remain. As surveys progress, however, a greater latitude in the choice of sites for excavation can be gotten (Riddell 1965).

In a roundabout way my appeal has been heeded, not just because I gave it, but because of environmental reviews required of most land development projects. As I noted above, a vast amount of data has been gathered as a consequence of meeting state and federal requirements. Unfortunately, however, much of these data are not readily available in published form. In fact, there seem to be few sources where bibliographic references to this great volume of information can be found without excessive searching. This multitude of reports includes surveys, testing, and excavations made for both private and public agencies, which then become the proprietor. In many cases these reports are of the highest importance to the archaeologist doing research in the San Joaquin Valley, but obtaining them presents a serious problem of time, money and logistics. One cannot know what has been done without canvassing the various public and private agencies for which the work was done. This onerous task could be alleviated if each entity for which the work was done would, on an annual basis, update its list of reports. Each entry should be annotated, and each report turned in should have an abstract.

The compilation and maintenance of a listing of reports for California is an immense job, but as each agency undertakes this task for itself a central clearinghouse can bring the data together. The Information Centers have such a task in mind, and some have met this challenge successfully. The results of their efforts, when brought together by the central agency, presumably OHP, and made available to those needing such information will be a monumental step. It will be possible then to determine where work has been done and the scope of each investigation. In short, we do not fully know what has been done in the San Joaquin Valley with regard to its prehistory. All we know is that much significant work has been done since 1965 when I made my appeal, but much of this information is not readily available.

Another aspect of the problem of the current status of the archaeology of the San Joaquin Valley is knowing the condition and the possibility of imminent destruction of the remaining sites. In fact, how many sites still exist—in *any* condition? Much of the data needed for such an illumination are available in the files and computers in the agencies and at the Information Centers, as well as at the Office of Historic Preservation. Is there a mechanism that can be put into play, which will present them in a manner useful to the researcher? Ideally each of the numerous cultural resource consulting companies have (or should), as noted above, make available to a central clearing house (Information Center) an annotated list of reports prepared by each company/consultant. With these data in hand it would be possible to determine the status of the archaeology of a region, in this case, the San Joaquin Valley. In my recent contacts with those Information Centers involved with the San Joaquin Valley I have been encouraged by the stated aim of each to bring these data into a computerized system for ready availability. This will require much time and money to accomplish, but it is a basic necessity.

It was with despair I viewed the future of the archaeological record of the San Joaquin Valley in 1965, a despair also shared at that time by William Wallace. Our despair continued until after many years of hand wringing we decided to shed a bit of light on the problem by establishing an agglomeration of people having an interest in the area. As co-directors of the Tulare Lake Archaeological Research Group (TULARG) we started a newsletter and began visiting sites and recording private collections, and urging others to do the same. This interest resulted in several symposia at annual meetings of the Society of California Archaeology and the publication of *Contributions to Tulare Lake Archaeology I* and *Contributions to Tulare Lake Archaeology II* (Wallace and Riddell 1991 and 1993). The spin-off has been quite rewarding in that a number of large collections have been seen and recorded, the small newsletter is widely disseminated, and several similar groups were started—the Coalinga Archaeological Research Group (COALARG) and the Fresno Archaeological Research Group (FRESNARG); the former, under the direction of Dan Foster (California Department of Forestry) has prepared a newsletter on work done; and the latter as an adjunct of the Fresno County Archaeological Society. TULARG has had its main focus on the Tulare Lake Basin, and in particular, the extensive evidence of Clovis-period remains found along its ancient shoreline. COLARG has been concerned with the sites and collections from the Coalinga area, and has determined the quarry source for the chert materials used by the Paleo-Indians at Tulare Lake. A local collector, Lou Deford, brought the site to the professionals' attention. TULARG has found that the many local collectors to be an outstanding asset in gaining knowledge about the sites of the region, and their collections, often with good provenience data, of inestimable value. FRESNARG, too, has gotten a lot of data from private collectors and their collections; data that might well have been lost forever had they not been reviewed by members of the research group.

In recent discussions with colleagues some optimism has crept in regarding the status and future of archaeological research in the San Joaquin Valley. It has been pointed out to me that the valley receives an accretion of from one to 1.5 m of alluvium each millennium (Moratto personal communication, 1994). Under these circumstances it is reasonable to expect numerous archaeological sites to be buried sufficiently to avoid being leveled through agricultural activities. Preparing a model for the discovery of these sites through new and improved technological means seems feasible and productive. It would seem prudent, therefore, to initiate a plan by which these site locations can be determined and tested. We must, therefore, be alert to the probability that important archaeological sites lie buried at depth only to be revealed in the process of deep excavation for construction, or by carefully planned and executed test excavations by professional archaeologists. So much of the San Joaquin Valley's past has been squandered and lost by agricultural and urban development that we cannot waste what remains, must remain vigilant in our discovery and protection of these finite values.

In addition to the research groups noted above it is particularly heartening to see that programs of regional research are being pursued at the State University, Bakersfield, by Mark Sutton and Gerrit Fenenga, faculty members in the Department of Anthropology. The California State University, Stanislaus, also, is in a prime position to be a monumental contributor to the collection of critical archaeological data for the San Joaquin Valley (Napton and Greathouse, in press). It is through such institutions as the state universities—Fresno, Stanislaus, and Bakersfield—we can pin our hopes for a continuation of research, which will determine if the archaeological story for the San Joaquin Valley will ever be adequately told.

In a sense, Bill Wallace and I are passing the baton on to a younger and fortuitously located sets of professional investigators. It is to be hoped, also, that Leslie Hartzell will be in a position to continue her research at Buena Vista Lake. With these and other younger archaeologists, especially those having institutional support, the future of archaeological research looks far rosier than it did when I presented my warning in 1965 regarding the losses being sustained by the archaeological sites in the San Joaquin Valley. Perhaps Wallace and I have played a significant part in continuing to sound the alarm and to keep the door open to opportunities in archaeological research in the San Joaquin Valley.

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THE STONEWARE SITE, A 16TH CENTURY SITE ON DRAKES BAY

Clement W. Meighan

Introduction

This study began in 1949, when I was a graduate student at Berkeley, triggered by the interests of R. F. Heizer, my faculty advisor and later my boss when I worked for the Archaeological Survey. Heizer had a long-standing interest in the historical archaeology of Drakes Bay in Marin County north of San Francisco. He obtained a small grant from the California Historical Society, which funded my student crew of four to continue sampling of the Estero Site (Mrn-232) on the shore of Limantour Estero. The site had been previously dug by Treganza and others and was used by Beardsley to define a coastal variant of late Central California culture. It was also among the first of the Drakes Bay sites to yield 16th century Ming porcelain fragments, later attributed to the wreck of Cermeño's galleon in 1595 (Heizer 1941; see Wagner 1924 for an account of the Cermeño voyage). At that time, such porcelain had been recognized in several sites around Drakes Bay; later work was to show that there were dozens of such finds from a large number of sites (Von der Porten 1968). Archaeologically, these finds are very important; they identify some of the few clearly dated 16th century sites on the West Coast, and they allow for recognition of the archaeological remains of the protohistoric period. After the initial contacts between the Indians and the European voyagers, two centuries elapsed before the Spanish discovery of San Francisco Bay and European settlement of this part of California.

Historical Evidence

The objective of the present paper is to present the evidence for the aboriginal artifacts rather than to review once more the historical artifacts and the arguments concerning early explorers in the Drakes Bay area. However, the significance of the site, and indeed the reasons for its excavation, derive largely from its connection to historical events, and a brief background discussion is necessary to provide the context of the studies and the relationship of historical to aboriginal finds.

The compelling interest in Drakes Bay had to do with the 1579 visit of Sir Francis Drake to northern California. This major historical figure, the second round-the-world voyager (preceded only by Magellan) spent several weeks on the coast of northern California. Reasonably detailed accounts of his voyage were written. Regrettably, his logbook has never been found, and the existing contemporary accounts have allowed for much debate over the identification of his landing place (see Temple 1969 for original historical documents; also Heizer 1947; Wagner 1926, 1929). I do not review here this widely published and contentious debate nor the arguments that have been put forward for just about every bay and Inlet of Marin County. Everybody seems to agree at least that Drake was in Marin County, but it is possible to present more or less plausible arguments for several places along the coast, including San Francisco Bay. My own interpretation of the record is that Drake was in Drakes Bay.

An important historical relic from Marin County is the Drake Plate, a piece of brass with a chiseled inscription. Such a plate was said in the Drake account to have been placed near the landing location, on a "...great and firm post." There is an extensive literature examining the Drake Plate, with various studies which conclude that it is genuine, or that it is a fake, depending on the writer and the approach taken. Fink (1938) conducted chemical and metallurgical analyses and considered the plate to be authentic. The most recent study (Anonymous 1977) declares the weight of the evidence leaning toward falsification based on such things as literary style and chemical comparison with European brass of the 16th century. I think the issue is still open, since there is no necessity for the brass to be of English origin-Drake could well have had brass from almost anywhere in the world because he had sacked numerous Spanish ships, some of which returning from Asia. As for style of expression and letters, the lettering is done with a hammer and chisel and the plate cannot be compared with what is done on paper or parchment. Somewhat confusing recollections state that the plate was found not too far from the sites discussed here, but it was not recovered directly from an archaeological context, and it is therefore a side issue so far as this report is concerned. Although now largely discredited, the Drake Plate remains on display in the Bancroft Library at Berkeley.

Our interest in archaeological investigations at Drakes Bay is apparent: we hoped to find in the 16th century Indian villages some evidence for the visit of Drake, Cermeño, or other, as yet unidentified, early explorers, and at the same time define in greater detail the Indian villages and material culture of the time. It has to be remembered that most of the current archaeological dating methods, including radiocarbon dating, were being developed and were unavailable for California sites at the time this work began. The so-called "direct historical approach" was therefore an important way of developing an archaeological sequence-once the artifacts of a known historical period were defined, it was possible to recognize the "Late" period, and materials that differed sharply had to be older. The exact dating of archaeological levels by association with the Cermeño shipwreck in 1595 (Heizer 1941) gave us better chronological control than we had for the protohistoric archaeology of coastal California.

The Stoneware Site Excavations

At the time my small crew was digging under the auspices of the California Historical Society, at the Estero Site (Mrn-232), I spent a couple of days sampling another quite small site which was on the shore, at the mouth of a small ravine only a couple of hundred yards away (Figure 1). This site was not named; its site number is Mrn-307. Since it is cumbersome to read reports with site numbers repeated in every paragraph, I have named this site the Stoneware Site, after its unique historical finds as discussed below. Preliminary test pits showed the site to contain some large iron bars and bits of the characteristic blue-and-white Ming porcelain assigned to a 1595 shipwreck (Figure 2) (Heizer 1941). I decided that further investigation of this site was worthwhile, and between 1949-51 managed to spend ten weekends with volunteer crews in continuing this study. On a couple of occasions, I was able to muster crews of several volunteers (as many as 18 on one weekend), but most of the time the field crews included only two to five workers. Due to the small size of the site, however, our effort resulted in excavation of 112 pits (5 by 5 ft.), totaling 230 cubic yards and over 95% of the total midden. Only very shallow margins remained unexcavated. The collections are in the Hearst Museum, University of California, Berkeley.

During this period, I spent summers on various projects, including participation as a crewmember on Frank Fenenga's digs at Bodega Bay and in the Sierra foothills on the Kings River. Frank had also been one of my T.A.'s, back when I was taking my introductory courses in anthropology. He was an outstanding teacher, an excellent field archaeologist, and knew all the literature (as well as background and personalities) related to California archaeology. In later years, he sometimes said that he taught me all I know—I never argued with this since he was an essential person in my early training and I consider him a model of what an archaeologist should be.

Due to the transfer of my professional responsibilities to UCLA before I was able to complete this site report, I had to put "my" site of Mrn-307 aside, and except for occasional work with it, the report languished in Filing cabinets for years. Since the report dates from the period when I was actively working with Fenenga, and since it deals with his central and lifelong interest in California archaeology, it seems an appropriate tribute to him.

There is some historical interest in this project in terms of the many changes that have taken place in American archaeology since this study was begun. As mentioned above, dating of California sites was rudimentary and difficult, and the direct historical approach was still a significant tool. In addition, contract archaeology was virtually nonexistent and nobody could make a living at it in California. There were no National Science Foundation grants, and such feeble grant money as could be obtained often came from individuals or private foundations.

Since there was no money, archaeologists were motivated to conduct investigations based on their own enthusiasm and interest, and this included a great deal of work for which no reward was expected, of money, college credit, or anything else. It has been many years since archaeology of this kind was done in California except by a few avocational groups. It may be of note that the excavations reported here were entirely done with volunteers who paid their own way, and the research budget from the University or other sources came to zero. This is "free" archaeology of a kind which used to be common. Based on what the State of California and private property owners are now expected to pay for archaeological investigations (at least $5000 a cubic yard for excavation studies), to do our Drakes Bay project today would demand a budget of over a million dollars by the time that overhead, salaries, employment of Indian monitors, etc. was added up. Such a budget would ensure that the site would not be studied at all, since it is small, remote, and not in the path of freeway or subdivision.

The present report concentrates on the data pertaining to the aboriginal remains from the site, which have been only briefly discussed in print (Meighan 1966). This is to place on the aboriginal artifacts which date from the early historical period in this part of California. The historical material has been much more extensively discussed; archaeological studies surveying the historical finds include Heizer (1941); Meighan (1950); Meighan and Heizer (1952, 1953); Shangraw and Von der Porten (1981); Von der Porten (1963, 1965, 1968). A good popular summary is Williams (1953). Not discussed here are the numerous examinations of the historical record which do not involve archaeological evidence; particularly the interpretations of 16th century accounts and the debate about the exact locations visited by Drake and others. The historical archaeology is mentioned briefly in the following discussion of artifacts from the site.

Site Description

The Stoneware Site is a small and shallow shell midden (Map 1). The deepest pits were just over 4 feet deep, the majority less than 3 feet. The site soil is a black clay (usually damp) with numerous fragments of shell, but the shell is by no means as abundant as in other shell middens of the area, and the population of the site must have been small in number and intermittent in time. The real "village" in this area is the nearly adjacent Estero Site (Mrn-232) which is much more extensive and has much more evidence of habitation refuse.

The site is on the north edge of a small ravine emptying into the ocean. Only a few feet wide and deep, in the rainy season a small stream of water flows past the south edge of the site and empties onto the beach. In recent years this has been dry except for a few days of the rainy season, but in earlier times it is possible that water was available here during much of the year, and it was apparently fed by a small spring in times past. The trickle of water emptying onto the beach forms a small waterfall a few feet high; this would have been a convenient place to fill water containers for both Indians and historical visitors. Procurement of fresh water was certainly one of the uses of the site by the people of the adjacent Estero Site. The large stoneware jar of the historic period, represented by several fragments, was also commonly used as a container for water as well as other liquids, and the evidence of such a jar (only at the Stoneware Site so far) may indicate a visit from early voyagers to obtain water.

With the thought that aboriginal and/or historical artifacts might have been lost in the mud of the gully outlet, we conducted some excavation here and screened and washed substantial amounts of mud. Results were negative and no cultural material was found. Anything that may have been there has been washed onto the beach and lost.

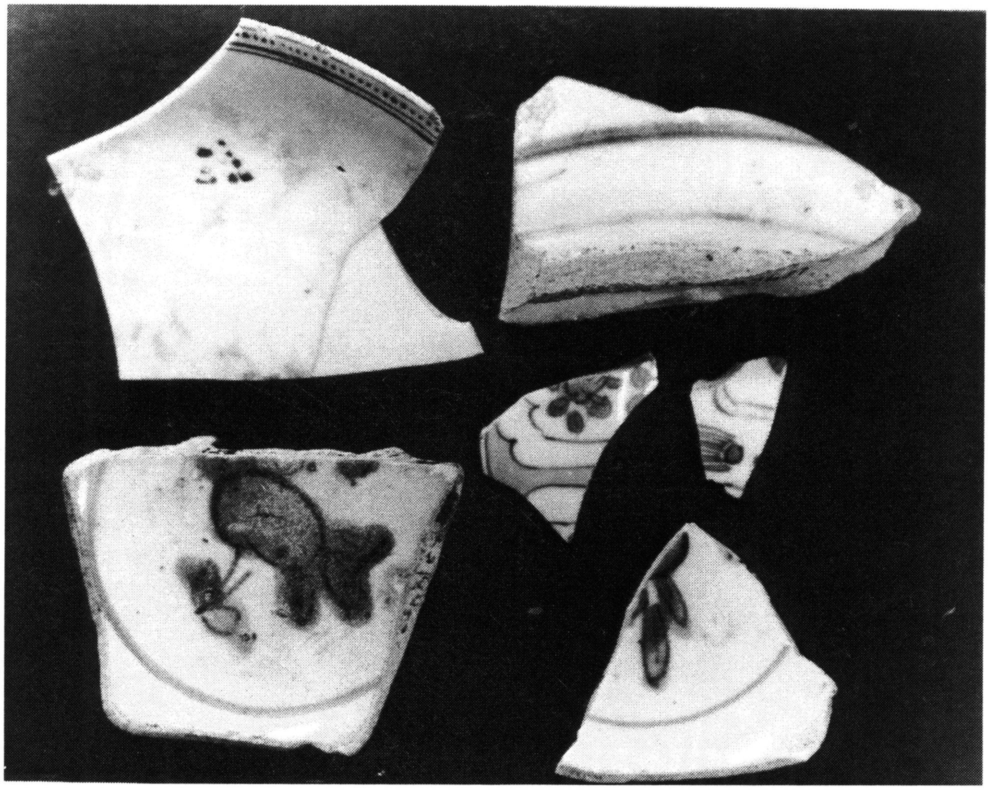
The entire site would have long since disappeared to agricultural machinery, except for the small ravine and the necessity of driving traitors and cultivators around the inland origin of this gully. The area surrounding the site has been extensively cultivated.

Stratigraphy And Dating

The site is in a low area which collects drainage from three sides and is somewhat boggy in the wet season. This no doubt explains the dark clay soil; somewhat distinctive compared to nearby sites. The site soil is also unusual in that it supports a dense stand of thistles, which grow nowhere else in the immediate vicinity. In the summer, the dry stalks of these thistles are often over six feet in height and form a thicket visible from a distance.

The site is shallow and homogeneous and there is little detail in the stratigraphic profiles.

Figure 1: The Stoneware Site (Mrn-307), Limantour Estero. Upper: J. Arthur Freed and Robert J. Squier clearing the site, 1950. View southwest, Limantour Estero in background. Site Mrn-232, the Estero Site, is atop the small bluff at the left. Lower: Site view looking north, 1950. The site is around a dark patch of dried thistles (center) adjacent to the beach. The area immediately adjacent is dairy pasture; the generally treeless grassland of the Point Reyes Peninsula and adjacent mainland is well shown in this view.



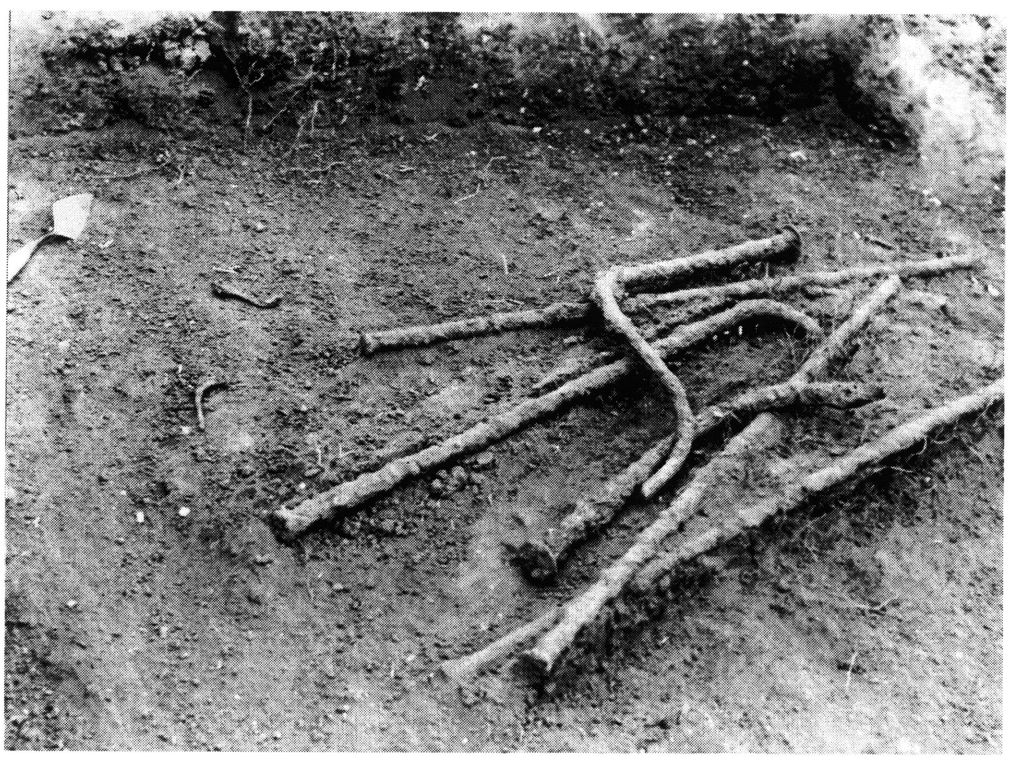
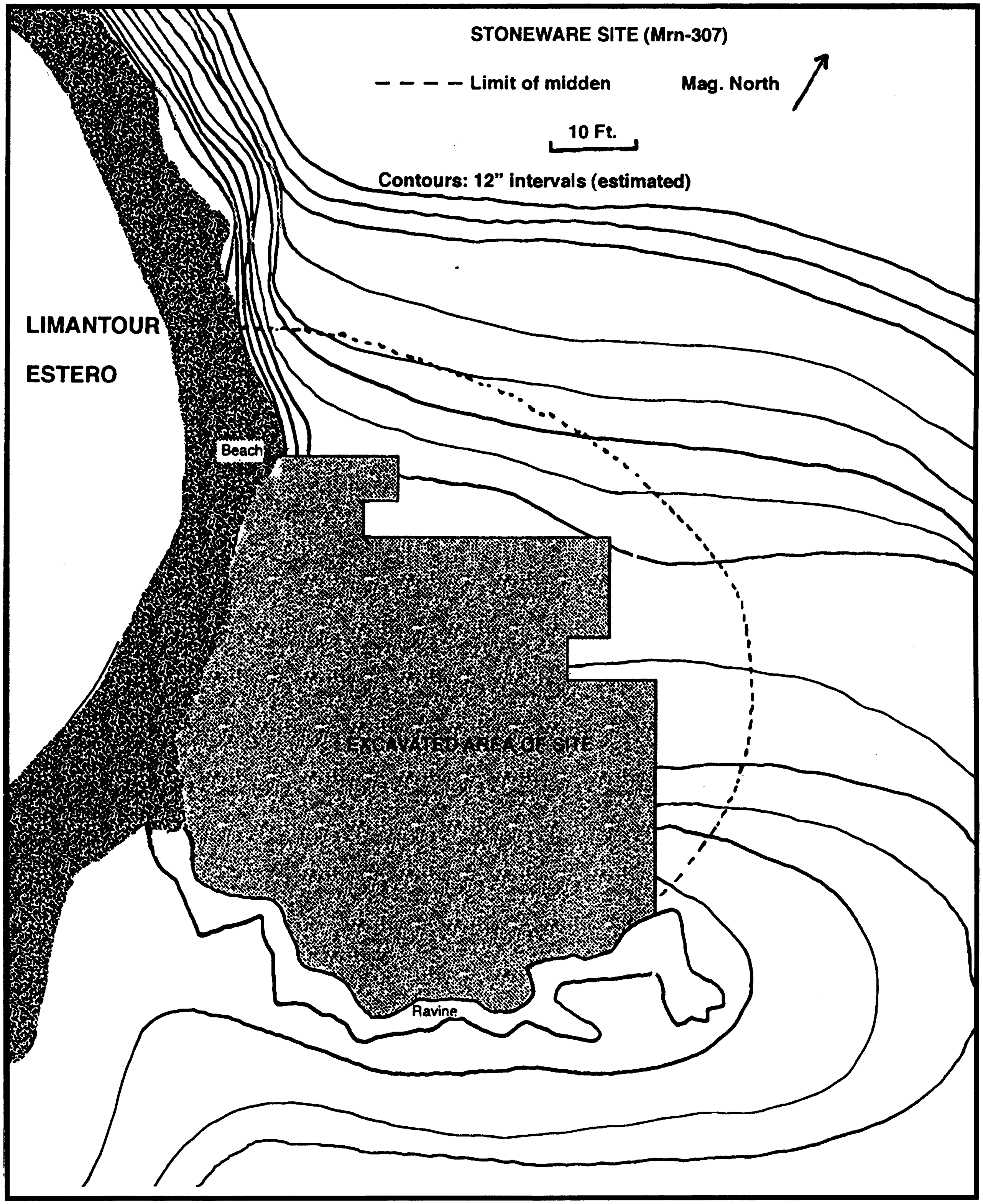


Figure 2: Historic artifacts from the Stoneware Site (Mrn-307). Upper: Ming dynasty Chinese porcelain attributed to the wreck of Cermeno's ship, the *San Agustin*, in 1595. Lower: Large fastenings of wrought iron, originally held in timbers by iron washers pinned on ends. Unknown origin.



Map 1: The Stoneware Site (Mrn-307)

Standard layers of a California midden are present:

A-horizon: The uppermost horizon is a "sod layer" which is friable and marked by an abundance of weed roots and diminished, weathered amounts of shell fragments. The soil below is dense, and the sod layer varies from virtually nothing to as much as 2 or 3 inches thick, averaging about an inch. Several pieces of the porcelain attributed to the 1595 shipwreck were found in this layer, virtually on the surface of the site. The sod layer is mixed with a layer of brown clay washed in from the slopes above, accumulating in the lower and more level areas of the midden to a depth of as much as 7 inches. This slopewash is no doubt the result of cultivation of the area above the site and dates from recent years. A 5 inch layer of slopewash covered nearly all of the site area where porcelain fragments were found.

B-horizon: Below the sod/slopewash layer is a dark midden with shell and bone fragments. The thickest of this midden layer is just over 4 feet in a few pits; most of the site is shallower, and marginal pits at the edges of the site have only a few inches of midden. Only a few artifacts were found below 30 inches in depth; the majority of the artifacts come from the top 18 inches.

C-horizon: Most midden sites have a "zone of mixture" between midden and sterile sub-soil, where the original inhabitants mixed together the native soil with their accumulating midden, largely by digging fire pits and other disturbances of the base soil. This layer is only a few inches thick over most of the Stoneware Site and it is virtually absent in some pits.

D-horizon: The base soil is a black clay, very sticky when wet. The site is elevated only a few feet above the adjacent beach.

Chronological Considerations

The end date for occupation can be derived from the near-surface occurrence of porcelain attributed to the shipwreck of 1595. The apparent abrupt termination of the village coinciding with this visit by Europeans suggests strongly the possibility that Old World diseases may have been introduced which sharply reduced the local population; in any event, there is no evidence of Indian occupation after A.D. 1600.

The beginning date for the site is harder to estimate. We have no radiocarbon dates; they would not be too useful for such a recent deposit. There is no cultural stratigraphy of artifacts indicating occupation by other than late peoples. While some historic artifacts are "surface," others are found to a depth of a couple of feet, which is effectively the whole midden.

The few pits which were excavated to deeper levels went into zones C and D above and were largely sterile of cultural remains in the lower levels. While casual Indian visitors may have passed this way for thousands of years, the evidence is that residential occupation of the site was confined to no more than a few centuries prior to A.D. 1600, and it may have been less.

Aboriginal Population

The site is seen as a satellite of the Estero Site a couple of hundred yards distant. The latter is on a terrace overlooking Drakes Bay. The small site area and limited midden remains suggest that the Stoneware Site never sustained a fixed population, but was inhabited seasonally by a small band of people, probably no more than one or two families at a time.

In aboriginal times, the population of Marin County was quite sparse. Kroeber (1925) estimated the inhabitants, Coast Miwok, to number only about 1500 persons. Cook (1943:182) examined mission records and estimates that about 2000 Coast Miwok were missionized and that this represents nearly all of the Indians of Marin County. Of these converts, almost half came from San Rafael on San Francisco Bay. The Coast Miwok had all of Marin County, including the best areas for hunters and gatherers along Bodega, Tomales, and San Francisco Bays. The rather barren Pt. Reyes and Drakes Bay region probably supported no more than a couple of hundred people. Kroeber (1925:273) even suggests that the Pt. Reyes Peninsula "...seems to have been uninhabited," and none of the known Coast Miwok villages are shown for Pt. Reyes, the closest being Olema, several miles inland from Drakes Bay. The archaeology shows clearly that the Pt. Reyes peninsula and the area around Drakes Bay were not unused in the past, but sites in this area are smaller and more widely dispersed than in other parts of Coast Miwok territory, and most of these sites were apparently seasonal settlements. None of them approach the size of the Coast Miwok archaeological sites on Bodega Bay or San Francisco Bay. The encounters of the early explorers were initially with only a few people, and it took some days before people came from all directions to form an assembly of perhaps 100 persons to see the English (and later Spanish) explorers who were the first Europeans to land in this part of California.

Subsistence

The Stoneware Site yielded an abundance of faunal remains of which only a sample was identified. As usual in sites with no plant material preserved, the amount of plant foods cannot be quantified, although seeds, roots, and bulbs no doubt formed a significant component of the diet. Acorns, the staple of central California Indian economy, are not available in the Drakes Bay area because there are no oak trees. Such foods would have been collected a few miles inland, however, and were no doubt used by the Indians at Drakes Bay. Both the Drake and Cermefic, parties took plant foods (seeds) from the coastal Indians during their sojourns in Marin County. Indirect evidence for plant foods is seen in the artifact collection, which includes 16 pestles and 42 mortar fragments. These attest to considerable, but not quantifiable, seed-grinding activity.

Animal foods are abundantly represented at the Stoneware Site. For bird and mammal bones, the identified sample was taken from the 53 cubic yards of trenches C and D. This sample contains 192 mammal bones and a little over 500 bird bones. Because fish bones were comparatively rare, all fish bones from the entire site were saved and identified. Assuming a constant density of faunal remains in the midden, extrapolation of the sample indicates the total site contained 3875 bones, the distribution being: bird, 79.4%; mammal 18.6% and fish 1.8%.

Stated another way, each cubic yard of midden contains 15 bird bones, 3.6 mammal bones, and 0.3 fish bones. These figures show a heavy dependence upon birds and a surprising scarcity of fish, considering the location of the site on a shallow estuary. Note that shellfish, discussed below, may have been even more important meat resources. The distribution of bones does not reflect flesh weight, so the actual food resources were somewhat higher for fish and mammals than the percentage of bones indicates. Identified birds are listed in Table 1, mammals in Table 2, and fish species in Table 3.

Although fishing was of minor importance, two very important resources were derived from the estuary: crabs, which make up a large amount of shell remains in the site, and shellfish (principally clams). Column samples from this site have been analyzed and published by Greengo (1953).

The general picture is of a littoral-dwelling population which relied on estuarine and inland resources but did no significant ocean fishing. The absence of adaptation to ocean resources supports the idea that the sites were seasonal camps occupied by inland peoples who came to the Drakes Bay region to collect grass seeds and estuarine foods. The crabs and shellfish were obtainable with minimal or no technology-the estuary becomes a vast mud flat at low tide and resources can be collected by hand. The only tools needed would be basketry or net containers and perhaps digging sticks for some shellfish.

Shellfish

Identification and analysis of shellfish was done with column samples taken of the midden (Greengo 1953). The common food resource was the large clam Saxidomus numalli, an excellent food still found in the estuary today (and on occasion consumed by the archaeological crew). There is very little shell of rock-dwelling species, such as chitons, showing the major foraging area to be the mud flats when the tide was low. Greengo noted that this site contained the highest amount of crab shell of any site he had studied, and the collecting of crabs in the shallow water of Limantour Estero must have been an important subsistence activity. There is no evidence of how the crabs were caught, but baited basketry traps are a logical suggestion.

Since shellfish have a high ratio of shell weight to flesh weight, and since they produce a large amount of obvious midden debris, they are often assumed to be a major food resource. It is difficult to evaluate the relative importance of shellfish compared to other resources at this site, particularly in the absence of quantitative information on plant foods, but in my opinion shellfish were not more than 25% of the food consumed at the site and may have been considerably less. Crabs may well have been more important as food, but at present there is no method for evaluating the food represented by a given weight of crab shell versus the same weight of mollusks.

Table I: Bird Bones from the Stoneware Site, Mrn-307 (identified by Joan Malloy, 1953)*

Scientific Name	Common Name	3	4	5	6	7
Mergus serrator	***Red-Breasted Merganser***		***1***	***1***	***2***	
Buteo borealis	Red-Tailed Hawk		1			
Limosa fedoa	Marbelled Godwit**			1	3	
Larus occidentalis	Northern-western Gull	1	3	2		
Larus argentatus smitbsonianus	American Herring Gull		1			
Larus philadelphia	Bonaparte Gull				2	
Gavia immer	Common Loon**	1		1	2	
Gavia immer elasson	Lesser Loon					1
Gavia stellata	Red-Throated Loon	1		1	1	2
Colymbus auritus	Horned Grebe			1		
Aechmorphus occidentalis	Western Grebe		1			
Pelecanus occidentalis	California Brown Pelican			1		
Phalocrocorax auritus albociliatus	Farallon Cormorant**	1		11	6	
Phatocrocorax penicillatus	Brandt Cormorant**	2	1	9	6	
Branta canadensis	Canada Goose				3	
Branta canadensis minima	Cackling Canada Goose			3	3	
Anser albifrons a.	White-Fronted Goose			9	15	
Anser albifrons gambeli	Tule Goose			2	1	
Cken hyperboreus H.	Lesser Snow Goose			7	5	
Anas platyrhynchos	Common Mallard	4	2	9	8	
Chaulelasmus streperus	Gadwall	2	2	13	11	
Dafila acuta tzitzihoa	American Pintail			2	1	

Column Key

Column 3	Right Tarso-Metatarsal	Column 6	Left Humerous
Column 4	Left Tarso-Metatarsal	Column 7	Skull
Column 5	Right Humerous		

*The entire collection from the site was reviewed, ca. 2500 bone fragments, most too small for identification. Emphasis was placed on identification of the bones from trenches C and D. The table identifies 223 bones; at least that many more appear to be of the same species but are not tallied because of uncertainties in the identification. The collection is 80% anserine (ducks and geese). The remainders are all shore or estuarine species except for a few open water birds and a red-tailed hawk.

The number of individual fragments should be considered more important than the minimum number of birds, since the bones were so scattered it is doubtful that more than one or two bones from a bird would occur in the same pit and level. Cormorant bones were sorted by pit and level; only once out of 56 bones did two bones from the same species occur in the same pit and level.

All identified species occur in this area today, and the species of low frequency in the site are also rare in the bay area today. This indicates no significant environmental change so far as bird life is concerned-not surprising since the time period is less than 500 years since abandonment of the site and the Drakes Bay area is little impacted by modern settlement. All identified species could have been obtained in the immediate vicinity of the Stoneware Site.

**These species were also noted in the Emeryville Shellmound on San Francisco Bay (Howard, 1929). The Emeryville report does not identify ducks, geese, and gulls to species, but it was found that Anatidae and Laridae could be identified to species when compared to modern identified bird bones.

Table 2: Mammal Bones from Mrn-307 (identified by Arthur Freed)*

Scientific Name	Common Name	Number	%
Odocoileus columbianus	***Deer***	***43***	***63.2***
Enhydra lutris	***Sea Otter***	***8***	***11.8***
Phoca richardii	Harbor Seal	4	5.9
Sylvilagus sp.	Rabbit	4	5.9
Lepus sp. (?)	Rabbit	1	1.5
Cervus sp.	Elk	4	5.9
Zalophus californainus	California Sea Lion	3	4.4
Thomomys sp.	Gopher	1	1.5

*The examined collection included all mammal bones from trenches C and D, a sample of 53 cubic yards or slightly over 25% of the total excavation. Total mammal bone fragments in the sample are 192, of which 68 (35.4%) could be identified. The remainder lack articular surfaces (all bone was saved, even chips).

Of the mammalian resources utilized by the Indians, 78% were land animals, 22% sea mammals. All of the sea mammals could be obtained on the beaches or in die estuaries; all but the sea otter are present today. Deer were by far the most important land animal resource. Rabbits are less common than would be expected, and the absence of ocher small mammals (foxes, raccoons, badgers, skunks) is noteworthy. Although the smaller mammals arc somewhat more difficult to identify and may more often deteriorate in the ground, the absence in this case is real, and we are confident that small mammals were simply nor of importance to the Indians of this site. The obvious explanation for this is the concentration of hunting effort on birds such as ducks and geese. Pursuit of mammals was limited to the larger animals, which would supply enough meat to make the effort worthwhile.

Table 3: Fish Remains from Mrn-307 (by W. L. Follett)*

Scientific Name	Common Name	Number	%
Triakis semifasciata	Leopard Shark	4	6.1
Platichthys stellatus rugosus	Southern Starry Flounder	3	4.5
Holconotus rhodoterus	Redtail Surf Perch	1	1.5
Embiotoca jacksoni	Bay Black Perch	22	33.3
Damalichthys vacra	Pile Perch	28	42.4
Rbacochilus toxotes	Rubberlip Sea Perch	8	12.1

*Follett's detailed report on these fish bones is published (Follett 1964). The collection includes all of the fish bones from the site. All of these are considered fair to good food fish, all occur in the area today, and all but one (*Holconotus*) are available all year in Limantour Estero adjacent to the site. *Holconotus* is found in the Estero during late winter and early spring. Except for one large leopard shark approximately 5 feet long, all of the fish bones represent specimens from 10 to 26 inches in length. All of these species are characteristic of shallow estuaries and are readily captured by hook and line. It is likely that some of these fish were obtained using nets or basketry fish traps (or even fish spears), for the Limantour Estero is quite shallow even at high tide, and at a low tide much of it is a mud flat. Virtually all of it is shallow enough for a fisherman to wade much of the time. Fishing from boats must have been minimal. There is nothing in this collection to indicate fishing outside the Limanrour Estero, let alone on the open ocean outside Drakes Bay. The small amount of fish bones compared with other food resources indicate that fish were eaten when they could be easily got, but no there was no emphasis on fishing.

Follett notes the absence of stingray material from this collection. This is puzzling since rays are common in the Limanrour Estero, are edible, and are commonly found in archaeological sites around San Francisco Bay, and indeed in sites from Bodega Bay down to southern California. Absence of rays from this site cannot be attributed to sampling problems, since virtually the whole site was dug and all of the fish bones were retained and examined. It might be suggested that there was some sort of food taboo concerning stingrays, but if so it was strictly local and did not apply to other coastal areas.

The predominant mollusk, *Saxidomus nuttalli*, is a clam with a large and thick shell, not only important for food but also for the manufacture of clamshell disk beads, a universal ornament and medium of exchange in Central California (and still produced to the present day). There was an extensive trade in these shells from Bodega Bay and other coastal locations, but we do not know if the area of the Stoneware Site was involved in this trade. Total number of clamshell disk beads in the Stoneware Site is very few, and it can be concluded that these beads were not manufactured in any significant number at this location.

The artifact collection from the Stoneware Site gives little information on subsistence activities. Mortars and pestles attest to grinding of plant foods, and projectile points obviously indicate hunting. However, many of the food resources discussed above are not reflected in the artifact assemblage. Many foods could be collected by hand, and many more apparently involved the use of implements of wood or fiber which have not survived in the archaeological site. For example, there are no fish-hooks or gorges, harpoons or fish-spears, snares, nets or basketry fish traps, although all of these were no doubt known and used in food-getting.

It is interesting that there are no historic artifacts representing tools that might have been traded to the Indians by early explorers. In 18th and 19th century California sites, knives and other metal tools are found, and there is frequent use of fragments of glass to make tools. At the Stoneware Site, the many historic artifacts seem to have been merely curiosities salvaged from wrecks. There are a couple of pieces of Ming porcelain which show some efforts at chipping—one (from the Estero Site) appears to be an unfinished point and one piece of porcelain in the collection described here has some chipping along one edge. However, porcelain is a poor material for pressure flaking and beyond a couple of tentative experiments it was not used. A considerable amount of iron found its way the sites, again mostly salvaged (and probably left behind when wood from the wrecks was used for firewood); there is no indication that any of these objects was used or turned into implements. As for European goods deliberately traded to the Indians, there are none —no glass beads, buttons, or other trinkets so commonly traded to Indians are present in this 16th century site. The 16th century visitors were of course transient, very far from their homes, hard pressed for supplies and not giving much of anything away, and neither Spanish nor English of the period had come to trade with the Indians. It is nonetheless somewhat surprising that considerable numbers of Europeans could be in the Drakes Bay area for several weeks without some traded or pilfered European artifacts turning up in the site.

Social Features

There is almost no archaeological evidence about the society of the Stoneware Site's inhabitants, although a generally simple picture can be drawn from the small population of hunters and gatherers represented at the site. From-ethnohistoric information, band chiefs and shamans were the only people of distinct importance compared to the rest of the population.

No physical remains of houses were found, but four "hearth" or fireplace features were uncovered. These universal finds in California sites, consisting of accumulations of burned stones, were from 15 to 28 inches in maximum dimensions. Three were in the bottom of the shallow midden, from 29 to 39 inches deep, and may have originally been located on the floor of excavated pit houses, although no direct evidence of such houses were found. The fourth was at a depth of a foot. If these hearths are indicators of domestic structures, they would indicate no more than three houses at one time at the site, and there may never have been more than one house at a time. Although direct archaeological evidence for the construction features of houses is lacking, we know from the 16th century accounts and from recent ethnography that the houses were semi-subterranean huts made of brush and whatever driftwood was available. Like most of the Central California hunters and gatherers, "house" may be a misleading term for these structures, because most of the activities of everyday life were outdoors (including cooking) and the houses served primarily as storage places and protection from severe weather.

The economic picture shows very little in the way of trade or external connections. All of the food resources in the archaeological collection were obtained in the immediate vicinity of the site, and most of the artifacts are also made of materials obtainable within a few miles. An exception is the occurrence of some obsidian artifacts, the nearest source of obsidian being in Napa Valley, some 40 miles to the east. There is also a pipe fragment of steatite, another material which had to be imported from somewhere to the east. There is no debitage from either obsidian or steatite; these exotic materials had to come to the Stoneware Site in finished form.

Religious Beliefs

Indications of religious beliefs are found at the Stoneware Site only in the presence of seven of the ubiquitous charmstones or power objects characteristic of Central California. Ethnographic accounts are our source of information about these objects in the protohistoric period. There was one flexed burial in very poor condition, unaccompanied by any offerings. Absent were other common items of ritual import in California, such as quartz crystals. The site clearly had no particular importance to ceremony, religion, or mortuary ritual, and as all evidence indicates, was merely a small camp of hunters and gatherers primarily engaged in subsistence activities.

Historic Artifacts

Historic artifacts include 17 fragments of Chinese porcelain of the late Ming dynasty, all attributed by Heizer (1941) to the wreck of Cermeño's ship in 1595. As previously mentioned, some of these were virtually on the surface and most were within the top few inches of the site; subtracting the layer of slopewash over the surface of the area where the porcelain was found, the midden depth for the porcelain was only 3.8 inches. A reexamination of 466 porcelain average sherds from the Drakes Bay archaeological sites (Shangraw and Von der Porten, 1981) indicates that there are two distinct sets of pottery represented: one is a group of sherds showing abrasion, from minimal to severe, representing sherds which must derive from the Cermeño wreck, which were waterworn as they were washed to the beaches where they were found. This group of sherds is not from the primary Ching Te Chen area, but from nearby Chinese kilns. It is also noted to be some somewhat less artistic refinement than the second group of sherds. The second lot, finer in artistic conception, shows no evidence of water wear and is said to originate at Ching Te Chen, a major pottery source in the Ming Dynasty. Shangraw and Von der Porten argue that the distinctions in source, style, and evidence of wear argue for two separate introductions of porcelain fragments to the Drakes Bay area, one being the shipwreck of Cermeño (1595) and the other being the visit of Drake (1579). Of the sherds assigned to the Drake visit, one is identified as coming from the Stoneware Site discussed here.

At a deeper level (averaging 17 inches depth), and also separated horizontally from the main distribution of porcelain, were found 9 fragments of a large brown stoneware jar of Asian origin, representing only a small part of the complete vessel. Several experts examined these pieces and all agreed that they were of early age, some specifying a 16th century date. Jars of this type have been common utilitarian wares for centuries, and indeed are still in use. They were widely used throughout Southeast Asia, China, Japan, and (most significantly) the Philippines, where the Trans-Pacific galleons regularly visited. It is impossible to say who brought the stoneware jar to the archaeological site; it could have been on any Spanish ship of the period, or on Drake's ship which had taken several Spanish ships before arriving off the coast of California. It could also derive from a voyager of which we have no record. Since the Stoneware Site is the only known California site to have such historic remains, and since all the fragments are from the same vessel, it is logical to assume that the jar was broken while collecting water at the site.

There is a clear stratigraphy between the Chinese porcelain attributed to Cermeño and the group of sherds from the brown stoneware (Meighan and Heizer 1953). These indicate a 16th century visitor prior to Cermeño. The only earlier recorded visit was that of Drake, but it is possible that the stoneware derives from some other early explorer of whom we have no record.

Cabrillo traveled this far north in 1542, but there is no statement that he landed in northern California. The stoneware might also conceivably have come from a wrecked Japanese junk, many of which reached the West Coast after losing mast and rudder in storms and drifting across the Pacific on the prevailing currents. Most of the unfortunate crewmembers died before reaching land, but a few survived (Weber 1994). An Asian voyager as the source of the stoneware is a possibility, but in the absence of any other-evidence it remains speculative and it appears more likely that the stoneware is from a European vessel, and in the historical record Drake's is the most likely ship. Although this is a significant find, the site has been almost entirely excavated, and it will not yield any further information on 16th century remains. If the mystery of the Drake landing site is to be finally resolved by archaeological evidence, it will have to come from some other location.

Also found (with a metal-detector) was a cache of seven large iron rods, the largest just over 3 feet in length and an inch in diameter. These were buried several inches deep at the edge of the site. They appear to have been used for securing large ship's timbers. Originally they all had metal washers on the ends which were held in place by flattening the ends of the rods with a heavy hammer. The metallurgists who originally looked at the smaller iron spikes from the Drakes Bay sites examined the iron rods; their findings were that the rods are of wrought iron but the age was uncertain and they could be more recent than the 16th century. These rods remain a puzzle.

Recent ranchers and hunters have certainly visited the site area, and the upper marginal boundary of the site produced some late debris including rim-fire cartridges and pieces of glass. On the other hand, it seems unlikely that recent visitors would collect and bury these rusted iron rods, which have no apparent use or value, in an archaeological site. It is conceivable, although not provable, that these large pieces of iron were part of the construction material of Cermeño's wrecked ship, and that they were thrown aside by the Indians after using the ship's timbers for firewood.

The site also produced four of the smaller iron spikes which are much more numerous at other locations including the adjacent Estero Site. Metallurgists as very probably of the 16th century have identified spikes of this kind. It is significant that the only spikes of this kind recovered from the Stoneware Site were associated with the large iron rods discussed above. These spikes are most likely from the planks of Cermeño's ship, collected by the Indians and used for house construction (and no doubt firewood). Cermeño's men had a skirmish with the Indians over their taking of ship's planks, since they needed these planks themselves to construct a boat and make their way down the coast.

There is no evidence that any of the historic artifacts at the Stoneware Site were utilized by the Indians, with the exception of a single piece of Ming porcelain which bears some flaking along one edge. It is like the flake scrapers from the site, but in this case the chipping may have been merely an experimental effort to work the porcelain. The blue-and-white porcelain pieces were probably picked up on the beach and brought to the sites as a curiosity. The stoneware jar is believed to have broken at the site and been discarded, and the metal objects are simply residue of construction and fires.

Aboriginal Artifacts

The aboriginal artifacts collected from the site are listed (Tables 4-8). These are clearly of Phase 2 of the Late Central California Horizon, specifically the Estero facies of the Marin Province as defined by Beardsley (1954). There is no evidence of earlier occupation at the Stoneware Site. Every artifact type which was identified by Beardsley as diagnostic of the Estero facies was found at the Stoneware Site, as well as a few additional types of relatively rare occurrence. This is not surprising since the facies was defined largely from the Estero Site, and the Stoneware Site is clearly a minor satellite settlement of that site

Discussion of Aboriginal Artifacts

Most of the simple artifacts are adequately defined in the tables and illustrations. The more varied classes are discussed briefly here:

Hunting

Projectile points are the most common hunting instruments (Table 4, Figure 3). Small points with side or corner notching are most common; there is a complete intergradation of forms from side-notched to corner-notched, with some types intermediate in form; division of this collection into types is arbitrary and probably has little cultural meaning. All of the notched points with rounded or straight bases are classified as Type I (Figure 3A-C, H-V). A sub-type (1A, Figure 3D-G) includes four small points with notched edges, a form long recognized as diagnostic of Late Central California. Other point forms (types 2-6 here, Figure 3X-BB) may well have been hafted and used as knives since they are larger than the projectile points and most lack the notches.

Table 4. Chipped Stone Artifacts from the Stoneware Site (Mrn-307)

Artifact			Depth in Inches from Surface						
	Size in cm	Total	0-6	6-12	12-18	18-24	24-30	30-36	36+
Points and Knives									
Type 1	1.3-4.1	34	14	10	4	3	2	1	
Type 1a	1.4-4.3	8	3	4	1				
Type 2	3.4	1			1				
Type 3	4.4	1	1						
Type 3-4	3.9	1			1				
Type 4	3.5-6.5	8	2		3	1	1		1
Type 5	5.1-6.4	4		1	2				1
Type 6	6.0	1		1					
Unclassifiable		9	1	3	2	1	2		
Scrapers									
Type 1	2.8-6.7	16	3	5	3	4		1	
Type 1a	3.2-5.5	7	1		1	3	1		
Type 2	3.5-8.5	5	3	2				1	
Type 3	1.7-3.6	3	3						
Drills (Reamers)	4.4-5.6	5	1	1	2	1			
Hammerstones	5.7-15.0	6	1	1		2		2	
Crescent	5.0	1	1						
Core Choppers	4-10.4	2				1		1	

Table 5: Ground Stone Artifacts from the Stoneware Site (Mrn-307)

Artifacts			Depth in Inches from Surface						
	Size in cm	Total	0-6	6-12	12-18	18-24	24-30	30-36	36+
Charmstones			*1*						
Type 1	10.9	1							
Type 1a	9.7	1		1					
Type 2	7.3	1	1	1					
Type 3	7.2-8.3	2		1					
Type 4	10.4	1							
Type 5	4.5	1					1		
Pestles									
Type 1	14.5-17.3	6		2	2		1	1	
Type 1a	5.4	1			1				
Type 2	4-6 (frag.)	3		2	1				
Unclassifiable		6		1	1	1	3		
Mortars									
Type 1		2			1			1	
Type 2		2		2					
Type 3		13	1	2	3	1	2	1	3
Unclassifiable		25	1	4	7	8		2	1
Sinkers									
Type 1	10.4	1		1					1
Type 2	3.5 (frag.)	1							
Tubular Pipe	***3.4 (frag.)***	***1***	*1*						
Sandstone Disk	3.0	1		1					
Pumice Sphere	3.0	1	1						
Abrader	6.0	1		1					

Table 6: Bone Artifacts from the Stoneware Site (Mrn-307)

Artifacts			Depth in Inches from Surface						
	Size in cm	Total	0-6	6-12	12-18	18-24	24-30	30-36	36+
Awls			***1***						
Type 1	5-11.5	26	3	5	7	2	4	1	
Type 2	to 12.0	21	1	6	3	3	5	2	1
Type 3	to 7.0	2					1		1
Type 4	frags.	2			1			1	
Unclassifiable	5.3	1							1
Bird Bone Whistles	***9.0-9.9***	***2***		***1***					***1***
Bird Bone Tubes	3.0-10.4	6	1	3	1	1			
Flakers	9.0-17.5	10		2	3	1	1	1	2
Beamers	5-15.0	6			2	2		1	1
Antler Wrench	20.0	1				1			
Scapula Saws	***7-9.3***	***2***					***1***		*1*
Scraper	10.4	1	1						
Whalebone Club	35.0	1				1			
Whalebone Wedges	7-21.5	10		1	3	4	1		1
Antler Wedges	7-18.5	7	1		1	2	1	1	1
Pointed Bone	***9.5***	***1***							***1***
Cut Bird Bone		1		1					
Cut Mammal Bone		6	1	1		2		1	1

Table 7: Shell Artifacts from the Stoneware Site (Mrn-307)

Artifacts			Depth in Inches from Surface						
	Size in cm	Total	0-6	6-12	12-18	18-24	24-30	30-36	36+
Clamshell Disk Beads	0.8-1.2	4		1		3			
Olivella Disk Bead	1.7	1		1					
Spire-Lopped *Olivella*	1.4	1		1					
Haliotis Ornaments*	2.3-3.1	3		2	1				
Clamshell Cylinders*	2.2-4.1	2		1	1				
Cardium Container**	9.3	1				1			

*There are no perforations.
**This is an unworked, large and deep whole shell.

Table 8: Miscellaneous Finds from the Stoneware Site (Mrn-307)

Artifacts		Depth in Inches from Surface							
	Size in cm	Total	0-6	6-12	12-18	18-24	24-30	30-36	36+
Retouched Porcelain Fragment		3.1	1	1					
Bone with Asphaltum	5.5	1	1						
Asphaltum Lump	1.5	1		1					1
Red Ochre Lumps	6.5	1	1						
Rock with Red Ochre Paint		8.5	1			1			
Problematic Stone Objects		10.4	4	1		3			

Obsidian was the material of choice for points; only four of the illustrated examples are of other materials (Figure 3AA, black flint; 3Q, green chert; 3L, 3Z, gray chert). The obsidian presumably came from the inland sources near Napa, and most of the points must have come to the site in finished form since only a couple of dozen pieces of chipping waste were found in the excavation. However, these latter indicate some working and re-working of stone artifacts, and flakers are present in the site.

Late Central California sites from the interior are marked by a profusion of points similar to these but often characterized by extremely fine workmanship, regular form, and delicate chipping. In comparison, the assemblage from the Stoneware Site is, on the whole, rather crude and shows little refinement. There is a hint here of a marginal and impoverished group compared to the more prosperous centers of Late Central California culture.

Other artifacts related to hunting include a whale bone club (Figure 8G) and a variety of simple scrapers (Figure 9N-S) presumably used in the preparation of animal skins (a number of bone beamers were also used in this activity (Figure 6C-E). A perforated shaft wrench (Figure 7Q) of antler is an artifact type not previously recorded from this region, although widely known in California. Some ten flaking tools of bone and antler (Figure 6G; Figure 7N-P) attest to stone chipping, although the points of obsidian apparently came to the site in finished form. However, points and other artifacts of chert may have been produced at the site from locally available stone.

Fishing

Little artifactual evidence of fishing is present. There are three sinkers, one a grooved stone and the others small notched beach cobbles. There is no artifact evidence for the relative abundance of crabs, and I do not know how these were obtained. Some sort of basketry crab trap seems likely. It may also be suggested that the Limantour Estero is an ideal location for a fishing weir, for virtually the whole estuary becomes a mud flat at low tide. However, we have no evidence that such a fishing method was used and the early explorers make no mention of it.

Besides, if weirs were used it would be expected that the site would contain much more evidence of fish.

Houses and Domestic Furnishings

Direct archaeological evidence of houses was limited to the fire hearths previously discussed. We must rely on the statements of the early explorers for house descriptions, which indicate that the basic p1t house of Central California was used.

Domestic implements presumably used by the women include grinding tools (mortars and pestles, Table 5, Figure 9M), and many bone awls primarily used for basket making (Table 6, Figure 5, Figure 6). As a group, the awls are relatively small and finely pointed suggesting finely woven kinds of baskets-typical of Central California. Fragments of carbonized basketry have been recovered elsewhere in Marin and Contra Costa Counties, but none was found at the Stoneware Site.

Two scapula saws, made of notched deer scapulae, were also found (Table 6). Although these artifacts are common in late and protohistoric sites in Central California, they are not described in the ethnographic record. Several speculations have been made about their function, but their use remains uncertain.

Tools probably used for woodworking include fist-sized hammerstones (Table 4), and a number of wedges of elk antler and whalebone (Table 6, Figure 8). There is no timber in the vicinity of the site, and these tools were presumably used on driftwood, including redwood logs and other wood washed up on the beach. A few nondescript drills or reamers may also have been used in manufacture of wooden objects (Table 6), although no wooden objects survive in the site.

Nonutilitarian Objects

Few ornaments were found at the Stoneware Site but there is a considerable variety (Table 7, Figure 9). The presence of shell and bone beads is characteristic of the region, particularly the clamshell disk beads, still manufactured and used by the Pomo to the north, and important both as ornaments and a medium of exchange in the ethnohistory of Central California. The paucity of such items in a near-total excavation of the site is a reflection of the small population and relative poverty of the inhabitants of the site.

Two birdbone whistles were also found (Figure 7A, B). These are universal artifacts in later sites in Central California. These, along with drums and rattles, are the only musical instruments used aboriginally. The whistles have been used down to contemporary times in ritual dances and ceremonies.

A most important Central California artifact is the charmstone, known from ethnohistoric formation to have served a variety of religious and magical purposes. The Stoneware Site yielded seven examples (Table 5, Figure 4). No two are alike, although they fall within the generally known pattern of Late Central California charmstones. Most of these charmstone forms have been collected in recent times from the Pomo.

While there is no cultural stratigraphy at the Stoneware Site, and its occupation was all in protohistoric times, a couple of the artifacts may be items of older age that were collected and used by the Indians. These include half of a brown flint crescent, completely out of the pattern for the site in both material and workmanship. Such artifacts are associated with PaleoIndian occupations in the West, and they are most common in the Great Basin. There is also a large concave-based point or Icnive (Figure 3BB), much like specimens associated with Middle Central California sites. Points like this have been found on the beach adjacent to the nearby Estero Site, and they may well be older artifact forms which were picked up by recent Indians, in the same way that they scavenged the beaches for the Chinese porcelain fragments.

Conclusion

The total collection from the Stoneware Site is one of simplicity, if not poverty, compared to many contemporaneous sites of Central California. In part, this is because the site is not a major village but a satellite

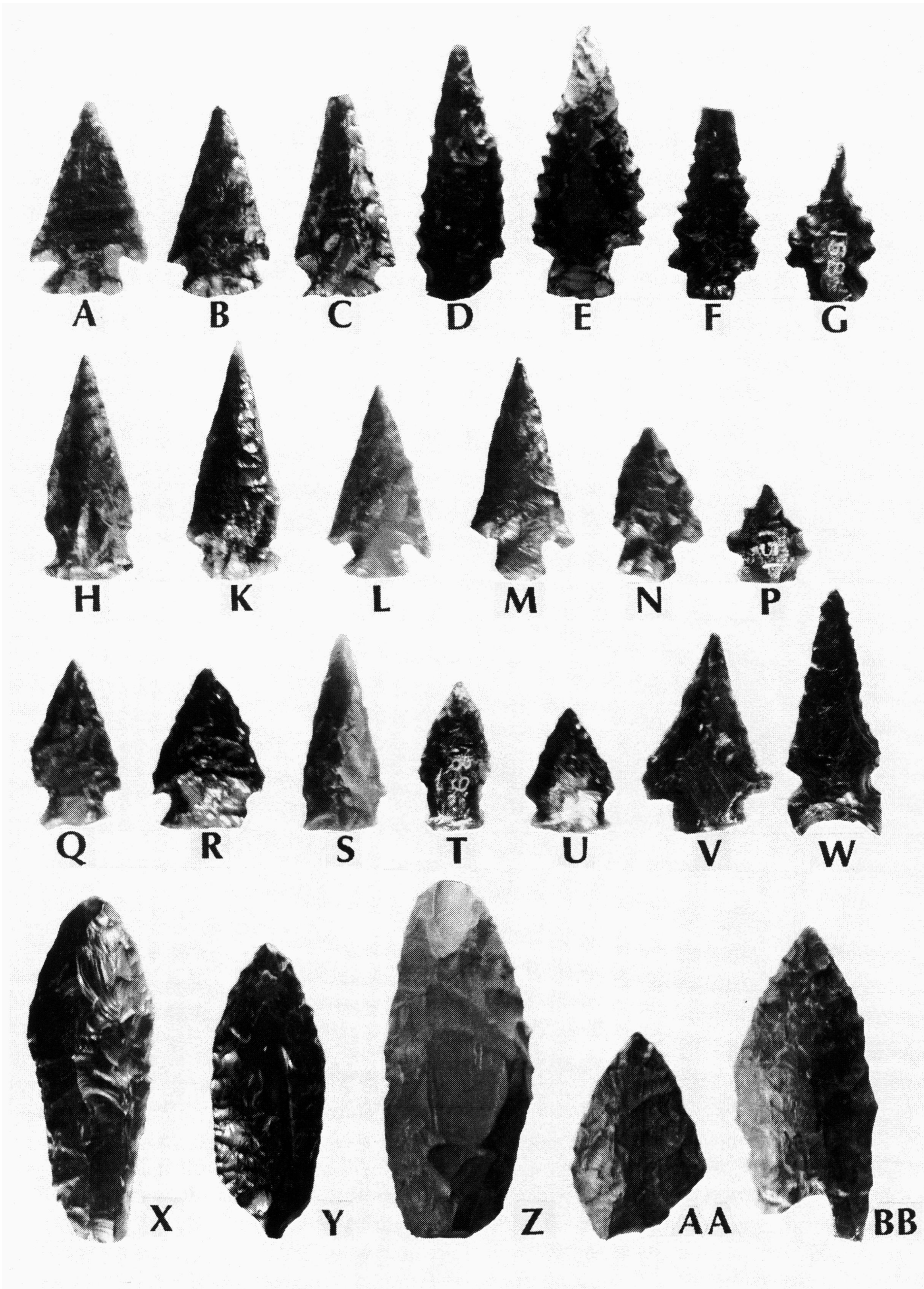


Figure 3: Stone points from the Stoneware Site (Mrn-307). Length of P is 1.3 cm; all others to same scale. Type 1: A-C, H-V. Type 1a: D-G. Type 2: W. Type 3: Z. Type 4: Y. Type 5: X. Type 6: BB.

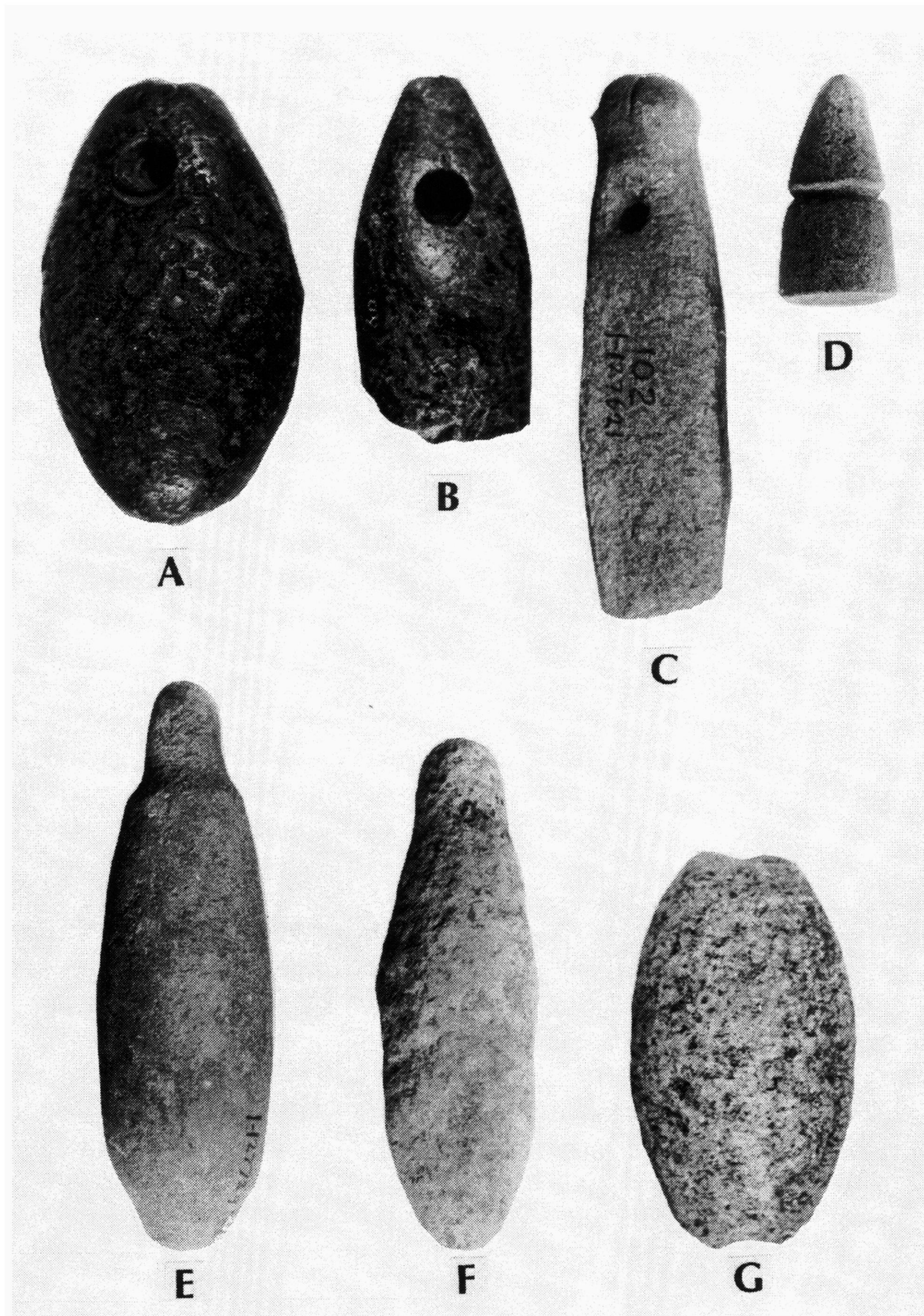


Figure 4: Ground stone artifacts from the Stoneware Site (Mrn-307). Charmstones: A-F. Grooved Sinker: G. Length of D is 4.5cm; all others to same scale. Sinker: Type 1 (phallic): C, Type 2: A, Type 3: B, Type 4: E (F may be unfinished example of the same type), Type 5: D (this may be a fragment of a larger specimen, but it is ground flat on the bottom and appears complete).

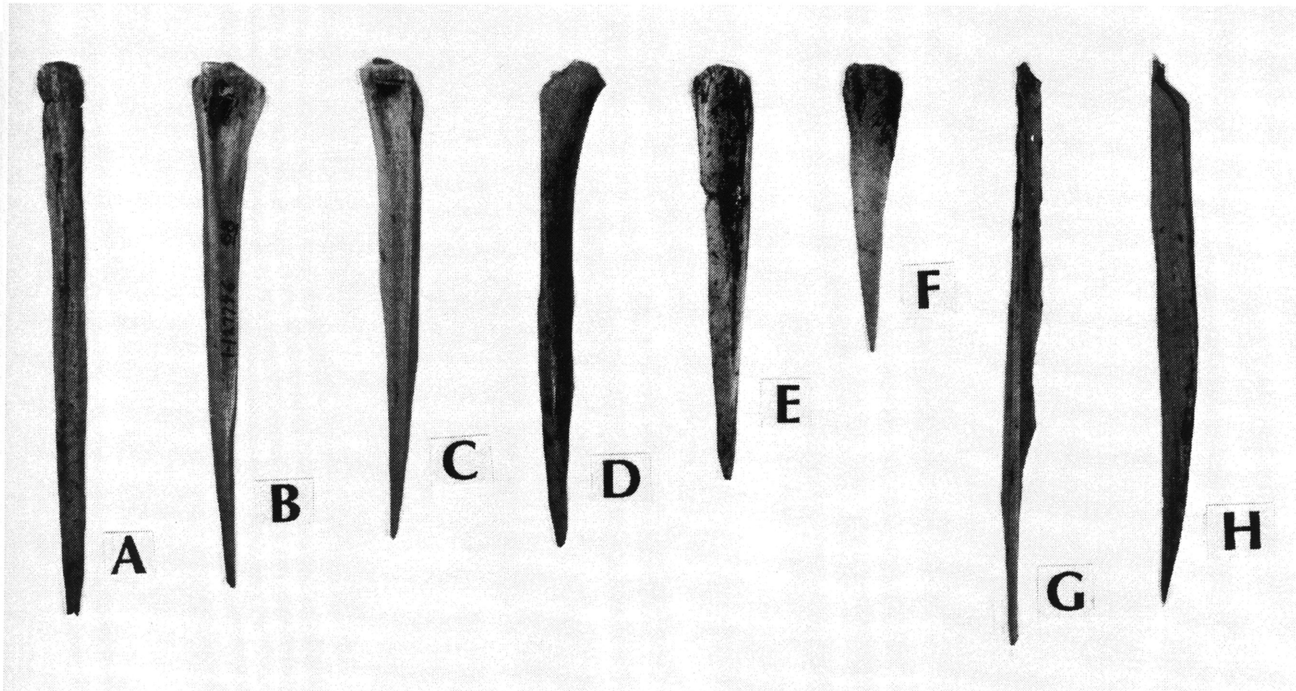


Figure 5: Bone awls from the Stoneware Site (Mrn-307). Length of A is 12 cm; all others to same scale. Type 1: A-F (quartered deer cannon bones), Type 4: G-H (mammal bone splinters).

of larger communities nearby. It is also because a major part of the culture history of Central California has depended upon mortuary offerings, of which there are none at the Stoneware Site, the collections all being derived from objects lost or discarded in midden refuse. Even so, the Drakes Bay region does not show the relative security and prosperity of other hunter-gatherers seen in the archaeological record, and it must be concluded that Drakes Bay was marginal and peripheral to the centers of cultural development of the time (as indeed it is today). On the other hand, the protohistoric Coast Miwok of the Stoneware Site shared the major features of the cultures of their area.

Isolated and marginal as Drakes Bay was, and with no knowledge of any humans other than those adjacent to them, it must have been a shattering experience for these simple people when the European ships of the 16th century suddenly appeared, bearing people who were as alien as men from Mars so far as the aboriginal world view was concerned. These contacts and their implications are discussed elsewhere (Meighan, 1981). The Drake voyagers were clearly

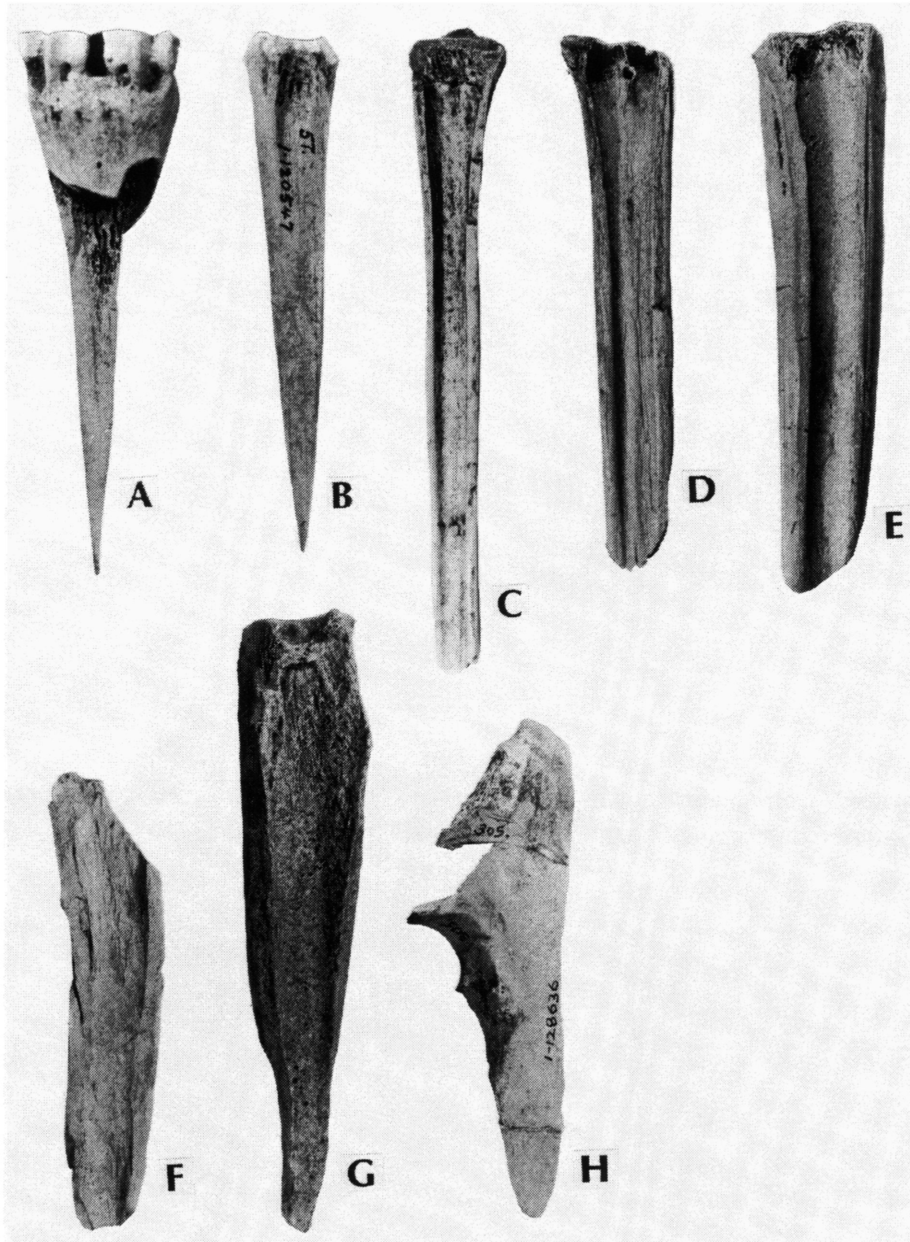


Figure 6: Bone artifacts from the Stoneware Site (Mrn-307). Length of C is 15 cm; all others to same scale. Awls, Type 2: B (split deer cannon bones); Type 3: A (deer cannon bone). Beamers: C-E (mammal bones with polished ends, believed to be used in softening animal skins). Bone scraper: F. Flakers: G-H.

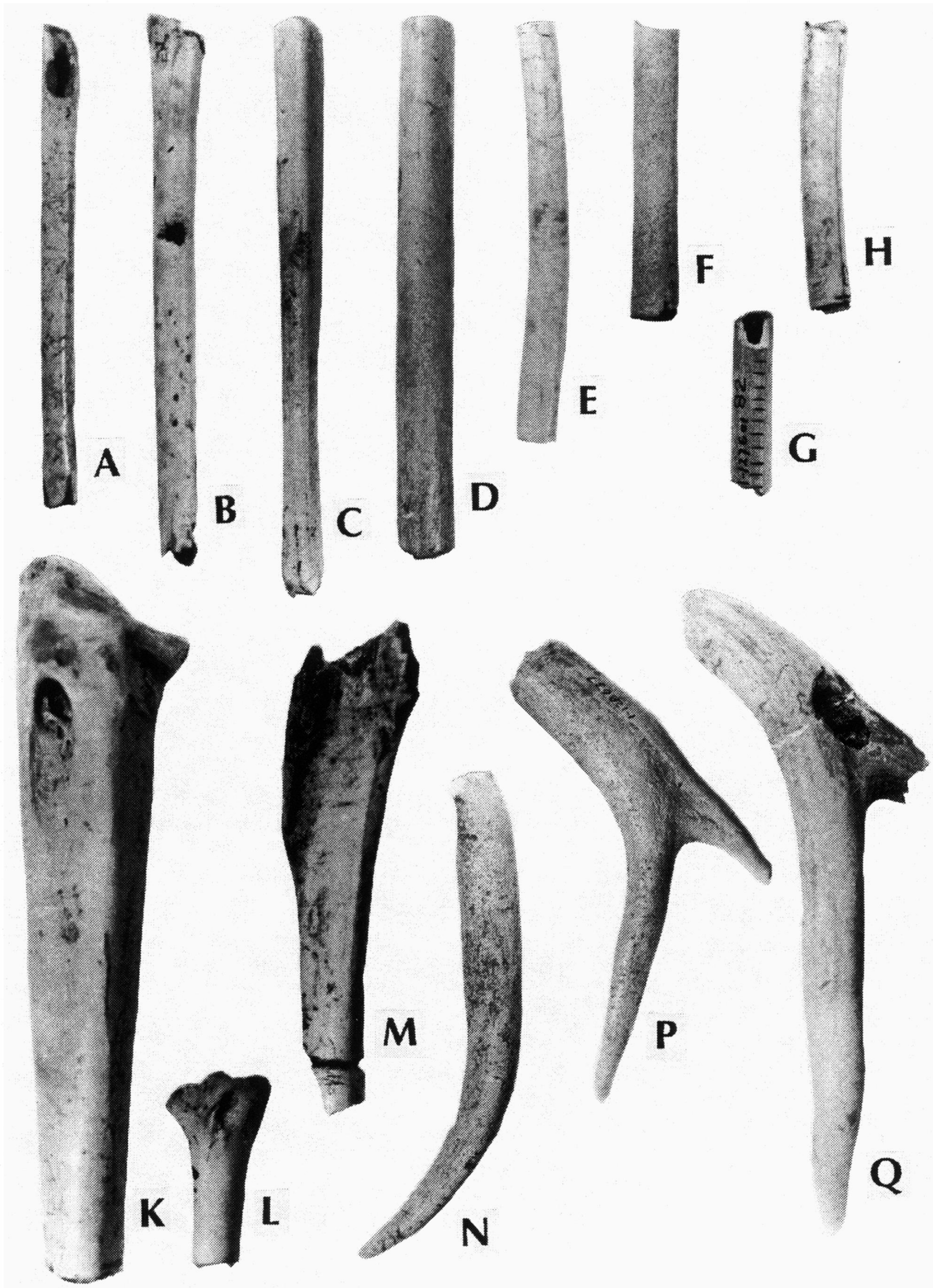


Figure 7: Bone and antler artifacts from the Stoneware Site (Mrn-307). Length of B is 9.9 cm; A-M to same scale. Length of Q is 20 cm; N-Q to same scale. Bird bone whistles: A-B. Bone tubes: C-G (g has incised decoration). Cut-off articular ends of bird bones: K-M. Deer antler flakes: N-P. Antler Shaft Wrench: Q.

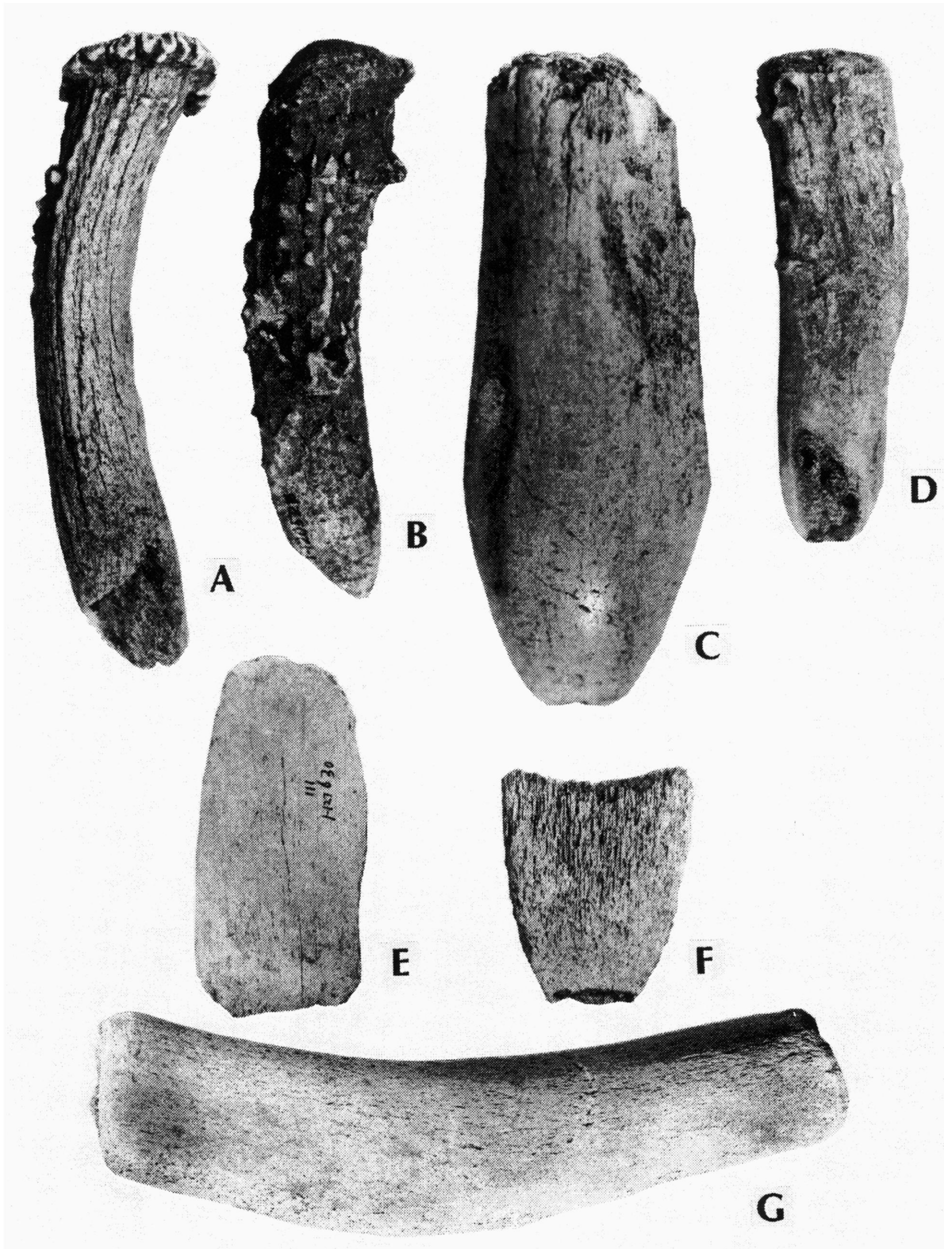


Figure 8: Antler and whalebone artifacts from the Stoneware Site (Mrn-307). Length of A is 18.5 cm; A-F to same scale. Length of G is 35.0 cm. Deer antler wedges: A-C. Whalebone wedges: E-F. Whalebone club: G

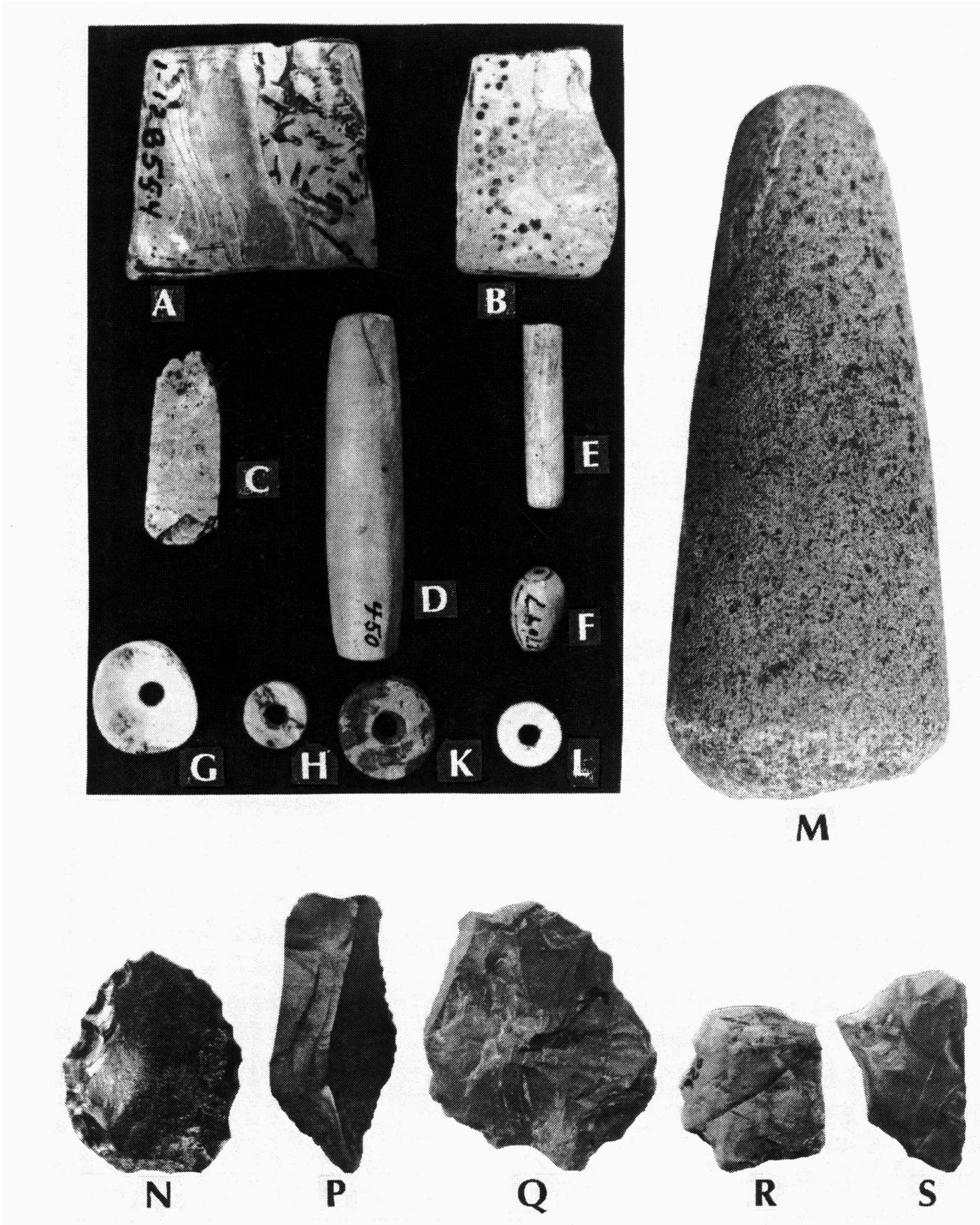


Figure 9: Miscellaneous artifacts from the Stoneware Site (Mrn-307). Upper left: shell artifacts. Length of D is 4.1 cm; all others to same scale. Shell artifacts: A-L, cut pieces of *Haliotis*: A-B, pendant shaped piece of *Haliotis*: C (may have had a perforation, but upper portion is missing), cylinders of clamshell: D-E (no perforations), *Olivella* spire-lopped bead: F, *Olivella* disk bead: G, clamshell disk beads: H-L. Upper right: conical stone pestle: M (length is 17.3cm). Bottom: Stone scrapers: Type 1: P, Type 1a: Q, Type 2:R-S, Type 3:N.

seen by the Indians as people returned from the dead, but this cataclysmic experience was not apparent when Cermeho appeared 16 years later, by which time the all-too-human qualities of Europeans had been recognized by the natives.

There are no museum treasures in the Stoneware Site, and little that would be of interest to collectors. The site is relatively unimportant compared to the larger and more informative sites reported for the West Coast. However, the site is of great value to the history and ethnohistory of California, and it typifies the value of careful and complete analysis of small sites to regional and temporal understanding. Very few accurately dated historic sites of the 16th century are known on the West Coast of the United States, and the association of this site with famous explorers, both Spanish and English, gives it a particular interest. The direct evidence recovered in our archaeological study amplifies the accounts of the 16th century voyagers. The evidence is also of value adding an early perspective on the little known Coast Miwok, who had largely disappeared by the time California became part of the United States.

Acknowledgements

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[This is a somewhat revised version of the 1952 article above, with new illustrations and appendix material. "The Plate of Brass" also reprints key articles on the Drake Plate].

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AN INTERMEDIATE HORIZON SITE ON THE PALOS VERDES PENINSULA

Eleanor H. Bates

The Palos Verdes Peninsula, a hilly extension of the Los Angeles Basin jutting into the Pacific Ocean, has attracted settlers since early prehistoric times. Environmental resources, from the inland to the seaward side, offered both an abundance and a diversity of foods and raw materials, thus providing incentive for aboriginal habitation. The greatest limitations were availability of fresh water, a scarcity of wood for fires or shelters, and an absence of acorn-bearing oak trees, source of California Indians' staple food.

Archaeological sites attesting to the former presence of native peoples were once numerous on the Peninsula. The sites were of two main kinds — habitation and quarry workshops. The latter were situated close to outcroppings or deposits of material used in the manufacture of stone tools. Living sites tended to be located towards the edges of broad, marine terraces, along coastal bluffs or near canyons where water might be found. It is not possible, today, to estimate how many prehistoric sites once existed on the peninsula, but it can be safely said that they numbered in the scores, if not hundreds. Some 70 were recorded during an investigation conducted during the early 1960s (Figure 1) (Bates 1963: Map 1).

Although the date of earliest occupation of the peninsula has not been precisely determined, there are indications of a long, and presumably, continued habitation beginning perhaps eight thousand years ago (Wallace 1994:2). Throughout this long time span prehistoric peoples lived on a technologically simple level and were dependent for their livelihood upon foods and raw materials, which could be gathered, ready-made from nature. Certain minor modifications in subsistence patterns, which produced changes in the frequency of use of artifact forms, took place. These changes provide a basis for developing a local chronology (Wallace 1994) and for correlating it with the fourfold sequence established for the Southern California coastal region (Wallace 1955).

Lunada Bay Archaeological Sites

Five habitation sites were situated along the bluff that rises approximately one hundred feet above Lunada Bay. The existence of prehistoric dwelling places at this locality had been noted by N. C. Nelson as long ago as 1912 and again in the 1930s by Dr. F. H. Racer and Richard Van Valkenburgh. Although artifacts had been collected from their surfaces, as far as is known, no excavating was done at any of the five sites.

The Lunada Bay shoreline offered certain attractions to a native people, including easy access to a wide inlet with one of the few sandy beaches along this stretch of the coast. Wave-washed rock formations provided a habitat for mollusks and offshore kelp beds harbored a variety of fish.

In 1961, when it was learned that the land was to be leveled for a housing subdivision, the Department of Anthropology at the University of Southern California requested permission to conduct an archaeological investigation. The developers granted the request with a stipulation that the archaeological work should not interfere with construction activities. Archaeological and earth-moving work began and continued simultaneously.

The entire bluff was first searched and a test pit dug at one of the sites in an area destined to be radically altered by bulldozing. Here, occupational debris proved to be largely confined to the surface. It was decided to concentrate efforts at the largest of the village sites (designated as PV 8).

The site lay at the base of a 175-foot-high rocky knoll (Figure 2). Cultural debris consisting of marine shells, pieces of chert and fragmentary stone implements extended outward from the base of the knoll over a gently sloping area, measuring 225 x 390 feet. The land had long been cultivated and was planted to barley when the excavation began.

A 50-foot-long, five-foot-wide trench was dug from the base of the rocky knoll toward the ocean (Figure 3). Two additional side units were added to form a U-shaped excavation. A total of 21 five-by-five pits were excavated. A second trench, consisting of five 5 x 5 foot squares, was laid out to the north and west in order to sample the site's northern periphery.

A volunteer crew, averaging six to eight members, began excavating on July 12 and continued to work daily until August 7, 1961. In all 142+ person days were devoted to the digging. The soil was troweled in six-inch levels to sterile soil or rock and sifted through a quarter-inch mesh screen. In places where the soil became too compact for troweling it was loosened with ice picks.

The archaeological deposit consisted of a heavy, dark gray to black adobe soil containing an abundance of marine shells and pieces of chert, as well as a scattering of artifacts. A humus line resulting from continued cultivation extended six to eight inches below the surface. In the U-shaped trench, the midden deposit varied in depth from 22-54 inches, shallower (10-18 inches) in several of the five-foot excavation units. As the digging proceeded downward, the soil became lime impregnated and more compacted. It was underlain by a rough-surfaced layer of limestone. At the northwest corner, the limestone formation gave way to a fine-grained, brownish clay loam. In the shorter trench the archaeological deposit proved to be much the same, attaining a depth of 21-43 inches.

Artifacts

A total of 470 artifacts (including fragments) were recovered. They consist largely of utilitarian stone tools that, generally speaking, lack complex workmanship. Locally available materials went into their manufacture. Bone and shell artifacts were few in number.

The pecking and grinding process shaped the greater numbers of artifacts. Two complete milling stones were found on the surface. Both are slightly basined sandstone slabs, covered with a calcareous deposit. The larger of the two is 50.8 cm long, 25.8 cm wide, 13.5 cm thick and weighs 54 pounds. The other is about half the size and weighs only 10.25 pounds. Three fragments, one picked up from the surface, are also of sandstone.

Handstones form the largest group of artifacts (Figure 4). Of 90 recovered, 68 have two grinding surfaces; the remaining 22 show evidence of use on only one side. Most specimens are of sandstone, but there are a few of granite, basalt and mudstone. Three are pitted on their grinding surfaces and eight show evidence of secondary use as hammers. Two of the unifacial handstones are pitted. Some of the handstones are fire-blackened; others are covered with a calcareous deposit. All are of a size easily manipulated with one hand. They range in length from 9.4-14.0 cm, in width 6.4-11.1 cm and 2.3-5.6 cm in thickness.

The 24 mortars, complete and fragmentary, are bowl-shaped, thick-walled with shallow cavities. Either hard sandstone or sandstone conglomerate rounded beach stones were selected for their manufacture. Exteriors of the vessels appear to have been pecked and ground and their grinding cavities worn smooth. Rims are rounded. The mortars stand 7.8-9.7 cm high with maximum diameters of 6.9-9.5 cm and depths between 7.8 and 9.7 cm.

Five complete and six broken pestles of sandstone or mudstone are in the collection. Two of the whole pestles are shaped, conical in form with rounded working ends. One is highly polished with somewhat flattened sides (Figure 5). The largest of the two measures 20.5 cm in length and 8.7 cm in diameter. The second is smaller with dimensions of 16.4 cm and 7.2 cm. Two fragments are parts of similarly shaped pestles.

Three whole and four broken pestles are natural cobbles of suitable size and form, put to use without shaping. One of the complete specimens has a pit pecked into one side and gives signs of having been employed as a hammer.

A half dozen more stone objects were fashioned by pecking and/or grinding. One is a square mudstone bead with cut and ground edges and a hole drilled through its center. The bead measures 1.0 x 1.0 cm and is 2 mm thick. The remaining specimens are of uncertain purpose. Most unusual is a fair-sized (66 x 66 x 5 mm) actinolite cobble with a groove passing completely around it. Traces of asphalt can be detected in the 4 mm wide, 3 mm deep groove. A thin oval-shaped mudstone pebble also has an encircling groove and an elongated piece of steatite has two such. A portion of a red siltstone disk and a piece of steatite with lines scratched into the surface complete the inventory of pecked ground artifacts.

Chipped stone artifacts are relatively plentiful in the Lunada Bay assemblage. The material most commonly used in their manufacture was cherty-shale, obtainable from outcroppings along the bluff. Chert and chalcedony, both available on the Palos Verdes peninsula, were occasionally utilized. One specimen appears to be of green jade, a stone once found along local beaches.

Eight complete (or nearly so) projectile points and three fragments were found. Their size and weight suggests that they tipped darts rather than arrows. Workmanship appears to be of rather poor quality, but this may be due to the nature of the material, rather than to lack of stone-chipping skill.

The projectile points form a heterogeneous group, with five types represented (Figure 6):

1. Leaf-shaped, rounded base—one, nearly complete, three fragments, cherty shale, length (projected) 50 mm, and width 23 mm.
2. Triangular, straight base—one, cherty shale 39 mm x 26 mm x 6 mm.
3. Triangular, concave base—one, green jade (?), 57 mm x 21 mm x 6 mm, exceptionally fine workmanship.
4. Triangular, long tapering stem—two, one chert and one chalcedony. 37 x 21 x 6 mm, 35 x 18 x 7 mm.
5. Triangular, side-notched, concave base—two, one cherty shale, one chalcedony, 43 x 20 x 8 mm.
6. Unclassifiable fragments—two, cherty shale.

Fifty-seven large, heavy and roughly worked cherty-shale blades, some obviously unfinished, are roughly leaf-shaped (Figure 7). However, they exhibit some variations in form. Five complete specimens and five fragments are quite narrow. They range in length from 71-80 mm, 23-29 mm in width and 9-13 mm in thickness. Broader blades, three whole and 13 broken have lengths of 86-90 mm, widths of 38-44 mm and thickness of 7-15 mm. One leaf-shaped fragment has a concave base, another a straight base, a third exhibits incurving sides. A unique triangular chalcedony blade, broken and then resharpened has a pointed base. Twenty-eight blade pieces cannot be classified as to original forms.

Numerous chert, cherty-shale, or chalcedony flakes of various shapes and sizes that could have functioned as scraping tools were turned up by the digging. One long edge on 33 of them was sharpened by removing flakes from one side, an additional 49 sharp-edged pieces were put to use without previous modification. Fairly thick (14-21 mm) flakes struck off from hard-textured beach cobbles also served as scrapers. Several have been sharpened from one or both sides along one border. There are four core scrapers—chert nodules flaked from both surfaces around three-fourths of their perimeters. The smallest measures 65 mm x 41 mm x 14 mm; the largest 76 mm x 61 mm x 21 mm.

Drills consist of thick triangular pieces of chert, chipped along their edges. Twelve of the tools, ten lacking their tips, were found. Tips, where present, are blunt and show considerable wear. Two complete drills are 38 mm and 37 mm long.

Chopping tools were produced from tough-textured cobbles (Figure 8). The great majority of the thirty-six found are cobbles split across the short axis and then trimmed from one side so as to give a sharp chopping edge. A few are made from large, thick cobble flakes.

Fifty smooth, unworked beach cobbles, mostly oval, with one or more battered ends, obviously served as hammerstones. Eleven similar cobbles have shallow depressions pecked into one or both surfaces for better grasping. Ten more hammers are split across the short axis of the stone and exhibit heavy battering. Three of the thirteen are made from handstones. The pounding tools are all of a size to be easily manipulated with one hand.

The remaining twelve stone items are modified only by use. Peck marks and/or scarring on flat surfaces of eight sandstone or mudstone slabs suggest that they saw service as anvils. Two sandstone pieces and one of slate, each with two worn and smoothed surfaces, appear to be hones for fashioning, sharpening or polishing objects. An elongated piece of sandstone, rubbed flat on one surface and battered at one end, may well be a combination tool for both polishing and pecking.

The Lunada Bay archaeological deposit was very poorly supplied with bone artifacts, yielding only three. Two are slender, smoothed-edged pieces, possibly parts of awls. The third is a section of a round, polished rod.

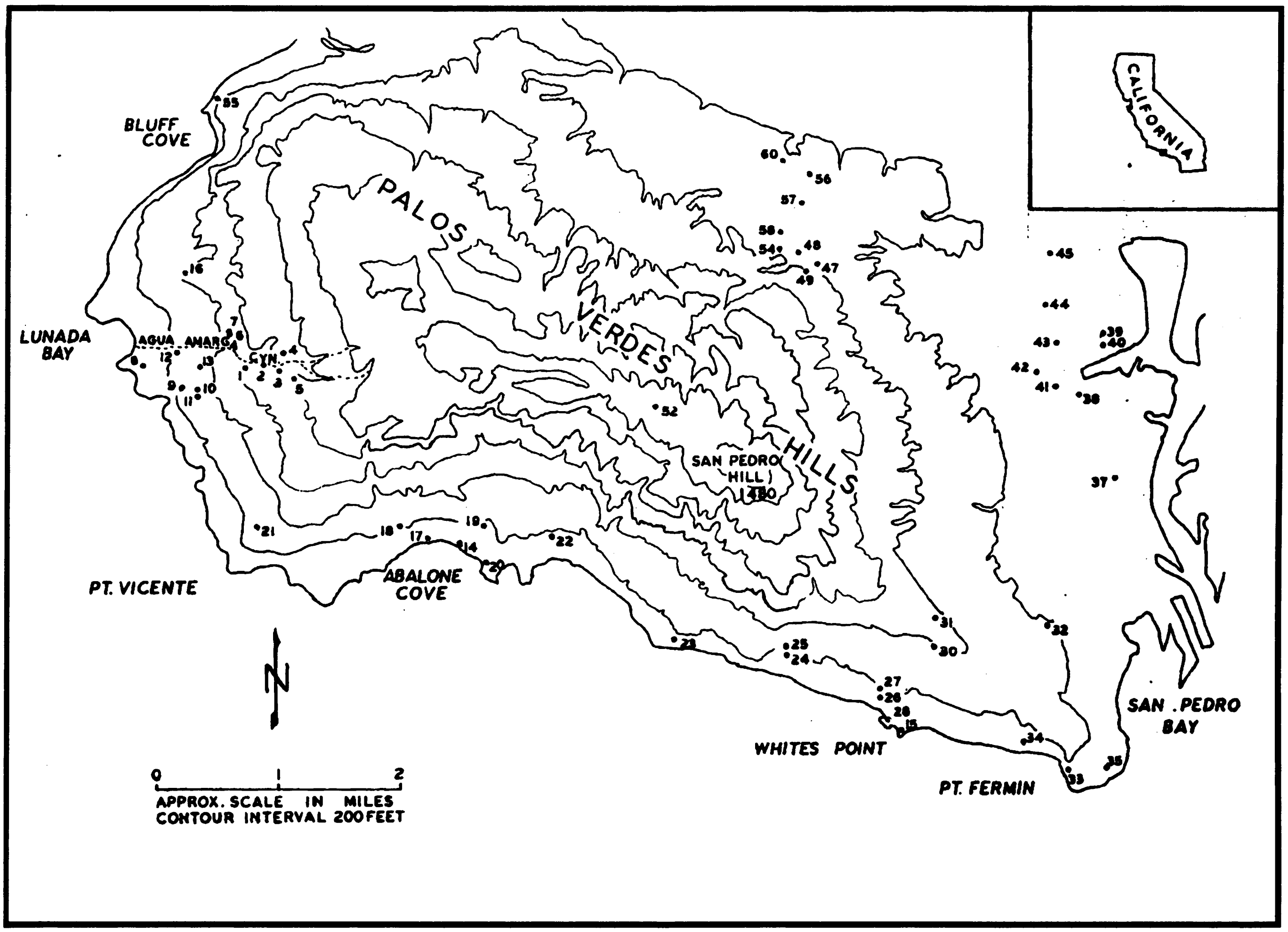

Figure 1: Map of the Palos Verdes Sites

Figure 2: Site

Figure 3: Trench at the Palos Verdes Site

Figure 4: Handstones from the Palos Verdes Site

Figure 5: Pestles from the Palos Verdes Site

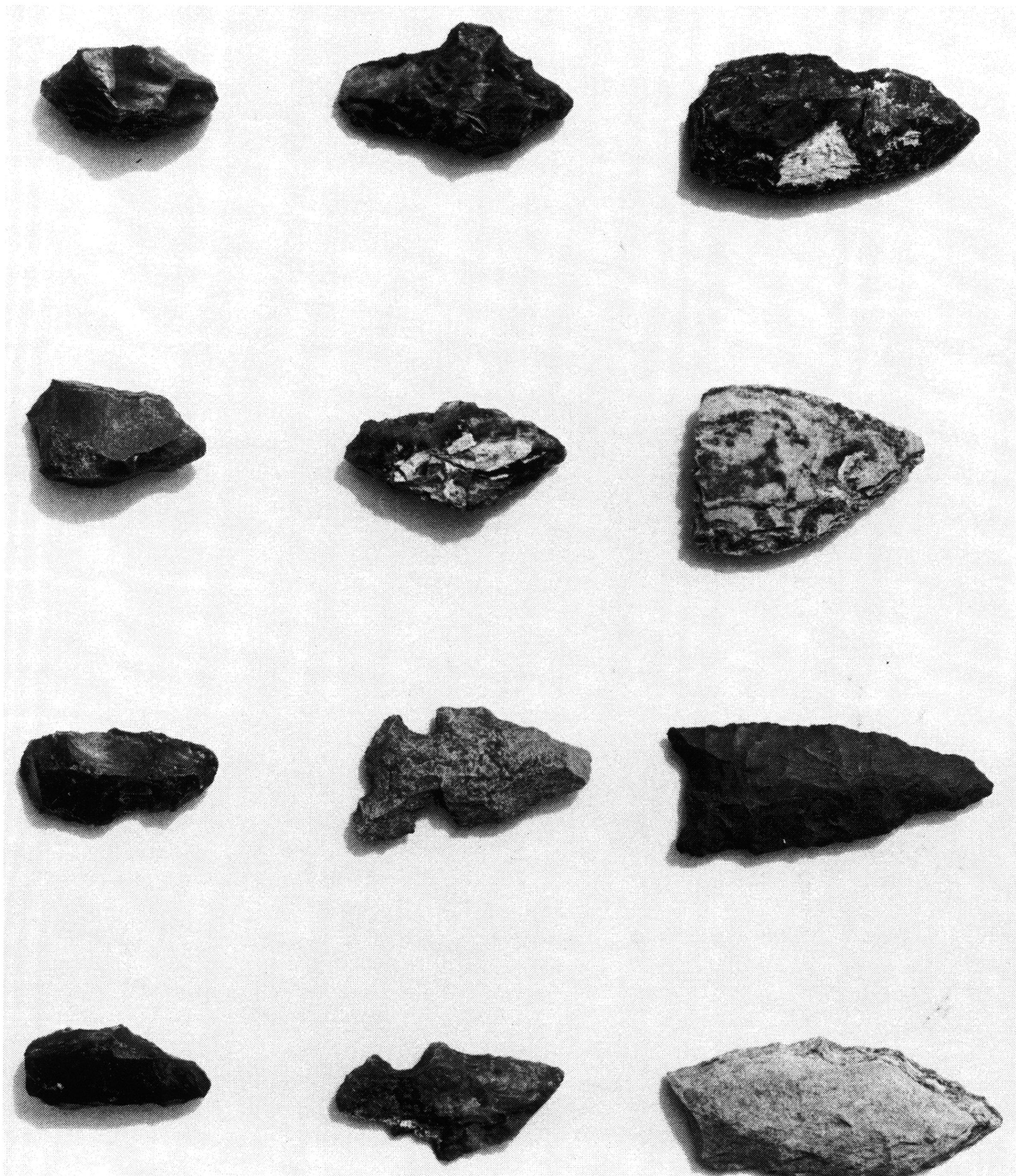

Figure 6: Projectile Points from the Palos Verdes Site

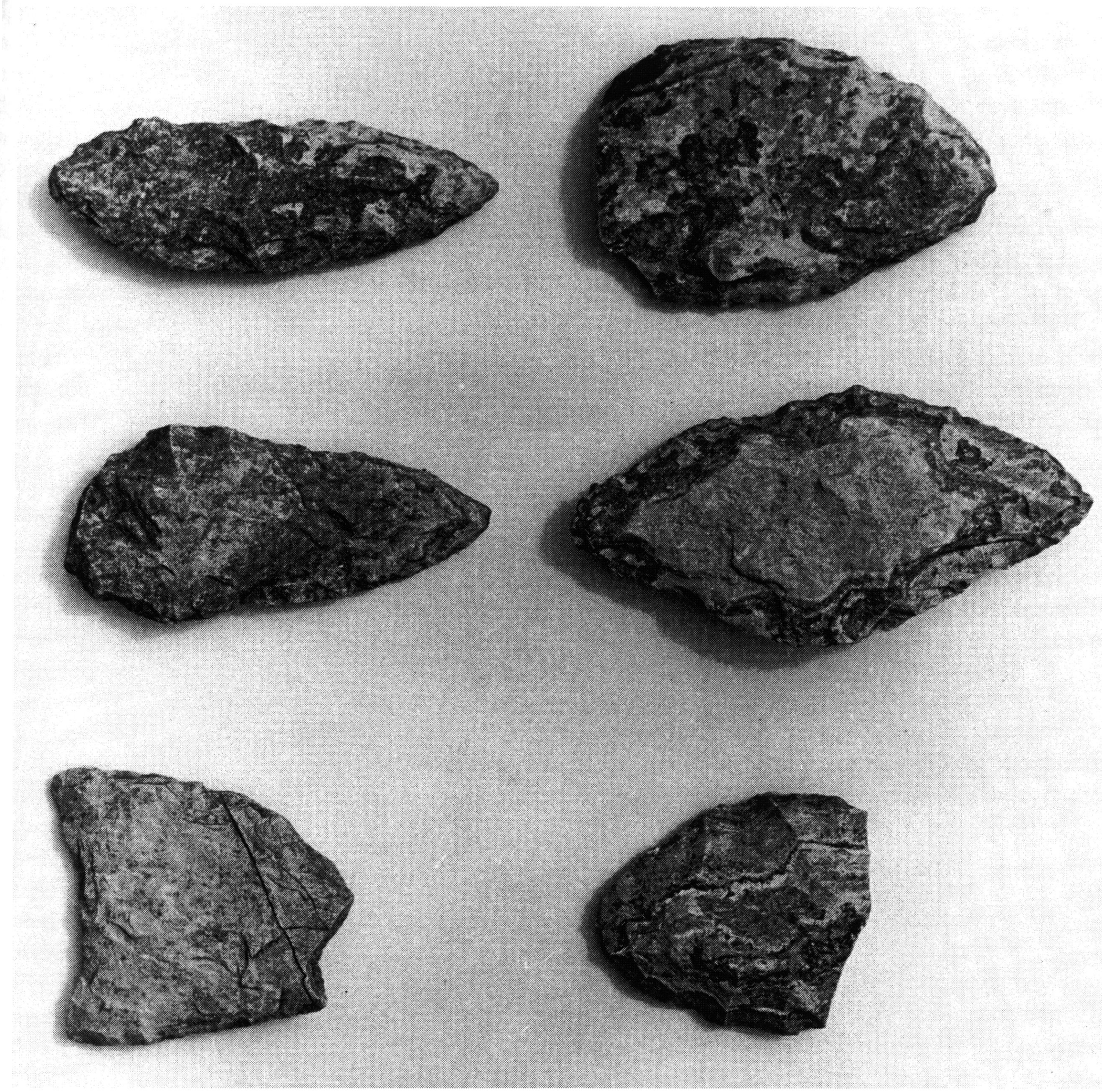

Figure 7: Blades from the Palos Verdes Site

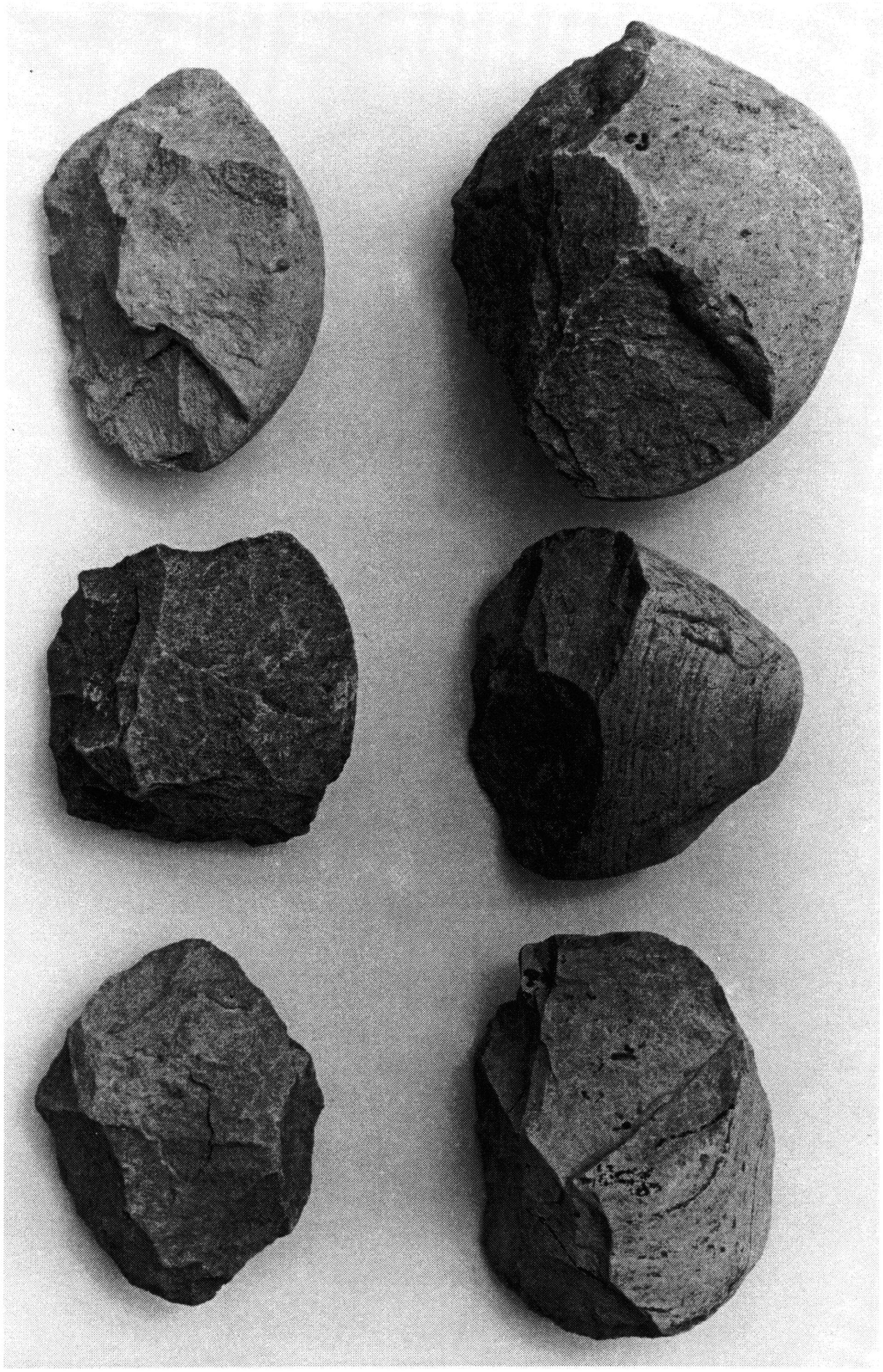

Figure 8: Choppers from the Palos Verdes Site

Shell items were also few in number, with two *Olivella* beads and nine cut fragments making up the total. One bead is spire-lopped and ground almost down to the main whorl; the other is a disk, 18 mm in diameter, with a central perforation drilled from one surface. Eight of the nine cut pieces are from abalone shells; one is of mussel. Two of the abalone pieces appear to be parts of ornaments broken during manufacture. The edges on one are serrated and another has a hole bored through it. The remaining seven cut pieces are probably waste fragments.

While not classed as artifacts, mention should be made here of pigments and asphalt. Specks of pigment, apparently coloring matter, occurred throughout the deposit. Hematite, in shades from orange to deep red, was most common and dotted a mudstone slab. Asphalt coated one surface of an irregular piece of slate and one of a sandstone cobble.

Food Remains

Shellfish remains formed an important constituent of all levels of the archaeological deposit, though there was some decline in quantity as the bottom of the midden was approached. Shells of the California Mussel, Black Abalone and Speckled Top Shell appeared most consistently in all levels.

Other species represented included:

Native Oyster	Scaly Worm Shell
Speckled Pecten	Owl Limpet
Branch-ribbed Mussel	Wavy Turban Shell
Forty-ribbed Heart Clam	Pink Abalone
Giant Keyhole Limpet	Pismo Clam
Volcano Keyhole Limpet	Smooth Cockle
Banded Cockle	California Cone
Cooper's Tower Shell	Mossy Chiton
Festive Rock Shell	Horn of Plenty
Poulson's Rock Shell	Netted Button Shell
Rock-Dwelling Thais	Seaweed Limpet
Nut-brown Cowry	Showy Chiton

Most numerous in the scanty aggregation of fish remains are those of the Pacific Sheepshead. There are also some Rockfish, shark (species unidentifiable) and eel (probably Moray) bones.

Although by no means plentiful, small fragments of mammal and bird bone, many calcined, were scattered throughout the deposit. Identifiable are those of the California mule deer and sea otter.

Summary and Conclusion

Information gained from the archaeological investigation points to occupation of the Lunada Bay site by a relatively small group of people who followed a simple food-gathering way of life. The abundance of shellfish remains in the midden implies that they depended heavily on collecting shellfish for subsistence. Numerous stone implements suited for processing wild plant foods suggests that they also drew extensively upon local grasses and herbs for food. That hunting and fishing played a lesser role in their food-getting activities is shown by the scarcity of fish, bird and mammal bones in the midden.

Depth of the archaeological deposit suggests occupation over a fairly extended period of time. Quite likely the site saw year-round habitation, perhaps with short forays away from the village to harvest wild crops or to hunt.

Most of the Lunada Bay villagers' equipment consisted of utilitarian, technologically simple stone implements, manufactured from local, easily accessible stone materials. Surprisingly few bone tools seems to have been made and used. Ornamental or other non-utilitarian items of stone or shell were only occasionally made.

No major cultural changes appear to have taken place during the period of occupation. The only possible exception is an increasing use of mortars and pestles as time passed. The greater numbers of these implements were either surface finds or came from upper levels of the midden (Table 1).

No information on disposal of the dead was obtained. Considering the amount of grading and earthmoving that went on at Lunada Bay, it seems probable that if burials existed in the area they would have been uncovered. Given the compact, dense nature of the abode soil, interment of corpses may have been done elsewhere in sandy or light soil where the digging of graves would have been less laborious.

Chronological placement of the Lunada Bay site presents some difficulties, since it shares characteristics of two of the prehistoric periods (Milling Stone and Intermediate) recognized for the southern California coastal district (Wallace 1955). The prominence of the millingstone-handstone complex and scarcity

Table 1: Depth Distribution of Artifacts

Class of Artifact				*Depth in Inches*							
	0	0-6	6-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54	54-60
Milling Stone	1				1		1				
Manos	26	6	3	12	12	8	3		2		
Mortars	14			2							
Pestles	4										
Projectile Points	2		1	6		1	1				
Blades	21	3	7	7	3	7	2	1	2	1	1
Scrapers	27	14	15	9	5	5	5	3	2		
Drills	7	3	1				1				
Choppers	28	5	6	4	3	4	2				
Hammers	29	3	7	9	3	3	5				
Hones				2	1						
Anvils	2					1					
Stone Beads				1	1						
Grooved Stone	1										
Shell Beads						1					
Worked Shells				2	3	3		2			
Bone			1		1	1					

of bone, shell and steatite artifacts are traits shared with the Milling Stone stage. However, none of the large, deep-basined mills typical of the time period are in the collection, and there is a greater abundance and variety of chipped stone implements. Conforming more to the Intermediate period are traits such as greater use of mortars and pestles, an abundance and diversity of chipped stone artifacts and a mode of subsistence more dependent upon shellfish gathering. The weight of the archaeological evidence seems to demonstrate that native occupation of the Lunada Bay village site occurred during the Intermediate period (tentatively dated between 2000 B.C. and A.D. 500), perhaps early on when a shift was being made from an essentially wild-plant-gathering mode of subsistence to one more solidly based upon shellfish collecting.

Several other Palos Verdes Peninsula prehistoric sites have been assigned to the Intermediate period: a quarry-workshop in Rolling hills (Cooley 1982), a village site at Rancho Palos Verdes (Hector and Rosen 1980) and another on the western slope above San Pedro harbor (Butler 1974). The latter was inhabited from Milling Stone to Late times. Native peoples also lived at the nearby, long-occupied and culturally-stratified Malaga Cove Site at this time (Walker 1952). Farther afield, the Little Harbor Site on Catalina, the basal levels of which were radiocarbon dated at 3880 +/-25 B.P., has been assigned to the Intermediate era (Meighan 1959). The Little Harbor excavation produced a much richer and diversified assemblage of artifacts. Conspicuous differences between Little Harbor from Lunada Bay include a much higher proportion of projectile points to blades, a wider array of bone tools and many more animal food remains.

Aboriginal occupation at Lunada Bay evidently ceased prior to the beginning of the last prehistoric phase, for no typical Late period artifacts such as small projectile points, abalone shell fishhooks, and cooking vessels fashioned from Catalina steatite were recovered. What drew people away from their attractive living place and why it was never reoccupied is by no means clear.

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EXCAVATIONS AT AN ARCHAEOLOGICAL SITE NEAR LIVERMORE, CALIFORNIA

Donald F. McGeein

Archaeological investigations in interior Alameda County have been relatively few in number and limited in scope. Consequently, knowledge of the region's prehistoric human past remains extremely limited. Some useful information on the nature of aboriginal usage of this little-known section of California was obtained from excavations conducted at the McCoy Site (CA-Ala-28) in the 1950s.

So-named because it occupied a portion of a ranch owned by James McCoy, the archaeological site is located about four and one-half miles southeast of Livermore. It is not in the Livermore Valley proper but lies at the base of adjoining hills at an elevation of approximately 725 feet above sea level. Originally designated as Arroyo Mocho 4, the site was recorded by Donald W. Lathrap and Michael Harner while carrying on a surface survey of the Livermore area for the University of California Archaeological Survey in 1950. Excavation was undertaken in 1955-56 at the suggestion of Alfred Elsasser, then archaeologist for the survey.

The McCoy Site

Covering an area of about 105 x 308 feet, the McCoy Site lies atop a flat, gravel stream terrace, eight to ten feet above the bottom of Arroyo Mocho, a wet-weather stream that flows northwesterly out of the hills to become lost in a shallow lake or swamp near Pleasanton (Thompson and West 1978:17).

Though slightly higher near its center than at the borders, the site can hardly be called a mound. Nine shallow (10-18 inch-deep) depressions, tentatively identified as house pits dot its surface. Short grasses of several kinds cover most of the ground, with a small grove of oaks at the southern end. Buckeyes, toyon and a few oaks grow along the stream's banks; willows, sycamores, and brush line its bed.

Excavations

Investigations at the McCoy Site began on October 22, 1955 and continued each weekend (unless interrupted by rain) until March 18, 1956. A second season of work commenced on November 10, 1956 and lasted until April 7, 1957. The crew consisted of the writer and his brother, Douglas J. McGeein.

Before any excavating took place, the entire site plus a fair-sized section beyond its boundaries was mapped and laid out in five-foot squares (Map 1). A block of 25 five-foot units at the center (which included a supposed house pit) was initially explored (Map 2). A different strategy was followed during the second season. Two parallel rows of eleven squares, each spaced ten feet apart, across the long axis were explored. Four additional units were excavated so as to include a second assumed house pit. Soil in each square was removed in arbitrary six-inch levels. The digging was done with trowel and shovel. Occasionally a pick or geological hammer was needed to loosen a patch of hardened earth.

Gray-brown in color, the occupational layer contained fire-cracked rock, ash, charcoal, and other domestic debris intermixed with stream ten-ace gravel and water worn stones. The deposit proved to be relatively shallow; ranging from 12 to slightly over 34 inches in depth. Generally it was quite compact, particularly near the surface. Rodent burrows honeycombed the soil.

Artifacts

Considering the amount of earth removed (approximately 96.5 cubic yards), the artifact yield was very small. Only 53 specimens, three of them surface finds, were recovered in the first season. The second season's digging proved more productive, producing 85 objects. Though neither abundant nor spectacular, the artifacts are quite diverse and provide a good sampling of the kinds of things made and used by McCoy's aboriginal inhabitants.

Bone tools make up a surprisingly high proportion of the finds. Predominant are awls, represented by 4 intact and 18 fragmentary specimens. Apparently all manufactured from deer leg bones, the tools exhibit well-smoothed and well-polished surfaces.

One whole awl consists of a deer cannon bone with a split head. It is 117 mm long. The other three are splinter awls, fashioned from pieces of deer leg bone. They vary in length from 53 to 107.5 mm. Among the 18 fragments are a cannon bone awl lacking its handle, one handle end and 13 central or edge pieces.

A deer metatarsal worked to a sharp point may also have seen service as an awl. Less likely is a sharpened piece from a fairly large mammal bone. With a length of only 53 mm., it seems much too short to have functioned effectively as an awl.

Four deer or elk bone tools with blunt rounded ends appear to have been awls put to secondary use after their sharp points had become dulled or broken away. They could have functioned as gouges, smoothers or flakers (Gifford 1940:170-171, 207). A coyote (?) carpal or metapodial ground to a blunt point may also have served one of these purposes.

One more or less complete and four broken tools are made from deer shoulder blades. Often called "scapula saws," each has one notched or toothed edge. The proximal end of the bone evidently served as a handle. The nearly whole specimen is 167 mm long and 34 mm wide. Scapula tools of this sort have been variously identified as saws, fleshers, bark-shredders or grass-cutters (Bennyhoff 1953:268-269; Fredrickson 1968:48; Gifford 1940:172).

A few artifacts manufactured from bird bone are among the finds. Included is a single-holed whistle, with both ends snapped off, leaving them ragged and unfinished. Not far from the middle is 2 by 3 mm notch. No plug of asphalt or pitch was found inside. Fashioned from the ulna of a small bird, the whistle is 44.2 mm long and 9 mm in diameter. A second whistle, broken across at the stop, is made from a larger, sturdier (7.2 mm diameter) bird bone.

Both ends of a long (107 mm) bird bone tube have been cut and smoothed. Striations, apparently from a scraping tool, appear on all surfaces. Two short (20-23 mm) tubular sections of a wing bone are probably beads or bead "blanks." Several worked scraps of bird bone are apparently manufacturing waste.

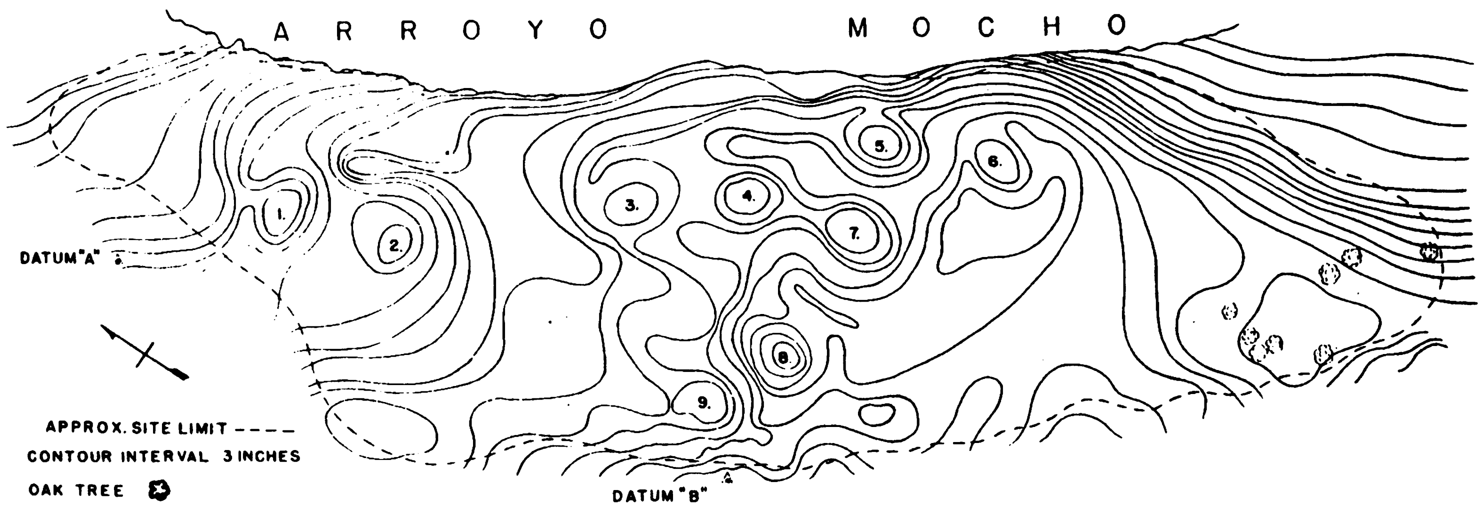
Stone implements for processing acorns and other plant foods are well represented among the finds. Generally speaking, these are simple in design with little care lavished on them. Eight flat sandstone slabs with small, shallow grinding cavities at the center are probably hopper mortars, though no signs of an adhesive for attachment of the basketry hopper can be detected around any of the cavities. None of the grinding holes appear to have been purposely pecked. Rather, they seem to have developed from pounding with a stone pestle. These mortars vary considerably in form and size. Evidently any suitable flattened slab was picked up and put to use.

Bowl-like mortars are represented by two wall pieces. The first is from a fairly large vessel made from a stream boulder. No effort seems to have been made to alter the boulder's surface. A section of the wall of what may have been a shaped mortar shows pecking scars and smoothing on the outside surface.

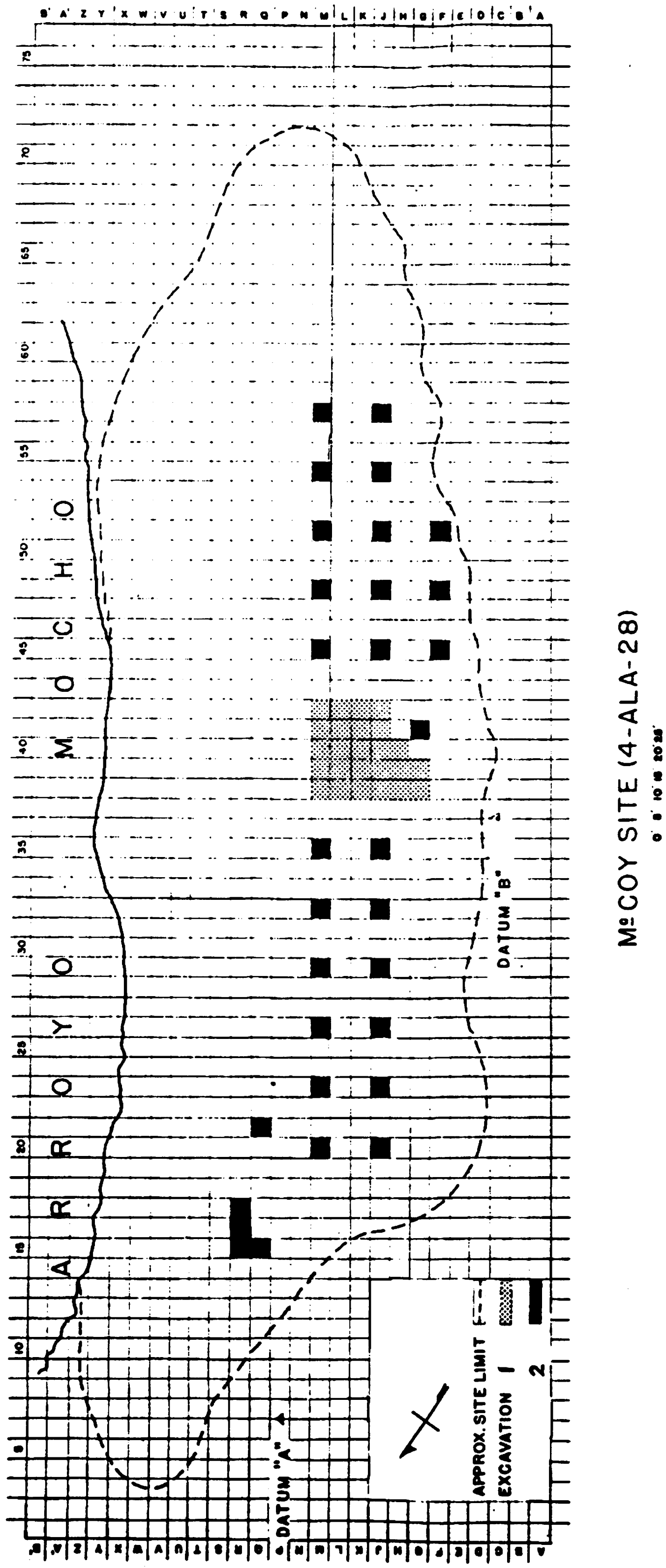
Twenty-six pieces of a large, well-shaped mortar of gray, vesicular basalt were found together. Most of the pieces are reddish-brown from exposure to fire. A partial reconstruction indicates that the vessel was flat-bottomed, with sloping sides and presumably flattened rim. Quite large, it must have stood about 31 cm high and had a top diameter of around 39 cm. In all likelihood, this fine mortar served a special purpose. In form and size, it is like ceremonial stone vessels in which coastal California native peoples crushed and steeped jimsonweed roots to produce a strong hallucinogenic drink administered to boys during a puberty rite (Kroeber 1925:668-673).

Four whole and seventeen fragmentary pestles were found. Three basic types are recognizable. Most common, with nine examples, are water worn cobbles with a few peck marks visible on their sides. Eight pieces are parts of shaped pestles with parallel sides and grinding surfaces at both ends. The third type, with four examples, is long and tapered with its greatest diameter at the base. Grinding surfaces on almost all of the implements are tabular. Tough fine-grained sandstone cobbles were most often selected for pestles. Four are of a hard microcrystalline rock. The whole pestles have lengths of 227 to 290 mm.

One complete handstone and a part of a possible second incomplete specimen are among the finds. Slightly "out of round," the intact specimen varies in diameter from 73.5 to 83 mm and has a thickness of 45.5 mm. A broken stream cobble shows wear on one flat surface, possibly resulting from rubbing back



Map 1: McCoy Site (4-ALA-28)



Map 2: McCoy Site (4-ALA-28)

and forth on a mill. Both specimens are of sandstone. A roughly rectangular slab of tough, fine-grained sandstone, broken in half, may well be an incipient millingstone. A natural shallow depression covers most of one surface. Batter marks at both ends and along the sides suggests that the slab was being shaped when it broke in half. A triangular section from near one end of a chunk of sandstone is slightly worn from usage. However, its small size (ca. 95 mm across) argues against its being part of a millingstone.

Chipped stone artifacts are relatively few in number. Nine of the fourteen recovered are projectile points of a size and weight that suggests they once tipped arrows. Seven of them have straight or slightly out-curved sides and rounded to straight bases. Deep, squared serrations line the borders of six. Dimensions are: length 30-35 mm, width 12-15 mm, and thickness 3-5 mm. Two other small points are corner-notched with short, narrow stems. Somewhat smaller than the others, they are 21 and 24 mm in length and 10-15 mm wide.

Nine of the small points are made of obsidian; one is of a material tentatively identified as chalcedony. Chances are that none of them was manufactured at the site, for only ten to twelve tiny waste flakes occurred in the archaeological deposit, and these could easily have resulted from repairing damaged points or resharpening dulled ones.

Considerably larger and thicker is a missile tip fashioned from banded, mottled chert. Rather coarsely flaked, it has corner notches and an expanded, rounded base. With a length of 56 mm, a width of 20 mm and a thickness of 10 mm, the point is of a size suitable for arming a dart or spear.

Two knife blades are in the collection. The first, missing a bit of its tip and base, has nearly straight sides and a slightly rounded base. Of obsidian, the blade is 68.5 mm long, 26 mm wide and 7 mm thick. A shorter knife is made of petrified wood, light buff and white in color. The forepart is well flaked, whereas the remainder is less finished. It can be surmised that this part was inserted in a haft.

A reamer and a possible drill are the only other stone artifacts shaped by chipping. An irregularly shaped obsidian artifact is classified as a "reamer," because it appears to be too dull-and-blunt-pointed to be a drill. It probably was used to ream out or enlarge already drilled holes. Its edges exhibit considerable wear. The specimen is 35.5 mm long, 11.1 mm wide and 6.5 mm thick. Provisionally identified as a drill, an obsidian artifact has a rounded base like the arrowhead and a short, rather dull point. It may well be a broken projectile point converted into a drill.

Eleven stone flakes show "use chipping" along one or more edges, probably from use as scraping tools. The flakes vary considerably in size and thickness, with the largest measuring 53 x 26 x 15 mm; the smallest 21 x 13 x 6 mm. These makeshift tools are of various materials: five are chert, three chalcedony; one each of obsidian, quartzite and petrified wood.

Only three hammerstones were collected. Others possibly went undetected among the many stream cobbles scattered throughout the archaeological deposit. Of dense sandstone, the three hammers are water worn stones with marks of battering (faint on one) at the ends. All three are of a size easily grasped in one hand. The scarcity of hammerstones is puzzling. Normally, simple tools of this sort, utilized in a variety of pounding and abrading tasks, figure prominently in California Indian tool kits.

Five *Olivella* beads, and two of clamshell, were unearthed. Slightly cupped, four of the *Olivella* beads are made from sections cut from the body whorl. Circular and centrally perforated, they are 8-13 mm in diameter. A fifth is spire-lopped, with the upper part of the shell ground down to the main whorl. The two clamshell beads are disks, 3.9 and 5.5 mm in diameter.

Three fragmentary abalone shell pendants were also found. Long and slender, the first is a flat, curved rim piece drilled near its upper end. Enough remains of a second pendant to demonstrate that it had straight sides and a rounded top with a hole bored through near the upper edge. The third specimen consists of a piece of abalone shell bearing a partially drilled hole.

Perhaps intended as an inset, a curved scrap of abalone shell has fine incised lines spaced less than a millimeter apart running across its surface. The only other shell item is a rounded and smoothed bit of freshwater mussel shell that apparently broke while it was shaped into a bead or pendant.

Faunal Remains

Animal bone was by no means plentiful in the archaeological deposit. Most of what was found consisted of splinters or tiny scraps. As a rule, only identifiable pieces were saved. However, to gain a measure of the average amount present, all bits and pieces were gathered from two five-by-five-foot squares. Each yielded enough to fill a teacup. Bones of the following mammals were identified:

Antelope
Deer
Cottontail or Brush Rabbit
Jackrabbit
Badger
Coyote
Wildcat
Ground Squirrel
Pocket Gopher
Mouse

Ground squirrel and gopher bones comprised well over one-third of the total. Undoubtedly, these represent remains of creatures that died in their burrows. Antelope and deer made up 25% of the lot, coyote half as much, and rabbits a little less than 10%. Although parts of at least four coyote skulls were found, the only other body parts were a small fragment of pelvis and possible tibia. The preponderance of skull bones suggests that coyotes were skinned at the kill sites and their pelts with the heads attached carried back to camp.

Scarcely any bird bones were unearthed. The bones resemble those of ducks or small birds, but have not been identified as to species. Rather surprisingly, bones of at least five kinds of fish—Sacramento Sucker, Hardhead, Sacramento Perch, Squawfish and White Sturgeon—were present in the midden. Just where and how McCoy's inhabitants acquired fish is not immediately apparent. Other faunal remains consisted of bits of freshwater mussel shell, two pond turtle bones and a pincer from a small crab.

House Remains

Two of the eight assumed house pits (Numbers 1 and 8) were partially explored. The northern half of House 8 was cleared, exposing a hard surface, judged to be the floor. Encountered 19-20 inches down beneath a layer of sand, gravel, charcoal and occasional scraps of calcined bone, the hardened surface appears to have been developed by tramping. Slightly concave, it measures approximately 21 x 24 feet.

On or near the floor's surface lay a part of a bowl mortar and half of a slab mortar. Remains of cooking and/or heating fires, surrounded by red-brown burned earth, occurred in two places. From all appearances, a 6 inch deep mass of pure white ash was all that was left of a quick-burning fire built directly on the floor. A pit, 16-17 inches deep, was filled with soft, light gray ash mixed with flecks of charcoal and burned gravel. At the almost exact center of the floor was an apparent posthole, 3.5-4.5 inches in diameter. Its depth could not be determined; a midden-filled pit lay just below it.

The pit was filled with soft soil holding a high proportion of ash and charcoal, a few scraps of mammal bone and two or three bits of fishbone. In it lay the obsidian knife blade and large projectile point. Possibly the hole served as a storage pit before being filled in with fire residue and domestic refuse.

Only a small portion of House 1 was investigated. Oval in outline and rather steeply basined, the depression measured 16 x 35 feet. Evidently the structure that once stood above had not been lived in long enough for a solid floor to develop. An irregular midden-filled hole, which once held a post, measured eight inches across and extended 14-15 inches downward. Fires had been built in a shallow pit. Several artifacts occurred within the house area. Included were two clamshell beads, a bone awl, a bone tube and two arrow points.

Three spots where the cooking fires had been built outside of the house depressions were exposed. None constituted a formal, rock-encircled fireplace. Six to eight inches below the surface, a huge lens of fire-cracked rock, gravel, charcoal and ash covered the southeast corner of the area excavated during the first season.

Human Remains

Two graves were uncovered during the first season's digging and one more in the second season. All three contained skeletal remains of infants, who died at birth or shortly thereafter. Their bodies apparently were interred with little ceremony and no accompanying offerings.

Burial 1

Scattered infant bones, including the frontal bone, a humerus, a portion of a vertebra and a scapula lay scattered over several square feet at a depth of 20-23 inches below the surface. Evidently burrowing rodents had pushed about the remains.

Burial 2

A complete infant skeleton, lying on its left side in a moderately tight-flexed position with the skull orientated to the north, rested in a grave some 32 inches below ground level. Directly over the skull lay a 35 x 24 inch triangular piece of stone.

Burial 3

Dispersed bones of a third infant lay on gravel, 35 inches down in the deposit. A tibia, radius (?), scapula, rib fragment, a toe or finger bone and a few skull fragments were present. Rodent action again appears to have been the cause of the skeleton's disarrangement.

Isolated Bones

Isolated bones of at least two more infants were found. Included were a tibia, a radius and a tiny rib. It is noteworthy that all the skeletal remains are those of infants.

Concluding Remarks

A few general conclusions about the McCoy Site and the nature of its usage by its onetime inhabitants can be drawn from the archaeological evidence gathered during two seasons of digging. The shallowness of the occupational deposit combined with an overall paucity of artifacts implies transient residence rather than year-round settlement. Quite likely, the locality served as a seasonal camping place, returned to, if not yearly, at least fairly frequently. It is likely that small groups of people came here when the acorn crop was ready for harvesting. At least four species of acorn-bearing oaks grow in the vicinity, assuring a plentiful supply of this dietary staple. Projectile points, along with a scattering of animal bones, indicate that some hunting took place. The site's residents either went on fishing expeditions or obtained fish through trade. The seasonal occupants of the site came lightly burdened and improvised many of the implements at the site.

All things considered, there is good reason to suppose that the McCoy Site was occupied rather late in the prehistoric period. In its essentials, the cultural assemblage resembles that characteristic of the San Francisco Bay area Late Horizon (Beardsley 1948:16-20), generally assumed to have begun around A.D. 500, possibly a century or two earlier (Moratto 1984: Figure 5.7).

A number of cultural traits are shared with the Alamo Site in nearby Contra Costa County, which is assigned to this time span (Fredrickson 1968). Held in common are:

1. Obsidian arrowpoints with deep angular serrations
2. Sandstone slab (hopper) mortars
3. Scapula saws
4. Numerous bone awls
5. Cupped *Olivella* beads
6. Clamshell disk beads
7. Few millingstone and handstones
8. Few hammerstones
9. Burned flat-bottomed mortars

The Alamo assemblage is richer in content than McCoy's, implying more intensive occupation. Since linguistic evidence suggests that Costanoan-speakers entered the San Francisco Bay region around A.D. 500 (Levy 1978:486), it seems probable that McCoy's seasonal visitors spoke a Costanoan language. They may well have been members of the Leucha tribelet, which held the land southeast of Livermore, including Arroyo Mocho (Milliken 1994:172).

Missionization of the local Indians may well have brought seasonal stays at McCoy to an end. Baptismal records show that Leuchas went to Mission Santa Clara in 1806 and 1807; a smaller number were baptized at Mission San Jose in the same two-year period (Milliken 1994:172).

Note

This is a condensed, revised version of two reports (one for each season of digging) prepared by the writer and his brother. Copies of the two are on file at the Archaeological Research Facility, University of California Berkeley, California State Department of Parks and Recreation in Sacramento and at Livermore Heritage Museum. The artifact collection is housed in the Phoebe A. Hearst Museum of Anthropology in Berkeley.

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CALIFORNIA PALAEOINDIANS: LACK OF EVIDENCE, OR EVIDENCE OF A LACK?

Brian D. Dillon

Introduction

For the past decade, under the auspices of the California Department of Forestry and Fire Protection, I have taught archaeology to Registered Professional Foresters. This training is designed to enable these Foresters, already highly skilled at "reading" the landscape, to recognize archaeological sites on timber harvest plans so that such sites may be protected. The instruction includes a discussion of the nature and importance of PalaeoIndian artifacts such as fluted points, and an exhortation to the students to be on the lookout for these earliest indications of human presence in California. One measure of the success of this instruction has been the discovery of fluted, PalaeoIndian, projectile points by such RPFs in parts of California where such artifacts have hitherto been minimally represented. In 1992 and 1993, for example, four previously undocumented California fluted points came to light directly as the result of this CDF training, including the first specimen reported for Tehama County (Dillon and Murphy 1994), the second for Shasta County (Dillon and Riddell 1994) and the second and third for Mendocino County (Dillon and Hamilton 1994).

Like many archaeologists, I never used to think of California as particularly well endowed with PalaeoIndian artifacts, at least by comparison with other parts of North America such as the Great Basin or Southwest. Nevertheless, after a few years spent tracking down sometimes elusive references and persuading amateur archaeologists to "go public" with their finds, I began to realize that fluted points have been found over the length and breadth of California. The present paper attempts to inventory and geographically locate all fluted points so far discovered within California's borders. An ever-growing body of evidence argues for a new appreciation of the PalaeoIndian period in California, contrary to the still-popular notion that the time was one when very few people were present, and these living isolated from each other in very few places. The numbers and broad geographic distribution of the fluted points so far inventoried instead suggest most strongly that PalaeoIndian people were dispersed throughout all the lands within what we know today as California, so much so that a PalaeoIndian cultural horizon can be proposed.

California has the undeserved reputation of being somewhat poor in fluted points and fluted point sites in comparison with other parts of North America (cf: Wormington 1957; Haynes 1964; Willey 1966; Jennings 1968). As late as the 1980's, it was assumed by many archaeologists that fluted points and fluted point sites were more common in the Great Basin, on the High Plains, and in the Southwest, than in California. Unlike these other areas, no C-14 samples dating in the 10,000-12,000 years B.P. range had been directly associated with any California fluted points, and no indisputable stratigraphic associations between such California fluted points and extinct Pleistocene fauna (i.e. the projectile point penetrating the skull, pelvis, vertebra, etc.) had been documented (cf: Wallace 1978).

A common archaeological presumption was that fluted point sites, if not fluted points themselves, were so rare in California as to be best explained in the context of neighboring (and better-studied) areas such as the Southwest or Great Basin where direct associations between fluted points and both extinct animals and C-14 dates have been established for decades. This perception was of course aided and abetted by the continued use of good Southwestern type names such as "Folsom" and "Clovis" as identifiers for the California specimens. One leading California archaeologist (Heizer 1968) even went so far as to argue that fluted points in California arrived without direct human agency. Heizer's scenario was that such specimens could have been imbedded in migratory animals by early Great Basin or Southwestern hunters whose aim was "off", the result being that the wounded animals survived long enough to carry such "non-Californian" artifacts into what is now the Golden State, introducing them into the archaeological record upon their expiration.

The first archaeological evidence of fluted projectile points in California was encountered in the late 1930's at a number of locations, first at Lake Mohave (Campbell et al. 1937:87, 104) and other locations in the southeastern desert portion of the state such as the Owens Valley and Pinto Basin, then shortly afterwards at Borax Lake (Harrington 1938) in the northern coast range. Similarities between these initial finds and the Folsom and Clovis fluted points earlier discovered in the Southwest were immediately recognized. The publication of these first California fluted points prompted the restudy of many collections made earlier in other parts of the state, with the result that a projectile point from the Sacramento Valley, previously unappreciated for what it truly was, was newly revealed as fluted (Heizer 1938). Throughout California a growing number of chipped-stone projectile points (i.e.: Rogers 1939:67-68; Plate 19) and even fluted point sites (Campbell & Campbell 1940) came to be identified with a fluted projectile point tradition of broad geographic distribution that had its area of greatest concentration in New Mexico and Arizona. Interpretations of these early California fluted points stressed their obvious similarities with Clovis and Folsom examples discovered the previous decade in the Southwest and suggested cultural and chronological links with such earlier discoveries.

During the next few decades, the inventory of fluted points from the first few discovery locations steadily increased, with new specimens appearing from Lake Mojave (Simpson 1947) and major investigations at Borax Lake producing the first stratigraphically associated examples (Harrington 1948) and the largest number of fluted points from any single California site. By the late 1960's, however, the PalaeoIndian center of gravity in California began shifting as Lake Tulare (Riddell and Olsen 1969) was found to contain more fluted projectile points, and examples in a greater variety of types, than any other location within the state. New locations such as China Lake (Davis 1974 & 1978) boasting numbers of fluted projectile points, continued to be found, but, the only *bona fide* fluted point site subjected to rigorous excavation remained Borax Lake (Harrington 1948; Meighan and Haynes 1968 and 1970) into the 1980's, when a single, extremely important site in Mono County (Basgall 1988) and a series of sites at Fort Irwin in San Bernardino County (Warren and Phagan 1988) were investigated.

The perception that fluted points in California are scarce and limited in their distribution has persisted despite the efforts of a small group of scholars (Davis & Shutler 1969; Beck 1970; Glennan 1971; Moratto 1984) who have done their best to demonstrate that the artifacts have a much wider distribution than commonly assumed. Davis & Shutler (1969) specify ten California fluted point locations on their map (Figure 1), which I reduce to nine through rejection of their *M-175* site artifact (ibid: Figure 2a-b), as I do not believe this to constitute an intentionally fluted point. Beck (1970) also arrived at a total count of nine California locations from which fluted points had been recovered, while Glennan (1971) again specified nine California fluted point locations, the majority of which coincide with Davis and Shutler's and with Beck's locations. More recently, Moratto (1984: Figure 3.1) locates no fewer than 17 localities in California where fluted points have been found. Obviously, by the mid-1980's, the earlier perception of California fluted points as scarce was coming to be questioned, if only to judge by the broad geographical distribution of the specimens inventoried up to that time. My own inventory (Table 1, Figure 5) expands upon those presented by the scholars noted above, and no doubt will be out of date itself shortly after publication of the present paper. With increasing numbers of fluted points reported from all parts of the state, past impressions about the California PalaeoIndian period now appear to have been formed through a lack of evidence; the numbers and distribution of California fluted points reveals no evidence of a lack.

The California PalaeoIndian Horizon Defined

I believe that enough fluted points and fluted point discovery locations have now been inventoried for a PalaeoIndian Horizon to be proposed for California. However, because different archaeologists might attach different meanings to the notion of a *California PalaeoIndian Horizon*, it seems appropriate at present to define all three terms.

Firstly, the geographical coverage of this inventory is limited to *California* as defined by the state's present political boundaries. These boundaries are, of course, arbitrary and artificial in the context of prehistory. Nevertheless, they have the great benefit of being clearly defined and understood as the same by all present researchers, as opposed to more nebulous and subjective cultural or natural frontiers which fluctuated over time and whose locations are subject to different placement by different students. Obviously, fluted points have been reported from immediately adjacent Oregon, Nevada, and Baja California, sometimes just a few miles "over the line", but such finds are not considered by the present study. Similarly, many if not most archaeologists consider portions of eastern California to belong within the Great Basin cultural province, and parts of northern California to be within the Cascade province; some might argue for the deletion of these areas from the present inventory coverage. Such subdivisions, however, are usually made on the basis of cultural differences established in the ethnographic present, or within comparatively recent prehistoric past. The PalaeoIndian period, 12,000 to 10,000 years ago, to which we presume all specimens inventoried in the present study belonged, probably predates the development of such cultural distinctions, so the admittedly arbitrary modern political boundaries of California are as good as any other criteria for delimiting our study zone.

Secondly, *PalaeoIndian* indicates the earliest New World peoples, recently arrived from northeast Asia via Beringia and Alaska in the terminal Pleistocene, who made and used large, heavy, but most importantly, fluted, projectile points so as to hunt Pleistocene animals now extinct. The PalaeoIndian name was originally proposed more than half a century ago (Roberts 1940) and has been applied to newly discovered sites and isolated finds throughout western North America, including California, ever since. Whether we spell the term "Paleo-Indian" with a single "a" and a hyphen, or "PalaeoIndian" without the hyphen but with a second "a" is of as little importance as whether we spell archaeology the academic way or in bureaucratic fashion with only one "a". What is significant is that our use of the term supports the interpretation that the ancient fluted projectile point making peoples were members of the earliest archaeological culture in California for which we have both acceptable dating and diagnostic artifacts.

For the purposes of the present study, our consideration of PalaeoIndian evidence in California is limited to fluted projectile points alone: these artifacts and the descriptive term are inseparably linked. Fluted projectile points are not only the best diagnostic artifacts of the PalaeoIndian period, but the only ones exclusively limited to that period. Fluted points can neither be confused with accidents of nature nor with chronologically later specimens. There are, of course, other categories of archaeological evidence claimed as PalaeoIndian, osteological as well as tools of stone and of bone, and, in some cases, such evidence may indeed be contemporaneous with fluted projectile points and consequently of PalaeoIndian age. Yet, most such alternative forms of evidence are principally of value because of their associations with better, more diagnostic, PalaeoIndian evidence in the form of fluted points. When found unassociated with fluted points, such alternative forms of evidence can and often do predate (i.e.: paleontological finds of extinct animals) or postdate (human skeletal remains) the fluted points themselves. As such, they are not exclusively diagnostic of the PalaeoIndian period in the same way that fluted points are, and are dismissed from the present study.

Our concentration upon that category of archaeological evidence exclusively associated with PalaeoIndian peoples, fluted projectile points, and avoids the pitfalls encountered by those who abuse the term "PalaeoIndian" as indicating any archaeological site, artifact, or context thought to be "early". In California, use of the "PalaeoIndian" cultural identifier is improper for any and all archaeological contexts lacking fluted points. Ostensibly "early" sites or materials have been shown again and again to also lack PalaeoIndian affinities of any kind. For example, more than twenty years ago Berger (et al. 1971) identified a number of human skeletons from California as "PalaeoIndian" simply because of their putatively early dating, despite a total lack of associated fluted points (and, in some cases,

Table 1: California Fluted Projectile Points

County	#	Location	Reference / Illustration
Alpine	1	Ebbett's Pass	Davis & Schutler 1969: Figure 5B; Moratto 1984: Figure 3.1
Imperial	1	Yuha Desert	Davis, et al. 1980: Figure VII-5
Inyo	1	Owens Valley	Campbell et al. 1937: Plate XLV-a
	11	Owens Lake	Campbell & Campbell 1940:8
	2	Owens Valley	Davis 1963: Figure 1a-b
	1	Death Valley	Wallace 1968
	1	Panamint Dry Lake	Davis & Schutler 1969
	2	Rose Spring/Valley	Yohe 1992: Figure 2; Borden 1971
	6	Little Lake	Warren & Phagan 1988: 22-123
	?	Haiwee Reservoir	?
Kern	1	El Paso Mountains	Glennan 1987a:16
	1	Tehachapi (Willow Spg.)	Glennan 1987b: Figure 2; Beck 1970
	1	CA-Ker-300	Zimmerman, et al. 1989
Kings	269	Lake Tulare (Witt Site)	Riddell & Olsen 1969; Wallace & Riddell 1988, 1991; Hopkins 1991, Personal Communication 1993; Wilke 1991; G. Fenega 1993
Lake	20	Borax Lake (Lak-36)	Harrington 1948: Plates XIIIa-d, XIVa-d, XVa-d, XVIc-d, Figures 21, 22a, 23, 24; Meighan & Haynes 1968, 1970
Lassen	2	Eagle Lake	Riddell, Personal Communication
Mendocino	1	Caspar	Simons, et al. 1985
	2	Eden Valley	Dillion & Hamilton 1994: Figures 2, 3
Merced	1	Wolfsen Md. (Mer-215)	Peak & Weber 1978: 49, Figure 24a
Modoc	1	Mammoth Springs	Howe 1979: Figure 12
Mono	7	Komodo Site	Basgall 1988: Figure 2
Napa	1	CA-Napa-131	Meighan 1953: Plates A, C-30
Orange	?	?	Wallace, Personal Communication
Plumas	1	Big Meadows	Kowta 1988: Map 3
Riverside	1	Pinto Basin	Campbell & Campbell 1935: Plate 14e; Campbell et al. 1937: Plate XLVb

County	#	Location	Reference / Illustration
San Bernardino	1	Lake Mojave	Campbell et al. 1937: Plate XLVc, Lie
	1	Lake Mojave	Rogers 1939: Figure 19d; Davis & Shutler 1969: Figure 3b-c
	1	Lake Mojave	Simpson 1947; Beck 1970
	1	Fossil Spring (M-57)	Rogers 1939: Plate 19e; Brott 1966:170; Davis & Shutler 1969
	15	China Lake	Davis & Panlaqui 1978:48-51, Figures 29b-c,e-g, 30b-f,h, 31a,d-f
	1	Pilot Knob Valley	Campbell et al. 1937: Plate XLVc; Glennan 1987a:14-15
	1	Tietfort Basin (M-130)	Brott 1966:170; Davis & Shutler 1969: Fig. 3f; Sutton & Wilke 1984
	2	CA-Sbr-5250	Jenkins 1985; Warren and Phagan 1988: Figure 1f
	3	Bow Willow (4952-4502)	Skinner 1984; Warren & Phagan 1988: Figure 1a,c
	3	Henwood Site (4966)	Warren & Phagan 1988:123, Figure 1b,d
	?	Searles Lake	Moratto 1984: Figure 3.1
San Diego	1	Cuyamaca Mountains	Davis & Shutler 169: Figure 3a; Moratto 1984: Figure 3.1
San Joaquin	1	Tracy Lake	Heizer 1938: Figure 1; Beck 1970; Moratto 1984: Figure 3.1
Santa Barbara	1	CA-Sba-1951	Erlandson, Cooley & Carrico 1987
Shasta	1	Samuel Creek	Treganza 1964; Beck 1970; Kowta 1988
	1	Hat Creek	Dillon & Riddell 1994: Figure 2
Siskiyou	1	Sconchin Butte	Moratto 1984:87, Figure 3.1
Sonoma	1	Hidden Valley	Graham 1951: Figure 1a
Tehama	1	Thomas Creek	Dillion & Murphy 1994: Figures 2, 3
Tulare	19	Lake Tulare (Trico Site)	Hopkins 1993: Figure 1

Total Counties: 23
Total Specimens: 390*
Total Location: 42*

* Confirmed localities only.

diagnostic artifacts of any kind). Later, more careful chronometric reanalysis of these same skeletal specimens (Taylor, et al. 1985) led to their reclassification as comparatively recent in age, and revealed just how inappropriate their earlier labeling as "PalaeoIndian" was. Similarly, the recent "PalaeoIndian" connection claimed for some expressions of California rock art, unassociated with any fluted projectile points and dated by still-experimental chronometric methods, also seems quite premature. The position of this writer is that if it is (fluted) "pointless", it might be PalaeoIndian, but then again, if might not.

Denying the existence of a Pre-projectile Point or Early Man period (cf: Graham and Heizer 1967) leaves the first, or initial, period of human occupation in California contemporaneous with the various PalaeoIndian cultures called *Clovis, Folsom, Llano,* or the *Big Game Hunting Tradition* in other parts of North America (cf: Haynes 1964; Willey 1966; Jennings 1968). Most archaeologists, myself included, would probably accept a chronological position for California fluted points on the order of 10,000 to 12,000 years B.P. through cross-dating with better established sequences. Willig and Aikens (1988:9) provide the most up-to-date summary of radiocarbon age determinations for fluted projectile point sites in the far west, incorporating seven dates from California, Oregon, Utah, Idaho, and Nevada ranging from 11,950 to 11,200 years before present. Lacking convincing evidence to the contrary, we accept this chronometric evidence as representative of the earliest cultural baseline for California and the Great Basin, if not for the Western United States as a whole.

Because of incautious use of the PalaeoIndian term or, perhaps, dislike for "Clovis" and "Folsom" labels with their undeniably Southwestern geographic associations, some archaeologists (cf: Elston 1982:192; Jennings, 1986:115) prefer to instead refer to the earliest prehistoric period of human occupation in the western Great Basin, including California, by the clumsy and somewhat artificial term "Pre-Archaic". Moratto (1984), on the other hand, uses the much more accurate designation "Western Fluted Point Tradition", which has the happy facility of eliminating probably early but nevertheless non-fluted projectile points from being inserted into the PalaeoIndian category. Wallace (personal communication) has suggested that the Folsom and Clovis labels for most fluted point finds in California are inappropriate, stressing that these names tend to suggest a southwestern cultural connection which is yet to be proven, and may not exist at all. Alternatively, Meighan (personal communication) reminds us that both terms are so well imbedded in the literature and so well recognized as valid types, that eliminating them might cause more confusion than it would correct. Referring to the archaeological culture which produced the fluted points scattered throughout California as "PalaeoIndian" seems an excellent term when all the above considerations are applied to it, as it neither contradicts nor excessively modifies labels such as "Folsom", "Clovis", or even "Pre-Archaic".

The third and final part of our proposed three-part label, that of the "horizon", entered the archaeological literature much earlier than the PalaeoIndian rubric, but is a concept initially popularized in North America by California researchers. Nearly a century ago Max Uhle (1907) published a report on what is generally considered to be the first modern, scientific, archaeological project completed in California. Uhle came to the University of California after formal anthropological training in Germany and many years of archaeological fieldwork in Peru, where he had developed the interpretive notion of horizon styles. Uhle's brief stint as a California archaeologist exposed North American anthropologists such as Alfred Louis Kroeber to the horizon concept perhaps first inculcated in Germany, then later honed through practice in South America (Rowe 1954). After many years of using the horizon style idea in his research and writing, Kroeber (1944) codified Uhle's concept, suggesting that archaeological horizons be characterized by three irreducible elements: 1) broad geographical distribution; 2) a comparatively short lifespan; and 3) diagnostic artifacts which cannot be confused with those representing other times or places separate from the horizon which they define.

Kroeber's expression of the "cultural horizon", both in lectures and later in publications, stimulated a younger generation of archaeologists to make use of the horizon concept in California research (cf: Heizer and Fenenga 1939; Beardsley 1954; Wallace 1955). In recent years, however, the horizon label, always somewhat general in application, has been largely replaced in California archaeology by more specific terms indicating smaller cultural and chronological units (phase, complex, focus, etc.) linked both to precise chronometric dating and presumed cultural affiliation. Despite this trend, I believe that the horizon concept fits the California PalaeoIndian evidence better than any other interpretive label, for fluted points are: 1) not just widely distributed throughout California (Table 1, Figure 5), but have also been found from Alaska to Patagonia; 2) they did indeed have a comparatively short period of usage, of only approximately two thousand years (Haynes 1964; Willig and Aikens 1988); and they cannot easily be confused with any other artifact type.

The California PalaeoIndian Horizon: Geographic Distribution

While isolated finds of PalaeoIndian, fluted projectile points in California have been made from the Oregon line to the Mexican frontier, and from cliffs literally overlooking the Pacific shoreline to the Nevada state line, PalaeoIndian evidence in the form of fluted points is generally divisible into three broad sub areas within the state. From north to south, these are the North Coast Range province, where the Borax Lake site is the best-known example; the southern San Joaquin Valley, where along the ancient shoreline of Lake Tulare many PalaeoIndian sites once existed; and finally, that of the western Great Basin province, within the state's eastern and southeastern deserts.

Perhaps the most interesting and enigmatic archaeological region in the Central Valley of California, if not the state as a whole, is Lake Tulare in the southern San Joaquin Valley. Lake Tulare offers the best evidence for a substantial PalaeoIndian occupation in California prior to 10,000 years ago: many more fluted projectile points have been recovered from Lake Tulare than from all other locations in California combined (Table 1). Best known is the Witt site (Riddell and Olson 1969), which produced a broad array of fluted projectile points. In the three decades since the original recording of this site, many additional examples of these typologically early points have come to light at other Tulare Lake locations (Wallace and Riddell 1988; Hopkins 1991; Wilke 1991), and new PalaeoIndian sites (Hopkins 1993) have been discovered at some distance from the area where most previous finds were concentrated. Osteological materials collected at Lake Tulare (G. Fenenga 1991) indicate a rich and varied Pleistocene fauna including now-extinct elephants, ground sloth, bison, camels, and horses contemporaneous with the PalaeoIndian lithic artifacts. Future work at locations around the margins of ancient Lake Tulare will be of the most crucial importance to our understanding of the original peopling of California and the Western United States as a whole.

In the North Coast Ranges, the Borax Lake site (Harrington 1948) was recognized early on as containing projectile points with morphological affinities towards the better known Folsom types, but remained undated until many years after its original excavation (Meighan and Haynes 1968; 1970). Now, the Borax Lake site is accepted as dating as early as any Folsom site from the southwest, and its previous, seeming isolation, has been greatly diminished by a series of isolated discoveries of fluted points in the North Coast ranges from Sonoma, Napa, Mendocino and Tehama Counties (Table 1), as well as the recent discovery at a second site, only a few miles from Borax Lake, of another stratigraphic deposit which may contain fluted projectile points *in situ* (Hamilton, personal communication).

The most expansive and as-of-yet poorly understood PalaeoIndian presence within California is that which might otherwise be ascribed to the westernmost Great Basin, existing in the eastern and southeastern California deserts. San Bernardino County, as large as many eastern states, probably contains more isolated fluted point discovery locations than any other California county. In particular, the China Lake - Fort Irwin area (Davis 1975 & 1978; Warren & Phagan 1988) has proven to be spectacularly productive of fluted projectile points. Nevertheless, without diminishing the importance of either location, their productivity may be owed more to their research exposure, the result of many repeated years of militarily-sponsored contract archaeology, greater than that devoted to any other region of comparable size, than to any inherent superiority in PalaeoIndian artifacts. If this is so, we may find that other locations in the California desert may well be equally rich, and if a similar amount of research time were to be invested in them, might be equally productive of fluted projectile points.

One such promising area, obvious from a glance at Figure 5, is the Owens Valley, from which a series of isolated fluted point finds and even fluted point sites have been made over the past 50 years. Unfortunately, all the PalaeoIndian artifacts so far recovered from the Owens Valley, like those from Lake Tulare, are from surface contexts, and cannot yet be absolutely dated or directly associated with extinct Pleistocene megafauna or excavatable archaeological deposits. However, to the north, in Mono County's Long Valley, lies the Komodo Site (CA-MN0-679) near the Casa Diablo obsidian source (Basgall 1988), possibly the first stratified PalaeoIndian site excavated in the high country of eastern California. Despite disclaimers to the contrary (Gerrit Fenenga, personal communication) the Komodo site may represent the first PalaeoIndian hunting camp so far identified within the state. Most of the fluted points recovered from the Komodo site are snapped bases. Basgall (ibid: 115) interprets these as portions of points brought back to the site still hafted on fore shafts after use-breakage. Such specimens were discarded at the base camp during the process of re-hafting new, unbroken points as replacements.

No *bona fide* stratified PalaeoIndian site has yet been identified in the Sacramento Valley, the western Sierra Nevada north of Tulare Lake, Cascades, South Coast, or Peninsular ranges. Nevertheless, isolated finds of individual fluted points have been made in most of these areas (Table 1, Figure 5), and additional searching may very well reveal such sites. The Sierra Nevada foothills are a particularly likely location for fluted point sites, but when and if found, these will probably be only that small fraction to have escaped destruction through hydraulic mining and other recent alterations focused upon that region.

An unconfirmed report of a fluted point from Orange County (Wallace, personal communication) is encouraging, but not too surprising in light of earlier fluted point finds in the Peninsular ranges of San Diego County (Davis & Shutler 1969) and adjacent margins of the Imperial Valley to the east (Davis, et al. 1980). Similarly, an unconfirmed tale of a large collection of fluted points from Lassen County accidentally burned up in a fire over 30 years ago is most suggestive of an as of yet not relocated, but possibly stratified, PalaeoIndian site or sites in the southernmost Cascades.

From the San Francisco Peninsula to Point Conception, no fluted projectile points have yet been found in the South Coast Ranges. The discovery (Erlandson, et al. 1987) of a fluted point fragment in coastal Santa Barbara County, however, is suggestive that more intensive searching in the Southern Coastal Ranges will result in the discovery of additional specimens and, possibly, even in PalaeoIndian sites. Despite the increasing number of very early radiocarbon dates recently made available for the Channel Islands, some of which approach PalaeoIndian age, intensive survey and exacting excavation has yet to produce a single fluted point from this important archaeological province (C. W. Meighan, personal communication 1994; L. Mark Raab, personal communication 1999).

This negative evidence has obvious implications for our understanding of the initial arrival and direction of diffusion of fluted point technology in California, unfortunately beyond the scope of the present paper. Suffice it to say, however, that if the earliest PalaeoIndians to arrive in California traveled south along a now-submerged coastal route, the best location to find traces of their presence remain the Channel Islands.

Perhaps the most promising location for future study in the entire South Coast province is the Coalinga Valley and adjacent interior mountain area, where for some years it has been suspected that the Lake Tulare PalaeoIndians obtained much of the raw materials for production of the fluted points found farther south and east (Dan Foster, personal communication). A few years ago Foster, Francis Riddell, Gerrit Fenenga and I visited an extensive site in the Jacalitos drainage (CA-FRE-2549/H) dating primarily to the Early Archaic. Much of the Early Archaic, and, potentially, even earlier, deposits at the site had been eroded away as a result of stream dynamics, and, once the location at which the natural re-deposition of such eroded materials was identified, two very long, parallel-sided flakes of the type which would have been produced by the removal of channel flakes from fluted points were in fact discovered. Intensive searching here may reveal California's first PalaeoIndian quarry/workshop.

Moving northwards, despite isolated finds of fluted points in Sonoma, Napa, and Mendocino counties, as well as the famous Borax Lake site in Lake County, no fluted point finds have yet been made in northwestern most California, essentially, Humboldt, Trinity and Del Norte counties. When the first such fluted points are found in this area, it is likely that they will be derived from the interior river valleys rather than from the coastal strip itself, and searching in the Klamath/Trinity and Eel River drainages is likely to be most rewarding of future investigation.

Despite the growing evidence for a broad geographical distribution of fluted projectile points throughout California, a total inventory of just over 50 discovery locations and just over 400 specimens compares quite unfavorably with the signature artifacts of later periods. Fluted projectile points in California are undeniably scarce by comparison with the Early Millingstone manos and metates, cobble pestles and bedrock mortars, or Late Archaic Elko Eared or Late Prehistoric Desert Side-Notched projectile points of more recent millennia.

The scarcity of PalaeoIndian points as surface finds in California may be attributable in no small way to the probability that later prehistoric people re-flaked and reused fluted points as sources of first-rate raw material for later, smaller, projectile points. In fact, evidence of such reuse is coming to be recognized on individual specimens (Dillon and Murphy 1994). The scarcity of known PalaeoIndian sites in California may also be attributable to the common situation in which many if not most early sites are deeply buried either by later cultural deposits of subsequent, non-PalaeoIndian peoples, or by natural strata resulting from natural processes of erosion and deposition in the 10,000 years since abandonment by the PalaeoIndians themselves (Moratto, personal communication). And, fluted points probably still reside in archaeological collections unrecognized for what they are (cf: Heizer 1938; Yohe 1992) and will continue to be "discovered" as old collections are re-analyzed.

Past Problems and Future Directions

Having just briefly summarized our present level of knowledge regarding the geographic distribution of fluted projectile points in California, it is appropriate that some of the obstacles encountered in such work be noted. In the strictest sense, archaeological evidence can be limited to only two, inseparable, categories: artifacts (or physical remains) and the geographic associations (positional relationships or discovery locations) of such artifacts. Not surprisingly, most problems in current California PalaeoIndian studies are the result of poor description of either the fluted points themselves, or of imprecise or inaccurate accounts of their provenience.

Caution must be exercised in compiling a statewide fluted projectile point inventory if any pretensions towards accuracy are to be hoped for. The mere existence of fluted projectile points in someone's collection does not constitute indisputably scientific evidence, for without accurate provenience data and adequate description, such fluted points represent no better than "hearsay" proof of early human presence. Accurate distribution analysis cannot be done, nor even that most elementary of all scientific tasks, the specimen count, be made, unless one has confidence in the provenience data associated with the artifacts inventoried. Most archaeologists would agree that the utility of what aspires to be a precise count (Table 1) and accurate distribution study (Figure 5) would be compromised by even a single erroneous entry. Unfortunately, in the course of preparing this inventory I have found error after error in basic reporting of discovery locations and uncertainty as to the identity of individual specimens in the published literature. Original errors have sometimes been repeated several times by subsequent researchers; hopefully, not too many such errors have crept into the present study.

The problems alluded to above are compounded by some professional researchers who conceal their discovery locations because of real or imagined fears of "poaching" by competitors, and by some amateurs who are loathe to reveal theirs because of worries about legal status. Similarly, some past researchers have been remarkably sloppy in presenting basic provenience data for fluted point finds, so much so, that it is not immediately possible to determine what drainage, county or even state the finds were made in. Problems with geographical accuracy can be minor ones such as when Heizer's (1938) specimen from Tracy Lake (Heizer provides range and township coordinates) on the Mokelumne River near Lodi in the southernmost Sacramento Valley is mistakenly assumed to have instead come from the town of Tracy, some 30 miles to the southwest, in the northernmost San

Joaquin Valley. Or, they can be of substantially greater scale, such as when Brott (1966:150) produces a site distribution map for early finds in Southern California in which Riverside County is inexplicably left out.

The most frustrating kinds of errors, those of transposition, can only be exposed through painstaking checking of the actual specimens themselves, or of scientific drawings of the specimens against each other. Hence, Carlson's (1983: Fig. 6.8B) illustration of a fluted projectile point base he identifies as from "Southern California (Rogers)" one would assume is derived from Malcolm J. Rogers substantial body of work in the Colorado Desert area. However, a review of Rogers' major publications for this region (1939 & 1966) reveals no such specimen. Further archival detective work, however, reveals the same artifact illustrated by Davis and Shutler (1969: Figure 2d), who identify it not from California at all but from southeastern Nevada, the "southernmost lake in Dry Lakes Valley".

Even more confusing is the transpositioning of not just single artifacts, but entire sites. Campbell and Campbell (1940:7) briefly described a remarkable fluted point site "on the beach of a Pleistocene lake" more than 50 years ago without locating it geographically, only stating that it lay within the "Great Basin". Subsequently, Wormington (1957:60) located the Campbell's' (1940) site in "southeastern Nevada" while Davis (1963:211) a few years later stated that the same site was to be found instead in the Owens Valley of Inyo County, California. Later still, Glennan (1971:29) located this same site in southwestern Nevada, near Tonopah, while Beck (1970:11), after rejecting Wormington's location but still unable to determine which two out of three choices (Davis or Glennan's) were best, located the site, without explanation, in both places.

Obviously, we cannot have the same projectile point discovered in two different places, nor the same site existing within three separate counties in two different states. Mysteries such as the actual location of the Campbell and Campbell (1940) site can be solved only by returning to the source: Dr. Tom Wilson and Mr. George Kritzman of the Southwest Museum (personal communication) at my request were kind enough to send me a copy of Elizabeth Campbell's original 1940 field notes, transcribed to typescript in the early 1970's, from their archives. While the 1940 field notes unfortunately do not describe the artifacts in the 1940 publication, and the well-illustrated 1940 publication does not describe the discovery location, by combining the two documents there is no longer any doubt whatsoever that the Campbell and Campbell (1940) fluted point site lies at the north end of Owens Lake in Inyo County.

A final, but related, problem relates to basic description and definition. As noted earlier in this paper, we consider the only indisputably diagnostic PalaeoIndian artifacts to be fluted projectile points, otherwise commonly referred to as either Clovis or Folsom types. But, what may constitute a "fluted" point to one archaeologist or even to two, (cf: Davis and Shutler 1969: Figure 2a) may qualify only as wishful thinking to others (cf: Warren and Phagan 1988:122). For our purposes, fluted points are elongate, bifacially flaked projectile points with basal fluting on both sides (Figures 1-4). This fluting cannot be mistaken either for accidental flake removal scars or the shallow kinds of flake removal resulting from light basal thinning. Such points frequently, but not always, exhibit grinding on their lowermost sides and bases, presumably as a means of facilitating lashing for hafting. Our definition immediately deletes from consideration finds with "fluting" on but a single side, as well as the much more numerous basal fragments which could "go either way" in being identified as parts of fluted points, or, alternatively, as parts of basally-thinned but unfluted points.

Even when there is no doubt about the status of the artifacts as fluted points, some students of the California PalaeoIndian period describe their specimens so haphazardly that the actual

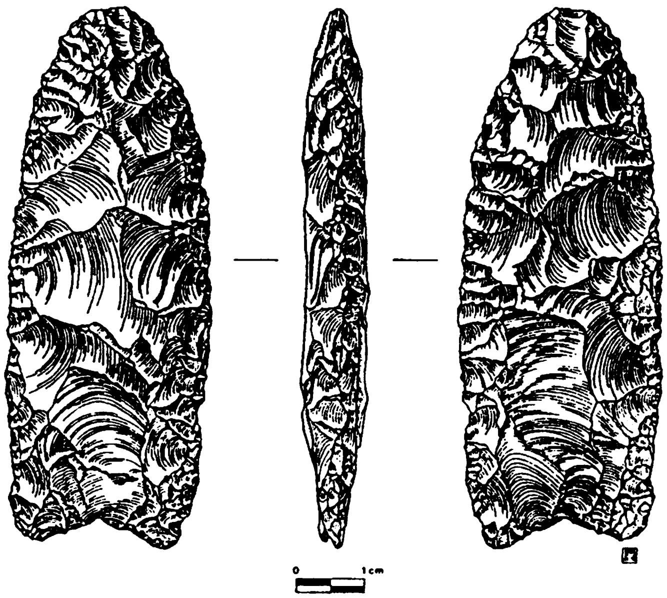


Figure 1: Fluted projectile points from Hat Creek, Shasta County, California. Drawing by John McCammon, 1992 (Dillon & Riddell 1994).

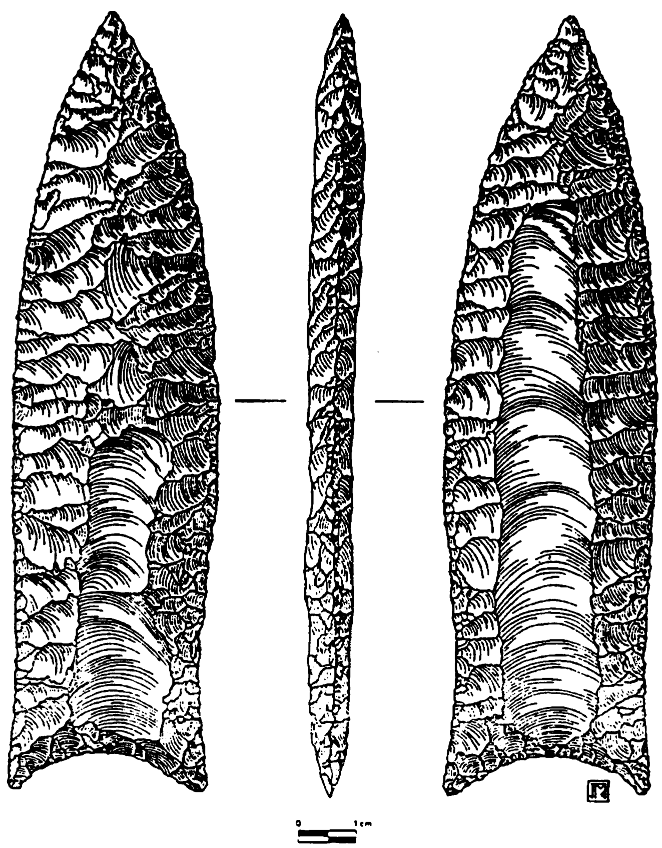


Figure 2: Fluted projectile point from Eden Valley, Mendocino County, California. Drawing by John McCammon,

1993 (Dillon & Hamilton 1994).

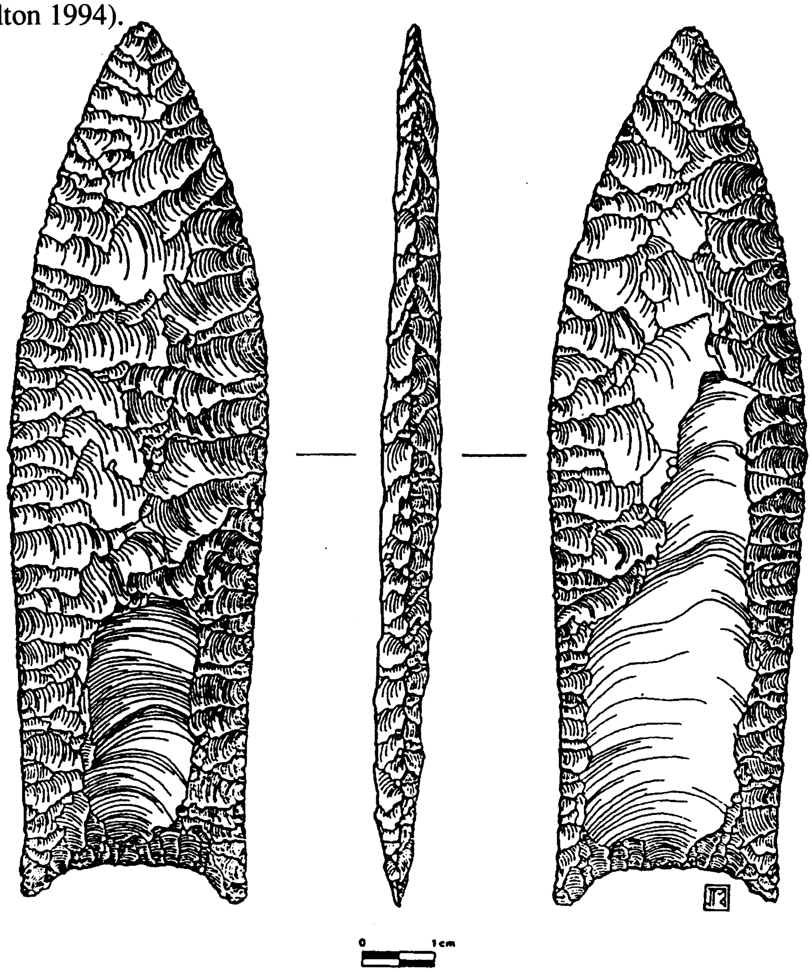


Figure 3: Fluted projectile point from Eden Valley, Menocino County, California. Drawing by John McCammon, 1993 (Dillon & Hamilton 1994).

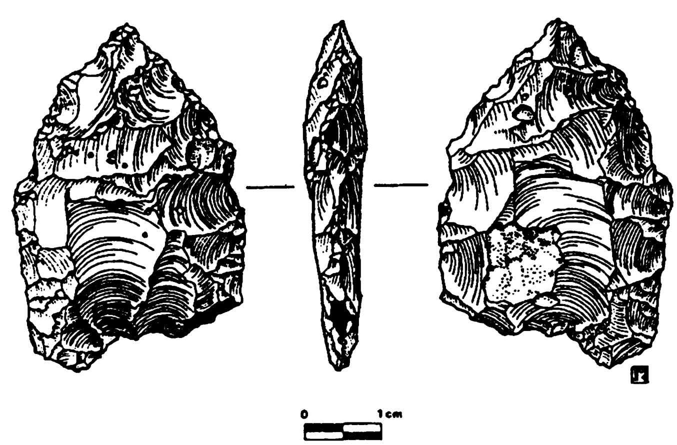
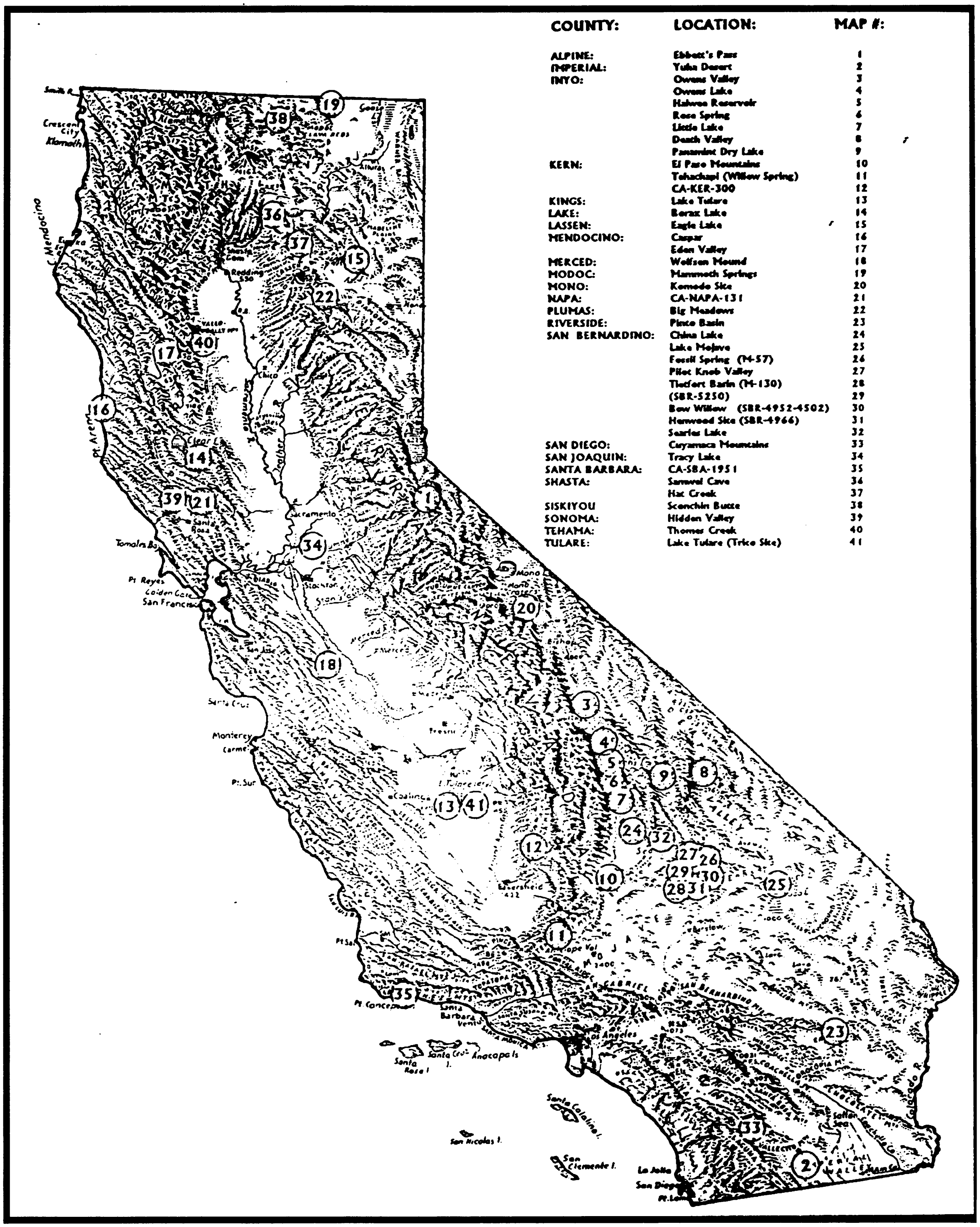


Figure 4: Fluted projectile point from Thomas Creek, Tehama County, California. Drawing by John McCammon, 1993 (Dillon & Murphy 1994).



COUNTY:	LOCATION:	MAP #:
ALPINE:	Ebbett's Pass	1
IMPERIAL:	Yuha Desert	2
INYO:	Owens Valley	3
	Owens Lake	4
	Haiwee Reservoir	5
	Rose Spring	6
	Little Lake	7
	Death Valley	8
	Panamint Dry Lake	9
KERN:	El Paso Mountains	10
	Tehachapi (Willow Spring)	11
	CA-KER-300	12
KINGS:	Lake Tulare	13
LAKE:	Borax Lake	14
LASSEN:	Eagle Lake	15
MENDOCINO:	Caspar	16
	Eden Valley	17
MERCED:	Wolfsen Mound	18
MODOC:	Mammoth Springs	19
MONO:	Komodo Site	20
NAPA:	CA-NAPA-131	21
PLUMAS:	Big Meadows	22
RIVERSIDE:	Pinto Basin	23
SAN BERNARDINO:	China Lake	24
	Lake Mojave	25
	Fossil Spring (M-57)	26
	Pilot Knob Valley	27
	Tiefort Basin (M-130)	28
	(SBR-5250)	29
	Bow Willow (SBR-4952-4502)	30
	Henwood Site (SBR-4966)	31
	Searles Lake	32
SAN DIEGO:	Cuyamaca Mountains	33
SAN JOAQUIN:	Tracy Lake	34
SANTA BARBARA:	CA-SBA-1951	35
SHASTA:	Samwel Cave	36
	Hat Creek	37
SISKIYOU	Sconchin Butte	38
SONOMA:	Hidden Valley	39
TEHAMA:	Thomes Creek	40
TULARE:	Lake Tulare (Trico Site)	41

Figure 5: Distribution of fluted projectile points in California; circled map numbers correspond to list at upper right. Base map courtesy of the California State University, Northridge, Geography Department; locations by Dillon, 1994.

number of specimens encountered cannot be determined. Similarly, when specimens are illustrated, they often are not shown to their best advantage, and specimens either poorly illustrated or described without illustrations are of little value for comparative purposes. Obviously, cases of duplication and/or transposition are only possible when artifacts from different contexts are mistaken for each other: such confusion is only possible when shortcomings in basic description and illustration preclude immediate differentiation between different specimens. Unfortunately, many California examples are not yet described in anything like comprehensive detail. For example, some of the most crucial specimens, those from China Lake (Davis and Panlaqui 1978: Figures 29-31), deserve three-angle illustration at large scale as well as high-contrast photographs, but only one face of each point is rendered at a scale so reduced that these illustrations are of little use for comparative purposes.

In ideal circumstances, ancient artifacts as rare and as important as fluted projectile points should in every case be not just described with text, but illustrated with high-quality photographs (cf: Riddell and Olsen 1969; Wilke 1991) and/or three-angle line drawings of high quality (cf: Figures 1-4 of this report). Single specimens are sometimes so exhaustively described (cf: Sutton & Wilke 1984; Erlandson et al. 1987; Yohe 1992; Dillon & Riddell 1994; Dillon & Hamilton 1994; Dillon & Murphy 1994) that such attention to detail seems like overkill. Nevertheless, considering the cultural and chronological significance of the specimens, no amount of description and illustration can really be too much. The reverse can result in the non-recognition of fluted points as actually fluted.

The situation in which fluted points are collected, misidentified, then filed and forgotten is only possible when poor documentation allows it. While such cases are recurrent in amateur archaeology in California, there have also been a few spectacular examples from the upper echelons of archaeological research as well, when "shorthand" description and slipshod illustration ignored the most salient features of fluted projectile points, the fluting itself. Hopkins (1993b), for example, points out that Gifford and Schenck (1926) illustrated all their points from the southern San Joaquin Valley in such minimal fashion that at least two fluted Clovis points were lumped in with other non-fluted types under the "Nab3" types and therein lay camouflaged for some 70 years.

The kinds of errors noted above are, of course, particularistic, and may be of little concern to those more interested in the broad theoretical implications of California's PalaeoIndian occupation. But, all distribution studies, including the present one, are nothing if not particularistic. One of the most common clichés of the "New Archaeology" for the past quarter-century or more has been that "archaeology should be anthropology or nothing at all." Unfortunately, dogmatic overemphasis on the ethnographic present can lead to the contributions of other disciplines such as historical geography being overlooked or downplayed. Those of us who believe that Carl Sauer has at least as much to contribute to modern archaeology as any of the self-identified "New Archaeologists" sometimes feel tempted to fight one cliché with another, often seen on bumper stickers: "Without Geography, you are nowhere". Despite the brief recitation of shortcomings above, in general most reporting is excellent. The present trend is towards much greater completeness in description and illustration, and in accuracy in presenting provenience data, and this trend will no doubt become dominant in the future.

Conclusion

All archaeological thinking and writing can be categorized as either archaeological evidence (essentially objective and descriptive) or archaeological interpretation (essentially subjective and explanatory); if it is not one, it must be the other. Archaeological interpretation can be, and frequently is, based upon very limited archaeological evidence, and this has certainly been the case with PalaeoIndian archaeology in California. While even the terms we hope to promote in this study (*California PalaeoIndian Horizon*) constitute an interpretive and, consequently, subjective, statement, we have nevertheless tried to achieve a responsible ratio of archaeological evidence to archaeological interpretation. We believe that a PalaeoIndian cultural horizon existed throughout California some 10,000 to 12,000 years ago; as evidence there are the artifacts themselves (Table 1), and their geographical distribution (Figure 5).

Fluted projectile points, indicating the presence of California PalaeoIndians, have now been found in 28 of California's 58 counties; at conservative count, over 400 fluted projectile points are presently documented from over 50 separate locations, both in actual prehistoric sites and as isolates. This distribution of fluted, PalaeoIndian projectile points across the length and breadth of the state represents either a broad scale investment by small groups of people, or an only minimally less extensive occupation by wide-ranging, possibly more centrally-based, groups. Doubtless, distinctive PalaeoIndian artifacts such as fluted points survived as heirloom pieces amongst later peoples, possibly for many thousands of years, and some may have even been transported short distances, leaving "false trails" which can confuse our distribution analysis. Nevertheless, regardless of the final form our interpretations take, the fluted point evidence now in hand demands that California no longer be considered peripheral to other parts of PalaeoIndian North America. California had its own unique PalaeoIndian pattern, its own *PalaeoIndian Horizon*.

Acknowledgments

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TIME, FORM AND VARIABILITY: LAKE MOJAVE AND PINTO PERIODS IN MOJAVE DESERT PREHISTORY

Claude N. Warren

Introduction: Time, Culture, and Chronological Types

Disagreements and controversy regarding the age of cultural assemblages and the basis for establishing cultural sequences have characterized the archaeology of California and southern Nevada deserts since the first cultural chronology was established. Elizabeth and William Campbell (1935, 1937; E. Campbell 1936), M. R. Harrington (1933) and M. J. Rogers (1939) all attempted to develop a method of establishing a cultural sequence in the Mojave Desert, where there are few stratified sites and where most known archaeological assemblages were recovered from the surface of the ground. Harrington (1933) reported the association of the Gypsum point with dung of the extinct ground sloth in Gypsum Cave, and claimed a Pleistocene age for the Gypsum point type. The Campbells, in collaboration with Antevs and other geologists, reported the association of Lake Mojave points with the shorelines of Pleistocene Lake Mojave (Campbell, et al. 1937), and Pinto points with ancient stream channels in Pinto Basin (Campbell and Campbell 1935). The Campbells claimed late Pleistocene and early post-Pleistocene ages for the Lake Mojave and Pinto points. Rogers (1939), held that these point types were associated with topographic features of the later wet period of the Little Ice Age. All of these authors attempted to demonstrate the relationships between a point type and a dated geological feature. Once such a connection was made it was then possible to use typological cross dating for other assemblages containing the same point types.

After 1950, radiocarbon dating was applied where possible in conjunction with typological cross dating of projectile points. The difference between cultural equivalency and temporal equivalency became more significant as the amount of information to be synthesized increased. The concept of chronological period (a unit of time), based on radiocarbon dates and typological cross dating using projectile points, emerged next. This concept has been used successfully in the Mojave Desert since 1974 (Bettinger and Taylor 1974; Warren 1980a, 1984; Warren and Crabtree 1986); however, it is important that concepts of time such as period and horizon, remain distinct from concepts of cultural units, such as component and phase.

Period and horizon are both concepts that assist the archaeologist in organizing temporal relationships, e.g., chronology. The period is a unit of time, not a unit of culture. When that unit of time is recognized by the presence of an artifact type (called a period marker), then the temporal distribution of the artifact type becomes the basis for defining the unit of time, although they seldom are congruent. A period may be long or short. It is identified by a period marker; other artifacts and cultural materials associated with that period marker are thus considered to fall within the same period of time. This concept organizes archaeological materials into periods of either short or long duration. The shorter the periods, the more sensitive the chronology is to changes in aspects of the prehistoric culture other than the period marker.

The horizon is also a unit of time marked by an artifact type, an attribute such as a pottery design, or even a widespread geological stratum such a volcanic ash. The horizon is conceived as a very short span of time or a distinct break in the cultural sequences that extends through a wide area of space in a "geological instant." The horizon concept is a means of identifying chronologically equivalent points in time in two or more cultural sequences. Therefore, the shorter the duration and the wider the distribution, the better the horizon marker.

The concept of component and phase are both cultural units that are defined without regard to temporal placement. A component is an assemblage of artifacts derived from a spatial unit, e.g., a stratum or arbitrary unit of midden or an entire site, of appropriate size for use by a population. The "appropriate size" will vary with the complexity of the cultural remains, the intensity of occupation, and the rate of geological deposition. A component is placed in time by means of dating that is independent of the specific component's definition.

Components are organized into larger cultural units called "complexes," "phases," "cultures" or "cultural traditions" on the basis of similarity among the artifact assemblages of the different components. The content of the cultural remains is the basis for defining these concepts, and their temporal placement and extent are determined by independent means.

In the California and southern Nevada deserts typological cross dating has been primarily based on "traditional" projectile point types, and secondarily on "traditional" types of other artifact categories. These traditional types ideally should have been defined on the basis of time sensitive attributes. However, traditional projectile point types have been intuitively identified and described; no time sensitive attributes have been formally identified for the California and southern Nevada deserts. As a result, archaeologists have not been consistent in their type descriptions and there are disagreements as to which attributes are characteristic of any given type. Most of the projectile points from the early assemblages of the Mojave Desert fall within the traditional Lake Mojave, Silver Lake, and Pinto types. All other types are represented by small numbers of specimens. All other types are represented by small numbers of specimens. The Lake Mojave and Pinto projectile point types <u>appear</u> to function as period markers in a limited but useful way.

Types of types and the Chronological Type

An artifact typology most often communicates a description of classes of objects based on selected "important" attributes for each class. Such a typology is too often used as the basis for seriation and chronological placement, for functional categories, for illustrating "culture change." It is then said to represent the "mental template" of the makers of the artifacts. It should not be surprising that such typologies do not function well in all, or even any of these endeavors. To answer questions of technological trajectory, ethnic identity, artifact function, or chronology, requires different sets of data and therefore different types of types. Whether or not a type represents the "mental template" is both irrelevant and unprovable. To distinguish between several taxonomies and apply different typologies to different problems as needed should be a common practice for archaeologists. Types are conceptual tools for the archaeologist. They work best when designed for specific tasks, and more than one taxonomic system may be required to answer the questions the archaeologist asks (or test the hypotheses the archaeologist constructs). As Vaughan and Warren (1987:199) state:

> The necessary quality for a temporal type is the correlation of physical attribute(s) with a unit of time. It matters not if the attribute(s) results from a change of cultural preference or a change in the availability of a lithic source. We need not know whether the forms we observe result from patterned resharpening of reoccurring fractures patterned by use, from intractability of the preferred raw material, or from the "mental template" of the prehistoric craftsman. The only necessary qualities are reoccurring attribute(s) that are restricted to a definable period of time. The temporal type is the archaeologist's tool for constructing chronological units, not cultural units. It need reflect the cultural behavior of the prehistoric people no more than does the charcoal used in radiocarbon dating.

The Lake Mojave series and Pinto series point types are tentatively defined below. These definitions should be recognized as working definitions of chronological types. However, it is stressed that these definitions are tentative because they have their foundations planted firmly in the early descriptions of Lake Mojave, Silver Lake, and Pinto points by Amsden (1935, 1937), Rogers (1939) and Harrington (1957). Therefore, the attributes used in the definition cannot be shown to be time sensitive and their validity must be tested. Amsden (1935, 1937) provided the type descriptions for the Lake Mojave, Silver Lake, and Pinto points. Rogers' (1939) and Harrington's (1957) descriptions vary somewhat from Amsden's in that their types include more attributes and more variations in forms. Furthermore, Rogers (1939) and Harrington (1957) each had goals quite different from each other and from those of Amsden.

The typology that follows is not a combination of the types established by Amsden, Rogers, and Harrington. The attributes selected were based on observations made by these three early archaeologists, but they often disagreed on the importance of the validity of specific characteristics (most obvious in Rogers' leaf shaped variant of the Pinto point). In the discussions below decisions were based on the arguments presented by each of these men and on the basis of my own experience in developing a chronology for the California and southern Nevada deserts. It must be clearly understood that the selection of the attributes and their variables, to some degree, has been established intuitively. Consequently, these type descriptions must be tentative and have yet to be adequately tested. However, if the key presented below separates the Lake Mojave, Silver Lake and Pinto points into units that are consistent in form and in chronological placement, then they are valid temporal types and the taxonomy is to some degree successful.

Other archaeologists are currently developing definitions of these traditional point types and their taxonomies as well as definitions that may be quite different from those presented here. Basgall and Hall's (1993) paper on more than 300 points from 24 sites promises the first definition of Pinto points based on an adequate sample and statistical analysis.

The Taxonomy and Types

We follow Thomas' (1970, 1981) taxonomic methods, but use attributes based on the descriptions of the traditional point types of the early occupations of the Mojave Desert. Nearly all of the points of the Lake Mojave and Pinto series defined here are relatively large and stemmed. Consequently, the first few steps of this taxonomic key are equivalent to those of Thomas'. After these initial comparisons, however, the two keys are quite different in terms of attribute variations. The criteria used herein to distinguish the projectile point types in the Mojave Desert center on length of stem and width of shoulders, attributes not included in Thomas' key. Therefore, these types are not comparable to Thomas' without applying the same criteria to those defined by Thomas (1981).

Lake Mojave and Silver Lake Types: The Lake Mojave Series

The Lake Mojave and Silver Lake types were first described by Amsden (1937:80-84) more than 50 years ago. Although the phrasing of that description appears archaic and ambiguous today, the attributes cited by Amsden cited as characteristic of the Lake Mojave point type are:

1. Long tapering stem;
2. Slight (narrow) shoulders (if present);
3. Generally diamond-shaped with longer stem than blade; and
4. Varies in form between an oval form on one hand and the Silver Lake type on the other.

The Silver Lake type by contrast is said to exhibit:

1. Greater definition of shoulder than the Lake Mojave type;
2. A shorter stem than the Lake Mojave type, never more than one-half the length and usually about one-third of the length; and
3. Convex base.

Rogers (1939:35) placed both Lake Mojave and Silver Lake points in a single "Stemmed Blades" category. He states that this category is:

> Characterized by a long, broad stem with a rounded base. It was constructed from a leaf-shaped blade by reducing the width of the blade from the base end toward the tip for a distance of one-half to two-thirds the total length. This usually left pronounced shoulders at the junction of the stem and blade. The blade section is usually short, stubby and obtusely pointed (Rogers 1939:35).

Rogers (1939:35) also notes that Amsden subdivided this category into Lake Mojave and Silver Lake types. In this paper the Lake Mojave and Silver Lake types are recognized as a morphologically and technologically related series of forms herein called the Lake Mojave series.

Amsden's (1935, 1937) and Rogers' (1939) descriptions formed the basis for the traditional intuitive types even though Amsden's descriptions were based on only twelve Lake Mojave and fifteen Silver Lake points (Amsden 1937:80, 84), and Rogers' (1939:35) were based on a total of twenty-five specimens. The attributes given priority by Rogers and Amsden and apparently by later archaeologists were: the Length of Blade (LB), Length of Stem (LS), Proximal Shoulder Angel (PSA), Basal Width (WB), and Width of Shoulders (WS). The Width of Shoulders measurement is calculated by subtracting the Neck Width (WN) from the Maximum Width at the Shoulders (MWSh).

These attributes are described here as linear measurements and degrees of angles. A "type" is assumed to represent patterned behavior by the makers; these measurements will reflect that behavior. As Thomas (1981:14-15) notes, however, there are changes that occur in these measurements after manufacture, due to wear, breakage and maintenance. These "use-life modifications" change the measurements and introduce variability that is not a result of the patterned behavior of point manufacture.

Rogers (1939:35) states that among his "Stemmed Blades" category "many...have blunted irregular tips as if they had been broken and resharpened." Tuohy (1969) describes the pattern of breakage and resharpening on similar points from the western Great Basin. There is ample evidence for breaking and resharpening of blades, with breaks often occurring just above or just below the shoulder (Tuohy 1969:138). The attributes of the blade as originally flaked, are often missing and when present, are highly variable because of the use-life modification. Because of this high degree of variability in blade form the use of blade attributes in defining the types is limited here to only those relevant to the shape and size of the shoulders. This, unfortunately, eliminates one of the traditional attributes for distinguishing lake Mojave from Silver lake points: the length of stem relative to length of blade.

Pinto Point Series

In the original description of Pinto points, Amsden (1935:44) notes as major attributes the "definite although narrow shoulders and usually...incurving [concave] base," as well as the relatively great thickness. Rogers (1939:54) later subdivided Pinto points into four stemmed types and a leaf-shaped type. The four-stemmed types were based on attributes of stem form. In 1957, Harrington (1957:51-53) redefined the Pinto types so as to include five stemmed forms based primarily on shoulder attributes.

Harrington (1957:51) notes the resharpening of the blades of the Pinto points and its effect on the overall form; however, neither Rogers (1939) nor Amsden (19350 make similar observations. The major criteria for determining the Pinto types are attributes of the shoulders and stem. Most blade attributes are again omitted from the definition of the types. The basal concavity is recognized by Amsden (1935) and Harrington (1957) as a distinguishing characteristic of the Pinto types, but Rogers' (1939:54-55) Type 2 Pinto exhibits a straight base in all examples he illustrates. In recent years the indented base has become an element of the Pinto point definition (Thomas 1970, 1981; Vaughan and Warren 1987).

The definition of the Pinto point is recognized by archaeologists of the desert west as a problem in need of clarification and resolution (Basgall and Hall 1993; Schroth 1994; Warren 1980a, 1980b; Warren and Vaughan 1987). Warren and Vaughan (1987) address some of the problems, but without a large sample of points and innovative typological analyses, the problem of type identification cannot be resolved (Schroth 1994; Vaughan and Warren 1987). The Pinto point, as defined here, is essentially what traditional knowledge of Mojave Desert archaeology recognizes as Pinto points. The goal here is to describe the shape of the stem and shoulders of the traditional Pinto points in terms of linear and degrees of angle measurements, clear descriptive observations which can be duplicated by other archaeologists.

Definition of Attributes

The attributes listed here (Figure 1) include some borrowed directly from Thomas (1981) and others that experience has demonstrated to be important in distinguishing points of the Lake Mojave and Pinto series in the Mojave Desert. These are as follows:

Distal Shoulder Angle – DSA. The Distal Shoulder Angle is that angle formed between line (A) defined by the shoulder at the distal point of juncture and line (B) drawn perpendicular to the longitudinal

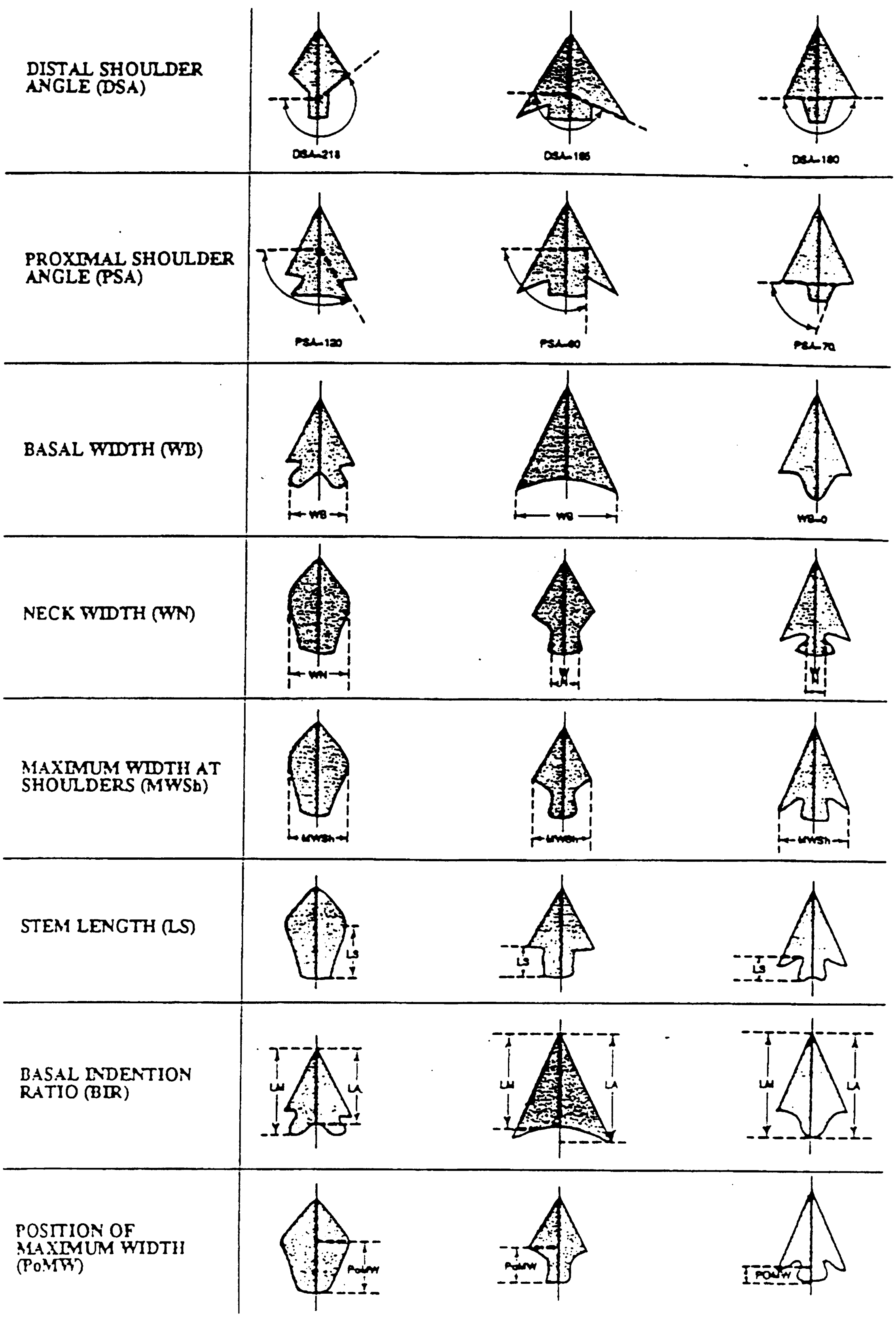

Figure 1: Projectile Point Attributes

axis (C) at the intersection of A and C. DSA ranges between 290 and 270 degrees. If points are asymmetrical, the small angle value of the DSA is measured. DSA is recorded to the nearest 5 degrees (Thomas 1981:11).

Proximal Shoulder Angle – PSA. The Proximal Shoulder Angle is that angle formed between the line (D) defined by the proximal point of juncture and line (B) plotted perpendicular to the longitudinal axis at the intersection of C and D. PSA ranges between zero and 270 degrees. If points are asymmetrical, the larger angle for the PSA is measured. (Thomas measured the smaller angle. However, by measuring only the smaller angle the possibility of recording use-life modification is increased.) PSA is recorded to the nearest five degrees (Thomas 1981:11).

Basal Indentation Ration – BIR. The length measured along the longitudinal axis (C) divided by the maximum length measured parallel to the longitudinal axis (C). The Basal Indentation Ratio ranges between .0 and about .90 (Thomas 1981:11).

Basal Width – WB. The width of the widest portion of the base (Thomas 1981:13).

Neck Width – WN. The width of the stem at the intersection of the stem and shoulders.

Maximum Width of Shoulder – MWSh. Width of blade at the intersection of blade edge and shoulder.

Shoulder Width-Maximum Width at Shoulder Ratio – WSh/MWSh. Ratio of the Shoulder Width to the Maximum Width at the Shoulder. Shoulder Width-Maximum Width at Shoulder Ratio = WSh/MWSh.

Stem Length – LS. Stem Length is the length of the stem from base to intersection with shoulder, measured parallel to Longitudinal Axis. If shoulders are asymmetrical the smaller value is measured.

An additional term needs to be defined before this key can be used in a consistent manner. The term "shoulder" is not defined by Thomas (1970, 1981) although the primary division in his key is based on the presence or absence of this attribute. In most cases the presence or absence of a shoulder would be agreed upon by most archaeologists. However, as the shoulder becomes less pronounced and as the DSA and PSA approach a difference of 180 degrees, agreement as to the presence or absence of the shoulder will certainly decrease. Lake Mojave points often exhibit very slight or no shoulders with the difference between the DSA and PSA approaching or equaling 180 degrees. There is also a clear continuum from these "lanceolate" points to the clearly shouldered points within what traditionally is called the Lake Mojave point type. The term "shoulder" clearly needs a definition which can be objectively identified.

The terms "shoulder" and "stem" refer to the proximal end of the projectile point, from the location where the width is reduced to facilitate hafting, to the base. The angle formed by the shoulder and the stem equals the angle of the notch opening (Thomas 1981:14). As the notch opening increases the differentiation between the shoulder and the stem decrease. When the notch opening reaches 180 degrees the shoulder and the stem are no longer differentiated and the point becomes "lanceolate" or "diamond" shaped, and is often described as lacking a stem. However, the taxonomy used here defines the widest point on lanceolate and diamond shaped forms as the shoulder with the stem defined by measurable Proximal Shoulder Angle and Distal Shoulder Angle. If the edge below the shoulder is convex so the DSA and PSA cannot be measured, or if the difference between the PSA and DSA is greater than 180 degrees, then the projectile points is classed as shoulderless and nonstemmed.

It should also be noted that lanceolate and diamond shaped shouldered points can be segregated from the "traditionally" shouldered and stemmed forms by the Shoulder Width (Maximum Width at Shoulder [MWSh] minus Neck Width [WN], MWSh-WN=WSh). All lanceolate and diamond shaped points will have a shoulder width of zero (MWSh-WN=0) whereas all points with notch openings less than 180 degrees will have Shoulder Widths greater than zero (MWSh-WN>0).

The Taxonomy: Key I for Lake Mojave and Pinto Series

The taxonomic system utilized here is borrowed directly from Thomas (1981); the initial steps are identical to those described in Thomas' Monitor Valley Projectile Point Key (Thomas 1981:25). Because the unstemmed, side-notched and small stemmed points are not part of the Lake Mojave and Pinto Series points that portion of the key has not been reproduced here. The following represents steps added to the Monitor Valley Projectile Point Key in order to incorporate the Pinto, Lake Mojave, and Silver Lake Points from the Mojave Desert.

Key I: Lake Mojave and Pinto Point Series

1.	Point is unshouldered	Out of key
1a.	Point is shouldered	(2)
2.	Point is side-notched	Out of Key
2a.	Point is stemmed	(3)
3.	Point is small. Neck width < 10.00 mm	Out of Key
3a.	Point has neck width ≥10.00 mm	(4)
4.	Point has basal width ≥ 10.00 mm	(5)
4a.	Point has basal width < 10.00 mm	(14)
5.	Point has BIR < .98	(6)
5a.	Point has BIR ≥ .98	(17)
6.	Point has thickness < 6.4 mm	Elko or Gatecliff Series
6a.	Point has thickness ≥ 6.4 mm and WSh < 12.75 mm	(7)
6b.	Point has WSh/MWSh ration £ 7.4 mm and WSh ≥ 12.75	Elko or Gatecliff Series
7.	Point has WSh/MWSh ratio £ .15	Pinto Series
7a.	Point has WSh/MWSh ratio > .15	(8)
8.	Point has PSA £ 105	(9)
8a.	Point has PSA > 105	(12)
9.	Point has PSA ≥ 80	(10)
9a.	Point has PSA < 80	Out of key
10.	Point has DSA ≥ 80	(11)
10a.	Point has DSA < 80	Out of key
11.	Point has DSA ≥ 220	Pinto sloping shoulder with straight stem
11a.	Point has DSA < 220	Pinto square shoulder with straight stem
12.	Point has Basal Width ≥ MWSh	Out of key
12a.	Point has Basal Width < MWSh	(13)
13.	Point has DSA ≥ 220	Pinto sloping shoulder with expanding stem
13a.	Point has DSA < 220	Pinto square shoulder with expanding stem
14.	Point has LS/MWSh ratio < .68	(15)
14a.	Point has LS/MWSh ratio ≥ .68	(16)
15.	Point has LS/MWSh ratio £ .45	Out of Key
15a.	Point has LS/MWSh ratio > .45	Lake Mojave Short-stem (formally Silver Lake)
16.	Point has PSA > 85	Lake Mojave Short-stem (formally Silver Lake)
16a.	Point has PSA £ 85	Lake Mojave Long-stem (formally Lake Mojave)
17.	Point has 8.5 mm ≥ ShW ≥ 2.0 mm	(18)
17a.	Other	Out of Key
18.	Point has LS/MWSh ratio ≥ .25	Silver Lake Rectangular
18a.	Point has LS/MWSh ratio < .25	Out of Key

Discussion

The method of typological cross dating appears to be relatively simple and straight forward, but differentiation between periods and horizons, and between these concepts of time and the concepts of cultural units are not consistently recognized. The following discussion contains descriptions of two uses of the time sensitive artifact types, the (through convention) are forms that are easily recognized, relatively complex, and preferably numerous. Such artifacts may be either horizon markers or period markers, and the difference between them requires different applications for developing chronologies. Because the differences between the two concepts is not always recognized, scholars have arrived at incorrect evaluations of the effectiveness of typological cross dating.

Meighan (1989) presents a critical review of the two articles that concerned the age of the Pinto points. These articles (Jenkins 1987; Vaughan and Warren 1987) were the result of archaeological investigations at Fort Irwin, and used the Warren (1980, 1984; Warren and Crabtree 1986) chronology. Meighan's comments illustrate some misconceptions regarding the use if this projectile point chronology.

> Both of these articles, and most previous workers, started with the assumption that Pinto points were time markers and that they could be used to delineate reasonably short time periods (Meighan 1989:114).

The Pinto period in Warren's chronology extends over 3000 years (4000 to 7000 B.P.) and Jenkins (1987) argues for a <u>beginning</u> date of 8400 B.P. for Pinto points, giving the Pinto points at least a 4400 years time span. Clearly, neither Jenkins nor Vaughan and warren assumed that Pinto points "could be used to delineate reasonably short time periods."

There are few projectile point forms in the California and southern Nevada deserts that can be shown to have persisted for only a brief period of time, and there is much temporal overlapping of the projectile point forms. This leads to a problem of the "traditional" use of time sensitive artifact types in constructing chronologies. Most often time periods are assumed to be equivalent to the temporal distribution of the "time marker" projectile point type. If this were correct, either there is overlapping of time periods (which is neither logically correct nor archaeologically desirable), or one time-sensitive projectile point type replaces an earlier one in an instant, and they do not coexist. To assume that a projectile point form, characteristic of a temporal unit, would be immediately REPLACED by another projectile point form characteristic of the succeeding period is to embrace the unlikely. About the only way such a change of point types could take place is I the people of the later period occupied it. That is a scenario that seldom occurs in the prehistory of the world, and is of limited use to archaeologists attempting to establish a chronology.

Although his numbers may prove to be wrong, Meighan's (1989:114) point is well taken when he writes:

> Pinto points may well occur over a period of more than 5000 years, and published age estimates span 7000 years. If this is so, use of these points as a time marker provides a pretty blunt instrument for observing climatic or any other sequential changes...

The Pinto point type is defined here as a part of a chronological model that makes it possible to demonstrate cultural continuity and change throughout the early prehistory of the Mojave Desert. This model is neither fine grained nor chronologically fixed. It is a model designed to reflect the real time of the past and as such must be modified and adjusted as additional data are recovered. The Awl site, CA-SBr-4562 (Basgall and Hall 1992; Jenkins and Warren 1984; Jenkins; Warren and Wheeler 1986); site CA-SBr-5251 (Hall 1992); Rogers Ridge, CA-SBr-5250 (Hall 1992; Jenkins 1985, 1986); and sites on Nelson Wash (Warren 1991) have provided data that clearly support an <u>initial</u> age for Pinto points greater than the 3000 to 4000 years ago, generally accepted in 1980. The new dates for the appearance of Pinto points eliminates the hiatus between the Lake Mojave and Pinto occupations and illustrates a cultural continuity between the two periods.

A single cultural tradition extends from the beginning of the Lake Mojave period (which is not yet adequately dated) at earlier than ca. 9500 years, to well into the Pinto period. The Lake Mojave period is characterized by the Lake Mojave projectile point types as defined above, e.g., Short Stemmed and Long Stemmed Lake Mojave points. The characteristic cultural assemblage of this period (e.g., San Dieguito or Lake Mojave complex) includes (in addition to the projectile points) a larger number of leaf-shaped bifaces that served as cutting and piercing tools, cores from which flakes could be removed as needed, and other functions still unknown. Other characteristics of this assemblage are: well formed domed unifaces ("scrapers"), shaped rather like tortoise shells; flaked stone crescents and eccentrics; small beaked engravers, and manos and metates (rare).

The materials used in the production of the flaked stone tools are oddly patterned. The bifaces were produced most often from basalt and other fine grained volcanics and more rarely of cryptocrystalline materials and obsidian. The unifaces, on the other hand, were most often made on flakes of cryptocrystalline materials, with basalt and other fine grained stones making up a smaller percentage of these tools.

The transition from the Lake Mojave complex to the Pinto Basin complex of the Pinto period does not occur at a single moment; but over some as yet undetermined span of time, which may be on the order of 500 to 1000 years. The changes that occur include a change in projectile types with: first an addition of Pinto points and unnamed forms resembling Pinto and Silver Lake points; an increase in the use of milling stones; the disappearance of the crescents, eccentrics, and small beaked gravers; and the addition of drills. The uniface types continue as do the bifaces. Furthermore, the pattern of tool stone use, with basalt and other fine grained volcanics preferred for the manufacture of bifaces and cryptocrystalline materials most common for unifacial tools, is found throughout at least the first half of the Pinto period.

The end of the Pinto period is marked by the introduction of the Gypsum and Elko series points. There is an associated change in artifact assemblages with a greatly reduced use of the large, well-formed domed unifaces, and the occurrence of large numbers of unifacially worked flakes. In addition, cryptocrystalline materials were used for the production of unifaces and bifaces in very high percentages.

Theoretically, the early (Lake Mojave-Pinto periods) portion of the cultural sequence of the California and southern Nevada deserts can be subdivided into at least three periods based on the occurrence of projectile point types (Figure 2). Lake Mojave points characterize the Lake Mojave period. The end of the Lake Mojave period is marked by the introduction of the Pinto points. Thus the initial, or early, Pinto period contains both Lake Mojave and Pinto points, together with Silver Lake and other point forms. Following this initial Pinto period the Lake Mojave points are no longer found, but Pinto and Silver Lake forms continue and other forms are developed. This model predicts the projectile point assemblages of the Rogers Ridge site (Jenkins 1987) and the Awl site (Basgall and Hall 1992). However, the validity of this hypothetical period has been criticize (Basgall and Hall 1992) because they do not accept the dates obtained, or the association of Pinto and Lake Mojave points in the same geological unit.

Chronological periods are units of time marked by the use of diagnostic projectile points. Thus the Lake Mojave period begins with the introduction of the Lake Mojave point series; the Pinto period with the first occurrence of Pinto point types, and the Gypsum period with the occurrence of the Elko point series, Gypsum point type, and/or Humboldt point series. <u>Each period ends when a new diagnostic projectile point type first occurs, not when the characteristic point type no longer occurs</u>.

When referring to chronological periods there are no "transitions" between periods, as there are no transitions between years, or months, or days. The definition of a chronological period is not a definition of a cultural unit. Cultural units do undergo transformations, and those transformations may occur within or across boundaries of chronological periods; or in rare instances correspond to the boundary of chronological periods. It is becoming increasingly clear that the Pinto period is a time of major cultural transformations. The cultural assemblage that is characteristic of the late Pinto period is poorly represented, may be absent in the central Mojave, and where it occurs elsewhere in the Mojave may be very different from the artifact assemblage that characterizes the early Pinto period.

If the concept of periods, marked by a Lake Mojave and Pinto point series, is used as a chronological framework, the cultural data associated with them are the material remains of Late Pleistocene-Early Holocene peoples. When this chronological framework is used in conjunction with absolute and relative dating techniques, such as radiocarbon, obsidian hydration, seriation, etc., the associated cultural data can then be

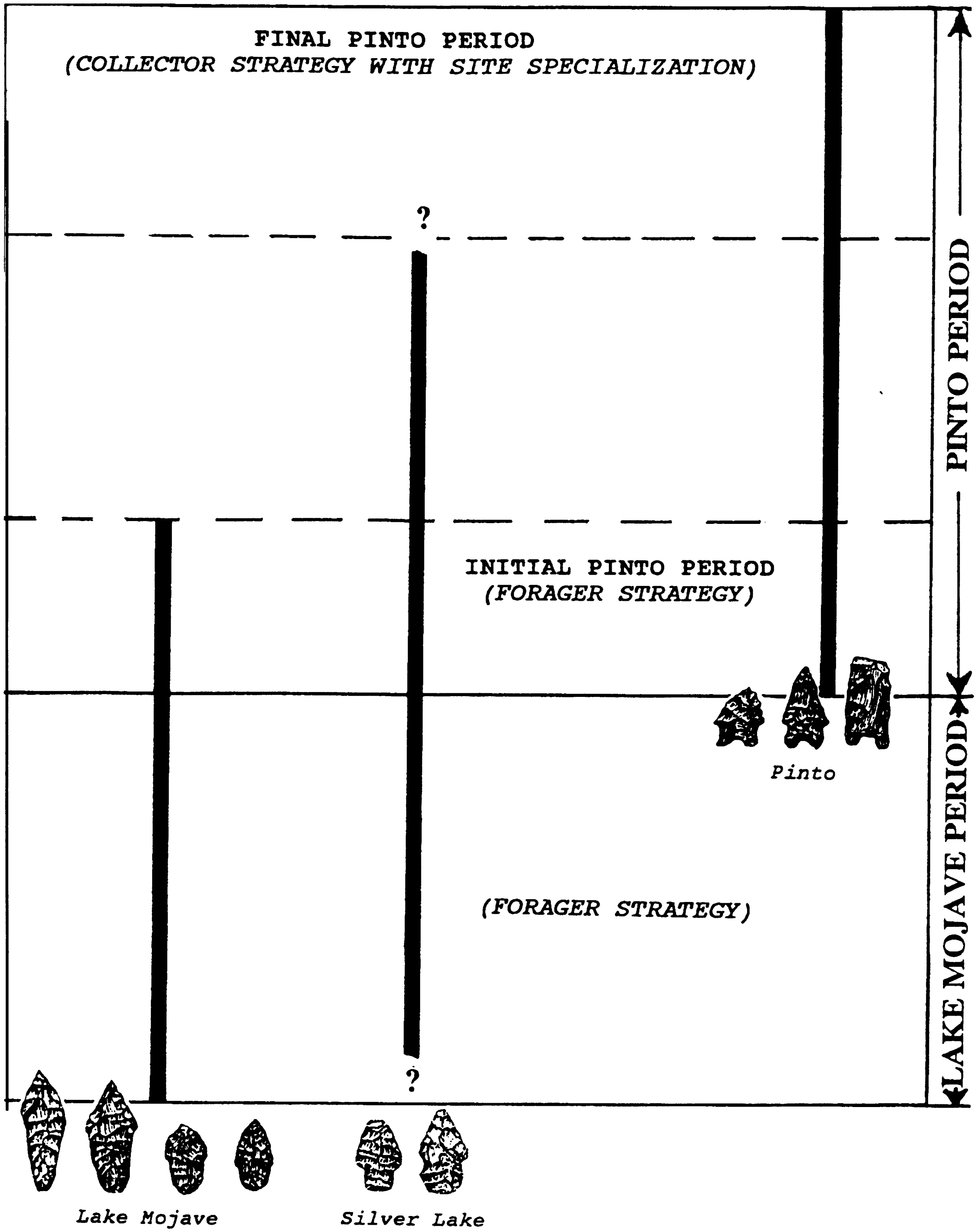

Figure 2: Lake Mojave and Pinto Periods in the Central Mojave Desert

analyzed for spatial/temporal units of cultural similarities, and for variability of cultural data. The units of cultural similarity are the building blocks of cultural history; but the framework of temporal periods facilitated the identification of a single cultural tradition for the Lake Mojave and Pinto periods.

The temporal units, i.e., periods, identified by time markers and subdivided by means of horizon markers, radiocarbon dates, obsidian hydration readings, seriation of artifact types, and other forms of chronological orderings, facilitate in the identification and analysis of variability within the cultural data. We have identified the Lake Mojave-Pinto cultural tradition that persists for several thousand years. During these several thousand years the Mojave becomes increasingly arid and resources, including artiodactyls, decrease. The human populations must adapt to these changing conditions or decrease in number. Warren has postulated certain kinds of changes under these conditions by use of a "subsistence focus model" (Warren 1986; Warren and Lyneis 1986).

> Focusing...may be viewed as the process in which a group of individuals directs its interests and energies toward a production system and its application to the environment. This results in the acceptance of innovation arising within the subsystem and resistance to change originating outside the focus. The subsistence focus thus has an internal dynamic that is separate from, but interacts with, environmental and demographic forces. Changes in the subsistence system result from these dynamic systems.
>
> The subsistence focus model predicts a two-stage response to declining resources. Because the subsistence focus is the production system where creativity is most freely expressed and resistance to innovation minimized, the initial response is an attempt to increase productivity within the subsistence focus through manipulation of the technology and its application, and intensification of these procurement activities. If productivity continues to decrease then the second stage response may begin, taking the form of a decrease in population and/or general reduction in cultural complexity and cost of its maintenance. This entails some degree of cultural disintegration, which in turn weakens the subsistence focus. If the second stage response is initiated then new emphasis is placed on manipulation of, and experimentation with the technologies of other production systems and their application, creating diversification within the subsistence system (Warren 1986:8).

As a point of illustration, the first stage response is considered here. On the basis of the subsistence focus model it may be predicted that as the Mojave Desert dried and artiodactyls became increasingly difficult to take, the first reaction of the hunters would be to manipulate elements of the artiodactyl hunting focus. This manipulation would be seen archaeologically in an increased variability in the hunting tools; for example, increased number of types, and/or increased variability of forms within types. In order to demonstrate the correlation of the increased variability with changing resources chronological control must be maintained. This is most cleanly done when the chronological framework is conceptually distinct from the cultural units.

It is in the correlation of cultural variability within the Lake Mojave-Pinto tradition with the increased aridity and changes of local resources that the culture-environment relationships are to be found. These relationships form the basis for the study of the ecology of this prehistoric cultural tradition. This correlation of changing cultural variability with changing environmental conditions would not be easily made if the chronological unit were congruent with the cultural unit. Changing diversity and variability may be identified within the Lake Mojave-Pinto cultural tradition, and it is the flexibility of this framework of temporal periods that allows for the investigation of cultural ecological processes.

In summary, the period concept allows for the inferential establishment of culture history, but contains the flexibility necessary for the investigation of cultural processes that involve changing cultural variability through time, space and cultural units.

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TOLOACHE MORTARS (?) FROM THE PALOS VERDES PENINSULA

William J. Wallace

Early in 1961 two remarkable ornamented mortars, one intact, the other broken in half, were turned up by earthmoving equipment at an archaeological site at the Palos Verdes Estates in the southern coastal district of Los Angeles County (E. Wallace 1961). The site at which they were found covers a level to gently sloping stretch of land atop a sea cliff overlooking Malaga Cove at the southern end of Santa Monica Bay. Just up the coast was the long-occupied culturally stratified Malaga Cove Site, excavated in 1936 and 1937 by Edwin F. Walker (1951:27-69) and which disappeared under a housing development in 1955 (Wallace 1985).

When first seen, the two mortars lay in loose, dark, sandy soil. Because bulldozers had churned the ground up, their original depth below surface could not be precisely ascertained. However, they seem to have rested two to three feet down in the archaeological deposit. Close by, broken in half, lay a long, slender pestle. That the mortars and pestle had been randomly discarded seems highly unlikely. Rather, it appeared as if they had been carefully placed in the ground. Shaped from tough, fine-grained gray sandstone, the whole mortar is of the "flower pot" or truncated cone variety (Figure 1). It has sloping sides, a flat base and a broad, neatly squared rim. Of generous size, the vessel stands 21.5 cm high, has a top diameter of 38 cm and weighs 48 pounds. The grinding cavity is deep, well worn and round-bottomed.

Encircling the broad, flat rim are two concentric lines of asphalt bearing impressions of tiny (5-6 mm) cupped shell beads. Along the inner circle are four smears of asphalt, equidistant from one another. On the outer circle, near the rim's edge, is a larger daub. None of the asphalt smudges shows shell bead impressions.

Split lengthwise, the second mortar (Figure 2) is also fashioned from hard, fine-grained sandstone. It closely conforms to the first in form and size, with a height of 22 cm, a 37.8 cm top diameter and a weight of 45 pounds. Again, the grinding cavity is deep and round-bottomed.

Two asphalted circles marked with bead impressions run around the rim. The circles are interrupted in four places by sets of three cross-lines. An effort had been made to make the mortar whole again. Asphalt, presumably heated, had been thickly smeared over the broken edges of the two parts to glue them together. For further strengthening, two thongs had been bound around the vessel. Seated in shallow grooves pecked into the mortar's outer surface and asphalted in place, the thongs consisted of thin flat strips, perhaps of rawhide. Clear imprints of them can be seen in the asphalt.

Comparable stone mortars, some with rims inlaid with shell beads, have been found elsewhere in southern California (Harrington 1928:72-74; Hudson and Blackburn 1983:110, Figure 112-1, 112-2; Kroeber 1909:17-18). An outstanding cache of at least a dozen was unearthed near Chatsworth (Walker 1951:199, Plate XXXV). Examples have also turned up in the San Joaquin Valley (Latta 1977:414).

Lacking only a small part of its working end, the pestle is an admirably shaped and smoothed implement (Figure 1). When fitted together, the two pieces form an unusually long (34.5+ cm) and slender (5 cm diameter) pestle. Interestingly, two "very long and beautifully proportioned stone pestles" accompanied the Chatsworth mortars (Walker 1951:99, Plate XXXVI).

Eight years after the first discoveries at the Palos Verdes Estates sites, a cluster of five mortars was uncovered in a narrow trench excavated with a mechanical digger for installation of an underground electric line (Wallace and Wallace 1970). Regrettably, the vessels had been removed from the ground before being seen by archaeologists. However, an inspection of the trench walls and a little scraping away with trowels revealed that the mortars had been placed in a pit dug into the dark midden soil almost down to an underlying stratum of light-colored, coarse-grained sand. Lying 12-26 inches below the surface, they had originally reposed deeper underground, for a foot or more of soil had been stripped off this section of the archaeological site during land-leveling operations some years before.

Beyond doubt, the pit had been lined with thin, flat, pieces of whitish siltstone. Found high up, the largest, (measuring 48 cm x 28 cm x 2.5 cm) may well have covered the top of the hole. A slightly smaller one, standing vertically, perhaps lined one side of the pit and another, lying flat, its bottom. Broken pieces of several more siltstone slabs, smashed by the mechanical digger, lay about the pit.

All of sandstone, the five mortars, though nicely shaped and finished, are more simply made than the two found earlier and none bears any form of decoration. Four of the vessels are bowl-shaped with thick outcurving walls (Figure 3a – 3c and 3e). Bases are flat on three, slightly rounded on the fourth. Three of the four have fairly broad flattened rims, whereas one has a thin rounded lip. None of the mortars are particularly big, the largest having a height of 17 cm and a top diameter of 22 cm. Grinding cavities of three of them are round-bottomed, somewhat tapered on the fourth.

The fifth mortar is a crude example of the "flower pot" variety (Figure 3d). Its outer surface is somewhat asymmetrical due to an imperfection in the sandstone. Not as large as the two others of this form, the vessel stands 17.5 cm high and has a top diameter of 22 cm. Its grinding cavity narrows toward the bottom.

In the pit with the five mortars were a handsome granite millingstone and a steatite cup. Elongate oval in outline and nearly flat on the underside, the mill (Figure 3f) has been carefully smoothed on all surfaces. Quite large, the mill measures 45 cm x 27 cm. Conceivably; it could have served as a dish or shallow basin rather than for seed grinding.

Made of coarse, granular steatite, the cup is roughly oval in shape with flattened base and rounded lip (Figure 3g). Apparently once well finished, the cup's exterior is now extensively scarred. A dark stain partially covers the damaged lip. The small container stands 6.5 cm high and varies between 7.2 and 9.2 cm in diameter.

A critical question to be asked is, what do these finds mean? That the mortars were intended for hard day-to-day usage in mashing acorns or other plant products seems highly unlikely. Their nature and apparent concealment suggest that they served a special purpose. Ethnographic information offers a possible clue as to their function.

Gabrielino Indians, inhabitants of this coastal strip in the late prehistoric and historic times, manufactured fine mortars for use in a boy's initiation rite that centered around drinking a concoction prepared from the roots of the datura or jimsonweed plant, often called toloache[1] (Bean and Vane 1978:667-668; Gayton 1928:27-28; Kroeber 1925:668-673). Aimed at putting youths in contact with the spiritual world and preparing them for manhood and tribal status, the ceremony was held whenever there was a sufficient number of eligible young males.

Gathered, dried and mashed up in stone mortars reserved for this purpose, the Jimsonweed roots were steeped in water to produce a potent narcotic drink. Given to the initiates, usually in a special cup, the beverage brought on stupor or unconsciousness that lasted for many hours. While in this state, the youths experienced vivid color dreams or visions that brought special blessings and a spiritual helper or guardian. At the end of the rite, the mortars used in preparing the drink were carefully and reverently hidden away in the ground, to be dug up and used again when a new lot of boys were ready for initiation.

Believed to have had its origin among the Gabrielino (Kroeber 1925:621-622), the so-called Toloache Ceremony was performed by a number of native peoples living in the coastal district of California. Among the Gabrielino the ritual had become closely tied to observances connected with Chingichnich, a wise, powerful deity who laid down rules for human conduct and punished transgressors. Because a moralistic deity of this sort seems out of place in an aboriginal religion, it has been suggested that Christianity provided the stimulus (Kroeber 1925:656; 1959:291) and that Chingichnich represents the Franciscan missionaries' God, given a new name and fitted into existing native beliefs and practices.

If indeed the Palos Verdes Estates finds represent datura-drinking paraphernalia, they provide a fairly early record of the practice, for radiocarbon determinations date the site's occupancy between A.D. 150 and 780 (Berger,

Figure 1: Whole Mortar of the "Flower Pot" or Truncated Cone Variety.

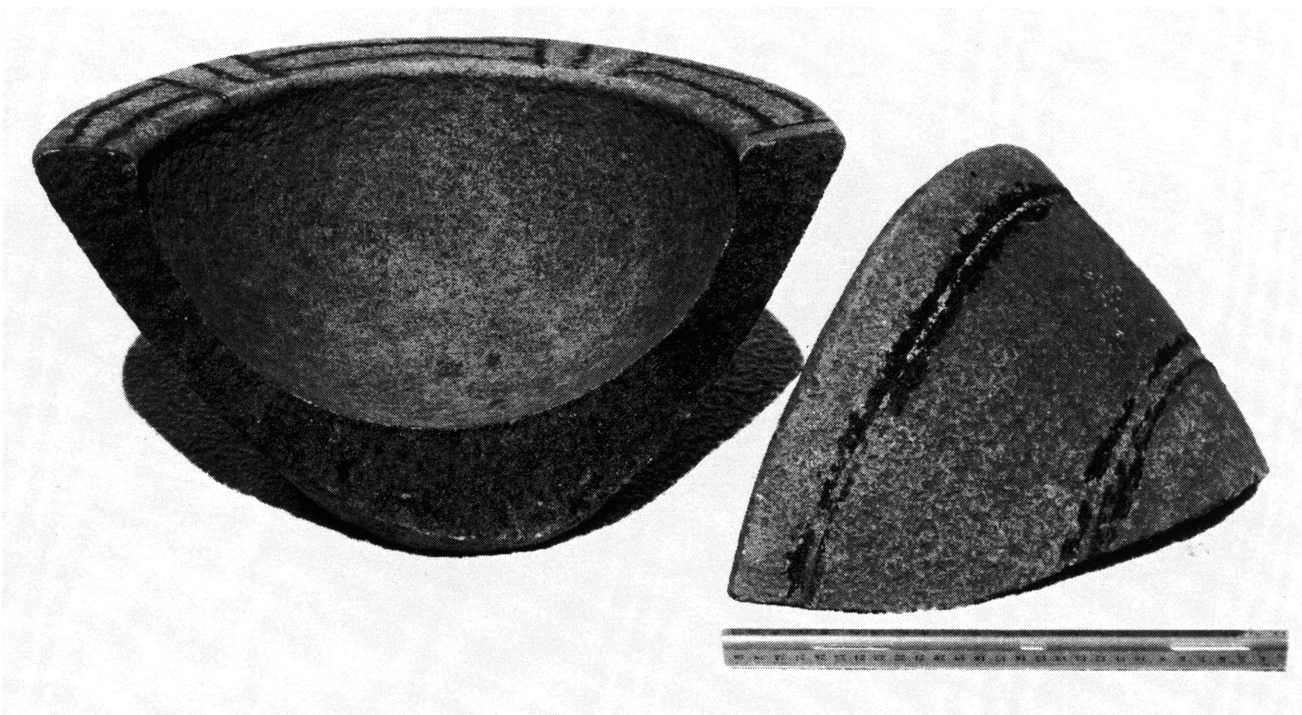

Figure 2: Second Mortar Found Split Lengthwise.

Figure 3: Mortars, Mill and Cup.

Ferguson and Libby 1965:342)[2]. Thus, if there is any validity to the view that the Chingichnich religion represents a post-contact phenomenon, the mortars and other specimens offer a strong hint, if not proof, that the Toloache Ceremony was firmly entrenched here centuries before Chingichnich appeared on the scene.

True enough, all this is an excursion into the realm of surmise and conjecture. It might rightfully be said, that to attribute ceremonial significance, and in this case a specific ritual purpose, to objects dug from the ground is a risky, if not imprudent, procedure. Nonetheless, the archaeological evidence, by no means complete and tidy, does go some way towards raising the possibility, or even probability, that the Palos Verdes Estates mortars did see employment in the Toloache Ceremony.

Endnotes

1. The term "toloache" has attained wide currency among California anthropologists. It is a hispanicized form of "toloatzin," an Aztec name for the Datura.
2. The mortars can be placed in a cultural as well as a time frame. Controlled digging at the Palos Verdes Estates Site in 1961-62 produced an assortment of artifacts typical of the closing prehistoric phase of the southern California coastal region.

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OBSIDIAN HYDRATION IN THE BORAX LAKE BASIN, LAKE COUNTY, CALIFORNIA

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The Borax Lake archaeological site (CA-LAK-36), located near Clear Lake in Lake County, California, is best known for the occurrence of Clovis-like fluted projectile points and bifacially flaked crescents manufactured from obsidian from the adjacent Borax Lake flow (Harrington 1938, 1948). Archaeologists were first made aware of the site in 1938 through the efforts of avocationalist Chester Post who recognized similarities between fluted points he discovered at the site and those first discovered in 1926 near Folsom, New Mexico, and later elsewhere in association with extinct bison (Roberts 1935; Sellards 1952). The Borax Lake site was subsequently excavated by M. R. Harrington of the Southwest Museum with a report on his work published in 1948.

It was not until 1968, twenty years later, that Meighan and Haynes (1968, 1970) clarified some of the ambiguity surrounding the site (Meighan 1955; Treganza 1950) through seminal geoarchaeological and obsidian hydration studies that 1) indicated an age of approximately 12,000 years for the lacustrine clays underlying the alluvial fan which contained the archaeological materials and 2) demonstrated through obsidian hydration analysis that there were three major cultural periods represented at the site: (a) one represented by the fluted points and crescents, shown by hydration to be contemporaneous with one another; (b) one represented by Borax Lake widestem points; and (c) one represented by large stemmed points and nonfluted concave base points.

Of particular interest is the occurrence at the Borax Lake site of Clovis-like projectile points and chipped stone crescents, suggestive of both the Fluted Point Tradition and the Western Pluvial Lakes Tradition (Moratto 1984:75ff). Obsidian hydration readings from these two artifact forms, reported by Meighan and Haynes (1970) suggest that they are contemporaneous at LAK-36. Elsewhere, fluted points precede crescents (Willig 1988). The two artifact forms are usually considered diagnostic of two different adaptations, Big Game Hunting (not yet directly supported in northern California by archaeological data) and generalized foraging, with remains often found on ancient lakeshores.

Obsidian from the extensive Borax Lake flow was used for thousands of years as a source of raw material for flaked stone tools manufactured by native peoples of the Clear Lake region. The obsidian was used not only locally but was also traded within a restricted zone in northern California, for the most part along a north-south axis, northward into the region of the Middle Eel River and southward into the region of present-day Lake Berryessa with small quantities moved as far south as Santa Cruz County (Fredrickson 1987). Borax Lake obsidian was also moved to some extent along an east-west axis, westward to the Pacific Ocean and, in relatively small quantities, eastward into the Sierra.

Prompted by environmental protection legislation, a number of archaeological investigations, including surveys and obsidian hydration studies, have been conducted over the past several years within the Borax Lake basin. Areas surveyed contained CA-LAK-36 (the Borax Lake site) and CA-LAK-35 (an important quarry workshop immediately adjacent to LAK-36), and several other quarry workshops within the Borax Lake flow, as well as numerous nonquarry workshops and other sites in the plain and hills that surround Borax Lake. Because there was a likelihood that better understanding of the Borax Lake site could be gained through placing it within a larger universe of nearby sites, the present writers initiated a series of obsidian hydration studies culminating in the one presented here (Fredrickson 1987, 1989; Fredrickson and

Origer 1986; see also Fredrickson and White 1988). To a great extent, this paper follows the lead of earlier hydration studies pertaining to the Borax Lake basin carried out by Clark (1964), Ericson (1977), Findlow et al. (1978), Kaufman (1978, 1980, 1988), and Meighan and Haynes (1968, 1970). All available hydration readings from the Borax Lake basin are brought together here, broken down for comparative purposes by site type and hydration value. The cumulative results reported here from 28 locations within a one-mile radius of the Borax Lake site are then compared with the overall occurrence of the glass over time. In total, the temporal distribution of 512 hydration readings from the vicinity of Borax Lake are compared with the temporal spread of 1929 readings from more widespread occurrences of this variety of obsidian.

The Obsidian Hydration Method

Obsidian hydration is a method originally described by Friedman and Smith (1960) for determining the chronological and relative ages of flaked surfaces of obsidian. The method is based on the fact that a newly exposed obsidian surface will absorb water to form a small but measurable rind, which becomes thicker over time. The two major variables that affect the rate of hydration are chemical composition and temperature. With minor exceptions, obsidian within and in the vicinity of the Borax Lake flow has identical chemical composition and has been subject to the same effective temperature. Major variables affecting hydration rate for this study are thus controlled.

A question arises regarding the advisability of comparing hydration values produced by different investigators. Experimental evidence has shown that, although there is variability between different technicians, there is overall consistency in hydration results produced by different technicians (Clark 1964:150, 181; Schiffman 1988; Stevenson et al. 1989). The assumption of the present study, considering the relatively large samples from each technician, is that combining hydration values obtained by different technicians does not significantly bias the findings.

It is also known that obsidian other than that from the Borax Lake flow occurs at the Borax Lake site, although in very small proportions (Findlow et al. 1978:135). This has most relevance to the early studies by Clark (1964) whose specimens were not identified by source. (Findlow et al. 1978:135) cite a personal communication from R.F. Heizer that "all but two of the artifacts from the Borax Lake Site have been shown to come from the Borax Lake obsidian source" but do not give the evidence on which Heizer based this information. Today it is possible to distinguish visually on the basis of macroscopic characteristics between Borax Lake and other North Coast Ranges obsidian with a relatively low error rate, with 90-100% accuracy, when visually sourced specimens are compared with sourcing through use of x-ray fluorescence analysis. Thus we believe that our comparisons are not significantly biased because of differences between technicians or the lack of geochemical documentation that specimens in the sample actually derive from the Borax Lake flow.

The Data Base

This study employs obsidian hydration readings from both published and unpublished sources, including the pioneering work by Donovan Clark (1964), data from the Meighan and Haynes (1970) study, and other data published in the UCLA compendia of obsidian hydration determinations (Meighan et al. 1974; Meighan and Scalise 1988; Meighan and Vanderhoeven 1978). Other, previously unpublished data are from the files of the Obsidian Hydration Laboratory, Sonoma State University, some, but not all of which were reported but not formally published (Fredrickson 1989; Fredrickson and Origer 1986).

The obsidian samples from all of these studies consisted of projectile points, other bifaces and tools, and debitage. Because the specimens were collected by different researchers at different times as part of different kinds of studies and are not consistently reported with reference to inferred function, no effort was made in the present study to distinguish between formal artifacts and debitage. It can be pointed out, however, that the Borax Lake site, in comparison with other sites in the present study, is over-represented by formal artifacts.

Figure 1 lists the 28 archaeological sites from which 512 useable obsidian hydration readings were obtained. Figure 2 maps the approximate location of these sites; each mapped location contains one and sometimes two sites. Data in Figure 1 shows that about 72% of the 95 unreadable bands (weathered, diffuse, or otherwise not useable) were from specimens obtained from quarry sites. As indicated in Fig. 1, 46 specimens contained multiple bands, all double except for a single triple. In most cases multiple bands appeared to be due to reuse. Quarry sites provided over 76% of the 17 bands that measured over 13 microns. These large readings, which ranged from 13.2 to 24.7 microns (mean = 15.4 microns) derived in large part from chunks and core-like specimens and, because their cultural origin is questionable, were not used in this analysis (Fredrickson and Origer 1986).

Specifically, this paper presents comparisons of the obsidian hydration readings from (1) the Borax Lake site itself, (2) quarry workshops within the Borax Lake flow, and (3) non-quarry workshops and other sites in the hills and plain that form the Borax Lake basin. Sources of hydration data for each of these localities are provided below.

The Borax Lake Site

Several suites of obsidian hydration measurements, with a total of 161 useable readings, are available from LAK-36, the Borax Lake site. The initial readings from the site were the 31 made by Clark (1964:189-193) as part of his groundbreaking study of obsidian hydration and archaeological chronology in California. Clark stated his concern that thermal activity in the region "could account for a greatly increased hydration locally" (1964:192-193). However, Meighan and Haynes (1970:1218), who excavated 20 backhoe trenches across the site to an average depth of ten feet, considered it unlikely that thermal activity affected their hydration readings, which yielded results similar to those of Clark. Kaufman (1980:197ff), however, suggested that larger hydration readings from sites near the northeast edge of the Borax Lake flow, especially quarry site CA-LAK-690, "tend to exhibit larger hydration readings than do sites in other areas of the basin," and states the need for further investigation concerning the effects of geothermal activity on hydration rates in the Clear Lake region. Our larger sample indicates that the hydration values from CA-LAK-690 are well within the range of the sample as a whole. In our view, these large readings represent early quarry use of this location rather than distortion caused by geothermal action.

A second suite of 74 useable hydration readings from the Borax Lake site was obtained by Meighan and Haynes (1968, 1970) in their re-examination of the age of the Borax Lake site. A third suite of 56 obsidian hydration readings was obtained from documented surface collections made over a period of years during archaeological surveys by Sonoma State University and others; these readings, on file at Sonoma State University's Obsidian Laboratory, are reported here for the first time.

Figure 3 presents the distribution of obsidian hydration values from the Borax Lake site by each of the three collections, the 31 reported by Clark (1964), the 74 published by Meighan and Haynes (1970; Meighan et al. 1974:17-19; Findlow et al. 1978), and the 56 determined by Sonoma State University (SSU Obsidian Laboratory files). In comparison, the three samples are remarkably consistent, with the vast majority falling between about 4 to 10 microns within a bell-shaped curve having a mode in the mid-sevens. This consistency may be because the majority of the specimens in these three samples are bifacially worked tools collected to address the possible age and antiquity of the site. The consistencies between the samples support one another with respect to the period of occupation represented at the site. The marked fall off of readings greater than 10 microns is also notable, prompting the suggestion that little human use of the area occurred prior to the time implied by this hydration value.

Borax Lake Quarry Sites

A total of 211 obsidian hydration readings from twelve quarry locations within the Borax Lake obsidian flow contribute to the present study. The Borax Lake flow, located south of Borax Lake and east of the southern arm of Clear Lake, encompasses an area greater than one square mile. The flow is within an area that has been subdivided and now contains paved streets, many homes, and other urban features. Within the complex of streets and homes spread throughout the flow are numerous discrete quarry locations; some of these are major and have state trinomial identification numbers, others are comparatively small and have not been systematically recorded. One of the best-known quarry sites, contributing 38 readings to this study, is CA-LAK-35, a large quarry-workshop located several hundred meters from CA-LAK-36.

In 1975, an archaeological survey of the Borax Lake basin, including much of the quarry area, was conducted in association with proposed geothermal development (Fredrickson 1976). A total of 64 useable obsidian hydration readings obtained from seven quarry sites recorded during this survey were reported by Tom Kaufman in his 1980 dissertation (see also Kaufman 1978). An additional five readings from the 1975 collection were prepared by the authors for a 1989 Society for California Archaeology paper (Fredrickson 1989).

As part of a 1986 environmental impact study, Jay Flaherty of Archaeological Services, Inc., collected obsidian samples for hydration analysis from seven separate locations within the Borax Lake flow during a street improvement project. The hydration study, conducted jointly with the present writers, had two major goals: (1) to examine temporal variability in the use of obsidian from several different quarry locations and (2) to begin the systematic accumulation of obsidian hydration data that would monitor cultural use of the Borax Lake obsidian flow over time (Fredrickson and Origer 1987).

Figure 4 provides the 211 obsidian hydration values from the twelve quarry sites within the Borax Lake flow by each of the three collections, including the 64 readings reported by Kaufman (1980), the 142 readings from the Flaherty, Origer, and Fredrickson quarry study (Fredrickson and Origer 1987), and five additional readings from the 1975 geothermal survey (Fredrickson 1976; SSU Obsidian Laboratory files). In contrast with specimens from the Borax Lake site itself, the specimens represented by all three samples are overwhelmingly restricted to debitage rather than bifacially worked tools. Also, there was no collection bias with respect to antiquity. As a result, the most obvious contrast with the Borax Lake site is the lack of a notable mode and the continuing use of obsidian from the quarry after significant use dropped off at the Borax Lake site.

Nonquarry Sites within the Borax Lake Basin

A total of fifteen nonquarry sites within the Borax Lake basin (but not including the Borax Lake site), contribute another 140 obsidian hydration readings to this study. These fifteen sites were recorded (or re-recorded) during the 1975 survey carried out in association with proposed geothermal development (Fredrickson 1976). During a subsequent 1989 visit to these sites, the present authors collected additional specimens to provide data for a paper prepared for the annual meeting of the Society for California Archaeology (Fredrickson 1989).

For the most part, these fifteen nonquarry locations appear to be flake scatters, although several at the edges of Borax Lake and along surrounding ridge tops may have depth, as judged by surface appearances only. Others, especially those on small flats just below the surrounding ridges, appear much more ephemeral, in some cases possibly representing a single knapping episode. At least four of the sites located around the edge of the lake, which had been accessible when they were recorded during the drought year of 1975, were under water and inaccessible when revisited in 1989.

Figure 5 provides the 140 obsidian hydration values including six that Clark (1964) had reported from specimens obtained earlier from one of sites re-recorded in 1975 and also include the nineteen useable readings from seven sites that Kaufman (1980) obtained from the 1975 collection. The remaining 115 values were obtained by the present writers in 1989 (Fredrickson 1989; SSU Obsidian Laboratory files).

Of particular interest is the extent to which the distribution of hydration readings from these nonquarry sites parallels that of the Borax Lake site itself. The major difference is a not unexpected increase in the number of relatively late readings, 21.4% of the nonquarry hydration values are less than 4 microns compared with 10.6% for the Borax Lake site. Although this relatively high rate compares well with the 23.7% of the quarry sites with hydration values less that four microns, those of the nonquarry sites are quite late in time, with most being 1.5 microns or less. Quarry site values, while peaking below 1.5 microns, are more equally distributed throughout the entire range.

Discussion

Because obsidian from the Borax Lake flow fostered sustained human use beginning in the Paleoindian Period, the Borax Lake basin, which contains both quarry and nonquarry sites, has potential to provide insight into several dimensions of local and regional prehistory. The hydration values from CA-LAK-36, with its Clovis-like projectile points, together with the readings from other nonquarry and quarry sites within the basin, provide evidence for long term use of the vicinity. Data presented in Figures 3 and 5, combined in Figure 6, disclose several patterns in the distribution of obsidian hydration values over time and by site type. These patterns, presumed to reflect changes in obsidian production, suggest both similarities and differences between modal distributions found in the Borax Lake basin and the cultural chronologies for the larger Clear Lake basin.

The temporal congruence of the obsidian hydration profiles representing CA-LAK-36 and the other nonquarry sites within the Borax Lake basin is remarkably striking. The similarities suggest that these sites are part of a local cultural system that is not strongly reflected in the obsidian hydration profile from the quarry sites (Figure 4). The quarry sites presumably were furnishing obsidian not only for the present study area but also for other, more distant localities. It is notable that readings from CA-LAK-36 derive in the main from projectile points and other bifacially worked tools rather than flaking debris. This is understandable since the emphasis in studies of the Borax Lake site has been upon artifacts with potential to be temporally diagnostic. The study of the nonquarry flake scatters in the vicinity of the Borax Lake site contrasts in this regard. Hydration readings were overwhelmingly from debitage, all from the surface. Virtually no bifacially worked tools or tool fragments were noted during the initial 1975 survey; the identical observation was made as additional obsidian was collected for analysis in 1989.

In addition, the hydration sample from the Borax Lake site was biased in terms of artifacts believed to be ancient, most notably the fluted points, crescents, and wide-stem points, whereas there was no deliberate selection bias with respect to age in the samples collected from the other nonquarry sites. Flakes were collected as encountered with the aim of sampling as large a portion as possible of each site's surface.

The hydration distribution data presented here show marked shifts in frequency over time. The frequency distribution from the Borax Lake basin differs considerably from that of hydration readings from a large sample of Borax Lake specimens (n=1929) from about 150 northern California archaeological sites located outside of the Borax Lake basin that are presented in Figure 8. Sites represented in this figure are spread from Sonoma and Napa counties to Mendocino and Humboldt counties, from the Pacific coast to the central Sierra. Thus, it appears proper to state that this generalized distribution is heavily biased by the exchange system, rather than local use. Elsewhere, Fredrickson (1987) discusses comparative data from the different localities where Borax Lake obsidian occurs in cultural contexts.

In the following discussion, hydration values are placed into a culture-historical framework, from most ancient to most recent. Figure 7 suggests that initial use of the Borax Lake obsidian flow may have been as early as the time indicated by about 12 microns, probably the maximum age of the Post Pattern, i.e., the culture represented by fluted points and crescents (Fredrickson 1973, 1974). Hydration values from these tools (Meighan and Haynes 1970; SSU Obsidian Laboratory Files) suggest that this early period was over by the time indicated by approximately 8 microns.

The mean hydration value for wide-stem points, representative of the Borax Lake Pattern, is about 7.2 microns (Fredrickson and White 1988) with some overlap with fluted points and crescents at the higher end of the range. This overlap may denote contemporaneity, but may also be due to limitations of the optical equipment and technician variability and/or a product of the hydration process itself. The Mostin site, from which Borax Lake obsidian averages about 6.5 microns, follows the wide-stem point in time. The Mostin site, now seen as part of the continuum of the Houx Pattern (White and Fredrickson 1992), was once believed to be quite ancient but it now appears that the relatively ancient radiometric dates may have been influenced by fossil carbonates emanating from subaqueous thermal springs at the bottom of adjacent Clear Lake (Fredrickson and White 1988; White and King 1993).

Although Figure 8 excludes readings from the Borax Lake flow and basin, it does include readings from other Lake County sites, including nearby CA-LAK-510 at Lower Lake and Burns Valley adjacent to the Borax Lake basin, both known to have produced notably large hydration readings (e.g., Weber 1978), and the Mostin site, which also produced relatively large readings. Even with the bias introduced by readings from these three locations, it is evident that Borax Lake obsidian did not enter the exchange system in quantity until about the time period represented by about 6 microns. Parker (1993:317) has shown that the use of upland zones in the Clear Lake basin began during the 6 to 7 micron range. It is possible that these two phenomena are related, since there is a corresponding culture-historical shift apparent in the Houx Pattern at about the time indicated by 6 microns. Prior to this, Houx sites are assumed to represent family bands, but Houx sites dating after 6 microns frequently contain relatively rich midden deposits indicative of at least semisedentary habitation (Fredrickson and White 1994). We suggest that expansion of Borax Lake obsidian into a regional exchange system may represent this fluorescence of the Houx Pattern, an outgrowth of its adaptive success. Whether Houx peoples or others used upland zones has not yet been shown.

It is notable that the greatest use of the Borax Lake basin was between about 9.5 and 4.5 microns, when production dropped off considerably. This drop off may reflect the emergence of a Houx Pattern tribelet structure in the Clear Lake basin, as suggested elsewhere (Fredrickson and White 1994; White and Fredrickson 1992). Tribelet control over access to the obsidian quarries is a believable consequence of such a development. A secondary drop off indicated at about 3.5 microns may reflect a change in the nature of obsidian production, presumably a decline in the production of large bifaces fostered by the beginning of the late period and the introduction of the bow and arrow. The distinctive surge in hydration readings that begins at about 1.7 microns may well represent the beginning of Phase 2, the protohistoric period.

Summary

The temporal distribution of obsidian hydration values within the Borax Lake basin may be viewed as a function of cultural pulses some of, which are local in nature and others emanating from outside of the basin. The basin is unique in northern California in that it contains the Borax Lake site that has yielded the best evidence for paleoindian Post Pattern occupation of the region. Similarly, it has yielded the best evidence for the Borax Lake Pattern, believed to be ancestral to the Houx Pattern, whose earliest key site is Mostin, located at Kelseyville in Lake County.

It is noteworthy that the Borax Lake basin does not seem to reflect in any obvious way the expansion of Borax Lake obsidian into the regional exchange system at the time indicated by about six microns. This expansion may well be a product of a shift in the Houx Pattern from a family band structure to semisedentary organization, documented by excavations near the town of Lower Lake (Fredrickson and White 1994). This is about the same time that use of upland zones in the Clear Lake basin commenced (Parker 1993).

We have posited that the drop off of obsidian production in the Borax Lake basin at the time indicated by about 4.5 microns is related to the emergence of Houx tribelet structure, resulting in Houx Pattern control of access to the obsidian flow. The rise in hydration values somewhat prior to the time indicated by 3.5 microns may be a result of feedback processes that both entrenched and regularized control of access to the obsidian quarries. At the time indicated by about 3.5 microns another drop off occurred within the Borax Lake basin, one that may be related to a shift in obsidian production due to a technological shift from the large bifaces to small arrow points at the beginning of the late period's Clear Lake Aspect. It is also likely that the increase in hydration values at about 1.7 microns was a function of activities during Phase 2 of the Clear Lake Aspect, a process as yet little understood.

Addendum

The use of hydration alone to establish what is in essence a relative chronology is particularly frustrating when many would prefer to see temporal measurements in years, not microns. There are no radiocarbon dates available for the Borax Lake basin nor are there entirely satisfactory hydration rates that have been established for Borax Lake obsidian (Ericson 1977; Findlow et al. 1978). In response to this situation, Parker (1994:189) correlated radiocarbon dates from Lake County sites with hydration values but did not develop a hydration rate. Instead, Parker (1994:183-184; Fredrickson 1989) employed the rate developed by Origer (1987) for the Napa Valley source in Sonoma County. Parker converted Borax Lake

Figure 1: List of Sites with Site Type and Status of Obsidian Values

Site	Type*	#1**	(db	>13	pb)***	#2**	(db	>13	pb)***	#3**	(db	>13	pb)***	#4**	(db	>13	pb)***	
Lak-35	Q									13	(-	-	1)	25	(3	2	7)	38
Lak-36	NQ	31	(4	?	?)	74	(6	1	8)					56	(5	-	2)	161
Lak-83	NQ													4	(-	-	1)	4
Lak-84	NQ													6	(1	-	-)	6
Lak-85	NQ	6	(1	?	?)									5				11
Lak-86	NQ									3	(1	1	-)	6	(1	-	-)	9
Lak-87	NQ													8	(3	-	-)	8
Lak-88	NQ													6	(2	1	-)	6
Lak-546	Q									11	(1	-	-)					11
Lak-547	Q									9	(2	2	1)					9
Lak-621	Q									10	(2	-	2)					10
Lak-679	Q													31	(2	1	7)	31
Lak-690	Q									17	(4	1	1)	27	(-	-	9)	44
Lak-694	NQ									3	(-	-	1)	12	(1	0	4)	15
Lak-695	NQ									3				11	(1	-	1)	14
Lak-696	NQ													12	(2	-	1)	12
Lak-697	NQ									2				4	(1	-	1)	6
Lak-698	NQ									3				23	(-	-	4)	26
Lak-699	NQ									2				6	(-	-	3)	8
Lak-700	NQ									0	(-	-	3)	5	(1	-	-)	5
Lak-701	NQ									3				2				5
Lak-1143	NQ									0	(-	-	3)	5	(-	-	1)	5
Bl-22	Q													20	(-	-	16)	20
Bl-23	Q													7	(-	-	8)	7
Bl-33	Q									3	(-	-	1)					3
Bl-37	Q									1	(1	1	-)					1
Pw-1	Q													22	(1	5	6)	22
Pw-2	Q													15	(-	1	4)	15
Totals		37	(5	?	?)	74	(6	1	8)	83	(11	5	11)	318	(24	11	76)	512

* Types - Q: Quarry site; NQ: Non-Quarry site;

**#1: Clark 1964; #2: Meighan, et al. 1974; #3: Kaufman 1980; #4: California State University, Sonoma (Obsidian Hydration, Files).

***Codes - db: double band; >13: obsidian hydration value greater than 13 microns; pb: poor (unreadable) band. All readings from specimens with double bands (coded "db") are included except for those that were unreadable and those that were greater than 13 microns. Numbers in parentheses coded "> 13" and "pb" represent hydration readings that, for reasons indicated by the code, are not included in counts of useable readings.

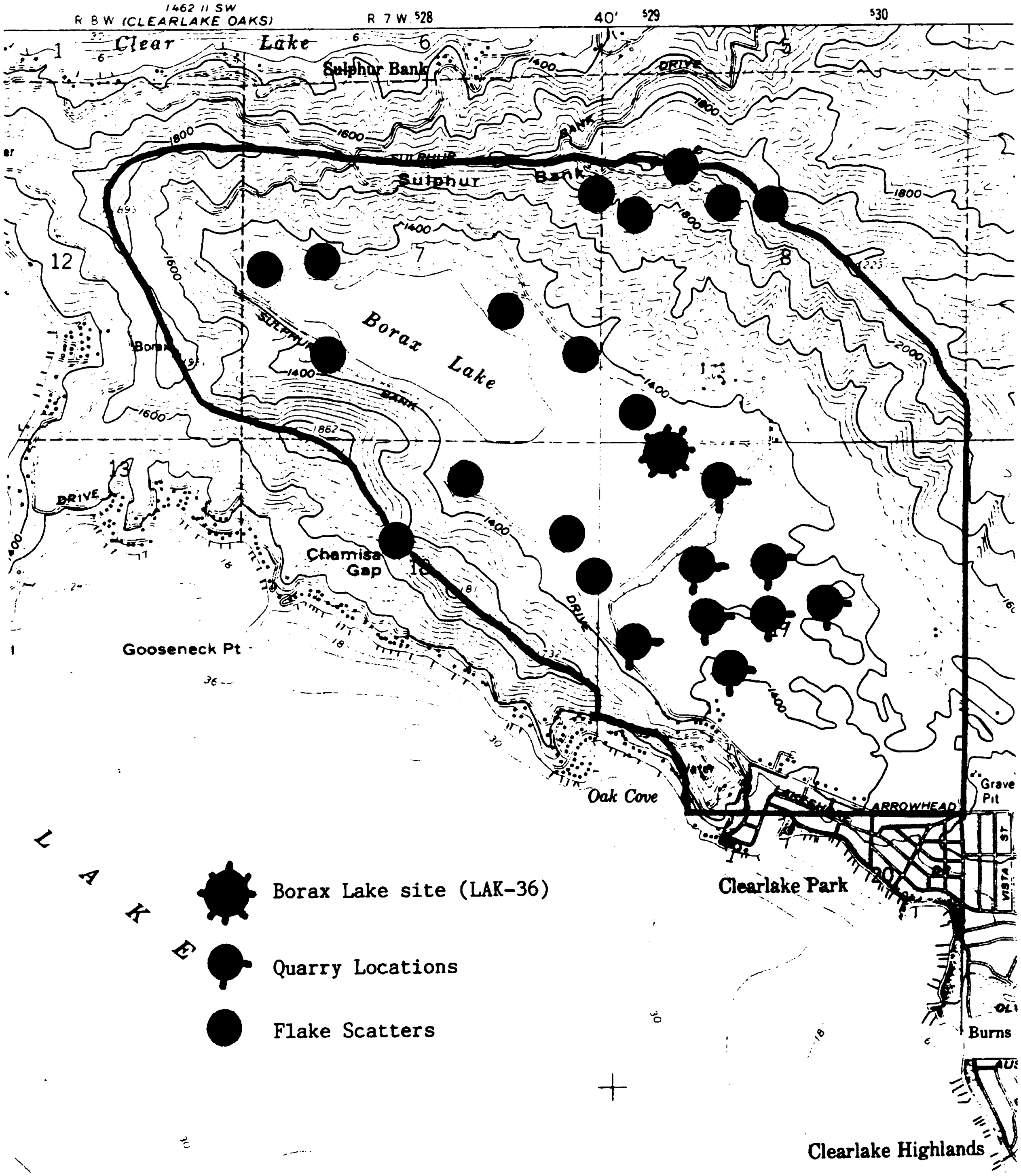

Figure 2: Borax Lake Basin, map showing archaeological sites by site type and location.

Figure 3: Obsidian Hydration Values from the Borax Lake Site

Obsidian Hydration	Sample 1*	Sample 2*	Sample 3*	Totals
1.0 - 1.1		1		1
1.2 - 1.3				0
1.4 - 1.5.		3	1	4
1.6 - 1.7		4	1	5
1.8 - 1.9				0
2.0 – 2.1				0
2.2 – 2.3		1		1
2.4 – 2.5				0
2.6 – 2.7		1		1
2.8 – 2.9		1		1
3.0 – 3.1				0
3.2 – 3.3				0
3.4 – 3.5				0
3.6 – 3.7			1	1
3.8 – 3.9		2	1	3
4.0 – 4.1				
4.2 – 4.3		1		1
4.4 – 4.5				0
4.6 – 4.7	1		2	3
4.8 – 4.9	1	2	2	5
5.0 – 5.1		2	3	5
5.2 – 5.3	1	1	3	5
5.4 – 5.5	1	1		2
5.6 – 5.7		3	2	5
5.8 – 5.9		4	1	5
6.0 – 6.1	3			3
6.2 – 6.3	2	2	3	7
6.4 – 6.5	3	3	2	8
6.6 – 6.7	1	1	2	4
6.8 - 6.9	3	2	5	10
7.0 – 7.1	4	3	2	9
7.2 – 7.3	1	3	4	8
7.4 – 7.5	5	5	1	11
7.6 – 7.7	2	3	2	7
7.8 – 7.9			2	2
8.0 – 8.1		5		5
8.2 – 8.3			2	2
8.4 – 8.5	2	4	1	7
8.6 – 8.7	1	2	5	8
8.8 – 8.9		3		3
9.0 – 9.1		1	2	3
9.2 – 9.3		2	1	3
9.4 – 9.5		2	1	3
9.6 – 9.7		1	1	2
9.8 – 9.9		2		2
10.0 – 10.1			1	1
10.2 – 10.3			1	1
10.4 – 10.5				0
10.6 – 10.7				0
10.8 – 10.9				0
11.0 – 11.1		1		1
11.2 – 11.3				0
11.4 – 11.5				0
11.6 – 11.7				0
11.8 – 11.9				0
12.0 – 12.1		1	1	2
12.2 – 12.3				0
12.4 – 12.5				0
12.6 – 12.7				0
12.8 – 12.9		1		1
13.0				0
Totals	31	74	56	161

*Sample 1: Clark 1964; Sample 2: Meighan, et al. 1974; Sample 3: California State University, Sonoma (SSU Obsidian Laboratory, Files).

Figure 4: Obsidian Hydration Values from the Borax Lake Quarry Sites

Obsidian Hydration	Sample 1*	Sample 2*	Sample 3*	Totals
0.8 – 0.9		3		3
1.0 - 1.1		10		10
1.2 - 1.3		3		3
1.4 - 1.5.		3		3
1.6 - 1.7	1	1		2
1.8 - 1.9	1	2		3
2.0 – 2.1	1			1
2.2 – 2.3		4		4
2.4 – 2.5		2		2
2.6 – 2.7	1	1		2
2.8 – 2.9		1	1	2
3.0 – 3.1	1	2	1	4
3.2 – 3.3	1	1		2
3.4 – 3.5		1		1
3.6 – 3.7	1	3		4
3.8 – 3.9	1	3		4
4.0 – 4.1		4		4
4.2 – 4.3	2	2		4
4.4 – 4.5		2		2
4.6 – 4.7		2		2
4.8 – 4.9	2	5		7
5.0 – 5.1		2		2
5.2 – 5.3	1	5	1	7
5.4 – 5.5	3	4	1	8
5.6 – 5.7	1	3		4
5.8 – 5.9		3		3
6.0 – 6.1		3	1	4
6.2 – 6.3	1	2		3
6.4 – 6.5	1	5		6
6.6 – 6.7	1	4		5
6.8 – 6.9	2	3		5
7.0 – 7.1	2	3		5
7.2 – 7.3	1	3		4
7.4 – 7.5	1	5		6
7.6 – 7.7	1	3		4
7.8 – 7.9		3		3
8.0 – 8.1	2	1		3
8.2 – 8.3	2	6		8
8.4 – 8.5		1		1
8.6 – 8.7	3	4		7
8.8 – 8.9	2	4		6
9.0 – 9.1		5		5
9.2 – 9.3	1	2		3
9.4 – 9.5	2	3		5
9.6 – 9.7	1	1		2
9.8 – 9.9	4	2		6
10.0 – 10.1	2			2
10.2 – 10.3	2	1		3
10.4 – 10.5	4			4
10.6 – 10.7	2			2
10.8 – 10.9	1	2		3
11.0 – 11.1	1	2		3
11.2 – 11.3	1			1
11.4 – 11.5	1			1
11.6 – 11.7	1			1
11.8 – 11.9	3	1		4
12.0 – 12.1	1			1
12.2 – 12.3				0
12.4 – 12.5		1		1
12.6 – 12.7	1			1
12.8 – 12.9				0
13.0				0
Totals	64	142	5	211

*Sample 1: Kaufman 1980; Sample 2: Fredrickson & Origer 1989; Sample 3: California State University, Sonoma (SSU Obsidian Laboratory, Files).

Figure 5: Obsidian Hydration Values from the Borax Lake Non-Quarry Sites

Obsidian Hydration	Sample 1*	Sample 2*	Sample 3*	Totals
1.0 - 1.1			1	1
1.2 - 1.3			11	11
1.4 - 1.5.		1	4	5
1.6 - 1.7			1	1
1.8 - 1.9				0
2.0 – 2.1		2		2
2.2 – 2.3		1		1
2.4 – 2.5				0
2.6 – 2.7				0
2.8 – 2.9				0
3.0 – 3.1			1	1
3.2 – 3.3				0
3.4 – 3.5			3	3
3.6 – 3.7			3	3
3.8 – 3.9			2	2
4.0 – 4.1			1	1
4.2 – 4.3			1	1
4.4 – 4.5	1			1
4.6 – 4.7		2		2
4.8 – 4.9		1	5	6
5.0 – 5.1			4	4
5.2 – 5.3	1	1	3	5
5.4 – 5.5		1	2	3
5.6 – 5.7			6	6
5.8 – 5.9		1	5	6
6.0 – 6.1		1	6	7
6.2 – 6.3		3	7	10
6.4 – 6.5	1	2	3	6
6.6 – 6.7			3	3
6.8 – 6.9	1	1	5	7
7.0 – 7.1	1		3	4
7.2 – 7.3			4	4
7.4 – 7.5		1	3	4
7.6 – 7.7		1	3	4
7.8 – 7.9			3	3
8.0 – 8.1			5	5
8.2 – 8.3				0
8.4 – 8.5				0
8.6 – 8.7			2	2
8.8 – 8.9			1	1
9.0 – 9.1	1		4	5
9.2 – 9.3			2	2
9.4 – 9.5				0
9.6 – 9.7				0
9.8 – 9.9				0
10.0 – 10.1			1	1
10.2 – 10.3			1	1
10.4 – 10.5			2	2
10.6 – 10.7				0
10.8 – 10.9			2	2
11.0 – 11.1			1	1
11.2 – 11.3				0
11.4 – 11.5			1	1
11.6 – 11.7				0
11.8 – 11.9				0
12.0 – 12.1				0
12.2 – 12.3				0
12.4 – 12.5				0
12.6 – 12.7				0
12.8 – 12.9				0
13.0				0
Totals	6	19	115	140

*Sample 1: Clark 1964; Sample 2: Kaufman 1980; Sample 3: Fredrickson & Origer 1989.

Figure 6: Obsidian Hydration Values from the Borax Lake Site and Other Non-Quarry Sites within the Borax Lake Basin

Obsidian Hydration	Sample 1*	Sample 2*	Totals
1.0 - 1.1	1	1	2
1.2 - 1.3		11	11
1.4 - 1.5.	4	5	9
1.6 - 1.7	5	1	6
1.8 - 1.9			0
2.0 – 2.1		2	2
2.2 – 2.3	1	1	2
2.4 – 2.5			0
2.6 – 2.7	1		1
2.8 – 2.9	1		1
3.0 – 3.1		1	1
3.2 – 3.3			0
3.4 – 3.5		3	3
3.6 – 3.7	1	3	4
3.8 – 3.9	3	2	5
4.0 – 4.1		1	1
4.2 – 4.3	1	1	2
4.4 – 4.5		1	1
4.6 – 4.7	3	2	5
4.8 – 4.9	5	6	11
5.0 – 5.1	5	4	9
5.2 – 5.3	5	5	10
5.4 – 5.5	2	3	5
5.6 – 5.7	5	6	11
5.8 – 5.9	5	6	11
6.0 – 6.1	3	7	10
6.2 – 6.3	7	10	17
6.4 – 6.5	8	6	14
6.6 – 6.7	4	3	7
6.8 – 6.9	10	7	17
7.0 – 7.1	9	4	13
7.2 – 7.3	8	4	12
7.4 – 7.5	11	4	15
7.6 – 7.7	7	4	11
7.8 – 7.9	2	3	5
8.0 – 8.1	5	5	10
8.2 – 8.3	2		2
8.4 – 8.5	7		7
8.6 – 8.7	8	2	10
8.8 – 8.9	3	1	4
9.0 – 9.1	3	5	8
9.2 – 9.3	3	2	5
9.4 – 9.5	3		3
9.6 – 9.7	2		2
9.8 – 9.9	2		2
10.0 – 10.1	1	1	2
10.2 – 10.3	1	1	2
10.4 – 10.5		2	2
10.6 – 10.7			0
10.8 – 10.9		2	2
11.0 – 11.1	1	1	2
11.2 – 11.3			0
11.4 – 11.5		1	1
11.6 – 11.7			0
11.8 – 11.9			0
12.0 – 12.1	2		2
12.2 – 12.3			0
12.4 – 12.5			0
12.6 – 12.7			0
12.8 – 12.9	1		1
13.0			0
Totals	161	140	301

*Sample 1: The Borax Lake Site (from Figure 2); Sample 2: Other Non-Quarry Sites (from Figure 4).

Figure 7: Obsidian Hydration Values from the Borax Lake Site, Other Non-Quarry Sites and Quarry Sites in the Borax Lake Basin

Obsidian Hydration	Total*
0.8 – 0.9	3
1.0 - 1.1	12
1.2 - 1.3	14
1.4 - 1.5.	12
1.6 - 1.7	8
1.8 - 1.9	3
2.0 – 2.1	3
2.2 – 2.3	6
2.4 – 2.5	2
2.6 – 2.7	3
2.8 – 2.9	3
3.0 – 3.1	5
3.2 – 3.3	2
3.4 – 3.5	4
3.6 – 3.7	8
3.8 – 3.9	9
4.0 – 4.1	5
4.2 – 4.3	6
4.4 – 4.5	3
4.6 – 4.7	7
4.8 – 4.9	18
5.0 – 5.1	11
5.2 – 5.3	17
5.4 – 5.5	13
5.6 – 5.7	15
5.8 – 5.9	14
6.0 – 6.1	14
6.2 – 6.3	20
6.4 – 6.5	20
6.6 – 6.7	12
6.8 – 6.9	22
7.0 – 7.1	18
7.2 – 7.3	16
7.4 – 7.5	21
7.6 – 7.7	15
7.8 – 7.9	8
8.0 – 8.1	13
8.2 – 8.3	10
8.4 – 8.5	8
8.6 – 8.7	17
8.8 – 8.9	10
9.0 – 9.1	13
9.2 – 9.3	8
9.4 – 9.5	8
9.6 – 9.7	4
9.8 – 9.9	8
10.0 – 10.1	4
10.2 – 10.3	5
10.4 – 10.5	6
10.6 – 10.7	2
10.8 – 10.9	5
11.0 – 11.1	5
11.2 – 11.3	1
11.4 – 11.5	2
11.6 – 11.7	1
11.8 – 11.9	4
12.0 – 12.1	3
12.2 – 12.3	0
12.4 – 12.5	1
12.6 – 12.7	1
12.8 – 12.9	1
13.0	0
Total	512

*Data represents combined totals from Figures 2, 3 and 4.

Figure 8: Obsidian Hydration Values from Areas Other Than the Borax Lake Basin

Obsidian Hydration	Total *
0.8 – 0.9	12
1.0 - 1.1	40
1.2 - 1.3	29
1.4 - 1.5.	42
1.6 - 1.7	37
1.8 - 1.9	33
2.0 – 2.1	48
2.2 – 2.3	51
2.4 – 2.5	65
2.6 – 2.7	75
2.8 – 2.9	59
3.0 – 3.1	61
3.2 – 3.3	99
3.4 – 3.5	84
3.6 – 3.7	83
3.8 – 3.9	78
4.0 – 4.1	67
4.2 – 4.3	91
4.4 – 4.5	85
4.6 – 4.7	70
4.8 – 4.9	50
5.0 – 5.1	76
5.2 – 5.3	75
5.4 – 5.5	68
5.6 – 5.7	93
5.8 – 5.9	56
6.0 – 6.1	44
6.2 – 6.3	26
6.4 – 6.5	32
6.6 – 6.7	31
6.8 – 6.9	24
7.0 – 7.1	24
7.2 – 7.3	12
7.4 – 7.5	16
7.6 – 7.7	12
7.8 – 7.9	9
8.0 – 8.1	9
8.2 – 8.3	7
8.4 – 8.5	4
8.6 – 8.7	5
8.8 – 8.9	7
9.0 – 9.1	4
9.2 – 9.3	3
9.4 – 9.5	1
9.6 – 9.7	8
9.8 – 9.9	3
>9.9	21
Total	1929

*Data from Fredrickson 1987.

Figure 9: Cultural – Historical Summary

Microns	Years BP*	Site	Associations
12	12500	Borax Lake Site (CA-Lak-36) Non-Quarry Sites Quarry Sites	- Post Pattern PaleoIndian Period - Basement culture in North Coast ranges
9.5	7800	Borax Lake Site	- Significant use of Borax Lake site and other non-quarry sites begins
8	5600	Borax Lake Site Mean value for Mostin Site (CA-Lak-381)	-Borax Lake pattern, Lower Archaic period
6.5	3700	Alsop Site (CA-Lak-72) (CA-Lak-510)	- Houx Pattern - Houx sites representative of family bands
6	3100		- Relatively rich midden deposits; indicative of semisedentary habitation for Houx - Borax Lake obsidian enters regional exchange system - Initial sustained use of Clear Lake basin uplands
4.5	1800		- Emergence of Houx tribelet structure in Clear Lake basin - Triblet control of access to Borax Lake obsidian flow
3.5	1100		- Clear Lake aspect, Augustine pattern - Decline of large biface production as technol ogy shifts to bow and arrow
1.7	200		- Phase 2 of Clear Lake aspect (Protohistoric Period)

*Years BP calculated using Tremaine's (1993) conversion constant for Borax Lake to Napa (0.79), Origer's (1987) Napa flow hydration constant (153.4), Origer's (1989) temperature conversion factor (5%) and the diffusion formula of years before present equals hydration constant times hydration value squared.

obsidian values to Napa Valley equivalency through use of Tremaine's (1993) comparison constants, i.e., by multiplying the Borax Lake value by 0.79, the experimentally derived constant for this conversion. Parker then employed Origer's Napa Valley hydration rate constant of 153.4 in the diffusion formula, $T=kx^2$, where T is years before present, k is the hydration rate constant, and x^2 is the hydration value squared. The present authors have selected to employ identical procedures while adding a correction for the temperature difference between Sonoma County, where the rate was developed, and Lake County. Although Trembour and Friedman (1984) suggested that there is about a 10% increase in hydration for each increase of one degree centigrade, Origer (1989), using hydration measurements of debitage produced by Ishi and accessioned in the Phoebe Hearst Anthropology Museum in 1915, concluded that the increase was more likely to be in the neighborhood of 4-6%. Five percent was used in the adjustment here because Lake County averages about one degree centigrade warmer than Sonoma County, and because the numbers produced using 5% more closely approximate estimated ages based upon other data.

Figure 9, which includes years before present, rounded to the closest hundred years, briefly outlines the shifts discussed above. The years before present should be viewed with considerable caution since it is obvious that the method employed in generating the numbers had little elegance. Overall, it may be better were we to refrain from calculating age in years until we gain better understanding of the hydration process over long periods of time. For example, to our knowledge, no work has been done to estimate the effects on hydration of past paleoclimatic temperature variations. Also, because of the small sample and relatively young age of the hydration/radiocarbon associations employed to produce Origer's Napa Valley rate, it would be wise were we to be skeptical regarding the accuracy of the ages provided in Figure 9, especially ages greater than 3000 B.P., which we believe empirical data will eventually prove to be younger than indicated here.

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A REMARKABLE PETROGLYPH LOCALITY IN DEATH VALLEY NATIONAL MONUMENT

Edith Wallace

Rock art figures prominently among the reminders of Indian presence and activity that dot the landscape of Death Valley National Monument. Over 100 occurrences have been discovered and recorded (Martin 1976). Petroglyphs, designs pecked into cliff faces, outcroppings and boulders are by far the most numerous. But a few pictographs, either painted on walls of rockshelters (Wallace and Taylor 1955:364-5) or beneath overhanging ledges (Clements 1958), have been discovered. None of the rock art displays is more impressive or more interesting than the one in Arrastre Spring Canyon on the eastern (Death Valley) side of the Panamint Mountains. Narrow, winding, and sparsely endowed, the canyon was poorly suited for human living and only relatively few traces of human occupancy are found (Wallace 1956). However, a well-worn trail skirting the west side shows that small parties of native peoples regularly traveled through on their annual journey to and from pinyon groves high up in the mountains.

At variance with scanty signs of human habitation, is the canyon's wealth of rock art. Eighteen separate places can be seen where figures have been pecked into rock surfaces. Mostly, these line the trail, but several, including the largest concentration, lie a short distance from it. Not all the markings are alike, nor do they all appear to be the same age. A few sketchily abraded and schematized human and bighorn sheep figures almost certainly represent work of recent Death Valley Shoshone Indians. Of obviously greater antiquity are the deeply scored, broad-lined geometric and amorphous patterns, not a few noteworthy for their complexity.

An outstanding group of these older-type petroglyphs occurs on the blocks of stone forming a steep talus slope at the base of a hillside on the canyon's eastern side (Figure 1), almost directly opposite the only spring. Most often, surfaces stained a deep mahogany brown with desert varnish were selected for decoration. These lent themselves particularly well to petroglyphs, for when penetrated even to a slight depth, the rock's underlying gray color appears, causing designs to stand out clearly against the dark background. Slabs of all sizes bear markings, including several that measure only a foot or so across.

No fewer than one hundred decorated rock faces are visible. Many more must lie hidden from view, either overturned or covered with downwash from the slope above. The patterns occur singly or in combination. Sometimes they overspread an entire surface without any discernible order. Quite a high proportion remain amazingly fresh-looking, whereas others have been dimmed by the elements or made inconspicuous by a heavy coating of desert varnish (Figure 2).

A wide selection of curvilinear elements appears on the stone blocks. Included are circles, wavy lines and complex "meanders" (Figure 3). Several of the latter give unmistakable signs of having been added to at different times or having had their lines broadened and deepened by pecking and rubbing. Worthy of special mention is a large, highly visible figure composed of two big concentric circles, the outer one studded with T-shaped projections (Figure 4). This vertical slab stands alone.

Markings rendered with straight rather than curved lines also appear. Among them are various arrangements of parallel and crossed lines, generally called "rakes," "ladders" and "grids" by students of native rock art. Since rectilinear patterns occur side by side with curvilinear and display the same degree of weathering and patination, there is nothing to suggest that they were created at a different time or represent a separate tradition or style.

Recognizable naturalistic elements are all but absent. Only three—a sketchy human figure, a bighorn, and an unidentified quadruped—are present. All appear to be of fairly recent origin. Conceivably, some geometric forms are meant to depict living things. For example, the wavy lines resemble snakes and connected circles give the impression of insect bodies.

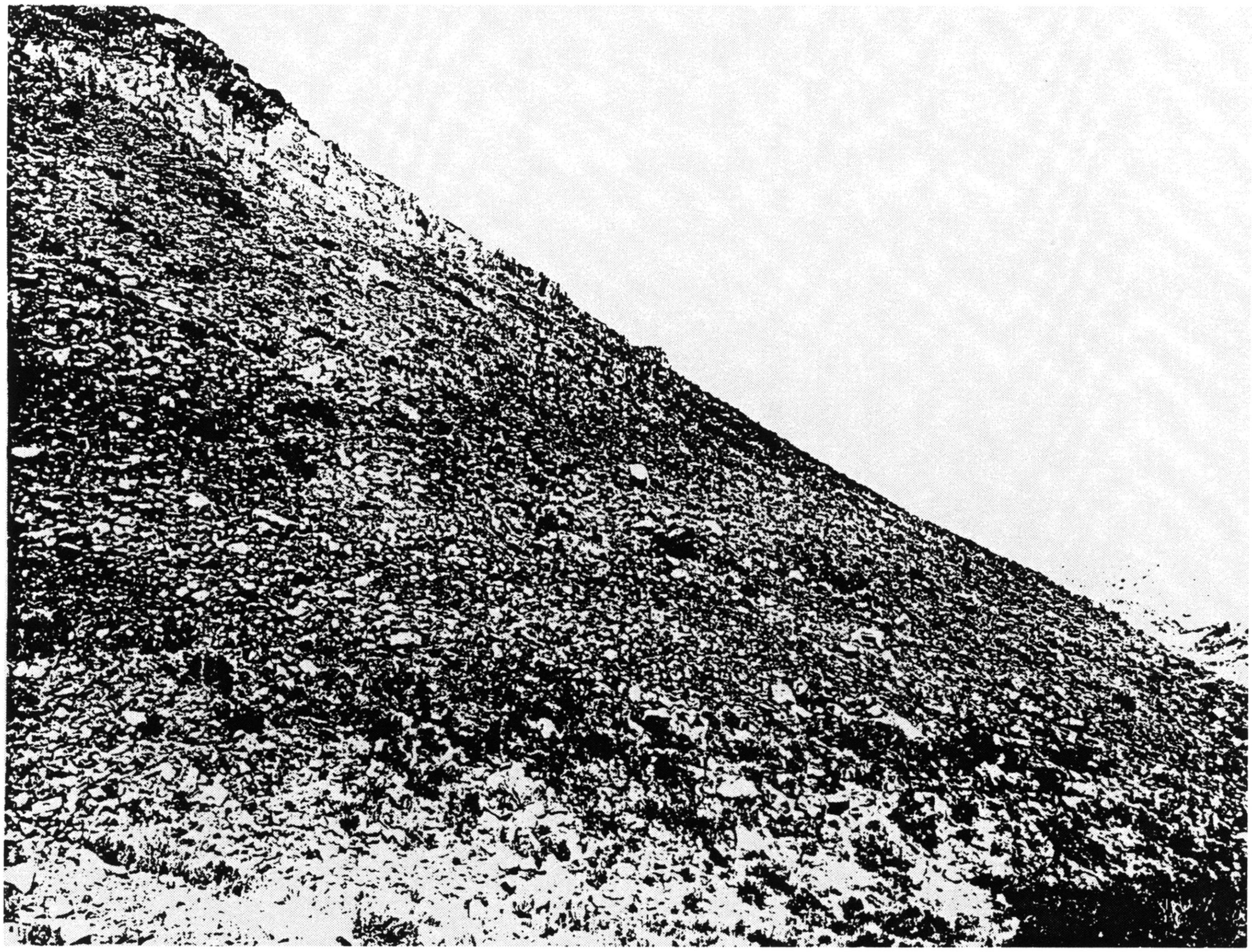

Figure 1: Hillside on the Canyon's Eastern Side

Figure 2: Petroglyph Dimmed by the Elements

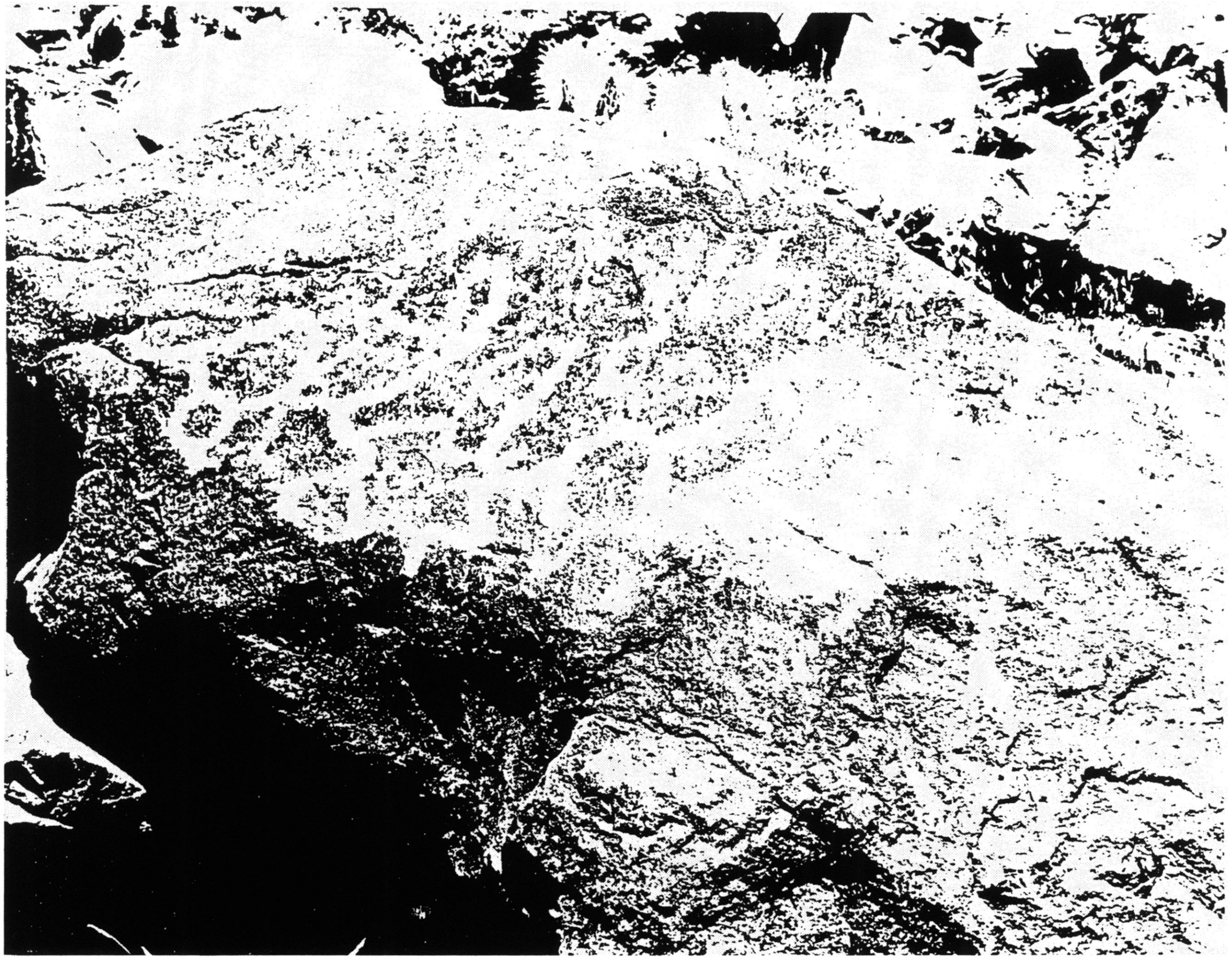

Figure 3: Petroglyph with Curvilinear Elements

Figure 4: Petroglyph with Large Circles and "T" Projections

But, if so intended, they are much too conventionalized to be so identified.

Just when the petroglyphs were made remains uncertain. There is a strong possibility that some were created in the latter part of the Death Valley II (Mesquite Flat) period, dated between 3000 B.C. and the beginning of the Christian Era (Wallace and Wallace 1978:4-12), when native peoples first began to go through Arrastre Spring Canyon (Wallace 1956). Some measure of support for this relatively early placement comes from the deep coating of desert varnish that covers several sets of figures. Although conditions under which this dark stain forms are still open to discussion, it is generally agreed that it accumulates very slowly.

The great majority of the Arrastre Spring petroglyphs seem to have been created during the Death Valley III (Saratoga Springs) period when the canyon saw more human activity. This would place them in the first thousand years of the Christian era (Wallace and Wallace 1978:12-21). Elsewhere in the Desert West, similar petroglyphs have been assigned to the Great Basin Abstract Style (which includes Curvilinear and Rectilinear sub-categories), believed to have had its beginnings around 1000 B.C. and to have continued to have been in style until A.D. 1500 (Clewlow 1978:620-621; Heizer and Braumhoff 1962:205-7; Heizer and Clewlow 1973:23-25). Sometime after A.D. 1000, Death Valley Shoshone Indians added a few of their distinctive representations to the Arrastre Spring display.

Even more obscure than their antiquity is the reason why people came to this particular spot, evidently generation after generation, to laboriously peck symbols into hard rock surfaces. It could not have been merely availability of suitable rock surfaces that drew them here, for these can be found nearly everywhere along the canyon's sides. Stone slabs on adjoining talus slopes bear no designs whatsoever. The concentration of petroglyphs at this one place makes it difficult to escape the inference that it held special and important meaning for the region's inhabitants.

In recent years, it has become increasingly popular to identify rock art localities of this sort, often found close to a game trail, grazing area or favored ambush, as places where small bands of men gathered prior to a hunt. Supposedly hunters assembled under a religious leader who perhaps created the petroglyphs and performed other rituals to expedite killing big game. A tie with hunting magic seems quite plausible, for the Arrastre Spring site lies no great distance from a trail (the same one followed by humans) by which bighorn sheep approach the spring to drink on their annual migration. Though no blinds for concealing waiting hunters stand in the vicinity, a skilled bowman could have shot down animals from cover in the dense grove of willows that surrounds the spring.

Attractive though this explanation may be, it is not the only possibility. Some other motive, wholly unrelated to hunting, could have led to creation of the rock engravings. Rites requiring their making could have been held here, opposite the most comfortable camping spots in the canyon, by men seeking supernatural aid, or perhaps to ensure safe passage to and from mountain pinyon groves and a rich harvest of pine nuts. Or, on the return trip, to give thanks for a bountiful one.

Obviously, much about the Arrastre Spring Canyon petroglyphs remains unknown and probably unknowable. Nonetheless, they compel attention and interest as a unique and enduring record of a vanished people and another age.

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