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**ON THE TRAIL TO THE COAST
A VIEW FROM CA-MEN-2136: THE ZENI SITE**

A Thesis

Presented to

The Faculty of the Department of Social Sciences

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

By

Patricia A. Dunning

May 1996

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ABSTRACT

ON THE TRAIL TO THE COAST A VIEW FROM CA-MEN-2136: THE ZENI SITE

by Patricia A. Dunning

The goals for this thesis were to (1) describe the materials excavated from the site and explain the site's unusual setting; and (2) use these materials as an archaeological test of the linguistic models of Pomoan expansion.

The Zeni site is situated in the redwood belt, along an Indian trail, in southwestern Mendocino County, California. Primary site occupation is assigned to the Dry Creek Phase (Houx Aspect), dated between 2000 and 700 B.P., when the site was used as a hunting camp and manufacturing location—possibly for shell ornaments and wood or bone objects. The high frequency of artifacts in this component suggests regular, if seasonal, occupation.

The site was less intensively occupied during both the earlier Skaggs Phase (Mendocino Pattern)—possibly by Yukian groups—and in the later Smith Phase (Clear Lake Aspect), probably by Pomoan peoples. Both of these components are sparse and suggest sporadic visits by hunters.

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This thesis would not have been possible without the support of George Zeni and his family. George and Shirley Zeni let us excavate on the ranch, back-filled our trenches, and fed and housed us. George lent me his artifact collection for illustration and permitted the cutting of eight of his Rattlesnake series points and his two ceremonial blades to allow obsidian-hydration dating. To George and Shirley Zeni, son Raymond and his wife Jane, thanks for all your help.

This thesis would not have been possible without the unstinting help, encouragement, support, and occasional prodding, by Tom Layton — a mentor as well as my thesis committee chair. Tom admitted me, as an Open University student, into his fully enrolled archaeology class in Fall 1992. His inspired teaching and infectious enthusiasm for archaeology led me on. This thesis benefited greatly from his knowledge of archaeology, his unerring ability to see through the clutter to the point (in the field as well as in argument), and his editorial suggestions. Tom was always there when I needed help, and gave freely of his time, particularly at the end, to help make this deadline. Thank you, Tom.

To my other committee members, Dwight Simons helped me learn to write more precisely with his review of the 1994 drafts, and sorted the bone fragments reported in Chapter Six. Hein Do generously stepped in as a committee member at the last minute to

represent the Department of Social Sciences. Though I gave him little time, he read his first site report, and offered cogent comments.

I owe a debt to many others. Glen Wilson not only measured the hydration on most of the obsidian artifacts in this thesis, he also helped me map the site, and taught me much about discriminating Monterey chert. Our archaeology discussions over many lunches broadened my knowledge of the field. Greg White suffered through interminable phone calls as I struggled to learn the local taxonomies, always answering with patience and good cheer. He also drew the illustrations for the Zeni ceremonial blades at a time when his own schedule was overextended, extracted the flakes used to date them, and provided Map 3. Mark Basgall searched through 20 boxes of papers to locate the Elmendorf articles I had been unable to find elsewhere. Robert Oswalt answered innumerable questions on linguistics in general and the Pomo in particular, with great patience, and commented on a paper from which the linguistics section was drawn. Tom Origer did all the visual obsidian sourcing and dozens of hydration measurements (with unbelievably rapid turnaround) at bargain-basement rates. Tom Jackson provided the XRF analysis, gratis. Tom Layton, Alan Leventhal, Greg White, Michael Rondeau, and Dave Beiling tried to teach me something about lithic analysis. Alan Leventhal led me through the use-wear analysis of the drills; Mike Rondeau analyzed the projectile point fragments for rework, the scrapers for edge-damage, and the debitage in unit 7S1W. Matt MacMacken identified the material used to make some of the ground stone — and taught me more than I know about geology. Robert Bettinger allowed me to view parts of the

Warm Springs collection at UC Davis. My cohorts shared their experience; Jeff Hamilton dug me out of more than one hole, Viviana Bellifemine shared with me the angst of learning to write artifact descriptions, and, with Liz Lake and Muriel Maverick, helped me laugh instead of cry. Jane Holland typed page numbers on illustrations and charts the night before the deadline. Rich Carlson housed me and the 1993 volunteers. To each and every one of you, I do not have enough words to express my thanks.

Nelson (Scotty) Thompson determined the site contours and drew seven maps (1, 2, 4, 7-10) and three figures (1, 2, 12). Greg White created Map 3 and drew the illustrations of the Zeni's ceremonial blades. Rusty van Rossmann crafted the rest of the artifact illustrations. Tom Layton took the photographs used in Figures 5-11. Jeff Hamilton took the aerial photographs used in Figures 3 and 4. Map 5 was copied from Stewart 1943, and Map 6 extracted from Barrett 1908, both uncopyrighted publications of the University of California, Berkeley.

Students and volunteers in the 1988 field class provided much of the labor. They included: Mignonette Blazek, Paul Brunato, Tom Cole, Margaret Donnelly, Margaret Farnsworth, Judy Fulton, Patricia Jones, Kelly Smith, and Margaret Tamisiea, joined by volunteers Richard Carlson, Mark Gary, Deborah McLear-Gary, and Dwight Simons. The volunteers who excavated Unit 11S1W and made the surface collections in 1993 included Viviana Bellifemine, Richard Carlson, Mark Gary, Judy Gregg, Jeff Hamilton, Tom Layton, Deborah McLear-Gary, Dwight Simons and Rachel Singh. Tom Layton, Scotty Thompson, and I made the 1994 surface collections. Students who prepared slides for

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To each of you, my deepest thanks. Any insights this thesis has to offer are due to you—only the errors are all my own. But, first, last, and always, thank you, Tom Layton.

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CHAPTER ONE

INTRODUCTION

MENDOCINO PROJECT DESIGN AND SUMMARY OF RESULTS

CA-MEN-2136, the Zeni site, is one of 12 sites excavated during the last 15 years by San Jose State University's Mendocino (née Albion) Project, under the direction of Dr. Thomas N. Layton. The research design for this project is to perform an independent, archaeological test of the linguistic models of Pomoan language expansion.

The predominant Pomoan language models (Oswalt 1964, Halpern 1964) posit a homeland around Clear Lake, with subsequent population movements and language drift, resulting in the seven ethnographically known, mutually unintelligible Pomoan languages. Initially one group (known as the Western Pomo) moved west from Clear Lake to the Russian River, then fanned north, south, and west. The concomitant subgroup isolation caused further language differentiation, ultimately resulting in the Northern, Central, Southern, and Kashaya Pomo languages. The Yuki, most likely the previous occupants of the western territory, were divided by the Pomo movements, into northern and southern (Wappo) branches (Elmendorf 1968, 1980, 1981).

The initial project excavations, between 1980 and 1984, were at Albion Head (Layton 1990), where SJSU field schools excavated three sites (Map 1). Albion Head was chosen for the initial excavations because (1) ethnographic accounts showed no permanent settlements on the coast north of the Navarro River before contact, suggesting

Map 1. North Coast Ranges Archaeological Sites

the area was used for task-specific forays by people living elsewhere; (2) the lack of local flakeable toolstone suggested these people would bring curated tool assemblages with them, helping to identify their homeland; and (3) Layton was convinced it would be easier to measure boundary realignments at the edges of a territory than at its center.

Layton hypothesized he could identify the time when the Pomo included Albion Head in their seasonal round by the abrupt arrival of abundant obsidian from Clear Lake sources. He argued that in other sites with long archaeological sequences, located west of the Clear Lake basin, an initial period, where chert artifacts and debitage predominated, was followed by an abrupt increase in obsidian dating between 2.5 to 3.5 μ (Konocite rate). Layton theorized that obsidian should appear earliest just west of the Clear Lake basin, somewhat later to the north and further west, while in long archaeological sequences outside Pomo territory no abrupt increase in obsidian would occur. The initial appearance of obsidian should mark the inclusion of the coast into the still undifferentiated "Western Pomo" seasonal round. Time and additional group isolation, resulting in the Northern and Central language split, should be demonstrable by differences in the tool assemblages left by the different groups.

At Albion Head, Layton (1990:52-57) identifies seven archaeological components covering a time span from about 5500 B.P. to 200 B.P. Because of deposit mixing, some are defined only by projectile point styles, others, which include still-recognizable living surfaces, allow definition of whole tool assemblages and some determination of lifeways. The oldest three components, identified as pre-Pomo, are dominated by chert artifacts: Component 1 includes 12 Mendocino Concave-base projectile points recovered above

charcoal radiocarbon dated to 5500 B.P. Fifty-eight percent of these points are made from Monterey chert (available only south of Point Arena), suggesting they were left by people visiting from the south coast. Component 2 includes 19 Mendocino Side-notched dart tips, all made from Franciscan chert; the absence of Monterey chert specimens supports use by a different group with an interior homeland. Mendocino-Side-notched points are found at MEN-1929, 26 km to the southeast, in the Shandel collection at Comptche, 16 km to the east, and to the north, but are rare further south. The Mendocino Concave-base and Side-notched point styles were mixed in the deposits—the components may thus represent either successive or concurrent but intermittent use by at least two different groups. The presence of projectile points and apparent absence of other types of tools imply short stays with a hunting focus.

Component 3, the third chert-dominated component, includes a broader assemblage, implying a broader use of the area's resources. This assemblage includes Franciscan chert leaf-shaped bipoints, a decorated mortar, handstones, net weights and large numbers of beach cobbles, suggesting use of shellfish as well as the hunting of terrestrial animals. Layton dates this component between 2500 and 2200 B.P.

Component 4 marks the abrupt arrival of obsidian (and the Pomo). Visible in all three sites, it is most easily recognized at MEN-1809 where it forms the basal deposit. Twenty of the 24 bipoints recovered at MEN-1809 are obsidian (16 from the Konocti source, four from the Borax Lake source), three are Franciscan chert and one of Monterey chert. Component 4 appears to mark a return to a simple hunting focus—there was no recognizable living surface, and no cobbles or cobble tools. Obsidian hydration

measurements date this component between 2.5 and 1.5 μ (Konocti), which Layton calibrates to a beginning date of 1500 B.P. However, in subsequent excavations in MacKerricher Park, in a similar temperature regime, White (1989:107) found 2.5 μ (K) readings associated with ^{14}C dates of 1900-1700 B.P., suggesting a slightly earlier beginning for Component 4.

In Component 5, Layton recovered stemmed chert dart points on a living surface with deer and elk bones and evidence of shellfish roasting. The lack of obsidian led Layton to conclude an interior group, possibly Yukian, had returned to the area.

The following Component 6 assemblage marked the introduction of arrow tips at the sites. The 65 Rattlesnake series points recovered were 42 percent Franciscan chert, 38 percent Monterey chert, and 23 percent obsidian (eight Borax Lake, four Konocti, and one Napa source), suggesting use by Central Pomo people with access to both Monterey chert and Clear Lake basin obsidian. Faunal remains suggest hunting of marine mammals as well as deer and elk, and more concern with sociotechnic items: clamshell disk beads, *Olivella* shells, and evidence of an abalone shell industry were recovered. Relative to Component 4, there is a higher ratio of Monterey to Franciscan chert in the debitage, and a shift from Konocti to Borax Lake dominance in the obsidian artifacts. The hydration measurements suggest a time frame of 1.5 to 1.0 μ Konocti. Layton (1990:55) associates the hydration dates with three ^{14}C dates ranging from AD 1245 to 1540 (at one standard deviation), suggesting a date range of AD 1200 to 1600 for the component.

Component 7, the final assemblage identified by Layton at Albion Head, is comprised of Gunther series arrow tips—made from Franciscan chert—and beach

cobbles, suggesting short visits by people from the interior for hunting and shellfish collecting and roasting. No sociotechnic artifacts were recovered. The late dating (AD 1600-1800) of this component led Layton to conclude these artifacts were left by a Northern Pomo group, although the heavy reliance on Franciscan chert would also be consistent with Yukian peoples.

At four other sites excavated by the Mendocino Project, (MEN-500, near Willits, MEN-1805 [Nightbirds' Retreat], near Calpella, MEN-1929 [the Carlson site], near Navarro, and MEN-2136 [the Zeni site], southeast of Point Arena), obsidian also first appears in abundance between 3.5 and 2.5 μ (Konocti). Insufficient analysis at that point left Layton unable to demonstrate the hypothesized lag from east to west in obsidian arrival, but he noted that obsidian had appeared earlier at Warm Springs.

To verify that obsidian was restricted to Pomo territory, Layton's team excavated, in 1987, two sites in Long Valley near Laytonville, outside ethnographic Pomo territory. In the long sequence investigated, there was little obsidian evident, supporting the association of obsidian in the area to the south with Pomoan groups.

More recently, however, MEN-2306 and MEN-2307, in ethnographic Coast Yuki territory, have been excavated. Analysis of these sites has just begun, but their assemblages are dominated by chert artifacts: stemmed and lanceolate dart points and Gunther series arrow tips. Only ten obsidian artifact fragments were recovered. Obsidian, however, comprises 15 percent of the debitage at MEN-2306, the older of the two sites, and the hydration results document its abrupt arrival at 2.5 μ , an unexpected result still to be explained. It is possible that the area was once included in the Pomo seasonal round.

At MEN-2307, the more recent site, only five obsidian flakes were recovered, in line with expectations.

To demonstrate that obsidian-dominated assemblages are indeed associated with Pomo peoples, two sites with ethnographic associations to Pomo tribelets were excavated. Results from Three Chop Ridge (MEN-790), a Mitom Pomo summer village with still-visible house depressions, include three identifiable components. The last two components include four Rattlesnake series (two Konocti) and nine Gunther series arrow tips (all chert), similar to the final component at Albion Head and consistent with the ethnographic Northern Pomo. Bead blanks made from Chinese porcelain salvaged from the *Frolic* shipwreck attest to the use of the site around 1850. The majority of the hydration readings are small ($1.2\text{--}0.7\ \mu\text{ [K]}$), but there are three additional small clusters at 1.7 , 2.5 , and $3.4\ \mu\text{ (K)}$, suggesting some earlier use. The earliest component at this site is comprised of seven bipoints (six chert, one obsidian) and eight or nine chert stemmed points similar to those in Component 5 at Albion Head. Layton (1990:187) considers this component evidence for Yukian persistence in the area until AD 1200.

At Nightbirds' retreat (MEN-1805), the early component is also comprised of stemmed points of Franciscan chert, associated with Yukian use. In Component 2, obsidian appears abruptly at $3.0\ \mu\text{ (K)}$, associated with obsidian leaf-shaped bipoints, probably marking the entrance of the Pomo sometime before AD 500 (Layton 1990:138). The Component 2 assemblage includes flake tools and handstones but no mortars or pestles, suggesting only seasonal use. The final component represents more intensive use and some task specialization, documented by the 27 drill bits recovered, elsewhere

associated with clamshell disk bead manufacture. Rattlesnake series (12) and Gunther (5) series arrow tips and a glass bead validate an historic Northern Pomo association.

Two sites, MEN-2136 (in Central Pomo territory) and MEN-1929 (in Northern Pomo territory) were excavated in 1987 and 1988. Excavation of these sites focused on determining when obsidian appeared in quantity (to date their inclusion in the Pomo seasonal round) and on tracing the evolution and timing of the divergence of the two assemblages and thus the reduced interaction and differentiation of Northern and Central Pomo tribelets.

MEN-2136 RESEARCH DESIGN

The MEN-2136 investigation began with two goals: (1) to determine the arrival of abundant obsidian, and probable beginning of Pomo occupation at the site, and (2) by comparison with MEN-1929, to trace the divergence in artifact assemblages of Northern and Central Pomo groups. However, we soon discovered that most of the assemblage recovered at MEN-2136 pertains to a single component analogous to Component 4 (initial obsidian use) at Albion Head, with a limited admixture of pre-Pomo chert elements and scarce evidence of the later arrow tips. The assemblage from MEN-1929 (the Carlson site), on the other hand, is primarily comprised of cultural remains from earlier and later temporal periods, with less representation of the intermediate, Leaf-shaped point assemblage that predominates at the Zeni site. In addition, while the Zeni site appears to have been used as a seasonal camp, the Carlson site, with its wide range and quantity of grinding equipment, suggests a more permanent village. As a result,

artifact differences between the two sites may be partially due to differences in task focus and not necessarily attributable to the stylistic differences that might mark the growing isolation of two neighboring but differentiating language groups.

This thesis will therefore address a slightly different set of questions: From an analysis of the artifacts recovered at the Zeni Ranch, what can be said about the peoples who used the site? Is there evidence to support early use of the site by Yukian groups? Can we detect and date a subsequent abrupt appearance of obsidian debitage and artifacts, and if so, can we associate this to the Pomoan expansion? Can we see concurrent use of the site by different groups, and/or, the replacement of one group by another? Can we determine the resource focus of site usage? Can we extrapolate from information gained at the ranch to formulate a theory of how southwestern Mendocino County was utilized by middle and upper archaic hunters and gatherers?

MEN-2136 is situated on a ridge in the redwood belt—an environment generally considered impoverished in food resources. Yet, the artifact and waste flake density indicate it was heavily utilized. This thesis seeks to determine why Native Americans found this area so attractive.

To answer these questions, we need to: (1) define the cultural components at the Zeni site using what stratigraphy is available and compare typeable artifacts to those from better stratified sites; (2) identify, characterize, and date the appearance of obsidian at the site and determine whether this is restricted to the Pomoan expansion; (3) attempt to determine how this site was used from an analysis of the tool classes recovered; and (4)

investigate whether changes in the toolstone materials used through time allow definition of interaction spheres and foraging ranges.

The association of the abrupt arrival of obsidian with the Pomo, which Layton (1990) argued for at Albion Head and which was also discerned at Warm Springs (Basgall and Bouey 1991) has been challenged by S. Stewart (1993), citing her work at SON-1471 (Rockpile Road) and Rondeau's (1985, 1990:12-13) at MEN-1802 (near Cloverdale) as contra-indicators. Both sites exhibited high obsidian-to-chert ratios, but appeared to their excavators, based on obsidian hydration readings (SON-1471) or a preponderance of handstones (MEN-1802) to be pre-Pomo sites. Although this issue will be considered further below, two points require discussion: (1) inter-site obsidian hydration range comparisons and (2) the usefulness of inter-site obsidian-to-chert ratio comparisons, both crucial parts of Stewart's argument.

Obsidian hydration rates are known to be temperature dependent, but the size of the effect is not well understood. Today most researchers use a correction factor of 6 percent per degree Celsius temperature difference, because it "works consistently well with the greatest number of localities" (Basgall 1990, cited in Hildebrandt and Mikkelsen 1993:78; Origer 1987; Hildebrandt and Mikkelsen 1993:78); although Trembour and Friedman (1984) developed a similar rate analytically.¹ Many other site-specific issues remain unresolved. These include the effect of such other factors as ground cover, aspect, burial depth and relative humidity on the effective hydration temperature and the hydration rate. And, even when the mean temperature at a site is known, how does one calculate the effective temperature?

Lee (1969) buried Pullman probes (temperature-sensitive chemical packs) at weather stations in western Pennsylvania in order to develop empirically a conversion equation relating the temperature measured by the probe to the air temperature. He believed his result would apply to similar temperature areas elsewhere. Lee's equation has been used by Trembour and Friedman (1984), Origer 1987, and Hildebrandt and Mikkelsen (1993) to calculate the effective hydration temperature. However, two incompatible approaches have been used to determine the temperature range required by the Lee equation. Origer (1987) used the difference between the highest and lowest months' mean temperatures as the range. Bouey (1992, quoted in Hildebrandt and Mikkelsen 1993:78) asserts instead that the difference between the annual mean high and low temperatures should be used, which results in effective temperatures 1 to 10 percent higher than Origer's (although part of the difference appears to be due to the different sources for the temperature data). Lee apparently used the maximum and minimum temperatures recorded in each two-week period he measured, probably somewhat closer to Bouey's approach than Origer's, but resulting in a greater range than either.

The net of this discussion is unfortunately not a solution, but a caution, that inter-site comparison of obsidian hydration data is difficult. Obsidian hydration as understood today probably does allow relative dating within a site with reasonable clarity, but a much better understanding of the hydration process is required before relative dating across sites in different temperature regimes within a short time horizon is possible. As a result, obsidian-hydration dating by itself, without supporting typeable artifacts and assemblages, cannot be used today to contradict evidence obtained in better dated

settings. Nevertheless, this paper will present graphically, in a consistent format, the obsidian hydration measurement data currently available for sites in Western Pomo territory, as the first step in monitoring the Pomo spread. Resolution of the spread sequence must await better understanding of the temperature dependence of the hydration rate and measurement of the effective temperatures at the sites to be compared.

Obsidian-chert ratios in Western Pomo site sequences appear to change in conjunction with projectile point styles. The Warm Springs report (Basgall and Bouey 1991) documents little obsidian debitage in Skaggs Phase (pre-Pomo) sites, obsidian dominance in the Dry Creek Phase (initial Pomo components), and balanced obsidian-chert usage in the later, Smith Phase Pomo occupations. Similar patterns are observed at Albion Head and the Zeni site. On the other hand, in the Clear Lake basin, close to two obsidian sources, an almost exclusive use of obsidian is observed in all assemblages, while in the northernmost sites within Northern Pomo territory, far from obsidian quarries, obsidian usage is never very large, although the obsidian-chert ratios do change through time.

Clearly, economic factors as well as accessibility affect toolstone use; transportation costs associated with obsidian at sites far from the quarries would tend to constrain its use to tools where obsidian has a distinct functional advantage. Therefore, obsidian-chert ratio changes through time within a site may offer insight into changes in toolstone accessibility and/or economic value, but intersite comparisons between sites at different distances from obsidian sources must be used with caution.

The challenge of the Zeni site is to explain why the site is where it is. High artifact concentrations, from a Dry Creek Phase assemblage, suggest either a large number of people visiting sporadically or a small number of people visiting repeatedly over a long period of time. The use focus was hunting, “drilling” (beads?), and “scraping” (probably hard materials). The sparse ground stone recovery suggests it was probably not a winter village.

Other than tiny fragments of calcined bone, there is no direct evidence at the Zeni site to identify the resources exploited. An attempt in 1993 to collect a column sample for macrobotanical analysis was thwarted when we discovered the unit chosen had been disturbed years before when the Zeni family burned out a long forgotten redwood stump we found below the surface. Shell and bone do not preserve in the acidic soil of the redwood belt, leaving us no direct indication of what animal species were utilized. A catchment analysis (Chapter Eight) was undertaken to investigate what resources were available for use by the prehistoric inhabitants of the site. This catchment study provided limited new information. Thus, of necessity, most of the site investigation reported in this thesis will come from an analysis of the abundant flaked stone tool collection recovered from the Zeni site.

CHAPTER TWO

THE SITE

SETTING

CA-MEN-2136 is situated on Signal Ridge, in the west-central portion of the North Coast Ranges, approximately 110 miles (176 km) north-northwest of San Francisco (Map 1). It is located on the Zeni Ranch, just west of Fish Rock Road, 13.5 km southwest of its junction with Highway 128 and 14 km north-northeast of the Pacific coast, in southern Mendocino County, California (Figures 1-2, Map 2).²

The Zeni Ranch is a 200 acre spread partially planted in grapes, chestnuts, and Christmas trees. George Zeni, the property owner, was born on the ranch in 1923. His father, Edwino Zeni, came to this country from Austria in 1892, walking in from Yorkville to establish his original 160 acre homestead (about two miles north), and to initially earn a living peeling tanbark and picking grapes (at vineyards established in the area a few years before). When Edwino Zeni arrived, the road from Yorkville did not go all the way to the coast. In 1894, the elder Zeni helped extend the wagon road to Point Arena, needed by then to transport tanbark to the coast for shipment to San Francisco. Edwino Zeni traded his original homestead for the current property in 1916.

George Zeni has been “picking up arrowheads” on the ranch all his life, but until 20 years ago he did not save them. Today he has an extensive collection of projectile points and ground stone recovered from the property (Appendix C). His son, Raymond,

Map 2. Archaeological Site Location

and daughter-in-law Jane, who also live and work on the ranch, have a second collection which has not been studied for this paper.

MEN-2136 is situated on a flat atop east-west trending Signal Ridge at approximately 490 meters (1600 feet) above MSL. Signal Ridge marks the divide between the drainages of the Garcia River and the North Fork of the Gualala River. The area of the site is drained by Signal Creek, 0.7 km to the west and Inman Creek, 1.1 km to the north, both tributaries of the Garcia River, and by an unnamed creek 0.4 km to the east, which empties into Billings Creek and then the North Fork of the Gualala River (Map 9). There is a permanent spring within the site boundaries and numerous others in the immediate vicinity.

Most of the site is located in a corral (Figure 5); the surrounding area is cultivated, planted in Christmas trees and grapes. Two large redwood stumps are still visible in the corral and large roots systems appeared in most excavated units, confirming the area was wooded in the past. Today, the surrounding area is redwood forest, interspersed with grasslands and mixed evergreen forest. The redwood forest is a mixed environment, including significant numbers of tan oak, madrone, and Douglas fir, with sugar pine in the area to the south and west and interior live oak in the north and east (see Map 9). The vegetation seems dependent on soil type: deeper soils support conifers and hardwoods, shallower soils, grasslands and chaparral. The soils at the site, derived from sandstone, are classified as Yellowhound-Kibesillah-Ornbaun. They are more than four feet deep and strongly acidic and permeable (USDA 1987).

MEN-2136 is not the only archaeological site on the Zeni Ranch. Debitage, mostly Franciscan and Monterey chert, Mendocino Concave-base projectile points, scrapers, and modified flakes appearing on the surface in Field 6 after plowing (Map 8), attest to another site (not yet recorded) 140 m northwest of the MEN-2136 locus. Results of a surface collection will be discussed separately in Chapter Five. In addition, Hamilton (1995) recorded a surface scatter of chert and obsidian artifacts and flakes southeast of MEN-2136 on the border of the Zeni Ranch.

The Zeni sites are located above the coastal fog belt, but still influenced by the maritime environment. The closest weather station was Point Arena (no longer active). Available data indicate the mean temperature at Point Arena is approximately equal to the average of the mean temperatures at Fort Ross and Fort Bragg (53.2°F, or 11.8°C), the two closest coastal weather stations with long term temperature records.

The available data for inland coastal settings (Zinke 1988:690, Figure 19-6) suggests the mean temperature 14 km inland is approximately the same as that at the coast, but with wider extremes (19°C mean in July, 7°C in January). The description of the Yellowhound-Kibesillah-Ornbaun Soil complex, which covers the Zeni Ranch, indicates a mean temperature of 53°F (11.7°C) for the 200-2000 ft (61-610 m) elevation (USDA 1987). The three available sources, then, suggest an estimated mean annual temperature at the ranch of about 53°F (11.7°C).

The area receives at least 50 to 70 inches (127 to 178 cm) of rain annually (USDA 1987). George Zeni's measurements at the ranch range from 60 inches (152 cm) to a high of 120 inches (305 cm). There are occasional frosts every winter, but it snows only once

every 10 years. The highest elevations along the ridge, east and west of the site, however, average one snowfall annually (George Zeni, personal communication 1994).

Southwestern Mendocino County, east of the San Andreas Fault, is rugged country. The area is comprised of predominantly northwest-southeast trending ridges, with peaks at about 700 meters, and narrow canyons. The ridge tops may be the most hospitable environment—more open than the surrounding areas. Geologically, this region lies in the Coastal Belt of the Franciscan Formation, dating from the Upper Cretaceous through at least Eocene times (Kramer 1976; Wagner and Bortugno 1982). The Coastal Belt is comprised of massively bedded graywacke, with minor amounts of shale and conglomerate. But, unlike the central portion of the Franciscan Formation, it contains only small amounts of chert, serpentine, greenstone and blueschist (Bailey et. al. 1964:13). There are no known chert sources within 20 km of the site.

The coast south and west of MEN-2136 is formed by steep cliffs with small beaches at the creek mouths. A small stretch of coastal prairie provides habitat for elk and root crops. The coast west of the San Andreas fault, between Fort Ross and Point Arena, differs geologically from the Coastal Belt Franciscan. Of the various geological formations west of the fault, the Monterey Formation was the most significant to Native Americans. The Monterey Formation began in the middle Miocene, about 17 million years ago, in a series of deep ocean basins near the coast of southern California, and ended with widespread uplifting in the Pliocene. The formation was pushed north by slippage along the San Andreas Fault. It consists of shale, mudstone, sandstone, basaltic lava, coal, and petroleum, with lesser amounts of diatomite, porcelanite, and chert. The

glossy, black Monterey chert, which outcrops at Arena Cove and washes onshore as float at three beaches just north of Schooner Gulch (Map 1), was an important toolstone at MEN-2136 and other Native American sites near the coast.

The Zeni site is probably adjacent to an old Indian trail. Fish Rock Road, generally following Signal Ridge, is the only route to the coast between Mountain View Road to the north (Point Arena to Boonville) and Skaggs Springs Road to the south (Stewart Point to Healdsburg). Powers (1877:119) asserts that Indian trails followed ridge lines five to 10 meters below the crest. Tuomey (1926:445, quoted in Peri et al. 1985:217) and Finley (1937:393, quoted in Peri et al. 1985:217) concluded that all Sonoma County country roads coincided with Indian trails. That is likely to be true in Mendocino County as well.

Signal Ridge is not depicted as an old Indian trail on most maps (Kroeber 1925: Plate 36 [Map 3], Stewart 1943: opposite page 29 [Map 5], Peri et al. 1985:214). Instead, maps show a trail running south, rather than north, of the North Fork of the Gualala River. A trail (not a road) tracing only a section of that route is depicted on the USMDA 1921 map of Ormbaun Quadrangle (the first map of the quadrangle published; not updated until 1943). But, this was probably not the main route between the interior and the coast; topographically it is a more difficult path than Signal Ridge.

Stewart (1943:29) must have used the USMDA 1921 Ormbaun map for his field work in 1935: "Topographic maps were used to locate boundaries, trails, village sites, 'mines,' and other geographic features." In his discussion of the Hopland tribelet, Stewart (1943:46) asserts: "The trail to the coast followed about the same route as the wagon road

from Yorkville to Anchor Bay, the valley tribes going there as guests of the Bokeya [sic] of Point Arena.” That wagon road is Fish Rock Road. In 1921, a minor road continued from Yorkville to Hopland, about half of which survives today as “Old Hopland-Yorkville Road.” It should be noted that in 1921 Yorkville was on Rancheria Creek, about four miles north of its current location, and only two miles south of the turn for Fish Rock Rd.³

To summarize, MEN-2136 is situated on a ridge in an at least partially open area within the redwood belt, on a major trail between the interior and the coast.

PALEOENVIRONMENT

A number of researchers have investigated the Holocene climate, primarily through analysis of pollen from lake cores. Simons (1990:32-33), working at Albion Head, provides an extensive summary of the available data. He concludes

These pollen profiles suggest that: (1) vegetation, similar to that found along the coast, has characterized this area for the last 5,000 to 6000 years, and (2) fluctuations in effective temperature and moisture minimally impacted vegetation. Thus, during the mid- and late Holocene, the outer northern California coast is best described as climatically and environmentally “complacent” (see Moratto, King, and Woolfenden 1978:153, 158 for a similar conclusion).

These results also apply to the Zeni site. Most likely, then, throughout the 3000 to 5000 years the site was utilized, the environment and vegetation were similar to that found today. (More accurately, similar to the vegetation before farming and logging began in the area in the 1890s.) However, this area may once have been a more open, productive habitat. According to Stewart (1943:48), the *Lachupda* (local) peoples kept

forest clearings free of brush by annual burning (usually in the fall). Other ethnographic accounts support Indian burning in the redwood forest belt, to maintain both open space to attract deer and elk and the quality of the seed crop (Lewis 1973:68-69).

CHAPTER THREE

CULTURAL CONTEXT

LINGUISTIC BACKGROUND

Examination of the archaeological consequences of several linguistic theories is a central element of the research design for this thesis. We will explore here some fundamentals of linguistic theory, the results of the analysis of the Pomoan languages, and a brief discussion of some interpretations of Pomoan language research that has appeared in the archaeological literature.

Theory

Languages change through time (drift), and when a group of people speaking a single language split apart, for some cultural or geographic reason, their languages will drift independently. Given sufficient time and isolation, the “daughter” languages become mutually unintelligible. Comparative linguistics is a methodology that compares the morphology and lexicons of sets of languages to examine the degree of similarity among the compared languages, determine their genetic relationship, if any, and suggest a sequence of separation.

Glottochronology, developed by Morris Swadesh and Robert Lees in the late 1940s, attempts to quantify the time of separation of daughter languages (Crystal 1987:331). It is based on lexicostatistics, which employs a list of 100 or 200 words selected as universal concepts (numbers, body parts, geographical features and culture-

independent activities) believed to be reasonably resistant to change. Word lists of the target languages are compared, and the number of words judged to be cognates (after allowing for systematic sound shifts), divided by the length of the list (times 100), provides a cognate percentage, an indication of the closeness of the languages (Swadesh 1955, Lees 1953).

To calibrate the rate of language change, Lees (1953:113-127) used a 215 word list on 13 written languages with known time of separation. Most of his examples are Indo-European (e.g. Plautine Latin of 200 BC and Molière French of AD 1650: 62.5% cognate), but two non-Indo-European language pairs, Middle Egyptian of 2100-1700 BC and Coptic of AD 300 (53%) and Ancient Classical Chinese of AD 950 with Modern Mandarin (79.6%) were also considered. By averaging the percentage of cognates remaining between the pairs, normalizing to a time separation of 1000 years, and using various statistical techniques to measure error, Lees concluded that the average rate of change for *all* languages was a constant 80.5 percent words retained per 1000 years (Lees 1952:118-119).

Lees' (1953:113-127) approach relied on three assumptions, one of which he tried to prove. First, all words in the list were equally likely to persist (if untrue the decay rate would not be a constant); second, languages drift statistically independently of each other after separation (an assumption difficult to verify), and third, all languages change at the same rate (which he tried to prove empirically).

Swadesh (1955:124-126) addressed the issue of equivalency of word persistence by rejecting all but 92 of Lees' 215 word list, first, because not all words were universal

and non-cultural and second, because the initial list included “potential duplicates [e.g. woman and wife], identical roots, sound imitation and semantic shading.” He could find only eight additional words to meet his criteria, resulting in a 100 word list. Using eight of Lees’ control languages (because the other five overlapped and thus were not independent cases), he compared the original 215 word list and the 92 words retained in his new list for cognate retention, and found a much more even retention rate for the latter. He concluded the 100 word list was a significant improvement. Using this list and seven of Lees’ control languages (eliminating Coptic because it did not fit the pattern!), Swadesh (1955:126-131) recalculated the cognate retention rate for the 100-word list to 86.4 percent per 1000 years.

Rea (1958:145-150) tested Swadesh’s glottochronological formula using pairs of Romance languages. His calculated dates of divergence (maximum 1100 years B.P.) are much shorter than the known time of separation of these languages (approximately 2200 B.P.). Given that the Romance languages were used to develop the divergence rate, the inability of the formula to reconstruct appropriate separation dates casts serious doubt on the efficacy of glottochronology.

Needless to say, glottochronology is controversial: it may be impossible to construct a culture-independent word list; most linguists do not accept a constant rate of language change; and many languages (including the Pomoan family) continue to interact after they separate, and therefore do not drift (statistically) independently.

Languages divergence rates are at least partially dependent on the degree of language isolation. Languages of groups which continue to interact will diverge more

slowly than those of completely isolated groups. Nevertheless, lexicostatistics is useful in showing the relative similarities among languages and indicating the sequence in which they separated, and glottochronology can suggest something about time depth (perhaps a minimum time since separation?).

An alternative approach to estimating time depth is by analogy to the Indo-European languages, whose time of separation is reasonably well known. This is the approach preferred by Oswalt (1962).

Three additional linguistic techniques, *Wörter und Sachen*, dialect geography, and areal linguistics, can also be used to recover information about prehistoric peoples. *Wörter und Sachen* can help determine the original homeland and lifeway of peoples speaking related languages. By comparing the extant languages, a “proto” language may be reconstructed from the cognates remaining in the daughter languages. From the faunal and floral species which reconstruct, and using the assumption that these must all have existed in the geographic area of the proto-language, some idea of the homeland can be deduced. As a corollary, if certain floral and faunal species widespread in the current language area either do not reconstruct or are clearly borrowed from a now-neighboring language group, the original homeland was elsewhere and the group came into the area after the group from which the words were borrowed (Crystal 1987:296).

Dialect geography, another approach to determining a proto-language homeland, uses the assumption of parsimony: the greatest linguistic diversity will be found close to where the language originated. Finally, areal linguistics has been used by some linguists

to study the impact of languages on each other and to hypothesize earlier contact between two now separated groups.

Pomo Linguistics

At contact, there were seven mutually unintelligible Pomoan Languages spoken by peoples living in the Clear Lake basin and on the Russian River, interior valleys and along the coast of Mendocino and Sonoma Counties. One additional small group was isolated on the eastern side of the North Coast Ranges. Barrett (1908:21 note 4) named these languages (he called them dialects) Northern (N), Central (C), Southern (S), Southwestern, Eastern (E), Southeastern (Se), and Northeastern (Ne) Pomo, based on their relative locations to one another (Map 3). Unlike the others, the Kashaya (K), Barrett's Southwestern Pomo speaking group, had a name for themselves, and that appellation has replaced Barrett's.

A number of linguists have examined these languages to determine their genetic relationship, and the sequence (and relative timing) of their separation (Barrett 1908:95-101, Kroeber 1925:227, Halpern 1964:90-91, Oswalt 1964:413-418, Webb 1971:48-53). Oswalt (1964:413) used the 100 word lexicostatistic list to determine the relationship among the languages (see Figure 1a). He argued for an initial Clear Lake homeland for Proto-Pomo because that area showed the greatest language diversity. He suspected the initial Pomoan language differentiation (into Ne, Se, E, and a Western group) occurred while their speakers were still around Clear Lake. The Western language group

Map 3. Pomo Language Areas (based on Kroeber 1925)

a.

b.

c.

Figure 1. Interrelationships of the Pomoan Languages (a. Oswalt [1964] classification; b.,c. Halpern [1964] alternative classifications)

subsequently moved west to the Russian River, perhaps around Ukiah, with a portion of that group (later Northern Pomo) then moving further north and splitting from the rest. The remaining Southern language group moved south, split again, ultimately differentiating into C, S, and K.

Oswalt suggests that the movement to permanent villages on the coast began in the south; the Kashaya moved west while the Southern and Central groups were still along the Russian River. He (1964:420) asserts that “[o]nly in comparatively recent times did some of the Central bands settle the year around on the coast—there has not been enough linguistic differentiation between the Central Pomo, inland and coastal, to cause mutual unintelligibility.” Robert Oswalt (personal communication 1995) estimates that the Central Pomo have been resident on the coast for less than 500 years, while the first Northern Pomo tribelet to move to the coast, at *Buldam*, did so only after contact (Stewart 1943:33).

Halpern’s (1964:90) phylogeny is based on phonetic shifts. His sequence is not unlike Oswalt’s, although he differs on the position of Ne. He posits an initial split of Se, then E, from what he calls the Russian River group, which includes Ne as well as N, C, S, and K (Figure 1b). He is unsure whether N and Ne split from the Russian River group first, followed by the differentiation of C, S, and K, or whether Ne split first, followed by a N and C group and a K and S group (Figure 1c). Halpern (1964:91) also seems to argue for an original Clear Lake homeland, with the Russian River group spreading out from a point between the Russian River and Clear Lake, from which Ne moved east, the remaining four fanned out to the north, south, and west.

Webb (1971:52-53)) argues for a Russian River homeland for the Pomoan family. She argues that Se, E, and Ne speakers moved to the east after the N, C, S, and K had differentiated and spread within the Russian River drainage. Webb, however, worked from Halpern's unanalyzed notes, which contained internal inconsistencies (McLendon 1974:7) and misapplied the theory that the homeland was at the point of greatest linguistic diversity. Webb (1971) counted a larger number of *dialects* along the Russian River, rather than the greater diversity evident in the *mutually unintelligible languages* around Clear Lake (Robert Oswalt, personal communication 1995), invalidating her conclusions.

McLendon (1973:62) derived Proto-Pomo from the seven daughter languages, and based on the flora and fauna which she reconstructed, concludes that the Pomoan family had been living in the general area where they were then located for a significant period of time. As words for acorn, acorn bread, leaching, and mortar also reconstructed, one could conclude that the group had been processing acorns before the family split apart. McLendon (1973:66, 68) had more trouble reconstructing the words for bow and arrow. Both words resulted in two proto forms, suggesting their introduction postdated the language split.⁴

Whistler (1988:72-74) applied *Wörter und Sachen* techniques to help resolve the Pomoan homeland argument: Clear Lake (Halpern 1964, Oswalt 1964) or the Russian River (Kroeber 1925, Webb 1971). First, using McLendon's (1973) and Oswalt's (1969 ms, revised 1972, quoted in Whistler 1988:73) data, Whistler found 36 flora which could be reconstructed from all the Pomoan languages, indicating a homeland consistent with

both hypotheses. But, he identified 21 additional species, with habitats limited to the coastal forest and shore, that reconstructed only in the Western Pomo languages, thus supporting Oswalt's and Halpern's thesis of a Clear Lake homeland and subsequent move west for the Western group. Whistler (1988:75-77) tried to solidify his argument using salmon (for the Russian River group) and black fish (for the Clear Lake group), but this argument was more controversial (see Olmstead 1985).

The Pomoan language family is a member of the hypothesized Hokan Stock (Dixon and Kroeber 1914), believed to be one of the earliest language groups in California. Pomo is separated from other members of the Hokan Stock by language groups believed to have entered California later: the Wintun on the east and the Miwok on the south. But, to the north and the southeast of the Pomoan languages were four Yukian speaking groups, comprising a language stock believed to be even older than Hokan in California. It has been suggested that the Yukian languages once occupied the entire area from northern Mendocino County to Marin. Most linguists believe that this once continuous Yukian speaking area was split into two groups by the Pomo expansion to the west (Elmendorf 1968).

The northern Yukian group (nY) consisted of three languages: Yuki (Y), Huchnom (H), and Coast Yuki (CY). These groups retain 83 percent to 90 percent cognates in the 100 word list, but differ more significantly in other vocabulary. Elmendorf (1968:6) suggests they separated about 1000 years ago. nY differs substantially from Wappo, or southern Yuki (sY), such that some question that the languages are even genetically related. Elmendorf (1968:7) is convinced that they are,

and uses a relationship analogy of Italian to German (both Indo-European, but in different language families). Although Elmendorf (1968:8) initially suggested a split date of 2500 to 3000 years ago for nY and sY (with preference for the latter) he more recently published a glottochronological date of 3480 ± 423 (1981:13 note 7), with which he is in basic agreement. He speculates that the two languages started to diverge before the northern and southern branches were split by the western expansion of the Pomo.

Time Depth

Knowledge of when the seven Pomoan languages separated would be helpful in understanding the prehistoric archaeological sequence in the North Coast Ranges. Several researchers have attempted to estimate the time of separation of the various languages. Oswalt, the most proficient in the four Western Pomo languages, will estimate the time of separation only by analogy. He finds (based on lexical subgrouping, supported by morphological evidence), that C, S, and K differ about as much as do French, Spanish and Italian, while N differs from those as does Rumanian from Western Romance (McLendon and Oswalt 1978:274). He sees the disparity in the entire seven language group as larger than that of Romance or modern Germanic, but less than that of Indo-European. The Romance languages have been diverging for some 2200 years (Rea 1958:150), "and Indo-European probably 6000, Oswalt's estimate could perhaps be translated into a rough time depth of 3500 ± 1000 years" (Whistler 1988:90).

Basgall (1982:12), using Oswalt's lexicostatistic data for the Pomoan languages, calculated grottochronological dates. In spite of their dubious efficacy, they offer some insight on relative time of separation. He derived the following:

1. initial split:	2570 B.P.
2. age of Western Branch	2160
3. Northern/Southern split	1380
4. Southern group differentiation:	910

There is some correlation of the glottochronology dates and the Indo-European analogy:

(1) is at the low end of 3500 ± 1000 , and (2) is about equal to the 2200 B.P. separation of the Romance languages. Basgall (1982:12) asserted that Oswalt (1964) and Elmendorf (1968, 1980) supported a 2500 B.P. separation date, but both actually suggest initial separation of Pomo and Yukian began at least 3000 years ago.⁵

Summary

Most linguistic analyses support an origin for the Pomoan language family in the Clear Lake basin. Subsequent group fragmentation and relative isolation began at least 3000 years ago. A group or groups of people moved to the Russian River, spreading north and south, and eventually west, from there. Permanent residence on the coast may have begun with the Kashaya, while Southern and Central Pomo speakers were still living on the Russian River and using the coast only seasonally to gather seafood. Yukian groups continued to use the area west of the Russian River. Later, possibly as late as 500 years ago, a group, or groups, of Central Pomo speakers established permanent villages on the coast.

ETHNOGRAPHY

Introduction

Initially, there appears to be a wealth of ethnographic data concerning the Pomo (Barrett 1908, Kroeber 1925, Loeb 1926, Gifford and Kroeber 1937, Stewart 1943, summarized by Theodoratus 1971). However, the ethnographers working in the first 40 years of the century were interested only in pre-contact conditions. A few of their informants, born before 1850 (when white encroachment in the area began), could provide personal recollections, but most informants, born after contact, were relating stories learned from their ancestors, but colored by post contact events. The ethnographers gave no consideration to the effects the missions exacted on tribal cultures, and purposely ignored signs of acculturation. As a result,

...what is generally taken to be a record of aboriginal, pristine, pre-contact California Indian ethnography is not that at all, but rather the record of native culture which is a modified or acculturated version of how things were before 1770. The ethnographic record for California, in short, contains within it the evidence of historical events and influences. (Heizer 1975:9-10)

The decimation of Native Americans due to introduced diseases, genocide, and other causes after the Gold Rush is well documented. But, Old World diseases may have affected the area much earlier, either from the shore visits of Cermeño (1542) and Drake (1579), or by spreading north from Mexico, where epidemics are documented in the sixteenth century. Population reductions would have had numerous effects: groups hard hit by disease would contract, less affected groups would expand into now vacant

territory. The linguistic maps may have a very shallow time depth if they are the result of missionization, not more than 400 years if widespread dislocations occurred earlier.

A drastic population decline would also affect the social structure: disrupt or eliminate trade, and reduce the complexity of the society (if, for example, there were no longer enough people to support specialists, or the people who knew specific ceremonies died leaving no successors). As a result, we can expect the ethnographic accounts to provide only limited help in understanding pre-contact lifeways, particularly for a site used more than a thousand years ago.

A second, unrelated problem with the ethnographic accounts is their treatment of the Pomo as a “tribe”; the assumption that information provided by one group applies to all. Sometimes the identity of the source group is identified, often not, and few informants from the coastal areas were interviewed, leaving us limited information relating to life on the coast. There is virtually no information on the territory which includes the Zeni site. Theodoratus (1971:324-374) integrates and summarizes all available ethnographic information on the Coast Central Pomo, neglecting only Merriam. This paper discusses only those aspects relevant to interpreting MEN-2136.

Discussion of ethnographic accounts is difficult, because different ethnographers used different terms to describe the same groups. Barrett (1908) labels the Central Pomo speaking people living on the coast the Coast Division. Merriam calls them the *Bó-yah* and *Kan-nó-ah* (McLendon and Oswalt [1978] prefer the spelling *Boya* and *Kanowa*). Stewart refers to them as the *Bokeya* of Point Arena—probably an error. *Bokeya* refers to the Central-Pomo-speaking peoples living between the coast and the Russian River

Valley, not to people living on the coast itself (McLendon and Oswalt 1978:281). Theodoratus (1971:326) calls the post-contact group living at Manchester and Point Arena the Coast Central Pomo. This paper will follow McLendon and Oswalt, and call the two coastal groups the *Boya* and *Kanowa*, and follow Theodoratus in using the term Coast Central Pomo when both groups are intended.

Social Organization

The basic community organization of the Pomo was the tribelet. A tribelet consisted of a primary village and one or more smaller, satellite villages. The largest village was the political center, the residence of the chief, and the location of the assembly house. The chief was generally a hereditary office, passing, in some tribelets, to the last chief's son, in others to the chief's sister's son. The chief's power, as remembered by informants, was due primarily to his persuasiveness; he apparently had no coercive power. The chief organized ceremonies and handled trade. In the larger, multifamily villages, there were also sub-chiefs, most likely the family heads. An average tribelet was composed of about 200 people and held a territory of approximately 100 square miles (Gifford and Kroeber 1937:119). But, some tribelets were much larger; Stewart's (1943:43, 45) informants described the population of the *Yokia* (near Ukiah) tribelet to be 500 to 1000 inhabitants and that of the *Cokoa* (Hopland) tribelet as 1500.

Tribelets are believed to have been autonomous, thus most of the Pomoan language areas were comprised of multiple autonomous tribelets. There are some reports of larger aggregations. Stewart (1943:35, 47) drew an analogy between the Coast Central

Pomo, where he thought at least two, if not all three of its divisions acted as a single group, and the three subdivisions of the Mato poma (Sherwood Valley), which shared an assembly house and seemed to act as a single unit. All Kashaya and Northeastern Pomo speakers, respectively, may have been part of a single tribelet (Stewart 1943:49), although the former may be a response to the Russian presence.

What forces acted to keep one set of autonomous tribelets speaking Northern Pomo, another set Central Pomo, another Southern Pomo, etc., when tribelets in similar proximity, but across a language boundary, spoke a different language? Assuming that the language territories visible at contact have some time depth, Silliman (1995:15-16) suggests two possibilities: (1) there were once “super-tribelets,” occupying territories something like the ethnographic language areas, whose political or social interaction kept the member tribelets’ languages mutually intelligible; or (2) some religious or ceremonial connection served to maintain language intelligibility among certain groups.

Alternatively, the Pomoan languages may have differentiated when the individual groups were small and occupied small territories. The subsequent rapid increase in population, and concomitant new tribelet formation and spread into the historic language territories, occurred too recently for new mutually unintelligible languages to develop. Stewart (1943) reports that the individual tribelets did speak slightly different dialects, testifying that language differentiation due to separation was continuing within the language groups.

Territory

The territory of the peoples who spoke dialects of Central Pomo has been mapped by numerous researchers, including Barrett (1908), Merriam (1966:1:15-17); Heizer (1966:39-40, Map 5), Kroeber (1925:Plate 36), Stewart (1943:43-49, Plate opposite p. 29), and McLendon and Oswalt (1978:278, 281-282) (see Maps 3-6). All generally agree that the territory extends from north of the Navarro River, south at least 64 km along the coast, to the mouth of the Gualala River. The southern boundary (with the Southern Pomo) follows the divide between the drainages of the North Fork of the Gualala River and Rockpile Creek, then continues east, crossing the Russian River about 2.5 miles north of Cloverdale, to the Mayacmas Mountains (the divide between the drainages of the Russian River and Clear Lake). The Mayacmas Mountains form the eastern border, between the Central Pomo and the Eastern and Northern Pomo language areas.

The location of the northern border, between the Central and Northern Pomo languages, is in dispute. Barrett (1908:159-161) traces it from the coast just north of the Navarro River, eight miles along Navarro Ridge, then south, along the ridge west of the Navarro River to just below Boonville, then north and east to the Mayacmas Mountains, on a line 2.5 miles (4 km) south of Ukiah (Map 3). Alternatively, Barrett (1908:125 note 109) admits that one of his informants placed the border just north of Ukiah.

Map 4. Pomo Language Areas (based on Merriam 1966)

Map 5. Pomo Language Areas (From Stewart 1943)

Merriam (1966:16, Merriam and Talbot 1974:19) maps a larger area (Map 4). He traces the northern border from the coast at Little River, follows the southern divide east and southeast, along the course of Big River, its South Fork, and Dougherty Creek, then east, passing approximately three km north of Ukiah, to the Mayacmas Mountains.

Stewart's (1943: facing page 29) boundary appears to be a compromise between the two (Map 5). His border starts from the coast just north of the Navarro, but then proceeds east and northeast, crossing the South Fork of Big River, dropping south to just north of the South Fork of the Navarro River, then heading east, on approximately the same line as Merriam's. Stewart, however, is uncertain about the language allegiance of the area between the South Fork of the Navarro River to just south of Boonville, which Barrett classified as Northern Pomo but Merriam considered Central Pomo. Stewart's (1943:42) informants suggest that the people in this area spoke a mixed dialect, half-way between that of the Northern and Central Pomo.

McLendon and Oswalt (1978:281) generally follow Barrett. However, using a linguistic analysis, they split Stewart's uncertain area, placing *Pdataya* (meaning "downstreamers" in Central Pomo), the area around Boonville, in Central Pomo territory, but feel *Tabate* ("big gravel" in Northern Pomo), the name of the village and area further downstream, is more Northern Pomo in form, so leave it in Northern Pomo language territory.

Whether or not the Coast Central Pomo tribelets once "owned" the coastal territory between the Navarro and Little rivers, there is no evidence that there were any permanent villages on the coast north of the Navarro River before *Buldam* was

established in 1850 (Barrett 1908, Stewart 1943:33). There is, however, evidence that the Central Pomo claimed territory north of the Navarro—they challenged the establishment of *Buldam* by a Northern Pomo tribelet, but lost—and archaeological evidence suggests that area was used by many groups, including the Central Pomo (Layton 1990).

As to the linguistic affiliation of the Philo - Boonville area, Merriam's (nd) informants were inconsistent. The eldest, "old chief John Boston" (also one of Loeb's [1926] informants) and "old" Bill Dock of Láte, asserted the area around *Tabate* spoke Northern Pomo. McLendon and Oswalt's (1978) solution, splitting Stewart's disputed area, is probably best.

Coast Central Pomo

Coast Central Pomo territory extends 73 km along the coast from Little River to the mouth of the Gualala. The eastern border, with the *Tabate*, Boonville, and Yorkville tribelets, "extends from Comptche, south by east past Christine and along the divide west of Rancheria Creek to a point about 5 miles west by south of Yorkville" (Merriam and Talbot 1974:19) where it meets, then follows, the divide between the North Fork of the Gualala River (or Billings Creek) and Rockpile Creek, the border with the Southern Pomo (Map 4 12 u, r).

Kroeber (1925: Plate 36) and Stewart (1943:47-49) divide the Coast Central Pomo into three autonomous divisions (tribelet). The northern most group claimed the territory from the Navarro River south to Alder Creek. Kroeber (1925:232) placed its primary village at *Kodalau* near Brush Creek. But, Stewart (1943:47-8) claims *Kodalau* was

established after contact, and the original principal village, *Kauca*, was located on Cliff Ridge, between Elk and Greenwood Creeks. Both Kroeber and Stewart agree that *Pdahau*, located near the mouth of the Garcia River, was the major village of the second division (Kroeber 1925:232, Stewart 1943:48). Its territory extended from Alder Creek to Signal Ridge, the divide between the Garcia and the North Fork of the Gualala River. In both the *Kauca* and *Pdahau* tribelets, the principal village was within five miles of the coast.

Lachupda (Kroeber 1925:232) or *Latcupda* (Stewart 1943:48), the major village of the third subdivision, was 15 km from the coast, on the headwaters of the North Fork of the Gualala River. This group claimed the area between Signal Ridge and the border with the Southern Pomo (basically the drainage of the North Fork of the Gualala River) and controlled 4 miles (7 km) along the coast, from Fish Rock to the mouth of the Gualala River.

Stewart's (1943:48) informants were divided as to whether the *Lachapda* group, whom they called the *Kanoa*, were a subdivision of the *Boya* before contact, or an autonomous tribelet. All three Coast Central Pomo divisions, with their three separate chiefs, consolidated at *Pdahau* after contact. Stewart claimed they were a recognizable unit; the peoples of the three main villages considered themselves *Boya* with no boundaries recognized. The three groups intermarried and families often changed residence. The populations were small. One informant gave the prewhite population as 200 at *Pdahau*, 100 at *Kauca* and 80 at *Lachapda* (Stewart 1943:49). However, Stewart's

data may reflect the post-contact situation. Data in Merriam (nd) and Loeb (1926) suggest the Kanowa were an autonomous tribelet.⁶

In any case, *Lachapda* had an unusual setting, “situated almost on top of the mountain in the center of the redwood forests” (Stewart 1943:48). These people kept their forest clearings free of brush with annual burnings, usually in the fall. They procured seafood and salt near the mouth of the Gualala River.

McLendon and Oswalt (1978: 281) assert that the word *Kanowa* comes from the Boya word *q^hnó-wa*. *q^hnó* means mountain mahogany (abundant in the area and used to make arrows). The suffix *-wa* is unknown, but may be a variant of *-ya*, people. “*Latcupda*” (Barrett 1908, Stewart 1943:48) is an anglicized version of *lá[✓]ca pda*, “ax creek,” including the Spanish loan word *la hacha*, “the ax” (McLendon and Oswalt 1978:282). As such, the village, or at least the appellation, cannot be very old.

East of the Coast Central Pomo was a group called the *Danokeya*, meaning “upstreamers.” Their principal village was *Láte*, near Yorkville. These people were referred to as *Bokeya*, “people of the west, westerners,” a term used to describe the people who lived between the coast and the Russian River (McLendon and Oswalt 1978:281). The people near Boonville, the *Pdataya*, “downstreamers,” are included in this appellation. One of Robert Oswalt’s (personal communication 1995) informants considered the *Kanowa* to be *Bokeya*. However, one of Merriam’s (nd) informants (Dan

Map 6. Coast Central Pomo Territory (Extracted From Barrett 1908)

Scott) considered the *Kanowa* dialect to be similar to the *Boya*'s, while the *Láte* dialect was closer to the valley tribes. This aligns the *Kanowa* more closely to the coastal group.

Kanowa Villages

Barrett (1908:164-5) locates *Lachapda*, the principal village, on the north bank of a small tributary about 1.5 miles from its confluence with the North Fork of the Gualala (most likely on a tributary of Robinson Creek [Gary and McKenzie 1989]). It was just north of Rockpile Peak. Barrett's map is not precise, so it is difficult to determine exactly where the village was. Somewhere on Bear or Robinson Creek is consistent with Stewart's more accurate, but less detailed, map. Barrett (1908:164-5) listed six subsidiary villages in the area around *Lachapda*, and described them as neither continuously inhabited nor long abandoned. Four of those are on the North Fork of the Gualala, the other two on Signal Ridge. *Kle'tel* is "in the mountains between Garcia river and the headwaters of the north fork of Gualala river at a point probably about three miles and a half northwest of the old village of *la'tcupda*." The Zeni Ranch matches this description. *Tca'msumli* is "on the ridge separating the headwaters of Garcia river from those of the north fork of Gualala river and at a point probably about two miles and a half from the old village of *la'tcupda*." This village, as shown on Barrett's map, is probably somewhat north and east of MEN-2136, but if it is on the ridge, it must also be about 3.5 miles from the general area of *Lachapda*.

In addition to the villages described above, Barrett (1908:166-167) lists three camps on the coast in *Kanowa* territory: *Iwi'tcal*, at the mouth of the Gualala; *Kam'li*,

about 1.75 miles northwest of the town of Gualala, and *Ka'dalau*, in the town of Fish Rock, about 3.5 miles northwest of Gualala. Merriam (n.d.) considers the first, which he transcribes *We-chahl*, to be a very large, permanent village on north side of the mouth of the Gualala.

Subsistence

Various ethnographers have clustered the Central Pomo tribelets based on economic zone: the Russian River Valley group, with four or five tribelets, the Coast Central Pomo, with two or three tribelets, and the *Bokeya*, inhabiting the Anderson and Rancheria Valleys, between the coast and the river, with two to four tribelets.

The subsistence pattern recorded for the Pomo who lived along the Russian River was basically sedentary. Permanent villages were located near the river, where the tribelet gathered for most of the year and the elderly remained permanently. Families dispersed into the surrounding hills during the summer months to hunt and to gather roots and seeds, and in the fall to gather acorns. Food staples included the acorn, salmon from the Russian River and its tributaries, and deer and other game. These valley people traded with the coast for seafood and with the Clear Lake basin for lake fish and for the obsidian and magnesite used to make tools and beads. Ethnographic accounts record visits to the coast in summer for direct collection of seafood and to Bodega Bay for the clam shells used in making beads. Whether such trips were possible before the disruption after contact is unclear. Heizer (1975:10) asserts that inland peoples' trips to Bodega Bay were

only possible in historic times, but his claimed source (Hudson 1897) doesn't document that.

The ethnographic accounts of Pomo speakers living on the coast suggest a more varied diet and a less sedentary existence. The Coast Central Pomo territory included two of the three North Coast Ranges economic zones: the coast, including the coastal shelf, and the redwood belt; all useable resources from both areas were exploited. Sea animals and aquatic plants came from the ocean, berries and seeds were gathered on the coastal shelf and in forest openings, and acorns (tan oak) and wood products were available in the redwood belt. Anadromous fish could be had in the rivers and their tributaries, and Monterey chert was available in the seven km stretch between Schooner Gulch and Arena Cove. Terrestrial animals, especially deer, Roosevelt elk, rabbit, and quail, were pervasive. Some shore birds were eaten as well, and land and shore birds provided feathers for basket decoration and ceremonial dress (Stewart 1943:49).

Stewart (1943:60-61) asserts that shellfish were a larger component of the Point Arena Indians' diet than were either terrestrial animals or anadromous fish. This may not have been true for the *Kanowa*, who controlled only four miles (7 km) of coastline and lived three times as far from the coast. Nevertheless, the *Kanowa* undoubtedly used the same coastal resources, if not to the same degree, and Stewart's (1943:60-61) list of such resources should still apply: mussels, chiton, and abalone, (perhaps ranked in that order), sea anemone, sea urchins, limpets, octopus, clam, barnacles, and various seaweeds.

Mussels were baked to open the shells, then dried and strung to be carried inland. Chitons (both *Katherina tunicata* and *Cryptochiton stelleri*) were gutted after cooking,

then dried. Abalone, when they could be found, were cooked and dried for winter use. Acorn and goose barnacles, delicacies because of their flavor, could not be preserved, and were eaten only when residing on the coast.

Tan oak acorns were the species preferred by most Pomo groups (Baumhoff 1963) and were readily available in the mountains east of the coast. They were gathered in the fall when ripe, and stored either in separate, above ground, granaries, or in storage baskets within the house. The acorns were ground in mortar with pestle, and leached to remove the tannin, then eaten either as a mush (heated in baskets with water and heating stones) or baked into bread in earth ovens (Gifford and Kroeber 1937:136).

There are no ethnographic accounts of the *Boya* or *Kanowa* "seasonal round." Accounts, however, are available for the Kashaya and the Coast Yuki. Although there are geographical differences, the Coast Central Pomo's pattern was probably similar. (The coastal shelf north of Point Arena is broader than any that exists to the north or south, and the South Fork of the Gualala, in Kashaya territory, parallels the coast only five miles inland, a relatively unique environment that might have resulted in a greater reliance on fresh water fish.) The ethnographic accounts of the Coast Yuki and Kashaya Pomo seasonal rounds differ from accounts of the Russian River and Clear Lake peoples in that they suggest a less sedentary pattern. At the very least, these coast peoples, after contact, lived in two villages, one on the coast in the summer, a second inland during the winter.

Kniffen (1939:384-388) describes the Kashaya Pomo seasonal round. They occupied their permanent villages only part of the year. During other seasons they moved about. They spent the winter months, when the coast was inhospitable, in their interior,

permanent villages. In mid-winter, after the winter rains opened the river mouths and the salmon started upstream, the men went to the smaller tributary streams to spear and trap fish. Surplus fish were dried and stored. As the salmon runs dwindled, in April and May, the Kashaya moved to villages on the coast. At the shore they collected mussels, clams, abalone, sea fish, and seaweed. From the coastal plain they gathered wild clover and the roots of wild celery, wild onion, and wild potato. Sometimes in June they went to Clear Lake for obsidian. During the summer they gathered berries and seeds in the forests and steppes and trapped quail. In September they moved inland to gather acorns and to hunt, returning, finally, to their winter villages.

Gifford (1967:1-4) quotes an account of the Kashaya by Kostromitonov, a director of the Russian Colony at Fort Ross. This account suffers in resource identification, but was written 100 years before Kniffen's:

The season determines the place where they might find subsistence. In the spring they live near rivers and in well watered places, in order to catch fish and gather roots and herbs. They spend the summer in the forests and the steppes, where they collect berries and the seeds of wild plants. In the autumn they pile up stores of acorns and wild chestnuts, and sometimes also nuts; and shoot bisons [sic] and wild goats [sic] with their arrows. The Indians' diet consists of everything they can find; large and small animals, shellfish, fish, lobsters, roots, herbs, berries, and other products of nature, even insects and worms. (Kostromitonov in von Baer and von Heimersen 1839, quoted in Gifford 1967:2)

Gifford's (1965:43) description of the Coast Yuki seasonal round parallels Kniffen's for the Kashaya: The Coast Yuki moved to the beach in April, where they built summer houses and gathered seaweed and shell fish. In May they gathered clover leaves, bulbs and corms (Indian "potatoes"), in June, clover seeds, bulbs and corms. In July they

collected and dried fish (especially abalone and surfscabbard) and gathered grass and clover seeds, berries (strawberries, blackberries, and salal berries), and hazelnuts. In August they hunted deer and continued gathering hazelnuts and salal berries and drying sea foods. In September they went to the hills to look for acorns and to gather seeds, but continued to live on the coast. In October they constructed their winter houses, but did not yet settle in them. In November they were "still moving about." In December (best month) and January they fished for salmon in the interior, doing little hunting. Late January and February were bad months, with little food because heavy rain made the streams too high to fish for salmon. In March, although still living in their winter villages, they made foraging trips to the coast to collect shellfish.

Houses in the coastal belt were made of redwood slabs and bark (Gifford and Kroeber 1937:143, 184). Both conical, single family houses and L-shaped multifamily houses have been described. Elk antler wedges were used in prying off the bark (Stewart 1943:48), although Gifford and Kroeber (1937) asserted they were unknown, and only fire was used to work wood. One of Stewart's (1943:47) informants, who had lived at *Lachapda*, described a greenstone hand ax used to fell trees.

Population

One of Stewart's (1943:49) informants gave the pre-white population of *Lachapda* as 80, *Pdahau* 200 and *Kauca* 100. Cook (1956:116-117), working with Stewart's, Barrett's, and Merriam's village data and estimates of the number of houses per village and number of people per house, calculated the original population of the

Coast Central Pomo to be about 1190, including approximately 350 in *Kanowa* territory. Cook compared his Coast Central Pomo estimate of 3.97 people per square mile to his density estimate for the Coast Yuki (based on better information), who lived in what he considered to be a less favorable environment. The *Kanowa* territory, however, is only about 56 square miles, and a population of 350 people would yield a density of 6.25 people per square mile, surely too many unless the habitat was much more favorable than most anthropologists believe.

Cook was probably double-counting when he included estimates of both the population of *Lachapda* and its surrounding satellite villages and *Wechahl*, which Merriam (but not Barrett) described as a “large permanent village at the mouth of the Gualala.”

If the *Kanowa* followed the Kashaya and Coast Yuki practice of spending the winter in the interior and the summer on the coast, *Wechahl* could be a permanent *summer* village, but inhabited by peoples who lived around *Lachapda* in the winter. Eliminating the counts associated with *Wechahl* suggests a population before white encroachment of up to 200 people for *Kanowa*, equal to 3.6 people per square mile, and more consistent with estimates for the surrounding coastal territories.

CHAPTER FOUR

PREVIOUS ARCHAEOLOGICAL RESEARCH

The history of archaeological research in the North Coast Ranges has been reviewed by White and Fredrickson (1992:37) and Stewart (1993:132-158) and will not be repeated here. This paper will summarize the two current taxonomies in use in the central portion of the area and discuss those sites relevant to understanding MEN-2136.

Meighan (1955) developed the first chronology for the North Coast Ranges, using data from the six sites which had then been excavated, plus ethnographic artifact collections. He identified three "Complexes" which are still relevant today:

The **Borax Lake Complex**, initially dated to 2000+ B.P., provided the earliest evidence of occupation in the North Coast Ranges. It included the "Borax-Lake fluted" points and chipped stone crescents recovered at the Borax Lake site (Harrington 1948), and the "Wide-Stem" points, manos, and millingslabs, which were recovered throughout the central North Coast Ranges. A subsequent obsidian hydration analysis on artifacts from the Borax Lake site (Meighan and Haynes 1970:1217-1220) allowed separation of the complex into two assemblages: the fluted points and crescents were assigned to the Paleoindian period, while the wide-stem points were dated to 8000 to 6000 B.P.

The **Mendocino Complex**, which Meighan initially dated between AD 500 and 1000 (subsequently revised to 5000 to 3000 B.P. [Meighan and Haynes 1970:1220] and now 5000 to 1300 B.P. [White and Fredrickson 1992:80]), used MEN-500, near Willits, as the type site. The artifact assemblage included heavy chert projectile points (none

fluted), flaked stone scrapers and drills, mortars and pestles as well as manos and millingslabs, and unperforated charmstones. Artifacts assigned to this complex were found in the area extending from northern Sonoma County to the northern California border.

The **Clear Lake Complex**, which Meighan dated between AD 1700 and 1850, although he suspected it began somewhat earlier, was characterized by small triangular arrow tips (normally of obsidian), hopper mortars and pestles, perforated charmstones, magnesite cylinders, clamshell disk and *Olivella* beads and *Haliotis* pendants.

Three other complexes Meighan defined at that time are not relevant to this paper.

CLEAR LAKE BASIN CHRONOLOGY

Fredrickson (1973, 1974), working with Bennyhoff, employed data generated by Meighan, his own excavations at LAK-261, and the results from a small number of additional sites, redefined the North Coast Ranges chronology and attempted to correlate it with the Bay Area and Delta. His taxonomy is widely used by researchers working in Lake and Sonoma Counties and, to a lesser extent, elsewhere. Fredrickson's scheme included temporal, technological, subsistence pattern and mortuary characteristics and assumed that only one group, with one set of characteristics, occupied any given area at one time. White and Fredrickson (1992:37-42, 80, Figure 20) recently revised the original taxonomy to address some of these assumptions.

In Fredrickson's taxonomy, a pattern designation applies to a broad area where assemblages share similar technological levels and economic modes (production,

distribution, consumption). Patterns are subdivided into aspects, which divide space into local districts which differ primarily in artifact styles. Finally, aspects are divided into phases with restricted temporal dimension (White and Fredrickson 1992:38). The following summarizes White and Fredrickson's (1992:37-85) revised model of Clear Lake prehistory (Figure 2):

Post Pattern (9000 B.P. to no earlier than 11000 B.P.; 9.5-11.5 μ [B]). The Paleoindian period in the central North Coast Ranges is known only from the Borax Lake site (Harrington 1948, Meighan and Haynes 1970) and isolated finds of crescents and Clovis-like fluted points. Unfortunately, the Borax Lake site is stratigraphically mixed, thus it is not possible to determine the rest of the assemblage. The largest hydration measurements on debitage recovered at the Borax Lake quarry are about 11.5 μ (White and Fredrickson 1992:45).

Borax Lake Aspect of the Borax Lake Pattern (9000 to 7000 B.P. around Clear Lake, to 2800 B.P. in the north): Characterized by large, wide-stemmed points, this pattern is found at Clear Lake and in upland locations in both the northern North Coast Ranges and north-central California, but has generally not been found near the coast. The type site is LAK-36, where Borax Lake Wide-stemmed points have rim readings of 9.5 to 7.5 μ (B) (White and Fredrickson 1992:47). This pattern evolved into the Houx Aspect of the Berkeley Pattern.

Figure 2. Revised Model of Clear Lake Prehistory from White and Fredrickson 1992: 80

Houx Aspect of the Berkeley Pattern (7000 B.P. to 1300/600 B.P.). White and

Fredrickson (1992:49-63) trace the evolution of the Houx Aspect through four phases:

PHASE	TYPE SITE	DATING	O.H. (μ B)	WIDE-STEM STYLE
Mostin	LAK-380/1	7000 B.P.	7.5-5.9	Square-stem
Creager	LAK-510	<3000 B.P.	5.8-5.3	Contracting & Houx
Houx	LAK-261	2500-1800 B.P.	5.1-3.7	Contracting & Houx
Terminal Houx	Lewis Ridge	to 1300/600	> 2.9	none

The Houx Aspect includes shouldered and unshouldered “Excelsior” points in all phases, and a wide-stemmed series pervasive in the first three phases, rare beginning about 2000 years ago, and absent by 1800 B.P. (White and Fredrickson 1992:51, 53). Associated flaked-stone artifacts include heavily serrated flake tools, simple drills, graters, roughly worked bifaces and long knives. Formal flake tools, such as shaped ovate and discoidal scrapers, are uncommon to absent. Mortars and pestles appear throughout the pattern, while milling slabs and handstones predominate before the Houx Phase and disappear thereafter.

Clear Lake Aspect of the Augustine Pattern (1300/600 B.P. to 170 B.P., 3.8 - 1.4 μ B). Although there is some evidence for this pattern beginning 1300 years ago, most associations postdate 600 B.P. Rattlesnake series projectile points—corner-notched, side-notched, and/or triangular—occur in all assemblages. The corner-notched form appears to span the entire range, while the side-notched variant is a late Clear Lake marker. Dart-sized “Excelsiors” persist throughout this phase. Small chert drills associated with bead-making appear at some sites. Milling tools are predominantly pestles of various sorts, associated with bedrock mortars, but a slab mortar was recovered

at the one site without boulders. The abundant bone tools and associated beads found in these sites are, unfortunately, not helpful for understanding MEN-2136, where little bone has preserved (White and Fredrickson 1992:74-79).

Mendocino Pattern (5000 B.P. to 1300 B.P., 6.7 - 3.1 μ B). This pattern is now considered intrusive into the Clear Lake basin, coexisting with the Houx Aspect, but indicative of a different subsistence pattern. Sites are predominantly lithic scatters, with little to no organic matter, indicative of short-term stays. The pattern is characterized by concave-base, stemmed, and thick (thickness/width $>.43$) leaf-shaped points. Formal flake tools, roughly worked bifaces and thin knives occur, but beads and ornaments are rare. By 3000 B.P. two variants appear: the **Mendocino Aspect**, in the region generally north and west of the Lake, is dominated by large notched points of chert (here Willits series). In areas south of the Lake and east of the Russian River, the **Hultman Aspect** is characterized by obsidian concave-base (Mendocino Concave-base) and thick leaf-shaped forms (Copsey Bipoints). Both forms are found in Clear Lake Basin sites (formed mostly from Borax Lake obsidian). Most milling tools were handstones—both shaped and unshaped—and millingslabs. But, a few shaped pestles have also been found (White and Fredrickson 1992:63-73).

White and Fredrickson (1992:97-101) associate the Borax Lake, Houx, and Clear Lake Patterns with the Pomoan speaking peoples, originating in a Clear Lake basin homeland. The Pomo are described as mobile peoples during the Borax Lake Pattern, more sedentary with more complex societies during the Houx Pattern, and reaching a climax in the Clear Lake Pattern. The Mendocino Pattern is ascribed to more mobile

Yukian groups who occupied more upland settings, visiting the Clear Lake basin only seasonally for fish. This group is believed to have occupied the area north, south, and west of Clear Lake when the Pomoan speaking peoples started moving west between 2500 and 1500 years ago. Both Houx Aspect and Mendocino Pattern peoples occupied these areas until about 1500 years ago, when the Yukian groups were apparently split and pushed to the north and south.

Fredrickson retains reservations on the ascription of the Houx Aspect to the Pomo, noting that archaeological data from the North Bay indicate both Pomo and western Miwok speakers “employed a basic Berkeley Pattern material culture, interacted extensively, and thus may be indistinguishable using archaeological methods” (White and Fredrickson 1992:96). Fredrickson’s (1973) initial formulation of the North Coast Ranges sequence viewed the Houx Aspect as marking the intrusion of Miwokian speakers into the Clear Lake basin; he still considers this to be a viable alternative hypothesis (c.f. Stewart 1994:166).

WARM SPRINGS CHRONOLOGY

Basgall (1982), analyzing the data from the Warm Springs project in northern Sonoma County, chose to use a “local” sequence for that area. This taxonomy, although initially intended for use only within the project area, has been adapted for use by other researchers (e.g. Layton 1990, Gary and McLearn-Gary 1990, Maniery 1990a, 1990b; Rondeau 1985, 1990) working in Western Pomo linguistic territory. This taxonomy is the most frequently used model in Mendocino County, and will be employed in this paper. It

has the advantage of shorter rubrics, and the phases appropriate to the western area are still undefined in the White and Fredrickson (1992:89) model.

Basgall (1982) defined three phases in the multiple sites investigated. The earliest, the **Skaggs Phase** (analogous to Fredrickson's Mendocino Pattern), dated by radiocarbon to 5000 to 2500 years ago, appeared in a relatively few sites, characterized by little or no midden. Mendocino Concave-base and Willits Side-notched projectile points, almost all of chert, were recovered, associated with manos and millingslabs.

The following phase, **Dry Creek** (Fredrickson's Houx Aspect of the Berkeley Pattern), was originally dated between 2500 B.P. and 500 B.P. (Basgall 1982:7), but now, based on additional radiocarbon data, ends at 900 B.P. (Basgall 1993:170). Shouldered Excelsiors and large leaf-type points, mostly of obsidian, were associated with bowl mortars and pestles. Although most of the components dating to this phase were relatively thin, they did show more midden, and thus more intensive occupation, than did those of the preceding Skaggs Phase.

The late phase, **Smith** (Fredrickson's Clear Lake Aspect of the Augustine Pattern), dates from 900 B.P. to the historic period. Projectile points are now of arrow-tip size, typed as the Rattlesnake series, and manufactured from both chert and obsidian. Mortars and pestles persist, as do cupule rocks, and a specialized drill/bead industry appears at some sites. In general, there are relatively more Smith Phase sites, they are larger in extent, and show deeper middens than the earlier sites. This suggests more intensive use of the region and larger populations (Basgall 1982:8).

To allow phase placement of sites with neither diagnostic artifacts nor ^{14}C dates, the Warm Springs researchers developed an obsidian-hydration micron range for each phase. The ranges were determined by mean obsidian-hydration measurements, plus and minus one standard deviation, on temporally distinctive projectile points: Rattlesnake series (Smith), Excelsior (Dry Creek), and Mendocino Concave-base (Skaggs) (Basgall and Bouey 1991:70). The plus and minus one standard deviation range was selected in an attempt to define a discrete temporal period for each phase. Subsequent evidence strongly suggests that the Skaggs and Dry Creek phases overlap, and thus the defined phase ranges are probably too narrow.

PHASE	SMITH	DRY CREEK	SKAGGS
KONOCTI	< 2.4 μ	2.4-3.3 μ	> 3.3 μ
NAPA	< 2.4 μ	2.4-3.6 μ	> 3.6 μ

Basgall argues that the Skaggs/Dry Creek transition marked the entrance of Pomo-speaking peoples to Warm Springs: (1) there was more discontinuity between Skaggs/Dry Creek than between Dry Creek/Smith, (2) the cupule rocks require a Pomo association, and (3) 2500 B.P. is consistent with both the glottochronological dates for the separation of Proto-Pomo and with the estimated linguistic separation of northern Yukian from Wappo (Basgall 1982:12).

SITES WEST OF THE CLEAR LAKE BASIN

This section documents sites located in ethnographic Pomo territory west of the Clear Lake basin, in the area from northern Mendocino County south to, and including, the Warm Springs project. Sites are ordered from north to south. Site descriptions

emphasize artifacts, debitage and obsidian hydration measurements which can be used to derive context for the Zeni Ranch materials.

MacKerricher Sites

White's 1988 and 1989 excavations on the coast in MacKerricher Park, near the border of ethnographic Coast Yuki territory, have not been fully reported. He found two small, intrusive Dry Creek (Houx Aspect) habitation sites (called the MacKerricher Phase), radiocarbon dated to 1700-1900 B.P. (White 1989:110; White and Fredrickson 1992:100). Artifacts include obsidian and chert Excelsior points, debitage, a hopper mortar/anvil, a shaped pestle/mano fragment and bone tools. Faunal remains indicate a subsistence strategy including shellfish, stellar sea lion and elk. White (1989:125) concludes that the sites were used in late spring and summer, and that the Houx Aspect peoples used the area more intensively than subsequent (non-Pomo) occupations. White found no subsequent use of the area by Pomo peoples, although a short occupation, which he identifies as Algic, was detected (Greg White, personal communication 1994).

Hydration measurements on nine obsidian flakes recovered from MEN-828, one of the MacKerricher sites, are as follows (White 1989:107):

	BORAX LAKE	KONOCTI
N	5	4
Mean	3.3	2.6
Range	3.0-4.0 μ	2.2-2.9 μ
S.D.	0.37	0.27

The Borax Lake and Konocti measurements are coeval, based on Tremaine's (1989a:3) comparison constants.

MEN-500

MEN-500, 2 miles (1.2 km) northeast of Willits and a few kilometers south of the historic boundary between the Yuki and Northern Pomo, was excavated in 1951 by Meighan (1955:2). Sixty-two 5 foot by 5 foot pits were dug in 1 foot levels; only one was screened, through 1/4" (6 mm) mesh. One hundred fifty-nine typeable projectile points were recovered: 141 Franciscan chert, 17 obsidian, and 1 green bottle glass. Diagnostic projectile points included 21 Mendocino Concave-base, 12 Mendocino Side-notched, 52 stemmed (probable Willits series: 7 corner-notched, 16 side-notched and 29 contracting stem) and 14 arrow tips, most probably Rattlesnake series. Forty-six less diagnostic points, most of diverse leaf shapes, were also recovered.

Meighan assigned the projectile points to either the Mendocino Complex, the Clear Lake Complex, or to both, based on stratigraphy (perhaps influenced by point size). Points recovered in the top 12" of deposit were assigned to either the Clear Lake Complex or to both the Mendocino and Clear Lake periods, depending on the average depth of all such points recovered. The deposits, however, are probably stratigraphically mixed (see below). Reassigning points based on today's typology results as follows:

	CHERT	OBSIDIAN	GLASS	TOTAL
Mendocino (Skaggs)	90	9		99
Leaf-shaped*	41	5		46
Clear Lake (Smith)	10	3	1	14
Total	141	17	1	159
* some probably Skaggs, others possibly Dry Creek				

Milling equipment and fragments were associated as follows:

COMPLEX	MILLINGSLABS	MANOS	MORTARS	PESTLES†
Mendocino	22*	34*	9* (1 bowl)	9
Clear Lake			2 (hopper)	9
† plus 3 of unknown association				
* includes fragments				

Meighan reported the weight of the debitage recovered from unit S-43 in 6" levels. The chipping debris was not counted nor the obsidian sourced. There was 2.5 times as much obsidian, by weight, in the top (0-6") level as in the bottom-most (36-42") (Meighan 1955:6-7). However, by weight, obsidian, represented only 26.7 g (4.3%) and 10.7 g (1.8%), respectively, of the debitage in those levels and 4.3 percent of the total debitage in the unit.

Layton excavated six 1.5 by 1.5 meter units in 1987, in the same area as Meighan's easternmost excavation units. The debitage from three units (2S7E, 4N4E, 4N5E) has been analyzed. Of the 5,451 flakes recovered: 4,738 (87%) are Franciscan chert, and 713 (13%) are obsidian. Origer visually sourced the glass; by count, 60.3 percent is Borax Lake, 37.7 percent Konocti, 0.7 percent Napa Valley, and 1.3 percent of unknown source. Obsidian comprises less than 10 percent, by count, of the levels below 60 cm, and over 20 percent (maximum 22.7%) of a few levels above 60 cm. Total debitage from these units weighs 5,857.8 g, of which 4.4 percent by weight is obsidian, similar to Meighan's results.

Hydration rims were measured on 338 flakes, six corner-notched points and nine biface fragments (Chart 27). Both Borax Lake and Konocti obsidian measurements show bimodal distributions. Borax Lake rims range from 6.9 to 1.2 μ , with a break between 4.8

and 4.6 μ , and peak usage between 4.0 and 3.1 μ and 1.6-1.3 μ . Konocti obsidian usage appears to begin somewhat later—sustained usage begins about 4.0 μ , peaks between 2.6 and 2.4 μ , drops off below 1.9 μ then peaks again at 1.2 μ . Although the sample submitted for hydration measurement is overweighted with Konocti glass (47% of hydration sample, 38% of the debitage), it appears that more Konocti than Borax Lake obsidian was used between 2.6 and 2.2 μ K (3.3-2.7 μ B) and at 1.2 μ K (1.5 μ B). During the rest of the period Borax Lake usage exceeded that of Konocti. Analyzing the hydration measurements by excavation level strongly suggests that substantial mixing of the deposits occurred, and thus Meighan's assignments of artifacts to complexes based on average recovery depth is questionable.

To summarize, at MEN-500, obsidian, as reflected in both the debitage and projectile points, was always a minor constituent at the site, although there was some increase in the number of obsidian projectile points through time. Peak obsidian usage was between 2.6 and 2.4 μ and at 1.2 μ Konocti. The hydration readings suggest, however, that obsidian usage, albeit in small amounts, began before 4.0 μ (K) and 6.0 μ (B), probably before use of the area by Pomo-speaking peoples.

MEN-790 Three Chop Village

MEN-790 is located 18.5 km east of the coast, on Three Chop Ridge at 390 m. Three of 26 house depressions were excavated by Layton (1990:180) in 1984. Layton divides the recovery into three numbered components. The last two include four Rattlesnake series (two Konocti) and nine Gunther series arrow tips (all chert), similar to

the last component at Albion Head and consistent with the ethnographic Northern Pomo. The site was probably a Mitom Pomo summer village. Bead blanks and chipping debris of Chinese porcelain salvaged from the *Frolic* shipwreck document use of the site to 1850. The majority of the hydration readings are small ($1.2\text{--}0.7\ \mu\text{ [K]}$), but there are three additional small clusters at 1.7, 2.5, and $3.4\ \mu\text{ (K)}$. The earliest component at this site is comprised of seven bipoints (six chert, one obsidian) and eight or nine chert stemmed points similar to those in component 5 at Albion Head. Layton (1990:187) considers this component evidence for Yukian persistence in the area until AD 1200.

MEN-2138 East Road Bridge Site

This site, situated near the Russian River in an oak woodland environment at the north end of Redwood Valley, was tested by Maniery (1990a, 1990b) in 1988 and 1989. A small number of artifacts were recovered: 16 projectile points (14 typeable), 43 bifaces (71% chert), 9 scrapers, 3 unifaces, 34 retouched flakes, and debitage. Three chert Mendocino Concave-base points and large chert corner-notched and contracting-stem points are all probably associated with the Mendocino Pattern (Skaggs). A single side-notched point of Borax Lake obsidian (probably a Rattlesnake), with a hydration band of $2.4\ \mu$, attests to some Smith Phase use. Four small leaf shaped points (2 chert, 1K, 1B) are harder to place—the hydration reading on the Borax Lake specimen was $6.5\ \mu$ (5.1 K). A small number of flakes were produced by bipolar reduction. Twenty-seven of 30 readings on bipolar cores and flakes range between 3.6 and $1.8\ \mu$, suggesting some Dry

Creek use of the area, the author arguing bipolar reduction to be a characteristic of that phase.

The most interesting results from the site are the obsidian sourcing and hydration data. In the test phase, 3,442 debitage flakes were recovered from 18.5 m³ excavated (186 flakes per m³). Of these, 63.6 percent were chert, 36.0 percent obsidian, and 0.4 percent basalt. The 1,288 obsidian flakes were visually sourced by Origer: 74.9 percent K, 24.1 percent B, 0.9 percent N, and 0.2 percent A. Hydration was measured on 182 obsidian flakes and tools. Sustained usage of Konocti obsidian began at 4.3 μ and continued to 1.5 μ . Frequency peaks are visible at 3.7, 3.0, and 2.7 μ (Chart 29). Maniery deduces from his data that the Pomo entered the area of this site earlier than they appeared in other Western Pomo areas. Unfortunately, given the small number of typeable artifacts recovered, all that can really be said is that (ignoring temperature effects) significant obsidian usage at MEN-2138 appears to have begun earlier than at most Dry Creek sites.

MEN-1805 Nightbirds' Retreat

MEN-1805 is located 8.4 km northwest of Calpella at 442 m elevation, in an oak woodland environment near the edge of the redwood belt. The site contained 11 to 15 house depressions (Layton 1990:126). Four house depressions and seven 1.5 m by 1.5 m units were excavated in 1985. Layton distinguishes three components. The oldest, ending sometime before AD 500, consists of Mendocino Pattern projectile points (Willits series, Mendocino Concave-base, Mendocino Side-notched, and chert bipoints). Obsidian represents 6.3 percent⁷ of the debitage (56% B, 40% K, 4% N). Component 2,

characterized by the abrupt appearance of obsidian at about 3.0 μ Konocti, shows evidence of much more intensive use of the site (1,776 flakes and 24.4 artifacts per m^3). Thirty percent of the debitage is now obsidian (87% B, 13% K). Obsidian bipoints and fragments characterize this component. The assemblage includes flake tools and manos but neither mortars nor pestles and few fire-cracked rocks. Layton (1990:138) interprets this as a seasonal, not winter, village. He assigns it to the Dry Creek Phase.

In Component 3, found in the housepits and surface midden, Layton (1990:138) found yet more intensive use (2,408 flakes and 31 artifacts per m^3) and sees some signs of craft specialization. He associates this component with the Masut Pomo. Obsidian drops to 24 percent of the midden debitage and 21 percent of that in the houses (77% B, 18% K, 0.8% N, 3% A). Annadel glass was found only in the houses, in conjunction with hafted drills for bead making, suggesting the Annadel obsidian was obtained either through trade or in concert with trips to Bodega Bay to collect clam shells. Projectile points include five chert Gunther series and 12 Rattlesnake series arrow tips (3 chert, 9 obsidian [2B, 2K, 4A, 1 KorA]). One glass bead, one steatite bead and a pestle were recovered from the houses.

MEN-584 Cold Creek Site

The California State Department of Parks and Recreation excavated 34 one by two meter units in 1965 at this site at 260 m in Cold Creek Valley, east of Ukiah. Chert was locally available as cobbles in Cold Creek. Four hundred seventy-three projectile points (276 chert, 196 obsidian, 1 bottle glass; half typeable), 504 scrapers, 20 knives, 27

drills, 21 shell beads and a variety of ground stone, including two perforated charmstones, and bone artifacts were recovered. Milling equipment included 10 pestles and 2 manos. Soule (1975) analyzed the site for his masters thesis. He described the recovered points employing an eclectic mixture of Great Basin, Houx variant and Mendocino Complex terminologies; only the latter attribution is considered valid today. Mendocino Pattern (Skaggs) points include three Mendocino Concave-base, one Mendocino Side-notched, and 27 probable Willits series (3 obsidian). Clear Lake Complex (Smith) styles include 93 Rattlesnake series (72% obsidian, 27% chert, 1% bottle glass), 19 Gunther series (26% obsidian, 74% chert) and 43 "Cottonwood Triangular" (64% obsidian), which appear from the illustration to be a mix of arrow-point preforms and dart point fragments. Points with unclear affiliations include 14 described as leaf, Willow leaf and diamond shaped (2 obsidian) and 22 "Houx contracting-stem" points (half obsidian), which appear, from a poor copy of the 15 illustrated, to perhaps be a mixture of Excelsiors, Mendocino Corner-notched and Mendocino Contracting-stem points.

Debitage was weighed but not counted, and has since been lost (Stewart 1993:136). For the total excavation, 62.9 kg chert and 6.52 kg obsidian was recovered (9.4% obsidian by weight). By weight,debitage was 1.6 percent obsidian below 100 cm, 9 to 11 percent above 60 cm, and 6 to 8 percent in the intervening levels, indicating some increase in obsidian usage through time. Debitage from five levels that had passed through 1/4 inch mesh but was caught in 1/8 inch mesh suggest that obsidian comprised a larger percentage of small flakes. In that sample, obsidian flakes increased as a

percentage of all flakes slightly through time: 23 percent by weight in the 80-90 cm level to 29 percent in the 0-10 cm level.

In summary, MEN-584 was a major Masut Pomo habitation site, known ethnographically as *matu'ku* (Soule 1975:12). The large number of arrow tips, hafted drills, clamshell and glass beads and pestles support this affiliation. Soule (1975:74) saw a significant increase in the use of obsidian during the late period, primarily in the form of obsidian artifacts, not waste flakes. He attributed more than 50 percent of the deposit to the Clear Lake Complex, with a much larger area of the site in use at that time. The small number of historic artifacts, however, suggest occupation ended shortly after white contact (Soule 1975:75). The site also appears to have been a Mendocino Pattern (Skaggs) site. The dominance of stemmed versus concave base forms suggests its primary use was late in that period. Use of the site by Dry Creek/Houx Aspect peoples is problematic.

MEN-1608 Caballo Blanco

MEN-1608, Caballo Blanco, is located on Robinson Creek about 8 km southwest of Ukiah. In a vineyard, Gary and McLearn-Gary (1990:19) uncovered a cache of 16 Konocti bifaces which they judged to be at an early stage of reduction. Hydration measurements on 13 ranged from 4.0 to 3.3 μ , with an average of 3.6 μ (S.D. = 0.21 μ , calculated from Table 1 p. 23). Gary and McLearn-Gary (1990:26) interpret the cache as a single event at the start of the Dry Creek Phase, marking "the arrival of the ancestral Pomoan people west of the Russian River Valley."

Albion Head Sites

Layton (1990:13) excavated approximately 200 m³ at three sites on the coast at Albion Head between 1980 and 1984. He discerned seven components. The first three he considers pre-Pomo: (1) 12 Mendocino Concave-base projectile points (58% Monterey Chert) suggest site use by peoples with a homeland near Point Arena. (2) 19 Mendocino Side-notched points, all of Franciscan chert and all at MEN-1704, suggest use by peoples with an interior homeland (possibly the MEN-1929 area where 39 such points were found), and (3) characterized by 5 chert bipoints, a large number of beach cobbles, 11 manos and a mortar, but little obsidian or Monterey chert, again probably reflects use by peoples with an interior homeland. Radiocarbon dates in components 1 and 3 suggest this period ranged from at least 5450 B.P. to about 2200 B.P.

Component 4 is marked by the advent of obsidian: leaf-shaped bipoints, biface fragments, and a large number of small obsidian flakes. Twenty-four bipoints were found: 16 Konocti, 4 Borax Lake, 3 Franciscan, and 1 Monterey chert (83% obsidian, Konocti 80% of the obsidian). Of the small amount of debitage where this component was most easily isolated, 77 percent is obsidian. But, unlike the bipoints, 73.7 percent of the glass debitage is Borax Lake, 24.6 percent Konocti, and 1.8 percent other (mostly Napa). Layton dates this component to 2.5 to 1.5 μ (K). The absence of Monterey chert suggests an interior homeland. The high percentage of obsidian suggests the entry of the Pomo, who had ready access to obsidian at Clear Lake. Layton assigns the beginning of this period to 1500 B.P. White and Fredrickson (1992:100) suggest, however, that the

beginning date, based on similar obsidian hydration readings associated with radiocarbon dates at MacKerricher, in a similar temperature environment, is earlier—perhaps 1900 B.P.

In the following three components Layton (1990:54-55) sees use of Albion Head by three different groups. Component 5 is characterized by 12 Franciscan chert Willits series points but little to no obsidian, a living surface radiocarbon dated 1080 ± 70 B.P., with deer and elk bones but few marine mammal remains, and beach cobbles associated with shellfish roasting. Layton associates this component with reoccupation of the area by inland peoples, probably Yukian.

Component 6, dated by Layton (1990:61) to AD 1200-1600, includes 65 Rattlesnake series points (52 chert: 27 [41.5%] Franciscan, 25 [38.5%] Monterey and 13 [20.0%] obsidian [8 B, 4 K, 1 N]). Obsidian in this component, as evidenced at MEN-1809, comprises 59 percent of debitage (60% B, 37% K, 1.5% N). Of the chert debitage, 76 percent is Monterey. The hydration rim readings range from 1.5 to 1.0 μ . This component is more focused on marine than terrestrial mammals. Presence of clamshell disk beads and haftable chert drills suggests bead production. Abalone shell fragments displaying score lines suggest abalone pendants were made here as well. Considering both the obsidian and abundant Monterey chert, Layton identifies these visitors as Coast Central Pomo.

Component 7 is characterized by 28 Franciscan chert Gunther series arrow tips, a faunal assemblage emphasizing deer and elk rather than sea mammal; use of shellfish, but little obsidian, no shell ornaments or beads and no historic artifacts. A Zone 2

radiocarbon date of AD 1625±100 suggests a time span for this component of AD 1600 to 1800. The assemblage is consistent with use by either the Yuki or interior Northern Pomo. Because of the late date, Layton concludes the users were Northern Pomo.

The hydration data suggest that these last three (or four) components may not be separable into discrete time intervals. A possible alternate interpretation is that at different times of the year, or in different years, the Component 4 peoples from the interior used Albion Head at least sporadically from 1900 B.P. to as late as contact, and at the same time Component 5 (Yukian) peoples from the north also used the area, especially during the floruit of Willits series points—and possibly continuing after the switch to Gunther series arrow tips.

The hiatus in Monterey chert artifacts between Component 1 (Mendocino Concave-base) and Component 6 (Rattlesnake series) suggests that visits to Albion Head by people with access to Monterey chert were interrupted after the floruit of Mendocino Concave-base points, and did not resume until arrow tips were introduced. Layton (1990:61) dates the beginning of Component 6, which includes the Rattlesnake series points, to AD 1200. The Monterey chert Rattlesnake specimens may date somewhat later if Oswalt is correct and Central Pomo people did not move permanently to the coast until 500 or so years ago.

MEN-1929 The Carlson Site

This village site is located on an open stream terrace in a redwood and mixed hardwood forest environment, 4.8 km south-southeast of Navarro. MEN-1929 was

excavated in 1987 by a SJSU field school, directed by Thomas Layton, with subsequent work by SJSU in 1992. Richard Carlson, the property owner, has a sizable collection of projectile points and ground stone from the property. This site is the subject of a thesis (Hamilton n.d.). Three components are discernible. The Skaggs Phase is identified by eight Mendocino Concave-base, 39 Mendocino Side-notched and 21 Willits series and variant stemmed points. The 39 Mendocino Side-notched points are the largest known collection from a single site in the North Coast Ranges. The 4.2 μ hydration measurement on the single obsidian specimen, of Konocti glass, supports Skaggs Phase use of Mendocino Side-notched points.

The Dry Creek Phase is documented by 87 Leaf-shaped Points (27 chert [30.2%], 50 obsidian [43 K, 17 B]). Hydration readings on these points range from 4.9 to 1.0 μ , with sustained usage between 2.6 and 2.1 μ . The large number of specimens with hydration measurements below 2.0 μ suggests the latter may have been used as knives during the Smith Phase.

The Smith Phase is represented by 158 Rattlesnake series points (129 chert [82%], 29 obsidian [11 K, 15 B, 2 N, 1 A]) and 46 chert unnotched triangular specimens. The large number of specimens documents intense occupation, but the much smaller proportion of glass points documents a change in obsidian accessibility and a shift from Konocti to Borax Lake predominance (also seen at Albion Head). Hydration readings on these points peak at 1.2 μ (K) with a cluster between 2.2 and 1.8 μ . Five earlier readings go back to 3.5 μ .

Debitage from MEN-1929 is comprised of 61 percent chert (virtually all Franciscan) and 39 percent obsidian (85% K, 12% B, 3.4% N). The total number of obsidian and chertdebitage flakes increases from the basal level through the 10-20 cm level, suggesting increasing intensity of use. However, obsidian, as a percentage of the totaldebitage, increases from 24.5 percent in the basal level to 47.5 percent in the 30-40 cm level, and then declines as a proportion, perhaps paralleling the shift to chert seen in the Rattlesnake series points.

MEN-1802 (Meagan Site) and MEN-2220 (Kindra Site)

The Meagan site, 1.5 miles (2.4 km) north of the Sonoma border, and the Kindra site 6 miles (10 km) further north, are close to the Russian River and just north of Cloverdale. They are the only sites which have been excavated along the Russian River in ethnographic Central Pomo territory. Both were excavated by Caltrans as a prelude to widening Highway 101 (Rondeau 1985, 1990). Both show high obsidian-to-chertdebitage ratios (approximately 75% obsidian). Although the obsidian was not all sourced, it was judged to be 99 percent Konocti (Rondeau 1985:47, 1990:26).

At MEN-1802, 56 projectile points, 17 typeable, were recovered. These include three Mendocino Concave-base, one Mendocino Corner-notched, three possible Excelsiors, six Rattlesnake series and some lanceolates. A large number of handstones, five whole and 37 fragments, were recovered. Two were shaped, the rest unmodified cobbles. Rondeau (1985:51) used magnification and careful lighting to detect usage on 85 percent of these artifacts.

Although the site produced 16,431 obsidian flakes, “99 percent Konocti,” only 11 Konocti flakes were submitted for hydration analysis, far too few to provide much help in dating the use of obsidian at the site. Hydration readings ranged between 4.3 μ and 3.0 μ (mean = 3.5) with five of the flakes clustered between 3.6 and 3.3 μ . Seven Konocti “biface fragments” were also measured, with a range of 5.7 to 2.6 μ , mean = 3.8 μ , median = 3.5 μ .

Rondeau (1985:61) initially concluded, based on Warm Springs hydration chronology, that the main use of the site was during the Dry Creek Phase, with lesser use during Skaggs and Smith. He later (1990:12) questioned the Dry Creek association because of the high proportion of handstones recovered, an artifact type not usually associated with the Dry Creek Phase (Houx Aspect). He offered three possible explanations for this anomaly: (1) use of microscopic inspection detected handstones in Dry Creek components that conventional macroscopic analysis would have missed, (2) Dry Creek Phase peoples expressed a different adaptive posture in this locality, or (3) the site was used by a different cultural group during this time period: either Willits (*sensu* Hildebrandt and Hayes) or Mendocino Pattern.

MEN-2220 produced a small assemblage of projectile points (three Rattlesnake, three possible Excelsiors, and a possible McKee uniface tip), 14 unifaces, three hafted drills, cores, edge modified flakes and five mano fragments. Hydration measurements on 108 Konocti flakes range from below 6.0 μ to 1.0 μ , with a distinct peak between 2.9 and 2.5 μ (Rondeau 1990:85, Figure 15). Hydration results suggest some early use of the site, with persistent use after 4 μ (K). Rondeau (1990:50) assigns primary site usage to the Dry

Creek Phase, with a small overlay of Smith Phase use, and concludes that the site was used only seasonally.

MEN-789 Havens Neck

This site is near the coast in southern Mendocino County, about 7 km northwest of Gualala and just east of the Havens Neck promontory. It is 15 km west-southwest of MEN-2136. When this site was recorded, the midden extended on the top and southeast side of a sea stack remnant on the lowermost terrace (Thompson 1985). The owner, believing the presence of an archaeological site would prevent building on his property, bulldozed the midden from the top of the knoll. In 1988, a SJSU field class, under the direction of Thomas Layton, attempted to salvage some information from the site. Over 300 five gallon buckets (about 3 m³) of bulldozed midden were screened through 1/4" (6 mm) mesh, and four 1.5 by 1.5 m units were excavated to 40 cm in an undisturbed area on the south side of the knoll.

The 3 m³ of disturbed deposit screened from the knoll yielded 100 flakes (83% M, 13% F, 4% K obsidian), two biface fragments and a drill, all of Monterey chert, several pitted cobbles, end-battered cobbles, a pestle, a clam shell disk bead, a biconically drilled sea mammal canine tooth, and a few intrusive historical artifacts.

The four units excavated (3.6 m³) yielded 353 debitage flakes: 63 percent chert (98% M) and 37 percent obsidian (81.7% K, 13.7% B, 4.6% N). Obsidian comprised 37 percent of the 30-40 cm level, 55 percent of the 20-30 cm, 33 percent of 10-20, and 23

percent of the 0-10 cm level, possibly suggesting reduced obsidian availability later in time. No hydration measurements are available.

Artifacts from the site, from both the disturbed midden and the excavated units, include three projectile points (one arrow tip fragment (M), two obsidian Leaf-shaped points [K]), four chert biface fragments (3M, 1F), four drills (2M, 1F, 1K), three flake tools (2M, 1K), a reamer and a core (M), 12 bipitted cobbles, two clamshell disk beads, and three whole *Olivella* shells. The high percentage of Monterey chert (69% of the chipped stone artifacts and 62% of the excavated debitage) reflects the availability of this toolstone 8.5 km north at Schooner Gulch.

An analysis of the shell recovered from two levels of the test pit shows that mussel, *Katherina tunicata* and *Tegula* sp. were the primary shellfish species exploited. The bipitted cobbles and sea mammal tooth support a focus on coastal resources. The two small drills in association with the clamshell disk beads and *Olivella* shells at least suggest some bead manufacturing may have occurred on site.

Barrett (1908:167) asserts that there were no regularly used coastal sites between Fish Rock (1.5 km to the south) and Point Arena. The rich midden soil of this site, however, suggests it was once a seasonal camp. Without hydration measurements, it is difficult to date the deposit. The arrow tip and clamshell disk beads suggest use during the Smith Phase. The Leaf-shaped points might indicate Dry Creek Phase usage as well.

SON-571 (Poolside) and SON-572 (Banded Rock Pool)

The Warm Springs project, in work extending from 1974 through 1981, located, tested, and to some extent excavated, 61 sites to be impacted by Lake Sonoma. These sites are located on Dry and Warm Springs creeks and their tributaries (Map 1). SON-571 and SON-572 are located about 27 km ESE of MEN-2136, about 400 m apart on upper Dry Creek, at about 145 m elevation, in an oak-grassland environment. Although both sites show use in all three phases of the Warm Springs sequence, SON-572 is the most significant Skaggs Phase site located during the project, while SON-571 is the major Dry Creek site in the Dry Creek drainage.

From the 45 m³ excavated at SON-572, 133 typeable projectile points were recovered: 59 Skaggs Phase (42 Mendocino Concave-base, [including 12 Mendocino Side-notched variants], 11 Willits series and 6 stemmed), 34 Dry Creek (20 Excelsior and 14 Leaf) and 40 Smith (all Rattlesnake series), although not all were found in the “proper” context (Basgall and Bouey 1991 II:201-230, Bouey 1983). The 42 Mendocino Concave-base points represent 55 percent of all such points found during the project (the 12 Mendocino Side-notched variants represent 75 percent of that subtype), emphasizing the importance of SON-572 during the floruit of the Mendocino Concave-base point styles. Conversely, the 11 Willits series points found represent only 17 percent of such points recovered from Warm Springs, suggesting either relatively less use of the area or more widespread use of the project area during Willits series dominance.

It is impossible to determine, from the 1991 project report, the obsidian/chert ratios by point style, and Bouey's (1983) site report uses a somewhat different typology and was written before all points had been analyzed. Of the 106 points Bouey describes (80% of the ultimate total), 27 (79%) of 34 Rattlesnake series points are obsidian, as are 15 (79%) of 19 Excelsiors and one (25%) of four Leaf-shaped points. Only five (18%) of the 28 Mendocino Concave-base specimens (excluding the side-notched variants) and three (19%) of 16 side-notched points are obsidian, supporting much lower obsidian usage in the earliest phase. (Bouey's [1983] side-notched forms were later reclassified into the Willits series and the Mendocino Side-notched variant of the Mendocino Concave-base series. It is not reported where the obsidian points fall in the reclassification.) Sourcing of obsidian projectile points was similar in Smith and Dry Creek: 68 percent and 70 percent Konocti, 26 percent and 25 percent Napa, and 6 percent and 5 percent Borax Lake, respectively, supporting similar source access in the two phases. Half of the small number of Skaggs Phase obsidian points were Konocti glass, half Napa.

Debitage obsidian-chert ratios parallel the point results, with a higher percentage in the later phases. Debitage recovered from 6 mm screens was 16.5 percent obsidian, by count, in Skaggs, 54.4 percent in Dry Creek, and 56.1 percent in Smith (Basgall and Bouey 1991 II:214). Source determination on 130 to 140 flakes per phase showed Konocti as the dominant source, with Napa contributing 6 to 13 percent and other sources virtually absent (Bouey 1986:237). However, the analyzed sample is very small.

The researchers conclude the site was used during middle and late Skaggs, early and middle Dry Creek, and early Smith, up to about 300 B.P. Artifact density per cubic meter is similar in all three phases, but indexing to adjust for the different phase durations suggests the most intensive usage was during Smith:

Phase	Debitage		artifacts/ m ³	artifacts/m ³ / 100 yrs	Duration (yrs)
	% obs.	% K			
Smith	56.1	92	19.7	6.6	300
Dry Creek	54.4	95	22.1	1.9	1200
Skaggs	16.5	86	18.5	1.2	1500

All three phases document broad-based and balanced activities, including both faunal and vegetable processing. Handstones and millingslabs were recovered in all three phases, while mortars and pestles were confined to the Dry Creek and Smith deposits. Lithic production emphasized chert during Skaggs, obsidian biface reworking during Dry Creek, and finished bifaces and bipolar obsidian cores during Smith.

At SON-571 (Basgall and Bouey 1991:II:231-266; Basgall 1983), major site occupation occurred during the Dry Creek Phase, primarily after 2000 B.P. Cultural remains recovered from the main terrace (34.7 m³ excavated) are predominantly Dry Creek forms, with limited Skaggs use in the basal levels and an ephemeral overlay of Smith (perhaps wash from the upper terrace); the upper terrace was predominantly Smith (4.6 m³ excavated). The 98 points recovered from the main terrace included eight Rattlesnake series, 53 Excelsior, 34 Leaf, two Willits series and a Mendocino Concave-base—predominantly Dry Creek forms. A wide range of vegetal processing equipment, primarily bowl mortars (13) and pestles (22), but including handstones (11) and a milling

slab, suggest a range of vegetal processing activities in this phase. There are a large number of finished bifaces and reworked biface fragments (most obsidian) and some sociotechnic artifacts. Artifact density is 53.6 per m³, equivalent to 4.1/m³/100 years based on a 1300 year occupancy (about twice the intensity of SON-572).

SON-571 appears to have been the locus of an obsidian biface manufacturing and reworking industry. On the main terrace, 627 finished bifaces (92% obsidian), 517 reworked bifaces (99% obsidian) and 39 preforms (51% obsidian) were recovered. The preponderance of obsidian bifaces in all stages of manufacture led the researchers to conclude that SON-571 was a key obsidian workshop starting in the Dry Creek Phase (Basgall and Bouey 1991:250). This focus could be a signature for specialists who controlled obsidian access in the region.

The Skaggs deposits (4.3 m³) are not well dated, and appear mixed with the Dry Creek component. Of the 13 projectile points recovered from Skaggs levels, only two Willits series and one Mendocino Concave-base are clearly Skaggs forms. Three leaf-shaped and seven Excelsiors were also recovered from the Skaggs levels, along with a milling slab, two handstones and a (probably intrusive) pestle.

The Smith Phase was almost absent on the main terrace, but was the primary occupation on the upper terrace, where 21 Rattlesnake series, seven Excelsiors, four leaf and one Willits series point were found.

	Debitage		artifacts/m ³	artifacts/m ³ / 100 yr	Duration yr
	% obs.*	% K			
Smith	88	93	31.0	6.1	500
Dry Creek	92	85	53.6	4.1	1300
Skaggs	77	83	19.4	<1.9	±1000

* includesdebitage recovered from both 3 mm and 6 mm screens

Fifty-five unifaces (scrapers) were recovered, nine from Smith contexts, 42 (28 obsidian and 14 chert) during Dry Creek, and four in Skaggs (2 obsidian, 2 chert).

The Dry Creek component on the main terrace contains the largest and most diverse assemblage present at the site. Six ground stone classes—with mortar/pestle most abundant, attest to varied vegetal processing as well as a hunting focus. Hammers and abraders appear to relate to biface manufacture, and beads, pendants and a steatite pipe suggest a more complex society. Entire family units are probably represented, with occupation between 2000 and 700 B.P.

The Skaggs Phase also included a broad range of tool classes, including milling slab/handstones, but not mortars and pestles. These suggest some vegetal processing, but hunting was probably the major focus. There were only a small number of reworked bifaces, and the smaller number of hammers and abraders appear to indicate that flake-stone tool production was more limited than during Dry Creek. Obsidian comprised a much lower percentage of the tools anddebitage. The duration of the Skaggs Phase could not be determined; it may have been used during the entire 2500 years span or only a small portion of it.

The Smith Phase usage was moderate, probably extending across the length of the phase, but also probably sporadic and episodic.

SON-1471 Rockpile Road

This site is situated at about 550 m on a saddle on Rockpile Ridge, about 9 km southwest of Cloverdale, in an area of mixed conifer-hardwood forest. It is slightly south and west of the Warm Springs project area and about 300 m higher than the tested Warm Springs sites. A total of 22.3 m³ was excavated in 1986 and 1987, during the test and recovery phases of the project (Stewart 1989).

Stewart (1989) divides the site into two temporal components (early and late) plus a mixed component, employing the obsidian hydration phase boundaries determined at Warm Springs. The small number of temporally diagnostic projectile points prevented extensive cross-dating. Four Rattlesnake series arrow tips are assigned to the late component. Stewart identifies one Willits side-notched and one Mendocino Concave-base basal fragment, both of chert, and one Mendocino-Side-notched point fragment (Borax Lake, hydration rim = 3.0 μ) from the early (Mendocino Pattern) component. However, the latter, based on the illustration (Stewart 1989:37 Figure 2e; 61 Plate 3x) is most likely not a Mendocino Side-notch.⁸ Four chert lanceolates and the small and large bifaces are not easily assignable.

In the recovery stage, obsidian comprises 80 percent by count (57% by weight) of the 9,444 flakes recovered. The obsidian ratio increases with depth: 0-10 cm levels range from 52 percent to 83 percent obsidian (mean 72%), while the 90-100 cm levels range

from 77 percent to 93 percent obsidian (mean 88%). For the three sourced units (2,565 flakes), Konocti comprises 93.3 percent, Napa 4.5 percent, Annadel 1.8 percent, and Borax Lake 0.4 percent. Of the 37 tools with useable hydration measurements, 62.2 percent are Konocti, 24.3 percent Napa, 8.1 percent Annadel, and 5.4 percent Borax Lake.

A single radiocarbon date of 1040 ± 70 (AD 950 corrected), was obtained from a hearth or oven. Hydration measurements on 10 associated Konocti flakes ranged from 4.5 to 1.6 μ , mean = 3.21, S.D. = 1.09, not exactly a tight cluster.

Stewart (1989:116) defines components based on hydration readings and stratigraphic positioning. Her early component, influenced by the 3.3 μ Konocti break between Skaggs and Dry Creek at Warm Springs, is defined as the range between 4.7 and 3.3 μ (K). In this component obsidian averages 84 percent of the debitage, points are half obsidian and half chert (Mendocino Side-notched [sic], leaf-shaped and diamond lanceolate), reworked bifaces are common, and milling slabs, bowl mortars and a pestle were recovered.

In the late component, defined as 2.3 to 0.9 μ (K), obsidian comprises 73 percent of the debitage; Rattlesnake Corner-notched, small reworked corner-notched, Willits side-notched and shouldered lanceolate points are present. A higher percentage of the points are made of chert than in the early phase, but the Rattlesnakes are obsidian. A bowl mortar and ground stone fragments comprise the milling equipment. Activities at the site were considered varied in both periods, with some use of the site by whole family groups, given the presence of milling equipment.

The mixed levels include concave-base and leaf-shaped points, mostly of chert, one pestle and some ground stone fragments. These levels, obsidian dated between 3.2 and 2.4 μ , are not considered to form a distinct component, and little use of the area is seen during the Dry Creek Phase.

The problem with this analysis is the use of obsidian dating and the Warm Springs phase break points to define phases, with no supporting artifact assemblages. Reanalysis of the available hydration readings could support a somewhat different conclusion, although the obsidian usage peak usually visible around 2.5 μ is missing (Chart 40), suggesting either reduced use of the area during the Dry Creek Phase, or a sampling problem:

	K	N
Sample	153	20
<2.4 μ	52.3%	30.0%
2.4 - 4.0 μ	28.8	35.0
>4.0	19.0	35.0

Some of the recovered artifacts do suggest Dry Creek lifeways: Mortars and pestles and the reworked biface industry are usually attributed to Dry Creek contexts, but are sparse in Skaggs Phase settings. The absence of any Skaggs point styles manufactured from obsidian challenges Stewart's association of the obsidian with the Skaggs population. Even the putative Mendocino Side-notch is made from Borax Lake obsidian, a source barely represented in the abundant obsidian debitage. Nevertheless, unless there were severe sampling problems, the unusual obsidian hydration profile does demonstrate use of obsidian before 4.0 μ .

Summary

The archaeological results summarized here provide a framework for analysis at MEN-2136. Skaggs Phase assemblages are generally dominated by chert tools and debitage. Time-sensitive projectile points include Mendocino Concave-base and Mendocino Side-notched forms, thick leaf-shaped, and Willits series points. They are associated with handstones and millingslabs.

Dry Creek Phase assemblages include a higher proportion of obsidian in the tools and debitage—in most sites obsidian dominates. Diagnostic points include Excelsiors and “thin” lanceolate points. An obsidian biface reworking industry is evident at a few sites. Milling equipment includes both mortar and pestle and millingslabs and handstones, although the former generally predominate. Wealth items such as shell beads and pendants appear at some sites.

Smith Phase assemblages are generally characterized by a somewhat smaller proportion of obsidian tools and debitage than is seen in the Dry Creek Phase. Time-sensitive artifacts include both Rattlesnake and Gunther series projectile points. Milling equipment is predominantly hopper mortars and pestles, but bowl mortars and handstones and millingslabs also occur.

CHAPTER FIVE

METHODS

FIELD RECOVERY

Site Recording

CDF Forester Jim Purcell was the first to recognize the importance of the site, from looking at George Zeni's artifact collection. Purcell brought CDF Archaeologist Dan Foster to the ranch, and they, together with Mark Gary and Deborah McLear, recorded the site on August 21, 1987 (Foster et al. 1987).

Test Excavation and Surface Collection

The initial SJSU investigation occurred on January 13, 1988, with a surface collection of obsidian artifacts and debitage and a tabulation of the owner's collection. To provide a test for site chronology, the surface-collected obsidian was sourced and 25 specimens submitted for obsidian hydration measurement. On February 6, 1988, a single 1.5 by 1.5 m test pit (Test Pit 1), 50 cm outside the corral fence, was excavated in 10 cm arbitrary levels by shovel into five gallon buckets (Map 7). The buckets were screened through 1/4" (6 mm) mesh. All artifacts, debitage, and bone were bagged by level and saved. The high water table at that time of year stopped the excavation in the 30-40 cm level because the excavated dirt would no longer go through the screen. That day, artifacts and debitage were also collected from the surface of the corral and Field 6 (Map 8).

Map 7. CA-MEN-2136 Archaeological Site Map

Map 8. Zeni Ranch Map

Mapping

Layton (1988) established the site datum 1 m west of the picket fence (Map 7). The excavation grid origin was established 20.75 m due south, and ten 1.5 by 1.5 m units were defined using a transit. Unit 21S24E was laid out within the corral, 30 m south and 34.5 m east of the grid origin. The initial archaeological site map was drawn at the end of the 1988 field excavations (Layton 1988). Nelson Thompson determined the site contours in August, 1994, and drew the final archaeological site maps, using Layton's original map, additional data determined by Wilson in March, 1983, and a USGS aerial photograph.

Excavation Methods

The area of highest artifact density identified in the January, 1988 surface survey was in the corral (Corral 1N, Map 7). However, to minimize disruption to Zeni Ranch operations, the 1988 SJSU excavations were mainly conducted outside the corral fence. Nine 1.5 by 1.5 m units were marked on a north-south axis, one meter west of the corral fence. In addition, to sample inside the corral, one unit (21S24E) was laid out within the corral, at a point which still showed significant surface debitage, but was as far as possible from the main trench.

The site was excavated between June 5 and June 11 by the SJSU 1988 field class of nine students and three volunteers, under the direction of Dr. Thomas Layton. Two students/volunteers were assigned to each unit. Excavation, in 10 cm arbitrary levels, was by shovel and trowel to bucket and bucket to screen, using 1/4" (6 mm) mesh.

A block of 10 reference numbers was assigned to each unit, one used per 10 cm level. Excavation continued until sterile soil was reached: between 60 and 70 cm in the units outside the corral. (Due primarily to extensive rodent burrowing, but also to disturbance from tree roots and excavation for the fence posts located along the east wall of several units, the basal level in some units contained substantial amounts of debitage in otherwise sterile soil). All chipped and ground stone artifacts, chipping debris and bone were pulled from the screen and saved. Midway through the excavation, acorn shells were recognized and collected as well. Fire-cracked rock greater than 8 cm in maximum dimension was counted in several control units, but not saved.

The single feature identified during the 1988 field class, a hearth or small oven in unit 1S1W, was left pedestaled until excavation of that unit was complete. At that time the rocks above and on one side were removed, and the hearth contents were collected by trowel into plastic bags and saved (Figures 9 and 12).

Between August 27 and 29, 1993, a small crew of volunteers from SJSU excavated one additional unit (11S1W) in 10 cm arbitrary levels. Due to time constraints, at 60 cm the unit was cut in half, and only the north half was excavated in the bottom two levels.

Fifteen liters of deposit excavated from each full level and 7.5 liters from each half-level of 11S1W were floated and water screened. Flotation involved pouring approximately 7.5 liters at a time from bucket to tub, half filling the tub with water, and stirring to allow light substances to float. The float was scooped with a 2 mm strainer onto paper and dried. The dried float was bagged, labeled and returned to the lab. The

float was later submitted to Charles Miksicek at BioSystems Analysis for macrobotanical analysis.

After the float was removed, the contents of the tub were poured into a 1/8" (3 mm) mesh screen and washed with a garden hose. Obvious artifacts, debitage and bone were extracted from the screen in the field, but the tailings were dried, bagged, and returned to the lab for 100 percent recovery of these materials.

THE EXCAVATIONS

Nine 1.5 by 1.5 m units were excavated from a 1.5 by 16.5 m grid located 1 m west of the corral fence, near what appeared to be the most intensively used area of the site (Map 7). Eight of the units were excavated in 1988, the ninth in 1993. In addition, unit 21S24E, located 44 m to the southeast, was excavated within the corral.

All excavation was by trowel or shovel to bucket, in 10 cm arbitrary levels. Unit 21S24E reached sterile soil at 60 cm; the 1W units reached sterile between 60 and 70 cm; units 8S1W and 11S1W were continued to 80 cm.

No cultural stratigraphy was detected in the field. The deposits had been mixed by rodent burrowing, exacerbated by large tree roots beginning 30 to 40 cm below the surface in all but units 1S1W through 3S1W, and fence posts visible in the east sidewalls of units 1S1W through 3S1W (extending down to 60 cm) and appearing further west in units 4S1W, 7S1W, 9S1W, and 11S1W (Figures 7 and 8). (The feature forms for units 5S1W and 8S1W have been lost; fence posts may have intruded into those units as well.) Part of a burned-out redwood stump was discovered in the southwest corner of unit

11S1W, and the stratigraphy in the eastern side wall suggested that the Zenis had exposed the stump to burn it out, severely disturbing the integrity of the unit.

The soil profile exhibits four zones (Figure 12): (1) a shallow root zone of dark brown, very friable soil (Munsel 5YR 2.5/2) about 5 cm deep, underlain by (2) a gray-brown midden zone (5YR 4/2) 15 to 30 cm deep. (3) A similar horizon, somewhat more red-brown in tint (7.5 YR 4/4) and harder packed extends to 50 to 70 cm below the surface. The basal, sterile layer is a reddish-yellow clay (7.5YR 5.5/6), hardpan in consistency. The deposit becomes increasingly moist with depth. Abundant angular rock fragments in the upper levels decrease significantly with depth. Rodent holes riddled the units, and were visible in the sidewalls down to 80 cm.

Only two features were recognized. One, a hearth or oven, began at 31 cm below datum in unit 1S1W. The other, the remnants of a burned out redwood stump filled with cobbles, was visible in the 10 to 20 cm level in unit 11S1W. Both are described in detail in Chapter Six.

FIELD SIX

Most of the artifacts described in this paper were excavated or surface collected from the MEN-2136 midden, located in and around the corral (Map 7). A second, still unrecorded, site exists in Field 6, about 140 m north-northwest of the corral (Map 8). Part of the Christmas tree farm in 1988, it has recently been plowed and planted with grapes. The Zenis recovered several Mendocino Concave-base points during the plowing, and have found additional specimens more recently. A surface survey of Field 6 by the author

in 1995 revealed numerous Franciscan and Monterey chert flakes but no obsidian (not collected). Five artifacts surface collected from the field in 1988 by SJSU are included in the MEN-2136 collection: one Mendocino Concave-base and one Leaf-shaped point, a projectile point midsection, a biface tip, and a scraper, all made from Franciscan chert (Reference numbers 35-). One hundred seven “flakes” were also collected during the 1988 survey: 72 Franciscan chert, 25 Monterey chert, and 10 pieces of obsidian (5 Konocti, 4 Borax Lake, 1 Napa). A recent re-analysis of the debitage revealed 14 additional artifacts among the flakes: most modified and utilized flakes, but also a biface, a scraper, a backed knife and an exhausted core. These have been cataloged, but are not otherwise described in this thesis. Field 6 differs from the corral in the predominance of chert artifacts and chipping debris, whereas the corral is dominated by obsidian. The high frequency of Mendocino Concave-base style points suggests that occupancy of this area corresponds to the earliest occupancy of MEN-2136.

CORRAL SURFACE COLLECTIONS

The 1988 surface collections covered most of the corral under a single reference number. In 1993, to better understand any differential use of the site, the corral was subdivided into smaller collection units. Three of these (Corral 1N, Corral 2N, and Corral 2S) were surveyed on August 28 and 29, 1993. All artifacts, debitage, and bone were collected, bagged by collection unit, and returned to the lab. In the Corral 2S collection we recovered five Rattlesnake series arrow tips eroding from a small knoll. As late period artifacts were scarce in the SJSU excavations, the 1993 surface collection results

suggested the possibility of horizontal stratigraphy. To explore that possibility, Corral 2S was divided in half (Corral 2SE and Corral 2SW), and each section separately surveyed on August 3, 1994. Again all artifacts and debitage were collected, bagged, and returned to the lab. Unfortunately, others were aware of the Rattlesnake points recovered in that area in 1993, which may explain why no additional arrow tips were recovered in 1994.

LAB METHODS

During the 1988 field school, recovered artifacts were washed and cataloged at the expedition laboratory near Point Arena. Debitage was sorted into Monterey chert, Franciscan chert, quartz, and obsidian, then counted, and weighed. After the field season, all obsidian artifacts and the debitage from units 1S1W, 3S1W, 5S1W, 7S1W, 9S1W, and 21S24E were visually sourced by Thomas Origer of the Sonoma State Anthropological Studies Center, then counted and weighed by SJSU students.

Artifacts and debitage excavated and collected in the 1993/4 expeditions were washed and separated into Monterey and Franciscan chert and obsidian by the author with the help of student volunteers. Artifacts were cataloged, the chert and obsidian debitage counted and weighed, and the obsidian sourced by Origer. The tailings from the 1993 water screening were rewashed with soap and re-sorted by Leon E. Pappanastos, DMD, using a lighted magnifying glass. The debitage he recovered was approximately equal in amount to that recovered directly from the water screens in the field.

Artifact Measurements

All artifacts were measured and weighed by the author. Metrical attributes of the projectile points were measured according to Thomas's (1981:7) approach. Dial calipers calibrated to 0.1 mm were used for all measurements.

1. Maximum Length (mL) on complete artifacts measures the total length of the artifact (by aligning the vertical axis perpendicular to the caliper arms).
2. Maximum Width (mW) was measured by aligning the specimen parallel to the arms.
3. Neck Width (nW) was measured at the narrowest point on the neck.
4. Basal Width (bW) was measured by placing the arms (3.7 mm wide) of the calipers as close to the base of the artifact as possible. This measurement is not equivalent to the maximum haft width described by Thomas (1981:13).
5. Maximum Thickness (Th) was measured by placing the arms perpendicular to the width of the artifact and searching for the maximum point. On curved artifacts, this results in a different measurement than when the entire artifact is placed between the arms.
6. Distal Shoulder Angle (DSA) and Proximal Shoulder Angle (PSA) were measured using polar graph paper. Where both could be measured on the same side of the artifact, the angle was also measured directly by aligning the proximal leg vertically on the graph paper and measuring the angle to the distal leg. When the measured angle did not agree with the difference between the DSA and PSA initially measured, all three angles were remeasured until they cross-checked. This technician believes

her measurements are valid only to 10°. DSA and PSA, where possible, were measured on both sides of the artifact and the results reported in the artifact attribute tables in Appendix B. Despite Thomas's (1981:11) recommendation that the smallest DSA and PSA be used in calculating mean measurements, this paper utilizes DSA and PSA measurements from the same side of the artifact. When measurements for both sides were available, the side with the most acute PSA was used for the calculations shown in the summary attribute tables.

7. Notch angle (NOA) was calculated only when DSA and PSA were measurable on the same side (and was also measured directly).
 8. Edge angles on scrapers were measured with a Ward's contact goniometer. The edge angle used here is at the working edge of the tool, and reflects any damage from use. The original spine plane angle, produced in tool shaping, was not measured because the curvature of the basal surface precluded use of the goniometer, thus requiring some different measurement approach.
 9. Weights were measured with an Ohaus triple balance beam scale graduated to 0.1 g. Some artifacts were weighed after they had been cut for obsidian hydration analysis. These measurements are indicated in the attribute tables with an H. Either 0.1 or 0.2 g, depending on the artifact's thickness and material, was added to the measured weight to account for the cut.
 10. Maximum width position (mWp) was measured by tracing the artifact, determining the point of mW, measuring, on the tracing, the distance to the base with calipers, then dividing by mL.
-

11. Measurement of the basal indent (Bind) follows Basgall and Bouey (1991) and measures the depth of the concavity on concave-base points. Thomas's (1981:11) Basal Indentation Ratio can be calculated: $BIR = (mL - Bind) / mL$.
12. Bit Length (bL) was measured by determining, under 15-20 x magnification, the extent of the use-wear, then measuring from the tip the extent of the damage.
13. Bit Width (bitW) measures the cross-section of the drill bit at the distance from the tip determined by the bit length.
14. Percent of Perimeter (% Perim.) indicates the proportion of the circumference of the artifact which has been deliberately modified. The proportion was estimated and is accurate to about ± 10 percent.

Estimated measurements were calculated when the artifact was sufficiently complete to allow reasonable extrapolation of its complete size (generally only where mWp could be determined). Estimates were to the last resharpening event—no attempt was made to reconstruct the size of the “original” tool. Estimated lengths and widths were drawn and measurements made from the drawing. Weights were estimated by weighing a tip (of the same toolstone), which matched in size the missing portion of the artifact, together with the artifact remnant. In most cases only mL (and the associated weight) were estimated. Maximum width was estimated only when a fracture eliminated a small portion of one side of the artifact. Estimated measurements are indicated by an asterisk.

Ground stone artifacts too large for measuring with calipers were measured on an osteometric board calibrated in mm.

Obsidian Hydration

The obsidian hydration study is covered in Chapter Seven, Obsidian Hydration Analysis. Only slide preparation, measurement, and rate conversion techniques are described here.

Slides for measurements made in the San Jose State University Obsidian Hydration Laboratory were prepared by making two small parallel cuts along an edge of the artifact or flake with a diamond saw, and removing the center piece by snapping with a razor blade. The obsidian slice was mounted on a glass slide with melted Canadian Balsam. One side was ground with #600 grit by tracing figure eights. The resin was then remelted, the sample inverted, and the second side ground until the specimen measured 50 to 100 microns on a dial-indicating micrometer, or until light was visible through the specimen. The slide was washed, reheated slightly to clear the resin, and the specimen covered with a slide cover attached with Kleermount.

Hydration band measurements were made with an Olympus BHSF polarizing microscope using a 40-power lens and 12.5-power eye piece. Six measurements were taken along the edges of each specimen and the mean measurement calculated. All measurements used in this report were made by Glen Wilson, SJSU Obsidian Hydration Laboratory, or by Thomas Origer, Anthropological Studies Center, Sonoma State University.

Tremaine's (1989a:3) comparison constants were used to convert Borax Lake and Annadel hydration rim depths to the Konocti rate, allowing hydration measurements from

the different glass sources to be plotted on the same chart. This facilitates analysis of changes in obsidian source preference through time. However, using rim depths of one decimal point accuracy (as is usually reported) results in distorted graphs after conversion. For example, when converting Borax Lake to Konocti by multiplying by 0.79, a one micron range is compressed to 0.8 μ , and two Borax Lake rim measurements convert to a single Konocti data point:

B	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
K	1.6	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3

Note that both 2.1 and 2.2 μ (B) convert to 1.7 μ (K); conversely, 1.7 and 1.8 μ (K) convert to 2.1 and 2.3 μ (B), respectively, leaving 2.2 μ empty. This problem can be ameliorated by calculating the mean to two decimal places. Obviously the measurement is not accurate to that level (the measurement error is on the order of 0.2 μ), but this approach offers a replicable method of smoothing the curves. For the charts included in this thesis, Borax Lake and Annadel measurements were recalculated to two decimals whenever the data were available.

Most of the MEN-2136 charts reflect this process. However, only the means are available on 17 Borax Lake measurements made by Origer in 1989 from slides prepared at SJSU. Some of the MEN-1930 and MEN-1932 readings depicted here are also Origer's measurements, and only means are available.

Measuring the Site Catchment

A catchment area of approximately 5 km radius was defined around the Zeni site to determine the food resources which may have been available to its prehistoric visitors. Soil vegetation maps were used to derive the vegetation associations (Map 9). The results are described in Chapter Eight: Site Catchment Analysis. Here, only the technique used to calculate the area of the various vegetation associations is described.

Areas in the site catchment were measured using a Numonics Corporation electronic graphics calculator. Irregular areas were broken into sections to eliminate “necks” of land, which the calculator could not measure properly. Each area was initially measured twice; if the two measurements were within 3 percent of each other, the measurements were averaged. If the two initial measurements differed by more than 3 percent, a third measurement was taken. If two of the three measurements were within 3 percent of each other, the two closest results were averaged. In the few cases where no two of the three measurements were sufficiently close together (usually because of instrument mismeasurement of an irregularly shaped region), the area was either split and remeasured in sections, or several additional measurements were made and all measurements averaged.

CHAPTER SIX

CULTURAL REMAINS

ARTIFACT DESCRIPTIONS

This study includes the 1148 artifacts recovered by SJSU in 1988, 1993 and 1994 from surface collections and the excavation of eleven 1.5 by 1.5 meter units (a total of 16.4 m³) and 191 artifacts from the Zeni family's surface collection. The 1148 artifacts SJSU recovered at MEN-2136 include 283 typeable projectile points, 432 projectile point fragments, 253 other flaked stone tools, 27 ground stone tools, and 153 artifacts and fragments of Euroamerican manufacture. Of the total, 982 (85.5%) artifacts were excavated [829 Native American (50.5 per m³) and 145 Euroamerican (8.8 per m³)], while 166 Native American and eight Euroamerican artifacts were surface collected. All artifacts are discussed below.

Although the Zeni family collection is comprised of artifacts collected from all areas of their ranch, the vast majority were recovered from the locus of MEN-2136—the corral and the first few rows of the adjacent vineyard (Map 7). There are actually two separate collections: The George Zeni Collection, which is covered by this study, and the Jane and Raymond Zeni Collection, which is not. Most of George Zeni's collection was assembled in the last 20 years; earlier, artifacts were recognized, sometimes picked up, but not systematically collected. The George Zeni collection is biased toward easily recognizable and complete artifacts. However, because it was collected over a larger area of the ranch than we investigated, the collection adds breadth to this study. A total of 191

artifacts from the George Zeni collection (hereafter called the Zeni Collection), including 174 projectile points, 12 pestles, three handstones, and two ceremonial bifaces, are described in the appropriate sections below. The ceremonial bifaces and some of the Zeni projectile points are illustrated in Appendix C.

In the text and tables which follow, chipped stone artifacts are coded by source material as follows:

A = Annadel obsidian
 B = Borax Lake obsidian
 Bt = Basalt
 F = Franciscan chert
 K = Mount Konocti obsidian
 M = Monterey chert

MH = Medicine Lake Highlands obsidian
 N = Napa Valley obsidian
 Q = Quartz
 Qt = Quartzite
 U = Obsidian of unknown source
 ? = uncertain obsidian source

Abbreviations used in the tables below are defined in Table 24. The measurement techniques employed are detailed in Chapter Five.

Projectile Points

A total of 283 typeable projectile points was recovered by SJSU at MEN-2136. The points were grouped into morphological types based on size and shape. They were then compared to point styles recognized elsewhere in the North Coast Ranges. Multiple typologies are currently used in the region. The typology followed for the numbered and named projectile point descriptions below is described in each section. These types are described qualitatively and quantitatively. Metric attributes were measured following procedures defined by Thomas (1981:11-13, Figure 3). Actual measurements for complete points and estimated measurements for incomplete specimens were made. Measurements were estimated for incomplete points only when maximum width position

was visible on the remnant base. The MEN-2136 assemblage was extensively resharpened. The estimated measurements refer to the final resharpening. Measurements for “freshly made” points would surely be longer than those given here. The Methods Section contains a more complete description of how measurements were taken.

The Zeni collection includes 174 typeable points and increases the sample size for some point styles where the SJSU collection is limited. For each type, except Type 2, Leaf-Shaped Projectile Points, a description of the Zeni collection follows the description of the SJSU collection. The statistical tables presented below include only the SJSU specimens. Tables showing artifact measurements and summary statistics for the Zeni collection are found in Appendix C.

Type 1 Rattlesnake Series Variants

Total: 52

SJSU collection: 10 (2M, 4F, 1K, 2B, 1N) (Figure 13)

Zeni collection: 42 (2M, 9F, 14K, 4B, 10N, 3A) (Figure 28, 29 a-o)

Attribute**	N	Range	Mean	S.D.
Length (mm)	8*	20.1*-31.6*	24.8	4.08
Width (mm)	7*	11.2-17.7	15.1	2.09
Thickness (mm)	8	2.4-5.1	3.6	0.94
Weight (g)	8*	0.7*-1.6*	1.1	0.37
nW (mm)	7	4.8-8.9	7.0	1.54
bW (mm)	5	9.1-10.4	9.9	0.53
bW/mW	5	0.51-0.74	0.63	0.09
nW/mW	6	0.37-0.62	0.48	0.09
DSA	10	145-220	168	24
PSA	8	95-140	115	18
NOA	8	35-125	57	32
* includes estimated measurements		** SJSU collection only		

The Rattlesnake Corner-notched designation for “very small and light-weight corner-notched points” was introduced by White (1979:178) in Stewart and Fredrickson (1979). The designation was taken from Rattlesnake Island where Harrington (1948:131; Plate 33) first excavated, described and illustrated specimens of this type. White and Fredrickson (1992:75; Figure 19) recently redefined the designation as a series, subsuming three variant types: side-notched, corner-notched, and unnotched-triangular. In his obsidian hydration analysis of projectile points from the Santa Rosa Plain and environs, Origer (1987:32-35) identifies three types: corner-notched, serrated and triangular. He (1987:46) contends there was a temporal distinction between the serrated and unserrated forms, with serrated specimens of Napa obsidian averaging 2.1μ (range $1.5 - 2.7 \mu$, S.D. = 0.29), and somewhat more recent unserrated points averaging 1.5μ (range $1.0 - 2.2 \mu$, S.D. = 0.30). The Rattlesnake points recovered from MEN-2136 include eight corner-notched (two serrated), and two side-notched forms. Thus, the series designation is used here.

The 10 Rattlesnake series points excavated and surface collected by SJSU at MEN-2136 have triangular blades, expanding stems, and straight bases. One (specimen 182-3; Figure 13 e) has square shoulders. The remainder have short barbs on at least one side. Two of these have sloping shoulders on the more obtuse side.

The blade on specimen 181-6 (Figure 13 a) exhibits distinct, rounded to pointed serrations, while specimen 182-2 (Figure 13 b) is denticulate. These two points are similar to points Origer (1987:Plate 6 1-8 f) has classified as serrated. Tom Origer (personal communication 1994), however, argues that serrated points from the Santa

Rosa Plain are a local cultural marker, and are distinct from serrated points found to the north. Two points (specimens 141-1 and 182-1; Figure 13 d, c), with PSAs greater than 130° (Thomas (1981:18), are side-notched. The remaining six specimens are corner-notched (Figure 13 e-j).

The Zeni collection contains 42 Rattlesnake series points (Table 41). As expected with a larger sample, there is more variation than in the SJSU collection. Blade margins range from slightly convex to slightly concave and bases range from straight to convex. One specimen (200-10, Figure 28 i) has sloping shoulders on both sides. Six obsidian specimens are serrated (Figure 28 s-x) and one is denticulate (Figure 29 a). Thirteen specimens (3 chert, 10 obsidian) have PSAs equal to or greater than 130° , and are therefore side-notched. Twenty-five are corner-notched. The PSAs on the remaining four are not measurable. Workmanship ranges from carefully made chert specimens (Figure 28 a-f) to expediently-shaped obsidian specimens. Few of the Zeni collection artifacts are complete: most are missing the tip, part of a barb, or part of the base.

Jobson (1991:316 ff) proposed two ways to discriminate between Rattlesnake series and Gunther Barbed projectile points: (1) a set of diagnostic criteria, and (2) a pair of classification functions derived from stepwise discriminate analysis. Both approaches were used to test the MEN-2136 and Zeni collection Rattlesnake series points. Using the Warm Springs collection, Jobson (1991:323) established three criteria to classify “typical” Rattlesnake series points:

Size: $Wt < 1.55 \text{ g}$; $length < 31 \text{ mm}$; $4 \text{ mm} < bW < 16 \text{ mm}$
 Shape: $PSA > 89^\circ$ or $bW + 1.0 \text{ mm} > nW$
 Scale: $bW/mW > 0.4$

The critical boundaries exclude “aberrant” specimens. Approximately five percent of the Warm Springs points fall outside some of the attribute ranges. Rattlesnake series points recovered from MEN-2136 generally conform to Jobson’s (1991:323) criteria. However, one MEN-2136 specimen, 131-1, made of Monterey chert, has an estimated weight of 1.6 g, 103 percent of the “typical” maximum, while specimen 181-7, with an estimated length of 31.6 mm, is 2 percent longer than the maximum length criterion. Since 10 percent of MEN-2136’s specimens fall outside Jobson’s ranges for two attributes, a classification scheme for the Rattlesnake series based solely on Warm Springs specimens may be too restrictive. On the other hand, the MEN-2136 situation may be merely attributable to small sample size.

Jobson’s (1991:333) equations which discriminate between Rattlesnake series and Gunther Barbed points were successfully used to classify those MEN-2136 and Zeni collection projectile points on which length, basal width, maximum width, and notch angle could be measured or estimated. It should be noted that Jobson’s equations require length to be measured in centimeters, not millimeters, an essential fact left unstated in his paper (entering length in millimeters classifies both Rattlesnake series and Gunther Barbed series points as Gunther Barbed).

Rattlesnake series points occur primarily in the southern portion of the North Coast Ranges, from Marin County in the south to central Mendocino and Lake Counties in the north (Baumhoff 1985:176; Origer 1982:54; Basgall 1993:187). North and east of this area, the Gunther series predominates. At the boundary, both types are recovered.

Serrated specimens are abundant in the Santa Rosa Plain and to the south, but are virtually absent farther north (Basgall 1993:189; Origer 1982:57).

Type 2 Leaf-Shaped Projectile Points

Total: 328

SJSU collection: 238 (10M, 40F, 1Q, 141K, 33B, 11N, 1A, 1A?) (Figures 13-19)

Zeni collection: 90 (4M, 25F, 1Q, 38K, 11B, 7N, 2K?, 1N?, 1U)

Attribute**	N	Range	Mean	S.D.
Length (mm)	112*	18.1-78.9*	38.5	12.69
Width (mm)	110*	12.0-29.1	19.0	3.51
Thickness (mm)	109	4.7-11.5	7.7	1.36
Weight (g)	110*	1.4-20.0*	5.5	3.57
mWp	103*	0.20-0.68	0.41	0.09
Th/mW	109*	0.22-0.65	0.41	0.08
* includes estimated measurements		**SJSU collection only		

There is no consensus in North Coast Ranges archaeology on how to classify stemless, leaf-shaped points, with and without shoulders. Layton (1990:19) designates all such points Leaf-shaped Bipoints (Type 9 at Albion Head). Fredrickson (1973:199) working at the Houx site, and White and Fredrickson (1992:52), looking at the Clear Lake basin and environs, group stemless points with thickness-to-width ratios less than .43 under the rubric Excelsior. At Warm Springs, Basgall and Bouey (1991:82) confine the Excelsior category to shouldered points, combining “unshouldered, lanceolate or ‘Willow Leaf’” points into a type labeled “Leaf-shaped Variants.” While generally finding Leaf-shaped Variants to be temporally associated with shouldered Excelsiors, they suggest the former were used over a longer period, appearing earlier and persisting later than shouldered points (Basgall and Bouey 1991:92, Table 18). Baumhoff

(1985:175, 187) also splits stemless points into Excelsior (shouldered) and Leaf-shaped (unshouldered) categories, but infers that the former might be but a variant of the latter.

This author sees three problems with splitting shouldered from unshouldered points. First, criteria for discerning the presence of a shoulder are principally intuitive: shouldered points grade into unshouldered lanceolates; near the crossover point some archaeologists see shoulders where others do not. Second, many specimens with distinct shoulders have been resharpened after breakage. They may initially have been leaf-shaped, but acquired shoulders during rejuvenation. Third, while Basgall and Bouey (1991:91) assert a longer period of use for Leaf-shaped Variants than for Excelsiors, they conclude that “medium to large, broad, and thinned [Leaf-shaped] specimens cluster in the same time frame as their shouldered counterparts.” Since the principal purpose of segregating point types is to understand the spatial and temporal extent of cultures, and in the North Coast Ranges shouldered and unshouldered points occur roughly coterminous in space and coeval in time, they are combined in this report into a single category: Leaf-shaped Projectile Points.

The Leaf-shaped category defined here includes all stemless points which have convex bases and maximum widths less than 30 mm. The blades on these points vary from a true lanceolate or “willow leaf” shape, with convex sides, on specimens showing no evidence of rework, to straight edges (with a few incurvate) on points apparently reworked in the haft. The convex bases range from pointed (Fredrickson’s 1973:199 ogival) to ovate, with a few best described as squared. Where shoulders exist, they appear, in virtually all cases, to be the result of rework.

There is considerable variation in flaking pattern, and a few specimens may represent an intermediate stage on the reduction trajectory. Most points have differential flaking; the hafted elements display large, irregular flake scars while the blades show more regular edge finishing. Only one specimen exhibits denticulate blade edges and 10 specimens are serrated.

The average maximum width position for this population is 41 percent from the base, indicating that the blade elements are about 50 percent longer than base elements. On 15 heavily reworked specimens, however, the blade element is actually shorter than the base.

The size of these points varies widely: lengths range from 18.1 mm to 78.9 mm, but display a definite short-end bias (mean = 38.5 mm, median = 36.6 mm, mode = 28.8 mm). There is ample evidence at MEN-2136 for iterative breakage and rework cycles, with the result that the discarded remnants are far shorter than they began. This sample, therefore, understates the size distribution of "freshly made" points.

The average weight of the reconstructed points is 5.5 g, suggesting use as dart tips. Of the 110 points where weight could be estimated, 33 (30%) weigh less than the 3.5 grams (Fenenga 1953) used to discriminate dart (atlatl) tips from arrow tips. Twenty-seven of these points show obvious resharpening, though, and inspection suggests they originally weighed more than 3.5 grams. Five points weighing less than 3.5 g do not show clear signs of having been reworked in the haft. Four of these points are also thin ($Th \leq 6$ mm), suggesting possible use as arrow tips.

Were small Leaf-shaped Points used as arrow tips? Baumhoff (1985:177) argues that small (mL < 30 mm, Wt < 3.5 g) Excelsior points were used as arrow tips and occur temporally later than the larger specimens. Basgall and Bouey (1991:84-85) tested that supposition in two ways. An analysis of the stratigraphic distribution of “large” and “small” (mL < 30 mm, Wt < 3.5 g) points at three Warm Springs sites led them to conclude that “‘small’ forms do in fact tend to be later than ‘large’ ones (Table 21).” Reanalyzing their data (Basgall and Bouey 1991:84 Table 21) supports a slightly different conclusion:

	Late Contexts	Early Contexts
Large	N = 19 (48.7%)	N = 59 (80.8%)
Small	N = 20 (51.3%)	N = 14 (19.2%)

While the frequent use of small points may have begun later than the use of large points, both point types co-occur with similar frequency in late contexts.

Table 1. Excelsior Size versus Hydration Data at Warm Springs

	Konocti		Napa	
	Large	Small	Large	Small
N	50	12	19	17
Mean	2.88	2.19	2.95	2.76
S.D.	0.65	0.65	0.87	0.84
	t = 3.27 p @ 0.01 = 2.66		t = 0.68 p @ 0.5 = 0.68	
Basgall and Bouey 1991:85 Table 22				

Basgall and Bouey (1991:85, Table 22) also used obsidian hydration data to test for a temporal distinction between small and large Excelsiors. They saw a statistically

significant difference between points made of Mount Konocti obsidian (see Table 1) but not for points made of Napa obsidian.

This test, applied at MEN-2136, shows virtually identical distributions for small and large points (Table 2). Application of Student's t-test shows no significant difference between the means. This implies, at least at MEN-2136, that size is not temporally distinctive. The most likely explanation is the substantial amount of point rejuvenation occurring at MEN-2136. The small points recovered are the result of repetitive reworking after breakage, rather than deliberate manufacture of small points.

Table 2. MEN-2136 Leaf Shaped Points: Size versus Hydration Data

	Konocti		All Sources*	
	Large	Small	Large	Small
N	40	11	52	18
Mean	2.20	2.14	2.33	2.20
S.D.	0.53	0.75	0.50	0.71
	t=0.75 p @ 0.4 = 0.85		t=0.82 p @ 0.4 = 0.85	
* incorporates data from all sources; B converted to K using Tremaine (1989a). Points were classified as small if their lengths could be estimated and were less than 30 mm and they weighed less than 3.5 g. All points, including fragment bases, weighing 3.5 g or more were considered large.				

White and Fredrickson (1992:51) exclude from their Excelsior category stemless points having thickness-to-width ratios equal or greater than 0.43. They classify such points as Thick Leaf points. They define one variant, where mL > 35 mm, mW < 19.5 mm, and Th/mW > 0.435, as Copsey Bipoints. These are associated with the Hultman Aspect of the Mendocino Pattern. All Copsey Bipoints recovered from Anderson Flat were made of Borax Lake obsidian (White and Fredrickson 1992:53)

The thickness-to-width ratio on Leaf-shaped points from MEN-2136 differs significantly from those found in and around the Clear Lake basin. The sample mean is 0.41. Forty-two points (38% of those for which measurements could be estimated) exceed 0.43. The MEN-2136 points show substantially more rejuvenation than those from the Clear Lake area, consistent with the greater distance to obsidian (and possibly chert) sources. Therefore, the exclusion from the "Excelsior" or Leaf-shaped categories of points with large thickness-to-width ratios may not be valid outside the Clear Lake basin.

Nine specimens from MEN-2136 meet the Copsey Bipoint criteria. But, only one of these, specimen 115-4 (Figure 17 a), made of Borax Lake obsidian, actually looks like a Copsey Bipoint. The remaining nine specimens are more regularly worked, not twisted, and manufactured from a variety of materials: F 5, Q 1, K 3.

Type 3 Mendocino Concave-Base Series

Total: 37

SJSU collection: 18 (1M, 14F, 2K, 1B) (Figure 20)

Zeni collection: 18 (5M, 12F, 1N?) (Figure 30 o-p, 31 a-p)

Attribute**	N	Range	X	S.D.
Length(mm)	8*	24.8-56.0*	38.1	9.95
Width (mm)	8*	15.9-22.1	18.7	2.57
Thickness (mm)	9	5.5-9.8	7.8	1.45
Weight (g)	8*	2.8-8.6*	5.1	2.14
bW	17*	11.1*-20.2	16.0	2.68
Th/mW	8*	0.25*-0.46	0.41	0.07
bW/mW	8*	0.68*-1.0*	0.81	0.11
Bind	18	0.1-4.4	1.6	1.18
* includes estimated measurements		**SJSU collection only		

The Mendocino Concave-base designation for non-fluted, concave-base projectile points found in southern North Coast Ranges sites entered the literature with Soule's (1975:39) thesis on MEN-584 at Cold Creek. White et al. (1982:67-79), working with 124 points collected from Marin County north to northern Mendocino County, grouped points with concave bases into six subtypes (Small, Wide, Deep Based, Shallow Base Shouldered, Shallow Base Hipped, and Shallow Base), and suggested these subcategories had both temporal and spatial significance. Basgall and Bouey (1991:88), using obsidian hydration data, found no temporal difference between these subtypes and subsumed them into a Mendocino Concave-base series. Basgall and Bouey (1991:89) also include in this series a seventh morphological form, which exhibits incipient side notching and co-occurs at Warm Springs with the other variants.

This paper follows Basgall and Bouey (1991:88) and combines White et al.'s (1982:68) six forms into the Mendocino Concave-base series. However, in contrast to Basgall and Bouey, we treat as a separate type the side-notched form—as do virtually all other researchers. Fortunately, Basgall and Bouey present their data in a manner so that the side-notched variants can be separated out.

The Mendocino Concave-base series points recovered at MEN-2136 display substantial morphological variation. They are typically medium to large in size. Their average weight of 5.1 g suggests they were used as dart tips. Basal shape ranges from concave to almost straight, and all have basal thinning. None, however, displays edge grinding, which was present on some of the specimens recovered at Albion Head (Thomas Layton, personal communication 1995). Most MEN-2136 specimens have

relatively shallow basal concavities (mean = 1.6 mm, S.D. = 1.18). Three of White et al.'s (1982:72) categories are represented; three specimens, weighing less than 3.5 g, are Small, one is Shallow Base Shouldered (two others, represented only by remnant bases, may be shouldered as well), while the 12 remaining are Shallow Base.

Blades edges vary from convex to straight, the latter often resulting from reworking. Fifteen (83%) are slightly "hipped" (bW:mW less than 1.0). Three specimens (Figure 20 m, n, o) are crudely made, possibly the result of poor quality chert. Specimen 180-8 (Figure 20 o) may represent an early stage of reduction; it may have broken along an intrusive quartz vein during manufacture. The remaining 15 points, displaying large, broad flake scars, appear to have been shaped by soft hammer percussion with finer, perhaps pressure, retouch. Five of the eight points long enough to measure show evidence of rework, including all three Small specimens. As a result, the length measurements listed above almost certainly understate the "template's" full dimensions.

The three obsidian specimens, 142-1, 85-6, and 184-4 (Figure 20 p-r), have hydration measurements of 3.9 μ (K), 3.3 μ (B, =2.6 μ K), and 2.6 μ (K), respectively. Although all three artifacts exhibit basal thinning as well as concave bases, the relatively small hydration readings on the latter two specimens suggest they may be aberrant leaf-shaped points.

The 18 Mendocino Concave-base points in the Zeni collection differ in some attributes from the SJSU collection. The Zeni's points are smaller (mean length = 32.3 mm, S.D. = 6.38 mm), more homogenous in style, and display deeper concavities (mean = 2.0 mm, S.D. = 0.82). Fourteen (78%) are almost complete. Certainly the owner's

collection comes from a larger area of the Zeni Ranch than does that of SJSU. However, the most likely explanation for the difference is that owners look for “display” specimens: almost complete artifacts. The reiterative breakage and resharpening of all projectile point types collected at the Zeni Ranch suggests that the only specimens “complete” when discarded are below the minimum effective size. They may have been resharpened during a hunt, then discarded when the hunter returned to camp (Greg White, personal communication 1994).

Most of the Zeni collection points are well made. Nine show clear evidence of rejuvenation. An additional six may have been resharpened. Rejuvenation is the most likely explanation for the 3.52 g (S.D. = 1.39) average weight of these points. According to White et al.’s (1982:72) classification, nine specimens are Small, five are Shallow Base Shouldered, while the remaining four are Shallow Base.

Mendocino Concave-base Series points are found from Round Valley in the north (Holson 1985:90, 163) to Napa and northern Marin Counties in the south (White et al. 1982:68; Origer 1987:38-39). Their material, size, and shape display regional variations. Most points found north and west of Clear Lake, for example, are manufactured from chert, while those found around Clear Lake and to the south are typically obsidian (see Table 3).

Table 3. Mendocino Concave-Base Series

Location	N	Chert %	Obs. %	Reference
Round Valley	27	100	-	Holson 1985:90, 163
MEPUAS	9	100	-	Jackson 1976:66, 108
MEN-500	21	95	5	Meighan 1955:14
Albion Head	12	100	-	Layton 1990:19
MEN-1929	8	100	-	Hamilton nd
MEN-2136	18	83	17	
Zeni collection	18	94	6	
Warm Springs	61*	84	16	Basgall & Bouey 1991:89, 91
Anderson Flat	27**	4	93	White et al. 1993
Lake/Sonoma Cty	64	19	81	White et al. 1982:69-71
Marin/Napa Cty	25	-	100	White et al. 1982:69-71
* excludes 16 side-notched variants			** includes one basalt specimen	

Points from Round Valley (Holson 1985:90, 163) and the Middle Eel Planning Unit Archaeological Survey (MEPUAS) (Jackson 1976:Plate 16) are smaller than those encountered farther south (see Table 4). There also appears to be less morphological variation in the north. Round Valley, MEPUAS, Willits, and Albion Head specimens are basically homogeneous in form within each site. It is impossible, however, to discern a similarly rigid "mental template" from the MEN-2136 assemblage. Mendocino Concave-base points from this site most closely resemble those recovered at Warm Springs in both size and morphological variation. (It should be noted that some researchers do not estimate dimensions for broken points. Since smaller points are more likely to be complete, the means they calculate will necessarily understate the true population [Basgall and Bouey 1991:82].)

Table 4. Mendocino Concave-Base Series Average Dimensions

Location	mL mm	mW mm	Wt g	Reference
MEPUAS	31			Jackson 1976:Plate 16*
MEN-268	30.8	14.8	2.6	Holson 1985:94**
MEN-320/643	25.3	13.3	2.0	Holson 1985:170**
MEN-500	39.4	17.0	4.3	Jackson 1976:177
Albion Head	52.4	20.3	8.3	Layton 1990:19
Zeni collection	32.3	17.2	3.5	
MEN-2136	38.1	18.7	5.1	
Warm Springs	37.6	18.7	5.3	Basgall and Bouey 1991:77 ⁺
Sonoma ⁺⁺	45.2	26.1	8.7	Origer 1987:39
* My estimate from Plate 16				
** My calculations from Holson's data				
⁺ Excludes 16 side-notched variants				
⁺⁺ Includes 1 Napa and 6 Marin sites				

Type 4 Mendocino Side-Notched

Total: 2

SJSU collection: 1 (1F) (Figure 21 a)

Zeni collection: 1 (F) (Figure 30 n)

The Mendocino Side-notched designation first entered the literature with Soule's (1975:41; Type 9, Plate 11 e) thesis, although Meighan (1955:15; Type 14, Plate 4 z-b') had previously illustrated similar specimens. Jackson (1976:49; Figure 3 top row), in his Middle Eel Report, describes the type as "generally triangular in form with distinct side-notches and a concave base." While most researchers, including this one, follow Jackson (see below), Basgall and Bouey (1984, 1988, 1991:89) subsume the Mendocino Side-notched type into their Mendocino Concave-base series.

The one Mendocino Side-notched projectile point (124-10) excavated from MEN-2136 is small (length = 29.4 mm, maximum width = 14.2 mm, thickness = 5.2 mm, neck width = 12.0 mm, and weight = 1.9 g; Figure 21 a). It is a finely made specimen and has a triangular blade, shallow side notching, and a concave base showing basal thinning. The point has been resharpened. The side-notching is closer to the base on this point than is the case with most other illustrated specimens (see references above and below), resulting in a shorter hafting length.

While the weight and size of specimen 124-10 are in the arrow tip range, the 12.0 mm neck width is in the dart point range (White 1969:171, Graph 1B). The specimen fits within the range of Mendocino Side-notched points found at Warm Springs (Basgall and Bouey 1991:77 Table 17: Mendocino Series, Side-notched Variants) and is only 0.1 g lighter than the smallest specimen from Albion Head (Layton 1990:18). Layton and Basgall and Bouey classify such points as dart tips. (But cf. Meighan 1955:15 and Jackson 1976:68).

The Zeni collection also includes a single, finely crafted Mendocino Side-notched specimen. It is slightly larger (length = 30.1 mm, maximum width = 16.8 mm, thickness = 5.1 mm, neck width = 14.5 mm, and weight = 2.0 g), and also appears to have been resharpened in the haft. The side notching on this specimen begins about 5 mm from the base, close to what is seen in other Mendocino Side-notched point assemblages.

The distribution of Mendocino Side-notched projectile points extends from Warm Springs in northern Sonoma County (Basgall and Bouey 1991:89) to the Middle Eel drainage in northern Mendocino County (Jackson 1976:49). They were recovered on the

coast at Albion Head (Layton 1990:53, Figure 2.22) and in the interior to the east at MEN-500, near Willits (Meighan 1955:15), MEN-1805 and MEN-1932, near Calpella (Layton 1990:131; Gary nd), and MEN-584 on Cold Creek (Soule 1975:41). They are most abundant in the northern part of their range. Layton (1990:53) recovered 19 at Albion Head and counted 10 in the Shandel family collection at Comptche, 16 km northeast. Thirty-nine were recovered from the Carlson Site (MEN-1929), 26 km southeast of Albion Head (Jeffrey Hamilton, personal communication 1994). Meighan found 12 at MEN-500 (Meighan 1955:14). Only one sizable collection is reported further south—the 16 from Warm Springs, 12 of which came from SON-572, on upper Dry Creek, in conjunction with 30 Mendocino Concave-base points (Basgall and Bouey 1984:93, 1991:II:206).

Most Mendocino Side-notched points are made from chert. From the collections listed in Table 5 only five (5%) of 98 specimens are obsidian. Average hydration measurements of 4.0 μ (Konocti) for three specimens from Warm Springs (Basgall and Bouey 1991:91) and 4.2 μ for a Konocti point from the Carlson site (MEN-1929) near Navarro (Jeffrey Hamilton, personal communication 1994) help date the type to the Skaggs Phase or Mendocino Pattern. The predominant use of chert helps confirm this attribution.

Table 5. Mendocino Side-Notched Projectile Points

Location	N	Chert	Obs	Reference
MEN-500	12	11	1	Meighan 1955:15
Albion Head	19	19	-	Layton 1990:53
Shandel	10	10	-	Layton 1990:53
MEN-1929	39	38	1	Hamilton nd
Zeni Ranch	2	2	-	
Warm Springs	16	13	3	Basgall and Bouey 1991:91
Total	98	93	5	

Type 5 Willits Series

Total: 25

SJSU collection: 11 (3M, 7F, 1N) (Figure 21 b-l)

Zeni collection: 14 (5M, 9F) (Figure 29 u, 30 a-m)

Attribute**	N	Range	X	S.D.
Length (mm)	4*	27.9*-59.9*	45.0	17.06
Width (mm)	6*	16.2-27.0	21.8	3.89
Thickness (mm)	5	6.2-9.8	8.1	1.57
Weight (g)	4*	3.0*-11.8*	7.5	4.11
nW (mm)	7	13.8-19.4	16.2	2.41
bW (mm)	7	13.4-21.7	17.2	3.00
bW/mW	4	0.71-0.92	0.84	0.10
DSA	10	140-245	218	29
PSA	9	95-140	112	15
NOA	8	85-145	119	19
* includes estimated measurements		**SJSU collection only		

There is no consensus among North Coast Ranges archaeologists on the taxonomy for large stemmed projectile points. Basgall and Bouey (1984, 1988, 1991:85) suggest grouping all medium to large points which have straight or expanding stems and corner- or side-notching into the Willits series. They contend all such points are temporally

coeval. White and Fredrickson (1992:66) and Hildebrandt and Hayes (1984:186, 1993:110), although they subdivide their specimens differently, agree that the various point morphologies are coeval in time and belong to the same pattern (designated the Mendocino Aspect of the Mendocino Pattern by White and Fredrickson and the Mendocino [formerly Willits] Pattern by Hildebrandt and Hayes). Given the lack of temporal difference among any of the suggested subdivisions and the small number of morphologically diverse specimens recovered at MEN-2136, Bouey and Basgall's (1984, 1988, 1991:85) "lumping" approach is followed here: all large corner- and side-notched points which other researchers have labeled "Willits Side-notched," "Mendocino Corner-notched," or "Mendocino series" are subsumed here under the Willits Series designation.

Two major point types have been subsumed into the Willits series: Willits Side-notched and Mendocino Corner-notched. Baumhoff (1982, 1985:181) proposed Willits Side-notched as the designation for "large [side-notched] points ... usually crudely made, always of chert." They were named after MEN-500, near Willits, where Meighan (1955: type 11, Plate 4s-u) found 16 specimens. Baumhoff's description was later expanded to include medium-sized and corner-notched points (Slaymaker 1983:80, Bouey and Basgall 1984, 1988, 1991:85).

Jackson's (1976:50) Middle Eel Report introduced the Mendocino Corner Notched designation for points having a "classically triangular blade element, expanding stem, and distinct barbs." White (1984:164), describing the LAK-510 collection, expanded the designation to include specimens with square to sloping shoulders and square as well as expanding stems. More recently, White (1988) has subsumed within his

Mendocino Corner-notched type those points he had previously designated as Willits Side-notched. As a consequence, White's Mendocino Corner-notched type now appears to be equivalent to Basgall and Bouey's (1984, 1988, 1991:85) Willits series.

In an attempt to achieve consensus, White and Fredrickson (1992:66) have recently adopted the Willits series designation, but broaden the definition. Their series includes three types: Mendocino Corner-notched (White's [1988] definition), Mendocino Contracting-stem (White 1984:172), which differs from the former only in stem shape, and Mayacmas Corner-notched (Greg White, personal communication 1994). The latter is a corner-notched point with a short stem and a relatively large maximum width to maximum length ratio.

Hayes and Hildebrandt (1985:32, 64), employ a different taxonomy in the South Fork Mountain/Six Rivers area. Their "Willits Series" is restricted to moderately large points with long, narrow blades, corner- to side-notching, and variable base shape. They accept as Willits series only six of the 12 points Baumhoff (1982, 1985 Figure 8) illustrated when he defined the Willits Side-notched form. They argue that two large specimens (*ibid.*: Figure 8 e, f) belong in their Group II (Hildebrandt and Hayes 1983: Figure 7 g, h), which they suggest may be a precursor to the Willits style (Hayes and Hildebrandt 1985:33). Another four points (Baumhoff 1982, 1985: Figure 8 i-l; Hayes and Hildebrandt 1985:64) are included in the "Mendocino series" into which they place most large corner-notched and contracting-stem points.

The Willits series projectile points recovered from MEN-2136 display substantial morphological variation. They are typically medium to large in size. Their average weight

of 7.5 g suggests they were used as dart tips. Basal shape ranges from convex to almost straight. Stems vary from almost square to expanding. Most specimens appear to exhibit wide, incipient "side-notching." This notching is so shallow, however, that the more acute proximal shoulder angle measures, in all cases, less than the 150° breakpoint for side-notching on large points (Thomas 1981:18). Two specimens do have PSAs which equal or exceed 150° on the more obtuse side. Nine points have sloping shoulders, while one has short barbs. The final specimen is a remnant base.

Blade elements range from short and triangular on two resharpened specimens to long, and lanceolate to triangular in shape. Blade edges vary from straight to convex, with the exception of specimen, 124-12 (Figure 21 l), which is finely made and has a slightly incurvate triangular blade, fine denticulation and short barbs. This point would be called a Mendocino Corner-notched by Jackson (1976) or placed in Group XI by Hildebrandt and Hayes (1983:4.9).

With the exception of specimen 124-12, these points exhibit little to no retouch. Two midsections (34-16 and 94-4, Figure 21 j, k) are assigned to this category. One appears to retain a vestige of its base, while the other is so similar in form that the two clearly belong together.

The Zeni collection of 14 Willits series points differs from the SJSU collection in some respects: more of the specimens are complete or nearly complete and three (21%) artifacts have contracting stems (Figure 30 b-d), while none of the SJSU collection does. Eight (57%) (Figure 30 a, f-k) appear to be side-notched. As with the MEN-2136 specimens, however, the side-notching is so shallow that none of the PSAs exceeds the

150° breakpoint (Thomas 1981:18) for side-notching on large points. The remaining three (21%) are corner-notched. The Zeni Willits series points suggest a broader “template” and rougher shaping than was the case with their Mendocino Concave-base specimens. Three (200-69, -71, -79, Figure 30 d-e, i) were crafted from poor quality chert. The Zeni points are slightly shorter (41.2 mm, S.D. = 8.94) than the SJSU collection (45.0 mm, S.D. = 17.1 mm), but other measurements are similar (Table 41).

Willits series points are scarce in the southern periphery of the North Coast Ranges (Hildebrandt and Hayes 1984:186; Origer 1987:35-36; White and Fredrickson 1992:66; Basgall 1993:181). They are more abundant in the north where their range extends into Oregon (Hildebrandt and Hayes 1984:186) and to the east, where they appear in Colusa County (Slaymaker 1983:80). Morphological variation occurs within this region. Basgall (1993:181) suggests that incipiently notched forms predominate in the southwestern portion of the North Coast Ranges, while corner-notched variants occur more frequently to the north and east.

Although Willits series points are predominantly manufactured from chert, specimens manufactured from obsidian are found at sites close to obsidian sources. Origer (1987:35), for example, includes 11 specimens in his study of Sonoma County obsidian points. There are nine obsidian points (14%) among the 65 specimens Basgall and Bouey (1991:86) recovered at Warm Springs; five (31%) of the 16 points Slaymaker (1983:80, 101-102) found at COL-81 (Fouts Springs) and half of the 16 specimens White (1984:164, 172) describes at LAK-510 are obsidian. There is one obsidian example at MEN-2136. However, further north virtually all Willits series points are chert (e.g. MEN-

1929 near Navarro [Jeffrey Hamilton, personal communication -1994], Albion Head [Layton 1990:19, Type 8] and MEN-500 near Willits [Meighan 1955:15]).

Type 6 Stemmed Points

Total: 11

SJSU collection: 4 (1M, 3F) (Figure 21 m-p)

Zeni collection: 7 (1M, 5F, 1K) (Figure 29 r-t, v-x)

Attribute**	N	Range	X	S.D.
Length (mm)	3*	27.1-43.4*	33.5	8.70
Width (mm)	3*	14.8*-16.8	15.7	1.01
Thickness (mm)	3	6.3-7.9	7.3	0.87
Weight (g)	3*	3.0*-5.2*	4.0	1.11
nW (mm)	4	9.1-13.3	10.7	1.82
bW (mm)	3	8.1-11.6	9.8	1.75
bW/mW	3	0.55-0.74	0.62	0.10
DSA	4	180-240	220	27
PSA	4	80-85	81	3
NOA	4	95-160	140	30
* includes estimated measurements		** SJSU collection only		

The four MEN-2136 stemmed points assigned to Type 6 were either so fragmentary or heavily reworked that they could not be assigned to a specific taxon. Only the neck and the proximal edge of a barb survive on specimen 83-33. The neck thickness of 7.5 mm suggests it was a dart point. The other three specimens are small, but their weight, thickness, and neck widths suggest they also were used as dart points. These three specimens, one of which was manufactured from poor quality chert, have slightly concave to convex bases, straight to contracting stems, sloping shoulders, and irregular

blade elements with convex edges. All appear to have been reworked. Specimen 141-2 has an apiculate tip.

The seven Zeni collection specimens classified as stemmed points are small and heavily reworked. Most are probably Willits series points. Two, however, are well-crafted artifacts with no clear signs of rejuvenation. Specimen 200-89 (Figure 29 v) is of Konocti obsidian, while specimen 200-89 (Figure 29 x) is Franciscan chert. The obsidian point weighs an estimated 2.3 g, suggesting it could be an arrow tip. Both its thickness and neck width are within arrow point range. Specimen 200-89, at 3.0 g, is technically within arrow tip range. But its maximum thickness of 8.1 mm is large for an arrow tip, suggesting it may be a small dart point.

Type 7

Total: 1

SJSU collection: 1 (1F) (Figure 19 f)

Zeni collection: not counted

This artifact (105-1) is a relatively small, triangular point which has been basally thinned. It is roughly flaked, possibly because of the poor quality of the chert, and broken at the tip. The base is almost straight. An abrupt change in flaking nine mm above the base indicates that this specimen has been hafted and resharpened while in the haft. It is not, therefore, a preform. Its estimated mL = 36.0 mm, mW = 18.2 mm, haft width = 18.0 mm, thickness = 6.3 mm, and estimated weight = 3.8 g. Based on its weight and haft width, it was a dart tip. It is most likely a "Mendocino Concave-base" point with an abnormally straight base.

Type 8

Total: 1

SJSU collection: 0

Zeni collection: 1 (1F) (Figure 29 p)

Specimen 200-2 is the only contracting-stem, arrow-tip size point collected on the Zeni Ranch. It exhibits slightly incurvate blade edges and short barbs. It is finely made. Its estimated $mL = 32.8$ mm, $mW = 19.4$ mm, $Th = 4.6$ mm, $nW = 7.5$ mm, $bW = 5.8$ mm, $Wt = 1.9$ g, $DSA = 150^\circ$, $PSA = 75^\circ$, and $NOA = 75^\circ$. Morphologically, it resembles a variant of the Gunther series, and satisfies both Jobson's (1991:328) characterization of Gunther Barbed points and his (1991:333) equations to discriminate Gunther Barbed from Rattlesnake series points.

Gunther series points, however, are rarely found as far south as MEN-2136. Jeffrey Hamilton (personal communication 1994) found none at MEN-1929 near Navarro, 30 km north. Moreover, at Albion Head, fifty km northwest, Layton (1990:61), found 2.3 times as many Rattlesnake series as Gunther series points; he attributed the latter, made exclusively of Franciscan chert, to Northern Pomo peoples with an interior homeland. At MEN-1805, near Calpella, Layton (1990:131) again found more Rattlesnake series projectile points than Gunthers, as did Soule (1973:36-37) at MEN-584 on Cold Creek. The normal range for Gunther series points, then, appears to be from Albion Head north. Gunther series points are found, in very small numbers, south of the Zeni site. Eight were recovered at Warm Springs along with 432 Rattlesnake series specimens (Jobson 1991:317, 329). Nevertheless, if the Zeni specimen is a Gunther series

artifact, it is an isolate, outside its normal range. Conversely, it could just be an aberrant Rattlesnake series variant.

Type 9

Total: 1

SJSU collection: 0

Zeni collection: 1 (1F) (Figure 29 q)

This finely made arrow tip has a sub-triangular blade with one sloping shoulder and one (broken) short barb. From the neck up it resembles a Rattlesnake series variant. However, its split-stem, concave basal element is unique. The mW = 14.3 mm, bW = 10.4 mm, nW = 6.3 mm, Th = 3.1 mm, and the basal indent = 0.2 mm; PSA = 130° and 140°, DSA = 200°; NOA = 70°. The estimated length is about 27 mm and weight about 1 g.

Projectile Point Fragments

Total Recovered: 432

SJSU collection: 432 (14M, 67F, 1Q, 282K, 39B, 22N, 1MH, 4K?, 1N?, 1U)

Zeni collection: not counted

These specimens were too fragmentary to type, but their general symmetry and flaking suggest they were projectile point fragments. The sample is comprised of tips, midsections and midsection fragments. Virtually all bases were considered typeable, and only one (Franciscan chert) is represented among the fragments tallied here. Eight additional specimens were unclassifiable (e.g. was it a tip or a barb?).

Of the 132 tips (Figure 19 g-l), six Konocti specimens were serrated. One Napa tip, based on its size, may be the tip of a biface. Sixteen tips (3M, 5F, 5K, 3N) were more

crudely made and may represent intermediate stages in the reduction trajectory. One midsection, made of Franciscan chert, is serrated. A maximum of 16 tips (4F, 11K, 1B), with maximum thicknesses less than 4.0 mm, may be tips of arrow points. Two midsections, made from Borax Lake obsidian, with maximum thicknesses less than 2.8 mm, appear to be in the arrow point range. Two unclassifiable projectile point fragments, one Franciscan chert and one of an unknown obsidian, also appear to be of arrow tip size. All other projectile point fragments appear to be parts of dart tips. Table 6 summarizes the fragments recovered.

Table 6. Projectile Point Fragments by Type and Material

Fragment	Material								Tot.
	M	F	K	B	N	K?	N?	Oth.	
Tips	8	34	72	8	8	1	-	1	132
Midsections	3	20	60	9	6		1	-	99
Midsec. Frag.	3	11	146	22	7	2	-	1	192
Fragments	-	2	4	-	1	1	-	1	9
Total	14	67	282	39	22	4	1	3	432
%	3.2	15.5	65.3	9.0	5.1	0.9	0.2	0.7	100

The ratio of the number of tips to bases offers one indication of the kinds of activities that occurred at MEN-2136. This will be discussed in Chapter Nine. Only fragmentary bases are normally counted in computing base-to-tip ratios. However, because most of the projectile points SJSU recovered have been resharpened, all projectile points are included in the "bases" count. Three bases, of quartz, Annadel, and Annadel?, do not appear in the table below because there are no tips made from those

materials. Two tips (K?, MH) are also not included because there are no bases made from those materials. The following table summarizes the ratios:

Material	Total	M	F	K	B	N
Tips	132	8	34	72	8	8
Bases	284	17	71	144	36	13
Tip:Base Ratio	.465	.471	.479	.500	.222	.615

The 192 medial fragments (3M, 11F, 146K, 22B, 7N, 2K?, 1U), 92.2 percent obsidian, suggest projectile point fragments were used as cores to make casual tools.

Other Chipped Stone Artifacts

In addition to projectile points, 253 other chipped stone tools were recovered at MEN-2136. These are classified as bifaces, drills, scrapers, modified flakes, utilized flakes, core/cobble tools, assayed cobbles and cores. Classification criteria are described within each section. In addition, two large obsidian ceremonial bifaces from the Zeni collection are described.

Bifaces

Total: 30

SJSU collection: 30 (8M, 22F) (Figure 22 a-k)

Zeni collection: not counted

Artifacts classified as bifaces display large, irregular flake scars with no secondary retouch, are generally thick relative to width, often asymmetrical, and frequently exhibit sinuous edges. They are distinguished from fragments (covered below) by retaining segments of both edges. They are distinguished from projectile points and projectile point fragments by their lack of regular flaking patterns and secondary retouch.

Bifaces in this category are all small. Only four, all Franciscan chert, have widths exceeding 30 mm. The only complete specimen, of Franciscan chert (90-19, Figure 22 a), is 56.2 mm long, 32.0 mm wide, 10.8 mm thick, and weighs 21.0 g. Its size and symmetry suggest it is late in the reduction sequence. Specimen 34-13, recovered as a base (Figure 22 i) is also Franciscan chert. It may originally have been slightly larger than specimen 90-19: it is 37.0 mm wide and 11.2 mm thick. Its estimated original length is about 74 mm and estimated weight about 36 g. All other specimens are smaller.

Most of the bifaces appear to be roughouts or preforms, probably for Type 2, Leaf-shaped projectile points. Evidence, both from these bifaces and from the chipping debris, suggests that most chert came to the site somewhere on the reduction sequence rather than in cobble form. Only the few cores and the poor chert quality of some of the bifaces suggest any primary reduction occurred on site.

The poor quality of six Franciscan chert specimens suggests there were no good Franciscan chert sources nearby. As a result, the occupants tried to knap whatever they could find. When reduction failed because of breakage along a vein, or thinning failure, or the material proved unworkable due to cortex or porcelenite, many of the resulting fragments show evidence of having been used as scrapers. The two specimens made from poor quality Monterey chert are harder to explain. The closest known Monterey chert source is at Schooner Gulch, 20 km away. Why was poor quality chert transported so far?

The occurrence of relatively small bifaces in a location used by mobile populations some distance from chert quarries is predicted by a model of efficient toolkits (Kuhn 1994). Kuhn found that it was more efficient (measured as usable edges divided by

mass) to carry a number of tools 1.5 to 3 times the size of the minimum effective tool than to carry source material as larger specimens.

Three small bases (34-9, 51-12, and 182-11) are included here. They may be in almost final form, awaiting only retouch for completion. Specimen 70-9 may be the proximal end of a tool. Two tips and eight medial sections were recovered (Figure 22 k). All are chert (2M, 8F).

Biface Fragments

Total: 24

SJSU collection: 24 (4M, 6F, 7K, 6B, 1N)

Zeni collection: not counted

Most of the 24 specimens classified as biface fragments are medial fragments exhibiting irregular flake scars on both faces. Most are small (Table 29). Ten (1M, 2F, 3K, 3B, 1N) exhibit use-generated edge damage (step-flakes) suggesting reuse as scrapers. Specimen 182-29 (Figure 22 l), of Konocti obsidian, is the only example of an obsidian artifact in the SJSU collection from early in the reduction sequence.

Large Bifaces (Ceremonial blades?)

Total: 2

SJSU collection: 0

Zeni collection: 2 (2 K) (Figures 32-33)

Two large (mL = 205 and 222 mm, average mW = 61.0 mm, thickness = 26.5, Wt = 337.5 g) lanceolate-shaped bifaces, displaying only percussion flaking and retaining somewhat sinuous edges, were recovered by George Zeni while plowing Field 5 (about 170 m northwest of the corral) on the Zeni Ranch (Map 8). The blade edges show no

The Zeni bifaces were manufactured later in time than the other caches. Both specimens have hydration rim depths of 2.4 μ , compared to 3.6 μ (Konocti, S.D. = 0.55 [sic, actually 0.21]) for the Caballo Blanco specimens, in a somewhat warmer environment (Gary and McLearn-Gary 1990) and 3.55 μ (Borax Lake, S.D. = 0.05) for the Great Blades, in a significantly cooler environment (Rick and Jackson 1992:48-49).

[illegible]

Drills

Total: 60

SJSU collection: 60 (11M, 48F, 1K) (Figure 23)

Zeni collection: not counted

Artifacts classified as drills are generally relatively long, narrow, and thick, constricting at the distal end to a bit-like tip, which is generally triangular in cross-section. Basgall and Bouey (1991:II:6) separate the drills found at Warm Springs into two groups: (1) Shouldered Drills, which encompass a broad range of sizes and morphologies, but all provide a “wide proximal ‘handle’ that can be firmly gripped without hafting, and (2) Hafted Drills, which are small (usually less than 20 mm in length) with proximal ends frequently as pointed as the distal ends. Basgall and Bouey conclude that the morphology of these drills would have made hand-holding difficult; they must, therefore, have been hafted during use. Following Basgall and Bouey, the MEN-2136 specimens have been divided into shouldered (2 specimens) and small hafted (28 specimens) types, plus a third, “large hafted” class, with 17 specimens, which, although probably hafted, are large enough to have been hand-held. In addition, based on an analysis of use-wear by Alan Leventhal, an additional 10 incomplete specimens have been categorized as preforms and three, with no evidence of use as drills, as gravers or perforators.

Small Hafted Drills

SJSU collection: 28 (6M, 22F) (Figure 23 a-n)

Attribute*	N	Range	Mean	S.D.
Length	24	14.2-22.5	18.3	2.51
Width	24	6.5-10.8	8.4	1.11
Weight	24	0.4-1.3	0.8	0.24
Bit Length	21	1.3-3.6	2.1	0.71
Bit Width	21	1.5-3.6	2.4	0.68
* includes only complete specimens				

The 28 specimens classified as small hafted drills appear to be too small to have been hand-held, and resemble Basgall and Bouey's hafted specimens (1991:I:Plate 26). However, many of the Warm Springs specimens are described as bipointed, and show distal ambifacial use-wear, implying use in a rotary fashion (Basgall and Bouey 1991:II:6). Few of the MEN-2136 specimens have two serviceable ends (although a few with basal snaps may have originally been bipointed), and only two show possible evidence of ambifacial wear, and thus rotary use. Bouey (1986:94-5) implies that all Warm Springs hafted drills were made from high quality green chert. This is not true of the MEN-2136 specimens: although six were manufactured from chert including some green, only two specimens were made from good quality chert (absence of cracks, fissures, and quartz vein inclusions [Bouey 1986:209]).

Of the 28 MEN-2136 artifacts, two show no evidence of use, three are snapped at the bit, probably from use, and the remaining 23 exhibit rounding at the tip, coupled with either gloss or evidence of grinding or crushing. Most edges near the tip show slight to definite rounding, gloss, grinding, nibbling, and/or crushing. Three also display twist

spalls, probably from use. Twenty-one of the 28 have bits with triangular cross-sections, four are sub-triangular, while three are lenticular.

Barrett (1952:286) describes use of similar chert implements, hafted onto a wooden shaft, for drilling beads. The shaft was held horizontally, and rolled on the right leg with the right hand, to drill a bead held in the left hand. Hudson (1897: footnote 1) describes a drill (*kawin*) as a straight stick about 18 inches long, with a "pointed bit of flint" attached to the shaft by fibers, probably of deer sinew. Hudson asserts that the drill was held vertically and worked by rolling it between the hands.

Large numbers of small drills were found at three Warm Springs sites: SON-553 (20), SON-568 (40), and SON-593-I (138), all in late contexts and associated with clamshell disk beads and shell refuse (Basgall and Bouey 1991:II:102-3). Types A1 and A2 clamshell disk beads were recovered, suggesting use both before and after AD 1700 (Type A1 AD 1500-1700, Type A2 AD 1700-1800, Bennyhoff and Fredrickson 1994:68, 71; Basgall and Bouey 1991:II:107, 317). Layton (1990:133, Figure 3.21) recovered 29 "hafted drills" at MEN-1805 (Nightbirds' Retreat), near Calpella, which he attributes to use for manufacturing clamshell disk beads. He does not provide measurements, but his illustrated specimens appear comparable to those recovered at Warm Springs. (Only six of Layton's specimens were made from green chert [personal observation 1996].)

Parker (1980) discusses small drills recovered from two Clear Lake sites, LAK-435 and LAK-785. LAK-435 (King 1975) produced evidence of the manufacturing sequence of small hafted drills, from prepared core to finished drills, associated with a small amount of shell. Conversely, at LAK-785, Parker (1977) recovered eight complete

drills (with no evidence of drill manufacture), in conjunction with evidence of all stages of bead manufacture, from bead blanks, through perforated blanks and blanks broken during perforation, to completed beads. Parker (1980:11-12) concludes that LAK-435 was a drill manufacturing site, at which a specialist produced triangular-shaped, small drills, while evidence from LAK-785 suggests the presence of a bead-manufacturing specialist, documented by associated shell and drills.

Bouey's (1986:94-96) data from Warm Springs does not support Parker's assertion that in the Clear Lake basin drills and beads were made by specialists in different locations. Drills, green chert cores (by implication, used only to manufacture hafted drills), beads, and bead blanks were found together in two houses at SON-593-I (although 73 of 118 drills found in houses at that site came from one house which had only one core and four beads but no bead blanks). The two other primary drill sites (SON-568 and -556) also contained cores and beads, suggesting that although there may have been specialists, the two functions did not necessarily occur at different sites or even in different households. Although no shell was recovered at MEN-2136, the evidence of use-wear on the recovered drills, in conjunction with the unused drills and unfinished drill preforms, suggest that drills were both made and used on-site.

The small drills recovered at MEN-2136 are somewhat larger than those Layton (1990:133, Figure 3.21) recovered at MEN-1805 (personal observation) and are also larger than those from two of the three Warm Springs sites. The average weight of drills from SON-593-I and SON-568 was 0.5 g and 0.4 g, respectively, while the 20 drills from SON-553 averaged 0.8 g, equal to the weight of the MEN-2136 small drills (Basgall and

Bouey 1991:II:94, 282, 314). On the other hand, the mean bit width (measured across the bit at the proximal extent of the use-wear) of 2.4 mm at MEN-2136 closely matches that at SON-568 (2.5 mm) and 593-ī (2.4 mm), but is much smaller than the 3.7 mm mean at SON-553 (Basgall and Bouey 1991:II:94, 282, 314).

Were the MEN-2136 drills used to perforate clamshell disk beads? That they were was the initial assumption of the North Coast Ranges archaeologists who saw them. But, clamshell disk beads are late (post AD 1500) and the small drills at MEN-2136 were found in the trench, an area dominated by obsidian Leaf-shaped points, with only two late period (Rattlesnake series) points. It seems unlikely that a major clamshell disk bead and drill manufacturing site existed in an otherwise Dry Creek (Houx) context. Although the vertical stratigraphy of this area is mixed, these drills were found in all levels of the deposit, associated with Leaf-shaped points. There was some concentration by unit; half of the drills were found in three adjacent units: 7S1W, 8S1W, and 9S1W.

It seems likely that most, if not all, these drills and those of the large hafted category (below) were associated with the Upper Archaic, Dry Creek Phase and were not used to make clamshell disk beads. Perhaps they were associated with drilling *Olivella biplicata* beads or *Haliotis* ornaments. A few 3b1 beveled and split drilled *Olivella* beads (Bennyhoff and Hughes 1987:85,122-3 Types C1 and C2) were recovered in Houx levels at LAK-261 with no evidence for on-site manufacture (Fredrickson 1961:51-52, White and Fredrickson 1992:55). Greg White (personal communication 1996) thinks that *Olivella* beads were made somewhere on the coast and traded into the Clear Lake basin during the Houx (Dry Creek) period. Perhaps MEN-2136 was such a near-coast site.

Table 8. Mean Attribute Measurements for Small Hafted Drills

Site	N	mL	mW	BitW*	Wt	Reference
SON-553	20	19.4	7.5	3.7	0.8	Basgall & Bouey 1991:II:94
SON-568	40	13.4	6.2	2.5	0.4	Basgall & Bouey 1991:II:282
SON-593-I	138	14.3	5.7	2.4	0.5	Basgall & Bouey 1991:II:314
MEN-2136	28	18.3	8.4	2.4	0.8	Small Hafted Drills
* see Chapter Five for definition						

Large Hafted Drills

SJSU collection: 17 (1M, 16F) (Figure 23 m-x)

Attribute*	N	Range	Mean	S.D.
Length	13	20.1-33.9	26.3	4.27
Width (mm)	13	10.3-13.7	11.7	1.06
Weight	13	1.1-3.4	2.0	0.73
Bit Length	9	1.0-2.4	1.8	0.46
Bit Width	9	1.7-3.3	2.4	0.58
* Includes only complete specimens				

These drills are larger (mL = 26.3 mm vs. 18.3 mm) and heavier (2.0 g vs. 0.8 g) than the small hafted drills. They are large enough that they may have been hand-held, although most were probably hafted. In general, complete specimens exceeding 20 mm in length and 10 mm in width were classified as large hafted drills. But, although the mean bit length of these drills is about 14 percent shorter than that of the smaller drills, the average bit width is the same, and it is likely that both classes of drills were used for similar functions. The two types have been separated here to allow comparison of the smaller specimens with those recovered from Warm Springs (see above). Of the 17 specimens from MEN-2136, two show no evidence of use, two were resharpened, with no

evidence of subsequent use, three have snapped bits (probably from use), and two show evidence of only light use, with rounding of the tip but minimal edge damage. The remaining eight specimens show use-wear similar to that of the small specimens: tip rounding, with gloss, grinding or crushing, coupled with rounding, gloss, or grinding on the edges and/or arrises near the tip.

Shouldered Drills

SJSU collection: 2 (1F, 1K) (Figure 23 cc, dd)

Attribute	N	Range	Mean	S.D.
Length (mm)	2	22.2-30.0	26.1	5.52
Width (mm)	2	10.8-20.4	15.6	6.79
Weight (g)	2	3.0	3.0	-
Bit Length**	2	2.6-6.6	4.6	2.83
Bit Width**	2	3.1-3.9	3.5	0.57
** see Chapter Five for definition				

Two specimens have been classified as shouldered drills, although neither exhibits the “wide proximal ‘handle’” illustrated in Basgall and Bouey (1991:I:Plate 25). Specimen 62-7 (Figure 23 cc), the only obsidian artifact classified as a drill, widens from a lenticular-shaped bit into a shaped hand-hold. It shows rounding and grinding on the tip and distal edges, and possible striations perpendicular to the tip. Specimen 70-12 (Figure 23 dd), has a thick proximal end, which appears too thick for hafting, but provides a grip for two fingers and the thumb. Use-wear includes rounding and gloss at the tip, slight gloss on the edges, and grinding on one arris. It was possibly used as a hand-held reamer, to even out a biconically drilled bead or pendant hole (Hudson 1897:106).

Drill Preforms

SJSU collection: 10 (4M, 6F) (Figure 23 y-bb)

The 10 specimens classified here display a general drill morphology, but the shaping of the bit was either not finished (8, see Figure 23 aa-bb) or the bit broke during manufacture (2, Figure 23 y-z)). Two specimens are incomplete hand-held drills, one is definitely and one probably an unfinished small hafted drill, and the remaining six are unfinished large hafted drills. The presence of these specimens at this site was unexpected. There is little evidence of on-site manufacture of any other shaped tool.

Gravers and Perforators

SJSU collection: 3 (3F) (Figure 23 ee, ff)

None of these three specimens shows use-wear consistent with drilling. The two possible gravers (83-5 [Figure 23 cc] and 111-4), with lenticular cross-sections, display damage or rounding at the tip and nibbling or gloss on one edge. Wear on specimen 111-4 suggests uni-directional use. Specimen 90-2 (Figure 23 ff), also with a lenticular cross-section, displays fine, regular flaking and a very sharp edge at the tip. It was possibly used as a perforator, or possibly as a hand-held reamer, to even out a biconically drilled bead or pendant hole (Hudson 1897:106).

Scrapers

Total: 45

SJSU collection: 45 (14M, 26F, 1Q, 3K, 1B) (Figures 24, 25, 26 a-h)

Zeni collection: not counted

Attribute*	N	Range	Mean	S.D.
Length	31	22.0-49.9	36.2	7.09
Width	31	10.3-34.7	25.4	6.18
Thickness	31	4.0-21.2	11.2	4.04
Weight	31	1.3-30.8	12.0	7.55
Th/mW	31	0.19-0.93	0.45	0.16
% Perim.	31	25-100	62	19

* Attribute measurements include only complete specimens

The rubric scraper has been superseded in the recent archaeological literature by terminology based more on observable form and less on inferred function, such as “uniface” (Basgall and Bouey 1991:II:6), “formed flake tool” (Gilreath 1989:A18) and “intentionally modified flake” (Rondeau). Most of these more general classifications, however, either “lump” tools of probable disparate use or require further division into such unmemorable classes as ‘FFT-1’ and ‘FFT-2,’ requiring coding tables to decipher.

This paper will retain the term scraper to classify artifacts which have a planar or nearly planar ventral face and generally unifacially flaked edges with a steep edge angle ($>60^\circ$) along at least a portion of the dorsal perimeter (Kowta 1969:20). Edge modification from use is confined to the dorsal surface. That surface is usually convex, but on some specimens is flat, keeled, or concave. Most specimens are worked only on the dorsal surface. Four (9%) have been worked sparingly on the ventral surface to provide a planar surface.

Artifacts classified as scrapers are distinguished from other tool categories by their more regular and intrusive retouch, which extends, on complete specimens, over a substantial portion of the dorsal perimeter. Artifacts with similar edge angles but less intensive or extensive retouch have been classified as modified flakes, utilized flakes, and core/cobble tools.

In plan view, 18 (46%) of the 39 specimens complete enough to classify are ovate. Five (13%) are lenticular, three (8%) are discoidal, three (8%) are straight-edged, one (3%) is beaked, and nine (23%) are irregularly shaped. The ovate group includes three specimens (Figure 24 j-l) which resemble the “ovate end scraper notched for hafting” category illustrated in White and Fredrickson (1992:70, Figure 17f) and assigned to the Mendocino Pattern (Skaggs Phase).

Of the total, 26 specimens (58%) are serrated, 9 (20%) are unserrated, and 10 (22%) may initially have been serrated, but either the serrations have been obliterated through use or the fragments are too small for certain classification. However, most of this serration is, in fact, the fine finishing usually described as denticulate. Only one specimen (85-4, Figure 24h) displays the heavy serrations described for “serrate flake tools,” a marker of the Houx Aspect (Dry Creek Phase) (White and Fredrickson 1992:53, 58, Figure 13c).

Most working edges are convex; one is concave, three are straight, and four additional artifacts have straight to barely convex edges. Edges on these specimens have been prepared on an average of 62 percent (S.D. = 0.19) of the basal circumference. Edge angles (measured at the working edge) range from 58° to 100°, averaging about 75°. The

steep edge angles on these artifacts and the apparent preferential use of chert (89%) in a collection otherwise dominated by obsidian suggest they may have been used to work hard materials such as wood or bone.

Michael Rondeau inspected 42 of the specimens for use-wear, using a binocular microscope with direct incandescent light at magnifications to 35 X. Edge rounding was the main criterion used to assign use-wear. To distinguish use-modification from weathering he inspected other artifact margins and the arrises, projections, and high points on the specimen's surface. He detected use-wear on twenty-eight (67%) specimens. In addition, striations perpendicular to the worked edge were observed on 12 (29%) of the inspected artifacts. These striations are consistent with scraping, but not cutting or sawing motions.

All lithic analysts this author consulted asserted that edge-damage analysis alone, without replicative studies, was insufficient to determine what materials had been worked with the MEN-2136 scrapers. The large number of predominantly chert scrapers recovered requires explanation; further comparison with other sites in specific environments may help resolve this question. Hide-scraping is one possibility, but can not explain the lack of polish, the significant scarring evident on some artifacts, or the apparent preference for chert. Working bone and/or wood are other possibilities consistent with the site's location and its apparent hunting focus.

Dating

Dating the chert scrapers simply by form is difficult; similar forms appear from Paleoindian to late contexts. White and Fredrickson (1992:53) assert that formal flake tools, similar to the MEN-2136 specimens, are prevalent in Mendocino Pattern (Skaggs Phase) contexts, but are rare in Houx Aspect (Dry Creek Phase) associations. Mark Basgall (personal communication 1994) also saw a Skaggs context for these scrapers.

However, White and Fredrickson and Basgall work in areas where obsidian or chert was readily available and where Mendocino/Skaggs populations are believed to have been more mobile than the Houx/Dry Creek peoples. Curated, formal tools are most often associated with mobile groups, informal tools with resident populations (White 1984). Neither chert nor obsidian is available near MEN-2136, and both Skaggs and Dry Creek users were probably seasonal visitors, and thus likely to have carried formal tools.

Inspection of the unifaces in the Warm Springs collection for SON-572 (a major Skaggs site) and SON-571 (a major Dry Creek site) suggests they display more similarities than differences, although at SON-571 there is a higher proportion of obsidian specimens in the Dry Creek levels (69%) than Skaggs levels (50%) (Basgall and Bouey:II:243). But, this is not true at SON-572 (9% Skaggs, 5% Dry Creek) (Basgall and Bouey:II:209). In general, the MEN-2136 specimens appear to be more regularly shaped, with more regular retouch, extending over a larger portion of the perimeter, than is the case with the Warm Springs artifacts and those of most other collections investigated. In fact, some of the specimens classified as unifaces at Warm Springs would have been

included in the modified flake category here. The MEN-2136 specimens appear to be smaller than those in many collections, but they are comparable in size and weight to the chert unifaces assigned to the Dry Creek Phase at both SON-571 and -572 (Basgall and Bouey 1991:II:209, 243). MEN-2136 scrapers are somewhat smaller and lighter than the chert Skaggs Phase unifaces at SON-572.

Hydration measurements on three MEN-2136 Konocti specimens, 144-5, 103-15, and 101-4, yielded rim measurements of 3.0, 2.9, and 2.7 μ , respectively. These three obsidian specimens can probably be attributed to the Dry Creek Phase. That suggests a Dry Creek association for at least some of the scrapers. A small surface collection from Field 6, which appears to be an almost pure Skaggs component, provides further support to this thesis. Two scrapers and four modified flakes were recovered (compared to a one-to-one relationship between scrapers and modified flakes in the main collection), at least suggesting that Skaggs Phase specimens were less carefully prepared than most of the specimens collected in the corral area.

Modified Flakes

Total Recovered: 39

SJSU collection: 39 (4M, 15F, 2Qt, 8K, 5B, 5N) (Figure 26 i-o)

Zeni Collection: not counted

Artifacts in this category are less uniformly modified than those classified as scrapers, but most appear to have been used for the same purpose. The two categories grade into one another, and at the boundary this author found herself moving a few artifacts back and forth between the two. Modified flakes were distinguished from

scrapers in that the modifications were less intrusive, covered a smaller portion of the dorsal perimeter, and were less regularly flaked. Edge modification ranges from a few large flakes placed to form a steep edge angle, to fine, regular flaking along a short edge. Edge units on these specimens have not been characterized, but step-flaking, crushing, polish and/or striations have been detected. Measured edge angles range between 46° and 100°, and average about 70°. Two specimens, 113-7 and 64-27, included here, are, in fact, scraper edge-rejuvenation flakes.

Hydration measurements were made on five specimens (1K, 1B, 3N), yielding readings of 2.3, 3.0 [=2.4 K], 2.2, 2.8, and 4.4 μ , respectively. The first four are most likely Dry Creek, the last possibly Skaggs, suggesting these tools may have been used in both phases.

Utilized Flakes

Total Recovered: 37

SJSU collection: 37 (12F, 1Q, 1Bt, 15K, 4B 4N)

Zeni collection: not counted

Artifacts included in this category display continuous use damage along at least one edge but show no deliberate post-detachment modification. Edge units on these specimens have not been characterized, but step-flaking, crushing, polish and/or striations parallel to, perpendicular to, and at oblique angles to the used edge(s) have been detected. Edge angles measured on these flakes range between 25° and 80° but are, in general, more acute than those of modified flakes and scrapers. The specimens with edge angles less than 45° may have been used for cutting rather than scraping.

Core/Cobble Tools

Total Recovered: 12

SJSU collection: 12 (2M, 9F, 1Bt)

Zeni collection: not counted

Attribute**	N	Range	Mean	S.D.
Length (mm)	10	21.2-56.0	42.0	12.29
Width (mm)	10	14.2-45.6	30.8	9.09
Thickness	10	14.0-42.4	26.5	8.56
Weight	10	4.2-95.8	47.4	28.85
** Table includes only spent cores reworked as tools				

Ten specimens, all chert (2M, 8F), are spent cores, reworked along at least part of one edge to create a steep-edged, scraper-like tool, with a planar or near-planar basal surface. All specimens are relatively small. Edge units on the specimens have not been characterized, but step-flaking and crushing have been detected. Edge angles average about 84°, somewhat steeper than the edges measured on the formal scrapers, which may suggest use on harder materials. The weight of most of the core/cobble tools, which average about four times that of the scrapers, supports this view. One of the Monterey chert specimens (130-10) retains the water-worn cortex of a beach cobble, suggesting it was recovered from a beach near Schooner Gulch.

The other two specimens in this category are not cores. Specimen 50-16 (maximum dimension = 63.5 mm, Wt = 130g), which retains cortex, is best described as angular waste. A small portion of one slightly concave edge may have been used as a scraper. The basalt specimen (180-19) is an angular chunk of meta-basalt which has been utilized along 25 percent of one face as a scraper. Its size (80.2 mm) and weight (326.5 g)

suggest it may also have been used for pounding, although no pounding damage was detected.

Chert Cobbles

Total Recovered: 2
SJSU collection: 1 (1M, 1F)
Zeni collection: not counted

Specimen 134-1, a small (48.4 X 40.1 X 23.5 mm, Wt = 64.2 g), stream-rounded, Franciscan chert cobble fragment, appears to have been heat fractured. Overheating may have made it unfit to work. Specimen 181-23, also a small (35.1 X 29.4 X 24.5 mm, Wt = 31.4 g), water-rounded cobble of Monterey chert, may also have been heat fractured.

Cores

Total Recovered: 4
SJSU collection: 4 (2F, 1Q, 1 Breccia)
Zeni collection: not counted

Ten of the 14 cores recovered at MEN-2136 were reworked into tools and are described above under Core/cobble tools. The two remaining Franciscan chert specimens are small spent cores of flakeable quality chert. Specimen 132-1 (maximum dimension = 87.7 mm, Wt = 155.3 g), may have been mistaken for poor quality chert, but is a breccia, probably from a hydro-thermal vein deposit (Matt McMacken, personal communication 1995). It includes visible amounts of red chalcedony, but not in flakeable quantity. It is included here as an indication that good core material was probably not available close by.

The massive quartz core (specimen 181-24, maximum dimension = 68.0 mm, Wt = 155.3 g) displays flake scars originating from multiple platforms.

Ground Stone Artifacts and Manuports

This section covers ground, pecked, and battered cobbles and manuports. Twenty-seven specimens were recovered by SJSU at MEN-2136: 11 handstones, four pestles, one possible millingslab fragment, four end-battered cobbles, two unidentified fragments, and five manuports. The Zeni collection includes an additional 15 artifacts: 12 pestles and three handstones.

Handstones

Total: 14

SJSU collection: 11 (11 graywacke) (Figure 27 b)

Zeni collection: 3 (3 graywacke)

Cobbles with one or two flat to slightly convex face(s) exhibiting polish, and with subtly beveled shouldering at the margins of the ground surfaces, are classified as handstones. In the SJSU collection, two specimens are complete; three others at least 50 percent complete; while the remaining six are small fragments. Of the total, five were unifacially worked and six used bifacially. Eight were also end-battered.

A single shaped, unifacial handstone was recovered (84-1, Figure 27 b). The half of the tool remaining is sub-rectangular in plan view, was shaped by deliberate pecking on one end, and displays distinct shouldering on the worked face. The working face has been resharpened by pecking. Two other handstone fragments, one unifacially, the other bifacially worked, may have been shaped, but the fragments are too small for certain

classification. The eight remaining unshaped handstones are rounded cobbles opportunistically selected for their general symmetrical shape. They show varying degrees of polish and beveling. Seven show evidence of end-battering. See Table 33 for measurements of the surviving fragments.

Two of the three handstones in the Zeni collection are shaped. One was used unifacially; the other, which has been resharpened by pecking, was bifacially used. The unshaped handstone shows distinct beveling on three faces. All three handstones are complete; none displays end battering.

Handstones are generally associated with the processing of hard seeds, and they may have been so used at the Zeni site. Their small number, when compared to the number of projectile points, suggests that either seed processing was not a major activity at this site or occurred in specialized areas which were not adequately sampled. The small Zeni collection may not help resolve the issue. There is too much opportunity for collection bias with this artifact type.

Pestles

Total: 16

SJSU collection: 4 (3 greywacke, 1 meta-basalt)

Zeni collection: 12 (12 greywacke)

Two pestles and two pestle fragments were recovered by SJSU. Specimen 38-8 is a small, tapered, naturally shaped, cobble pestle, which is end-battered and spalled at the distal end. It measures 127 mm long, tapers in width from 25.6 mm at the proximal end to 44.8 mm at the distal end, with a maximum thickness of 38.7 mm. It weighs 300 g. This

pestle seems too small to have been effective for pounding acorns, and was probably used for some other purpose. Specimen 181-21 (253 mm long, 78.3 mm maximum width, weighing 1.75 kg) is an unshaped cobble of meta-basalt exhibiting significant battering and spalling on the distal end.

Of the two pestle fragments, one is a fragment of a shaped cylindrical pestle exhibiting end battering on the distal end. The second fragment appears to be the proximal end of an almost perfectly cylindrical pestle with a convex end. It exhibits, however, little to no evidence of deliberate shaping and some evidence of rounding at the "break." It may be no more than a manuport.

The Zeni collection includes 12 pestles and pestle fragments, most end-battered and spalled, suggesting that some significant pounding activity occurred at the site. Two bowl mortars found by the family, but which have since disappeared, tentatively support that supposition. Four pestles are shaped, eight unshaped. Seven pestles are complete and two almost complete. One, 8.3 cm long, is small. The remaining eight $\pm$ complete specimens average 20 cm (range 12.9 - 37.0, S.D. = 7.5) in length. Weight ranges from 326 g to over 1.6 kg, with a mean greater than 1 kg. (Two pestles weighed more than the 1.6 kg maximum for the scale.)

Possible Millingslab Fragment

Total: 1

SJSU collection: 1 (1 graywacke)

Zeni collection: 0

Specimen 181-21 is a small fragment (76 mm x 46 mm x 49 mm) of what appears to be a shaped millingslab. It has been shaped by pecking along the lateral edge, extending into the base. What remains of the top surface shows polish, shoulders and a hint of a concave surface. This artifact is so fragmentary, however, that it could also be a fragment of a shaped handstone.

Unidentified Ground Stone Fragments

Total: 2

SJSU collection: 2 (2 graywacke) (Figure 27 a)

Zeni collection: 0

Specimen 84-3 (Figure 27 a) is a graywacke cobble fragment, plano-convex in cross-section, with a groove pecked around one end. There is no other evidence of shaping. Specimen 83-1 is a small cylindrical fragment with evidence of a ground depression around about 75 percent of the circumference. Both ends show substantial end battering. Both artifacts may be proximal ends of pestles.

End-Battered Cobbles

Total: 4

SJSU collection: 4 (4 graywacke)

Zeni collection: not counted

All specimens appear to be naturally shaped cobbles. One complete specimen exhibits battering on both ends. The three fragments show battering on the single remaining end. One of the fragments (specimen 181-26) may be part of a pestle.

Manuports

Total recovered: 5

SJSU collection: 5 (1 sandstone, 1 petrified wood, 3 tremalite schist)

Zeni collection: not counted

These five small fragments, of sandstone (not indurated), tremalite schist, and petrified wood, may have been intended for sanding or scraping, but bear no clear evidence of use. Lengths range from 66 to 86 mm, widths from 11 to 53 mm.

Debitage

Debitage analysis at MEN-2136 had four objectives: First, to determine what toolstones, in what proportions, were used at the site and in what form the different materials arrived. Second, to ascertain whether those proportions held constant across the site or varied either horizontally or vertically, indicating change in material use through time. Third, to compare MEN-2136 obsidian-to-chert ratios and the relative proportions of the several obsidians present with those from other sites, in order to delineate changing interaction spheres for the peoples using the site. Finally, to calculate flakes per m³ as a measure of the relative intensity of site use.

Toolstone Sources and Locations

MEN-2136 is located in the Coastal Belt of the Franciscan Formation (Wagner and Bortugno 1982: Sheet 1). Although there are numerous chert deposits in the Central and Eastern Belts of the Franciscan, they are rare in the Coastal Belt (Bailey et al. 1964:13; Kramer 1968:2-3). There are no known chert sources near MEN-2136—the closest quarries may be 20 km or more to the east, in the Central Belt. The sparse recovery of Franciscan chert cores, bifaces, and large flakes bearing cortex supports this supposition.

About 28 percent, by count, of the chert recovered at the site is from the Monterey Formation, which, north of San Pablo Bay, occurs only west of the San Andreas fault. In Mendocino County, water-worn Monterey chert cobbles wash on-shore at Schooner Gulch and three beaches immediately to the north (Gary et al 1986:2-5). Small quantities also outcrop in the cliffs above Arena Cove, near the town of Point Arena (Kaufmann 1985). Schooner Gulch is 20 km west-northwest of the site. There are no known Monterey chert sources north of Point Arena, where the San Andreas fault veers out to sea. To the south, the closest known sources are at Point Reyes (Kaufmann 1985). Consequently, the Monterey chert recovered at MEN-2136 probably came from a 7 km stretch of coast between Schooner Gulch and Point Arena.

Monterey chert has a waxy feel and the black and/or white varieties are distinctive and easily recognized. Discriminating Monterey from dark brown- and gray-colored Franciscan cherts is more difficult. As a result, some Monterey flakes in this study

probably went unrecognized, and the counts shown here may underestimate the amount of Monterey chert in the assemblage. (There *are* black Franciscan cherts, but they are not as uniform in color, and generally lack the gloss and waxy feel characteristic of Monterey cherts.)

Obsidian was identified from each of the four North Coast Ranges sources: Mount Konocti, Borax Lake, Napa Valley, and Annadel. Konocti obsidian, which dominates the assemblage, occurs as massive flows on the southern slopes of Mount Konocti near the western shore of Clear Lake. Konocti is considered the most difficult of the glasses to knap, because of its brittleness and phenocryst inclusions (Jackson 1986:45, 61). However, it is the closest source, located about 55 km to the east of MEN-2136, in ethnographic Eastern and Southeastern Pomo territories. Borax Lake glass, the second most abundant at the site, occurs near Borax Lake on the eastern side of Clear Lake, 67 km east of MEN-2136, in Southeastern Pomo territory. Borax Lake obsidian is considered a high quality glass.

Napa Valley obsidian, found at "Napa Glass Mountain" and several other locations in that vicinity, is the highest quality obsidian recovered at the site. The Napa Valley sources are about 75 km east-southeast, in ethnographic Wappo territory. Annadel, located about 85 km to the south, near Santa Rosa, in Southern Pomo territory, is the most distant source. Only 41 flakes (0.3%) of this glass were recovered.

Recovery

Debitage was collected at MEN-2136 from all excavation units and most surface collections. Of the 32,114 obsidian and chert flakes collected, 18,785 flakes weighing 8.75 kg, recovered from 1/4 inch (6 mm) screening of units 1S1W, 3S1W, 5S1W, 7S1W, 9S1W (hereafter called the trench), 11S1W, 21S24E, and the 1993-1994 surface collections, are considered in this analysis (Table 9).

An additional 1,694 flakes weighing 140 g were recovered from 1/8 inch (3 mm) wetscreening of 15 liters from each full level and 7.5 liters from the bottom two half levels of unit 11S1W. These flakes are considered separately below.

Table 9. MEN-2136 Analyzed Debitage

UNIT	CHERT N	OBS. N	OBS. %	CHERT WT (g)	OBS. WT (g)	OBS WT %
Trench*	2,368	12,232	83.8	2,664	3,226	54.8
11S1W	453	1,176	72.2	439	386	46.8
21S24E	301	413	57.8	357	113	24.0
Corral 1N	114	552	82.9	209	162	43.7
Corral 2N	131	319	58.9	471	83	15.0
Corral 2S	93	410	77.3	208	127	37.9
Corral 2SW	53	192	72.4	122	41	25.3
Corral 2SE	47	255	81.6	82	54	39.6
TOTAL	3,560	15,225	81.0	4,551	4,191	47.9
* Trench includes units 1S1W, 3S1W, 5S1W, 7S1W, AND 9S1W						

Debitage from the analyzed units was sorted by toolstone type (Monterey chert, Franciscan chert, obsidian and quartz), then counted, and weighed. All obsidian was visually sourced by Thomas Origer, Anthropological Studies Center, Sonoma State University. Obsidian-to-chert and obsidian source percentages were calculated by unit

and level for all analyzed units (Table 34). Quartz, with the exception of two units analyzed by Michael Rondeau in 1994 and discussed below, will not be considered further.

Obsidian-to-Chert Ratios

By count, obsidian comprises 81 percent of the total debitage (obsidian plus chert), and a similar percentage of most collection units (Table 9, Chart 1). However, it drops below 60 percent in unit 21S24E and Corral 2N, suggesting the ratio may be time-sensitive when traced horizontally across the site. By weight, obsidian drops to 47.9 percent of the overall total, but still represents 54.8 percent of the trench (Chart 2). Chert is more highly represented in the weight analysis both because of a higher specific weight and a slightly larger average flake size. As a result, the average chert flake weighs 1.28 g—more than four times the 0.28 g average for obsidian flakes.

The trench at MEN-2136 shows little variation by depth (Chart 3). Obsidian, by count, comprises a slightly higher percentage in levels 3-5 than it does in the levels above and below, but the differences are small. The data suggest there was little change through time in relative usage of obsidian and chert in that area of the site. The absolute number of flakes peaks in level three, suggesting some change in intensity of use through time, but substantial mixing of the deposit leaves that but a tentative conclusion (Chart 4).

Unit 21S24E is clearly different (Chart 5). Only 714 waste flakes were recovered from 60 cm of deposit, or 529 flakes per m³—29 percent of the 1854 flakes per m³ rate recovered from the trench. Clearly, this area was less intensively used (Map 7). Although

the small number of flakes from 21S24E is subject to sampling error, especially below 40 cm, an analysis by level shows much more variation than was apparent in the trench. The ratio of obsidian to chert is lower, and appears to decline with depth. This unit is believed to have some stratigraphic integrity and the upper levels appear to postdate the most intensive period of use of the trench.

Comparing the controlled surface collections in the corral with the trench and 21S24E demonstrates differential obsidian-to-chert usage across space (Chart 1). Ratios for the trench and Corral 1N are similar, suggesting the two areas were used in similar ways (Map 7). Corral 2N compares more closely with 21S24E, both exhibiting similar, but lower, obsidian-to-chert ratios. Corral 2SE and 2SW differ from the other four units mainly in the relative proportions of the different sources of obsidian (see below).

Obsidian-to-chert ratios are highest in the trench and in Corral 1 North, immediately to the east, and lowest in Corral 2 North, still further east, and in unit 21S24E. There appears to be a gradient running from north to south in the trench, with obsidian, by count, comprising 86.7 percent of unit 1S1W, 78.5 percent of unit 9S1W, and declining to 72.3 percent in unit 11S1W.

To summarize, obsidian and Monterey chert both have their highest frequencies in the trench and adjacent corral 1N. Both decline (obsidian relative to chert and Monterey relative to Franciscan) to the south and east.

Chert Usage

Of the 3,569 total chert flakes analyzed, 28.1 percent are Monterey chert and 71.8 percent Franciscan chert (Table 10). The pattern detected in the obsidian-to-chert ratios appears to repeat in the Monterey-to-Franciscan chert ratios: there is a higher percentage of Monterey chert in the trench and Corral 1N than in unit 21S24E and all subdivisions of Corral 2. No significant change in the Monterey-to-Franciscan ratio with depth was detected.

Table 10. Occurrence of Monterey and Franciscan Cherts

UNIT	MONT. N	FRAN. N	MONT. %	MONT. WT (g)	FRAN. WT (g)	MONT. WT %
Trench*	749	1,619	31.6	643	2,021	24.1
Corral 1N	34	80	29.8	48	161	23.0
21S24E	61	240	20.3	67	290	18.8
Other	158	619	20.3	183	1,132	13.8
Total	1,002	2,558	28.1	948	3,604	20.8
* Trench includes units 1S1W, 3S1W, 5S1W, 7S1W, AND 9S1W						

Obsidian Usage

Of the 15,225 obsidian flakes sourced, 82.5 percent are Konocti, 9.7 percent Borax Lake, 6.8 percent Napa Valley, 0.3 percent Annadel and 0.7 percent either from unknown sources or too small to source. (Similar proportions result when analyzing by weight.) Although there is variation in source ratio among the different units, Corral 2SE is significantly different (Table 11). In this unit, Konocti drops to 71.6 percent of the obsidian and Napa and Annadel increase to 15.4 percent and 5.8 percent, respectively. The Corral 2SE sample of 208 flakes is small, and thus subject to sampling error. But,

that anomalous representation of Napa and Annadel obsidians is supported by the 664 flake combined sample from Corral 2S, 2SW, and 2SE, where Napa comprises 9.5 percent and Annadel 4.4 percent of the obsidian—still substantially higher than their presence in the other units.

The surface collection from Corral 2SE may represent late period use: half of the 10 Rattlesnake series points recovered by SJSU were collected in this area. This suggests an increase in use of Annadel and Napa obsidian at that time, a phenomenon also noted at Warm Springs (Bouey 1986:236).

Table 11. Obsidian Relative Source Percentages by Unit

UNIT	N	K %	B %	N %	A %	U %
Trench	12,232	81.8	10.1	7.3	0.1	0.7
21S24E	413	86.0	11.4	1.9	0.0	0.7
Corral 1N	552	88.4	7.6	3.6	0.4	0.0
Corral 2N	188	84.0	11.7	3.2	0.5	0.5
Corral 2SE	208	71.6	6.7	15.4	5.8	0.5
Corral 2SW	139	86.3	5.8	5.0	2.9	0.0
Corral 2S ⁺	664	78.2	7.7	9.5	4.4	0.3
Total	15,225	82.5	9.7	6.8	0.3	0.7
* Trench includes units 1S1W, 3S1W, 5S1W, 7S1W, AND 9S1W						
+ Includes Corral 2S, 2SW, and 2SE						

Flake Size-Class Analysis

Debitage from unit 7S1W was analyzed for flake size and type to help determine how toolstone arrived at the site. This unit was selected because its debitage was still intact; no flakes had been removed for hydration analysis. The 3,349 flakes found in the

unit were divided into size classes by placing each flake on a set of five concentric circles and determining the largest circle intersected by the flake (maximum dimension). The resulting size classes are <1, 1, 1.5, 2, 3, 4, and ≥ 5 cm. The results, by toolstone, are plotted in Chart 6. The obsidian flakes are smaller than the chert flakes, with more than 75 percent under 1.5 cm and only 13 flakes (0.5%) 3 cm or larger. The Borax Lake flakes are slightly smaller than those of Konocti and Napa—86 percent measure less than 1.5 cm. The large number of small flakes and the virtual absence of large flakes strongly suggest little to no primary reduction of obsidian occurred on site.

The chert distribution is also skewed toward the smaller sizes, but not as radically: 59 percent of the Monterey chert and 54 percent of the Franciscan chert flakes are under 1.5 cm, while 3.3 and 8.1 percent, respectively, are ≥ 3 cm. This distribution suggests that chert was worked in a wider variety of ways than was obsidian and, coupled with the 13 small chert cores also recovered, suggests there may have been some primary reduction and thinning of blanks at MEN-2136.

One-eighth inch (Three mm) Screen Recovery

The size-class analysis of unit 7S1W (above) worked with debitage recovered from 1/4 inch (6 mm) mesh screens. The only use of 1/8 inch (3 mm) screens at MEN-2136 was in unit 11S1W, where 15 liters from each full level and 7.5 liters from the bottom two half-levels of 11S1W were wet-screened through 1/8 inch (3 mm) mesh. Artifacts and debitage were recovered from the wet-screen in the field, but the screen

residuum was reanalyzed in the lab. Results discussed below include the debitage recovered by both techniques.

Unfortunately, Unit 11S1W was heavily disturbed. A redwood stump appeared in the southwest corner in level 2, and the side walls showed evidence that the Zenis had tried to burn out the stump. Large roots appeared throughout the unit. As a result, although the amount of wet-screened deposit is known, the amount passed through 1/4 inch screens was not measured and is difficult to calculate. Nevertheless, the 1/8 inch screen results provide at least qualitative data. First, 1,694 flakes were recovered from 105 liters of deposit, an intensity of 16,133 flakes per cubic meter. That is almost 10 times the 1,620 flakes per cubic meter recovered from 1/4 inch screens in 9S1W, the closest undisturbed unit. This suggests that 90 percent of the flakes in the trench area are less than 6 mm in size, and were lost in the 1/4 inch recovery. Basgall (1983:67-68), found a similar relationship on the main terrace at SON-571, where 1/8 inch screens yielded 9 times the flakes found in 1/4 inch screens. The large number of small flakes is consistent with rejuvenation and edge finishing activities and not early stage reduction.

Table 12. Unit 11S1W Debitage by Source by Screen Size

SCREEN SIZE	TOT #	CHRT #	M %	F %	OBS #	K %	B %	N %	OBS %
1/8"	1,694	544	16.2	83.8	1,150	81.4	10.4	6.2	67.9
1/4"	1,629	453	21.0	79.0	1,176	88.1	7.3	4.1	72.2

Comparing the toolstone ratios from 1/4 and 1/8 inch mesh screens (Table 12) shows differences between the screens types. The higher Monterey-to-Franciscan chert ratio in the 1/4 inch recovery is not significant ($\chi^2 = 3.79$, $df=1$, $p @ 0.05 = 3.84$), but

the lower percentage of obsidian and higher proportions of Napa Valley and Borax Lake obsidians in the 1/8 inch recovery are statistically significant ($\chi^2 = 7.33$, $df=1$, @ $p = 0.01$; $\chi^2 = 14.33$, $df = 2$, @ $p = 0.01$). The latter may reflect more frequent edge finishing of the better toolstones.

The higher percentage of chert in the smaller screen is harder to explain. This unexpected result may be the consequence of differences in recovery technique rather than a cultural effect. Chert is harder than obsidian to see in the field, and thus more likely to be missed in dry screen recovery than when sorting washed material under magnification in a laboratory. If this is the explanation, the obsidian ratio for MEN-2136, which was calculated from the 1/4 inch dry screen recovery, may be slightly overstated.

Cortex

The presence of cortex can be an indication of primary reduction. Only 80 flakes from 7S1W, 2.4 percent of the total, exhibit cortex: 1.6 percent of the obsidian and 6.9 percent of the chert. A larger proportion of the large flakes show cortex: 5.3 percent of those ≥ 1.5 cm (12.8% of those ≥ 2 cm), compared to 1.4 percent of those < 1.5 cm. The presence of cortex does differ by type of toolstone:

MATERIAL	M	F	K	B	N
% Cortex	6.0	7.2	0.9	1.5	9.8

These results suggest that while a small amount of the two cherts may have been reduced on site, virtually no Konocti or Borax Lake obsidian came to the site in cobble form. The presence of cortex on 9.8 percent of the Napa flakes is anomalous. It may

reflect small natural cobble size at the source. More Napa obsidian artifacts exhibit cortex than do those from other sources.

Flake Type

Michael Rondeau (personal communication 1994) separated the 7S1W flakes by type: single-facet platform flakes; multiple-facet platform flakes; biface-edge flakes; angular waste; and flake fragments (defined as less than 90 percent of a complete flake). Chart 7 displays the percentages of flake fragments, angular waste chips, and complete flakes by toolstone. There are small differences between the toolstone types. Napa obsidian and Monterey chert show the highest percentage of complete flakes, while the percentage is the smallest for Konocti, possibly the product of flake breakage due to the phenocryst inclusions. The presence of some chert angular waste supports a low level of primary reduction of those materials.

Analyzing the complete flakes by type again shows a difference in the handling of obsidian and chert; approximately 80 percent of the obsidian flakes (compared to less than 60 percent of the chert flakes) are either biface-edge flakes or multiple-facet platform flakes. These two flake types are considered indicative of biface manufacture, but can also result from biface thinning and tool rejuvenation. The latter seems most likely at MEN-2136. More than 40 percent of the chert flakes are single-facet platform flakes, sometimes indicative of primary reduction, but also of early stage biface manufacture and formal-flake-tool rejuvenation. The few chert bifaces, cores, roughly shaped tools, and unfinished drills document some “biface” manufacture on site.

Intensity of Use

Comparisons of debitage densities (per m³) must be made with caution, because different environments lead to different rates of sediment deposition. The Zeni site is near the top of a ridge, where little sediment accumulation from downslope movement can be expected. As a result, the amount of debitage recovered from 1/4 inch screens, per unit volume, may be inflated. The trench produced an average of 1,854 flakes per m³, a higher recovery rate than most other sites. In comparison, unit 21S24E, 2.5 m lower in elevation and 38 m east-southeast of unit 9S1W, contained only 529 flakes per m³. The latter area must have been used less intensely, but may also have accumulated deposit at a slightly higher rate. Rough measures of differential site use can be determined from the 1993-1994 surface collections, although the owners' collecting activities may have affected the results. In Corral 1N, SJSU recovered 1.2 flakes per m². That is 3.5 to 4 times the density found in the Corral 2 subdivisions (2N = 0.27, 2SW = 0.28, 2SE = 0.34 flakes per m²) suggesting a core usage area around the trench, with less usage to the east. Unfortunately there is no data for the rest of the corral.

Quartz

Quartz was collected in all units, but not analyzed. Approximately 184 pieces were recovered from the analyzed units in the trench, about 1.2 percent of the total debitage had quartz had been included in the counts. Michael Rondeau (personal communication 1994) looked at 75 flakes from units 7S1W and 11S1W. He identified 64 (85.3 percent) flake fragments, 10 (13.4%) pieces of angular waste, and 1 (1.3%)

complete flake with a single-facet platform. Thirty-eight (50.7%) flakes exhibit cortex. Rondeau concludes that primary reduction of quartz took place on site, but sees no evidence of later stages of biface manufacture. Quartz, although a difficult material to work, does occur in the vicinity of MEN-2136. The absence of local sources of the better toolstones and the presence of six quartz artifacts suggest there was some attempt to utilize the locally available material.

Comparison to Other Sites

An analysis of obsidian debitage recovered from sites west of the Russian River indicates that Konocti is the predominant obsidian at sites located in the region between Warm Springs and Navarro. Further north, Borax Lake obsidian more frequently dominates, though both sources are usually well represented. On the coast, south of Haven's Neck, usage of Konocti obsidian drops precipitously. At Salt Point, Dowdell (1995) recovered mostly Napa and Annadel glasses, with only minor amounts of Konocti.

Table 13. Obsidian Proportion by Source - Selected North Coast Ranges Sites

Site	K	B	N	Reference
SON-571	84.9	13.3	1.8	Basgall and Bouey 1991:175
SON-1471	92.5	0.4	3.8	Stewart 1993:104
MEN-1802/2220	99			Rondeau 1985:47, 1990:26
MEN-2136	82.5	9.7	6.8	
MEN-1929	85.0	11.6	3.4	Hamilton nd
MEN-2138	74.9	24.1	0.9	Manerey 1990:119
Albion Head	43.4	53.2	2.4	Layton 1990:Tables 2.12-2.14
MEN-500	37.7	60.3	0.7	SJSU
MEN-1805	17.6	79.7	0.7	Layton 1990:Table 3.12

With the exception of Rockpile Road (SON-1471), Borax Lake is the second most prevalent obsidian in the area where Konocti dominates. Napa appears at a low level in most of these sites, although apparently only in trace amounts at MEN-1802/2220, and actually represents a larger proportion at MEN-2136 than at SON-571, in spite of the much greater distance from the source. Napa recovery drops off as one goes north: 3.4 percent at MEN-1929 and 2.4 percent at Albion Head, but less than 1 percent at MEN-1805, MEN-2138, and MEN-500. S. Stewart (1993:Map 7) suggests Borax Lake was traded north around the east side of Clear Lake, while Konocti obsidian moved up the Russian River on the west. This data partially supports her assertion, because Borax Lake is a higher proportion of the obsidian in the north. However, there is more Konocti than expected at MEN-2138, in Redwood Valley, and MEN-500, near Willits, suggesting the model is more complex. There is probably a time dependency in the trade pattern which is not captured in Table 13.

Obsidian-to-chert ratios are more variable. Layton (1990:3) found a sudden increase in use of obsidian to be an indicator of the arrival of the Pomo, but that does not require obsidian dominate the debitage. The 81 percent obsidian ratio found at MEN-2136 compares to 76 percent at MEN-1802 and MEN-2220, 80 percent at SON-1471 and 88 percent on the main terrace at SON-571 (Rondeau 1985, 1990; Stewart 1989; Basgall 1983:33). But obsidian is a much lower percentage at MEN-1929 (39.4%), MEN-1805 (30% in Component 2), MEN-1930/32 ($\leq 17.5\%$) and MEN-790 (7.5%), sites further from obsidian sources and relatively closer to chert sources (Hamilton nd; Layton 1990; Gary nd).

Summary

Both Monterey and Franciscan chert and all four major North Coast Ranges obsidians were recovered at MEN-2136. Obsidian, by count, was 81 percent of the total debitage. However, the obsidian-to-chert and Monterey-to-Franciscan chert ratios and the proportions of the various obsidian sources appear to change with time. The lower proportion of obsidian and Monterey chert and higher proportion of Konocti found in the temporally later components may indicate more circumscribed territories and restricted access to some toolstone sources later in time. Corral 2, particularly Corral 2SE, showed higher concentrations of Napa and Annadel obsidians, which may document short periods of different exchange relations or usage by a different group of people with different obsidian access.

Analysis of the debitage suggests that although there may have been some early-stage processing of chert, very little primary reduction occurred on site. Most of the toolstone must have arrived either as formed tools or roughouts, with on-site processing restricted primarily to rejuvenation and possibly edge-finishing.

With respect to obsidian, MEN-2136 appears to be on the distribution route for Konocti, which dominates obsidian at the upper Dry Creek sites at Warm Springs and sites west of the Russian River as far north as MEN-1929. Understanding the distribution of Borax Lake and Napa is beyond the scope of this thesis. Although the higher proportions of Borax Lake in the more northerly sites might support Stewart's thesis that Borax Lake was traded north around the east side of Clear Lake, the higher percentage of

that glass at SON-571 than at MEN-2136 implies that it can't be the only route. The proportion of Napa in the sample appears to decline with distance from the source, but that is not sufficient to explain the result. Different distribution systems at different times may ultimately account for the results.

Artifacts of Euroamerican Manufacture

One hundred fifty-three artifacts of Euroamerican manufacture were recovered from the SJSU excavations and surface collections. These include 34 pieces of glass (25 clear, five green, four amber), 11 iron fence staples, 17 iron nails, one iron clasp, one iron bar, one brass tack, one unidentified brass object, one clothing tag, three porcelain sherds, four cartridges, and 79 metal fragments (1 aluminum, 78 steel), most likely parts of cans. Five glass fragments (one clear, one green, three amber), from three units and the surface, show evidence of crushing. There is no evidence of use of MEN-2136 by Native Americans during the historic period—the crushed glass is most likely unintentional. The Euroamerican artifacts, which almost certainly date to the Zeni Ranch period, will not be described further.

The depth distribution of these artifacts, however, provides a measure of site disturbance. One hundred forty-six (95%) were either found on the surface or within the plow zone (upper 30 cm). Seven items from five different units range in depth from 30 to 60 cm. Their location is most likely the result of rodent action and earth-disturbing ranching activities such as digging post holes. The provenience of all Euroamerican artifacts, by unit and level, is summarized in Table 14.

Table 14. Euroamerican Artifact Provenience

	TPT 1	1S1W	2S1W	3S1W	4S1W	5S1W	7S1W	8S1W	9S1W	11S1W	21S24E	TOTAL
SURFACE												8
0-10	2	6	2	1	3	6	2	1		9	3	35
10-20	3	5	7			1	2	4		68	2	92
20-30	2			1			2	1		4	1	11
30-40							2	1				3
40-50		1		1	1							3
50-60		1										1
60-70												0
TOTAL	7	13	9	3	4	7	8	7	0	81	6	153

FAUNAL REMAINS

Little can be learned from the poorly preserved bone recovered at MEN-2136. The acidity of redwood belt soil, combined here with high precipitation levels, acted to dissolve faunal remains, reducing even burned/calcined bone to small fragments. A total of 1,111 bone fragments, weighing 251.7 g, was recovered. Of the total, 832 fragments (74.9%) weighing 234.8 g, were found in 1/4" (6 mm) screens, 273 (24.6%), weighing 15.2 g, in the 105 liters from unit 11S1W wet screened through 1/8" (3 mm) mesh, and 6 (0.5%), weighing 1.7 g, in surface collections. All recovered bone had been burned; all but six fragments were calcined. Only two specimens, both calcined, were identifiable. The remaining fragments, weighing an average of 0.23 g each, were sorted into small, medium, and large mammal bone by Dwight Simons. As might be expected from this heavily biased sample, 99 percent of the fragments were judged to be from large

mammals (deer or larger). Charts 8 and 9 display 1/4" (6 mm) faunal recovery of all unidentifiable bone fragments by level and unit, respectively.

The two identifiable fragments were both distal metapodials of small black-tailed deer (*Odocoileus hemionus*). One was recovered in unit 7S1W level 1, the other in unit 21S24E level 4. Although unit 21S24E shows some stratigraphic integrity below the plow zone, obsidian hydration results suggest there was still downward mixing. Given the poor preservation of most of the faunal collection, both metapodial fragments are most likely from deer procured during the historic period by the Zeni family.

FLORAL REMAINS

Burned acorn hulls collected from screens during the 1988 excavations were analyzed by Eric Wohlgemuth, of Far Western Anthropological Research Group, Inc. From that sample, he identified 212 burned acorn hull fragments, one unburned acorn shell (4S1W 0-10 cm), 11 unidentifiable fragments, and 33 pieces of wood charcoal (Table 15). Acorn hull fragments were found in all units, but were concentrated in unit 8S1W (55%). This concentration *may* be significant. Of the seven manos and three pestles excavated, five mano fragments and two pestle fragments were recovered from unit 8S1W and the adjacent 9S1W (Table 33). However, a more probable explanation for the uneven acorn hull distribution is excavator bias. The lower levels of Unit 8S1W were excavated by experienced archaeologists. The remaining units were excavated by students with no previous experience.

It may be significant that acorns were found only below 40 cm (30 cm in 21S24E) (Table 15). They were first recognized at that level in the initial group of units excavated (1S1W, 2S1W, 3S1W, 8S1W, and 9S1W) and collected thereafter. For the first days of the excavation, all student screens were checked. If acorn hull fragments had appeared in the upper levels, they would have been recognized by the checkers. Acorn hulls should have been pulled from all levels of the second group of units excavated (4S1W, 5S1W, 7S1W, and 21S24E). Hulls were found above 40 cm only in 21S24E, a unit whose stratigraphy differs from those of the trench. Unfortunately, acorn hulls were not selected for recovery from unit 11S1W.

Table 15. MEN-2136 Floral Recovery

UNIT	LEVELS	# ACORN FRAGMENTS	# NOT IDENTIFIED	WOOD CHARCOAL
1S1W	40-70	12	-	2
2S1W	50-70	13	-	-
3S1W	50-70	8	2	-
4S1W	40-60	35*	-	6
5S1W	60-70	1	-	-
7S1W	40-70	8	-	4
8S1W	50-80	116	-	2
9S1W	50-60	2	-	-
21S24E	30-60	17	9	19
Total		212	11	33
* plus 1 unburned shell in 0-10 cm level				

Did acorn processing occur at MEN-2136? Possibly. The Zenis found two bowl mortars (since lost) and 12 pestles (several of them large) on their property, but SJSU recovered only a small number of grinding implements and probably too limited a range of artifact types for the site to have been more than a seasonally occupied camp. Why,

then, would acorn processing have occurred here? Was the site used in the fall while acorns were gathered from local tan oaks, with some "sampling" of the new crop? Could the Zeni Ranch have been a location for a harvest festival, where multiple groups gathered to hunt deer, elk, and rabbits and to gather acorns? Such festivals are not noted in the ethnographies for the Pomo, but were practiced by other California Native American tribelets. Or, are the recovered hulls the remains of wormy acorns left behind, burned in some later fire? Do they just mark the location of a long-vanished tan oak tree? At best, the recovered, burned acorn hulls suggest some Native American use of acorns may have occurred here.

Other botanicals present in a redwood forest which might be found in 1/4" screens include hazelnut, wild cucumber, bay nut, and manzanita. The latter three, however, tend to break into smaller fragments, and might not be recovered in large screens (Eric Wohlgemuth, written communication 1995). None of these were excavated in 1988.

No botanicals were collected from screens during the excavation of unit 11S1W in 1993. Instead, 105 liters of soil were floated, in an attempt to collect smaller seeds. The flotation recovery from that unit was sent to Charles Miksicek at BioSystems Analysis, Inc. for macrobotanical analysis. Because of the disturbed nature of 11S1W, we agreed initially to test two levels (four and seven). Only one culturally significant food resource was identified: six charred hazelnut shell fragments in level four and two in level seven. Because of the large amount of charred wood from the Zeni's burning of the redwood stump, relative to the small amount of potentially relevant food resource, we abandoned

the analysis. This small sample does, however, offer evidence for use of hazelnuts, which ripen in August through October (Simons 1990).

FEATURE 1

A rock feature, approximately 40 cm in diameter and 15 to 20 cm in height, was uncovered in unit 1S1W, beginning 31 cm below the surface (just below the plow zone). The sides and top, but apparently not the bottom, were composed of rocks 5 to 10 cm in length. Some showed evidence of burning. The interior of the feature was filled with charcoal and charcoal flecks mixed with midden. The top layer of rocks was removed and the enclosed charcoal/midden trowelled to plastic bags—the remainder left pedestalled (Figures 9 and 12). Approximately 20 g of wood charcoal (species not identified) was submitted to Beta Analytic for radiocarbon dating (see Radiocarbon Date, below). During dry-sorting of the excavated matrix (after removing the carbon sample) one Franciscan chert flake, one Konocti projectile point tip and 24 obsidian flakes (17K, 2B, 3N, 2U) were recovered.

The feature may have continued into unit 2S1W. The 30-40 cm level sheets for that unit depict a probable hearth, with fire cracked rock and charcoal, extending approximately 35 cm along the north edge of the unit (measured from the west wall) and intruding into the unit 5 to 10 cm. The feature diagram in unit 1S1W, however, depicts a 10 cm gap between the southern edge of the feature and the southern edge of the unit. Perhaps the true extent of the feature was not recognized in the field. Alternatively, the “hearth” may originally have been larger or in a slightly different position.

The feature resembles ethnographically described earth ovens, but is considerably smaller. Stewart (1989:30-31) uncovered a feature with similar dimensions at SON-1471. There, burnt soil extended 10 cm below the base of the rock circle, and additional rocks (but no additional charcoal) were encountered in adjacent units. Charcoal from the feature was radiocarbon dated to 1040 ± 70 B.P. (AD 950, corrected) (Stewart 1989:107).

FEATURE 2

The remains of a burned redwood stump were discovered 10 to 50 cm below the surface in the southwest corner of unit 11S1W. The feature extended north about 50 cm and east 40 cm from the southwest corner, and included 60 rocks larger than 8 cm in length, many heat fractured and spalled. The two largest measured 23 and 31 cm in maximum dimension. Evidence in the unit stratigraphy suggested that the Zenis had tried to burn out the stump (confirmed by George Zeni). It is likely that the rocks were previously thrown into the hollow trunk while preparing the surrounding land for cultivation. No artifacts were recovered from 1/4 inch (6 mm) screens above 30 cm. Between 30 and 50 cm, two projectile point medial fragments (K), one biface medial fragment (M), and 108 debitage flakes (8M, 21F, 65K, 12B, 2N) were recovered.

RADIOCARBON DATE

The charcoal from Feature 1 submitted to Beta Analytic for dating produced a conventional radiocarbon age of 1590 ± 60 B.P.⁹ (Beta-73006). Adjusting for $^{13}\text{C}/^{12}\text{C}$ ratio and applying dendochronological calibration yields a calendar date of AD 450, with a two sigma range of AD 370 to 620 (1330 to 1580 years before AD 1950). Using the

Warm Springs chronology, AD 370 to 620 spans the penultimate quartile of the Dry Creek Phase, consistent with projectile point evidence for the major period of use at MEN-2136.

Hydration rims on 10 obsidian flakes were measured by Origer. Rims on five Konocti flakes measured 2.4, 2.5, 2.5, 2.5, and 2.6 μ (mean = 2.50, S.D. = 0.07). The two Borax Lake flakes measured 2.9 and 3.0 μ (equivalent to 2.3 and 2.4 μ K using Tremaine's [1989a:3] conversion formula). Those seven flakes are tightly clustered (mean = 2.45 μ [K], S.D. = 0.10), suggesting a cohesive feature. The Napa results, however, were anomalous, measuring 2.8, 3.6, and 4.7 μ . The 2.8 μ reading might be contemporaneous, but the other two clearly are not. Still, the tight clustering of 70 percent of the measurements suggests feature integrity. The Napa rims may be the result of scavenged obsidian, "old quarry" surfaces, or intrusions from the older levels into which the feature was dug.

Correlating the radiocarbon date with the hydration results is complicated by the temperature dependence of obsidian hydration. Origer's (1987:58) hydration rate formula for Napa obsidian, valid for the area around Santa Rosa, is 153.4 times the square of the hydration rim measurement (in μ). Substituting the mean hydration measurement of the Konocti and (converted) Borax Lake specimens yields 922 B.P., some 580 years later than the radiocarbon date. Correcting the rim measurements for the approximately 2.5°C difference in effective temperature between Santa Rosa and the site, using a 6 percent per °C adjustment factor (see Obsidian Hydration section), the 2.45 μ measured mean converts to 2.82 μ , and Origer's formula yields 1220 B.P., still 110 years less than the

minimum of the two sigma range of the radiocarbon date. What are the possible explanations?

1. The radiocarbon date may overstate the age of the feature. Radiocarbon date calibration assumes a 20 year “life” for the carbon being dated. The wood, especially if redwood, burned in the feature was most likely older than that. Charcoal chunks were selected for dating (presumably the core of whatever was burned), probably exacerbating the problem.

2. The temperature effect on hydration at the Zeni site may be underestimated, either because the effective temperature is lower than the assumed 14.7°C or because the temperature effect exceeds 6 percent per °C. Using a 7 percent adjustment per °C (Basgall and Hildebrandt 1989:198), the 2.5 μ average for the Konocti flakes (see point 3), and a 100 year “old wood” effect, reconciles the radiocarbon and hydration dates at about 1,400 years ago.

3. Tremaine’s constants may overadjust Borax Lake to Konocti rates. The converted average for the two Borax Lake flakes is 2.33 μ , compared to the 2.5 μ mean of the Konocti flakes. An adjustment factor of 0.847 rather than 0.79 (within one standard deviation of Tremaine’s derived ratios [Tremaine 1989b:68] would convert the B flakes to 2.5 μ . Using the Konocti mean of 2.5 μ , with a 6 percent temperature adjustment, yields 1268 B.P., just outside the two sigma band on the radiocarbon date.

4. Konocti obsidian may hydrate slightly more slowly than Napa (Basgall 1993). Assuming a 1.06:1 conversion rate for Napa to Konocti translates the Napa 2.8 μ reading to 2.6 μ , more in line with the Borax Lake and Konocti readings. Adjusting the 2.5 μ

average Konocti rim depth by 1.06 for the rate difference, plus 1.15 for the temperature difference, and substituting into Origer's formula yields a date of 1425 B.P., consistent with the radiocarbon date. But, that is a chain of convenient, but hardly unbiased, reasoning.

5. Origer's formula may underestimate the age of the artifacts.

In summary, we have a radiocarbon date for a feature which most likely is prehistoric (based on the consistent hydration data), and dates to 1600 to 1300 B.P. Due to a possible "old wood" effect, the later end of the range is probable. We also have a hint of support for a Konocti hydration rate somewhat slower than Napa's and a Borax Lake rate closer to 20 percent rather than 27 percent faster than Konocti's (Basgall 1993).

CHAPTER SEVEN

OBSIDIAN HYDRATION ANALYSIS

Introduction

Obsidian Hydration analysis is a relative dating technique based on the propensity of volcanic glass to adsorb water. The adsorption rate is believed to be constant, but dependent on the chemical composition of the glass, the reaction temperature, and a number of other, less well understood factors, such as relative humidity, soil pH, and depth of burial. Water adsorption begins when a new surface is created, whether deliberately in forming the edge of a tool, or unintentionally through breakage. The depth of penetration of water into the glass, viewed with a polarizing microscope, provides a relative measure of time since the analyzed surface was exposed.

Hydration measurement was first proposed by Friedman and Smith (1960). They predicted that the technique would eventually allow absolute dating of glass with a reliability analogous to radiocarbon analysis of organic material. Their prediction was overly optimistic. Although in the last 30 years many of the initial problems with the technique have been resolved—facilitated by the recognition that obsidians from different flows of different compositions hydrate at different rates—other problems remain unresolved. Although most archaeologists assume all samples from a single source have a uniform composition, that may not be the case. Stevenson et al. (1993) assert that the

intrinsic water content varies within volcanic flows, producing variation in the hydration rate. This paper ignores that possibility.

Theoretically, because hydration is a diffusion process, it should be possible to convert hydration measurements to calendric dates by squaring the rim depth and multiplying by some constant. But, there is no consensus that obsidian hydration conforms to theory. A number of hydration rates, using linear as well as exponential functions, have been proposed for North Coast Ranges obsidian sources, but most have been discarded for their inability to produce useful results. Attempts to derive hydration rates by inducing hydration at high temperatures (Michaels et al. 1983) have not been successful: the derived rates generate impossible dates for tested artifacts, suggesting that hydration may operate differently at elevated temperatures. Origer (1987:55-58) derived an hydration rate for Napa and Annadel obsidians in the Santa Rosa area by selecting only radiocarbon dates with tightly associated obsidian artifacts, and substituting into the diffusion equation. His formula for Napa obsidian: Time (before present in years) = $153.4 \times \text{rim depth squared (measured in microns } [\mu])$. Origer's formula appears to generate useful dates for the past 2000 years (the span of his radiocarbon data), but is less successful with older specimens.

The four obsidian sources commonly found in southern North Coast Ranges sites (Mount Konocti, Borax Lake, Napa Valley, and Annadel) have distinct macroscopic profiles, thus most artifacts and debitage from these sources can be identified visually. Tremaine (1989a) has facilitated the comparison of hydration measurements from these sources through a series of carefully designed induced-hydration experiments. She

determined hydration-rate ratios for each of the four sources, and calculated comparison constants which can be used to convert these measurements to a common rate. Tremaine contends that the hydration-rate ratios for the four glasses are unaffected by time or temperature, allowing intra-site comparison of artifacts produced from different obsidians sharing similar post-depositional environments. Although Tremaine's ratios may not be quite constant (there is evidence for variation in the relative rates, albeit small), her correlations allow us to monitor and compare changes in obsidian use from multiple sources through time, and to relatively date temporally diagnostic artifacts manufactured from these glasses.

This paper will use hydration measurements primarily for relative dating. In the discussion and conclusions sections Origer's (1987) Napa hydration rate formula will be used to calculate tentative calendric dates. This paper will discuss the effect of temperature adjustment on hydration distribution plots when comparing sites in different temperature environments, but the data depicted has not been adjusted for temperature.

Research Goals

Obsidian hydration analysis at MEN-2136 addresses four primary objectives:

1. to determine the initial appearance and duration of use of obsidian at the site;
 2. to investigate changes in obsidian source use and thus exchange patterns through time;
 3. to monitor vertical and/or horizontal stratigraphic integrity; and
 4. to help in component definition.
-

Over 76 percent of the obsidian tools and 82 percent of the obsidian debitage SJSU recovered at MEN-2136 was made from Konocti (K) obsidian. Napa Valley (N) glass, which comprises only 7.4 percent of the tools and 6.8 percent of the debitage, is believed to hydrate at the same rate as Konocti (Tremaine 1989a:3). Borax Lake (B) obsidian, comprising about 15 percent of the artifacts and 9.7 percent of the total debitage, however, hydrates about 27 percent faster, while Annadel (A) glass, barely represented at the site (0.3%), hydrates about 23 percent slower. To compare the temporal use of the various sources, all hydration measurements have been converted to the Konocti rate ($K = 0.79 \times B$; $K = 1.3 \times A$; and $K = N$). The following discussion and the majority of the accompanying charts use the converted measurements. Measured (unconverted) hydration rim depths are listed in the artifact attribute tables and the flake obsidian hydration measurement tables¹⁰. A few charts, with X-axes labeled “Microns (B),” display unconverted Borax Lake rim measurements. In order to smooth curves including converted measurements, Borax Lake and Annadel rim depths have been recalculated to two decimal places for use in the conversion formula. The Methods section (Chapter 5) discusses the conversion process in more detail. Double hydration bands, when they occurred, were considered evidence of reuse, and only the smaller measurement has been used in the charts displayed here. Measurements for the second band are listed in the artifact and flake obsidian hydration tables.

Hydration was measured on a total of 913 specimens (excluding the 22 which are discussed in other sections of this report). Thin-sections were prepared by Glen Wilson, San Jose State University Obsidian Hydration Laboratory; Thomas Origer,

Anthropological Studies Center, Sonoma State University; students in SJSU obsidian hydration classes (1989, 1992, 1994); and the author. All hydration measurements used in this report were made by Origer or Wilson. Late in the preparation of this thesis we discovered that the SJSU Obsidian Hydration Lab was missing or over-reading some small hydration bands (rims $< 1.5 \mu$, unconverted). All of the artifacts and some of the flakes which SJSU had recorded as "No Visible Hydration Band" were re-read by Origer. It is likely that a few readings currently recorded in the range between 1.5 and 2.0 μ have bands which are actually less than 1.5 μ , and a few (maximum = 16) of the remaining flake slides listed as NVB have, in fact, small hydration bands. All readings falling under 2.0 μ will be re-read and tables updated by the end of 1996. For readings above 2 μ , Origer's and Wilson's measurements on slides they have both read are generally within the 0.2 micron error threshold.

The measured sample includes: all typeable obsidian projectile points (193 useable readings); 26 projectile point midsections and tips; eight obsidian scrapers and modified flakes; one obsidian biface; and 623 debitage flakes. To increase the size of our sample of Rattlesnake series points, the Zeni family allowed us to cut eight arrow tips from their collection.

Of the 913 slides prepared, 53 showed no visible hydration band, diffuse hydration, or were improperly prepared. Another four readings, exceeding 5.0 μ (K), were considered to be old quarry surfaces, and have been ignored in this study. One 0.8 μ Borax Lake reading has also been discarded as a recent surface. The composition of the remaining 855 measurements is shown in Table 16.

Table 16. MEN-2136 Obsidian Hydration Analysis Sample

SOURCE:	SAMPLE				
	K	B	N	A	TOT
Leaf-Shaped Points	137	28	11	1	177
Mendocino Concave Base	2	1	-	-	3
Willits Series	-	-	1	-	1
Rattlesnake Series	1	2	1	-	4
RCN (Zeni collection)	3	1	3	1	8
Projectile Point Frags.	25	2	3	-	30
Bifaces	1	-	-	-	1
Tools	4	1	3	-	8
Flakes	321	156	137	9	623
TOTAL	494	191	159	11	855

Debitage

Debitage flakes for hydration analysis were selected from three trench units and 21S24E. Initially, five flakes per level of Konocti, Napa, and Borax Lake glass from 1S1W, 3S1W, and 5S1W were selected, cut, and measured. Measuring additional flakes from units 1S1W and 3S1W allowed normalization of the sample to reflect proportional representation by level for each source for those units. Finally, additional Konocti flakes from 3S1W were cut to attain a statistically sufficient sample of Konoctidebitage from that unit. Debitage from 21S24E was sampled proportionally by level for each obsidian source. There is probably some sample bias towards larger flakes (although none are very large). The students who prepared the slides were instructed to select flakes ≤ 1 cm, but did not always follow the directions.

The proportions ofdebitage (with useable readings) analyzed, as a percentage of the totaldebitage of each source, are as follows:

	Sample	K	B	N	A
1S1W	155	2.7%	19.0%	25.6%	100.0%
3S1W	245	6.7%	27.6%	25.3%	
5S1W	95	1.8%	11.8%	18.2%	
21S24E	122	26.0%	46.8%	100.0%	

In addition to the three Annadel flakes from 1S1W, six Annadel flakes from the Corral 2SW and 2SE surface collections were measured to date use of that glass.

Hydration measurements on debitage (all sources combined, Chart 10) indicate initial use of obsidian at MEN-2136 began about 4.8 μ and persisted through 0.8 μ (K). Although prior to 3.3 μ obsidian usage was limited, it is clear that small amounts of all four North Coast Ranges sources were utilized, suggesting either opportunistic obsidian procurement or visits to the site by multiple groups, each with access (albeit limited) to different glass sources. After 3.3 μ , usage steadily increased, peaking at 2.5-2.4 μ , then gradually dropped off, to 1.5 μ —followed by a second, albeit lower peak, around 1.3 (K). Bimodal hydration distribution curves appear in many western North Coast Ranges sites (a topic currently being studied by Layton). The profile at MEN-2136 is less distinct, possibly because little of the late part of the site was sampled.

Viewed separately, Konocti obsidian (Chart 11) expresses a similar pattern. However, there is a more abrupt increase in usage at 3.3 μ than in the combined chart, and the second, lower peak, is less distinct. Borax Lake glass (Chart 12) appears only sporadically before 3.2 μ (K) and drops off at 1.6 μ (K), with more limited usage continuing to 0.8 μ (K). The peak visible at 3.0 μ (K) may represent a single event. Five of the nine readings come from unit 21S24E, where 47 percent of the Borax Lake

debitage was measured. Chart 13 displays the Borax Lake distribution as measured, before conversion to the Konocti rate. Neither chart exhibits a bimodal distribution.

Napa obsidian (Chart 14), although only 7 percent of the obsidian at the site, seems to be skewed slightly earlier in time than is the case with Konocti and Borax Lake glass (a phenomenon also visible in hydration distributions from other western Mendocino County sites). Peak usage of Napa obsidian occurs at 2.6 μ , and usage drops significantly after 2.2 μ . A distinct second peak is visible at 1.3 μ .

Annadel obsidian (see Chart 10) makes up only 0.1 percent of the excavated flakes at MEN-2136, but comprises 5.8 percent of the obsidiandebitage collected in Corral 2SE. Of the nine Annadel flakes with hydration measurements, six are concentrated at or below 1.6 μ (K) (four between 1.2 and 1.4 μ), suggesting very late use, probably during the Smith Phase. The other three Annadel flake readings fall either in the peak period of obsidian usage or the opportunistic, early period.

In summary, Konocti, Borax Lake, and Napa obsidians co-occur in thedebitage throughout the period of obsidian usage at MEN-2136, while Annadel's appearance is ephemeral and generally late. Konocti is the dominant obsidian throughout. Napa glass is most evident early and late in time, while Borax Lake flakes are somewhat more concentrated in the middle.

Stratigraphic Testing

Stratigraphic integrity was tested on 21S24E and three trench units (1S1W, 3S1W, 5S1W). Charts 15 and 16 display hydration measurements by level (converted to

K) for 3S1W and 21S24E. In 3S1W, although there is a slight tendency for larger readings to occur in the deeper levels, all levels include flakes with small and large hydration readings. The result, then, is a lack of vertical stratigraphic integrity in the trench. Unit 21S24E does appear to have some stratigraphic integrity. The lower three levels show few readings less than 1.9 μ (K). The 20 to 30 cm level is mixed, while the two uppermost levels exhibit either upward mixing, or possibly some scavenging and reuse of older materials (the latter not supported by double hydration bands).

Comparison of 3S1W and 21S24E hydration distributions (Charts 17 and 18) indicates temporal differences in the use of the two areas—and thus some horizontal stratigraphy. While obsidian usage in 3S1W begins at 3.7 μ , increases dramatically at 3.1 μ , and falls off after 2.1 μ , sustained usage doesn't begin in 21S24E until 2.6 μ , but then continues with relatively greater intensity through 0.8 μ . Almost half the obsidian hydration readings in 21S24E are below 2.0 μ , compared to 25 percent in that range in 3S1W. Statistically, the means are significantly different (Table 17).

The artifact and flake recovery from unit 21S24E (21.5 artifacts and 529 flakes per m^3) was less than half that from the trench (54.6 artifacts and 1854 flakes per m^3), indicating a much less intensively used area, and the hydration measurements indicate that use was predominantly late. Results from the surface collection units suggest the late period was focused further east in the corral where most of the Rattlesnake series points were found.

Table 17. Comparison of Hydration Statistics for 21S24E and Trench Units

	All Specimens Converted to K			Konocti Specimens		
	N	Mean	S.D.	N	Mean	S.D.
21S24E	121	2.07	0.80	91	1.96	0.78
3S1W	245	2.46	0.75	142	2.46	0.80
Trench	495	2.42	0.74	229	2.46	0.76
	t = 4.55; p @ 0.01 = 2.58			t = 5.37; p @ 0.01 = 2.58		

Projectile Points**Table 18. Obsidian Hydration Values for Projectile Points (in Microns)**

TYPE	SOURCE	N	X (K)	RANGE (K)	S.D.
Rattlesnake Series	ALL	12	1.5	0.9-2.2	0.38
Leaf-shaped	ALL	177	2.37	0.8-4.4	0.65
Leaf-shaped	K	137	2.37	0.8-4.4	0.66
Leaf-shaped	B ⁺	28	2.28	1.2-3.1	0.47
Lea-shaped	N	11	2.60	1.0-4.1	0.89
Leaf-shaped	A ⁺⁺	1	2.9	-	-
Mend. Concave-base	2K,1B	3	3.0	2.6-3.8	0.68
Willits Series	N	1	2.5	-	-
All readings converted to Konocti rate (⁺ μ (B) = 2.89; 1.6-4.0; 0.59; ⁺⁺ (A) = 2.2)					

Hydration measurements for the 12 Rattlesnake arrow tips analyzed range from 2.2 to 0.9 μ (K), with a slight peak at 1.7 μ (Chart 19). The mean (after converting the Annadel and Borax Lake specimens to the Konocti rate) is 1.5 μ (S.D. = 0.38). All four sources are represented, and, within the limits of the available data, seem to have been used concurrently. Adding rim measurements from three probable arrow tip fragments (two Borax Lake midsections measured 1.9 and 2.6 μ [K], and one Konocti tip 1.5 μ)

raise the mean to 1.6 μ (K, S.D. = 0.45), extend the range, and increase the concentration between 1.5 and 1.9 μ , but do not change the overall picture.

Leaf-shaped points have hydration readings between 4.4 μ and 0.8 μ (K)¹¹ (Chart 20), but are concentrated between 3.2 and 1.6 μ . Konocti specimens range from 4.4 to 0.8 μ ; Borax Lake specimens between 3.1 and 1.2 μ (K) [4.0-1.6 μ B]; and Napa Valley specimens between 4.1 and 1.0 μ . The single certain Annadel Leaf-shaped point has an hydration band of 2.9 μ (K) [2.2 A].

For Leaf-shaped points there appears to be a slight shift in obsidian source presence through time (Table 19). For readings greater than 3.2 μ (K), Napa Valley points comprise 20 percent of the total, Konocti 80 percent, Borax Lake is absent. In the period after 1.6 μ , Borax Lake and Napa points each make up 6.7 percent of the total while Konocti points represent 86.7 percent. Between 3.2 and 1.6 μ , Napa is slightly underrepresented, Borax Lake over-represented, and Konocti about as expected. The descriptive statistics shown in Table 18 confirm the visual analysis. Borax Lake specimens average 2.3 μ (2.9 B), Konocti specimens 2.4 μ , and Napa Valley specimens 2.6 μ .

Table 19. MEN-2136 Hydration Ranges for Leaf-Shaped Points

Rim Depth μ	K		B		N		A		Total N
	N	%	N	%	N	%	N	%	
All	137	77.4	28	15.8	11	6.2	1	0.6	178
<1.6 μ	13	86.7	1	6.7	1	6.7	-	-	15
1.6-3.2 μ	112	76.2	27	18.4	7	4.8	1	0.7	147
>3.2 μ	12	80.0	-	-	3	20.0	-	-	15

Comparing the average hydration readings for the four types of projectile points (Table 18) shows that although the ranges of Rattlesnake series and Leaf-shaped points overlap, their means do not overlap within one standard deviation—supporting their assignment to two different phases. That is not the case when Leaf-shaped points are compared to the small sample of Mendocino Concave-base and Willits series points. Although the means of the latter point types, at 3.0 μ and 2.5 μ , respectively, are strictly higher than the mean of the Leaf-shaped points, the three means overlap within one standard deviation. That suggests the floruit of Mendocino Concave-base and Willits series points (as represented by a few obsidian specimens) overlapped the period of use of obsidian Leaf-shaped points, and that usage of Leaf-shaped points continued, albeit in decreased numbers, during the temporal range of the Rattlesnake series. A Student's t-test supports this argument: Rattlesnake series and Leaf-shaped points do form distinct populations ($t = 4.069$, $df = 187$, $p @ .01 = 2.576$); while Leaf-shaped points and the Mendocino Pattern specimens do not ($t = 0.771$, $df = 179$, $p @ 0.5 = 0.674$).

Charts 21-23 compare hydration measurements from debitage and projectile points for each major obsidian source. For Konocti obsidian (Chart 21), small amounts of debitage appear before, and larger amounts after, the floruit of Leaf-shaped points. Three of the Rattlesnake series points overlap the end of the Leaf-shaped point floruit, while the two Mendocino Concave-base specimens protrude into the first half of the Leaf-shaped point range. Overall, plots of Konocti obsidian hydration measurements for points and debitage have analogous distributions.

The Borax Lake distribution (Chart 22) is similar, although the Leaf-shaped points are more tightly clustered, and there is less overlap between the Leaf-shaped and Rattlesnake series points. The single Mendocino Concave-base measurement appears just before the sustained period of Leaf-shaped points.

The Napa Valley distribution (Chart 23) is dominated by the debitage, the result of over-sampling Napa debitage. The relationship between the debitage and points is unclear. The debitage suggests more concentrated usage of the toolstone than the projectile point data support. Chart 24 summarizes all hydration data from MEN-2136.

Table 20. Proportional Representation of Obsidian Sources by Point Type

TYPE	SAMPLE	K	B	N	A
Rattlesnake Series	35	42.9%	17.1%	31.4%	8.6%
Leaf-Shaped Points	242	74.0	18.2	7.7	0.4
Sample includes both SJSU and Zeni collections					

Although the available data indicate only subtle changes in obsidian source access within the floruit of the different point styles, there are distinct sourcing differences between the Leaf-shaped and Rattlesnake series types (Table 37). Whereas Konocti obsidian points represent 74.0 percent of all Leaf-shaped obsidian specimens, they make up only 42.9 percent of the Rattlesnake series arrow tips. Napa specimens, which represent only 7.7 percent of the Leaf-shaped points, make up 31.4 percent of the arrow tips. Annadel, which comprises only 0.4 percent of the Leaf-shaped collection, was used to make 8.6 percent of the arrow tips. Borax Lake specimens do retain essentially the same proportion in both periods: 18.2 percent and 17.1 percent, respectively. Clearly toolstone sourcing changed. This is less obvious in the debitage, where Konocti seems to

dominate until it drops out after 1.1 μ . Part of this difference may be due to sampling error. Most of the sampled debitage came from the trench, while the majority of the Rattlesnake series points were recovered in SJSU surface collections and the Zeni collection. The Corral 2SE surface collection unit showed elevated concentrations of Napa and Annadel obsidian. However, the higher proportion of Napa and lower proportion of Konocti in the Rattlesnake samples greatly exceeds the debitage proportions in Corral 2SE. It is likely that during the late period, Rattlesnake points are being traded ready made, and thus are not represented by abundant chipping debris derived from manufacture (see Bellifemine 1992).

Inter-Site Obsidian-Hydration Measurement Comparisons

Comparing MEN-2136 hydration results to those at other sites is complicated by probable temperature differences between sites and the lack of effective temperature data for most of them. Based on an estimated average temperature and range for MEN-2136 (Table 40), the effective temperature at the Zeni Ranch is about 2.5°C cooler than Santa Rosa and Lakeport and 3.5°C cooler than Healdsburg, Cloverdale, and Ukiah, but about 1°C warmer than the average temperature of Fort Ross and Fort Bragg. Still unknown are temperatures for the sites in the hills west of the Russian River, such as Warm Springs, Rockpile Road, and Nightbirds' Retreat. All comparison charts depict hydration readings without temperature adjustment. However, using a 6 percent per °C temperature adjustment factor, the Zeni Ranch measurements should probably be shifted upward by 15 percent when comparing to the Santa Rosa area (and when using Origer's hydration

formula); by 21 percent when comparing to the Russian River Valley floor sites, but reduced by 5.7 percent when comparing to sites located on the coast.

Comparing the hydration measurement distribution of Leaf-shaped points from MEN-2136 (Chart 20) with the combined distribution of Leaf-shaped and Excelsior points from Warm Springs (Chart 25), shows that although both sites exhibit a few examples beginning as early as 4.5 or 4.4 μ , consistent usage begins around 3.6 μ at Warm Springs and peaks at 2.9 μ , while sustained usage begins about 3.3 μ and peaks at 2.4 μ at the Zeni site. Examples drop off at both sites at 1.6 μ , with smaller numbers continuing to 1.0 to 0.9 μ . Mean measurements for the two sites, however, are much closer:

Table 21. MEN-2136 and Warm Springs Leaf-Shaped Point Hydration Comparison

Material	MEN-2136			WARM SPRINGS		
	N	Mean	S.D.	N	Mean	S.D.
All Sources*	178	2.37	0.65	191	2.65	0.70
Konocti	137	2.37	0.66	108	2.54	0.60
Borax Lake*	28	2.28	0.47	9	2.80	0.80
Napa Valley	11	2.60	0.89	60	2.85	0.84
* converted to Konocti rate						
Warm Springs data calculated from Basgall and Bouey 1991:61, 65-66; Figures 1, 3, 4						

The available data do not allow us to discriminate between the two possible explanations for the earlier peak at Warm Springs: a faster hydration rate due to a higher effective temperature, or the earlier introduction of obsidian Leaf-shaped points into the Warm Springs locality. Both may be valid.

Comparison of MEN-2136 and Warm Springs hydration measurements on debitage (Charts 10 and 26) documents an earlier use of obsidian in the Warm Springs locality. The Warm Springs data suggest an almost a tri-modal curve, with the earliest peak between 3.4 and 3.0 μ , the second around 2.4 μ , and the last (and lowest) between 1.4 and 1.2 μ . At MEN-2136, the beginning of intensive obsidian use is coeval with the initial peak at Warm Springs. Ignoring temperature differences, we would conclude that intensive obsidian use at the Zeni site postdates its advent at Warm Springs.

The MEN-500 Hydration distribution (Chart 27), looks very different, with only a single major peak at 2.4 μ , although a series of small peaks might be comparable to those at Warm Springs. More than half of the obsidian at MEN-500 is Borax Lake, which for comparison must be converted to the Konocti rate—adding uncertainty and reducing the precision of the chart. If Tremaine's (1989a) comparison constants over-adjust Borax Lake to Konocti, then all peaks (especially the earlier ones) would shift to the right. The chart shows a distinct drop in use of Konocti obsidian after 2.4 μ . The same data, plotted at the Borax Lake rate, is shown in Chart 28. Here, the introduction of obsidian, dominated by Borax Lake, occurs by 6.0 μ , with peak usage between 4 and 3 μ , and smaller peaks at 2.5 and 1.5 μ . (Both the Borax Lake to Konocti rate conversions in Chart 27 and the Konocti to Borax Lake rate conversions in Chart 28 are based on two decimal point means.)

The MEN-2138 (Redwood Valley) hydration distribution (Chart 29) peaks at 3.7-3.6 μ and between 3.0 and 2.6 μ , with sustained usage beginning as early as 4.3 μ , but dropping off after 2.4 μ . The MEN-2138 distribution might indicate an earlier

introduction of obsidian into Redwood Valley than into Warm Springs. However, if Redwood Valley were 2°C warmer than the Warm Springs locality, a 12 percent correction would shift the MEN-2138 results left, to parallel the Warm Springs data. It should be noted that all Borax Lake data included on this chart came from the first series of MEN-2138 hydration measurements. For some reason, early measurements were over represented in that sample compared to the results from subsequent additional Konocti measurements. It is likely that Borax Lake obsidian was also used at MEN-2138 after the period depicted here.

The obsidian debitage hydration distribution from MEN-1932, near Calpella (Chart 30), peaks between 3.6 and 2.9 μ on a Konocti scale and between 4.2 and 3.8 μ on a Borax Lake scale (Chart 31). These two charts are only partially smoothed: 80 and 73 measurements, respectively, were made by Origer and only mean measurements are available (SJSU 1991). Obsidian at MEN-1932 drops off significantly at 2.0 μ (K) and 2.5 μ (B), and remains at a lower level thereafter, suggesting that obsidian no longer entered the area in a form that produced flakes large enough to be trapped in 1/4 inch (6 mm) screens (Bellifemine 1992). Combining data from nearby MEN-1930 with that of MEN-1932 (Chart 32) shifts peak usage to 2.8 μ , and extends the visibility of obsidian debitage to 1.8/1.7 μ . Smaller hydration readings occur only on Rattlesnake series points (Bellifemine 1992).

Obsidian use at MEN-1929, near Navarro, appears to start and peak later than at MEN-500, MEN-1930/1932, and MEN-2138 (Chart 33). This site, located on the Anderson Valley floor, has the highest effective temperature, and thus the late advent of

obsidian is even more pronounced than the chart indicates. There is a small cluster of flakes between 3.6 and 3.4 μ (K), but sustained usage appears only after 3 μ and peaks between 2.7 and 1.9 μ , with smaller, later peaks. Borax Lake glass is over-represented on the chart: it comprises 12 percent of the MEN-1929 debitage, but 38 percent of the hydration readings. Unlike MEN-2136, Borax Lake was the first source utilized at MEN-1929, and appears in small amounts across the hydration range. Napa appears early, as it does at MEN-2136, but then seems to all but disappear after 3 μ . Combining hydration measurements on projectile points and fragments with the debitage measurements (Chart 34) helps resolve the distribution, suggesting a tri-modal curve, now showing a distinct late peak between 1.4 and 1.3 μ .

Hydration measurements on debitage from MEN-2220, near Cloverdale, are plotted in Chart 35. Forty-seven percent of the measurements are on Borax Lake and Napa glass, which combined comprise less than 3 percent of the debitage, distorting the picture slightly. Focusing first on the Konocti glass, most measurements cluster between 3.4 and 2.4 μ , with some earlier and later usage. The small amounts of Borax Lake debitage appear to co-occur with Konocti usage, while the Napa glass, as seen elsewhere, is concentrated in the early period: rim measurements on 17 Napa flakes range between 5.0 and 2.4 μ .

On the coast at Albion Head (Chart 36), obsidian increases abruptly at 2.5 μ (K). Konocti obsidian displays a distinct bimodal curve, dropping to a low between 1.8 and 1.6 μ , then peaking again between 1.3 and 1.1 μ or 0.9 μ (assuming the dip at 1.0 μ is instrument error). Albion Head is in a much cooler environment than any of the valley

sites, probably averaging over 4°C cooler, thus the increase in obsidian at 2.5 μ is comparable to 3.1 or 3.2 μ (K) in the Russian River Valley. Comparing the Albion Head distribution to that at MEN-2136 (Chart 10), and assuming only a 7 percent adjustment is required, reveals that obsidian usage at Albion Head commenced about the same time as usage peaked at MEN-2136. Thus there may, indeed, have been a lag between the time abundant obsidian reached MEN-2136, located 55 km from Mt. Konocti, and when it reached Albion, 40 km further away.

A plot of Albion Head Borax Lake measurements (Borax Lake scale, Chart 37) does not show the bimodal distribution evident with the Konocti glass. The drop at 2.3 μ may be real, but probably should be smoothed out. (Does this mean that use of Albion by groups coming from the south and using Konocti obsidian was interrupted, while use by people from the interior, employing Borax Lake obsidian, continued unabated?)

The Salt Point midden sites (Chart 38), in a regime probably just slightly warmer than Albion Head, show a very different occupation history. First, the major obsidian sources are different: predominantly Napa (68%) with smaller amounts of Konocti (17%) and Annadel (14%), but only a trace of Borax Lake (2%). Second, there is a single peak at 2.0 μ (ignoring a small gap as an artifact of the microscope). The coast at Salt Point seems to have a very different history than MEN-2136 or the coast at Albion Head. The lithic scatters (Chart 39) show a longer history of obsidian use, co-dominated by Annadel and Napa, but only 9 percent Konocti and 4 percent Borax Lake (Dowdall 1995).

Finally, we have to face SON-1471 (Chart 40). This ridge-top site near Warm Springs, dominated by obsidian, peaks early (4.3 μ), perhaps reaches a shallower peak

between 3.4 and 3.5 μ , then drops off. Usage picks up again at 2.3 μ and persists until 0.9 μ . However, the latter period is disproportionately included in the excavation sample. If the hydration measurement sample constitutes a proportional representation of site use before 2.3 μ (K), then, as Stewart (1993) asserts, something different was happening here during much of the Dry Creek Phase, resulting in reduced obsidian use. Perhaps the spring dried out or stopped flowing following an earthquake, and the camp was reestablished some distance away. Perhaps economic activities were focused on different resources.

Unfortunately, the uncertainty concerning site effective hydration temperature currently precludes drawing a regional chronology from this analysis. The author plans additional research to address (1) temperature adjustment factors for obsidian hydration measurements and (2) calculation of effective hydration temperature for specific sites, with the objective of reaching a better understanding of the spread of obsidian usage west of the Clear Lake basin.

CHAPTER EIGHT

SITE CATCHMENT ANALYSIS

Site catchment analysis, the examination of the economically significant resources available within a defined area around a specific site, has proven useful in studying past lifeways (Simons 1990). A catchment area was therefor developed for MEN-2136, to aid in calculating the resource potential for past subsistence systems.

The dramatic topographical relief surrounding MEN-2136 led to selecting a 5 km catchment. A catchment circle, with a 5 km radius centered on the site, was drawn on the USGS Ormbaun Valley 15 minute quadrangle. The boundary was then adjusted to the terrain, by extending it beyond 5 km to the south and northwest, where Signal and Zeni ridges allow movement on mostly level ground, but narrowing it to the east where continuing would require climbing the next ridge (Map 9). The resulting boundaries are primarily rivers: The Garcia and some of its tributaries (Inman, Pepperwood, and Signal Creeks) and the North Fork of the Gualala and a few of its tributaries (Billings and Dry Creeks).

The catchment was traced on 7.5 minute topographical maps (McGuire Ridge [USGS 1991b], Zeni Ridge [USGS 1991c], and Eureka Hill [USGS 1991a]), reduced, and superimposed on USDA/CDF Soil Vegetation maps (1950) 62A-4, 61B-2, and 61B-3. Five vegetation associations were defined from the soil-vegetation designations:

1. Redwood Forest: All areas on the Soil Vegetation maps coded for redwood were defined as redwood forest. In this area, redwood was not always mapped as the

Map 9. Men-2136 Catchment Vegetation Associations

dominant species because most of the area has been logged, and redwood and Douglas fir require 70-85 years to return to dominance after logging (Zinke 1988:689-690). There are few stands of pure redwood in this region. Most areas now support a mix of redwood (*Sequoia sempervirens*), Douglas fir (*Pseudotsuga menziesii*), tan oak (*Lithocarpus densiflora*), and madrone (*Arbutus menziesii*). Sugar pine (*Pinus lambertiana*) is a minor constituent, primarily in the southern and western areas, with interior live oak (*Quercus wislizenii*) appearing in some northern and eastern areas.

2. Mixed Evergreen Forest: All areas coded for Douglas fir, tan oak, and/or madrone, but excluding redwood, are included in this category. In most areas all three co-occur. Associated flora include grassland; sugar pine and canyon live oak (*Quercus chrysolepis*)—mostly in the south; California laurel (*Umbellularia californica*) and black oak (*Quercus kelloggii*)—mostly in the east; and Oregon white oak (*Quercus garryana*)—mostly to the north.
3. Grassland: Grasslands appear in the eastern and northern sections, almost exclusively on Laughlin soils, which are too shallow to support the larger tree species.
4. Chaparral: The relatively small areas in the catchment covered with chaparral also seem to result from the underlying soil. The very shallow Los Gatos and Mayen soils occur on steep upland slopes and are unsuited for either grassland or timber. Species occurring in one or more of these patches include: chamise (*Adenostoma fasciculatum*), eastwood manzanita (*Arctosaphylos glandulosa*), coast whitethorn (*Ceanothus incanus*), northern monkeyflower (*Diplacus aurantiacus*), California

yerba santa (*Eriodictyon californicum*), scrub interior live oak (*Quercus wislizenii frutescens*), and chaparral-pea (*Pickeringia montana*).

5. Oak Woodland: The three small areas so classified show either interior live oak (with grass or coast whitethorn) or valley white oak (*Quercus lobata*), with grass and California laurel. These areas appear on soils too shallow to support mixed evergreen species.
6. Cultivated: The 50.5 hectares classified as cultivated include soils which could support redwood (83%) and/or mixed evergreen forest (all). The cultivated area represents only 0.7 percent of the catchment, and has been ignored in this analysis.

The areas covered by each vegetation class were measured using a Numonics Corporation electronic graphics calculator (Table 22, Map 9).

Table 22. MEN-2136 Site Catchment

ASSOCIATION	HECTARES	SQ. MILES	%
Redwood Forest	5,279.9	20.39	74.8
Mixed evergreen	1,180.8	4.56	16.7
Grassland	438.8	1.69	6.2
Chaparral	86.1	0.33	1.2
Oak Woodland	27.0	0.10	0.4
Cultivated	50.5	0.19	0.7
TOTAL	7,063.1	27.27	100.0

The catchment is predominantly redwood forest (74.8%), with moderate expanses of mixed evergreen forest (16.7%) and grassland (6.2%). Chaparral (1.2%) and oak woodland (0.4%) appear only in areas where the soils are not suitable for either forest or grassland communities.

The potential productivity of the MEN-2136 site catchment in plant and animal resources was determined using techniques developed by Baumhoff (1963) to assess carrying capacities. Baumhoff considered three basic resources used by northern and central California Native Americans: anadromous fish (salmon and trout), acorns, and large game animals. He measured fish productivity using linear miles of salmon/trout streams, and acorns and game by square miles of territory. Streams were rated primary, secondary or tertiary based on the area the streams drained and the number of species and/or number of runs per year of anadromous fish. Vegetation associations (redwood forest, pine-fir forest, oak woodland, chaparral and grassland) were rated as primary, secondary or tertiary according to their suitability for game and acorns. Primary resource areas were arbitrarily assigned an index value of two, secondary areas a value of one, and tertiary areas a value of one-half (Baumhoff 1963:174-176).

Baumhoff (1963:196) rated three-quarters of Central Pomo redwood forest secondary and one-quarter tertiary for both game and acorns, because at the southern end of the redwood belt the forest is less dense, providing better habitat for game. Following Baumhoff's lead, the redwood forest around MEN-2136 is rated secondary for both of these resources. The mixed evergreen forest is also rated secondary for both acorns and game. It contains significant numbers of tan oaks, a preferred acorn source (Baumhoff 1963:164). Oak woodland is assigned a primary rating for both products; while chaparral is considered primary for game and tertiary for acorns; and grassland, used by Roosevelt elk for browsing during part of the year, is assigned secondary game and tertiary acorn indexes.

Baumhoff (1963:192) counted the lower course of the Garcia River as a tertiary source of anadromous fish. Using his definition, only 2.5 linear miles of fish resource lie within the MEN-2136 catchment. This almost certainly understates the amount of fish available in the past. George Zeni (personal communication 1995) asserts that until at least the late 1940s, the Garcia River salmon run in November and early December teemed with soho and king salmon, which migrated up Inman Creek and its tributaries and must also have extended further upriver than Baumhoff's diagram suggests. The North Fork of the Gualala River and Billings Creek had a steelhead run in December and early January, which extended into some of their tributaries, but was disregarded in Baumhoff's analysis. Underestimating the extent of the anadromous fish streams may help explain why Baumhoff could find no correlation between population size and fish resource in the central California area. For comparability, Baumhoff's factors will be used here, but with the understanding that fish could have been more important than the figures indicate.

Table 23. Resource Indices for the MEN-2136 Catchment

	EXTENT sq mi	RESOURCE COEFFICIENTS			RESOURCE INDICES		
		FISH	ACORN	GAME	FISH	ACORN	GAME
Redwood Forest	20.39		1	1		20.4	20.4
Mixed Evergreen	4.56		1	1		4.6	4.6
Grasslands	1.69		0.5	1		0.8	1.7
Chaparral	0.33		0.5	2		0.2	0.7
Oak Woodland	0.10		2	2		0.2	0.2
Fish Miles	2.50	0.5 x 10			12.5		
Total	27.27				12.5	26.2	27.5
Resource Proportions					18.9%	39.5%	41.6%

In this fairly small catchment area, game provides 42 percent of the potential resources, acorns 39 percent and fish 19 percent. Major game species would have included deer and Roosevelt elk, but the smaller carnivores, rabbits, and quail were also available. The large number of projectile points recovered on the Zeni Ranch confirms that game hunting was a primary activity at MEN-2136.

There is limited support in the archaeological record at MEN-2136 for prehistoric processing of acorns. A small number of acorn hulls were pulled from screens, and four pestles and fragments, but no mortars, were collected. The Zeni collection of milling equipment is larger, including 11 or 12 pestles and two bowl mortars (since lost). It is therefore possible that acorns were used, but processed in an area we did not sample. But, whether or not acorns were processed at the site, they may have been harvested here for use elsewhere.

Whether or not fish were used depends on the time of year people frequented the area. The salmon and trout runs are in winter, when tribelets gathered in their winter villages, and MEN-2136 does not appear to have been a village. There are better locations to camp, closer to the streams, when fishing is the primary activity.

Substituting the acorn and game indexes into Baumhoff's (1963:200) regression equation (scaled to handle the small area)¹²: $p = 3 (A) + 2 (G) - 210$, where p = population, A = acorn resource index and G = game resource index, calculates a population of 113 people, or a density of 4.1 persons per square mile, for the catchment area.

This author does not suggest that the catchment described here actually supported a population year-round. It was but one stop on a much larger seasonal round. Even during the Smith Phase, when territories were more circumscribed, the Zeni site was situated on the border between two tribelet territories, and was not the center of a tribelet's range. But, the result does suggest that the redwood belt, at least in southern Mendocino County, was not as impoverished a resource zone as is usually assumed. A density of 4 persons per mi^2 , while certainly less than the average of 6.2 persons per mi^2 for the entire central North Coast Ranges region, is still equal to the population density of the Coast Yuki and more than 80 percent of the population density attributed to the total Central Pomo territory (Baumhoff 1963:Table 9).

CHAPTER NINE

DISCUSSION

Four cultural components were identified at MEN-2136. Component definition was based on: (1) horizontal stratigraphy of time sensitive artifacts recovered at MEN-2136 and from Field 6, supplemented by data from the Zeni Collection, (2) the frequency of the different toolstone sources, (3) obsidian hydration measurements, (4) one radiocarbon date, and (5) analogies to components defined at other archaeological sites. The four MEN-2136 components are numbered from early to late.

COMPONENT 1

Component 1 is defined by the 18 Mendocino Concave-base and single Mendocino Side-notched projectile point recovered by SJSU, and an identical number of the same styles in the Zeni Collection. Of the 19 SJSU examples, 15 were excavated, all from the trench, and four surface collected (from Field 6, Corral 1N, Corral 2SE, and the general corral area).

The best evidence for the isolation of Component 1 is in Field 6, where SJSU surface collected one Mendocino Concave-base point, but, more recently, the Zenis have collected at least five additional specimens. The 1988 SJSU Field 6 surface collection includes one Leaf-shaped point base (F), one projectile point midsection (F), two bifaces (1M, 1F), one backed knife (F), two scrapers (2F), five modified flakes (3M, 1F, 1B), five utilized flakes (1M, 3F, 1K), and an exhausted core (F). This assemblage is consistent

with short term use by hunters with a seasonal round including the Monterey chert quarries located between Schooner Gulch and Point Arena, but with only limited access to obsidian. The debitage collected from Field 6 (20M, 65F, 6Q, 4K, 3B, 1N) is dominated by chert—obsidian comprising only 8.6 percent of the chert plus obsidian flakes.

Mendocino Concave-base points excavated from the trench provide three hydration measurements: 3.8 μ (K) for a well-formed Konocti base, and 3.3 μ (B) (2.6 K) and 2.6 K for Borax Lake and Konocti specimens with somewhat more questionable Mendocino Concave-base attributes (Figure 20 p-r). The 3.8 μ K measurement coincides with the earliest evidence for obsidian at MEN-2136, while the two latter measurements are interpreted as the end of the floruit of the point type.

Hydration measurements on the two obsidian artifacts and eight flakes recovered in Field 6, converted to the Konocti scale (mean = 2.1 μ ; S.D. = 0.40), suggest a light scatter of materials postdating Component 1, and attributable to Components 3 and 4:

SOURCE	RIM MEASUREMENTS
Konocti	1.9, 1.9, 2.2, 2.3, NVB
Borax Lake (real)	1.6, 2.6, 2.9, 2.9 (B)
Borax Lake (conv.)	1.3, 2.1, 2.3, 2.3 (K)
Napa Valley	2.7

The provenience of the excavated artifacts supports an early attribution for the Mendocino Concave-base type. Of the 15 Mendocino Concave-base points excavated, most are found in the lower levels of the site (below the plow zone), in spite of the loss of

resolution from stratigraphic mixing, as documented by plots by depth of hydration measurements (Chart 15).

PROVENIENCE	MENDOCINO CONCAVE-BASE		ALL TRENCH ARTIFACTS	
	NUMBER	PERCENT	NUMBER	PERCENT
above 30 cm	5	33.3%	413	52.1%
30-40 cm	3	20.0%	163	20.6%
below 40 cm	7*	46.7%	793	27.4%
* includes Mendocino Side-notched point				

The Field 6 assemblage (Mendocino Concave-base projectile points, chert scrapers, modified and utilized flakes, and a knife) is consistent with use by seasonal hunters with limited access to obsidian.

Although no milling equipment is known to have been found in Field 6, some of the ground stone recovered in the trench may belong to this component. Seven of the 15 Component 1 points excavated were recovered from two adjacent units, 7S1W and 8S1W (4 <40 cm, 2 between 30-40 cm, 1 >30 cm), with one additional specimen from unit 9S1W level 1. Nine of the 12 ground stone fragments were recovered in units 8S1W and 9S1W (5 <40 cm, 2 between 30-40 cm, 1 > 30 cm). The limited areal extent and relatively deep provenience of both the points and the ground stone suggests an association. The presence of grinding equipment would be consistent with use in early summer, when seeds ripen in grassland openings, or in the fall, when acorns are available.

The presence of Mendocino Concave-base points made from Monterey chert indicates use by people with access to the Monterey chert sources near Point Arena. These points may have been left by people permanently located on the coast, who used

Monterey chert as their primary toolstone and included the Zeni Ranch in their seasonal round. Alternatively (or additionally), the combination of Franciscan and Monterey specimens may indicate the site was part of the seasonal round of interior groups, who discarded their spent Franciscan chert tools on their way to the coast—replacing exhausted tools at the Monterey chert quarries—and discarding spent Monterey chert artifacts during their return inland.

Mendocino Concave-base points are assigned by other researchers to the Skaggs Phase at Warm Springs (5000 to 2500 B.P.) and to the Mendocino Pattern (particularly the Hultman Aspect) at Clear Lake (5000 to 1300 B.P.). They are associated with formed scrapers, thick leaf-shaped points and millingslabs and handstones. Mortars and pestles are rare. Willits series points (Component 2 at MEN-2136) are included in those pattern definitions. However, the author sees evidence in the archaeological literature, tentatively supported with data from the Zeni Ranch, that Willits series points were introduced later and persisted longer in the west-central North Coast Ranges than Mendocino Concave-base points. Layton (1990:52-54) separates the two types at Albion Head, assigning the Albion Mendocino Concave-base and Mendocino Side-notched specimens to his earliest components, and the Willits series specimens temporally later (Component 5). The Warm Springs researchers had little difficulty separating Mendocino Concave-base, Skaggs Phase, assemblages from their later, Dry Creek Phase, but recovered more Willits series points in Dry Creek than in Skaggs contexts (Basgall and Bouey 1991:80).

COMPONENT 2

This component, represented by the 15 notched points (11 Willits series and four dart-sized stemmed points) recovered by SJSU and the 21 notched (14 Willits and seven stemmed) points in the Zeni Collection, is distinguished from Component 1 here only because Willits series points have not (yet) appeared in Field 6, suggesting the introduction of this type may postdate the floruit of Mendocino Concave-base points in that area of the ranch.

Thirteen of the 15 notched points recovered by SJSU were excavated from the trench (including one in the test pit); two were surface-collected in the corral (Corral 2N and general corral). Because notched points were only found in mixed contexts, defining a full assemblage is impossible. The Component 2 points were not as deep as the Mendocino Concave-base examples, however seven of them are clustered in units 7S1W through 9S1W, where Mendocino Concave-base points and ground stone are also disproportionately represented.

PROVENIENCE	NUMBER	PERCENTAGE
> 30 cm	6	46.2%
30-40 cm	3	23.1%
< 40 cm	4	30.8%

White and Fredrickson (1992:66-67) assign Willits series points to the Mendocino Aspect of the Mendocino Pattern and associate them with groups located to the north and west of the Clear Lake basin. They assign Mendocino Concave-base and thick leaf-shaped points (normally of obsidian) to the Hultman Aspect, mainly located to the south

of the lake. The presence of both in the Clear Lake basin is attributed to alternating intrusions of both essentially contemporaneous groups.

Aside from the apparent absence of notched points in Field 6, the Zeni Ranch assemblage is consistent with Willits series points found elsewhere, predominantly of chert—with only one of 15 points in the SJSU collection and possibly one of 21 in the Zeni Collection of obsidian.

The notched points SJSU collected include four (27%) Monterey chert, one (7%) Napa, and 10 (67%) Franciscan chert examples; The Zeni Collection was similarly composed, with six (29%) of Monterey chert, one (5%) of Konocti, and 14 (67%) of Franciscan chert. The high frequency of Monterey chert use confirms use by people including the Point Arena area in their seasonal round. The presence of Willits series points of Monterey chert at MEN-2136 differs from Albion Head, where Layton (1990:52-54) recovered Mendocino Concave-base but not Willits series points made from this toolstone. This suggests territory boundaries may have become more rigidly defined through time.

There is only one hydration measurement to help date Component 2, a 2.5 μ rim on the Napa specimen. This reading, which converts to 1300 B.P. using Origer's formula (after adjusting for temperature) must fall near the end of use of the style. It is well within the floruit of Leaf-shaped points at MEN-2136, suggesting contemporaneity of late Willits series points with the early part of the succeeding component (consistent with the Warm Springs results).

COMPONENT 3

The beginning of Component 3 is defined by the abrupt increase in obsidian use at about 3.3 μ (K), and is documented by the 188 obsidian Leaf-shaped points. Many of the 50 chert Leaf-shaped specimens recovered probably belong to this component as well. Component 3 is the predominant assemblage in the trench and Corral 1N, but it also appears, heavily mixed with Component 4, on the east side of the corral.

The 190 Leaf-shaped points (35 chert, 155 obsidian) recovered from the trench comprise 86 percent of the projectile points found there, suggesting most trench artifacts belong in the Component 3 assemblage. This author argues the Leaf-shaped points and three other artifact classes (reworked projectile point medial fragments, hafted drills, and scrapers) dominate the Component 3 assemblage, and define usage of the site during the Dry Creek Phase.

Reworked Bifaces

Evidence for a Dry Creek obsidian reworking industry, using bipolar techniques, was first recognized at Warm Springs (Baumhoff 1980, Basgall and Bouey 1991:16-134). The 423 projectile point fragments recovered from MEN-2136 include 353 (83%) excavated from the trench: 108 (30.6%) tips, 74 (21.0%) midsections, and 171 (48.4%) medial fragments:

	TIPS	MIDSECTIONS	MEDIAL FRAGS.	POINTS
Obsidian	73	57	164	159
Chert	35	17	7	60
Total	108	74	171	219
% Obsidian	67.6	77.0	95.9	72.6

The medial fragments (end-product of rework) are disproportionately of obsidian, demonstrating that (as at Warm Springs) reworking was focused on obsidian. Located 55 km from the closest obsidian source, reworking fragments of broken projectile points provided an on-site source of material for casual tools at MEN-2136.

Hafted Drills

Forty-five hafted drills were recovered, 44 (98%) from the trench. Small hafted drills are usually assigned to late Smith Phase and Clear Lake Aspect assemblages in the North Coast Ranges, where the drills are associated with clamshell disk bead manufacture. There are three reasons why this is probably not the case at the Zeni site.

(1) All but one of the drills were recovered from the trench, where only two Rattlesnake series points (one percent of the points in the trench) were collected. This suggests the drills are far more likely attributable to Component 3 than to the later Component 4. This attribution is supported by the fact that there were no drills found in Corral 2S, where most of the Rattlesnake points were recovered.

(2) The drills from the Zeni Ranch differ from those recovered in contexts associated with clamshell disk beads. The MEN-2136 drills are larger than those found at the late Warm Springs sites (Basgall and Bouey (1991:II:94, 141, 314) and those

recovered by Layton at Nightbirds' Retreat (personal observation). Differing from Warm Springs, the MEN-2136 drills are not made from green chert, nor do they match the template described by Parker (1980) for Clear Lake basin specimens. Finally, the presence at MEN-2136 of drill preforms as well as finished and utilized specimens argues for both the manufacture and use of drills at the Zeni site. This contrasts with the evidence for separate drill and bead making specialists documented in both Parker's and Bouey's data.

(3) Finally, MEN-2136 is not on a direct route between Bodega Bay, the primary source of clamshell for disk beads, and the interior. There are no *Saxidomas* sp. clams on the nearby coast, but *Olivella* and *Haliotis* shells are available, and are more likely the materials worked at the Zeni Ranch. Fredrickson (1961) found evidence of both *Olivella* beads and *Haliotis* ornaments in Dry Creek (Houx Aspect) levels at LAK-261. Greg White (personal communication 1996), sees no evidence for the manufacture of such ornaments in the Clear Lake area, and thinks that they were made near the coast and taken or traded into the Clear Lake basin. The drills at MEN-2136 may be evidence of a similar industry.

Scrapers

The third special artifact type attributed to Component 3 are the 37 steep-edged scrapers recovered in the trench—although some undoubtedly belong in Components 1 and 2 as well. The three Konocti obsidian samples submitted for hydration measurement

have rims of 3.0, 2.9, and 2.7 μ , all consistent with Dry Creek Phase use. Many of the chert samples may be of comparable age.

It is not clear how the scrapers were used. Absence of polish indicates they were not employed specifically for scraping hides. Indeed, the preference for chert (more durable than obsidian), evidence of stepflaking, and the steep edge-angles are more consistent with the working of harder materials—wood, antler, or bone are suggested by the site's location.

The large number of projectile points, hafted drills, and steep-edged scrapers attributed to Component 3 are consistent with use of the site as a seasonal camp, primarily to hunt, but also to manufacture items using the drills and scrapers. The large number of task-specific tools, representing several manufacturing activities, reveals well established patterned behavior at MEN-2136 during Component 3, evidenced by manufacturing (drills and steep-edged scrapers) for trade and exchange as well as hunting and gathering for subsistence.

The apparent absence of milling equipment might suggest either the site was not used by whole family groups or was used at a time of year when neither grass seeds nor acorns were ripe. Alternatively, the absence of milling equipment may be the result of the limited extent of our excavations. The Zeni collection includes 11 or 12 pestles and George Zeni reports two bowl mortars found on his property—but since given away. Bowl mortars are associated with the Dry Creek Phase at other sites. If women assembled

in an activity area somewhat removed from the core of the site to process nuts and seeds, that area may not have been sampled by our excavations.

The two large obsidian bifaces or ceremonial blades found by George Zeni while plowing Field 5 (both with hydration rims of $2.4 \mu K$) are assigned to Component 3. Although technically recovered off-site, they may have been part of a purposefully hidden cache—adding support to the thesis that the site reveals evidence of complex activities above and beyond simple subsistence.

Component 3, with its emphasis on obsidian, can be “dated” through hydration measurements on the obsidian Leaf-shaped points and the trench debitage (Charts 10 and 20). Hydration measurements on Leaf-shaped points cluster between 3.1 and about $1.7 \mu K$. No accepted formula is available to convert Konocti hydration rims directly to calendric dates. However, Origer’s (1987) formula for Napa obsidian, used in conjunction with Tremaine’s (1989a) conversion constants, allows a tentative indirect conversion.

TEMPERATURE ASSUMPTION	DATE RANGE
Santa Rosa	1475-440 B.P.
MEN-2136 2.5°C cooler	1950-590 B.P.

Origer’s formula (without temperature adjustment) yields a range of 1475 to 440 B.P. for Component 3. This seems too recent, compared to dates assigned to Dry Creek and Houx Aspect components elsewhere. The Dry Creek Phase at Warm Springs is now dated between 2500 and 900 B.P. (Basgall 1993), while the Terminal Houx/Clear Lake Aspect transition ranges between 1300 and 600 B.P. (White and Fredrickson 1992:49). The 1950 to 580 B.P. range (calculated by adjusting MEN-2136 measurements with a 15

percent temperature correction) appears more reasonable, and is consistent with the end date originally determined for Warm Springs.

The apparent absence of Houx Wide-stem forms in the MEN-2136 assemblage argues for a Component 3 beginning date later than 1800 B.P., when such points disappear from Clear Lake basin assemblages. However, Houx Wide-stem points comprise only a small percentage of Houx assemblages after 2200 B.P., and point breakage below the tang and the rework or loss of the more distinctive midsections may make their total absence at MEN-2136 more apparent than real.

Obsidian dominates the chipped stone assemblage at MEN-2136 during Component 3. Obsidian comprises 83.8 percent of the debitage in the trench, but drops slightly, to 81.4 percent in the two basal levels. The relative frequency of obsidian is probably artificially depressed by the admixture of chert waste flakes dating to Components 1 and 2, suggesting the obsidian-to-chert ratio may have been even higher.

COMPONENT 4

Component 4 is represented by the 10 Rattlesnake series arrow tips recovered by SJSU, the 42 in the Zeni Collection, and one specimen each of projectile point types 8 and 9. Only three of the SJSU points were excavated, two from the trench (unit 11S1W level 2 and 4S1W level 7), and one from unit 21S24E level 2, located 38 m east-southeast of the trench. The remaining seven specimens were surface collected: five eroding from the knoll on the east side of Corral 2S and two in Corral 2N. The sparse numbers and

mixed distribution of the Rattlesnake series points prevents definition of the full assemblage for Component 4.

The data, however, does allow some description of site use during Component 4. The Zenis' larger collection of Rattlesnake series points implies they were collected from an area we inadequately sampled—possibly the east side of the corral where seven SJSU samples were recovered.

The obsidian hydration measurements on the 12 Rattlesnake series arrow tips tested range between 2.2 and 0.9 μ (K), but cluster between 1.9 and 1.2 μ (K). Applying Origer's (1987) formula, with and without a 15 percent adjustment for temperature:

Temperature Assumption	2.2 - 0.9 μ	1.9 - 1.2 μ
Santa Rosa	740-125 B.P.	554-220 B.P.
Adj. by 2.5°C	980-165 B.P.	730-290 B.P.

Assuming that the clustered readings best represent primary site use during the Smith Phase, Component 4 can tentatively be dated between 730 and 290 B.P., but may have extended up to 165 years ago (AD 1830).

Obsidian-hydration measurements from Unit 21S24E, located just inside the boundaries of Corral 2, allow at least the two uppermost levels to be assigned to Component 4. Recovered from those levels were one Rattlesnake series point (M), four Leaf-shaped point bases (2 K: 0.9 μ , 1.4 μ , 2F), three arrow-point size tips (2K: 1.5 μ , 5.2 μ ; 1B: diffuse hydration), three midsections (F), three midsection fragments (1K: 1.3 μ , 1M, 1F), and a biface (F), core/cobble tool (M), and utilized flake (F).

Artifact hydration measurements are supported by measurements on the debitage. Sixty-five percent of the hydration measurements in the uppermost two levels of 21S24E are $\leq 1.9\mu$. These levels are within the plow zone, so some of the flakes could have been dragged there from other areas, and rodent action and tree roots may have churned the deposits, but the hydration profile for unit 21S24E (Chart 16) also suggests that some of the flakes with higher measurements could be the result of reworking scavenged obsidian.

A lower proportion of obsidian is noted in both artifacts and debitage from the upper levels of this unit: only 67.2 percent of the debitage (compared to 83.4% in the trench [81.1 % uppermost 2 levels]), and a higher percentage of Konocti obsidian (90.1% K, 5.6% B, 3.0% N, 1.3% U). This suggests either reduced availability or a higher economic cost of obsidian during Component 4 times. The toolstones used in manufacturing the Rattlesnake series points also change: the proportion of Napa and Annadel increases, the proportion of Konocti decreases, but the proportion of Borax Lake specimens remains about the same, when compared to the Leaf-shaped points of Component 3. The Rattlesnake points may have been traded-in ready-made—helping to explain the difference in obsidian source proportions between the debitage and points in Component 4.

The contemporaneity of Rattlesnake series arrow points and Leaf-shaped points with small hydration readings documented in 21S24E is repeated in Corral 2N, where the five Leaf-shaped points recovered (all obsidian) produced hydration measurements clearly attributable to Component 4 (K:1.3 μ , 1.4 μ , 1.9 μ , B: 0.8 μ [0.6K], N:1.0 μ).

These data suggest that Leaf-shaped “points” of both obsidian and chert (possibly used as knives) continued to be manufactured and used during Component 4.

The narrow range of artifacts recovered in Corral 2 and the uppermost levels of 21S24E document site utilization with narrower focus than in Component 3, and probably much less intensive use. Unit 21S24E artifact and flake densities are less than half those in the trench, and the surface density in Corral 2 is less than a third that of Corral 1N. All this tentatively suggests MEN-2136 may have been used only sporadically—as a hunting camp—during Component 4.

Robert Oswalt (personal communication 1995) argues from linguistic evidence that permanent residence of Central Pomo tribelets on the coast did not begin much more than 500 years ago. If he is correct, the territorial claims of the new coastal residents may have restricted others’ use of the area, perhaps to a camping stop on their trip to the coast. The Zeni site is on the boundary between the ethnographic territories of the *Kanowa* and *Boya* tribelets. Although believed to have been friendly during the historic period, placement on a boundary could explain lower utilization of this site late in the prehistoric period, when larger populations may have placed the neighboring groups under subsistence stress, leading to use of camp sites in undisputed territory.

CHAPTER TEN

SUMMARY AND CONCLUSIONS

The analysis of the archaeological recovery at MEN-2136 proceeded in four steps. The first, reported in Chapters Two through Four, describes the setting, reviews the ethnographic literature, and surveys previous archaeological research. In the second step, covered in Chapters Five through Seven, the material remains are inventoried, described, and analyzed. In the third step, reported in Chapter Nine, the cultural remains are assembled into four components, using the vertical and horizontal stratigraphy available at the site, cross-dating to other, better stratified assemblages, and obsidian hydration measurements. These first three steps adhere closely to the data, and involve little speculative interpretation. The final analysis and the implications of the work are presented in this chapter. This final chapter summarizes from a broader perspective, employing ethnographic terminology and linguistic labels. As such, it is the least durable of the results—subject to revision as new data generated elsewhere improve our understanding of the past.

The initial objectives for this thesis were to investigate the prehistory of a portion of ethnographic Central Pomo territory, as represented at the Zeni site; to try to identify the groups who used it; and to identify the resources they exploited while living there. Working from the perspective of earlier work by Basgall (1982), Layton (1990), and White and Fredrickson (1992), we asked:

- (1) Could we recognize an early cultural component comparable to those identified elsewhere by Basgall (1982) and Layton (1990) as Yukian?
- (2) Could we identify the arrival of the Pomo through an abrupt increase in obsidian in the debitage and obsidian Leaf-shaped points?
- (3) Could we distinguish between alternating, but coeval, and successive site use by these two groups? and
- (4) Could we determine the primary resources exploited by the prehistoric visitors and thus why they found the site attractive.

To facilitate answering these questions, the site assemblage was analyzed and four discrete numbered components were defined. These components were compared to similar assemblages recovered elsewhere, and dated using obsidian hydration measurements. Three of these, Components 1, 2, and 4, are at best threadbare, representing light or sporadic occupations. The major contribution of this report is the definition of Component 3 (Dry Creek Phase), represented by a large assemblage, which stands in stark contrast to earlier and later occupations at the site.

The first two components are comprised of debitage, scrapers, flake tools and projectile points, almost exclusively of chert, and possibly a small number of milling implements. This assemblage is consistent with use by a group or groups, with limited access to obsidian, making sporadic visits, primarily to hunt, and perhaps process hard seeds, as one stop on their seasonal round. This author argues, following Basgall (1986) and Layton (1990), that the absence of obsidian, the projectile point types, and the apparent hunting focus suggest these groups were pre-Pomo—probably Yukian.

White and Fredrickson (1992) assert that Willits series points (primarily of chert) are associated with groups living to the north and west of Clear Lake, while Mendocino Concave-base and thick-leaf points (primarily of obsidian) characterize the Hultman Aspect peoples located to the south of the lake, with both essentially contemporaneous groups appearing alternately at Clear Lake sites. This author separates Mendocino Concave-base and Willits series points into separate components based on evidence suggesting they may have had different, if partially overlapping, temporal placements. The Field 6 data from the Zeni Ranch provides tentative evidence the concave-base points were introduced before the Willits series in this area, and may represent a different cultural component. The Field 6 sample, however, is small, and “absence of evidence is not evidence of absence.” But, surface collections around the LORAN station near Point Arena recovered numerous Mendocino Concave-base specimens, almost exclusively of Monterey chert, but no Willits series points, supporting a temporal (or group) difference in use of the two styles (Tom Layton, personal communication 1994, personal observation).

Basgall and Bouey (1991:Table 18) assign both Mendocino Concave-base and Willits series points to their Skaggs Phase. While 69 percent of the former points actually appear in Skaggs contexts, only 35 percent of Willits series specimens do. Basgall and Bouey (1991:87) assign a 5000 to 2500 B.P. range for Mendocino Concave-base points, and “more roughly” assign a 5000 to 1500 B.P. range to the Willits series. This thesis tentatively suggests that use of the Willits series began, as well as ended, later than the

Mendocino Concave-base points, at least in the southwestern Mendocino and northern Sonoma County area.

The only data available to date Components 1 and 2 at the Zeni site are four obsidian hydration measurements. The oldest, 3.8 μ (K) on a Mendocino Concave-base, converts to 2900 B.P. using Origer's (1987) Napa formula (after adjusting for temperature). But, this date falls beyond the range where Origer's formula has proven most successful, and the preponderance of chert specimens suggests an obsidian specimen is unlikely to mark the earliest use of the style. A small amount of debitage with larger hydration readings (the tail of Chart 10) *may* offer evidence of earlier use. (The average of the largest hydration measurements, about 4.5 μ (K), converts to 4100 B.P. using Origer's equation.)

The two Mendocino Concave-base points with 2.6 μ (K) measurements suggest the end of the range could be as late as 1400 B.P., later than the dating of the Skaggs Phase at Warm Springs. There is no data at the Zeni site to date the beginning of Willits series use. The single obsidian Willits series point ($N = 2.5 \mu$), translates to about 1300 B.P., and may date the end of the style. It is comparable to the Warm Springs "guess date" of about 1500 B.P. The hydration data on specimens from both components fall well within the range of Component 3. The obsidian hydration data, combined with the mixing of Components 1 through 3 in the trench, support partial contemporaneity of the three components.

Component 3 is dominated by obsidian Leaf-shaped points and debitage, documenting the arrival of groups with access to Clear Lake obsidian sources

(predominantly Konocti). As argued elsewhere for other locations, this suggests a Pomo affiliation. The Leaf-shaped projectile points are comparable to, if smaller than, the Excelsiors found in Houx Phase contexts at Clear Lake, and are similar to those recovered at Warm Springs, labeled Excelsiors, and considered the time-sensitive marker of the Dry Creek Phase.

The significant increase in the number of points and amount of debitage, as compared to Components 1 and 2, argues for much more intensive site use during this component. In fact, the 53.1 artifacts per cubic meter recovered in the MEN-2136 trench is comparable (ignoring probable differences in sediment accumulation rates) to the 53.6 artifacts per cubic meter recovered at SON-571, the largest Dry Creek site in the Dry Creek drainage with the highest artifact density recovered in the Warm Springs project (Basgall and Bouey 1991:II:261).

During Component 3, the Zeni site was a major activity center, used as a hunting camp, but also for specific manufacturing activities; the numerous hafted drills were possibly employed in the manufacture of *Olivella* or *Haliotis* ornaments and the steep-edged scrapers to make objects of wood or bone.

The limited, if any, milling equipment assigned to Component 3 argues against the site's use as a permanent village. In fact, the component likely predates the establishment of permanent Pomo settlements on the coast (Robert Oswalt, personal communication 1995). Obsidian hydration readings on projectile points, converted to calendric dates using Origer's (1987) formula, suggest a span of 2000-700 B.P. for Component 3 at MEN-2136—beginning about 500 years later than the date assigned to

the Dry Creek Phase at Warm Springs, but coeval with the commencement of the phase at SON-571 (Basgall and Bouey 1991:II), and slightly earlier than analogous components recovered by Layton (1990) at Albion Head and by White at MacKerricher and dated 1900-1700 B.P. (White and Fredrickson 1992).

Compared to Component 3, the Component 4 assemblage at the Zeni site is sparse—smaller both in absolute quantity of artifacts and in the variety of artifact classes represented. Clearly the Zeni site was used after the introduction of the bow and arrow (Component 4), but far less intensively than in Component 3, and perhaps only as a hunting camp. At Warm Springs, the assemblages analogous to the Component 4 assemblage at the Zeni site are assigned to the Smith Phase and dated to approximately 900 to 200 B.P.

To summarize, then, the answers to the thesis questions:

- (1) we recognized, in Components 1 and 2, materials interpreted as evidence of pre-Pomo (Yukian) use of the site;
- (2) we recognized an abrupt arrival of obsidian at the site in Component 3, here interpreted as expansion of the Pomoan subsistence/settlement system to include the Zeni site;
- (3) we interpreted the mixing and overlapping obsidian measurements as evidence of alternating but contemporaneous use of the Zeni site by both Yukian and Pomoan groups until about 1300 years ago.
- (4) We were less successful in identifying the specific activities performed on-site during Component 3—the Dry Creek Phase. The lack of preservation of bone, shell, and

unburned wood left us no direct evidence. We can only speculate that the numerous hafted drills were used for a shell ornament industry and the steep-edged scrapers for fashioning items from wood or bone. The site catchment study, albeit based on arbitrary resource indexes, nevertheless suggests that the redwood forest/mixed evergreen forest environment, at least in this portion of southern Mendocino County, was not as impoverished in food resources as is usually assumed.

How does MEN-2136 fit with our understanding of western Mendocino County prehistory? Components 1 and 2 add evidence that initial Native American use of that area is pre-Pomo (probably Yukian) and that occupation of the site began 3,000 to 4,000 years ago. Western Pomo groups first entered the area perhaps 2000 years ago with both Yukian and Pomo groups intermittently occupying the area until about 1300 years ago. If obsidian hydration measurements can be used to monitor changing intensities of use, peak obsidian—and thus Pomo use of the area—coincides with the time of the last obsidian Yukian projectile point. The area may have remained permanently in Pomo tribelet “control” after 1300 B.P.

Intensive site use and specialized activities during Component 3, documented by the steep-edged scrapers and hafted drills, a heavy reliance on obsidian, and the reworked biface industry, suggest the Zeni site Dry Creek Phase materials were from a society that had moved beyond pure subsistence activities, consistent with descriptions of the Houx Phase and the Dry Creek Phase elsewhere. Smith Phase occupation at the Zeni site seems

more ephemeral and more narrowly focused, suggesting this site was on the periphery rather than the center of activity later in time.

Comparison of toolstone proportions with those from other sites expands the range of Konocti obsidian dominance west to the coast in southern Mendocino County. More work with hydration measurements, a better understanding of temperature effects on hydration, and measurement of effective temperature at specific sites is required to truly monitor the Western Pomo expansion and to understand the implications of the Borax Lake and Konocti situation north of MEN-1929. To that end, the author plans further work in the area.

Not developed here, and also the subject for further research by the author, is the use of Monterey chert to delimit the seasonal round of groups with direct access (or exchange relationships) to the Monterey chert quarries near Schooner Gulch and Point Arena. All components identified at the Zeni Ranch include time-sensitive artifacts made from Monterey chert, implying that users in all time periods had access to those quarries.

The author surveyed site records for the area west of the Russian River, in both Mendocino and Sonoma Counties, for evidence of Monterey chert; the results are presented on Map 10. The map understates the number of sites, but probably not the range of use—many archaeologists do not distinguish between Monterey and Franciscan chert on their site record sheets.

The area of Monterey chert use begins at Albion Head in the north, and hugs the coast until just north of Point Arena, where it expands inland, approximately coterminous with the ethnographic territories of the *Boya* and *Kanowa*. It apparently disappears from

lithic assemblages at or just below the Gualala River. This suggests that groups using the Schooner Gulch-Point Arena quarries exploited coastal resources as far north as Albion Head, but confined their use of the interior to land immediately adjacent to the quarries.

A few Monterey chert artifacts have been found elsewhere: there is one Monterey chert Rattlesnake series point at MEN-1929 (Jeffrey Hamilton, personal communication 1994), fewer than 10 Monterey chert artifacts in the Shandel collection at Comptche (personal observation), and a small number of artifacts recovered by the Warm Springs project (Mark Basgall, personal communication 1994), at Salt Point (Kathleen Dowdell, personal communication 1993) and Fort Ross (Ann Schiff, personal communication 1994). But these artifacts of Monterey chert are more likely casual trade items, and do not represent regular use.

As its underlying goal, this thesis has attempted to achieve the three archaeological goals defined by Thomas (1989): (1) to determine chronology, (2) to elucidate lifeways, and (3) to investigate process. We have succeeded in roughly defining the chronology of MEN-2136, and, using the defined assemblages, specifying a framework for the associated lifeways. Elucidating process (the dynamics of cause and effect that bring change to systems) is beyond the available data.

Map 10. Mendocino County Archaeological Sites With Monterey Chert

END NOTES

¹ Trembour and Friedman (1984) are frequently quoted as recommending a 10% adjustment per °C. However, their rate applies to the hydration rate constant, not to the hydration rim depth, where the adjustment is normally applied today. Taking the square root of their 1.10 factor results in a factor of 1.05, or 5%, similar to the 6% currently preferred.

² MEN-2136 is located in Township 12 North, Range 14 West (Mount Diablo meridian), in the east 1/2 of the southeast 1/4 of the southwest 1/4 of Section 21, at UTMG coordinates 462450 to 462550 Easting and 4301600 to 4301700 Northing (Zone 10).

³ All other extant roads in the region were Indian trails:

1. All referenced maps show a trail between Point Arena and Boonville (trail 13 on Peri et al. 1985:214 Map). Today this is Mountain View Road.

2. Peri et al. (1985:214) depict a trail (12) between Black Point and Cloverdale, and another (11) between Stewart's Point and Healdsburg, with a connection between the two (12a), providing a route between Stewart's Point and Cloverdale. Stewart (1943) depicts the latter route. Today, Skagg's Springs Road follows Peri et al.'s trail 11. The private Kelley Road is still shown on the USGS Point Arena map (1981) and follows trail 12 to Cloverdale. Annapolis Road forms the link between the two.

3. Peri et al.'s trail 13 follows Route 128 between Cloverdale and Boonville.

The only modern road in the area missing from the Indian trail maps is Fish Rock Road. This must be an error.

⁴ Stewart (1993), investigating the word lists in Barrett (1908:59), thought she saw a correspondence across the seven Pomoan languages, and thus the possibility that the Western languages had split after the bow and arrow were introduced. However (1) Barrett's word lists have been found to be error-prone by later linguists, and (2) the word for arrow (*hisu* in Kashaya) is formed from a verb root meaning pointed, and thus could have been formed by analogy in the different languages long after they split (Robert Oswalt, personal communication 1995). It is also possible that the word was initially used to describe a dart, and by extension applied to arrow when it later came into use. The word for bow in the various languages is irregular. It does not show the correspondences expected had the word been in the proto-language (Robert Oswalt, personal communication 1995). The implication here is that the Pomoan languages had split before the bow and arrow came into use.

⁵ Elmendorf (1968:8) states:

The writer does not attach much confidence to dates of separation obtained through glottochronological techniques. Nevertheless, an adjusted

minimum date of 2500-3000 years obtained by this method, for the separation of W[appo] and N[orthern] Y[ukian], seems not unreasonable in view of the great lexical and structural divergence involved. In fact, I would definitely favor the lower rather than the upper end of the chronological range represented, and would thus settle for a tentative date of 1000 BC, for the beginning of linguistic separation between W and its northern relatives. It should be noted that the beginning of territorial separation between the two branches could coincide with this date, or could be later.

By 1980, Elmendorf favored a slightly earlier date "Wappo and Yuki are in some respects very dissimilar. ... However, the relation is not a close one, and a very tentative glottochronological date of separation would fall somewhere in the middle of the 2nd millennium BC." His final published words on the subject :

There are no precise criteria for determining this period of Yukian proto-language "unity." Sharing of 35 apparent cognates in the 100-word basic lexicostatistic test list (Elmendorf 1968) works out to a glottochronological "date" of 3480 ± 423 years B.P. (with deviation at 68% confidence level). This would indicate beginning of linguistic divergence between Yuki and Wappo some time between 1953 B.C. and 1107 B.C. Glottochronological dates do not always inspire rock-firm confidence, but this result is in general accord with my subjective impression of Yuki-Wappo differences. (Elmendorf 1981:13-14)

Oswalt has not offered specific dates in print. However, Elmendorf (1968:40 note 11) quotes him:

It is of further interest that Oswalt (1964) locates the original center of differentiation of the Pomo languages in the Clear Lake area, with an estimated time of separation for the major Pomo divisions of around 3000 years ago (personal communication). The coincidence of these dates—mine for separation of W and [n]Y and Oswalt's for separation within Pomo—is rather striking, especially as the two events may well have been connected. Wappo separation from their northern relatives may have been initiated by expansion westward of Pomo groups (N., C., S., S.W.). And it is plausible to associate such expansion and separation with the linguistic differentiation in both families.

⁶ Merriam (n.d.:3) was initially uncertain as to whether the *Kanowa* (which he spelled *Kan-no-ah*) were part of the *Boya* or a distinct tribelet. He must ultimately have concluded the latter: corrections, presumably in his hand, to the entry for *We'-chahl*, in his "Tribe List of the *Kan-no-ah*: A Pomoan Tribe closely related to *Boyah*," moved the village from *Boya* territory to that of the *Kanowa*. His map (Map 4 r) and the boundary

description compiled by his daughter between 1939 and 1946, initially under his supervision, depict the *Kanowa* as a separate territory (Merriam and Talbot 1974:19).

Loeb's list of villages invited by the Point Arena (*Pdahau*) people to their fish feasts supports a unique tribelet identity for the *Kanowa*:

...the people of Mendocino (Buldam); the people of Stewarts Point (Kacaya and Yutaya); the people from Boomville [sic] (Datayama); the people from Rock Pile (Mbamui or Knoya). In late times the Yorkville people and the Yokaia people were also invited. (Loeb 1926:194).

Yutaya (*yo'-taya*, "southerners") is the Boya name for the coast Southern Pomo tribelet which claimed the Rockpile Creek drainage (McLendon and Oswalt 1978:282; Stewart 1943:51), and were not from Stewart's Point (although they may have moved there after contact). The "Knoya" must be the *Kanowa*—sometimes referred to in English as the Rockpile Indians, "from the name of the peak just to the south" (McLendon and Oswalt 1978:282). No *Boya* villages are on Loeb's list; all others named are clearly autonomous tribelets. Most likely *Kanowa* is as well. We can date the time period referenced by the inclusion of *Buldam*, which was established in 1850.

⁷ All obsidian/chert percentages were recalculated from Layton 1990:152-3, Tables 3.9, 3.11, and 3.12.

⁸ Mendocino Side-notched points have parallel edges below the notch while the illustrated specimen's form acute angles with the base. Almost all Mendocino Side-notched points are made from Franciscan chert. The few obsidian specimens are Konocti; there are no known examples of Borax Lake glass. Finally, the hydration reading on this specimen appears much too recent.

⁹ Uncorrected ^{14}C age = 1580 ± 60 B.P.; $^{13}\text{C}/^{12}\text{C}$ ratio = -24.8%; $^{13}\text{C}/^{12}\text{C}$ adjusted age = 1590 ± 60 B.P.

¹⁰ The Flake Obsidian Hydration Measurement Tables are available by request.

¹¹ Hydration on specimen 181-3 (Borax Lake), which measured 0.8μ (0.6μ K), has been ignored. Even after adjusting by 15% for temperature, Origer's (1987) formula for Napa obsidian converts that measurement to less than 75 years B.P. The hydration must reflect recent breakage from plowing, not Native American activity.

¹² Baumhoff's (1963:200) regression equation ($p = 3 (A) + 2 (G) - 210$) was generated to calculate carrying capacities of entire North Coast Ranges linguistic groups. The territories of these groups ranged from 93.2 mi^2 to 1194.5 mi^2 . Substituting the MEN-2136 catchment resource indexes into Baumhoff's equation produces a negative population figure: the Zeni catchment is too small. The populations predicted by his equation for the two groups with the smallest territories, the Lake Miwok and the Coast Yuki, are about 56% of the "actual" size of the two groups, suggesting the equation is

territory-size dependent. (Although part of the problem here is probably attributable to the equation's neglect of fish.) Nevertheless, the smallest territory which generated a reasonable estimate was that of the Southwestern Pomo, who controlled 275 mi². This author scaled the MEN-2136 catchment figures by 10, substituted into the equation, then divided the resulting population by 10, to arrive at the 113 persons shown in the text. Note that scaling by a factor of 5 instead of 10 yields a population figure of 92 persons. But then, perhaps it is just an order of magnitude we are seeking.

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APPENDIX A
ILLUSTRATIONS

Figure Legend

Fig. 13 MEN-2136 Projectile Points

a 181-6 B	b 182-2 F	c 182-1 K	d 141-1 F	e 182-3 F
f 181-7 N	g 182-4 F	h 131-1 M	i 182-5 M	j 106-2 B
k 52-2 N	l 94-9 N	m 102-5 N	n 50-3 K	
o 85-7 N	p 34-26 K	q 86-9 A	r 103-8 K	
q 120-2 F	r 132-4 F	s 125-4 F	t 132-5 F	

Fig. 14 MEN-2136 Leaf-Shaped Points (chert)

a 100-1 F	b 124-9 F	c 126-2 F	d 64-1 F
e 34-5 F	f 54-2 F	g 94-7 F	h 102-1 M
i 180-1 F	j 34-2 F	k 182-13 F	l 91-15 F
m 125-5 M	n 182-7 F	o 50-2 F	p 39-6 M

Figure 15 MEN-2136 Leaf-Shaped Points (chert)

a 54-3 F	b 121-13 F	c 34-22 F	d 120-3 F
e 53-1 F	f 34-1 F	g 64-2 F	h 63-1 F
i 80-9 F	j 36-6 Q	k 50-24 M	l 36-1 F
m 130-1 F	n 75-4 M	o 100-2 F	p 100-3 F

Figure 16 MEN-2136 Leaf-Shaped Points (obsidian)

a 83-9 K	b 92-9 K	c 1-16 K	d 90-5 K
e 60-1 K	f 181-10 K	g 112-4 K	h 126-1 K
i 1-14 K	j 126-3 K	k 110-9 K	l 102-3 K
m 82-1 B	n 75-3 B	o 82-2 B	p 83-8 B

Figure 17 MEN-2136 Leaf-Shaped Points (obsidian)

a 115-4 B	b 39-1 B	c 150-2 B	d 142-2 B
e 144-1 K	f 182-10 K	g 39-4 K	h 70-2 K
i 54-1 K	j 50-5 B	k 92-11 K	l 55-2 K
m 33-5 K	n 62-1 K	o 182-6 K	p 65-4 K

Figure 18 MEN-2136 Leaf-Shaped Points (obsidian)

a 101-1 K	b 55-1 K	c 51-1 K	d 50-4 K	e 34-25 B
f 85-8 B	g 53-2 K	h 61-1 K	i 1-17 K	j 64-4 K
k 82-3 K	l 52-5 K	m 81-7 K	n 60-2 K	o 65-2 K
p 114-7 K	q 64-5 B	r 34-28 B	s 65-1 K	t 1-20 K
u 1-4 K	v 124-8 K	w 114-6 K	x 60-3 K	y 51-3 N

Figure 19 MEN-2136 Projectile Points and Tips

a 84-6 N	b 1-21 B	c 121-8 K	d 95-1 K
e 125-1 K	f 105-1 F	g 93-5 F	h 120-6 K
i 102-7	j 83-24 K	k 33-4 K	l 181-5 F

Figure 20 MEN-2136 Mendocino-Concave Base

a 54-4 F	b 83-6 F	c 123-10 F	d 81-11 F
e 126-8 F	f 85-5 F	g 110-7 F	h 90-16 F
i 145-1 F	j 103-11 F	k 34-8 M	
l 64-13 F	m 35-1 F	n 110-6 F	o 180-8 F
p 142-1 K	q 85-6 B	r 184-4 K	

Figure 21 MEN-2136 Projectile Points

a 124-10 F	b 115-5 N	c 110-8 F	d 121-15 F
e 181-17 F	f 64-3 M	g 60-8 M	h 91-12 F
i 82-17 F	j 94-4 F	k 34-16 M	l 124-12 F
m 83-33 M	n 39-2 F	o 141-2 F	p 83-7 F

Figure 22. MEN-2136 Bifaces

a 90-19 F	b 112-16 M	c 61-4 M
d 65-7 M	e 145-10 F	f 165-1 F
g 133-1 F	h 114-8 F	i 34-13 F
j 63-28 M	k 103-16 F	l 182-29 K

Figure 23. MEN-2136 Drills

Small hafted Drills

a 83-14 F	b 123-8 F	c 80-12 F	d 63-8 M	e 101-5 F	f 91-3 F	g 71-8 F
h 82-15 F	i 123-9 F	j 83-13 F	k 91-4 F	l 86-6 F	m 75-2 M	n 63-9 F

Large hafted Drills

o 55-7 F	p 91-2 F	q 64-11 F	r 62-8 F	s 90-1 F	t 60-4 F
u 106-1 F	v 63-11 F	w 121-12 F	x 38-6 F		

Drill Preforms

y 124-11 M	z 100-5 F	aa 113-17 F	bb 100-6 M
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Shouldered Drills

cc 62-7 K	dd 70-12 F
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Gravers and Perforators

ee 83-15 F	ff 90-2 F
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Figure 24. MEN-2136 Scrapers

a 63-12 M	b 93-6 F	c 111-8 F
d 75-1 F	e 122-4 F	f 142-6/143-5 F
g 63-13 F	h 85-4 F	i 110-19 F
j 83-3 F	k 101-4 F	l 34-6 M

Figure 25. MEN-2136 Scrapers

a 34-14 F	b 33-1 Q		
c 83-5 M	d 51-17 M	e 74-5 M	
f 83-2 F	g 50-23 M	h 163-1 F	i 85-3 M
j 83-4 M	k 112-21 F	l 126-11 F	m 110-18 M

Figure 26. MEN-2136

Scrapers

a 54-10 F	b 76-6 M	c 101-3 K	d 144-5 K
e 110-20 F	f 64-26 B	g 116-3 F	h 64-25 F

Modified Flakes

i 77-9 K	j 39-5 N	k 183-4 F	
l 100-11 F	m 100-7 Qt	n 81-10 N	o 72-5 N

Photograph by Jeffrey Hamilton

Figure 3. View of Zeni Ranch and MEN-2136, from the West

Photograph by Jeffrey Hamilton

Figure 4. View of the Zeni Ranch and MEN-2136, from the North

Photograph by Thomas Layton

Figure 5. View of the Corral

Photograph by Thomas Layton

Figure 6. View of the Trench and Unit 21S24E

Photograph by Thomas Layton

Figure 7. View of the Trench, from the North

Photograph by Thomas Layton

Figure 8. View of the Trench, from the South

Photograph by Thomas Layton

Figure 9. View of Unit 1S1W Stratigraphy (West Wall) and Feature 1

Photograph by Thomas Layton

Figure 10. View of Unit 2S1W Stratigraphy (West Wall)

Photograph by Thomas Layton

Figure 11. View of Unit 3S1W Stratigraphy (West Wall)

Figure 12. Men-2136 Representative Stratigraphic Section

Figure 13. MEN-2136 Projectile Points

Figure 14. MEN-2136 Leaf-Shaped Points (chert)

Figure 15. MEN-2136 Leaf-Shaped Points (chert)

Figure 16. MEN-2136 Leaf-Shaped Points (obsidian)

Figure 17. MEN-2136 Leaf-Shaped Points (obsidian)

Figure 18. MEN-2136 Leaf-Shaped Points (obsidian)

Figure 19. MEN-2136 Projectile Points and Tips

Figure 20. MEN-2136 Mendocino Concave-Base Points

Figure 21. MEN-2136 Projectile Points

Figure 22. MEN-2136 Bifaces

Figure 23. MEN-2136 Drills

Figure 24. MEN-2136 Scrapers

Figure 25. MEN-2136 Scrapers

Figure 26. MEN-2136 Scrapers and Modified Flakes

Figure 27. MEN-2136 Ground Stone

APPENDIX B

TABLES

Table 24. Table of Abbreviations

A	Annadel obsidian
B	Borax Lake obsidian
Bind	Indentation from the base
BitW	Diameter of drill bit at proximal extent of use wear
bL	Length of use wear on drill bit
bW	Basal width
bW/mW	Ratio of basal width to maximum width
DSA	Distal shoulder angle
Edge Angle	Angle of scraper plane, measured at worked edge
F	Franciscan chert
K	(Mount) Konocti obsidian
ILL	Illustration number
M	Monterey chert
MA	Material
MAT	Material
mL	Maximum length
mW	Maximum width
mWp	Relative position, measured from the base, of maximum width
N	Napa Valley obsidian
NOA	Notch angle - DSA minus PSA
nW	Neck width
O.H.	Obsidian hydration measurement
O.H.2	Obsidian hydration - 2nd band
PSA	Proximal shoulder angle
Th	Maximum thickness
Th/mW	Ratio of thickness to width
U	Unidentified obsidian
% M	Monterey Percentage of total chert
% OB	Obsidian percentage of total debitage
% Perim.	Modified portion of scraper perimeter
?	Source uncertain

Table 25. Rattlesnake Series, Mendocino Side-Notched, Willits Series, and Stemmed Points

CAT #	PROV	ENI	NC	M	mL	mW	Th	nW	bW	Wt	DSA	PSA	NO	DSA	PSA	NO	bW/	mW	nW/	OH	OH	REMARKS
UNIT	LEVEL				mm	mm	mm	mm	mm	g	°	°	°	°	°	°	mm	mm	mm	μ	μ	
Rattlesnake Series																						
106-2	4S1W	60-70	B							0.3+	150									2.4		
131-1	21S24E	10-20	M	24.6*	15.7	5.1				1.6*	150	110	40									
141-1	11S1W	10-20	F	20.1*		3.4	5.9			0.8*	180	140	40									
181-6	COR 2N	SURF	B	24.5*	17.7	5.0	7.7	9.1	9.1	1.4*	145	110	35	205	110	95	0.51	0.44	1.1	2.5		SIDE-NOTCH
181-7	COR 2N	SURF	N	31.6*	16.2	3.1	8.9	9.6	9.6	1.5*	220	95	125	160	110	50	0.59	0.55	2.2			SERRATED
182-1	COR 2S	SURF	K	21.4*	13.7*	3.2	8.5	10.2	10.2	0.9*	190	140	50				0.74	0.62	0.9			SIDE-NOTCH
182-2	COR 2S	SURF	F	22.0	15.7	3.4	7.7	10.1	10.1	0.8*	160	120	40				0.64	0.49				DENTICULATE
182-3	COR 2S	SURF	F	23.9*	11.2	2.4	4.8			0.7*	180	95	85	190	110	80						
182-4	COR 2S	SURF	F	30.1*	15.7	3.4	5.8	10.4	10.4	1.4*	150	110	40	160	130	30	0.66	0.37				PROB
182-5	COR 2S	SURF	M							0.6+	150											
Mendocino Side-notched																						
124-10	7S1W	40-50	F	29.4*	14.2	5.2	12.0	13.1	13.1	1.9*	230	100	130	230	120	100						
Willits Series Variants																						
34-16	COR	SURF	M		18.4		13.9			4.5+	230			220								
60-8	2S1W	0-10	M							5.0+	235	95	140	250	100	140						
64-3	2S1W	40-50	M	27.9*	16.2	7.2	13.8	14.6	14.6	3.0*	245	100	145	240	130	110						
82-17	8S1W	20-30	F	59.4*	22.0*	9.8	16.2	15.6	15.6	11.8*	210	95	115	210	110	100						
91-12	9S1W	10-20	F				14.2	13.4	13.4	2.9+	220	110	110	230	120	110						
94-4	9S1W	40-50	F							3.5+	230	120	110									
110-8	5S1W	0-10	F				16.4	18.9	16.6	3.0+	230	106	124	220	150	70						
115-5	5S1W	50-60	N							0.8+		140										
121-15	7S1W	10-20	F	59.9*	23.5	9.6	19.4	21.7	21.7	10.0*	235	106	130	210	125	85						
124-12	7S1W	40-50	F		27.0	6.2				5.7+	140			155								
181-17	COR 2N	SURF	F	32.7*	23.5	7.6	19.3	19.8	19.8	5.1*	210	104	110	220	104	120						
Stemmed Points																						
39-2	TSTPT1	30-40	F	43.4*	16.8	7.7	10.4	9.8	9.8	5.2*	230	80	155	230	110	120						
83-7	8S1W	30-40	F	30.0	14.8*	7.9	9.1	8.1	8.1	3.9*	240	80	160		80							
83-33	8S1W	30-40	M				10.0			1.0+	180	85	95									
141-2	11S1W	10-20	F	27.1	15.6	6.3	13.3	11.6	11.6	3.0*	230	80	150	220	96	125						
+ weight of point fragment																						
* estimated value																						

2.5 1.8 @ BREAK

PRONG, SER

REWORKED

REWORKED

REWORKED

Table 26. Leaf-shaped Points

CAT #	PROVENIENCE UNIT	LEVEL	MA	mL mm	mV mm	Th mm	WT g	Th/ mW	MwP	O.H.	O.H. 2	REMARKS	ILL Fig.
1-3	CORRAL	SURF	K				3.2+			2.2		BASE	
1-4	CORRAL	SURF	K	38.4*	16.2	7.5	4.1*	0.46	0.49	2.9		BASE?	18 u
1-5	CORRAL	SURF	K				3.4+			2.9	4.7	BASE	
1-6	CORRAL	SURF	K	36.0*	16.0	7.2	3.6*	0.45	0.34	1.7		BASE	
1-8	CORRAL	SURF	K				2.3+			2.0		BASE	
1-14	CORRAL	SURF	K	47.6*	22.8	7.3	6.5*	0.32	0.28	1.4		REWORKED	16 i
1-16	CORRAL	SURF	K	51.5*	24.4	8.5	10.9*	0.35	0.53	2.2			16 c
1-17	CORRAL	SURF	K	26.2	17.8	9.7	3.7H	0.54	0.45	2.1		REWORKED	18 i
1-20	CORRAL	SURF	K	27.5	20.0	7.6	3.5H	0.38	0.48	3.1		REWORKED	18 t
1-21	CORRAL	SURF	B	27.0	16.0	8.9	3.5+	0.56	0.53	2.8		REWORKED	19 b
33-5	VINYRD	SURF	K	35.2*	18.2	6.7	3.6*	0.37	0.52	2.1		reworked	17 m
34-1	CORRAL	SURF	F	40.0	18.0	8.2	5.2A	0.46	0.51			reworked	15 f
34-2	CORRAL	SURF	F	52.8*	22.1*	8.1	8.9*	0.37	0.41			base	14 j
34-5	CORRAL	SURF	F	59.0*	23.6	7.9	14.0*	0.33	0.42			base	14 e
34-22	CORRAL	SURF	F	55.9*	17.6	11.5	8.3*	0.65	0.24				15 c
34-24	CORRAL	SURF	F	57.1*	26.0*	8.0	14.4*	0.32	0.36			base	
34-25	CORRAL	SURF	B	29.5*	18.1	6.2	2.8*	0.34	0.38	1.6		reworked	18 r
34-26	CORRAL	SURF	K	32.3	20.3	10.1	4.8A	0.50		2.0		tool	18 e
34-28	CORRAL	SURF	B	18.1	16.0	8.0	1.6H	0.50	0.59	2.9		ZENI NUB	13 p
34-29	CORRAL	SURF	K				2.7+			2.7		BASE	
34-30	CORRAL	SURF	K				1.7+			1.9		base	
34-31	CORRAL	SURF	K				3.2+			2.6		BASE	
35-4	FLD 6	SURF	F				1.8+					base	
36-1	TSTPIT	0-10	F	28.7	16.4	6.3	3.2A	0.38	0.40			RW?SER CTX	15 l
36-6	TSTPIT	0-10	Q	36.8*	17.2	8.2	5.1*	0.48	0.39				15 j
37-5	TSTPIT	10-20	K				2.1+			3.7		base	
38-1	TSTPIT	20-30	K				2.6+			2.9		base	
39-1	TSTPIT	30-40	B	43.3	16.0	5.6	3.5A	0.35	0.39	3.2		bipoint	17 b
39-4	TSTPIT	30-40	K	37.8*	18.2*	7.8	5.0*	0.43	0.48	3.2		WEAR	17 g
39-6	TSTPIT	30-40	M	36.6	19.9*	8.1	6.9*	0.41	0.36				14 p
50-2	ISIW	0-10	F	32.9	18.4	7.5	5.0A	0.41	0.50			rewk perf	14 o
50-3	ISIW	0-10	K				2.8+			2.9		rwk base	13 n
50-4	ISIW	0-10	K	27.8*	18.1	8.1	2.8*	0.45	0.33	0.9		REWORKED	18 d
50-5	ISIW	0-10	B	36.6*	17.2	6.3	3.6*	0.37	0.47	3.4		BASE rwk	17 j
50-7	ISIW	0-10	K				0.8+			3.3		BASE	
50-24	ISIW	0-10	M	30.4	16.1	9.2	5.4A	0.57	0.39			bipoint?	15 k
51-1	ISIW	10-20	K	29.2*	17.4	6.9	2.7*	0.40	0.32	1.8		REWORKED	18 c
51-2	ISIW	10-20	B				1.4+			2.4		base	
51-3	ISIW	10-20	N				2.6+			2.1		BASE CTX	18 y
52-2	ISIW	20-30	N^	22.0	15.6	8.2	2.3H	0.53	0.68	2.3		REWORKED	13 k
52-3	ISIW	20-30	K				2.2+			3.4		REWORKED	
52-4	ISIW	20-30	B				2.1+			2.6		BASE	
52-5	ISIW	20-30	K	24.5	17.3	7.3	2.6H	0.42	0.67	2.3		REWORKED	18 l
52-7	ISIW	20-30	K				0.9+			2.4		BASE	
53-1	ISIW	30-40	F	38.0*	16.0	6.9	4.7*	0.44	0.33			also tool?	15 e
53-2	ISIW	30-40	K	29.5*	18.1	7.0	4.0*	0.39	0.44	DH		REWORKED	18 g
53-3	ISIW	30-40	B				1.5+			2.8		BASE	
53-4	ISIW	30-40	K				0.9+			1.6		BASE	
53-9	ISIW	30-40	K				0.4+			2.5		BASAL NUB	

Table 26. Leaf-shaped Points

CAT #	PROVENIENCE UNIT	LEVEL	MA	mL mm	mW mm	Th mm	WT g	Th/ mW	MwP	O.H.	O.H. 2	REMARKS	ILL Fig.
54-1	1S1W	40-50	K	41.5*	21.2	7.2	4.7*	0.34	0.38	2.1		REWORKED	17 i
54-2	1S1W	40-50	F	50.1*	22.2	8.4	9.5*	0.38	0.38			RWK BASE	14 f
54-3	1S1W	40-50	F	56.6*	22.2	10.2	12.1*	0.46	0.39			BASE	15 a
54-5	1S1W	40-50	K	57.9*	24.8	7.0	9.0*	0.28	0.23	1.6		BASE	
54-6	1S1W	40-50	K				0.6+			2.4		basal nub	
54-7	1S1W	40-50	K				0.8+			1.7		BASE	
55-1	1S1W	50-60	K	28.5	16.2	8.2	3.7H	0.51	0.53	1.7		REWORKED	18 b
55-2	1S1W	50-60	K	33.8	15.2	7.2	3.5*	0.47	0.29	2.7		REWORKED	17 l
55-3	1S1W	50-60	K				2.0+			3.0		REWORKED	
55-4	1S1W	50-60	K				2.4+			2.2		base	
60-1	2S1W	0-10	K	37.8*	22.5	7.0	5.1*	0.31	0.42	1.9		REWORKED	16 e
60-2	2S1W	0-10	K	28.8*	13.9	8.7	3.0*	0.63	0.46	1.1		REWORKED	18 n
60-3	2S1W	0-10	K	28.8	18.4	8.5	3.5*	0.46	0.38	2.4		REWORKED	18 x
61-1	2S1W	10-20	K	26.5	17.4*	8.8	3.7*	0.51	0.36	2.4		REWORKED	18 h
62-1	2S1W	20-30	K	32.3	20.4	8.7	4.6H	0.43	0.32	2.5		REWORKED	17 n
62-4	2S1W	20-30	K				2.4+			1.6		BASE	
62-5	2S1W	20-30	K	61.6*	23.5	6.7	9.0*	0.29	0.32	2.4		BASE	
62-6	2S1W	20-30	K				2.1+			3.2		BASE	
63-1	2S1W	30-40	F	36.7*	16.0	6.7	4.4*	0.42	0.46			reworked	15 h
63-3	2S1W	30-40	K				1.3+			3.0		BASE	
63-4	2S1W	30-40	K				1.9+			2.6		base	
63-5	2S1W	30-40	B				2.1+			2.6		base	
63-6	2S1W	30-40	F				2.2+					base	
64-1	2S1W	40-50	F	50.4	18.2	7.6	5.8*	0.42	0.37			McKee Un?	14 d
64-2	2S1W	40-50	F	39.2*	19.7	7.0	5.5*	0.36	0.53			reworked	15 g
64-4	2S1W	40-50	K	36.7*	17.0	6.9	3.2*	0.41	0.26	1.4			18 j
64-5	2S1W	40-50	B	22.6	12.0*	5.8	1.5*	0.48	0.40	NVB		REWORKED	18 q
64-7	2S1W	40-50	K				3.2+			2.6		BASE	
64-9	2S1W	40-50	K				1.5+			1.9	4.5	BASE	
64-21	2S1W	40-50	K				1.1+			3.0		base frag	
65-1	2S1W	50-60	K	26.4*	16.4	6.7	2.6*	0.41	0.50	NVB		REWORKED	18 s
65-2	2S1W	50-60	K	26.0	14.2	6.4	1.8H	0.45	0.40	3.6	5.3	reworked	18 o
65-4	2S1W	50-60	K				2.8+			DH		RWK BASE	17 p
65-5	2S1W	50-60	K				0.8+			2.4		BASE	
66-1	2S1W	60-70	K				2.0+			2.4		base	
70-2	3S1W	0-10	K	43.1*	21.4*	9.0	7.4*	0.42	0.38	2.2		REWORKED	17 h
70-4	3S1W	0-10	K				1.3+			1.8		BASE	
70-5	3S1W	0-10	K							0.8		BASE	
70-6	3S1W	0-10	K				0.6+			3.4		BASE	
70-21	3S1W	0-10	B				1.7+			2.7		BASE	
71-1	3S1W	10-20	K				3.2+			2.7		base	
71-17	3S1W	10-20	K				0.6+			2.8		BASAL FRAG	
72-3	3S1W	20-30	K				0.7+			2.9		base	
74-8	3S1W	40-50	K				1.8+			2.4		base	
75-3	3S1W	50-60	B	50.3*	23.0	9.5	10.2*	0.41	0.33	2.5			16 n
75-4	3S1W	50-60	M	29.7	15.0	7.9	2.9A	0.53	0.41			reworked	15 n
76-3	3S1W	60-70	K				0.8+			1.7		base	
76-5	3S1W	60-70	K	33.1*	19.3	5.8	3.5*	0.30	0.44	2.6		REWORKED	
80-8	8S1W	0-10	F				3.2+					base	

Table 26. Leaf-shaped Points

CAT #	PROVENIENCE	MA	mL	mW	Th	WT	Th/	MwP	O.H.	O.H.	REMARKS	ILL
	UNIT	LEVEL	mm	mm	mm	g	mW		2			Fig.
80-9	8S1W	0-10	F	43.8*	20.7	7.0	6.0*	0.34	0.47		RWK CTX	15 i
81-7	8S1W	10-20	K	24.8	18.5	7.2	2.6A	0.39	0.44	1.9	REWORKED	18 m
81-8	8S1W	10-20	K				1.1+			3.2	base	
82-1	8S1W	20-30	B	60.5*	20.3	7.4	9.1*	0.36	0.29	3.4		16 m
82-2	8S1W	20-30	B	58.6	24.5	9.4	11.0*	0.38	0.35	3.4		16 o
82-3	8S1W	20-30	K	23.6	18.2	6.3	2.3H	0.35	0.47	2.7	REWORKED	18 k
82-4	8S1W	20-30	K				2.9+			2.4	BASE	
82-5	8S1W	20-30	B				2.3+			3.1	base	
82-6	8S1W	20-30	K				1.8+			2.2	BASE	
82-7	8S1W	20-30	K				1.4+			3.5	base	
83-8	8S1W	30-40	B	49.0*	21.2	8.8	7.7*	0.42	0.37	3.6	REWORKED?	16 p
83-9	8S1W	30-40	K	46.0*	23.4	6.9	6.7*	0.29	0.48	2.9	UNIFACIAL	16 a
83-10	8S1W	30-40	B				0.8+			2.5	BASE	
83-11	8S1W	30-40	K				4.6+			2.7	BASE	
83-23	8S1W	30-40	K				1.0+			2.0	base	
84-5	8S1W	40-50	M				2.9+				base	
84-6	8S1W	40-50	N	36.6*	17.5	5.6	2.7*	0.32	0.51	2.2	REWORKED	19 a
84-7	8S1W	40-50	K				1.1+			3.8	base	
85-7	8S1W	50-60	N^	28.2	18.7	6.1	2.9H	0.33		1.9	RWK SER	13 o
85-8	8S1W	50-60	B	32.4	18.3	6.4	2.8H	0.35		2.9	REWORKED	18 f
85-9	8S1W	50-60	B				1.4+			3.0	BASE	
86-7	8S1W	60-70	K				2.4+			1.8	BASE	
86-9	8S1W	60-70	A^	27.9	19.2	7.2	2.8H	0.38		2.2	ZENI NUB	13 q
90-5	9S1W	0-10	K	42.2	17.4	7.7	5.9*	0.44	0.30	2.5	POINT	16 d
90-8	9S1W	0-10	K				1.7+			2.4	base	
90-10	9S1W	0-10	N^				1.3+			3.1	base	
90-18	9S1W	0-10	K				0.8+			1.9	BASAL FRAG	
91-6	9S1W	10-20	F				2.0+				BASE	
91-14	9S1W	10-20	K				1.4+			2.4	base	
91-15	9S1W	10-20	F	36.9*	25.9	9.9	9.9*	0.38	0.50			14 l
91-18	9S1W	10-20	B				0.9+			2.0	base	
91-27	9S1W	10-20	B				2.2+			4.0	BASE TOOL	
92-7	9S1W	20-30	K				0.7+			1.9	BASE	
92-8	9S1W	20-30	B				1.2+			2.3	BASE	
92-9	9S1W	20-30	K	52.3	23.0	7.3	7.1*	0.32	0.44	2.5	BASE	16 b
92-11	9S1W	20-30	K	33.6	15.7	7.6	3.8H	0.48	0.41	3.1	base	17 k
94-6	9S1W	40-50	M				0.7+				base	
94-7	9S1W	40-50	F				4.1+				BASE-CL	14 g
94-9	9S1W	40-50	N^	20.9	13.0	6.3	1.4H	0.48	0.40	2.1	Z nub	13 l
95-1	9S1W	50-60	K	65.5*	26.5	10.6	14.8*	0.40		3.4	?	19 d
95-3	9S1W	50-60	K				0.4+			2.0	BASAL NUB	
96-1	9S1W	60-70	K				1.4+			2.3	BASE	
100-1	4S1W	0-10	F	52.3	23.0	8.4	9.6A	0.37	0.46		classic?	14 a
100-2	4S1W	0-10	F	31.1	18.3	8.3	3.8A	0.45	0.41		reworked	15 o
100-3	4S1W	0-10	F	26.8	13.0	5.7	1.7A	0.44	0.42		reworked	15 p
101-1	4S1W	10-20	K	28.9	21.5	7.0	3.6*	0.33	0.53	2.5	REWORKED	18 a
101-2	4S1W	10-20	K				1.7+			2.9	base	
102-1	4S1W	20-30	M	48.4*	19.4	6.1	4.0*	0.31	0.41		reworked	14 h
102-3	4S1W	20-30	K	52.3*	21.1*	7.0	6.1*	0.33	0.42	1.6	base	16 l

Table 26. Leaf-shaped Points

CAT #	PROVENIENCE	MA	mL	mW	Th	WT	Th/	MwP	O.H.	O.H.	REMARKS	ILL
	UNIT	LEVEL	mm	mm	mm	g	mW		2			Fig.
102-4	4S1W	20-30	K	27.0*	19.5	8.0	3.7*	0.41	0.33	2.2	REWORKED	
102-5	4S1W	20-30	N	21.2	12.8	7.0	1.5H	0.55		3.4	ZENI PT	13 m
102-6	4S1W	20-30	N				1.0+			3.6	basal nub	
103-5	4S1W	30-40	K				1.3+			2.2	BASE	
103-7	4S1W	30-40	K				0.6+			2.4	base	
103-8	4S1W	30-40	K^				2.2+			4.0	BASE	13 r
103-9	4S1W	30-40	F	19.5	13.8	6.4	1.7*	0.46	0.31		base	
103-10	4S1W	30-40	F				1.9+				base	
105-2	4S1W	50-60	B				1.5+			3.6	BASE	
110-9	5S1W	O-10	K	49.8*	23.9*		4.4+		0.35	1.7		16 k
110-10	5S1W	O-10	B				1.0+			2.3	BASE	
110-12	5S1W	O-10	B				1.6+			3.7	base	
110-22	5S1W	O-10	B				0.3+			2.2	BASE	
111-7	5S1W	10-20	M				1.4+				BASE	
112-2	5S1W	20-30	K	31.1*	21.5	4.7	3.1*	0.22		2.3	REWORKED	
112-3	5S1W	20-30	K				1.6+			2.1	base	
112-4	5S1W	20-30	K	50.5*	22.5*	8.7	10.0*	0.39	0.33	2.5		16 q
113-10	5S1W	30-40	B	33.1*	17.7	8.6	3.8*	0.49	0.43	3.0	base	
113-11	5S1W	30-40	K				1.5+			2.7	BASE	
113-12	5S1W	30-40	K				2.2+			2.3	BASE	
114-1	5S1W	40-50	K				2.5+			1.9	BASE	
114-2	5S1W	40-50	N^				2.0*			2.8	BASE	
114-3	5S1W	40-50	K				1.8+			1.8	BASE	
114-4	5S1W	40-50	K				1.6+			2.0	BASE	
114-5	5S1W	40-50	K				1.9+			3.1	BASE	
114-6	5S1W	40-50	K	26.4	18.3	7.0	2.7*	0.38	0.45	2.4	RWK BASE	18 w
114-7	5S1W	40-50	K	22.1	14.4	6.3	1.9H	0.44	0.57	2.4	REWORKED	18 p
115-4	5S1W	50-60	B	48.1	14.2	7.6	4.6H	0.54	0.33	2.4	RWK?	17 a
120-2	7S1W	O-10	F	27.3	18.1	5.2	2.5A	0.29	0.40		reworked?	13 q
120-3	7S1W	O-10	F	45.0*	18.8	10.2	7.7*	0.54	0.55		chunky	15 d
120-9	7S1W	O-10	K				0.9+			3.6	BASE	
121-7	7S1W	10-20	K				0.5+			3.2	BASE	
121-8	7S1W	10-20	K	44.9*	20.8	10.3	8.7*	0.50	0.39	2.5	3.3 BASE	19 c
121-9	7S1W	10-20	K	22.1*	14.4	6.6	2.0*	0.46	0.31	2.5	reworked	
121-10	7S1W	10-20	K				0.2+			2.3	BASAL NUB	
121-13	7S1W	10-20	F	58.3*	22.1	10.7	13.2*	0.48	0.26		base	15 b
122-2	7S1W	20-30	B				3.7+			DH	BASAL FRAG	
123-4	7S1W	30-40	K				1.9+			2.8	BASAL FRAG	
123-5	7S1W	30-40	K				0.4+			2.5	BASAL NUB	
123-14	7S1W	30-40	K				0.5+			2.7	BASAL NUB	
123-15	7S1W	30-40	K				1.2+			NVB	BASE	
124-4	7S1W	40-50	K				1.6+			2.8	BASE	
124-5	7S1W	40-50	K				0.9+			2.2	base	
124-6	7S1W	40-50	K				2.8+			2.6	BASE	
124-8	7S1W	40-50	K	28.8*	15.2*	6.0	2.3*	0.41	0.56	1.9	REWORKED	18 v
124-9	7S1W	40-50	F	51.9	20.9	8.4	8.2A	0.40	0.40		classic?	14 b
125-1	7S1W	50-60	K	78.9*	29.1	11.3	20.0*	0.39	0.20	2.4	WIDE	19 c
125-4	7S1W	50-60	F	23.3	16.6*	6.8	2.8*	0.41	0.32		reworked	13 s
125-5	7S1W	50-60	M	32.4*	16.8	7.0	3.8*	0.42	0.33		RWK?	14 m

Table 26. Leaf-shaped Points

CAT #	PROVENIENCE		MA	mL	mW	Th	WT	Th/	MwP	O.H.	O.H.	REMARKS	ILL
	UNIT	LEVEL		mm	mm	mm	g	mW		2			Fig.
125-6	7S1W	50-60	K				2.1+			3.4		BASE	
126-1	7S1W	60-70	K	41.3	20.8	6.6	6.4*	0.32	0.35	2.7			16 h
126-2	7S1W	60-70	F	55.3	22.5*	10.5	14.4*	0.47	0.44				14 c
126-3	7S1W	60-70	K	58.2*	21.4	6.7	9.4*	0.31	0.38	2.4		BASE	16 j
126-4	7S1W	60-70	K				1.8+			2.8		base	
130-1	21S24E	0-10	F	31.3	14.5	8.3	3.6*	0.57	0.54			reworked	15 m
130-2	21S24E	0-10	K				0.9+			0.9		base	
131-2	21S24E	10-20	M	31.5	14.2	7.5	3.2A	0.53	0.49			RWK STEM?	
131-3	21S24E	10-20	K				0.4+			1.4		BASAL NUB	
132-4	21S24E	20-30	F	19.2	14.8	5.2	1.6A	0.35	0.44			reworked?	13 r
132-5	21S24E	20-30	F	25.7	15.2	6.6	2.7A	0.43	0.55			reworked	13 t
132-6	21S24E	20-30	K				2.5+			4.4		BASE, broke	
141-4	11S1W	10-20	N				2.5+			4.1		BASE	
141-5	11S1W	10-20	F				1.5+					BASE	
141-10	11S1W	10-20	M				1.2+					zeni nub	
141-20	11S1W	10-20	B				2.0+			DH		BASE	
142-2	11S1W	20-30	B	49.9*	20.5	7.5	5.2*	0.37	0.31	DH		REWORKED	17 d
142-7	11S1W	20-30	K				0.6+			1.5		BASE	
143-1	11S1W	30-40	K				1.7+			1.7		BASE	
143-6	11S1W	30-40	A?^				0.9+					BASE	
144-1	11S1W	40-50	K	61.5*	27.9	9.8	12.3*	0.35	0.42	0.9		REWORKED?	17 e
150-2	11S1W	FEAT 2	B	44.9*	18.5*	7.4	4.6*	0.40	0.29	4.0		REWORKED	17 c
163-2	11S1W	30-40	K				0.4+			1.2		BASAL NUB	
165-2	11S1W	50-60	K				0.1+			1.8		BASAL NUB	
165-3	11S1W	50-60	K				0.4+			2.2		BASAL NUB	
180-1	COR 1N	SURF	F	43.4*	18.7	8.6	7.9*	0.46	0.35			base	14 i
180-2	COR 1N	SURF	K				2.1+			2.9		BASE RWK?	
180-7	COR 1N	SURF	K				0.9+			2.0		BASAL NUB	
180-11	COR 1N	SURF	F				0.9+					base	
181-1	COR 2N	SURF	K				0.9+			1.3		BASAL NUB	
181-2	COR 2N	SURF	N				0.9+			1.0		BASE CTX	
181-3	COR 2N	SURF	B				1.2+			0.8		BASE	
181-4	COR 2N	SURF	K				1.1+			1.4		BASE	
181-10	COR 2N	SURF	K	53.8*	23.7*	8.6	9.5*	0.36	0.28	1.9		BASE	16 f
182-6	COR 2S	SURF	K				2.9+			2.5		BASE RWK	17 o
182-7	COR 2S	SURF	F	33.2	19.1	9.2	5.5A	0.48	0.44			reworked?	14 r
182-9	COR 2S	SURF	K				2.6+			NVB		BASE?	
182-10	COR 2S	SURF	K	60.0*	23.8	7.8	10.6*	0.33	0.41	2.1		BASE SER	17 f
182-12	COR 2S	SURF	F				2.0+					BASE CLAS	
182-13	COR 2S	SURF	F				2.3+					BASE CLAS	14 k
182-21	COR 2S	SURF	K				1.1+			2.6		BASE	
184-3	COR2SE	SURF	K				0.9+			1.2			

^ SOURCED BY XRF
 + WEIGHT OF POINT FRAGMENT
 * ESTIMATED VALUE
 A ACTUAL WEIGHT
 H WEIGHT ADJUSTED .1-.2 G FOR HYDRATION CUT

Table 28. Biface Attributes

CAT #	PROVENIENCE	MAT	mL	mW	Th	Wt	Th/	REMARKS	
	UNIT	LEVEL	mm	mm	mm	g	mW		
34-9	COR	SURF	M	21.0	22.9	8.2	4.6	0.36	BASE?
34-13	COR	SURF	F	38.9	37.0	11.2	20.1	0.30	BASE WEAR
34-21	COR	SURF	F	41.1	19.5	11.0	9.9	0.56	MIDSEC
34-23	COR	SURF	F	42.9	16.2	12.2	8.4	0.75	MID FR S? WEAR?
35-3	FLD6	SURF	F	36.1	24.1	12.1	9.9	0.50	TIP
50-1	1S1W	0-10	F	35.1	18.2	11.8	7.3	0.52	
51-11	1S1W	10-20	M	27.8	27.8	11.2	9.0	0.40	MIDSEC WEAR?
51-12	1S1W	10-20	F	15.5	19.5	6.2	1.7	0.32	BASE?
61-4	2S1W	10-20	M	46.9	24.9	12.7	12.7	0.51	BASE PQ
63-28	2S1W	30-40	M	31.0	25.7	15.0	10.3	0.58	END FRAG CX? WEAR?
63-29	2S1W	30-40	F	50.5	21.7	13.5	13.6	0.62	END FRAG CORT SCR?
65-6	2S1W	50-60	M	19.4	21.3	12.8	6.5	0.60	MED. FRAG PQ
65-7	2S1W	50-60	M	40.7	24.8	11.7	9.9	0.47	BASE? PH W
70-8	3S1W	0-10	F	27.8	13.7	9.2	4.0	0.67	
70-9	3S1W	0-10	F	20.6	11.3	8.7	2.6	0.77	FRAG PR E T?
73-10	3S1W	30-40	F	29.1	21.7	12.2	7.3	0.56	END PQ CORT?
80-11	8S1W	0-10	F	41.3	19.4	11.2	9.3	0.58	MID PQ CORT? SCR
90-19	9S1W	0-10	F	57.5	32.0	10.8	21.0	0.34	PQ CORTEX? W
100-9	4S1W	0-10	F	45.9	19.8	9.1	8.0	0.46	TIP PQ WEAR SCR
103-16	4S1W	30-40	F	36.2	30.9	14.6	4.5	0.47	MIDSECTION
111-5	5S1W	10-20	F	23.1	13.2	6.2	2.4	0.47	
112-16	5S1W	20-30	M	47.8	28.7	12.6	13.8	0.44	WEAR?
114-8	5S1W	40-50	F	36.8	27.6	17.3	16.3	0.63	END PQ CORT
122-8	7S1W	20-30	F	44.9	21.1	10.7	8.9	0.51	END VEIN, SCR?
130-9	21S14E	0-10	F	39.5	26.6	13.4	15.4	0.50	MID PQ CORT? SCR
133-1	21S24E	30-40	F	40.3	25.3	13.7	15.7	0.54	END
145-10	11S1W	50-60	F	42.3	29.0	16.8	19.9	0.58	FAILED BLANK
165-1	11S1W	50-60	F	33.2	32.3	11.1	12.6	0.34	BASE WEAR
180-10	COR1N	SURF	F	30.2	17.9	11.7	5.5	0.65	MED FRAG WEAR
182-11	COR 2S	SURF	M	20.1	23.4	7.9	3.8	0.34	BASE WEAR?

Table 29. Biface Fragments - Attributes

CAT #	PROVENIENCE	MA	mL	mW	Th	Wt	Th/mW	REMARKS
	UNIT	LEVEL	mm	mm	mm	g		
34- 7	COR	SURF	M	16.9	19.9	7.7	3.0	0.39 FRAG WEAR SCR?
50-15	1S1W	SURF	F	27.5	12.2	9.4	3.3	0.77 MID FRAG, W SCR?
60-17	2S1W	0-10	N^	24.4	17.4	8.0	2.6	0.46 FRAG
62- 9	2S1W	20-30	B	35.8	18.4	4.6	3.1	0.25 FRAG, RED. FLAKE
63-26	2S1W	30-40	M	30.7	13.0	13.0	4.0	1.00 FRAG WEAR
63-27	2S1W	30-40	F	21.0	27.7	8.7	5.3	0.31 MIDSECT?
64-24	2S1W	40-50	B				0.3	FRAG
71- 6	3S1W	10-20	B				1.4	FRAG? WEAR
74- 1	3S1W	40-50	K	46.1	17.7	12.1	7.7	0.68 FRAG, W, SCR?
80- 3	8S1W	0-10	B	20.3	19.2	4.9	1.5	0.26 FRAG, WEAR
81- 1	8S1W	10-20	K	29.2	16.9	9.9	3.1	0.59 MID FRAG
91-13	9S1W	10-20	K	12.5	16.5	7.7	1.4	0.47 MID BURNED
91-25	9S1W	10-20	K	15.9	8.7	6.7	0.6	0.77 FRAG
92- 4	9S1W	20-30	F	36.1	18.9	10.7	9.6	0.57 FRAG WEAR
92-15	9S1W	20-30	B	24.1	19.8	7.0	2.8	0.35 FRAG
112-24	5S1W	20-30	B	24.6	13.9	3.8	1.1	0.27 FRAG
116- 2	5S1W	60-70	M	31.8	26.2	11.8	8.0	0.45 FRAG PQ CORT
120-10	7S1W	0-10	K	15.0	27.0	7.4	3.1	0.27 MID FRAG WEAR
131- 5	21S24E	10-20	F	10.5	31.5	10.5	4.2	0.33 MID FRAG WEAR
132- 8	21S24E	20-30	F	26.3	20.6	8.1	4.2	0.39 MID FRAG C?
141-21	11S1W	10-20	K	26.7	10.6	5.4	1.8	0.51 MID FRAG
159- 3	11S1W	30-50	M	9.0	20.3	7.5	1.7	0.37 MID FRAG
182- 8	COR2S	SURF	F	15.1	23.6	11.2	3.7	0.47 FRAG
182-29	2S1W	0-10	K	28.5	27.1	10.8	8.4	0.40 MID FRAG, W

Figure 30. Drills

CAT #	PROVENIENC	MAT	L	W	TH	bL	bW	WT	ILL	REMARKS
UNIT	LEVEL		mm	mm	mm	mm	mm	g		
Small Hafted Drills										
37-7	TPT-1	10-20	F	18.7	7	7		0.8		not used
50-10	1S1W	0-10	F	18.7	8.5	4.7	1.8	1.8	0.6	
51-16	1S1W	10-20	F	17	7.9	5.5		0.7		bit-snapped
63-8	2S1W	30-40	M	17.8	7.6	4.6	2.9	2.9	0.6	d twisting-snap
63-9	2S1W	30-40	F	21.3	9.2	5.3	1.5	1.7	1	n
63-10	2S1W	30-40	F	20	8.3	6	2	2.2	1	
64-12	2S1W	40-50	M	16.5	9.4	5.2	1.7	2	0.7	twist-spall
71-8	3S1W	10-20	F	14.3	8.4	6.5	1.3	1.5	0.6	g twisting snap?
75-2	3S1W	50-60	M	20.2	7.8	6		1	m	resharpened
80-12	8S1W	0-10	F	14.3	8.3	5.4	1.5	2	0.6	c
82-15	8S1W	20-30	F	19.8	7.6	5.2	3.2	3.2	0.7	h
83-13	8S1W	30-40	F	19.5	10.8	5.8	2.6	3	0.9	j
83-14	8S1W	30-40	F	15.1	9.2	5.5	2.6	2.7	0.6	a
86-6	8S1W	60-70	F	20.9	9.7	6.2	3.6	3.6	1.3	l
90-3	9S1W	0-10	F	18.8	7.7	6.9	2.2	2.1	0.9	use-spalls
91-1	9S1W	10-20	F	16.7	10.1	6.4	1.4	2.1	1.1	
91-3	9S1W	10-20	F	14.9	7.2	5.3	1.6	1.7	0.4	f potlid
91-4	9S1W	10-20	F	22.5	7.9	5.6	1.8	2.8	1.1	k
92-2	9S1W	20-30	M	20.8	9.3	5.3	1.3	1.7	1.1	
101-5	4S1W	10-20	F	16	6.5	6	2.8	3.2	0.5	e resharpened?
114-11	5S1W	40-50	M	18.4	9.2	4		0.6		not used
120-1	7S1W	0-10	F	15.6	8.7	6.9		0.8		twisting break
123-8	7S1W	30-40	F	18.2	7.5	4.6	3.3	3.5	0.5	b
123-9	7S1W	30-40	F	17.4	7.5	4.1	1.4	2.6	0.5	i prox missing?
125-7	7S1W	50-60	F	21	6.7	6	1.5	1.8	0.9	
126-6	7S1W	60-70	F	20.7	8	4.9	1.9	1.5	0.7	resharpened
126-7	7S1W	60-70	M	13.9	7.7	3.4		0.3		prox end
142-16	11S1W	20-30	F	14.2	9.4	3.7	2.4	2.7	0.5	resharpened

Figure 30. Drills (continued)

CAT #	PROVENIEN UNIT	MA LEVEL	L mm	W mm	TH mm	bL mm	bW mm	WT g	ILL	REMARKS
Large Hafted Drills										
38-6	TPT-1	20-30	F	25.7	11.2	6.0	1.9	1.9	2.1	x
55-7	1S1W	50-60	F	22.1	11.7	7.7	2.4	3.3	1.6	o
60-4	2S1W	0-10	F	27.5	13.0	10.8			3.4	t not used
62-8	2S1W	20-30	F	23.2	10.5	5.9	1.4	2.3	1.5	r
63-11	2S1W	30-40	F	25.7	9.5	7.8			2.6	v bit-snapped
64-11	2S1W	40-50	F?	23.2	11.9	7.7			1.2	q light use
82-13	8S1W	20-30	F	32.3	11.6	10.3			3.3	twist? snap
84-4	8S1W	40-50	F	20.1	10.3	5.5			1.1	resharpened
85-2	8S1W	50-60	M	23.5	12.0	6.8			1.7	not used
90-1	9S1W	0-10	F	26.5	13.2	6.9	2.2	3.1	2.5	s
91-2	9S1W	10-20	F	23.1	11.6	5.4	1.5	1.7	1.8	p
91-5	9S1W	10-20	F	30.4	10.8	5.6			1.6	reworked?
106-1	4S1W	60-70	F	31.2	11.2	4.4	1.8	2.7	2.1	u
114-12	5S1W	40-50	F	21.0	7.2	6.2			1.1	bit missing
121-12	7S1W	10-20	F	33.9	10.9	10.4	2.0	2.2	3.2	w twist-scar?
122-7	7S1W	20-30	F	19.0	10.9	6.0	1.6	2.9	1.2	bit broken
181-22	COR2	SURF	F	31.3	13.7	7.1	1.0	2.0	2.8	light use
Shouldered Drills										
62-7	2S1W	20-30	K	22.2	20.4	8.0	6.6	3.9	3.0	cc crown-shaped
70-12	3S1W	0-10	F	30.0	10.8	10.5	2.6	3.1	3.0	dd
Drill Preforms										
60-20	2S1W	0-10	M	30.7	11.7	8.7			3.3	early stage
61-2	2S1W	10-20	F	24.3	12.4	10.2			3.3	dd not finished
82-14	8S1W	20-30	F	34.7	16.8	9.8			6.5	v rough-out
83-16	8S1W	30-40	F	21.7	10.1	5.9			1.0	p in-process
100-5	4S1W	0-10	F	22.8	9.3	7.0			1.5	i broke in manuf
100-6	4S1W	0-10	M	26.5	8.5	7.1			1.6	r not finished
113-17	5S1W	30-40	F	30.0	10.2	7.2			2.3	q not finished
113-18	5S1W	30-40	M	28.6	8.6	7.5			1.9	in-process
124-11	7S1W	40-50	M	16.4	8.1	4.9			0.5	broke in manuf
160-11	11S1W	0-10	F	24.5	11.8	5.0			1.5	in-process
Gravers/Perforators										
83-15	8S1W	30-40	F	20.9	12.5	5.0	1.2	2.3	1.3	o graver?
90-2	9S1W	0-10	F	28.8	8.8	6.8			1.6	perforator?
111-4	5S1W	10-20	F	18.0	8.1	4.8			0.6	graver?

Table 31. Scrapers, Modified Flakes and Utilized Flakes

CAT #	PROVENIENCE UNIT	MAT LEVEL	mL mm	mW mm	Th mm	Wt g	EDGE ANGLE	REMARKS
Scrapers								
33- 1	COR	SURF	Q	47.3	27.2	12.5	25.1	70-80
33- 6	VINY	SURF	M	20.8	20.8	20.8	4.6	80+ FRAG
34- 6	COR	SURF	F	35.4	29.3	11.4	11.7	75+
34-14	COR	SURF	F	49.9	33.4	11.1	21.7	70-101
34-15	COR	SURF	M	23.4	16.1	7.6	3.3	68-104 THUMB SCR FRAG?
35- 2	FLD6	SURF	F	35.4	22.7	8.9	7.7	70-99 FRAG
50-11	1S1W	0-10	F	27.1	24.6	7.9	6.5	69+ REJUVENATED?
50-23	1S1W	0-10	M	30.8	24.2	7.8	6.4	57+ THUMB SCRAPER
51-17	1S1W	10-20	M	42.1	30.6	16.0	17.0	75+ CORTEX
54-10	1S1W	40-50	F	31.8	19.2	17.8	11.0	80+
63-12	2S1W	30-40	M	36.3	31.1	21.2	25.4	85-112 DOMED
63-13	2S1W	30-40	F	45.9	24.0	7.8	10.1	65+ 1 STR, 1 CVX EDGE
64-25	2S1W	40-50	F	27.4	26.9	11.2	6.6	80+ UTILIZED FLAKE
64-26	2S1W	40-50	B	13.3	10.5	4.5	0.9	70-86 HAFTED?
66- 3	2S1W	60-70	M	22.1	13.3	7.8	2.4	67-80+ THUMB SCR FRAG?
66- 4	2S1W	60-70	M	15.9	10.7	14.4	2.0	75+ FRAG?
74- 5	3S1W	40-50	M	38.0	14.9	9.1	5.9	80+
75- 1	3S1W	50-60	F	40.3	34.5	12.3	26.3	82
76- 6	3S1W	60-70	M	26.0	19.7	8.2	4.0	60-78 THUMB SCRAPER
83- 2	8S1W	30-40	F	27.7	26.0	11.1	10.0	70+ THUMB SCRAPER
83- 3	8S1W	30-40	F	36.7	25.5	8.1	7.1	75+ CONCAVE SPOT
83- 4	8S1W	30-40	M	34.0	29.0	10.7	10.4	56+
83- 5	8S1W	30-40	M	42.7	25.6	12.5	14.7	65+
85- 3	8S1W	50-60	M	25.8	22.1	9.0	5.2	63 THUMB SCRAPER
85- 4	8S1W	50-60	F	36.4	30.6	8.9	11.5	57+
92- 1	9S1W	20-30	F	27.0	10.3	4.4	1.3	68-83 MODIFIED FLAKE
93- 6	9S1W	30-40	F	36.6	29.9	15.7	17.5	69-92 DOMED
100- 8	4S1W	0-10	F	25.7	6.2	6.0	1.7	72-83 FRAG
101- 3	4S1W	10-20	K	19.0	15.5	6.4	1.6	58-75 OH=2.7 FRAG
101- 4	4S1W	10-20	F	37.9	26.5	11.1	7.9	75+ POT-LID
103-15	4S1W	30-40	K	22.0	18.0	4.6	2.0	60-74 O.H.=2.9 STRIA.
110-18	5S1W	0-10	M	19.9	18.8	12.3	8.0	90+
110-19	5S1W	0-10	F	33.9	26.7	11.3	11.1	70+
110-20	5S1W	0-10	F	21.3	16.2	6.6	2.7	72+ FRAG HAFTED?
111- 8	5S1W	10-20	F	37.0	34.7	18.7	30.8	68-80 DOMED
112-21	5S1W	20-30	F	38.0	30.1	13.0	11.8	59+
116- 3	5S1W	60-70	F	32.5	15.9	4.0	2.4	63-85 MODIFIED FLAKE
121-14	7S1W	10-20	F	33.5	15.2	9.7	4.9	72-80
122- 4	7S1W	20-30	F	49.7	32.2	11.6	20.4	69-85 BICONVEX
126-11	7S1W	60-70	F	35.9	21.5	9.7	7.8	70-100 THUMB FRAG
132- 3	21S24E	20-30	F	35.9	22.4	15.0	9.8	80-93 FRAG? WORN
142- 6	11S1W	20-30	F	29.8	19.6		5.2	60-90+ 1 OF 3

Table 31. Scrapers, Modified Flakes and Utilized Flakes

CAT #	PROVENIENCE UNIT	MAT LEVEL	mL mm	mW mm	Th mm	Wt g	EDGE ANGLE	REMARKS
143- 5	11S1W	30-40	F	32.0	24.9		4.5	72+ 2 OF 3
143- 9	11S1W	30-40	F	20.7	12.6		1.1	70+ 3 OF 3
143-9*	11S1W	20-40	F	47.9	30.6	5.8	10.7	60-90 3 SEGS COMBINED
144- 5	11S1W	40-50	K	24.9	21.4	4.4	2.9	58+ THUMB, OH= 3.0
163- 1	11S1W	30-40	F	25.3	22.5	5.9	5.1	80+ THUMB SCRAPER
182-24	COR2S	SURF	M	35.4	19.8	14.5	10.0	78-100
Modified Flakes								
39- 5	TPT1	30-40	N	38.8	23.4	10.3	7.7	46-53 OH=2.2,CX STRI PER
50-12	1S1W	0-10	F	29.8	21.0	13.3	6.9	67-80 SERI CORTEX
52-16	1S1W	20-30	K	25.1	16.1	9.9	3.5	62-88 FRAG?
54-47	1S1W	40-50	B	15.0	14.3	4.3	1.0	70-75
64-27	2S1W	40-50	F	28.4	6.5	4.7	0.7	61-65 EDGE REJUV FLAKE
70-13	3S1W	0-10	B	28.3	6.9	6.5	3.3	55-65 UTILIZED FLAKE
71- 4	3S1W	10-20	B	25.8	14.3	4.4	1.8	67-85 OH=3.0 MOD FLAKE
72- 5	3S1W	20-30	N	32.8	15.4	5.6	2.6	60-82 OH=2.8 MOD FL CORT
73- 9	3S1W	30-40	K	30.0	22.4	10.4	6.2	70+
81-10	8S1W	10-20	N^	28.2	13.6	4.2	2.0	67-76 OH=4.4 MOD FLAKE
82-12	8S1W	20-30	M	19.0	16.5	5.9	1.4	52-65 STRIATIONS
84- 8	8S1W	40-50	N	23.0	12.6	5.0	1.8	73-88 MOD. FLAKE FRAG
84-12	8S1W	40-50	F	52.6	43.1	7.0	16.2	47-54 UNIFACIAL
86- 4	8S1W	60-70	K	19.5	27.0	4.9	3.7	62-70 OH=2.3 STRIATIONS
92-14	9S1W	20-30	F	13.8	8.5	4.5	0.4	59-69 FRAG
100- 7	4S1W	0-10	Qt	19.2	18.8	6.0	2.2	75-80 MODIFIED FLAKE
100-11	4S1W	0-10	F	17.9	23.1	4.0	2.1	58-60 SLIGHTLY CONCAVE
110-21	5S1W	0-10	F	19.9	14.1	4.4	1.3	65-69 SERRATED BIFACIAL
112-20	5S1W	20-30	F	45.9	13.1	10.8	6.4	70-90
113- 7	5S1W	30-40	M	26.1	7.3	7.0	1.0	72-79 EDGE REJ FLAKE
116- 4	5S1W	60-70	F	36.8	20.2	15.9	11.2	65-72 BASE IS VEIN
121- 6	7S1W	10-20	K	15.9	19.6	6.7	2.0	64-74
122- 1	7S1W	20-30	K	22.5	18.1	8.4	3.5	70-80
122- 9	7S1W	20-30	B	19.3	12.3	7.7	1.3	55-65 FRAG
122-12	7S1W	20-30	F	29.8	15.4	11.6	4.9	61-80
125- 8	7S1W	50-60	K	30.5	14.7	11.9	4.6	57-70 FRAG?
125-10	7S1W	50-60	M	18.3	21.2	5.3	2.2	66-77 FRAG
126- 9	7S1W	60-70	F	43.4	30.1	9.3	16.0	60-85 PQ
126-10	7S1W	60-70	F	30.3	13.3	5.1	2.7	59-84 FRAG
144- 8	11S1W	40-50	F	45.4	18.8	12.4	9.8	64-82 2 FACES
161- 2	11S1W	10-20	K	27.0	12.1	4.2	1.4	65-70 REW PPF STRIA
180-22	COR1N	SURF	F	30.9	17.6	13.8	7.3	80-100
180-24	COR1N	SURF	K	19.2	18.5	5.2	1.4	66-68
180-25	COR1N	SURF	N	19.8	18.7	6.8	2.1	80 CONCAVE/CORTEX
181-12	COR2S	SURF	M	14.2	20.5	6.0	1.8	59-65 UNIFACE
182-26	COR2S	SURF	F	32.2	17.2	4.7	3.5	71-80 BIFACIAL

Table 31. Scrapers, Modified Flakes and Utilized Flakes

CAT #	PROVENIENCE UNIT	LEVEL	MAT	mL mm	mW mm	Th mm	Wt g	EDGE ANGLE	REMARKS
182-33	COR2S	SURF	Qt	38.5	36.1	17.2	22.3	69-88	
183-4	COR2SW	SURF	F	32.7	32.7	11.5	12.4	68-76	
184-1	COR2SE	SURF	B	23.3	16.6	6.5	2.1	65-68	
Utilized Flakes									
37-8	TPT1	10-20	B	13.0	11.2	4.6	0.7	40-48	THIN FK STRIA.
50-6	1S1W	0-10	B	20.8	20.3	5.2	2.4		LIM BIFACIAL
51-14	1S1W	10-20	F	21.4	7.0	6.7	3.5		UNIF. PREFORM?
51-15	1S1W	10-20	F	32.5	23.6	8.0	4.7		PQ OVERHEATED?
52-1	1S1W	20-30	K	27.9	24.1	6.4	4.4		STRIA PRL TO EDGE
52-17	1S1W	20-30	Q	72.3	51.6	16.9	83.3		PQ
54-9	1S1W	40-50	K	12.3	13.6	2.7	0.6		
60-9	2S1W	0-10	B	21.4	17.8	4.4	1.6		
60-10	2S1W	0-10	K	21.3	11.9	2.9	0.9		STRI PAR E CON?
60-11	2S1W	0-10	F	27.9	16.0	5.3	2.4		CORTEX?
63-14	2S1W	30-40	K	41.4	31.4	5.8	6.2		STRIA PL&PER EDGE
63-15	2S1W	30-40	N	29.6	20.6	3.3	1.8	30-38	STRIA PL & OBL
64-14	2S1W	40-50	K	28.0	16.3	4.5	1.9		UNIFACE
65-8	2S1W	50-60	K	39.8	25.2	6.1	6.1		STRI PAR,OBL 2 EDG
72-6	3S1W	20-30	K	32.1	13.6	8.5	3.4		
80-1	8S1W	0-10	K	18.7	22.0	4.1	1.8		
81-9	8S1W	10-20	K	39.4	23.0	8.7	7.1		RAD STRI V SURF
82-16	8S1W	20-30	F	28.5	12.8	4.8	1.8		
83-28	8S1W	30-40	K	26.2	11.5	7.6	2.6		
86-8	8S1W	60-70	F	17.8	8.2	3.2	0.3		FRAG
94-11	9S1W	40-50	F	27.9	21.6	2.7	1.8		
101-10	4S1W	10-20	F	44.1	49.0	29.1	78.0		PQ IN ASK GEO
112-1	5S1W	20-30	B	18.2	14.0	3.7	1.0	36-45	STRI 45 D EDGE
113-19	5S1W	30-40	N	25.6	19.0	6.5	2.8	64-72	RW BIF FRAG CX
123-11	7S1W	30-40	F	31.0	22.5	8.6	5.5		BROKE AT VIEN?
130-14	21S24E	0-10	F	20.1	18.3	6.8	2.1		POT HOLES
140-16	11S1W	0-10	N	14.8	16.3	5.7	1.3	57-63	
141-8	11S1W	10-20	K	27.6	16.3	6.5	3.0		ONCE PREFORM?
141-23	11S1W	10-20	K	29.0	25.6	5.3	3.7		
143-10	11S1W	30-40	K	22.4	22.0	8.5	3.9		FRAG
180-15	COR1N	SURF	N	13.7	11.0	3.8	0.6	52	FRAG, SCRATCHES
180-16	COR1N	SURF	K	12.0	14.8	3.0	0.5		
182-31	COR2S	SURF	F?	30.4	25.9	12.6	8.3		CHERT?
183-3	COR2SW	SURF	K	15.0	10.9	3.6	0.7		FRAG
184-5	COR2SE	SURF	F	27.4	19.0	9.9	4.0		
184-7	COR2SE	SURF	F	30.2	19.4	11.2	4.8		
184-16	COR2SE	SURF	Bt	66.3	29.4	12.1	7.8		

Table 32. Core Tools, Cores, and Chert Cobbles

CAT#	PROVENIENCE	MAT	mL	mW	Th	Wt	ANGL	REMARKS
	UNIT	LEVEL	mm	mm	mm	g		
Core Tools								
50-16	1S1W	0-10	F	63.5	47.0	34.0	130.0	90 CORTEX, ANG W
62-10	2S1W	20-30	F	47.5	31.1	26.5	48.8	60-90 SPENT, MULTI
80-13	8S1W	0-10	F	52.4	21.3	33.4	60.7	90+ CORTEX, BIPOLAR?
82-20	8S1W	20-30	F	56.0	39.8	25.9	59.8	60-92 MULT, BIFACIAL
101- 9	4S1W	10-20	F	55.0	45.6	34.3	95.8	80-90 UNIDIRECTIONAL
125-11	7S1W	50-60	F	21.2	14.2	14.0	4.2	78-100 CORE FRAG
130-10	21S24E	0-10	M	41.1	38.9	24.4	46.7	50-100 CORTEX, BEAK
141-15	11S1W	10-20	F	33.0	28.3	15.5	18.9	95-110 BIPOLAR?
180-19	COR1N	SURF	Bt	80.2	78.1	35.1	326.5	50-80 ANGULAR CHUNK
180-20	COR1N	SURF	M	30.9	28.9	26.3	33.8	80-90
180-21	COR1N	SURF	F	31.2	29.4	22.5	22.1	59-94 UNIDIRECTIONAL
184-12	COR2SE	SURF	F	52.1	30.5	42.4	83.6	90.0
Cores								
122-13	7S1W	20-30	F	36.2	33.8	19.8	25.1	SMALL
123-16	7S1W	30-40	F	32.1	13.9	10.9	6.0	SMALL
132- 1	21S24E	20-30	Br	88.3	55.7	33.2	155.0	REJECT
181-24	COR2N	SURF	Q	69.4	64.8	49.0	155.3	MULTIDIRECTIONAL
Chert Cobbles								
134- 1	21S24E	40-50	F	49.8	40.9	23.4	64.2	FIRE FRACTURED
181-23	COR2N	SURF	M	34.8	31.2	21.1	31.3	FIRE FRACTURED

Table 33. Ground Stone, End-battered Cobbles and Manuports

CAT #	PROVENIENCE	MA	mL	mW	Th	Wt	REMARKS
	UNIT	LEVEL	mm	mm	mm	g	
Handstones							
34-11	COR	SURF	G	69.5	50.9	29.0	176.8 FRAG UNIFACIAL, FLAT
34-12	COR	SURF	G	75.1	57.7	43.0	269.1 FRAG BIFACIAL
51-18	1S1W	10-20	G	71.5	66.1	43.4	259.1 FRAG BIFACIAL
82-21	8S1W	20-30	G	51.8	40.4	47.5	167.5 FRAG BIFACIAL
84- 1	8S1W	40-50	G	87.9	63.5	45.3	380.7 SHAPED, UNIF RESHARP.
87- 1	8S1W	NP	G	43.3	61.3	49.3	169.6 FRAG UNIFACIAL
94-12	9S1W	40-50	G	97.6	58.2	51.6	429.4 FRAG BIFACIAL
95- 4	9S1W	50-60	G	90.0	76.5	52.7	494.0 UNIFACIAL
140- 6	11S1W	0-10	G	83.3	74.1	38.6	344.3 UNIFACIAL
181-19	COR2N	SURF	G	109.5	84.0	60.2	847.4 END MISSING, BIFACIAL
181-25	COR2N	SURF	G	82.9	72.3	52.5	474.5 BIFACIAL
Pestles							
38- 8	TSPIT1	20-30	G	127.0	44.8	38.7	300.0 SM, END-BATTERED
84- 2	8S1W	40-50	G	100.0	47.5	45.2	345.8 SL SHAPED, PROX END?
93- 7	9S1W	30-40	G	139.0	53.0	34.7	455.4 SHAPED, END BAT
181-18	COR2N	SURF	Bt	253.0	78.3	60.8	1747.1 UNSHAPED
Possible Millingslab Fragment							
181-21	COR2N	SURF	G	76.0	46.1	49.3	228.9 SHAPED MILLSLAB FR?
Unidentified Ground Stone Fragments							
83- 1	8S1W	30-40	G	44.4	49.2	48.1	142.4 CONCAVE GROOVE
84- 3	8S1W	40-50	G	68.1	55.4	39.2	210.6 FRAG WITH GROOVE
End-battered Cobbles							
140- 7	11S1W	0-10	G	124.0	70.6	61.8	770.0 END-BAT BOTH ENDS
181-26	COR2N	SURF	G	58.8	45.5	41.0	126.0 FRAG PESTLE?
181-27	COR2N	SURF	G	58.7	43.3	30.0	79.8 END-BATTERED
184-13	COR2SE	SURF	G	70.3	59.8	41.2	203.3 FRAG END-BATTERED
Manuports							
39- 7	TSPIT1	30-40	Sc	73.5	10.6	8.8	12.1 TREMALITE SCHIST
82-22	8S1W	20-30	Sc	82.2	27.5	13.9	41.5 TREMALITE SCHIST
143- 3	11S1W	30-40	Sc	86.2	28.2	8.6	28.9 TREMALITE SCHIST
125- 9	7S1W	50-60	W	85.7	52.7	35.2	161.8 PETRIFIED WOOD
181-20	COR2N	SURF	S	65.9	53.4	35.4	161.8 UNINDURATED

Table 34. MEN-2136 Debitage - Flake Counts

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UNIT	CHERT				OBSIDIAN					TOT	%OB
	MONT	FRAN	TOT	%M	K	BL	N	A	?		
1S1W											
0-10	19	40	59	32.2	248	27	24	1	1	301	360 83.6
10-20	20	53	73	27.4	355	46	28		4	433	506 85.6
20-30	13	43	56	23.2	392	67	34	1	4	498	554 89.9
30-40	16	43	59	27.1	318	44	44			406	465 87.3
40-50	20	52	72	27.8	418	49	38	1	5	511	583 87.7
50-60	8	30	38	21.1	173	23	20			216	254 85.0
60-70	5	6	11	45.5	24	5	4			33	44 75.0
FEA 1		1	1	0.0	17	2	3		2	24	25 96.0
TOTAL	101	268	369	27.4	1945	263	195	3	16	2422	2791 86.8
	27.4%	72.6%			80.3%	10.9%	8.1%	0.1%	0.7%		
3S1W											
0-10	32	63	95	33.7	284	32	26		2	344	439 78.4
10-20	35	70	105	33.3	364	31	25		8	428	533 80.3
20-30	36	48	84	42.9	448	36	42		7	533	617 86.4
30-40	30	21	51	58.8	446	41	41		4	532	583 91.3
40-50	28	33	61	45.9	367	36	34		7	444	505 87.9
50-60	15	25	40	37.5	148	20	15		6	189	229 82.5
60-70	9	10	19	47.4	71	7	3		1	82	101 81.2
TOTAL	185	270	455	40.7	2128	203	186	0	35	2552	3007 84.9
	40.7%	59.3%			83.4%	8.0%	7.3%	0.0%	1.4%	84.9%	
5S1W											
0-10	31	61	92	33.7	318	42	39			399	491 81.3
10-20	18	35	53	34.0	249	19	15		5	288	341 84.5
20-30	41	69	110	37.3	492	72	32		4	600	710 84.5
30-40	32	75	107	29.9	516	59	45		3	623	730 85.3
40-50	10	23	33	30.3	172	22	22	1	1	218	251 86.9
50-60	17	47	64	26.6	165	17	18		1	201	265 75.8
60-70	8	18	26	30.8	72	6	5		5	88	114 77.2
TOTAL	157	328	485	32.4	1984	237	176	1	19	2417	2902 83.3
	32.4%	67.6%			82.1%	9.8%	7.3%	0.0%	0.8%	83.3%	
7S1W											
0-10	20	58	78	25.6	259	37	32			328	406 80.8
10-20	23	46	69	33.3	303	52	20			375	444 84.5
20-30	11	59	70	15.7	390	50	42	2	1	485	555 87.4
30-40	33	66	99	33.3	392	79	48	1		520	619 84.0
40-50	21	41	62	33.9	335	43	28			406	468 86.8
50-60	23	59	82	28.0	355	44	18			417	499 83.6
60-70	19	31	50	38.0	267	22	17		2	308	358 86.0
TOTAL	150	360	510	29.4	2301	327	205	3	3	2839	3349 84.8
	29.4%	70.6%			81.0%	11.5%	7.2%	0.1%	0.1%	84.8%	
9S1W											
0-10	36	78	114	31.6	296	41	29		4	370	484 76.4
10-20	39	105	144	27.1	450	51	26		1	528	672 78.6
20-30	25	77	102	24.5	385	51	31	1	5	473	575 82.3
30-40	17	32	49	34.7	209	27	23		1	260	309 84.1
40-50	26	61	87	29.9	193	22	15		1	231	318 72.6
50-60	6	26	32	18.8	88	5	6	1		100	132 75.8
60-70	7	14	21	33.3	30	5	3		2	40	61 65.6
TOTAL	156	393	549	28.4	1651	202	133	2	14	2002	2551 78.5
	28.4%	71.6%			82.5%	10.1%	6.6%	0.1%	0.7%	78.5%	

Table 34. MEN-2136 Debitage - Flake Counts

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UNIT	CHERT				OBSIDIAN						TOT	%OB
	MONT	FRAN	TOT	%M	K	BL	N	A	?	TOT		
TOTAL:	UNITS 1,3,5,7,9 S 1W											
0-10	138	300	438	31.5	1405	179	150	1	7	1742	2180	79.9
10-20	135	309	444	30.4	1721	199	114	0	18	2052	2496	82.2
20-30	126	296	422	29.9	2107	276	181	4	21	2589	3011	86.0
30-40	128	237	365	35.1	1881	250	201	1	8	2341	2706	86.5
40-50	105	210	315	33.3	1485	172	137	2	14	1810	2125	85.2
50-60	69	187	256	27.0	929	109	77	1	7	1123	1379	81.4
60-70	48	79	127	37.8	464	45	32	2	10	553	680	81.3
TOTAL	749	1619	2368	31.6	10009	1232	895	9	87	12232	14600	83.8
	31.6%	68.4%			81.8%	10.1%	7.3%	0.1%	0.7%	83.8%		
11S1W												
0-10	12	52	64	18.8	153	6	6		1	166	230	72.2
10-20	16	79	95	16.8	270	26	15		3	314	409	76.8
20-30	12	32	44	27.3	61	8	6		1	76	120	63.3
30-40	12	50	62	19.4	170	12	8			190	252	75.4
40-50	20	65	85	23.5	203	12	7		1	223	308	72.4
50-60	12	42	54	22.2	87	4	3			94	148	63.5
60-70		13	13	0.0	17	3	1			21	34	61.8
70-80	3	4	7	42.9	10	3				13	20	65.0
FEA 2	8	21	29	27.6	65	12	2			79	108	73.1
TOTAL	95	358	453	21.0	1036	86	48	0	6	1176	1629	72.2
	21.0%	79.0%			88.1%	7.3%	4.1%	0.0%	0.5%	72.2%		
21S24E												
0-10	11	48	59	18.6	128	7	5		3	143	202	70.8
10-20	19	35	54	35.2	81	6	2			89	143	62.2
20-30	7	48	55	12.7	54	14				68	123	55.3
30-40	10	53	63	15.9	61	15				76	139	54.7
40-50	7	32	39	17.9	20	2				22	61	36.1
50-60	7	24	31	22.6	11	3	1			15	46	32.6
TOTAL	61	240	301	20.3	355	47	8	0	3	413	714	57.8
	20.3%	79.7%			86.0%	11.4%	1.9%	0.0%	0.7%	57.8%		
SURFACE												
COR 1N	34	80	114	29.8	488	42	20	2		552	666	82.9
COR 2N	22	109	131	16.8	158	22	6	1	1	188	319	58.9
COR 2S	20	73	93	21.5	250	29	24	13	1	317	410	77.3
COR 2SW	10	43	53	18.9	120	8	7	4		139	192	72.4
COR 2SE	11	36	47	23.4	149	14	32	12	1	208	255	81.6
TOTAL	97	341	438	22.1	1165	115	89	32	3	1404	1842	76.2
COR 1N	29.8%	70.2%			88.4%	7.6%	3.6%	0.4%	0.0%	82.9%		
COR 2N	16.8%	83.2%			84.0%	11.7%	3.2%	0.5%	0.5%	58.9%		
COR 2S	21.5%	78.5%			78.9%	9.1%	7.6%	4.1%	0.3%	77.3%		
COR 2SW	18.9%	81.1%			86.3%	5.8%	5.0%	2.9%	0.0%	72.4%		
COR 2SE	23.4%	76.6%			71.6%	6.7%	15.4%	5.8%	0.5%	81.6%		
TOT SURF	22.1%	77.9%			83.0%	8.2%	6.3%	2.3%	0.2%	76.2%		
TOTAL	1002	2558	3560	28.1	12565	1480	1040	41	99	15225	18785	81.0
%	5.3%	13.6%	19.0%		66.9%	7.9%	5.5%	0.2%	0.5%	81.0%		
	28.1%	71.9%			82.5%	9.7%	6.8%	0.3%	0.7%			

Table 35. MEN-2136 Debitage - Weight (g)

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UNIT	CHERT				OBSIDIAN						%OB
	MONT	FRAN	TOT	%M	K	BL	N	A	?	TOT	
1S1W											
0-10	9.2	67.8	77.0	11.9	63.1	4.9	6.5	0.1	0.2	74.8	49.3
10-20	27.3	35.9	63.2	43.2	76.8	9.9	5.3		1.7	93.7	59.7
20-30	5.8	32.6	38.4	15.1	102.3	14.4	7.0	0.1		123.8	76.3
30-40	10.4	31.1	41.5	25.1	87.4	11.0	12.2			110.6	72.7
40-50	30.1	86.6	116.7	25.8	125.9	12.5	9.3	1.4	1.2	150.3	56.3
50-60	2.4	29.8	32.2	7.5	54.5	4.8	7.4			66.7	67.4
60-70	1.8	5.1	6.9	26.1	9.3	0.8	0.6			10.7	60.8
FEA 1		0.6	0.6	0.0	1.2	0.2	0.2		0.1	1.7	73.9
TOTAL	87.0	289.5	376.5	23.1	520.5	58.5	48.5	1.6	3.2	632.3	62.7
	23.1%	76.9%			82.3%	9.3%	7.7%	0.3%	0.5%		
3S1W											
0-10	33.1	114.1	147.2	22.5	74.6	5.4	6.6		2.2	88.8	37.6
10-20	23.0	117.8	140.8	16.3	81.9	7.3	5.0		1.8	96.0	40.5
20-30	33.7	53.4	87.1	38.7	110.8	9.2	15.6		2.7	138.3	61.4
30-40	26.4	19.3	45.7	57.8	99.8	9.7	2.5		1.5	113.5	71.3
40-50	10.0	26.0	36.0	27.8	101.9	7.4	7.7		1.4	118.4	76.7
50-60	12.5	37.5	50.0	25.0	39.5	3.8	3.3		3.1	49.7	49.8
60-70	6.6	4.5	11.1	59.5	23.4	1.1	0.3		0.3	25.1	69.3
TOTAL	145.3	372.6	517.9	28.1	531.9	43.9	41.0	0	13.0	629.8	54.9
	28.1%	71.9%			84.5%	7.0%	6.5%	0.0%	2.1%		
5S1W											
0-10	31.8	63.2	95.0	33.5	85.2	9.1	8.1			102.4	51.9
10-20	14.0	65.8	79.8	17.5	59.4	4.5	3.5		1.9	69.3	46.5
20-30	44.7	57.8	102.5	43.6	130.2	19.2	9.8		1.6	160.8	61.1
30-40	19.6	107.0	126.6	15.5	129.8	14.2	19.7		0.6	164.3	56.5
40-50	4.1	9.8	13.9	29.5	47.0	6.2	6.3	0.2	3.6	63.3	82.0
50-60	12.9	35.4	48.3	26.7	43.0	5.6	5.8		0.2	54.6	53.1
60-70	3.1	10.3	13.4	23.1	17.8	0.7	1.8		1.2	21.5	61.6
TOTAL	130.2	349.3	479.5	27.2	512.4	59.5	55.0	0.2	9.1	636.2	57.0
	27.2%	72.8%			80.5%	9.4%	8.6%	0.0%	1.4%		
7S1W											
0-10	21.5	91.8	113.3	19.0	73.3	6.7	7.5			87.5	43.6
10-20	26.6	48.5	75.1	35.4	81.6	14.3	5.4			101.3	57.4
20-30	25.4	77.2	102.6	24.8	102.5	9.5	9.9	0.5	0.1	122.5	54.4
30-40	19.7	92.5	112.2	17.6	106.4	18.1	10.5	0.2		135.2	54.6
40-50	25.5	37.4	62.9	40.5	100.8	10.0	7.5			118.3	65.3
50-60	21.5	115.3	136.8	15.7	115.2	7.0	3.8			126.0	47.9
60-70	11.8	40.5	52.3	22.6	89.3	5.7	3.3		0.3	98.6	65.3
TOTAL	152.0	503.2	655.2	23.2	669.1	71.3	47.9	0.7	0.4	789.4	54.6
	23.2%	76.8%			84.8%	9.0%	6.1%	0.1%	0.1%		
9S1W											
0-10	19.2	76.5	95.7	20.1	82.2	12.0	14.1		0.7	109.0	53.2
10-20	39.0	125.9	164.9	23.7	77.5	12.3	15.1		0.3	105.2	38.9
20-30	42.1	74.2	116.3	36.2	106.6	14.2	12.7		6.4	139.9	54.6
30-40	14.6	42.3	56.9	25.7	56.8	5.9	6.4		0.2	69.3	54.9
40-50	7.4	114.5	121.9	6.1	63.9	8.1	4.0		0.2	76.2	38.5
50-60	3.1	51.7	54.8	5.7	23.5	1.4	1.1		0.1	26.1	32.3
60-70	3.4	21.0	24.4	13.9	7.2	3.3	0.3		1.4	12.2	33.3
TOTAL	128.8	506.1	634.9	20.3	417.7	57.2	53.7	0.0	9.3	537.9	45.9
	20.3%	79.7%			77.7%	10.6%	10.0%	0.0%	1.7%		

Table 35. MEN-2136 Debitage - Weight (g)

300

UNIT	CHERT				OBSIDIAN						%OB
	MONT	FRAN	TOT	%M	K	BL	N	A	?	TOT	
TOTAL:	UNITS 1,3,5,7,9 S 1W										
0-10	114.8	413.4	528.2	21.7	378.4	38.1	42.8	0.1	3.1	462.5	46.7
10-20	129.9	393.9	523.8	24.8	377.2	48.3	34.3	0.0	5.7	465.5	47.1
20-30	151.7	295.2	446.9	33.9	552.4	66.5	55.0	0.6	10.8	685.3	60.5
30-40	90.7	292.2	382.9	23.7	480.2	58.9	51.3	0.2	2.3	592.9	60.8
40-50	77.1	274.3	351.4	21.9	439.5	44.2	34.8	1.6	6.4	526.5	60.0
50-60	52.4	269.7	322.1	16.3	275.7	22.6	21.4	0.0	3.4	323.1	50.1
60-70	26.7	81.4	108.1	24.7	147.0	11.6	6.3	0.0	3.2	168.1	60.9
TOTAL	643.3	2020.7	2664.0	24.1	2651.6	290.4	246.1	2.5	35.0	3225.6	54.8
	24.1%	75.9%			82.2%	9.0%	7.6%	0.1%	1.1%		
11S1W											
0-10	9.4	50.4	59.8	15.7	63.0	1.5	3.5		0.3	68.3	53.3
10-20	7.8	78.8	86.6	9.0	85.1	5.6	3.9		1.7	96.3	52.7
20-30	10.9	37.1	48.0	22.7	48.7	1.8	1.5		0.4	52.4	52.2
30-40	6.5	30.5	37.0	17.6	41.3	2.8	4.4		0.4	48.9	56.9
40-50	12.6	54.1	66.7	18.9	54.8	2.1	1.1		0.3	58.3	46.6
50-60	5.3	94.5	99.8	5.3	29.6	0.8	0.8			31.2	23.8
60-70		15.0	15.0	0.0	5.2	1.4	0.3			6.9	31.5
70-80	8.9	1.9	10.8	82.4	2.7	0.6	0.3			3.6	25.0
FEA 2	4.0	11.5	15.5	25.8	16.6	2.5	1.2			20.3	56.7
TOTAL	65.4	373.8	439.2		347.0	19.1	17.0	0.0	3.1	386.2	46.8
	14.9%	85.1%			89.8%	4.9%	4.4%	0.0%	0.8%		
21S24E											
0-10	22.4	66.7	89.1	25.1	31.2	2.3	3.1		0.7	37.3	29.5
10-20	19.5	53.7	73.2	26.6	21.8	1.4	0.5			23.7	24.5
20-30	3.8	62.5	66.3	5.7	16.2	3.8				20.0	23.2
30-40	12.5	58.2	70.7	17.7	15.5	4.0				19.5	21.6
40-50	4.7	40.0	44.7	10.5	8.3	0.5				8.8	16.4
50-60	4.3	9.1	13.4	32.1	1.9	0.9	0.6			3.4	20.2
TOTAL	67.2	290.2	357.4	18.8	94.9	12.9	4.2	0.0	0.7	112.7	24.0
	18.8%	81.2%			84.2%	11.4%	3.7%	0.0%	0.6%		
SURFACE											
COR 1N	48.0	160.8	208.8	23.0	135.3	17.6	8.0	1.1		162.0	43.7
COR 2N	48.8	421.7	470.5	10.4	61.3	10.0	10.0	0.3	1.2	82.8	15.0
COR 2S	61.8	146.6	208.4	29.7	88.9	18.1	14.0	5.2	0.8	127.0	37.9
COR 2SW	6.9	114.6	121.5	5.7	26.2	3.9	4.3	6.8		41.2	25.3
COR 2SE	6.3	75.3	81.6	7.7	36.1	3.1	11.4	2.6	0.3	53.5	39.6
TOTAL	171.8	919.0	1090.8	15.7	347.8	52.7	47.7	16.0	2.3	466.5	30.0
COR 1N	23.0%	77.0%			83.5%	10.9%	4.9%	0.7%	0.0%		
COR 2N	10.4%	89.6%			74.0%	12.1%	12.1%	0.4%	1.4%		
COR 2S	29.7%	70.3%			70.0%	14.3%	11.0%	4.1%	0.6%		
COR 2SW	5.7%	94.3%			63.6%	9.5%	10.4%	16.5%	0.0%		
COR 2SE	7.7%	92.3%			67.5%	5.8%	21.3%	4.9%	0.6%		
TOT SURF	15.7%	84.3%			74.6%	11.3%	10.2%	3.4%	0.5%		
TOTAL	947.7	3603.7	4551.4	20.8	3441.3	375.1	315.0	18.5	41.1	4191.0	47.9
%	10.8%	41.2%			39.4%	4.3%	3.6%	0.2%	0.5%		
	20.8%	79.2%			82.1%	9.0%	7.5%	0.4%	1.0%	100.0%	

Table 36. MEN-2136 Unit 11S1W Debitage - 1/8 Inch Screen

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	CHERT				OBSIDIAN						TOT	%OB
UNIT	MONT	FRAN	TOT	%M	K	BL	N	A	?	TOT		
FLAKE COUNT												
0-10	12	66	78	15.4	140	38	13	1	3	195	273	71.4
10-20	11	57	68	16.2	185	21	12		3	221	289	76.5
20-30	8	82	90	8.9	162	11	10			183	273	67.0
30-40	13	86	99	13.1	123	12	8		2	145	244	59.4
40-50	17	57	74	23.0	135	8	10		1	154	228	67.5
50-60	18	75	93	19.4	131	14	14		5	164	257	63.8
60-70	5	11	16	31.3	40	8	2		5	55	71	77.5
70-80	4	22	26	15.4	20	8	2		3	33	59	55.9
TOT	88	456	544	16.2	936	120	71	1	22	1150	1694	67.9
	16.2%	83.8%			81.4%	10.4%	6.2%	0.1%	1.9%			
FLAKE WEIGHT IN GRAMS												
0-10	10.1	10.9	21.0	48.1	6.7	2.5	0.5	0.2	0.2	10.1	31.1	32.5
10-20	1.0	8.8	9.8	10.2	9.0	1.1	0.6		0.1	10.8	20.6	52.4
20-30	0.6	12.1	12.7	4.7	9.1	0.7	0.4		0.1	10.3	23	44.8
30-40	1.5	17.3	18.8	8.0	6.7	0.4	0.3		0.1	7.5	26.3	28.5
40-50	5.3	4.0	9.3	57.0	4.8	0.6	0.8		0.1	6.3	15.6	40.4
50-60	1.1	4.8	5.9	18.6	8.0	1.1	0.4		0.3	9.8	15.7	62.4
60-70	0.5	0.7	1.2	41.7	2.4	0.3	0.1		0.3	3.1	4.3	72.1
70-80	0.2	0.9	1.1	18.2	1.4	0.3	0.1		0.2	2.0	3.1	64.5
TOT	20.3	59.5	79.8		48.1	7.0	3.2	0.2	1.4	59.9	139.7	42.9
	25.4%	74.6%			80.3%	11.7%	5.3%	0.3%	2.3%			
RATIO OF 1/8 INCH TO 1/4 INCH SCREEN RECOVERY												
FLAKE COUNT												
0-10	1.00	1.27	1.22		0.92	6.33	2.17		3.00	1.17	1.19	
10-20	0.69	0.72	0.72		0.69	0.81	0.80		1.00	0.70	0.71	
20-30	0.67	2.56	2.05		2.66	1.38	1.67		0.00	2.41	2.28	
30-40	1.08	1.72	1.60		0.72	1.00	1.00			0.76	0.97	
40-50	0.85	0.88	0.87		0.67	0.67	1.43		1.00	0.69	0.74	
50-60	1.50	1.79	1.72		1.51	3.50	4.67			1.74	1.74	
60-70		0.85	1.23		2.35	2.67	2.00			2.62	2.09	
70-80	1.33	5.50	3.71		2.00	2.67				2.54	2.95	
TOT	0.93	1.27	1.20		0.90	1.40	1.48		3.67	0.98	1.04	
FLAKE WEIGHT												
0-10	1.07	0.22	0.35		0.11	1.67	0.14		0.67	0.15	0.24	
10-20	0.13	0.11	0.11		0.11	0.20	0.15		0.06	0.11	0.11	
20-30	0.06	0.33	0.26		0.19	0.39	0.27		0.25	0.20	0.23	
30-40	0.23	0.57	0.51		0.16	0.14	0.07		0.25	0.15	0.31	
40-50	0.42	0.07	0.14		0.09	0.29	0.73		0.33	0.11	0.12	
50-60	0.21	0.05	0.06		0.27	1.38	0.50			0.31	0.12	
60-70		0.05	0.08		0.46	0.21	0.33			0.45	0.20	
70-80	0.02	0.47	0.10		0.52	0.50	0.33			0.56	0.22	
TOT	0.31	0.16	0.18		0.14	0.37	0.19		0.45	0.16	0.17	

Table 37. All Projectile Points by Material

	M	F	Q	K	B	N	A	OTH	TOT	%
SJSU										
Rattlesnake Series	2	4		1	2	1			10	3.5%
Leaf-shaped	10	40	1	141	33	11	1	1	238	84.1%
Mendocino Concave-base	1	14		2	1				18	6.4%
Mendocino Side-notched		1							1	0.4%
Willits series	3	7				1			11	3.9%
Stemmed points	1	3							4	1.4%
Type 7		1							1	0.4%
Total	17	70	1	144	36	13	1	1	283	100%
Percent	6.0%	24.7%	0.4%	50.9%	12.7%	4.6%	0.4%	0.4%	100%	
Zeni Collection										
Rattlesnake Series	2	9		14	4	10	3		42	24.1%
Leaf-shaped	4	25	1	38	11	7		4	90	51.7%
Mendocino Concave-base	5	12						1	18	10.3%
Mendocino Side-notched		1							1	0.6%
Willits series	5	9							14	8.0%
Stemmed points	1	5		1					7	4.0%
Type 7									0	0.0%
Type 8		1							1	0.6%
Type 9		1							1	0.6%
Total	17	63	1	53	15	17	3	5	174	100%
Percent	9.8%	36.2%	0.6%	30.5%	8.6%	9.8%	1.7%	2.9%	100%	

Table 38. Projectile Points by Collection by Material

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PROJECTILE POINTS BY TYPE BY MATERIAL											
	M	F	Q	K	B	N	A	OTH	TOT	% OBS	% M
RATTLESNAKE SERIES											
SJSU	2	4		1	2	1			10	40.0%	33.3%
ZENI	2	9		14	4	10	3		42	73.8%	18.2%
TOTAL	4	13	0	15	6	11	3		52	67.3%	23.5%
	7.7%	25.0%	0.0%	28.8%	11.5%	21.2%	5.8%	0.0%	100%		
LEAF-SHAPED											
SJSU	10	40	1	141	33	11	1	1	238	78.6%	20.0%
ZENI	4	25	1	38	11	7		4	90	66.7%	13.8%
TOTAL	14	65	2	179	44	18	1		323	74.9%	17.7%
	4.3%	20.1%	0.6%	55.4%	13.6%	5.6%	0.3%	0.0%	100%		
MENDOCINO CONCAVE-BASE											
SJSU	1	14		2	1				18	16.7%	6.7%
ZENI	5	12						1	18	5.6%	29.4%
TOTAL	6	26	0	2	1	0	0	1	36	11.1%	18.8%
	16.7%	72.2%	0.0%	5.6%	2.8%	0.0%	0.0%	2.8%	100%		
MENDOCINO SIDE-NOTCHED											
SJSU		1							1	0.0%	0.0%
ZENI		1							1	0.0%	0.0%
TOTAL		2							2	0.0%	0.0%
		100%							100%		
WILLITS SERIES											
SJSU	3	7				1			11	9.1%	30.0%
ZENI	5	9							14	0.0%	35.7%
TOTAL	8	16	0	0	0	1	0	0	25	4.0%	33.3%
	32.0%	64.0%	0.0%	0.0%	0.0%	4.0%	0.0%	0.0%	100%		
STEMMED POINTS											
SJSU	1	3							4	0.0%	25.0%
ZENI	1	5		1					7	14.3%	16.7%
TOTAL	2	8	0	1	0	0	0	0	11	9.1%	20.0%
	18.2%	72.7%	0.0%	9.1%	0.0%	0.0%	0.0%	0.0%	100.0%		

Table 39. All MEN-2136 Artifacts by Unit by Material

	1S1W						2S1W						3S1W						4S1W					
	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O
Rattlesnake series																								
Leaf-shaped points	1	4	18	4	2				4	19	2		1			10	2		1		5	7	1	2
Mendocino Concave-b		1							1											1				
Mendocino Side-n																								
Willits series points								2																
Stemmed points																								
Type 7																								
Tips		1	7	1					3	6						8	2	1		1	2	3		
Midsections		3	6	1					1	4	1	1				1	3	2			2	3	1	
Medial Fragments	1		16	1					1	23	2	1				2	19	4	1		1	12	2	
Projectile Point Frags		1														1								
Bifaces	1	2						4	1							3					2			
Biface Fragments		1						1	1		2	1				1	1							
Scrapers	2	2						3	2		1					2	1				2	2		
Modified Flakes		1	1	1					1							1	2	1			1			1
Utilized Flakes		2	2	1		1			1	4	1	1				1					1			
Drills		3						3	7	1						2				1	3			
Core/Cobble Tools		1							1												1			
Cores & Cobbles																								
Handstones						1																		
Pestles																								
Other Gnd. Stone																								
Total	5	22	50	9	2	2	13	24	57	9	4	0	4	9	44	13	3	0	3	22	27	5	2	1
Percent	5.6	24.4	55.6	10.0	2.2	2.2	12.1	22.4	53.3	8.4	3.7	0	5.5	12.3	60.3	17.8	4.1	0.0	5.0	36.7	45.0	8.3	3.3	1.7
Euroamerican						13						9						3						4

Table 39. All MEN-2136 Artifacts by Unit by Material

	5S1W						7S1W						8S1W						9S1W					
	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O
Rattlesnake series																								
Leaf-shaped points	1		12	5	1		1		6	17	1		1	2	11	7	2	1	1	3	10	3	2	
Mendocino Concave-b		2						2						3		1				1				
Mendocino Side-n									1															
Willits series points		1			1			2						1						2				
Stemmed points													1	1										
Type 7																								
Tips	2	1	8	1	1			3	7	1			1	6	8	2			2	9	7			
Midsections		2	9		1		1		3					2	5		1			3	3	1	2	
Medial Fragments			20	3					9	1	2				16					1	13	1	1	
Projectile Point Frags	1																	1						
Bifaces	1	2						1																
Biface Fragments	1			1					1											1				
Scrapers	1	5						3					3	3						2				
Modified Flakes	1	3					1	3	3	1			1	1	1		2		1	1				
Utilized Flakes				1	1			1					2	2	3					1				
Drills	2	3					2	7					1	10					1	8				
Core/Cobble Tools								2						2										
Cores & Cobbles								2																
Handstones																								2
Pestles																								1
Other Gnd. Stone												1							3					
Total	9	20	49	11	5	0	5	33	40	4	2	1	8	34	45	11	6	8	4	33	35	6	5	3
						94						85						112						86
Percent	9.6	21.3	52.1	11.7	5.3	0	5.9	38.8	47.1	4.7	2.4	1.2	7.1	30.4	40.2	9.8	5.4	7.1	4.7	38.4	40.7	7.0	5.8	3.5
Euroamerican						7						8						7						0

Table 39. All MEN-2136 Artifacts by Unit by Material

	11S1W						21S24E						TPT1						SURF						
	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O	
Rattlesnake series		1					1																		
Leaf-shaped points	1	1	6	3	1	1	1	3	3				1	1	3	1		1		6	15	3			
Mendocino Concave-b		1	1																1	1					
Mendocino Side-n																									
Willits series points																			1						
Stemmed points		1													1										
Type 7																									
Tips		4	5						2	1					2		1	1	1		1	5		1	
Midsections		1	4		2				3					2	1					1	11	1			
Medial Fragments		1	8	3	1		1	3	2					4	1			1	1	3			1		
Projectile Point Frags			2																		1				
Bifaces		2						2											1	4					
Biface Fragments	1		1					2											1						
Scrapers		2	1					1											2	3				1	
Modified Flakes		1	1														1								
Utilized Flakes			3		1			1								1									
Drills		2													2										
Core/Cobble Tools		1					1																		
Cores & Cobbles						1		1				1												2	
Handstones																									
Pestles																			1						
Other Grnd.Stone						2													1						
Total	2	18	32	6	5	4	4	13	10	1	0	1	1	1	6	10	3	2	4	7	16	35	4	1	4
						67						29							26					67	
Percent	3.0	26.9	47.8	9.0	7.5	6.0	13.8	44.8	34.5	3.4	0	3.4	3.8	23.1	38.5	11.5	7.7	15.4	10.4	23.9	52.2	6.0	1.5	6.0	
Euroamerican						81						6						7						1	

Table 39. All MEN-2136 Artifacts by Unit by Material

	Corral 1N						Corral 2N						Corral 2S						Corral 2SW					
	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O	M	F	K	B	N	O
Rattlesnake series																								
Leaf-shaped points		2																						
Mendocino Concave-b		1																						
Mendocino Side-n																								
Willits series points																								
Stemmed points																								
Type 7																								
Tips	1						1						1											
Midsections																								
Medial Fragments																								
Projectile Point Frags																								
Bifaces																								
Biface Fragments																								
Scrapers																								
Modified Flakes																								
Utilized Flakes																								
Drills																								
Core/Cobble Tools	1																							
Cores & Cobbles																								
Handstones																								
Pestles																								
Other Grnd Stone																								
Total	2	6	7	3	2	1	4	4	5	3	3	8	3	11	12	2	4	2	0	2	3	0	0	0
Percent	9.5	28.6	33.3	14.3	9.5	4.8	14.8	14.8	18.5	11.1	11.1	29.6	8.8	32.4	35.3	5.9	11.8	5.9	0	40.0	60.0	0	0	0
Euroamerican						2																		1

Table 39. All MEN-2136 Artifacts by Unit by Material

	Corral 2SE										TOTAL									
	M	F	K	B	N	O	M	F	K	B	N	O	TOT							
Rattlesnake series							2	4	1	2	1	0	10							
Leaf-shaped points			1				10	40	141	33	11	3	238							
Mendocino Concave-b			1				1	14	2	1	0	0	18							
Mendocino Side-n							0	1	0	0	0	0	1							
Willits series points							3	7	0	0	1	0	11							
Stemmed points							1	3	0	0	0	0	4							
Type 7							0	1	0	0	0	0	1							
Tips							8	34	73	8	8	1	132							
Midsections			2	1			3	20	60	9	7	0	99							
Medial Fragments	1						3	11	148	22	7	1	192							
Projectile Point Frags							0	2	5	0	1	1	9							
Bifaces							8	22	0	0	0	0	30							
Biface Fragments							4	6	7	6	1	0	24							
Scrapers							14	26	3	1	0	1	45							
Modified Flakes					1		4	15	8	5	5	2	39							
Utilized Flakes		2					0	12	15	4	4	2	37							
Drills							11	48	1	0	0	0	60							
Core/Cobble Tools		1					2	9	0	0	0	1	12							
Cores & Cobbles							1	3	0	0	0	0	6							
Handstones							0	0	0	0	0	0	11							
Pestles							0	0	0	0	0	0	4							
Other Grd.Stone						1	0	0	0	0	0	0	12							
Total	1	5	3	1	0	2	75	278	464	91	46	41	995							
Percent	8.3	41.7	25.0	8.3	0	16.7	7.5	27.9	46.6	9.1	4.6	4.1								
							7.7	28.7	47.9	9.4	4.8	1.4	968							
Euroamerican						4	0	0	0	0	0	0	153							

Table 40. Effective Hydration Temperature - North Coast Ranges Locations

	MAX °F	MIN °F	MEAN °F	MAX °C	MIN °C	MEAN °C	EHT °C	Origer °C
Cloverdale	73.4	45.8	59.6	23.0	7.7	15.3	18.0	16.3
Covalo	71.7	38.8	55.3	22.1	3.8	12.9	16.2	
Ft. Bragg	60.4	45.0	52.7	15.8	7.2	11.5	13.3	12.8
Ft. Ross	62.1	45.2	53.7	16.7	7.3	12.1	14.0	13.6
Graton	70.5	42.0	56.2	21.4	5.6	13.4	16.3	15.4
Healdsburg	73.9	46.1	60.0	23.3	7.8	15.6	18.2	17.3
Kentfield	70.2	45.1	57.7	21.2	7.3	14.3	16.8	16.0
Lakeport	72.8	41.1	57.0	22.7	5.1	13.9	17.0	16.7
Napa Hospital	71.6	45.5	58.6	22.0	7.5	14.8	17.3	16.6
Petaluma	70.5	44.9	57.7	21.4	7.2	14.3	16.8	16.2
Saint Helena	73.5	44.1	58.8	23.1	6.7	14.9	17.7	17.0
Santa Rosa	72.1	43.5	57.9	22.3	6.4	14.4	17.2	16.1
Sonoma	73.9	42.8	58.4	23.3	6.0	14.7	17.6	16.5
Ukiah	74.5	44.2	59.3	23.6	6.8	15.2	18.0	
Vacaville	75.0	46.0	60.5	23.9	7.8	15.8	18.6	18.4
MEN-2136				19.2	4.2	11.7	14.5	

APPENDIX C
ZENI COLLECTION

Figure Legend

Figure 28 Rattlesnake Series

a 1	b 3	c 4	d 5	e 6
f 7	g 8	h 9	i 10	j 11
k 12	l 13	m 14	n 15	o 16
p 17	q 18	r 19	s 20	t 21
u 22	v 23	w 24	x 25	y 28

Figure 29

Rattlesnake Series

a 26	b 27	c 29	d 31	e 32
f 33	g 34	h 35	i 37	j 40
k 38	l 39	m 41	n 42	o 43

Type 8 p 2

Type 9 q 36

Stemmed Points?

r 82	s 83	t 86
u 84	v 87	w 88 x 89

Figure 30

Willits Series

a 66	b 68	c 78	d 69
e 71	f 72	g 70	h 75
i 73	j 79	k 74	l 76
m 81			

Mendocino Side-notched n 53

Mendocino Concave-base

o 46	p 47
------	------

Figure 31

Mendocino Concave-base

a 48	b 49	c 50	d 51
e 52	f 85	g 54	h 55
i 57	j 58	k 64	l 60
m 61	n 62	o 59	p 65

Table 41. Zeni Collection: Rattlesnake Series, Type 8, Type 9, Mendocino Side-Notched, Willits Series, Stemmed Points

CAT#	PROVENIENC	M	mL	mW	Th	nW	bW	Wt	DSA	PSA	NO	DSA	PSA	NO	bW	nW	O.H.	REMARKS
UNIT	LEVEL		mm	mm	mm	mm	mm	g										
41	ZENI	SURF	N	2.5				0.4 + 135									1.2	PROB RCN
42	ZENI	SURF	N	16.7	14.6	5.8	7.4	0.4 *	150	130	20	120			0.51	0.40	1.5	
43	ZENI	SURF	A	2.5		6.5	11.0	0.5 +	155	130	25	130					1.3	
44	ZENI	SURF	K	2.5				0.4 +									1.6	PROB RCN
45	ZENI	SURF	M	3.4		6.1												
TYPE 8																		
2	ZENI	SURF	F	32.8	19.4	4.6	7.5	5.8	1.9 *	150	75	160	80	80	0.30	0.39		BROWN
TYPE 9																		
36	ZENI	SURF	F	14.3		6.3	10.4	0.7 +	200	140	60	140			0.73	0.44		GREY
MENDOCINO SIDE-NOTCHED																		
53	ZENI	SURF	F	30.1	16.8	5.1	14.5	16.8	2.0 *	240	130	110	250	125				GREY, REWORK
WILLITS SERIES																		
66	ZENI	SURF	F	39.1	19.4	6.9	14.1	11.8	5.6	220	125	95			0.61	0.73		LIGHT TAN
68	ZENI	SURF	M	54.0	21.4	9.1	14.6	10.7	9.6 *	200	70	130			0.50	0.68		BLK + WHITE
69	ZENI	SURF	F	37.3	24.1	11.6	11.5	11.5	9.1	220	70	150			0.48	0.48		GREY/TAN PQ
70	ZENI	SURF	F	21.7	8.4				7.9 +	210	140	70						GREY
71	ZENI	SURF	M	47.6	17.9	9.1	12.2	6.9 *	230	110					0.68			CREAM
72	ZENI	SURF	F	49.4	24.2	7.9	19.6	21.0	10.4 *	230	110	120			0.87	0.81		GREY-TAN
73	ZENI	SURF	F	24.2	8.7	22.1			9.1 +	245	110	135			0.00	0.91		GREY-APRICOT
74	ZENI	SURF	F	36.6	22.0	9.7	18.6	22.0	8.5	250	140	110			1.00	0.85		CREAM/APRICOT
75	ZENI	SURF	F	49.5	21.4	8.1	16.9	17.2	8.2	220	95	125			0.80	0.79		POT LIDS
76	ZENI	SURF	M	35.5	21.3	8.9	12.9	13.0	5.7 *	210	100	110			0.61	0.61		BROWN, WEATH.
78	ZENI	SURF	M	48.1	19.1	9.7	12.5	9.7	6.0 *	220	80	140			0.51			BROWN
79	ZENI	SURF	M	20.5		11.1	19.3	20.2	9.6 +	250	120	130			0.99			RED-BROWN
81	ZENI	SURF	F	26.8		5.9	11.0	12.3	3.3 +	190	100	90						
84	ZENI	SURF	F	29.8	19.7	6.8	16.2		3.5 *	230	110	120						
STEMMED POINTS																		
82	ZENI	SURF	F	27.1	16.0	4.8	12.0		2.1 *	250	85	165	230	100	120			BROWN
83	ZENI	SURF	F	26.9	17.9	7.4	14.5	12.5	3.0 *	220	80	140			0.70			GREY
86	ZENI	SURF	F			6.1			2.5 +	230	85	145						GREY
87	ZENI	SURF	K	32.5	14.7	5.4	8.0		2.3 *	200	150	50	190	120	70			
88	ZENI	SURF	M	30.6	15.4	6.9	11.1		2.9 *	245	125	120	230	110	120			
190	ZENI	SURF	F	33.7	14.1	7.8	11.4	11.6	3.5	255	105	150	260	80	180	0.82		
89	ZENI	SURF	F	34.0	12.5	8.1	9.6	10.5	3.0 *	230	115	115	220	110	110	0.84		WHITE

+ weight of point fragment

* estimated value

^ XRF sourced

Table 42. Zeni Collection: Mendocino Concave-Base Attributes

CAT #	PROVENIENCE	M	mL	mW	Th	Wt	bW	bW/	Bind	Th/	REMARKS		
	UNIT	LEVEL		mm	mm	mm	g	mm	mW		mW		
46	ZENI	SURF	F	24.7	16.2	6.0	2.2	*	16.2	1.00	1.5	0.37	GREY-TAN
47	ZENI	SURF	M?	29.9*	16.4	6.5	3.0	*	16.4	1.00	2.2	0.40	
48	ZENI	SURF	M	28.1*	16.5	6.3	2.9	*	13.8	0.84	0.1	0.38	
49	ZENI	SURF	F	23.3	16.0	6.1	2.3	A	15.1	0.94	2.2	0.38	MULTI, REW
50	ZENI	SURF	F	27.0	16.7	6.1	2.8	*	16.7*	1.00	2.0	0.37	RED/BROWN, REW
51	ZENI	SURF	F	27.9*	14.6	6.5	2.4	*	13.6	0.93	2.1	0.45	GREY-TAN, REW
52	ZENI	SURF	F	29.2	18.4	6.9	3.4	*	14.5	0.79	0.8	0.38	GREY/WH/BLK REW
54	ZENI	SURF	F	37.0	16.6	7.5	4.1	A	14.0	0.84	1.5	0.45	BROWN, REW
55	ZENI	SURF	F	36.2	18.6	8.8	5.3	*	18.6*	1.00	1.8	0.47	GREY PQ, CRUDE
57	ZENI	SURF	F		17.2	9.7	6.0	+	15.1	0.88	3.0	0.56	GREY
58	ZENI	SURF	F		19.3	9.0	9.1	+			3.4	0.47	BROWN-TAN
59	ZENI	SURF	M	33.1	17.7	5.6	2.7	A	17.7	1.00	2.2	0.32	
60	ZENI	SURF	M	40.5	16.3	8.0	5.0	A	15.2	0.93	2.2	0.49	
61	ZENI	SURF	N?	34.6	14.3	5.5	2.5	A	10.8	0.76	2.4	0.38	NOT FINISHED
62	ZENI	SURF	F			7.7	2.5	+	14.2		3.2		TAN
64	ZENI	SURF	M	46.2*	20.7	6.9	7.0	*	16.8	0.81	1.4	0.33	
65	ZENI	SURF	F	34.7*	18.7	6.0	3.7	*	17.6	0.9	2.3	0.32	BROWN
85	ZENI	SURF	F		17.4	6.7	3.4	+				0.39	WHITE

+ weight of point fragment
* estimated value
PQ poor quality chert
REW reworked

Table 43. Zeni Collection: Leaf-Shaped Points - Attributes

CAT #	PROVENIENCE	M	mL	mW	Th	Wt	Th/	REMARKS
	UNIT	LEVEL	mm	mm	mm	g	mW	
67	ZENI	SURF	K	42.6	21.1	8.3	7.2	0.39
77	ZENI	SURF	F	36.4	19.7	8.7	5.6	0.44
80	ZENI	SURF	K?	38.8	24.5	8.1	6.3	0.33
91	ZENI	SURF	F?	50.2	23.1	9.0	10.5	0.39
93	ZENI	SURF	F	68.0*	24.0	9.5	15.2 *	0.40
94	ZENI	SURF	N	59.3*	19.0	10.1	9.9 *	0.53
95	ZENI	SURF	F	49.5	19.6	10.1	9.4	0.52
96	ZENI	SURF	F?	48.1*	22.1	9.7	10.0	0.44
97	ZENI	SURF	F	46.5*	20.0	7.5	5.0	0.38
98	ZENI	SURF	B	45.9*	19.5	8.6	6.5	0.44
99	ZENI	SURF	K	48.0*	20.3	7.6	6.3	0.37
100	ZENI	SURF	F?	54.2*	21.7	9.8	8.5 +	0.45
101	ZENI	SURF	N?	45.4*	22.2	7.9	6.4	0.36
102	ZENI	SURF	F	48.4	16.9	9.7	7.2	0.57
103	ZENI	SURF	K	46.8*	19.3	8.2	6.1 +	0.42
104	ZENI	SURF	F		20.0	9.7	11.1 +	0.49
105	ZENI	SURF	K		20.8	7.8	5.8 +	0.38
106	ZENI	SURF	F		24.1	13.1	21.6 +	0.54
108	ZENI	SURF	B	61.5	24.0	8.7	11.1 +	0.36
109	ZENI	SURF	F		25.4		9.9 +	
110	ZENI	SURF	F?	50.3*	19.1	10.8	10.2 +	0.57
111	ZENI	SURF	F?	35.8	17.2	8.1	4.7	0.47
112	ZENI	SURF	B	35.8*	17.0	8.6	3.4 *	0.51
113	ZENI	SURF	K	37.2	23.3	9.4	7.0	0.40
114	ZENI	SURF	K	43.0	22.8	8.8	8.5	0.39
115	ZENI	SURF	K	32.4	18.4	7.9	4.5	0.43
116	ZENI	SURF	B	33.1	19.5	7.3	3.8	0.37
117	ZENI	SURF	K	33.1	18.1	8.7	4.2	0.48
118	ZENI	SURF	B	28.4	17.4	6.3	2.6	0.36
119	ZENI	SURF	N	39.6	19.1	7.1	4.0	0.37
120	ZENI	SURF	Q	43.7*	14.6	8.3	4.7 *	0.57
121	ZENI	SURF	K	35.6*	16.4	8.6	4.2 *	0.52
122	ZENI	SURF	F?	35.7*	16.8	9.1	5.0 *	0.54
123	ZENI	SURF	N			8.3	4.4 +	
124	ZENI	SURF	N	27.8	16.9	7.3	2.9	0.43
125	ZENI	SURF	B	35.8	17.8	6.8	3.1	0.38
126	ZENI	SURF	M?				3.4 +	
127	ZENI	SURF	K	24.2	15.5	5.6	2.0	0.36
128	ZENI	SURF	K	28.1	16.2	8.2	2.7	0.51
129	ZENI	SURF	K	32.0	17.7	7.2	3.0	0.41
130	ZENI	SURF	F	33.9	19.0	9.1	4.3	0.48
131	ZENI	SURF	K		15.8	4.6	1.1 +	0.29
132	ZENI	SURF	K	20.0	14.3	6.5	1.4	0.45
133	ZENI	SURF	F		13.0	6.0	1.9 +	0.46
134	ZENI	SURF	K	22.5			1.7 +	
135	ZENI	SURF	B	25.4	20.0	7.7	2.9	0.39
136	ZENI	SURF	M	31.1	20.6	8.2	4.3	0.40
137	ZENI	SURF	K	30.4	18.8	7.5	3.0	0.40

Table 43. Zeni Collection: Leaf-Shaped Points - Attributes

CAT #	PROVENIENCE UNIT	M LEVEL	M mm	mL mm	mW mm	Th mm	Wt g	Th/ mW	REMARKS
138	ZENI	SURF	F				3.8 +		RWK CORTEX
139	ZENI	SURF	F	25.8	15.8	7.8	2.6	0.49	
140	ZENI	SURF	F?		17.4	8.1	4.9 +	0.47	ROUGH PQ
141	ZENI	SURF	F		25.7	8.7	8.6 +	0.34	BASE
142	ZENI	SURF	F				4.4 +		BASE
143	ZENI	SURF	F				3.9 +		BASE
144	ZENI	SURF	M		19.0	9.8	5.2 +	0.52	BASE
145	ZENI	SURF	F			8.3	3.8 +		RWK
146	ZENI	SURF	B		17.6	7.8	3.0 +	0.44	BASE RWK
147	ZENI	SURF	B	30.1*	17.4	7.1	3.0 *	0.41	RWK?
148	ZENI	SURF	K				2.1 +		BASE
149	ZENI	SURF	K	43.2*	24.2	7.2	6.0 +	0.30	
150	ZENI	SURF	K				5.9 +		BASE
151	ZENI	SURF	K	30.2*	20.9	8.2	4.2 *	0.39	RWK
152	ZENI	SURF	K	34.6*	19.0	8.2	4.1 *	0.43	BASE RWKED
153	ZENI	SURF	K?		22.2	8.5	5.4 +	0.38	BASE >mWp
154	ZENI	SURF	N		16.7	5.5	2.2 *	0.33	RWK BIPOLAR?
155	ZENI	SURF	K		17.7	7.1	4.4 +	0.40	BASE > 50%
156	ZENI	SURF	U	27.0	20.5	7.3	2.9	0.36	
157	ZENI	SURF	K				1.7 +		BASE
158	ZENI	SURF	K		20.0	8.6	4.5 +	0.43	90% C
159	ZENI	SURF	B		20.5	7.2	4.2 +	0.35	RWK 50% C
160	ZENI	SURF	K		21.8	8.3	5.5 +	0.38	RWK
161	ZENI	SURF	N		19.0	6.6	3.4 +	0.35	RWK 80% C
162	ZENI	SURF	K		21.5	6.7	3.2 +	0.31	RWK
163	ZENI	SURF	K		16.9	7.3	2.9 +	0.43	RWK 90% C
164	ZENI	SURF	K		21.2	8.0	6.3 +	0.38	RGH RWK? 80% C
165	ZENI	SURF	K		21.9		5.5 +		RWK
166	ZENI	SURF	K				3.3 +		BASE
167	ZENI	SURF	K	22.4	15.7	4.9	1.7	0.31	RWK?
168	ZENI	SURF	K				4.1 +		BASE
169	ZENI	SURF	K		22.4		6.3 +		BASE >50% C
170	ZENI	SURF	K				2.6 +		BASE
171	ZENI	SURF	B		21.1	8.4	4.4 +	0.40	RWK 80+% C
172	ZENI	SURF	K				2.1 +		BASE
173	ZENI	SURF	K				1.4 +		RWK BASE
174	ZENI	SURF	K	29.4	14.2	7.1	2.3	0.50	RWK
175	ZENI	SURF	K		23.2	8.0	7.8 +	0.34	EWK
176	ZENI	SURF	F	25.5	10.6	4.8	1.2	0.45	BROWN RWK
177	ZENI	SURF	F		17.9	8.0	4.4 +	0.45	GREY RWK
178	ZENI	SURF	M				5.7 +		BASE FIRECRK
179	ZENI	SURF	N	39.8	23.5	6.5	6.0 *	0.28	

* Estimated Value

+ Weight of point fragment

Table 44. Zeni Collection: Pestles and Handstones - Attributes

mL	Wt	DESCRIPTION
Pestles		
165	944.5	DISTAL END. SHAPED
160	849.4	UNSHAPED, END BATTERED
180	897.2	UNSHAPED, END BATTERED
140	429.9	UNSHAPED, END BATTERED
200	1067.0	SHAPED
210	1178.5	SHAPED, END BATTERED
142	560.7	UNSHAPED, END BATTERED
129	325.9	UNSHAPED, END BATTERED, SPALLED
210	1600+	UNSHAPED?, END BATTERED
370	1600+	PARTIALLY SHAPED, BATTERED, SPALLED,
87	240.6	UNSHAPED, PROX END, BATTERED
83		POSS. UNSHAPED, MIN BATTERING
Handstones		
123	652.0	SHAPED, UNIFACIAL
119	786.5	UNSHAPED, TRIFACIAL
157	896.2	SHAPED, BIFACIAL, RESHARPENED

Table 45. Zeni Collection: Descriptive Statistics - Projectile Points

	mL	mW	Th	Wt	nW	bW	bW/mW	nW/mW	DSA	PSA	NOA
Rattlesnake Series											
MEAN	22.1	14.7	3.5	0.9	6.6	8.7	0.65	0.46	159	123	39
STD	3.84	2.53	0.90	0.31	1.44	1.75	0.15	0.11	24	15	19
MIN	16.7	10.3	2.1	0.4	4.6	5.7	0.43	0.31	130	95	15
MAX	33.4	19.5	5.9	1.7	11.8	12.0	0.99	0.74	225	150	95
N	30	21	42	21	37	22	14	21	38	36	35
Willits Series											
MEAN	41.2	21.3	8.7	7.4	15.8	14.7	0.70	0.75	223	106	117
STD	8.94	2.01	1.58	2.16	3.58	4.52	0.20	0.14	18	22	22
MIN	26.8	17.9	5.9	3.5	11.0	9.7	0.48	0.48	190	70	70
MAX	54.0	24.2	11.6	10.4	22.1	22.0	1.00	0.94	250	140	150
N	11	13	14	10	12	11	10	11	14	14	13
Stemmed Points											
MEAN	30.8	15.1	6.6	2.8	11.1	11.5	0.79	0.73	233	106	126
STD	3.18	1.83	1.25	0.51	2.21	1.00	0.08	0.10	19	26	38
MIN	26.9	12.5	4.8	2.1	8.0	10.5	0.70	0.54	200	80	50
MAX	34.0	17.9	8.1	3.5	14.5	12.5	0.84	0.81	255	150	165
N	6	6	7	6	6	3	3	6	7	7	7
Mendocino Concave-base											
MEAN	32.3	17.2	7.0	3.5	15.4	2.0	0.91	0.41			
STD	6.38	1.63	1.22	1.39	1.95	0.82	0.09	0.07			
MIN	23.3	14.3	5.5	2.2	10.8	0.1	0.76	0.32			
MAX	46.2	20.7	9.7	7.0	18.6	3.4	1.00	0.56			
N	14	17	18	14	16	17	15	17			
Leaf-Shaped Points											
MEAN	37.9	19.4	8.0	5.0				0.42			
STD	10.73	3.04	1.39	2.81				0.07			
MIN	20.0	10.6	4.6	1.4				0.28			
MAX	68.0	25.7	13.1	15.2				0.57			
N	50	74	73	43				71

Figure 28. Zeni Collection - Rattlesnake Series Points

Figure 29. Zeni Collection - Projectile Points

Figure 30. Zeni Collection - Projectile Points

Figure 31. Zeni Collection - Mendocino Concave-Base Points

Figure 32. Zeni Collection - Ceremonial Blade

APPENDIX D

CHARTS

Chart 1. MEN-2136 Debitage (Count) - By Source By Unit

Chart 2. MEN-2136 Debitage (Weight) - By Source By Unit

Chart 3. MEN-2136 Debitage (Count) - Trench By Source By Level

Chart 4. MEN-2136 Debitage - Trench By Source By Level

Chart 5. MEN-2136 Unit 21S34E Debitage (Count) - By Source By Level

Chart 6. MEN-2136 Unit 7S1W Debitage By Flake Size

Chart 7. MEN-2136 Unit 7S1W Debitage By Flake Type By Source

Chart 8. MEN-2136 Faunal Recovery By Level: Unidentifiable Bone Fragments

Chart 9. Faunal Recovery By Unit: Unidentifiable Bone Fragments

Chart 10. MEN-2136 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate

Chart 11. MEN-2136 Hydration Distribution: Debitage - Konocti

Chart 12. MEN-2136 Hydration Distribution: Debitage - Borax Lake - Converted to Konocti Rate

Chart 13. MEN-2136 Hydration Distribution: Debitage - Borax Lake

Chart 14. MEN-2136 Hydration Distribution: Debitage - Napa Valley

MICRONS	LEVEL						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
0.8	B	KK	K				
0.9	B	K					
1.0					B		
1.1				B			K
1.2	KKK	KKK	K				
1.3		N	K		K		K
1.4	K	KB		K	KB		
1.5		B		K	N		
1.6	K	KB		K	KB	B	
1.7	K	K	BN		K		
1.8			KN	K	KK	K	B
1.9	KB	K	KKB	KNNB			
2.0	KB	KK	KBB	KB			
2.1	KB	K	KBN	BB	KKK	BN	B
2.2	K	B	KKKKBB		KN		N
2.3	B	KKBN	K	KBN	KNN	KKB	
2.4	KKNN	KKKB	K	KK	KKN	B	
2.5		KK	KNN	BBN	BN		B
2.6	KK	N	KK	KKKBNN	KB	KK	KB
2.7	NN	N	BBN	KKKKKN	KKK		
2.8		KN	KKN	KK	B	KKK	
2.9	K	KN	BB	KKNNN	BN		K
3.0	K	B	KKK	KK	B		
3.1			KBBNN	KKKK	KK		N
3.2		B	K	KKB	K	B	
3.3	K		K		KKN		
3.4			N			K	B
3.5		K	N	NN		N	
3.6				K	KB		K
3.7	KKN	KN					
3.8			K				
3.9					K		
4.0							
4.1			K				
4.2			KK		B		
4.3							
4.4	KB						
4.5							
4.6		K					
4.7						N	

All sources, converted to Konocti rate

Chart 15. Unit 3S1W Hydration Distribution: Debitage by Level

MICRONS	LEVEL					
	0-10	10-20	20-30	30-40	40-50	50-60
0.8	KK					
0.9	K	KK				
1.0		KK	KK			
1.1	K	KKN		K		
1.2	KB	K				K
1.3	KKKKK	KK				
1.4	KKB	KK			K	
1.5	KKKK		K			
1.6	KB	KK	KK			
1.7	KKKN	KK	KKB			
1.8	K	KB				
1.9	K			K	K	K
2.0	BN		K	KK		B
2.1		K		KK		
2.2	KKKNN	K	K	KK		
2.3	K		KBB	K		
2.4	KK			KBB	B	KBN
2.5	KK		K	KKK	K	
2.6		N	KK		K	
2.7				B		
2.8				K		
2.9		KK	K	B		
3.0	K	B	B	BBB		
3.1						
3.2		K				
3.3	K		KK			
3.4						
3.5						
3.6	KN					
3.7						
3.8						
3.9						
4.0			B			
4.1						
4.2						
4.3						
4.4						
4.5						
4.6				K		
4.7		K		B		
All sources, converted to Konocti rate						

Chart 16. Unit 21S24E Hydration Distribution: Debitage by Level

Chart 17. MEN-2136 Unit 3S1W Debitage: All Sources Converted to Konocti Rate

Chart 18. MEN-2136 Unit 21S24E Debitage: All Sources Converted to Konocti Rate

Chart 19. MEN-2136 Hydration Distribution: Rattlesnake Series - All Sources Converted to Konocti Rate

Chart 20. MEN-2136 Hydration Distribution: Leaf-Shaped Points - All Sources Converted to Konocti Rate

Chart 21. MEN-2136 Hydration Distribution - Konocti Obsidian

Chart 22. MEN-2136 Hydration Distribution - Borax Lake Obsidian

Chart 23. MEN-2136 Hydration Distribution - Napa Valley Obsidian

Chart 24. MEN-2136 Hydration Distribution: All Measurements, Converted to Konociti Rate

Chart 25. Warm Springs Hydration Distribution: Leaf-Shaped and Excelsior Points - All Sources Converted to Konocti Rate

Chart 26. Warm Springs Hydration Distribution: Napa and Konocti Debitage

Chart 27. MEN-500 Hydration Distribution - All Sources Converted to Konocti

Chart 28. MEN-500 Hydration Distribution - All Sources Converted to Borax Lake Rate

Chart 29. MEN-2138 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate

Chart 30. MEN-1932 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate

Chart 31. MEN-1932 Hydration Distribution: Debitage - All Sources Converted to Borax Lake Rate

Chart 32. MEN-1930 and -1932 Hydration Distribution - All Sources Converted to Konocti Rate

Chart 33. MEN-1929 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate

Chart 34. MEN-1929 Hydration Distribution - All Sources Converted to Konocti Rate

Chart 35. Albion Head Hydration Distribution - All Sources Converted to Konocti Rate

Chart 36. Albion Head Hydration Distribution - All Sources Converted to Borax Lake Rate

Chart 37. MEN-2220 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate

Chart 38. Salt Point Midden Sites Hydration Distribution - All Sources Converted to Konocti Rate

Chart 39. Salt Point Lithic Scatters Hydration Distribution - All Sources Converted to Konocti Rate

Chart 40. SON-1471 Hydration Distribution: Debitage - All Sources Converted to Konocti Rate