Settlement Pattern Change in the Mountains of Northwest California: A View From Pilot Ridge

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One of the first attempts to identify prehistoric settlement pattern change in northwest California was made by Thomas King (1973, 1974). Based on limited data from a series of upland sites, King hypothesized that before 3000 B.P.,

> the North Coast Ranges were occupied by small, relatively nomadic bands of hunter-gatherers, who would move as complete social groups in response to seasonal game migrations and shifts in the maturation of seed and other vegetal crops. During the late prehistoric and proto-historic periods, however, social groups were presumably larger and more sedentary, with relatively permanent villages... from which small task groups might issue periodically to exploit specific resources (King 1973:7-9).

King further argued that early sites in the higher elevations would have assemblages indicative of activities associated with complete social groups, while more recent sites would contain much more limited, specialized tool kits. The emergence of lowland sedentary villages late in time was thought to have been made possible through the development of sophisticated trade networks. "As trade developed in the Sacramento Valley and North Coast Ranges, it was possible to move food to the people rather than people to food" (King 1974:23).

Relying on ethnographic data from the Chilula, Sinkyone, Wailaki, and Yuki, Jackson (1976) later developed a subsistence-settlement pattern model challenging King's hypothesis. Jackson's study showed that the above groups moved into high elevations during the summer and set up temporary villages. These villages would have been manifested archaeologically by a wide range of tool types rather than the specialized tool kits expected by King. Due to the strong influence of Jackson's work, settlement pattern studies progressed very little through the late 1970's and early 1980's. Data collected from large-scale surveys were forced into synchronic site types, and interpreted using subsistence-settlement pattern models derived from the ethnographic record (e.g., Bickel 1979; Stewart and Fredrickson 1979; Tamez 1978, 1981). This approach made no attempt to isolate chronologically discrete assemblages, creating a data base incapable of testing King's hypothesis or any other diachronic scheme.

In an attempt to alleviate these problems, Hildebrandt and Swenson (1982, 1985) proposed an alternative approach to the interpretation of survey data. Rather than focusing on "sites," they traced the frequency of co-occurrences among artifacts with presumed functional and temporal significance. Using data collected from 1120 site record forms obtained from Mendocino National Forest and adjacent Bureau of Land Management lands, they discovered trends not unlike those originally hypothesized by King (1973, 1974).

> most habitats within the study area were occupied to some degree or another from Early Borax Lake times

> to the present... However, the distribution and form of these occupations have not remained uniform over time and space. This is demonstrated on a general level by the fact that sites characterized by manos/metates, non-late projectile points, and the lack of obsidian are more frequently found in the conifer forest at high elevations and on ridges and slopes than sites characterized by mortars/pestles, late points, and greater amounts of obsidian. The latter assemblages are more frequently found outside the conifer forest, at lower elevations, and in valleys or near streams (Hildebrandt and Swenson 1985:143).

By measuring the frequency of sites per acre surveyed within a variety of environmental zones, it was also found that lowland sites tended to be concentrated in particular locations, while those of the uplands were more widely scattered across the landscape. They concluded from these patterns that early inhabitants of the region followed a rather mobile, expansive settlement system favoring high elevation areas currently occupied by conifer forest. Later peoples, in contrast, tended to congregate in higher densities within the acorn dominated lowlands.

Although the work of Hildebrandt and Swenson (1982, 1985) provided interesting insights regarding prehistoric land-use change, their reliance on site record data presented several interpretive constraints. The most important of these stems from their inability to distinguish true single component assemblages from those composed of artifacts co-occurring in space but actually deposited during different periods of occupation. This difficulty tends to homogenize assemblages by creating associations that did not exist in reality, ultimately blurring important contrasts in the archaeological record (e.g., Gunther Barbed projectile points from a specialized hunting encampment might incorrectly be assigned to a residential base if they were discarded next to milling equipment deposited by earlier inhabitants of the area).

The Pilot Ridge Project

An excellent opportunity to solve these problems emerged when a contract between Six Rivers National Forest and Sonoma State University allowed Hildebrandt and Hayes (1983, 1984 excavate 13 upland sites along the Pilot Ri South Fork Mountain ridge system (Humboldt Trinity Counties). The sites ranged in elevat from about 4500-6000 ft (1370-1830 m) and m were located within rather dense, montane fo habitats (Figure 1). In addition to testing hypotheses of King (1973, 1974) and Hildebra and Swenson (1982, 1985), a major goal of project was to monitor the influence of Holoc climatic change on prehistoric use of upla habitats. As a result of these concerns, West (19 1987) collected pollen cores from a series of lo contexts, providing important information for t paleoenvironmental sequence summarized belo

Paleoenvironmental Setting

West's Pilot Ridge data, when combined wi pollen spectra from a variety of other sampli locations throughout the North Coast Ranges, sh that Holocene climatic changes caused shifts in t distribution of several important plant species. northwest California, increasing temperatures the mid-Holocene (8000-2800 B.P.) allowed oaks move upslope 200-300 meters in elevation, creati an upland habitat characterized by a mixed forest Douglas fir (*Pseudotsuga menziesii*), oak (*Querc* sp.), and pine (*Pinus* sp.). Understory associatio probably included extensive upland prairie an patches of montane chaparral. Such a setting woul have produced high yields of acorns, pine nut deer, as well as a high diversity of other economicall important plants and animals.

After 2800 B.P., and continuing to the present temperatures cooled and available moistur increased. The montane forest lowered, coverin most of the higher elevations, while a mixe evergreen forest with tan oak (*Lithocarpus densiflora*) developed on the lower slopes and within the rive valleys. Upland resources were reduced both in terms of abundance and diversity while the lower elevations maintained a higher level of productivity by virtue of possessing an abundance of anadromous fish, acorns, and other plant and animal taxa.

Field Methods

Given the high priority placed on discovering temporally discrete assemblages, a field strategy specifically designed for shallow ridge-top deposits was developed with the help of Greg White, Larry Weigel, and Dave Fredrickson. Over 3,000 linear meters of one-meter wide transects were laid over

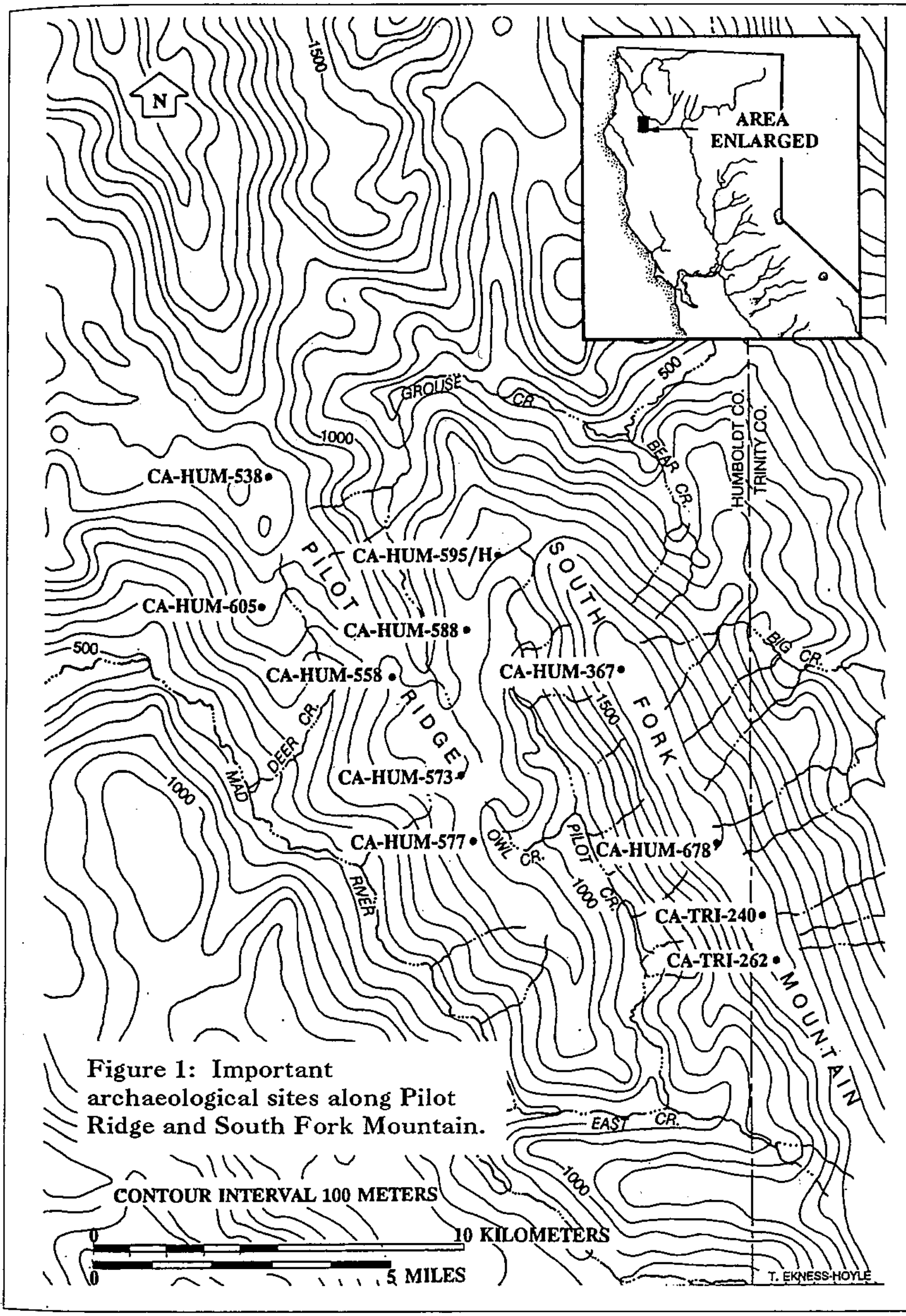


Figure 1: Important archaeological sites along Pilot Ridge and South Fork Mountain.

the project sites. Within each transect, 1x2 meter units were placed between two and three meters apart and excavated to a depth of 10 cm. Based largely on the recovery of temporally diagnostic projectile points from the transect excavations, probable single-component areas were identified. Within these areas, large exposures were excavated in hopes of finding intact assemblages. The large exposures combined with the transect units equalled over 325 cubic meters of excavation.

Whether or not the excavated areas yielded single-component assemblages was further tested with the use of obsidian hydration data. Unfortunately, due to the rarity of obsidian in this region, most of the hydration data was derived from associated debitage and not directly from the tools themselves. Locations exhibiting clustered rim readings with values equivalent in age to associated projectile points were considered good single-component areas. Locations with large ranges of variation in hydration or with rim values in conflict with associated projectile points were thought to be temporally mixed. Over 500 source-specific specimens were used for this purpose, the vast majority from the Medicine Lake Highlands geochemical group.

Chronological Considerations

Three cultural patterns are hypothesized for northwest California (Fredrickson 1984; Hildebrandt and Hayes 1984): **Gunther Pattern** (200-1500 B.P.), **Mendocino Pattern** (1500-3000 B.P. [formerly Willits Pattern]), and **Borax Lake Pattern** (3000-6000 B.P.). The projectile point forms used to isolate single-component areas in the field are illustrated in Figure 2 (see also Hayes and Hildebrandt 1985; Hayes 1985). Medicine Lake obsidian hydration ranges associated with the patterns are as follows: Gunther Pattern (0.6-2.0 microns), Mendocino Pattern (2.1-3.2 microns), and Borax Lake Pattern (3.3-4.9 microns). Unfortunately, however, no materials conducive for radiocarbon dating were recovered during the project, making it difficult to evaluate whether the above hydration ranges actually correspond to the calendric dates proposed.

More recent work by Basgall and Hildebrandt (1989), however, provides rough verification for the aforementioned sequence through the analysis of hydration-radiocarbon correlations for Medicine Lake Highlands obsidian. Seven data pairings from the Sacramento River Canyon produced the following relationship between radiocarbon ye and hydration values: Years B.P. = 295.12 microns^{1} Although precise temperature data is not availab for Pilot Ridge/South Fork Mountain, gene climatic maps indicate a mean annual temperatu of around 10°C (USDA n.d.), almost 5.0°C cool than the 14.9°C average recorded for the Sacramen River Canyon. Using a 7.0% adjustment per degr Celsius to correct for the temperature differen (see Basgall and Hildebrandt 1989:198), applicati of the Sacramento River Canyon rate to the Pil Ridge/South Fork Mountain data produces resul that are reasonably consistent with the origin estimates of Hildebrandt and Hayes (1984): Gunth Pattern (207-1361 B.P.), Mendocino Pattern (153 3045 B.P.), and Borax Lake Pattern (3159-60 B.P.).

Artifact Assemblages

The archaeological data are organize according to the three patterns listed above. Du to variable degrees of success in finding singl component areas, two additional categories are use Borax Lake-Mendocino and Mendocino-Gunth mixes. Although mixed, these collections exhib trends similar to those produced by the non-mixe assemblages and therefore strengthen the overa patterns observed.

Borax Lake components were found at fo sites (Table 1). Hydration means range from 3.3 4.2 microns and Borax Lake wide-stemmed point dominate at all locations. The assemblages sho little variability across loci and contain a range o artifacts characteristic of multi-activity base camps This interpretation is best supported by the finding at HUM-573. Within an area of approximately 5x meters, the probable remains of a structure wer discovered. Structural indicators included a possibl compacted floor surrounded by at least three pos holes. Within this small area, a remarkably larg number of artifacts representing a diversity o activities was recovered. These included 12 millin slabs (two of which were stacked upon one another) four hand stones, three hammer stones, one anvil 11 edge-flaked spalls, 32 bifaces, 12 flake tools, 1 cores, nine projectile points, and three cobble tools

Before moving to components containing mixture of Borax Lake and Mendocino materials, i is important to report the findings of Sundahl's (1988) excavation of TRI-1008. Located along the Trinity River at Cox Bar, less than 20 miles from the Pilot Ridge-South Fork Mountain system, the

Table 1: Borax Lake Pattern artifact assemblage.

	HUM-573	TRI-367	HUM-577	TRI-262	Total
Artifacts					
Hand stones	4	5	2	4	15
Milling slabs	12	1	2	2	17
Pestles	-	-	-	-	-
Mortars	-	-	-	-	-
Hammer stones	3	5	2	4	14
Anvils	1	-	-	-	1
Spall Tools	11	2	-	3	16
Bifaces	32	55	27	37	151
Flake Tools	12	17	10	9	48
Cores	11	10	1	2	14
Projectile Points	9	10	8	5	32
Drills	-	2	-	-	2
Cobble Tools	3	-	-	-	3
Total	98	97	52	66	313
Hydration Data					
Number	48	18	5	4	75
Mean Microns	4.2	3.6	3.6	3.3	3.7[a]
Standard Deviation	0.5	0.5	1.0	1.0	0.8[a]
Projectile Points[b]					
Gunther Pattern	1	1	-	-	2
Mendocino Pattern	-	-	-	1	1
Borax Lake Pattern	8	7	3	10	28
Total	9	8	3	11	31

a - average of all sites.
b - diagnostic point types illustrated in Figure 3.

Table 2: Borax Lake/Mendocino Pattern artifact assemblages.

	HUM-678	TRI-240	HUM-605	TRI-262	HUM-558	Total
Artifacts						
Hand stones	-	3	-	-	-	3
Milling slabs	1	4	-	-	-	5
Pestles	-	-	-	-	-	-
Mortars	-	-	-	-	-	-
Hammer stones	-	6	-	1	1	8
Anvils	-	-	-	-	1	1
Spall Tools	-	-	-	-	-	-
Bifaces	15	27	14	25	9	90
Flake Tools	9	11	14	10	7	51
Cores	-	2	-	1	-	3
Projectile Points	8	9	21	6	15	59
Drills	-	1	-	-	-	1
Cobble Tools	-	-	-	-	-	-
Total	33	63	49	43	33	221
Hydration Date						
Number	22	22	14	6	11	75
Mean Microns	2.7	2.5	1.9	1.8	1.4	2.6[a]
Standard Deviation	1.0	0.9	0.6	1.2	0.6	1.1[a]
Projectile Points[b]						
Gunther Pattern	-	1	1	-	2	4
Mendocino Pattern	1	3	4	2	3	13
Borax Lake Pattern	9	6	5	4	4	28
Total	10	10	10	6	9	45

a - average of all sites.
b - diagnostic point types illustrated in Figure 3.

Table 3: Mendocino Pattern artifact assemblages.

Artifacts	HUM-588	HUM-595	HUM-538	TRI-240	Total
Hand stones	-	-	-	-	-
Milling slabs	-	-	-	-	-
Pestles	-	-	-	3	3
Mortars	-	-	-	-	-
Hammer stones	-	1	-	1	2
Anvils	-	-	-	-	-
Spall Tools	-	-	-	-	-
Bifaces	6	10	3	18	37
Flake Tools	5	10	9	14	38
Cores	2	-	-	1	3
Projectile Points	8	9	4	6	30
Drills	-	-	-	-	-
Cobble Tools	-	-	-	-	-
Total	21	33	16	43	113
Hydration Data[b]					
Number	9	15	7	3	27
Mean Microns	2.5	2.8	4.7	1.7	2.3[a]
Standard Deviation	1.4	0.6	0.9	0.7	0.9[a]
Projectile Points[c]					
Gunther Pattern	-	2	-	-	2
Mendocino Pattern	2	1	5	3	11
Borax Lake Pattern	-	-	2	-	2
Total	2	3	7	3	15

a - average of all sites; b - site HUM-538 includes Borax Lake obsidian only; c - diagnostic point types illustrated in Figure 3.

Table 4: Mendocino/Gunther and Gunther Pattern artifact assemblages.

	-Mendocino/Gunther-				Gunther
Artifacts	HUM-558	HUM-605	HUM-577	Total	HUM-588
Hand stones	-	1	-	1	-
Milling slabs	1	4	-	5	-
Pestles	1	1	-	2	-
Mortars	-	1	-	1	1
Hammer stones	1	3	-	4	1
Anvils	1	-	-	1	-
Spall Tools	-	-	-	-	-
Bifaces	37	15	1	53	13
Flake Tools	21	16	4	41	5
Cores	2	-	-	2	2
Projectile Points	31	22	2	55	9
Drills	-	-	-	-	-
Cobble Tools	-	-	-	-	-
Total	95	63	7	165	31
Hydration Data					
Number	24	9	-	33	13
Mean Microns	1.6	1.9	-	1.8[a]	2.0
Standard Deviation	0.6	0.6	-	0.6[a]	0.6
Projectile Points[b]					
Gunther Pattern	10	8	1	19	6
Mendocino Pattern	13	5	1	19	1
Borax Lake Pattern	-	1	-	1	-
Total	23	14	2	39	7

a - average of all sites.
b - diagnostic point

site produced a Borax Lake Pattern assemblage almost identical to those encountered in the mountains. Common elements include Borax Lake wide-stemmed projectile points, serrated bifaces, ovoid flake tools, spall tools, hand stones, milling slabs, cobble tools, anvils, and drills. A large hydration sample of Medicine Lake Highlands obsidian was also generated, yielding a mean value of 5.7 microns (standard deviation of 1.3 microns). After correcting for temperature (Sayler reports a mean annual temperature of 13.9° C [Barrett 1966]), the Basgall and Hildebrandt (1989) rate converts the hydration mean to a calendric date of 5328 B.P.

Based on the combination of projectile point frequencies and hydration ranges, Borax Lake-Mendocino components were found at five sites (Table 2). Only one (TRI-240) exhibits the diversity of tools found in the clean Borax Lake deposits. The remaining components include specialized assemblages, composed of projectile points, bifaces, flake tools, and hammer stones. The dominance of these forms probably represents the manufacturing and use of tools associated with hunting and butchering game. Clean Mendocino components produced comparable results. Discovered at four sites (Table 3), assemblages are largely restricted to projectile points, bifaces, flake tools, and hammerstones (95% of the combined assemblages).

Mendocino-Gunther mixes were found at three sites (Table 4). Showing a slight shift in assemblage composition, only one site exhibits the specialized assemblage of bifaces, flake tools, and projectile points. The other two components have a minor presence of milling equipment which includes two pestles and one hopper mortar -- the first evidence of acorn-processing technology encountered. A similar assemblage is represented by the single Gunther Pattern component area (Table 4). The only piece of ground stone recovered from the deposit was a hopper mortar. The remainder of the assemblage (97%) is composed of cores, bifaces, flake tools, projectile points, and a single hammerstone.

When data from all loci are combined into the general classes of "flaked stone tools and hammer stones" and "all other tools," diachronic shifts in assemblage composition are clearly illustrated (Table 5). Borax Lake Pattern areas include a much greater percentage of artifacts associated with food processing and maintenance activities (i.e., hand stones, milling slabs, spall tools, cobble tools, and drills) than any occupations assigned to subsequent temporal intervals. Chi square analysis of this 2x5 celled table produces a value of 37.88, significant at the 0.001 level with four degrees of freedom.

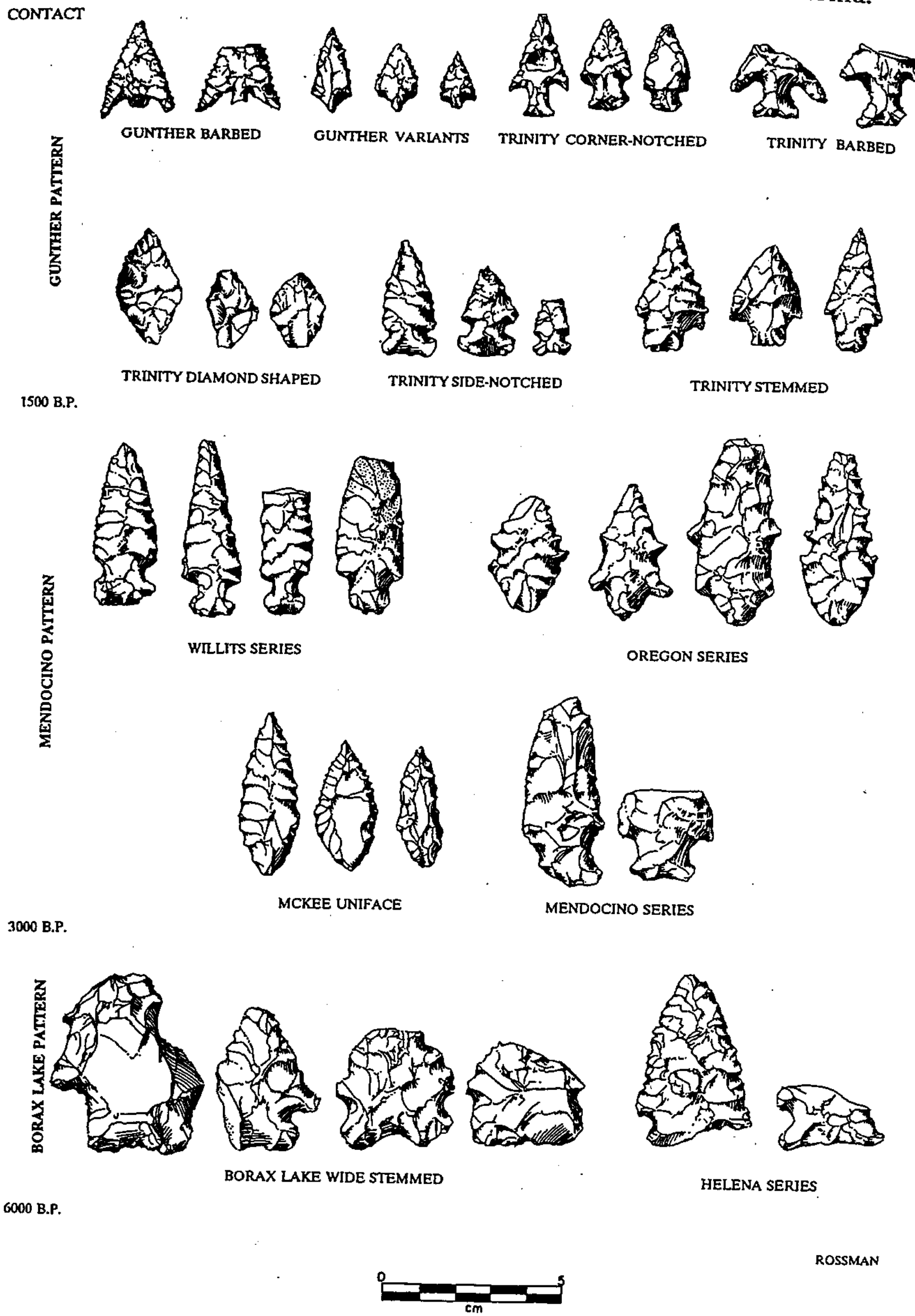
Summary

Palynological data indicate that during the interval represented by the Borax Lake Pattern (roughly 3000-6000 B.P.), the warm climate of the mid-Holocene created an upland habitat rich in resource abundance and diversity. Excavations by Hildebrandt and Hayes (1983, 1984) and Sundahl (1988) indicate that Borax Lake Pattern residential bases ranged from the terraces of the Trinity River (1300 ft) to the top of South Fork Mountain (5700 ft). As defined by Binford (1980), the nature and homogeneity of these habitation areas shows a strong similarity to what would be expected from a "forager" approach to subsistence-settlement organization. With this strategy, little emphasis is placed on storage, and incongruities in the distribution of resources over time and space are solved by moving people from places of declining productivity to areas where foraging opportunities

Table 5. Combined artifact classes across time.

	Hammers/FlakeStone	Other Tools	Total
Borax Lake	261	52	313
Borax/Mendocino	212	9	221
Mendocino	110	3	113
Mendocino/Gunther	155	10	165
Gunther	30	1	31
Total	768	75	843

Figure 2: Diagnostic projectile point from Northwestern California.



enhanced. This approach requires frequent residential moves by the entire social unit, resulting in the generalized assemblages and homogeneous settlement structure observed in the archaeological record.

After 2800 B.P. the climate cooled and effective moisture increased. Because of this change, montane forest began to dominate the uplands resulting in a significant decrease in the abundance and diversity of economically important plants and animals. Probably in response to this change, use of the Pilot Ridge-South Fork Mountain area became increasingly specialized. In contrast to the Borax Lake Pattern residential bases, Mendocino Pattern occupations are represented by a flaked stone tool assemblage probably associated with the exploitation of game. As evidenced by the Gunther Pattern assemblages, this narrow use of the uplands appears to have continued though the late period into historic times.

Storage, Sedentism, and Non-Egalitarian Society

Given these patterns, it is likely that lowland subsistence settlement strategies also changed. The decrease in upland resource abundance and diversity may have required an increase in the productivity of lowland resources such as acorns and salmon. Increased production of these commodities was probably best achieved through development of sophisticated exploitative techniques (e.g., weirs) and the ability to store these resources for extended periods of time. Testart (1982) argues that the practice of intensive food storage is linked causally to increases in degree of sedentism, population density, and extent of socioeconomic inequality. Regarding sedentism, the presence of substantial amounts of stored resources would remove the need for geographical mobility, while at the same time, inhibit such mobility due to the group's need to remain near its caches. In turn, sedentism reduces constraints on population growth. Given that population levels are regulated by the quantity of food available during the leanest season of the year, the addition of stored foods to supplement the diet during such a period would allow an increase in the number of people the economic system could support.

Sedentism also has several socioeconomic implications. Among non-storing peoples, food sharing is necessary in cases where a large portion of food had to be consumed in a limited amount of time to avoid spoilage or high opportunity costs associated with scheduling conflicts. With storage, however, the necessity of sharing is reduced. According to Testart, reduction in sharing is often accompanied by a shift in ideology toward an emphasis on individual ownership. Furthermore, the need to process large amounts of material during a relatively short period of time requires a change in work organization. Schalk (1977) argues that this was particularly the case in northwest California, where temporal congruence of the salmon run and acorn harvest in autumn required organizing a large number of people into several task specific groups. According to Testart, those controlling production organization usually also control storage surpluses, leading to the unequal distribution of wealth and power within the community.

Native groups of northwest California developed socio-economic strategies not unlike those outlined by Testart (1982). Subsistence staples, in order of decreasing importance, were anadromous fish, acorns, and game, with fish and acorns being available only on a seasonal basis. Acorns were collected and stored at the permanent village in September or October. Salmon were caught, smoked, and stored after the first heavy rains. It is quite clear the most important factor governing survival was the amount of these foods stored for the winter.

> The most difficult time in the annual cycle of food production was winter. There were very few fish and almost no game animals or crops for gathering. From late November to early March people had to rely on food that had been stored the previous year... In February or March the spring salmon run began, and after that the danger of starvation was past (Baumhoff 1958:158).

Efficient technological systems were developed to harvest these critical resources during their brief, seasonal availability. Salmon were harvested with the use of elaborate weirs, dip nets, harpoons, spears, gill nets, and basketry traps, of which the most productive were weirs. Weir building began during the period of low water, usually in September, in places where the river was uniformally six feet deep and no greater than 80 yards across. Once captured, fish were cured as quickly as possible. The first step was to gut and split them in half. The halves were then dried in large smoke houses and put away for winter in large storage baskets or in pits dug into the floor of the house (Kroeber and Barrett 1960). Similarly, acorns from the tanbark oak had to be collected quickly after they dropped to the ground, lest they become infested with weevils or eaten by other animals such as deer. Acorns were stored, most frequently while in the shell, in large baskets that were set around the inside walls of the houses (Gould 1975; Kroeber 1925).

Village populations were highest throughout the winter and spring, depending on the carrying capacity of the stored food during winter and on the arrival of fresh fish, deer, elk, and greens in spring. From early summer onward, many residents would leave the villages and occupy temporary camps within the higher reaches of the mixed evergreen forest, where game and a wide variety of plants were procured and either consumed immediately or transported to the village for use soon thereafter. Finally in late summer/early fall, everyone returned to the village to prepare for the salmon and acorn harvest.

With efficient scheduling, procurement, and storage, each residential unit could produce enough food to last an entire year. As proposed by Testart (1982), individual households possessing superior pools of labor could generate substantial surpluses and other items of wealth, ultimately separating themselves from the less successful family units (Drucker 1937; Goddard 1903; Goldschmidt 1951; Gould 1966, 1975; Kroeber 1925; Pilling 1978; Waterman 1920).

Testart's (1982) theoretical perspective, when combined with the upland settlement pattern changes documented by Hildebrandt and Hayes (1983, 1984), argues for a relatively early origin of the ethnographic pattern outlined above (probably between 2000-3000 B.P.). Bennyhoff (1950) and Whistler (1979), in contrast, believe these adaptations did not develop in place, but were brought in by non-local groups possessing technological systems preadapted to the local resource base (see also Fredrickson 1984). The original inhabitants of the region were thought to be ancestral Karok (Hokan Stock), and hypothesized to have had an interior subsistence focus. At around 1100 B.P., the Wiyot arrived and occupied previously under-used coastal habitats. Soon thereafter, the Yurok settled along the lower Klamath and adjacent coastline, a process made possible by their superior technological abilities to fish, build boats, and store salmon. Marking the beginning of the Gunther Pattern, these arrivals are thought to be manifested archaeologically at a series of coastal sites containing *Dentalium* shells, bone and antler harpoon points, various woodworking tools (e.g., adzes, wedges, mauls), ceremonial obsidian bifaces, ground stone zoomorphs, as well as a variety of other artifact forms (Fredrickson 1984).

The final hypothetical wave of immigrants were speakers of Athapascan languages (Tolowa, Chilula, and Whilkut). Arriving about 700 B.P. and occupying areas peripheral to the Wiyot and Yurok, these groups possessed an acute knowledge of forest and riverine environments, and possibly an improved technological system that included the toggle harpoon and sinew-backed bow (Fredrickson 1984).

Because the archaeological aspects of the Whistler-Bennyhoff model rely almost entirely on a post-1500 B.P. record, and the Hildebrandt-Hayes scenario is restricted to data almost exclusively from the uplands, ultimate resolution of these contrasting perspectives obviously requires analysis of Mendocino Pattern materials from lowland settings. Although none have been thoroughly excavated in the immediate area, a handful of pertinent sites exist within the larger region. To the east, in the vicinity of Whiskeytown Dam, there are three sites (SHA-192, SHA-543, and SHA-177) originally thought to be late period occupations by Jenson (1977), Johnson (1976), and Johnson and Skjelstad (1972). Fortunately, recent obsidian hydration and radiocarbon work by Baker (1984) and Basgall and Hildebrandt (1989) clearly demonstrate an earlier period of habitation at all three. The deposits are characterized by dark midden soils, diversified assemblages, and substantial numbers of non-utilitarian objects. With the possible exception of SHA-177, where only a small-scale excavation occurred, mortars and pestles were common within each assemblage. In addition, and probably directly related to mortar and pestle technology, flotation samples from SHA-177 produced a macroplant assemblage dominated by acorns -- by weight, acorns were found at a rate 6.5 times greater than that of gray pine nuts.

Excavations in southwest Humboldt County by Levulett and Hildebrandt (in preparation) produced similar results. Located on the Mattole River, the McKee Flat site (HUM-405) produced a diverse assemblage of occupational debris including Willits and McKee series projectile points, bowl mortars and pestles, and a variety of rock features. This stratum, which is also represented by a dark midden, is radiometrically dated to between 1600-2600 B.P. A final example comes from Redwood Creek where Hayes (1985) identified HUM-452 as a potential Mendocino Pattern village. Although excavations at the site were limited to less than two cubic meters, a wide diversity of ground and flaked stone tools were recovered, including a single a bowl mortar.

While none of these sites provide direct evidence for the exploitation of salmon or the extensive use of storage facilities (the former due to unfavorable soil conditions and the latter probably due to problems of archaeological visibility), they do provide evidence for acorn use and some degree of occupational stability. Whether or not they actually represent the type of settlements originally hypothesized by Hildebrandt and Hayes (1983, 1984) remains an open question -- a question that will hopefully be answered by future excavations within riverine northwest California.

References

Baker, S.
1984 Archaeological Investigations in the Towerhouse District, Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area, Shasta County, California. MS on file at Redwood National Park, Arcata, California.

Barrett, J.G.
1966 Climate of Trinity County. USDA Soil Conservation Service, Redding, California.

Basgall, M.E., and W.R. Hildebrandt
1989 Prehistory of the Sacramento River Canyon, Shasta County, California. Center for Archaeology at Davis, Publication No. 9

Baumhoff, M.A.
1958 California Athabascan Groups. University of California Anthropological Records 16: 157-238.

Bennyhoff, J.A.
1950 Californian Fish Spears and Harpoons. University of California Anthropological Records 9(4): 295-337.

Bickel, P.McW.
1979 A Study of Cultural Resources in Redwood National Park. MS on file at Redwood National Park, Arcata, California.

Binford, L.
1980 Willow Smoke and Dogs Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. American Antiquity 45(1): 4-50.

Drucker, P.
1937 The Tolowa and Their Southwest Oregon Kin. University of California Publications in American Archaeology and Ethnology 36(4): 221-300.

Fredrickson, D.A.
1984 The North Coast Region. In: California Archaeology, M.J. Moratto, pp. 471-528. New York: Academic Press.

Goddard, P.E.
1903 Life and Culture of the Hupa. University of California Publications in American Archaeology and Ethnology 1(1): 1-88.

Goldschmidt, W.
1951 Ethics and the Structure of Society. American Anthropologist 53: 506-524.

Gould, R.A.
1966 Archaeology of the Point St. George Site and Tolowa Prehistory. University of California Publications in Anthropology 4.

1975 Ecology and Adaptive Response Among the Tolowa Indians of Northwestern California. Journal of California Anthropology 2(2): 148-170.

Hayes, J.F.
1985 An Analysis of Redwood National Park Artifacts. MS on file at Redwood National Park, Arcata, California.

Hayes, J.F., and W.R. Hildebrandt
1985 Archaeological Investigations on Pilot Ridge: Results of the 1984 Field Season. MS on file at Six Rivers National Forest, Eureka, California.

Hildebrandt, W.R., and J.F. Hayes

1983 Archaeological Investigations on Pilot Ridge, Six Rivers National Forest. MS on file at Six Rivers National Forest, Eureka, California.

1984 Archaeological Investigations on South Fork Mountain. MS on file at Six Rivers National Forest, Eureka, California.

Hildebrandt, W.R., and L.K. Swenson

1982 Prehistoric Archaeology. In: Cultural Resource Overview for the Mendocino National Forest and East Lake Planning Unit, BLM, California, H. McCarthy, W. Hildebrandt, and L. Swenson, eds., pp. 93-169. MS on file at the Bureau of Land Management, Ukiah, California.

1985 Environment and Prehistory. In: Ethnography and Prehistory of the North Coast Ranges, California, H. McCarthy, W. Hildebrandt, and L. Swenson, eds., pp.9-23, 93-169. Center for Archaeological Research at Davis, Publication No. 8: 5-68.

Jackson, T.L.

1976 An Archaeological Report of the Middle Eel Planning Unit Archaeological Survey. MS on file at the Mendocino National Forest, Willows, California.

Jenson, P.M.

1977 Test Excavations at CA-SHA-563 on East Fork Creek, Shasta County, California. MS on file at the Bureau of Land Management, Redding, California.

Johnson, K.L.

1976 Test Excavations at the Old Tower House Site (CA-SHA-192), Whiskeytown National Recreation Area, Shasta County, California. MS on file at the Department of Anthropology, California State University, Chico.

Johnson, K.L., and L.S. Skjelstad

1974 The Salvage Archaeology of Site 4-SHA-177, Whiskeytown Recreation Area, Shasta County, California. MS on file at the National Park Service, San Francisco.

King, T.F.

1973 Patton Hill Pasture: An Archaeological Investigation. MS on file at the Mendocino National Forest, Willows, California.

1974 Manos on the Mountain: Borax Lake Pattern High-Altitude Settlement and Subsistence in the North Coast Ranges of California. MS on file at the Northwest Information Center, Sonoma State University, Rohnert Park, California.

Kroeber, A.L.

1925 Handbook of the Indians of California. Washington: Bureau of American Ethnology, Bulletin No. 78.

Kroeber, A.L., and S.A. Barrett

1960 Fishing among the Indians of Northwestern California. University of California Anthropological Records 21(1): 1-210.

Pilling, A.R.

1978 Yurok. In: Handbook of North American Indians, Volume 8, California, R. F. Heizer, ed., pp. 137-154. Washington: Smithsonian Institution.

Schalk, R.

1977 The Structure of an Anadromous Fish Resource. In: For Theory Building in Archaeology, L. Binford, ed., pp. 207-249. New York: Academic Press.

Stewart, S., and D.A. Fredrickson

1979 A Cultural Resources Survey of the Round Valley Indian Reservation. MS on file at the Northwest Information Center, Sonoma State University, Rohnert Park, California.

Sundahl, E.

1988 Cox Bar (CA-TRI-1008): A Borax Lake Pattern Site On the Trinity River, Trinity County, California. MS on file at the Shasta County Archaeology Lab, Redding, California.

Tamez, S.
1978 An Archaeological Overview of the North Coast Range and Northwestern California. MS on file at the Northwest Information Center, Sonoma State University, Rohnert Park, California.

1981 An Archaeological Overview of the North Coast Range and Northwest California. M.A. thesis, San Francisco State University.

Testart, A.
1982 The Significance of Food Storage Among Hunter-Gatherers: Resident Patterns, Population Densities, and Social Inequalities. Current Anthropology 23(5): 523-530.

United States Department of Agriculture Weather Bureau
n.d. Climatological Data, California Section. USDA Weather Bureau.

Waterman, T.T.
1920 Yurok Geography. University of California Publications in American Archaeology and Ethnology 16(5): 177-314.

West, G.J.
1985 Holocene Vegetation and Climatic Changes in California's North Coast Ranges. In: Archaeological Investigations on Pilot Ridge: Results of the 1984 Field Season, J. F. Hayes and W. R. Hildebrandt, eds., pp. 8-29. MS on file at the Six Rivers National Forest, Eureka, California.

1987 Pollen Analysis of Sediments from Tule Lake: A Record of Holocene Vegetation/Climatic Changes in the Mendocino National Forest, California. Proceedings of the Symposium on Holocene Climate and Archaeology of the California Coast and Desert, San Diego.

Whistler, K.A.
1979 Linguistic Prehistory in the Northwest California Culture Area. In: A Study of Cultural Resources in Redwood National Park, P. Bickel, ed. MS on file at the National Parks Service, Denver.