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The Milling Stone Horizon Revisited: New Perspectives from Northern and Central California

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For nearly half a century, the Milling Stone Horizon has been recognized as an integral element of California culture history, but representative components have long been thought to be restricted to the southern portion of the state. Claims to the contrary by D. L. True and a few of his students for the presence of Milling Stone Horizon manifestations further north have not been fully embraced due to inadequate dating and poor component resolution. In this article, we reassess the previously scanty evidence for a Milling Stone Horizon presence in northern California, and review data from nine recently investigated sites that have yielded strong evidence for the Milling Stone Culture in Early-Middle Holocene contexts north of southern California.

THE distinctive Early Holocene artifact complex commonly referred to as the Milling Stone Horizon (or Culture) has long been associated with southern California. First identified by David Banks Rogers (1929) in the Santa Barbara Channel, the Milling Stone Horizon was formally defined by Wallace (1955:219) as a "culture marked by extensive use of milling stones and mullers, a general lack of well made projectile points, and burials with rock cairns." Although lacking associated dates, Wallace (1955) was confident that this culture postdated the Late Pleistocene but predated the elaborate and more prolific cultures of the Late Holocene. He further considered it a "basic cultural stratum" for southern California (Wallace 1955:221). This assessment was bolstered by radiocarbon results that began to accumulate in the late 1950s and 1960s, when the Milling Stone Horizon became the focus of debate over mobility and seasonality (Owen 1964, 1967; Owen et al. 1964; Warren 1967).

Subsequently, the Milling Stone Horizon has been considered relevant to issues of optimization and diet (Erlandson 1991; Sutton 1993), gender (Hollimon 1991; Jones 1992:22, 1995, 1996; McGuire and Hildebrandt 1994), mobility (Glassow 1991; Koerper et al. 1991), New World colonization (Cohen 1977; Erlandson 1994), and the value of coastal versus terrestrial resources (Jones 1991; Erlandson 1994), as part of processual and postprocessual research agendas. With some important exceptions (e.g., McGuire and Hildebrandt 1994), these recent considerations have kept with historical tradition and continued to focus on southern California, where the culture was first recognized and where it is most visible in the archaeological record.

Over the years, a number of researchers (e.g., Curtice 1961; Edwards 1968; Chartkoff 1969; True et al. 1979) has suggested that Milling Stone Horizon components were present further north, but these claims were never widely accepted. Wallace (1978) projected the Milling Stone Complex over the entire state, but provided no empirical evidence for its presence in northern California. In a more commonly accepted synthesis of northern California culture history, Fredrickson (1974) ascribed the Borax Lake Pattern, marked by distinctive broad-stemmed projectile points, to the Early Holocene. Greenwood (1972) reported

solid evidence for Milling Stone Horizon components at Diablo Canyon in San Luis Obispo County in 1972, but these findings from the south-central coast did not provoke major rethinking of the association of this complex with southern California.

Strong empirical evidence in the form of abundant tool inventories from well-dated contexts was not available north of Diablo Canyon until more recently. Moratto (1984) reported important findings from Scotts Valley (CA-SCR-177) (subsequently published by Cartier [1993]) but ascribed the site to the putative "Paleo-Coastal Tradition," an early coastal culture thought to predate the advent of milling tools. Generally, significant data on other manifestations of the Milling Stone Horizon north of Santa Barbara County surfaced only after the 1984 syntheses of California archaeology (Moratto 1984) and prehistory (Chartkoff and Chartkoff 1984). Several important synthetic discussions (Erlandson 1994; McGuire and Hildebrandt 1994) subsequently focused on the Milling Stone Horizon and employed data from central California, but other important findings have been relegated to gray literature and are not known to broad audiences.

The purpose of this article is to review the growing body of evidence for the presence of the Milling Stone Complex in central and northern California in Early Holocene contexts. At least nine well-dated Milling Stone Horizon components are now known for the area between the south central coast (San Luis Obispo County) and Clear Lake in the North Coast Ranges (Fig. 1, Table 1). The presence of these components mandates rethinking of traditional northern California culture histories that do not recognize Milling Stone Horizon manifestations. In reviewing these components, the intent herein is to refute Pierce's (1992) assertion that the Milling Stone Horizon is simply a product of postdepositional sorting caused by rodent activity. Pierce's challenge, while intellectually valuable, obfuscates one of the clearest, most important artifact patterns identified in the archaeological record of California; thus, it is important to confirm the Milling Stone Horizon as a legitimate Early Holocene cultural complex that was present throughout much of western California.

Included in this article is a review of the problems related to defining the Milling Stone Horizon in northern California and a discussion of the alternative perspectives on its chronology, the lifeways it apparently represents, and its spatial and temporal relationships to other Early Holocene archaeological patterns (e.g., Paleoindian, San Dieguito, Lake Mojave, and Paleo-Coastal). It is not our goal to resolve some of these more complex and contentious issues; rather, it is to establish a cultural historical basis for further discussions. The discussion begins with a brief definition of the Milling Stone Horizon and its traditional southern California manifestations, and then summarizes findings from nine central and northern California locations that have yielded strong evidence for Early Holocene Milling Stone Horizon components.

THE SOUTHERN CALIFORNIA MILLING STONE HORIZON

Although parallels between milling stone assemblages in areas of southern California were drawn as early as the 1940s (Heizer and Lemert 1947; Treganza and Malamud 1950), it was not until Wallace's (1955) synthesis that the Milling Stone Horizon received broad acceptance. A plethora of salvage excavations conducted during the period of post-war growth in southern California resulted in the recognition of generally similar milling tool deposits from Santa Barbara County to Baja California. These components show remarkable homogeneity in tool assemblages, with four major geographical subvariants that have subtle yet distinctive variations in chronology and assemblage composition: Oak Grove in the Santa Barbara Channel (Rogers 1929); the Topanga Complex in Ventura and Los Angeles counties (Treganza 1950); the La Jolla Complex

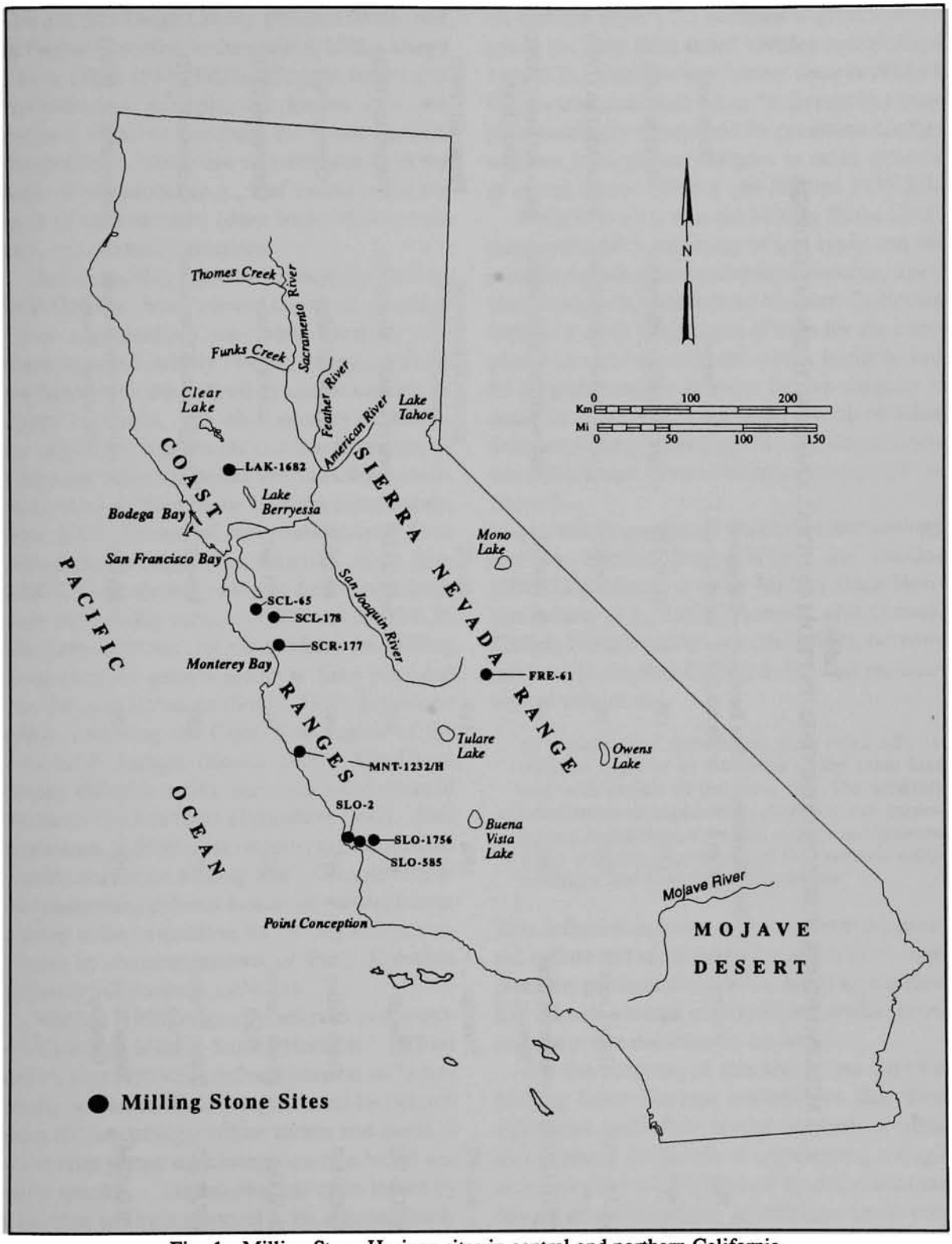

Fig. 1. Milling Stone Horizon sites in central and northern California.

Table 1
MILLING STONE HORIZON COMPONENTS FROM CENTRAL AND NORTHERN CALIFORNIA

Site	Name	Site Elevation (in m.)	Site Depth (in cm.)	Component Depth (in cm.)	Setting	Reference
CA-FRE-61	--	135	175	40/70-175	base of foothills, alluvial fan	McGuire (1994)
CA-LAK-1682	Crazy Creek	288	30	0-30	small interior valley floor	Rosenthal et al. (1995)
CA-MNT-1232/H	Interpretive Trail Stratum II	245	280	170-280	oak woodland, 1 km. inland	Jones and Haney (1992) Jones (1995)
CA-SCL-65	Saratoga	156	110	49-107	stream-cut terrace at base of foothills	Fitzgerald (1993)
CA-SCL-178	Metcalf	82	950	various-600	base of foothills, alluvial fan	Hildebrandt (1983)
CA-SCR-177	Scotts Valley	197	140	40-120	pericoastal valley	Cartier (1993)
CA-SLO-2	Diablo Canyon Site 1	12	340	230-340	coastal terrace	Greenwood (1972)
CA-SLO-585	Diablo Canyon Site 6	52	250	180-250	coastal bench, 370 m. inland	Greenwood (1972)
CA-SLO-1756	Salinas River Crossing	310	120	50-120	relic river terrace above flood plain of river	Fitzgerald et al. (1997)

in coastal San Diego County (Rogers 1945), and the Pauma Complex in the interior of San Diego County (True 1958, 1980). Cogged stones and discoidals, for example, are known from the southern sites but not from the Santa Barbara Channel area. There are also differences in the shape of handstones (e.g., loaf versus oval), the depth of milling slabs (deep basin versus shallow), and mortuary practices.

Such variability notwithstanding, the Milling Stone Horizon, when viewed en masse, seems to reflect a generalized subsistence strategy employed by small, widely ranging groups, who relied heavily on the collection and processing of vegetal resources. The often massive accumulation of grinding implements and low frequency of bifaces and projectile points are traits that consistently mark Milling Stone Horizon components. Since 1955, dozens of radiocarbon dates from such deposits suggest an antiquity of at least 8,000 B.P. for the beginning of the horizon, with many sites dating between 7,000 and 5,000 B.P. There are, however, locations where the Milling Stone Horizon pattern seems to have persisted into the Late Holocene (Sutton 1993; Erlandson 1994), including the Cajon Pass region of the Transverse Ranges (Kowta 1969), San Diego County (Warren 1964), and even some areas of the Santa Barbara coast (Erlandson 1997). This persistence highlights an ongoing problem in the classification of the Milling Stone Complex vis-à-vis standardized cultural historical nomenclature, causing some to question its validity and/or usefulness in characterizations of Early Holocene prehistory (Erlandson 1994:45).

Wallace (1955) originally referred to a southern California Milling Stone "Horizon." Willey and Phillips (1955:33) defined horizon as "a primarily spatial continuity represented by cultural traits and assemblages whose nature and mode of occurrence permit the assumption of a broad and rapid spread . . . archaeological units linked by a horizon are thus assumed to be approximately contemporaneous." They also commented that "a horizon style . . . occupies a great deal of space but very little time" (Willey and Phillips 1955:32). Horizon was further seen as distinct from a tradition, defined as "a (primarily) temporal continuity represented by persistent configurations in single technologies or other systems of related forms" (Willey and Phillips 1955:37).

While it is clear that the Milling Stone Complex represents a collection of tool types and assemblage traits that consistently co-occur, associated radiocarbon dates from southern California indicate a much longer span of time for the complex than can be associated with a horizon, and its long persistence in some locales suggests it could be considered a tradition. North of Santa Barbara County, however, Milling Stone Horizon components seem to be more temporally restricted.

In their discussion of California archaeology and the Archaic Stage, Willey and Phillips (1955:133) referred to Early Milling Stone Horizon *cultures* (e.g., Little Sycamore, Oak Grove). Earlier, Phillips and Willey (1953:617), borrowing from V. Gordon Childe, defined an archaeological culture as

> an assemblage of artifacts that recur repeatedly associated together in dwellings of the same kind and with burials of the same rite. The arbitrary peculiarities of implements, weapons, ornaments, houses, burial rites, and ritual objects are assumed to be concrete expressions of the common social traditions that bind together a people.

This definition assumes a linkage between material culture and social behavior that is fairly simplistic by processual standards, but it nonetheless has value as a means of classifying artifact types and traits that consistently co-occur.

For the purposes of this article, we envision Milling Stone Horizon assemblages that show significant uniformity across northern, central, and southern California as representing a single archaeological culture marked by dense accumulations of milling slabs, handstones, crude core and flake tools, low frequencies of projectile

points and bifaces, and cairn burials. The basic culture also shows some regional variations. We employ the term "Milling Stone Horizon," however, in reference to the historical definition used in southern California.

EARLY PERSPECTIVES FROM THE NORTH

True et al. (1979:124) pointed out that evidence for the Milling Stone Horizon in northern and central California was minuscule compared to the south. Although milling tools had been found throughout these regions, there were no well-dated assemblages north of San Luis Obispo County that showed the distinctive high frequency of handstones and milling slabs relative to bifaces. True et al. (1979:152) felt the apparent absence of the Milling Stone Horizon in the north was due to a historical bias toward the later, more sophisticated cultures of the Sacramento/San Joaquin Delta and San Francisco Bay, and that this bias was exacerbated by problems of visibility and preservation, which add to the difficulty in locating northern Milling Stone Horizon sites.

Despite a lack of hard evidence, there was speculation about the Milling Stone Horizon in northern California as early as the 1960s. Baumhoff and Olmstead (1963:280) suggested that the Early Horizon of the Sacramento Valley was "a highly evolved and specialized" variant of this pattern. Similarly, Whistler (1977, 1980) equated an undocumented Milling Stone Complex with Hokan speakers whom he suggested were present in central California ca. 7,000 B.P. King and Hickman (1973) proposed that Milling Stone Horizon peoples from the south coast may have established colonies as far north as the San Francisco Bay area. However, archaeological support for these theories was not immediately forthcoming. Possible Milling Stone Horizon components were reported by Curtice (1961) in Butte County, by Edwards (1968) at Thomes Creek in Tehama County, and by Chartkoff (1969) at Funks Creek in Colusa County, but none of these locations produced unambiguous, well-dated components comparable to those of southern California.

During the severe drought years of 1976-1977, True and his colleagues conducted surveys on the shores of man-made Lake Berryessa following exposed wave-cut terraces along its shores. A number of isolated tool scatters was recorded, consisting mostly of cobble tools, scrapers, and hammerstones, along with nine handstones and six milling slabs. Subsequent survey of a larger portion of the lake shore revealed more scattered concentrations of cobble tools and milling equipment. These aggregations were interpreted as resource collecting and processing areas adjacent to major camps (True et al. 1979; True and Baumhoff 1982, 1985). A general lack of bifacial tools and a preponderance of cobble tools, emphasizing scraping, chopping, and cutting, led to the conclusion that these sites represented a northern California manifestation of the Milling Stone Horizon (True et al. 1979). Dating the assemblages remained a significant problem, however, and these conclusions were not fully embraced by many northern California archaeologists.

EVIDENCE FROM NORTHERN AND CENTRAL CALIFORNIA

Over the last 25 years, a growing body of archaeological evidence has pointed to the presence of the Milling Stone Horizon in northern and central California during the Early and Middle Holocene. The first indisputable Milling Stone Horizon components north of Santa Barbara County were reported by Greenwood (1972) from Diablo Canyon (CA-SLO-2 and CA-SLO-585). No other clear examples were known from further north until 1983, when Hildebrandt (1983) attributed an Early Holocene milling tool assemblage at CA-SCL-178 to the Milling Stone Horizon.

Probably the most significant component north of Diablo Canyon is CA-SCL-65 (Fitzgerald

1993). As discussed below, this site yielded a classic Milling Stone Horizon assemblage, complete with burials marked by cairns of milling tools. Subsequently, Rosenthal et al. (1995) reported a well-dated Milling Stone Horizon component from CA-LAK-1682 in Lake County, marking the northernmost example of the culture. Collectively, there are now at least nine well-documented examples of the Milling Stone Complex known from central and northern California (Fig. 1, Table 2). Each of these components is discussed in detail below, in the order of their discovery and reporting.

CA-SLO-2

CA-SLO-2 is one of two sites from Diablo Canyon that produced Early Holocene radiocarbon dates and associated milling stone assemblage. Because it also yielded very old radiocarbon dates on marine shell, it has been widely recognized as a location of early marine resource exploitation, which has tended to overshadow its fairly substantial Milling Stone Horizon component. The site is an extremely large, complex shell midden located on a marine terrace at the mouth of Diablo Creek on the rocky coast of San Luis Obispo County (Fig. 1). At the time of its discovery in 1947, it was estimated to cover an area of about 320 x 400 yards (102,400 $m.^2$) (Greenwood 1972:5).

In 1968, Greenwood (1972) excavated 109 $m.^3$ from this deposit, exposing 54 burials. The midden was 340 cm. deep, multicomponent, culturally stratified, and partially mixed. Greenwood (1972:4) ascribed the Milling Stone Horizon component to the lowest site levels (230 to 340 cm.), although the distinctiveness of the component relative to other site materials is supported only modestly by the site data. Uncorrected radiocarbon dates of 8,960 $\pm$ 190 and 9,320 $\pm$ 140 B.P. (Greenwood 1972) were obtained from abalone shell and bone samples from the 290 and 320 to 330 cm. levels, respectively, but no chronometric data delineated the supposed Milling Stone Horizon/Hunting transition at 230 cm. (Table 3). However, Moratto (1984:107) argued that the earliest site levels mark a pre-Milling Stone Horizon (Paleo-Coastal) component, and indeed, no slabs or handstones were recovered from below 290 cm. (Table 4).

These conflicting interpretations are the result of stratigraphy that has been clearly impacted by a variety of mixing agents, especially small, burrowing animals. While it is clear that handstones were most abundant in the lower third of the deposit and Early Holocene radiocarbon dates were recovered from these same levels, the full Milling Stone Horizon assemblage is neither discrete nor well-defined. Pestles are significantly more abundant above 230 cm. (although not entirely absent below) and handstones increase below this depth. Other artifact types, however, show even more confusing distributional patterns (Greenwood 1972). For example, Contracting-stemmed points, which are generally restricted to the Early (3,500 to 600 B.C.) and Middle (600 B.C. to A.D. 1000) periods, were found as deep as 310 cm., while the only eccentric crescent recovered from the site was in the 30 to 40 cm. level. Curved shell fishhooks were found no deeper than 190 cm., which is consistent with their generally accepted Middle and Late period dating. Overall, some attributes of artifacts from the lower levels are consistent with Milling Stone Horizon assemblages, but the component suffered from vertical intrusion of materials from later site occupations (Greenwood 1972).

A detailed analysis of the fish remains from the site (Fitch 1972) showed that Milling Stone Horizon inhabitants fished, but they also apparently hunted sea mammals and deer. However, Greenwood (1972:50) felt there was little significant vertical or temporal variability in faunal remains other than increasing importance of fish through time. Fitch (1972:115) argued that during the Milling Stone Horizon occupation, people targeted species that could be found under exposed rocks at low tide and caught by hand, and

Table 2
MILLING STONE HORIZON ASSEMBLAGES FROM CENTRAL AND NORTHERN CALIFORNIA[a]

Site	Milling slabs	Hand-stones	Pestles	Mortars	Projectile points	Bifaces	Flake tools	Core tools	Scraper planes	Hammer-stones	Pitted stones	Bone awls	Other bone tools	Spire-lopped *Olivella* beads	*Olivella* Barrel beads	Bone bead/ pendant	Stone sphere	Bowl	Smoothing stones
CA-FRE-61	7	25	0	0	0	2	399	0	11	0	0	5	0	0	0	2	1	0	0
CA-LAK-1682	35	42	4	4	8	29	22	21	0	4	3	0	0	0	0	0	0	0	0
CA-MNT-1232/H Stratum II	2	5	0	0	2	2	3	0	0	2	0	0	2[b]	0	2	1	0	0	0
CA-SCL-65 Component I	3	6	0	0	1	2	7	1	1	2	0	0	0	0	0	1	0	0	0
CA-SCL-178	0	8	0	0	0	0	20	1	0	0	1	0	0	0	0	0	1	0	0
CA-SCR-177[c]	27	62	2	2	10	68	374	38	7	22	2	0	0	0	0	0	0	0	0
CA-SLO-2	0	9	1	2	12	40	79[d]	9	2	13	22	3	2	15	7	1	0	1	0
CA-SLO-585	28	14	0	0	1	16	40[d]	11	21	29	37	1	1[b]	14	0	0	0	1	0
CA-SLO-1756	5	21	0	0	6	5	39	0	6	1	0	0	0	0	0	0	0	0	0
Total	107	192	7	8	40	164	983	81	48	73	65	9	5	29	9	5	2	2	0

[a] See references in text.
[b] Antler tine artifacts listed include all site components.
[c] Artifact numbers listed include all site components.
[d] Identified as scrapers.

Table 3
RADIOCARBON DATES FROM NORTHERN AND CENTRAL CALIFORNIA MILLING STONE HORIZON COMPONENTS

Site Number	Site Name	Laboratory Number	Material	Provenience	Measured ^{14}C RCYBP[a]	$^{13}C/^{12}C$ Corrected RCYBP	Calibrated Date	Calibrated Year B.C. 2σ Range	Reference
CA-FRE-61	--	Beta-53456	human bone	N120/W30; 130-167 cm.	5,920 ± 220	6,000 ± 255	4,905 B.C. 4,872 B.C. 4,865 B.C.	5,440-4,340 B.C.	McGuire (1994)
CA-LAK-1682	Crazy Creek	Beta-70229	soil	Unit 1; 70-90 cm.	6,690 ± 70	not available	5,579 B.C.	5,600-5,520 B.C.	Rosenthal (1995)
CA-LAK-1682	Crazy Creek	Beta-71636	wood charcoal	Unit 3; 24-20 cm.	7,320 ± 270	not available	6,160 B.C. 6,140 B.C. 6,130 B.C. 6,080 B.C.	6,620-5,620 B.C.	Rosenthal (1995)
CA-MNT-1232/H	Interpretive Trail	Beta-43112	shell	Unit 3; 270-280 cm.	5,390 ± 80	5,790 ± 90	3,924 B.C.	4,090-3,690 B.C.	Jones (1995)
CA-MNT-1232/H	Interpretive Trail	Beta-43113	shell	Unit 3; 210-220 cm.	5,620 ± 80	6,060 ± 80	4,220 B.C.	4,360-4,990 B.C.	Jones (1995)
CA-MNT-1232/H	Interpretive Trail	Beta-43114	shell	Unit 4; 230-240 cm.	5,830 ± 80	6,250 ± 80	4,375 B.C.	4,570-4,230 B.C.	Jones (1995)
CA-SCL-65	Saratoga	WSU-3635	human bone	Burial 1, Unit 3; 19.5-30 in.	5,995 ± 150	6,075 ± 85	4,948 B.C.	5,420-5,360 B.C.	Fitzgerald (1993)
CA-SCL-65	Saratoga	WSU-3636	human bone	Burial 2, Unit 3; 37-41 in.	6,450 ± 160	6,530 ± 195	5,440 B.C.	5,730-5,060 B.C.	Fitzgerald (1993)
CA-SCL-178	Blood Alley	UCLA-2329B	charcoal	Unit 13; 330 cm.	8,400 ± 300	not available	7,480 B.C. 7,460 B.C. 7,440 B.C.	8,030-6,570 B.C.	Hildebrandt (1983)
CA-SCL-178	Blood Alley	UCLA-2329C	charcoal	Unit 13; 350 cm.	9,200 ± 1,000	not available	8,320 B.C. 8,190 B.C.	11,160-6,000 B.C.	Hildebrandt (1983)
CA-SCL-178	Blood Alley	UCLA-2329D	charcoal	Unit 13; 510 cm.	9,960 ± 500	not available	9,130 B.C. 9,100 B.C.	10,940-8,115 B.C.	Hildebrandt (1983)
CA-SCL-178	Blood Alley	UCR-12944	charcoal	Unit (70)4; 750 cm.	9,190 ± 600	not available	8,180 B.C. 8,170 B.C. 8,140 B.C. 8,100 B.C.	10,340-6,790 B.C.	Hildebrandt (1983)
CA-SCR-177 [b]	Scotts Valley	Beta-7713	charcoal	rock feature B26; 40-60 cm.	6,970 ± 150	not available	5,780 B.C.	6,113-5,528 B.C.	Cartier (1993)
CA-SCR-177	Scotts Valley	Beta-7714	charcoal	rock feature B29; 60-80 cm.	7,050 ± 110	not available	5,940 B.C. 5,911 B.C. 5,980 B.C.	6,114-5,673 B.C.	Cartier (1993)
CA-SLO-2	Diablo Canyon Site 1	GaK-2044	shell	N1/W5; 290 cm.	8,960 ± 190	9,370 ± 260	7,830 B.C.	8,380-7,150 B.C.	Greenwood (1972)
CA-SLO-2	Diablo Canyon Site 1	UCLA-1686A	human bone	S4/W9; 320-330 cm.	9,320 ± 140	9,400 ± 175	8,423 B.C.	9,020-8,040 B.C.	Greenwood (1972)
CA-SLO-585	Diablo Canyon Site 6	GaK-2040	shell	N12/W6; 200 cm.	8,410 ± 190	8,820 ± 260	7,200 B.C.	7,840-6,430 B.C.	Greenwood (1972)
CA-SLO-1756	Salinas River Crossing	BETA-90317	acorn husk	Feature 1 Unit 10; 93-100	2,780 ± 60	2,800 ± 60	925 B.C.	1,110-820 B.C.	Fitzgerald (1997)
CA-SLO-1756	Salinas River Crossing	BETA-91375	charcoal	Feature 1 Unit 10; 110-115	6,120 ± 60	6,100 ± 60	4,985 B.C.	5,215-4,855 B.C.	Fitzgerald (1997)

[a] RCYBP = radiocarbon years before present.

[b] Of the 37 radiometric dates generated from the Scotts Valley site, only the two listed above were clearly associated with a feature. The balance of the dates was obtained from charcoal derived from the site soils and was not directly associated with an archaeological feature.

Table 4
VERTICAL DISTRIBUTION OF ARTIFACTS FROM THE LOWER LEVELS OF CA-SLO-2[a]

Depth (in cm.)	Milling slabs	Hand-stones	Pestles	Mortars	Projectile points[b]	Knives/ bifaces	Scrapers/ flake tools	Choppers	Scraper planes	Hammer-stones	Pitted stones	Bone awls	Other bone tools	Class A *Olivella* beads	Class B *Olivella* beads	Bone beads	Pendants	Bowls	Drills
130-140	0	0	2	0	3	12	22	0	1	2	24	0	0	0	0	0	0	1	0
140-150	0	1	0	0	1	15	32	5	0	0	12	0	0	0	0	0	0	0	0
150-160	0	0	0	0	5	9	22	0	0	1	7	0	0	0	0	0	0	2	0
160-170	0	0	1	0	2	14	11	4	0	0	9	0	0	0	0	0	0	1	0
170-180	0	0	0	0	3	6	15	1	0	1	6	0	0	0	0	0	0	1	0
180-190	1	0	1	0	3	16	28	1	0	3	10	0	0	0	0	0	0	1	0
190-200	0	0	0	0	2	13	16	0	0	1	9	0	0	0	0	0	0	0	0
200-210	0	0	1	0	1	14	20	1	0	1	7	0	0	0	0	0	0	1	0
210-220	0	0	0	1	0	2	8	1	1	2	3	0	0	0	0	0	0	0	0
220-230	0	0	2	0	2	12	20	0	1	0	6	0	0	0	0	0	0	0	0
Subtotal	1	1	7	1	22	113	194	13	3	11	93	0	0	0	0	0	0	7	0
230-240	0	4	0	1	3	10	19	2	6	3	2	1	4	2	0	0	1	1	0
240-250	0	1	0	1	4	7	18	2	0	1	5	1	0	2	1	0	0	1	0
250-260	0	1	0	0	2	9	11	0	0	1	3	0	0	2	2	1	0	0	0
260-270	0	1	1	0	1	5	8	2	0	1	2	0	1	0	0	0	1	0	0
270-280	0	1	0	0	0	3	6	1	0	1	3	1	1	4	2	0	1	0	0
280-290	0	1	0	0	0	1	4	0	0	0	3	1	0	0	0	0	0	0	0
290-300	0	0	0	0	1	2	4	2	0	1	0	0	0	1	0	0	0	0	0
300-310	0	0	0	0	1	1	3	0	0	1	1	4	0	0	0	0	0	0	0
310-320	0	0	0	0	0	2	3	0	0	0	1	0	0	0	2	1	0	0	0
320-330	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0
330-340	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
Grand Total	1	10	8	3	34	153	273	22	9	20	115	8	6	11	8	2	3	9	0

[a] From Greenwood (1972).

[b] Projectile points by type: 12 Contracting-stemmed, 4 Square-stemmed, 6 narrow side-notched (130-230 cm); 3 Contracting-stemmed, 2 Square-stemmed, 7 wide side-notched (230-340 cm.).

that they also used some type of shore-based trap.

CA-SLO-585

CA-SLO-585 was the second site at Diablo Canyon to yield Early Holocene dates and typical Milling Stone Horizon tools (Greenwood 1972). The deposit is situated 370 m. inland on a small bench, where site loci 6A and 6B were identified on opposite sides of a small unnamed creek. The most meaningful information comes from Locus 6A on the east bank. A total of 39.4 $m.^3$ was excavated by hand from 11 units that reached a maximum depth of 210 cm. Backhoe excavation of an additional 30.0 $m.^3$ yielded artifacts from as deep as 250 cm. Vertical provenience for materials recovered by backhoe was limited to 0 to 130 and 130 to 250 cm. blocks. Uncorrected radiocarbon dates of 7,370 $\pm$ 150 and 7,520 $\pm$ 170 B.P. (Greenwood 1972) were obtained from red abalone (*Haliotis rufescens*) shells from the 160 to 170 and 120 to 130 cm. levels, respectively. A more recent date of 5,100 $\pm$ 110 B.P. (Greenwood 1972) was obtained from 160 cm., which led Greenwood (1972:4) to ascribe only levels below 180 cm. to the Milling Stone Horizon. Clearly, however, the vertical distribution of radiocarbon dates reflects vertical disturbance.

The cultural deposit was situated in an ancient alluvial fan on an uplifted marine terrace. The uppermost soil stratum was a typical black "A" horizon, but below 180 cm., the project geologist identified unusual brown strata with coarse-grained debris that appeared to represent catastrophic, cloudburst-induced debris flows (Greenwood 1972:56). As with CA-SLO-2, stratigraphy and component definition are clearly problematic. Controlled excavation data are available only for the levels between 180 and 220 cm., although backhoe trenching extended to 250 cm.

Slabs and handstones were more numerous at the base of this deposit than they were at CA-SLO-2, and no mortars or pestles were found below 150 cm. However, slabs and handstones were also abundant in the upper site levels, although pestles outnumbered handstones by a ratio of 8:3 in the more recent levels (0 to 90 cm.) (Table 5). In the Milling Stone Horizon component itself, slabs (n = 5) and handstones (n = 14) outnumbered points (n = 1) and bifaces (n = 7) by a ratio of 2.4:1, which is consistent with the general Milling Stone Horizon pattern (see Basgall and True 1985). The component also included flake and core tools, hammerstones, pitted stones, spire-lopped *Olivella* beads, two bone tools, and a grooved stone net weight. The latter is more common among Middle and/or Late Holocene assemblages and may reflect intercomponent mixing. In general, however, the CA-SLO-585 assemblage is more consistent with the Milling Stone Horizon pattern than CA-SLO-2, probably as a product of better stratigraphic integrity.

CA-SCL-178

The Metcalf site (CA-SCL-178) was excavated by E. G. Stickle for the California Department of Transportation in anticipation of the rerouting of Highway 101 in southern Santa Clara County. Between 1979 and 1981, and the results were subsequently reported by Stickle (1981) and Hildebrandt (1983). The site is located at the base of the Diablo Range on a small alluvial fan about 82 m. above sea level. This location overlooks an extinct freshwater marsh system designated *Laguna Seca* by Spanish explorers. It is situated 35 km. south of the historical shoreline of San Francisco Bay and 32 km. inland from Monterey Bay.

Stickle (1981) estimated the total size of the site to be 69,476 $m.^3$ and its depth to be 9.5 m., but few cultural materials were recovered below 6 m. (Hildebrandt 1983). A total of 169.3 m^3 of deposit was excavated by Stickle, from which four components (I through IV), spanning most of the Holocene, were isolated. The field strategy emphasized stratified random sampling, which

Table 5
VERTICAL DISTRIBUTION OF ARTIFACTS FROM THE LOWER LEVELS OF CA-SLO-585[a]

Depth (in cm.)	Milling slabs	Hand-stones	Pestles	Mortars	Projectile points[b]	Knives/ bifaces	Scrapers/ flake tools	Choppers	Scraper planes	Hammer-stones	Pitted stones	Bone awls	Other bone tools	Class A *Olivella* beads	Class B *Olivella* beads	Bone pendants	Bowls	Drills
0-90	0	3	8	0	5	57	296	20	0	21	103	6	0	9	3	0	9	7
90-100	0	1	0	0	3	12	40	5	0	2	33	0	0	6	0	0	2	0
100-110	0	4	1	0	6	12	51	6	0	1	23	1	0	3	0	1	3	0
110-120	2	6	0	0	4	16	41	1	0	4	15	0	0	0	0	0	1	1
120-130	0	1	0	0	3	4	23	0	0	2	6	1	0	1	3	0	1	1
130-140	2	6	0	0	0	9	9	0	0	6	10	1	0	3	0	0	0	0
140-150	2	11	0	1	1	5	22	1	0	5	12	1	1	7	2	0	2	0
150-160	2	2	0	0	1	2	9	0	0	3	2	0	0	4	0	0	0	0
160-170	0	2	0	0	1	4	8	0	0	6	0	0	0	3	1	0	2	0
170-180	0	0	0	0	1	1	13	1	0	5	1	0	0	2	0	0	0	0
Subtotal	8	36	9	1	25	122	512	34	0	55	205	10	1	38	9	1	20	9
180-190	1	4	0	0	1	3	6	1	0	5	3	0	0	6	0	0	2	0
190-200	3	4	0	0	0	3	7	0	0	4	3	1	0	6	0	0	0	0
200-210	1	5	0	0	0	0	1	1	0	0	0	0	0	2	0	0	0	0
210-220	0	1	0	0	0	1	2	0	1	0	0	0	0	0	0	0	0	0
230-250	23	0	0	0	0	9	24	9	21	20	31	0	0	0	0	0	1	0
Subtotal	28	14	0	0	1	16	40	11	22	29	37	1	0	14	0	0	3	0
Grand Total	36	64	9	1	26	138	552	45	22	84	242	11	1	52	9	1	23	9

[a] From Greenwood (1972).

[b] Projectile points by type: 13 wide side-notched, 3 narrow side-notched, 2 large triangular, 7 large leaf-shaped (0-180 cm.); 1 narrow side-notched, 1 large triangular (180-250 cm.).

did not allow the investigators to focus efforts on portions of the deposit that yielded the most promising and/or informative materials. This statistical approach proved to be ill-suited for data recovery at this site due to the depth of the deposit and the prohibitive logistical and monetary costs associated with deep excavation. As a consequence, the Milling Stone Horizon component was never thoroughly explored or delineated.

The depth and complexity of the deposit at CA-SCL-178 is due largely to its location in an alluvial fan. The Milling Stone Horizon component was buried under several meters of alluvium. Sediments containing the milling tools were found to have migrated and redeposited laterally, making any direct correlation of cultural horizons with discrete soil strata impossible (Haltenhoff 1983). This problem was exacerbated by the use of random sampling and the lack of broad exposures (e.g., trenches) which might have better revealed the structure of the site.

Owing to the complex geomorphology, Hildebrandt (1983) chose to lump all the cultural materials found beneath one clearly defined soil stratum (IVA3b) into Component I. A total of 69 $m.^3$ of sediments represented Component I, from which eight handstones, six cores, 16 utilized flakes, a chopper, a notched and grooved stone, and a bone awl fragment were recovered. Despite poor bone preservation, 130 faunal elements were identified (excluding bones of small, burrowing animals). The assemblage was dominated by cottontail/brush rabbits (NISP = 53; 41.5%), jackrabbits (NISP = 31; 23.8%), mule deer (NISP = 14; 10.8%), and bony fish (NISP = 11; 8.5%). Mussel, clam, and *Olivella* shell were also identified in Component I, suggesting that a wide range of animal resources was utilized by the earliest site inhabitants, and that forays were made to the coast.

This modest collection of artifacts and faunal remains produced four dates from small charcoal samples taken from levels that also produced debitage, bone, and shell. These samples produced uncorrected dates ranging from 9,960 ± 500 B.P. to 8,400 ± 300 B.P. (Hildebrandt 1983) (Table 3). Three samples from Unit 13 were in correct stratigraphic order, while a fourth (which yielded a date of 9,190 ± 600 B.P.) came from a depth of 750 cm. in Unit 704 (Hildebrandt 1983). Unfortunately, there is ample reason to question the association of the dates with the artifacts, so establishing a precise age for the Milling Stone Horizon component at CA-SCL-178 is not possible. Regrettably, a hearth feature discovered in Component I at a depth of 4.6 m., containing ample charcoal, burned bone and shell, fire-cracked rock, ash, "burned earth," and two handstones, was never dated (Fitzgerald 1983).

Problematic absolute dating aside, the frequency of milling slabs and handstones relative to mortars and pestles by component strongly supports a Milling Stone Horizon affiliation for Component I. The absence of mortars and pestles in Component I contrasts with three handstones, one milling slab, eight mortars, and eight pestles recovered from Components II through IV. A similar disparity is evident among the ratio of projectile points between Component I and the rest of the site (0:7). The low frequency of points, absence of mortars and pestles, and overall dominance of handstones in Component I are consistent with the established definition of the Milling Stone Complex.

CA-SCR-177

CA-SCR-177 is located in Scotts Valley, 6.4 km. north of Monterey Bay on the northwest edge of a small, inland valley, about 200 m. above sea level. Archaeological investigations began there in 1980 and continued off and on through 1987 (Cartier 1980, 1992, 1993). This site was the focus of a series of test excavations, followed by two major data recovery excavations in 1983 and 1987. Initial testing in 1980 revealed a large, multicomponent deposit (Cartier

1980). Although the exact volume excavated from the site remains uncalculated (over 200 $m.^3$ were hand-excavated during the 1983 excavation alone), seven years of investigation yielded over 14,000 artifacts (Cartier 1993). This large assemblage included a single eccentric crescent of the type widely identified with Early Holocene archaeological complexes (e.g., San Dieguito, Lake Mojave), and a poorly defined Paleo-Coastal Tradition component (Moratto 1984).

The soils at CA-SCR-177 were characterized as a complex series of highly acidic and sandy loams divided into six horizons (Cartier 1993). The deepest horizons included fragipans, a series of alternating stratigraphic bands representing episodic saturation of soils with groundwater. These unusual features lent an appearance of stratification to the deposit, but these apparent layers actually were of postdepositional origin and provide little assistance in defining the cultural stratigraphy (Erlandson 1994). The six soil horizons were remarkably homogeneous and demonstrated no correlation with the culture history of the site.

In the final report on CA-SCR-177 (Cartier 1993), the site assemblage was divided into three cultural patterns and five phases. Classification was aided by 37 radiocarbon dates obtained from wood charcoal, which suggested an occupational sequence dating back as early as 13,500 B.P. and persisting until approximately 300 years ago. Twenty-eight of these radiocarbon determinations were pre-5,000 B.P. However, the accuracy of the radiocarbon chronology from Scotts Valley is clouded by questions about the cultural origins of the charcoal samples used for dating and potential problems with "old wood" (Jones 1993:19).

Despite these problems, it is evident from the large assemblage of ground stone and cobble core tools that the site is dominated by a component marking the Milling Stone Horizon. The assemblage included 62 handstones, 27 milling slabs, 22 hammerstones, two anvils (i.e., pitted stones), four abraders, and two pestles.[1] Also recovered were numerous choppers, as well as pecked and battered cobbles. This assemblage demonstrates remarkable typological cohesiveness and, in contrast with the radiocarbon record, shows no evidence of Middle or Late Holocene occupation; for example, none of the stemmed projectile points that commonly dominate Middle and Late Holocene tool inventories (often in prolific numbers) were recovered. It should be emphasized, however, that overall dating and component definition are lacking at CA-SCR-177, and a Milling Stone Horizon component cannot be adequately defined with the site data; thus, the absolute chronology of the site is suspect (Cartier 1993).

The most provocative evidence for a Milling Stone Horizon component at Scotts Valley was found during the 1987 excavation when "a small rock cluster comprised of pieces of three milling stone (metates) was discovered . . . charcoal secured from the matrix surrounding this feature produced a radiocarbon date of 10,650 $\pm$ 180 years B.P." (Cartier 1993:220). Taken at face value, these artifacts represent one of the earliest Milling Stone Horizon manifestations in North America. However, as Cartier and others have noted, the association between the radiocarbon date and the small cairn of slabs is questionable because the charcoal that yielded the early date was gathered from sediments 20 cm. beneath the slabs. It has also been suggested that the milling slabs, one of which was found resting on edge (end up) may have been placed in a pit that was intrusive to the earlier stratum (Fitzgerald 1993: 99). On the other hand, the deliberate construction of this small cairn could indicate a grave marker for a burial that subsequently decomposed. Soil acidity was so high at the Scotts Valley site that no organic materials were preserved.

CA-SCL-65

CA-SCL-65 was excavated as a salvage project in the spring of 1973 by a group of volun-

teers directed by Chester King and Linda King. The site is situated at an elevation of 156 m. in rolling hills on the northwestern margin of Santa Clara Valley (Fig. 1). The deposit sits on a low alluvial terrace adjacent to Saratoga Creek, a large perennial stream that drains the eastern flank of the Santa Cruz Mountains. Working on weekends, the volunteer group excavated 20 3 x 5 ft. (0.9 x 1.5 m.) units and a 2 x 50 ft. (0.6 x 15.2 m.) trench, for a total recovery volume of 26 $m.^3$ Unfortunately, the site was graded after the second weekend of work, but several members of the crew were present during the grading and they managed to collect 678 artifacts (29% of the total site assemblage). Following cataloguing, all of the field records, photographs, and artifacts were curated at West Valley Junior College, where they and the site were forgotten for over a decade. Following transfer of the artifacts to San Jose State University, the collection was analyzed by Fitzgerald (1993).

The site materials included 406 complete and fragmentary ground stone specimens and 1,754 flaked stone artifacts. Three temporal components were identified based on obsidian hydration analysis, radiocarbon dates, and temporally diagnostic artifacts. The oldest component, marking the Saratoga Creek Phase, was defined by two burials and a few obsidian hydration readings. Both burials were marked by cairns of complete and fragmentary milling tools (Fitzgerald 1993).

The top of the cairn over Burial 1 was 19.5 in. (49 cm.) below the surface. The cairn included two handstones, two shaped milling slabs, one unshaped milling slab, a battered cobble, a core, and a number of burned fragments of ground stone. A light stain of red ocher was found on the grinding surface of one slab as an apparent grave offering. Bone collagen from Burial 1 yielded a date of 5,995 $\pm$ 150 B.P. (Fitzgerald 1993). Burial 2 was found below Burial 1, in the south sidewall of the same unit (Unit 3) at a depth of 37 in. (94 cm.). This burial was also marked by a cairn, with a milling slab over the cranium. Bone collagen from Burial 2 yielded a date of 6,450 $\pm$ 160 B.P. (Fitzgerald 1993).

Two other burials were also marked by cairns. Burial 3, located in the northern half of Unit 3, had "metates and rocks" covering it. Burial 4, also marked by a rock cairn, was found 75 ft. (22.9 m.) away from the others. Its cairn included milling tools and a mortar and pestle, the latter suggesting later interment than Burials 1 and 2. Obsidian hydration results from debitage and bifaces (not directly associated with the burials) support a Middle Holocene occupation, with a cluster between 5.0 and 7.2 microns on Napa obsidian (Fitzgerald 1993).

The importance of these burials is twofold. First, they predate the previously known oldest human remains from the San Francisco Bay Area by more than one thousand years. Second, and more important, is their association with cairns of milling tools, a trait long associated with the Milling Stone Horizon in southern California (Rogers 1929; Walker 1951; Peck 1955; Kaldenberg 1982).

CA-FRE-61

CA-FRE-61 was formally recorded by the University of California Archaeological Survey in 1939, but was not subjected to controlled subsurface investigation until 1992, when McGuire completed a National Register evaluation in anticipation of proposed improvements to an adjacent highway. The site is an extensive complex of bedrock milling features, rock art, and surface artifacts dominated by ground stone. It covers an area of 56,520 $m.^2$ A total of 38.7 $m.^3$ was excavated during the testing project, yielding over 347 formed artifacts and 6,078 pieces of debitage. Two major spatiotemporal units were defined: a horizontally restricted, stratigraphically inferior, Middle Holocene component marked primarily by handstones and milling slabs, dating between 6,000 and 2,500 B.P., and a more shallow Late Holocene deposit postdating

2,500 B.P., indicated by bedrock mortars, pestles, and a more extensive flaked stone assemblage (McGuire 1995:115-119).

Vertical integrity of the lower Milling Stone Horizon component is better than at Diablo Canyon, although CA-FRE-61 also shows complex horizontal variability. A single uncorrected radiocarbon date of 5,920 ± 220 B.P. (McGuire 1995:115) from the base of the deposit (130 to 167 cm.) on a sample of human bone chronologically anchors the earlier component, whereas dates of 2,880 ± 60 and 2,360 ± 60 B.P. (McGuire 1995: 115) from above the 100 cm. level define the more recent occupation. Obsidian hydration results, which include a major cluster between 4.0 and 10.0 microns on Casa Diablo obsidian, suggest the possibility of an Early Holocene occupation, but the significance of these readings in absolute time is debatable.

The relative frequency of artifacts marking the lower site levels (ca. 60 to 167 cm.) is consistent with the dearth of bifaces in southern California Milling Stone Horizon assemblages (McGuire 1995:121). Aside from flaked tools (n = 39), the most abundant artifacts were handstones (n = 25), hammerstones (n = 11), core tools (n = 9), and milling slabs (n = 7). Only two bifaces are clearly associated with the basal component. McGuire (1995) suggested that the hammerstones may reflect manufacture and/or resharpening of milling tools, supporting interpretations offered by King (1967:41) and Erlandson (1994:84).

Faunal analysis revealed a high frequency of small mammal remains in the Milling Stone Horizon levels, giving way to a dominance of larger game in the Late Holocene component. McGuire and Hildebrandt (1994) argued that the heavy exploitation of small animals reflects an effective adaptation in which trapping and gathering were emphasized over the hunting of large animals.

CA-MNT-1232/H Stratum II

Excavated by a University of California, Davis, field school in 1990, CA-MNT-1232/H was first reported by Jones and Haney (1992) and subsequently discussed by Jones (1993, 1995, 1996) and Jones and Waugh (1995, 1997). The site is 1.1 km. from the Big Sur shoreline in southern Monterey County, and is a relatively small (3,756 $m.^2$) shell midden situated on a small bench along the Landels Hill Big Creek Reserve Interpretive Trail at an elevation of 245 m. (Jones 1995).

Excavation revealed an unexpectedly deep deposit (280 cm.) with two discrete layers. Stratum I was a homogeneous, very dark grayish-brown (10YR 3/2), loamy shell midden that extended from the surface to 170 cm. Three radiocarbon dates indicate that this layer contained partially mixed evidence of multiple occupations postdating 5,300 B.P. Beneath it was Stratum II, a distinct, light brownish-gray (10 YR 6/2) midden with a heavy calcium carbonate precipitate. Four radiocarbon assays dated Stratum II from 6,400 to 5,300 B P., with the most recent date marking the Stratum I/II interface. Superposition of the dates indicates that Stratum II marks a discrete temporal component (Jones 1995).

A total of 5.4 $m.^3$ of deposit was recovered from Stratum II, including 2.6 $m.^3$ processed through three mm. mesh, and 0.0035 $m.^3$ processed through 1.5 mm. mesh. The assemblage recovered from Stratum II included two complete *Olivella* Barrel (B3) beads (see Bennyhoff and Hughes 1987), a single complete lanceolate projectile point, a nondiagnostic projectile tip fragment, three cores, two bifaces, three edge-modified flakes, 19 pieces of chert debitage, five handstones, two milling slabs, two hammerstones, two antler tines, and a bone pendant fragment. Obsidian was absent (Jones 1995).

The Stratum II faunal assemblage was highlighted by a dense concentration of mollusc shells. Column samples showed a heavy dominance of California mussel (*Mytilus californianus*) (97.3%), with minor frequencies of barnacle (*Balanus* sp.) (1.7%), and purple sea urchin (*Strongylocentrotus purpuratus*) (0.5%), which

were present in such low quantities that they were probably collected as riders on the mussel shells. Mean shell size was relatively large, indicating that site inhabitants used a "plucking" type of collection strategy (see Jones 1996). Vertebrate remains included 40 identified specimens, dominated by black-tailed deer (*Odocoileus hemionus*) (NISP = 27; 75.0%), harbor seal (*Phoca vitulina*) (NISP = 3; 8.3%), and gray fox (*Urocyon cineroargenteus*) (NISP = 3; 8.3%) (Jones 1995).

The fish assemblage (N = 77) was dominated by cabezon (*Scorpaenichthys marmoratus*) (NISP = 33; 42.8%), rockfish (*Sebastes* sp.) (NISP = 17; 22.0%), and lingcod (*Ophiodon elongatus*) (NISP = 8; 10.3%). Conversion of the Stratum II faunal remains into meat indices suggested a generalized diet, dominated slightly by terrestrial game (32.6%), marine mammals (30.5%), shellfish (26.3%), and fish (10.6%). Two pieces of human bone were also recovered from Stratum II, one of which showed an isotopic profile consistent with a terrestrially focused, herbivorous diet (Jones 1996), according to criteria established by Krueger (1985).

CA-SLO-1756

CA-SLO-1756, the Salinas River Crossing site, was excavated in 1995 during construction of the Coastal Branch Aqueduct, the final segment of the California State Water Project. The site was discovered during monitoring of a segment of pipeline that traverses the Salinas River in northeastern San Luis Obispo County, approximately 300 m. above sea level (Fitzgerald 1997). It is situated on the south bank of the river on a small, gently sloping terrace, approximately seven m. above the current river channel. The terrace is a fossil landform that lies just above a 4,000-year-old floodplain (Parsons 1997). The site covers approximately 672 $m.^2$

Cultural materials were present between 30 to 35 cm. below the surface in a nearly homogenous soil horizon containing little organic matter and a low concentration of artifacts, dominated by ground stone, cores, and fire-cracked rock. No shellfish or vertebrate faunal remains were recovered, other than intrusive rodent bones, presumably due to poor preservation. Excavation of 28.8 $m.^3$ produced one shaped and four unshaped milling slabs, eight shaped and 14 unshaped handstones, four hammerstones, three smoothing stones, a bi-pitted stone, five projectile points, four bifaces, a knife, a cobble chopper, 24 cores, 600 pieces of debitage, and three flake tools.

Chronological data were obtained from radiocarbon assays and temporally diagnostic artifacts. The paucity of organic matter in the deposit made procurement of adequate material for radiocarbon analysis difficult, but samples were available from a hearth feature of burned cobbles, charcoal flecks, and fire-altered soil between 70 and 110 cm. below the surface. Beneath the cobbles was a very thin, but distinctive, layer of charcoal. Three soil samples were collected from the feature. From the upper level, a fraction of burned acorn husk was submitted for Accelerator Mass Spectrometry (AMS) dating. This sample returned a calibrated date of 2,800 B.P. which does not conform with the artifact assemblage from the site, and probably reflects intrusion of a natural botanical specimen into the cultural deposit. A second AMS date derived from the charcoal lens beneath the cobbles of the hearth returned a calibrated date of 6,935 B.P., which is much more compatible with the site assemblage, since regional data suggest that by 5,500 B.P., the shift from handstones and milling slabs to the mortar and pestle had been initiated, coeval with the appearance of this technology in the Santa Barbara Channel (Greenwood 1972; Jones 1995; Jones and Waugh 1995; Glassow 1996).

The absence of mortars and pestles supports a pre-5,500 B.P. date, as does the projectile point collection, which produced five examples of a single type, large side-notched. On the central coast,

sites postdating 5,500 B.P. commonly produce prolific samples of stemmed points (e.g., CA-SLO-175; Jones and Waugh 1995), but these were absent from CA-SLO-1756. However, side-notched types have consistently been found to predate stemmed types (Carter 1941; Greenwood 1972; Pierce 1979). The more recent radiocarbon date is probably a product of rodent disturbance, which was apparent in the upper portion of the feature.

CA-SLO-1756 conforms well with the typical Milling Stone Horizon pattern of superior numbers of large grinding implements relative to bifaces and projectile points. Handstones were present in the deposit in a frequency of 0.7 per $m.^3$, whereas the frequency of projectile points was 0.17 per $m.^3$ Comparison of all battered and ground stone tools relative to chipped stone tools shows the same pattern: 1.26 per $m.^3$ versus 0.37 per $m.^3$ The ratio of handstones to projectile points is 4.4:1. Perhaps the most significant aspect of the Salinas River Crossing site is its inland location, since the majority of Milling Stone Horizon sites in the Santa Barbara Channel are in the littoral zone, as are the other two well-documented sites in San Luis Obispo County (CA-SLO-2 and CA-SLO-585). In contrast, the Salinas River Crossing site is situated nearly 30 km. from the coast, supporting the premise that Milling Stone Horizon peoples were highly mobile.

CA-LAK-1682

The Crazy Creek site (CA-LAK-1682) is the northernmost manifestation of the Milling Stone Horizon yet documented. The site was discovered by Roscoe and White (1991) during survey for a proposed wastewater treatment facility, and its milling stone assemblage was revealed through subsequent testing (White and Roscoe 1992) and data recovery (Rosenthal et al. 1995). It is situated on the floor of Coyote Valley at an elevation of 288 m., 20 km. southeast of Clear Lake. Cultural materials occur within a very shallow (20 to 40 cm.) natural matrix that overlies alluvial gravel.

The recovered assemblage is dominated by 42 handstones, 35 milling slabs/slab fragments, 29 bifaces, 22 flake tools, and 21 core tools—a classic Milling Stone Horizon representation. Projectile points were limited to four large, leaf-shaped specimens, one fragment classified as a Borax Lake Wide-stemmed, and three nondiagnostic fragments. Chronometric data include two radiocarbon dates, one at 6,690 $\pm$ 70 B.P. from soil humates, and the other at 7,320 $\pm$ 270 B.P. from a feature of burned rock and ground stone artifacts. These were supplemented with 70 obsidian hydration readings on Napa ($n = 44$), Mt. Konocti ($n = 17$), and Borax Lake ($n = 9$) obsidian. The hydration readings range from 1.3 to 7.5 microns, although the Napa results cluster between 3.6 and 6.1 microns (Rosenthal et al. 1995).

This wide range suggests a long occupation and the presence of multiple components, but the cohesiveness of the artifact assemblage and the radiocarbon dates suggest that the hydration readings do not accurately reflect the occupational history of the site. This is a common problem, in that many of what are otherwise cohesive Early or Middle Holocene components with good radiocarbon records yield hydration results that are inconsistent with the rest of the dating evidence (e.g., Cartier 1992; Jones and Haney 1992; Erlandson 1994). At CA-LAK-1682 and many other sites, such results probably reflect the imprecision of obsidian hydration and its potential to obscure or confuse otherwise coherent site dating. While CA-LAK-1682 may have been witness to limited use later in time, the site assemblage appears to represent a single component dating ca. 7,450 to 8,050 B.P.

SUMMARY AND DISCUSSION

In the nearly 20 years since True et al. (1979) proposed that the Milling Stone Horizon was present in northern California, empirical evidence has gradually accumulated in support of their position. Four sites were known by 1984,

when Moratto (1984) published his synthesis of California culture history, but the affiliation of those components with a broader central and northern California manifestation of the Milling Stone Horizon has only become clear in the face of more recent excavation results, particularly from Saratoga (CA-SCL-65) and Crazy Creek (CA-LAK-1682). The former demonstrated the presence of Milling Stone Horizon burial traits (i.e., interment beneath cairns composed partially of milling tools) in north-central California, while the latter demonstrated the existence of an Early Holocene Milling Stone Horizon component in the North Coast Ranges.

The assemblages from these nine sites show strong internal similarity, as well as typological continuity, with the southern California Milling Stone Horizon; all produced accumulations of handstones and milling slabs, high frequencies of core and flake tools, and low yields of bifaces and/or projectile points—a pattern that is typical of the Milling Stone Horizon. Aside from flake tools, handstones were the most abundant artifact at nearly all of the northern and central California sites, with CA-SLO-2 representing the only exception. Ratios of handstones to projectile points range from 25:0 at CA-FRE-61 to 2.5:1 at CA-MNT-1232/H.

From all nine sites combined, only 40 projectile points were reported, including 10 from CA-SCR-177, where component resolution was poor. Two point types dominate: large lanceolate or leaf-shaped types that were best represented at CA-MNT-1232/H and CA-LAK-1682, and large side-notched types from CA-SLO-2, -585, and -1756. One highly fragmentary Borax Lake Wide-stemmed specimen was recovered from CA-LAK-1682, but it was outnumbered by large lanceolate examples. A few Contracting- and Square-stemmed points were found in the Milling Stone Horizon levels at Diablo Canyon (Tables 4 and 5), but they were heavily outnumbered by the side-notched points, and were probably intrusive.

The exclusive occurrence of side-notched points at the Salinas River Crossing site (CA-SLO-1756) suggests fairly strongly that this type is part of the Milling Stone Horizon expression in San Luis Obispo County. Lanceolate or large leaf-shaped types, on the other hand, are consistent with Rogers' (1929) original description of the Oak Grove milling stone variant in the Santa Barbara Channel, and our inclusion of the side-notched among the Milling Stone Horizon inventory is likely to stir concern and/or doubt among some culture historians. Side-notched types are commonly thought to date no earlier than the Middle Holocene, especially in the Santa Barbara Channel. Nevertheless, the San Luis Obispo County examples add to a growing body of data that suggests greater antiquity than previously suspected for this type.

True and Beemer (1982:251) assigned large side-notched points as the only formal point type representing the Pauma Complex or early Milling Stone Horizon in San Diego County. Similar examples are increasingly associated with the Early Holocene in the southern California desert (Basgall et al. 1995) and the Great Basin (Hanes 1977). It should be reiterated that projectile points are a very minor constituent of Milling Stone Horizon assemblages throughout southern, central, and northern California, so that the typological variation, while deserving further study, should not be construed as a significant sign of noncohesiveness in the cultural assemblage. The presence of contemporaneous lanceolate and side-notched point expressions may also be a function of the antiquity and durability of the Milling Stone Complex, as different regional variants evolved from an earlier, uniform precursor.

Dating the Milling Stone Horizon in central and northern California is a separate issue. Radiocarbon dates (corrected and calibrated) from the central and northern sites are fairly consistent, ranging between ca. 6,000 and 9,000 B.P. In this regard, the Saratoga and Crazy Creek sites are again important, as the former links a

Milling Stone Horizon assemblage and cairn burials with dates around 6,000 to 6,500 years B.P., while the latter produced an exceptionally coherent assemblage with reasonably secure dating at about 8,000 B.P. Dating associations at the Scotts Valley, Metcalf, and Diablo Canyon sites are more problematic, although general stratigraphic distributions at Diablo Canyon support Early Holocene dating. The cohesive assemblage at Salinas River (CA-SLO-1756) is fairly securely dated to ca. 7,000 B.P.

The upper end of the Milling Stone Horizon is evident in central and northern California by the dating of well-established, non-Milling Stone Horizon complexes such as Windmiller in the Sacramento Valley (beginning ca. 5,000 B.P.) and the Rossi Phase on the central coast (5,500 B.P). The earliest antiquity for the Milling Stone Horizon in central and northern California is more difficult to determine. The Crazy Creek site establishes a minimal time depth of 8,000 B.P., but claims for antiquity around 9,000 to 10,000 B.P. from the Diablo Canyon, Metcalf, and Scotts Valley sites are all compromised by stratigraphic problems and poor dating associations (Erlandson 1994). Of these, the Scotts Valley site is least valuable, as artifacts from that location cannot be reliably assigned to components. While the Milling Stone Horizon may prove to have antiquity in the range of 9,000 to 10,000 B.P., data currently available from some of the older mixed, multicomponent sites remain problematic.

Pierce (1992:204) contended that the Milling Stone Horizon is not a legitimate cultural historical complex, but that the characteristic concentrations of milling tools, core tools, and hammerstones often found at the base of such deposits are the product of postdepositional downward sorting of larger artifacts. He argued that these concentrations, often found in stone lines or zones (see Johnson 1989), are most common on hilltops or terraces with little natural deposition, where postdepositional sorting is most likely to have had a strong impact on vertical distribution of artifacts. Pierce's ideas help explain the dense, basal concentrations found at many of the central and northern California Milling Stone Horizon sites, all of which show evidence of rodent activity. However, his theories fail to explain the composition of these concentrations, the typological consistency in assemblages from a variety of settings and deposits, or features.

In central and northern California, the Milling Stone Horizon has been recognized at both shallow, single-component sites (e.g., CA-LAK-1682) and deeply stratified sites (CA-SLO-2, CA-SLO-585, and CA-SCL-177). While stratigraphy was impacted by rodent activity at the deeper sites, the distribution of radiocarbon dates and marker artifacts shows that patterns of time/depth were not completely compromised at these locations. Furthermore, the low frequency of projectile points relative to handstones at a site like CA-LAK-1682 cannot be attributed to sorting processes, as the deposit was thoroughly sampled from top to bottom and large numbers of points were not recovered. The situation was the same at the Salinas River Crossing site, where a discrete single component yielded only a few points, despite hand excavation above and below an apparent zone of milling tool concentration. Moreover, only a single type was represented by the five points at the Salinas River Crossing site. Extensive temporal mixing would be expected to result in greater typological variation.

While the Milling Stone Horizon indeed represents a cohesive pattern in Early Holocene contexts, its existence north of southern California raises broader cultural historical questions. In California, the Paleoindian culture, while well-documented elsewhere, is enigmatic. Fluted points and the remains of extinct megafauna from Tulare Lake suggest some presence in the state, perhaps between 12,000 and 10,000 B.P., but no unequivocal, well-dated Paleoindian Period components have yet been unearthed. Uncertainty

over this culture aside, there are at least four other complexes that might prove to represent the Terminal Pleistocene/Early Holocene in California: the Paleo-Coastal Tradition, the San Dieguito/Lake Mojave Pattern, the Milling Stone Horizon, and the Borax Lake Pattern.

In contrast to the Milling Stone Horizon, the so-called Paleo-Coastal Tradition and San Dieguito/Lake Mojave Pattern are thought to be characterized by low densities or the absence of milling equipment. Both are also suspected of representing initial human colonization inasmuch as they represent the oldest known archaeological expressions in specific regions. The Paleo-Coastal Tradition, originally defined by Davis et al.(1969) and subsequently adopted by Moratto (1984:104) and others, includes CA-SLO-2 and CA-SLO-585 as two of only three sites thought to mark the tradition.

Based on his interpretation of the lowest levels at CA-SLO-2, Moratto (1984) suggested that the Paleo-Coastal Tradition was a pre- or non-Milling Stone Horizon culture distinct from the Paleoindian Period, marked largely by accumulations of shell remains. However, the stratigraphy at CA-SLO-2 is problematic, and the absence of milling equipment from the lowest levels of the site is far from compelling. Because small shell fragments are readily mixed into sterile substrata, the deepest levels in coastal middens commonly yield little besides shell, regardless of their antiquity. A shellfish collecting culture lacking milling tools will need to be substantiated with a well-sampled, well-dated, single-component deposit where concerns about site formation dynamics can be put aside. In general, data supporting the Paleo-Coastal Tradition as distinct from and predating the Milling Stone Horizon are weak and contribute to a lack of clarity over the nature of pre-9,000 B.P. assemblages in California.

The Lake Mojave/San Dieguito Pattern in the southern deserts is more securely defined as distinct from the Milling Stone Horizon, at least in the interior deserts. In these locales, Lake Mojave sites are marked by long-stemmed points and eccentric crescents and do not contain concentrations of milling tools typical of the Milling Stone Complex. On the coast in San Diego County, there is long-standing debate over the relationship between the San Dieguito Pattern and the Milling Stone Horizon, with some researchers (e.g., Bull 1987) suggesting that milling tools were a constituent of the former.

While this may eventually prove to be true, it is equally clear that some Early Holocene sites in central and southern California with long-stemmed points and/or eccentric crescents do not include milling stones, particularly the dense accumulations that typify the Milling Stone Horizon. Many of these are associated with lakes or estuaries, including the Buena Vista Lake site (Fredrickson and Grossman 1977), CA-MNT-229 on Elkhorn Slough in Monterey Bay (Jones and Jones 1992), and the Duncans Landing Site (CA-SON-348/H) in Sonoma County (Schwaderer 1992). Contrary to traditional cultural historical schema and based on radiocarbon findings, these sites do not predate the Milling Stone Horizon in either its southern or northern California manifestations. Rather, the two complexes (Milling Stone and Lake Mojave/San Dieguito) seem to be largely contemporaneous. Co-existence may reflect different historical migration trajectories and/or functional or ethnic distinctions.

In northwestern California, Fredrickson's (1974) widely accepted cultural historical synthesis ascribed the Borax Lake Pattern to the Early Holocene, based largely on findings from CA-LAK-36 (the Borax Lake site) near Clear Lake. The Borax Lake Pattern assemblage includes milling stones, but its diagnostic markers are broad-stemmed Borax Lake projectile points. This pattern was subsequently documented more completely at Pilot Ridge in northernmost California (Hildebrandt and Hayes 1983), but its full areal distribution and actual chronology are far

from established. Hildebrandt and Hayes (1983) dated Pilot Ridge at no earlier than 6,000 B.P.

Because of poor preservation and serious problems with site visibility (see True et al. 1979), cultural assemblages marking the Early Holocene in the North Coast Ranges are very unclear. However, the findings from Crazy Creek and Lake Berryessa, and the absence of significant numbers of Borax Lake stemmed points from Sonoma County southward, suggest that the Milling Stone Horizon extended at least as far north as Clear Lake in contexts dating to approximately 8,000 to 6,000 B.P., and probably was present throughout all of western California.

In general, poor preservation and less extensive inventory work are likely to blame for the late identification of Milling Stone Horizon components in northern California. From San Francisco Bay northward, the Early Holocene has long been unknown due to highly acidic soils, mountainous terrain, and dense forest vegetation. Annual rainfall is also much higher in the north than in the south, and alluvial deposition is so much greater that sites are buried more quickly and at more prohibitive depths. Sites such as CA-SCR-239 in the Santa Cruz Mountains produce materials only 5,000 years old beneath two to three meters of sterile alluvium (Cartier 1992). Sites in the Sacramento Valley likewise show antiquity of only 3,000 to 4,000 years three to five meters below the valley floor.

On the coast, where preservation is usually improved, so much land has been lost to sea level rise in northern California that few Early and Middle Holocene sites now exist. As data have slowly accumulated over the last 20 years, it has become increasingly apparent that the hypothesis advanced by True et al. (1979) that the Milling Stone Horizon was not restricted to southern California is being validated, and local and regional cultural historical schema for areas north of Santa Barbara County not incorporating a Milling Stone Horizon presence during the Early Holocene should be reconsidered.

NOTE

1. One mortar fragment was found at the site, although Cartier (1993) suggested that it may also be a deep basin milling slab.

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REFERENCES

Basgall, Mark E., and Delbert L. True
1985 Archaeological Investigations in Crowder Canyon, 1973-1984: Excavations at Sites SBr-713, SBr-421B, SBr-421C, and SBr-421D. Report on file at the Cultural Studies Office, California Department of Transportation, Sacramento.

Basgall, Mark E., Michael Delacorte, and Matthew Hall
1995 Fish Slough Side-notched Projectile Points: An Early Holocene Time Marker in the Western Great Basin. Current Research in the Pleistocene 12:1-4.

Baumhoff, Martin A., and David L. Olmsted
1963 Phalaihnihan: Radiocarbon Support for Glottochronology. American Anthropologist 65(2):278-284.

Bennyhoff, James A., and Richard E. Hughes
1987 Shell Bead and Ornament Exchange Networks Between California and the Western Great Basin. American Museum of Natural History Anthropological Papers 64(2).

Bull, Charles
1987 A New Proposal: Some Suggestions for San Diego Prehistory. In: San Dieguito-La Jolla: Chronology and Controversy, Dennis Gallegos, ed., pp. 35-42. San Diego County Archaeological Society Research Paper No. 1.

Carter, George F.
1941 Archaeological Notes on a Midden at Point Sal. American Antiquity 6(3):214-226.

Cartier, Robert
1980 Presentation of Descriptive and Scientific

Data for CA-SCR-33 and CA-SCR-177. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

1992 Data Recovery Report of the Borland Property on Santa's Village Road in the City of Scotts Valley, County of Santa Cruz. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Cartier, Robert (ed.)
1993 The Scotts Valley Site, CA-SCR-177. Santa Cruz: The Santa Cruz Archaeological Society.

Chartkoff, Joseph L.
1969 Archaeological Resources of the West Sacramento Canal Unit. Report on file at the National Park Service, Washington D.C.

Chartkoff, Joseph L., and Kerry Kona Chartkoff
1984 The Archaeology of California. Palo Alto: Stanford University Press.

Cohen, Mark N.
1977 The Food Crisis in Prehistory. New Haven: Yale University Press.

Curtice, Clifford G.
1961 Cultural and Physical Evidence of Prehistoric Peoples of Sacramento County. Master's thesis, California State University, Sacramento.

Davis, Emma Lou, Clark W. Brott, and David L. Weide
1969 The Western Lithic Co-Tradition. San Diego Museum Papers 6.

Edwards, Robert L.
1968 A Descriptive Report on the Salvage Archaeology of Three Sites on Thomes Creek, Tehama County. Report on file at the Department of Anthropology, University of California, Davis.

Erlandson, Jon M.
1991 Shellfish and Seeds as Optimal Resources: Early Holocene Subsistence on the Santa Barbara Coast. In: Hunter-Gatherers of Early Holocene Coastal California, Jon M. Erlandson and Roger H. Colten, eds., pp. 89-100. University of California, Los Angeles, Institute of Archaeology, Perspectives in California Archaeology, Vol. 1.

1994 Early Holocene Hunter-Gatherers of the California Coast. New York: Plenum Press.

1997 The Middle Holocene on the Western Santa Barbara Coast. In: The Archaeology of the California Coast During the Middle Holocene, Jon M. Erlandson and Michael A. Glassow, eds., pp. 91-109. University of California, Los Angeles, Institute of Archaeology, Perspectives on California Archaeology, Vol. 4.

Fitch, John
1972 Fish Remains, Primarily Otoliths. In: 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California, Roberta S. Greenwood, ed., pp. 101-120. San Luis Obispo County Archaeological Society Occasional Papers 7.

Fitzgerald, Richard T.
1983 Feature Analysis Results. In: Archaeological Research for the Southern Santa Clara Valley Project, William R. Hildebrandt, ed., pp. 8-115–8-125. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

1993 Archaic Milling Cultures of the Southern San Francisco Bay Region. Salinas: Coyote Press Archives of California Prehistory, No. 35.

1997 Archaeological Data Recovery at the Salinas River Crossing Site, CA-SLO-1756, San Luis Obispo County, California. Report on file at the Central Coast Information Center of the Historical Resources Information System, University of California, Santa Barbara.

Fredrickson, David A.
1974 Cultural Diversity in Early Central California: A View from the North Coast Ranges. The Journal of California Anthropology 1(1):41–53.

Fredrickson, David A., and Joel W. Grossman
1977 A San Dieguito Component at Buena Vista Lake, California. The Journal of California Anthropology 4(2):173-190.

Glassow, Michael A.
1991 Early Holocene Adaptations on Vandenberg Air Force Base, Santa Barbara County. In: Hunter-Gatherers of Early Holocene Coastal California, Jon M. Erlandson and Roger H. Colten, eds., pp. 113-124. University of California, Los Angeles, Institute of Archaeology, Perspectives in California Archaeology, Vol. 1.

1996 Purismeño Chumash Prehistory: Maritime Adaptations Along the Southern California Coast. Fort Worth: Harcourt Brace.

Greenwood, Roberta S. (ed.)
1972 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California. San Luis Obispo County Archaeological Society Occasional Papers 7.

Haltenhoff, Rick
1983 Geomorphological Results. In: Archaeological Research for the Southern Santa Clara Valley Project, William R. Hildebrandt, ed., pp. 8-10–8-42. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Hanes, Richard C.
1977 Lithic Tools of the Dirty Shame Rockshelter: Typology and Distribution. Tebiwa 6:1-24.

Heizer, Robert F., and Edwin M. Lemert
1947 Observations on Archaeological Sites in Topanga Canyon, California. University of California Publications in American Archaeology and Ethnology 44(2):237-258.

Hildebrandt, William R. (ed.)
1983 Archaeological Research for the Southern Santa Clara Valley Project. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Hildebrandt, William R., and John F. Hayes
1983 Archaeological Investigations at Pilot Ridge, Six Rivers National Forest Project. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Hollimon, Sandra E.
1991 Division of Labor and Gender Roles in Santa Barbara Channel Area Prehistory. Ph.D. dissertation, University of California, Santa Barbara.

Johnson, Donald L.
1989 Subsurface Stone Lines, Stone Zones, Artifact-Manuport Layers, and Biomantles Produced by Bioturbation Via Pocket Gophers (*Thomomys Bottae*). American Antiquity 54(2):370-389.

Jones, Terry L.
1991 Marine-Resource Value and the Priority of Coastal Settlement: A California Perspective. American Antiquity 56(3):419-443.

1992 Settlement Trends Along the California Coast. In: Essays on the Prehistory of Maritime California, Terry L. Jones, ed., pp. 1-38. Davis: Center for Archaeological Research at Davis, Publication No. 10.

1993 Big Sur: A Keystone in Central California Culture History. Pacific Coast Archaeological Society Quarterly 29(1):1-77.

1995 Transitions in Prehistoric Diet, Mobility, Exchange, and Social Organization Along California's Big Sur Coast. Ph.D. dissertation, University of California, Davis.

1996 Mortars, Pestles, and Division of Labor in Prehistoric California: A View from Big Sur. American Antiquity 61(2):243-264.

Jones, Terry L., and Jefferson W. Haney
1992 Excavation and Conservation of Six Archaeological Sites at Landels-Hill Big Creek Reserve, Monterey County, California. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Jones, Terry L., and Deborah A. Jones
1992 Elkhorn Slough Revisited: Reassessing the Chronology of CA-MNT-229. Journal of California and Great Basin Anthropology 14(2):159-179.

Jones, Terry L., and Georgie Waugh
1995 Central California Coastal Prehistory: A View from Little Pico Creek. University of California, Los Angeles, Institute of Archaeology, Perspectives in California Archaeology, Vol. 3.

1997 Climatic Consequences or Population Pragmatism?: A Middle Holocene Prehistory of the Central Coast. In: Archaeology of the California Coast During the Middle Holocene, Jon M. Erlandson and Michael A. Glassow, eds., pp. 111-128. University of California, Los Angeles, Institute of Archaeology, Perspectives in California Archaeology, Vol. 4.

Kaldenberg, Russell L.
1982 Rancho Park North: A San Dieguito-La Jolla Shellfish Processing Site in Coastal Southern California. El Centro: Imperial Valley College Museum Society Occasional Papers No. 6.

King, Chester D.
1967 The Sweetwater Mesa Site (LAn-267) and its Place in Southern California Prehistory. Los Angeles: University of California Archaeological Survey Annual Report, 1966-1967:25-76.

King, Thomas F., and Patricia Hickman
1973 The Southern Santa Clara Valley: A General Plan for Archaeology, San Felipe Division, Central Valley Project, Part 1. Report on file at the Department of the Interior, San Francisco.

Koerper, Henry C., Paul E. Langenwalter II, and Adella Schroth
1991 Early Holocene Adaptations and the Transition Phase Problem: Evidence from the Allan O. Kelly Site, Agua Hedionda Lagoon. In: Hunter-Gatherers of Early Holocene Coastal California, Jon M. Erlandson and Roger H. Colten, eds., pp. 43-62. University of California, Los Angeles, Institute of Archaeology, Perspectives in California Archaeology, Vol. 1.

Kowta, Makoto
1969 The Sayles Complex: A Late Milling Stone Assemblage from Cajon Pass and the Ecological Implications of its Scraper Planes. Berkeley: University of California Publications in Anthropology No. 6.

Krueger, Harold W.
1985 Models of Carbon and Nitrogen Isotopes in Bone. Paper presented at the Biomineralization Conference, Airlie House, Warrenton, Virginia.

McGuire, Kelly R.
1995 Test Excavations at CA-FRE-61, Fresno County, California. California State University, Bakersfield, Museum of Anthropology, Occasional Papers in Anthropology No. 5.

McGuire, Kelly R., and William R. Hildebrandt
1994 The Possibilities of Women and Men: Gender and the California Milling Stone Horizon. Journal of California and Great Basin Anthropology 16(1):41-59.

Moratto, Michael J.
1984 California Archaeology. Orlando: Academic Press.

Owen, Roger C.
1964 Early Milling Stone Horizon (Oak Grove), Santa Barbara County, California: Radiocarbon Dates. American Antiquity 30(2): 210-213.
1967 Assertions, Assumptions, and Early Horizon (Oak Grove) Settlement Patterns in Southern California: A Rejoinder. American Antiquity 32(2):236-240.

Owen, Roger C., Freddie Curtis, and Donald S. Miller
1964 The Glenn Annie Canyon Site (SBa-142), An Early Horizon Coastal Site of Santa Barbara County. Los Angeles: University of California Archaeological Survey Annual Report, 1963-1964:429-517.

Parsons, Jeff A.
1997 Description of Earth Deposits and Archaeological Unit Wall Profiles at the Salinas River Crossing Site, San Luis Obispo County. In: Archaeological Data Recovery at the Salinas River Crossing Site, CA-SLO-1756, San Luis Obispo County, California, by Richard T. Fitzgerald, Appendix B. Report on file at the Central Coast Information Center of the Historical Resources Information System, University of California, Santa Barbara.

Peck, Stuart L.
1955 An Archaeological Report on the Excavation of a Prehistoric Site at Zuma Creek, Los Angeles County, California. Los Angeles: Archaeological Survey Association of Southern California Paper 2.

Phillips, Phillip, and Gordon R. Willey
1953 Method and Theory in American Archaeology: An Operational Basis for Culture-Historical Integration. American Anthropologist 55(5):615-633.

Pierce, Ann M.
1979 Archaeological Investigations at SLO-177 and Vicinity, Cambria, California. Master's thesis, Stanford University.

Pierce, Christopher
1992 Effects of Pocket Gopher Burrowing on Archaeological Deposits: A Simulation Approach. Geoarchaeology 7(3):185-208.

Rogers, David B.
1929 Prehistoric Man of the Santa Barbara Coast. Santa Barbara: Santa Barbara Museum of Natural History.

Rogers, Malcolm J.
1945 An Outline of Yuman Prehistory. Southwestern Journal of Anthropology 1(2): 167-198.

Roscoe, James M., and Greg White
1991 Cultural Resources Assessment of Sites 1, 6, 7, 7A, 7B, 8, 8A, and 9, Hidden Valley

Lake Wastewater Treatment System, Lake County, California. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Rosenthal, Jeffrey S., Jack Meyer, and Greg White
1995 Archaeological Investigations at the Crazy Creek Site, CA-LAK-1682 and CA-LAK-1683, Lake County, California. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

Stickle, E. Gary
1981 Archaeological Research of the Southern Santa Clara Valley Project. Draft report on file at the California Department of Transportation, San Francisco.

Schwaderer, Rae
1992 Archaeological Test Excavation at the Duncans Point Cave, CA-SON-348/H. In: Essays on the Prehistory of Maritime California, Terry L. Jones, ed., pp. 55-71. Davis: Center for Archaeological Research at Davis, Publication No. 10.

Sutton, Mark Q.
1993 On the Subsistence Ecology of the "Late Inland Millingstone Horizon" in Southern California. Journal of California and Great Basin Anthropology 15(1):134-140.

Treganza, Adan E.
1950 The Topanga Culture and Southern California Prehistory. Ph.D. dissertation, University of California, Berkeley.

Treganza, Adan E., and Consuelo G. Malamud
1950 The Topanga Culture, First Season's Excavation of the Tank Site, 1948. University of California Anthropological Records 12: 129-170.

True, Delbert L.
1958 An Early Gathering Complex in San Diego, California. American Antiquity 23(3): 255-263.

1980 The Pauma Complex in Northern San Diego County. Journal of New World Archaeology 3(4):1-39.

True, Delbert L., and Martin A. Baumhoff
1982 Archaeological Investigations at Lake Berryessa, California. Report on file at the U.S. Bureau of Reclamation, Sacramento.

1985 Archaeological Investigations at Lake Berryessa, California: Berryessa II. Journal of California and Great Basin Anthropology 7(1):21-45.

True, Delbert L., and Eleanor Beemer
1982 Two Milling Stone Inventories from Northern San Diego County, California. Journal of California and Great Basin Anthropology 4(2):233-261.

True, Delbert L., Martin A. Baumhoff, and Joan E. Hellen
1979 Milling Stone Cultures in Northern California: Berryessa I. Journal of California and Great Basin Anthropology 1(1):124-154.

Wallace, William J.
1955 A Suggested Chronology for Southern California Coastal Archaeology. Southwestern Journal of Anthropology 11(3): 214-230.

1978 Post-Pleistocene Archeology, 9000 to 2000 B.C. In: Handbook of North American Indians, Vol. 8, California, Robert F. Heizer, ed., pp. 25-36. Washington: Smithsonian Institution.

Walker, Edwin
1951 Five Prehistoric Archaeological Sites in Los Angeles, California. Los Angeles: Frederick Webb Hodge Anniversary Publications Fund No. 6, Southwest Museum.

Warren, Claude N.
1964 Cultural Change and Continuity on the San Diego Coast. Ph.D. dissertation, University of California, Los Angeles.

1967 The Southern California Milling Stone Horizon: Some Comments. American Antiquity 32(2):233-236.

Whistler, Kenneth W.
1977 Wintun Prehistory: An Interpretation Based on Linguistic Reconstructions of Plant and Animal Nomenclature. Proceedings of the third annual meeting of the Berkeley Linguistics Society.

1980 Pomo Prehistory: A Case for Archaeological Linguistics. Report on file at the Northwest Information Center of the Historical Resources Information System, Sonoma State University, Rohnert Park.

White, Greg, and James M. Roscoe
1992 Results of Test Excavations at Crazy Creek Falls (CA-LAK-1682) and Serpentine Camp (CA-LAK-1683), Crazy Creek Valley, Near Hidden Valley, Lake County, California. Report on file at the Northwest Information Center of the Historical Re-

sources Information System, Sonoma State University, Rohnert Park.

Willey, Gordon, and Phillip Phillips
1955 Method and Theory in American Archaeology II: Historical-Developmental Interpretation. American Anthropologist 57(4): 723-819.