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### A Terminal Middle Period Site Near Purisima Point, Western Santa Barbara County, California

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*Two radiocarbon dates from CA-SBA-699, a site located near Purisima Point on Vandenberg Air Force Base, indicate that it was occupied for a short interval of time around A.D. 1150. Analysis of a column sample taken from a seacliff exposure of midden deposits revealed that the population occupying this site depended mainly on black turban (*Tegula funebris*) and California mussel (*Mytilus californianus*) for food resources, the former being dietarily more important than the latter. The dominance of black turban appears to reflect unique characteristics of the nearby shellfish communities rather than especially intensive shellfish collecting. Red abalone shells in the midden are reminiscent of Middle Holocene sites on the Channel Islands, where they appear to be indicative of cooler-than-present water temperatures. Their presence at CA-SBA-699, however, may be due to distinctive environmental conditions at Purisima Point. Although the site was occupied at the beginning of an environmentally stressful time known as the Middle-to-Late Period transition, no obvious evidence of subsistence stress is reflected in the faunal remains from the site.*

**LOCATED** 1.1 km. south of Purisima Point along the northern coast of Vandenberg Air Force Base (Fig. 1), CA-SBA-699 has two distinctive characteristics that stimulated the research reported herein. First, about 90% of the site deposits are covered with approximately four m. of dune sand, suggesting relative antiquity for the site. At another loca-

tion along the coastline of Vandenberg Air Force Base (VAFB), a thick mantle of dune sand covers site deposits of Middle Holocene age (Glassow 1996:64-65). Second, noticeable quantities of red abalone (*Haliotis rufescens*) shells are visible in profiles of midden deposits along the eroding edge of the seacliff. This occurrence is anomalous in that abalone shells present in VAFB middens typically are of black abalone (*H. cracherodii*). The occurrence of red abalone shells in the deposits at CA-SBA-699 is reminiscent of sites on the Channel Islands and farther north along the coast of San Luis Obispo and Monterey counties (Glassow 1993), which date between about 2,900 and 4,200 B.C.

Based on these site characteristics, a series of research questions was proposed. First, is the site as old as the dune overburden and presence of red abalone shells suggest? If so, at least one site in the VAFB region may be linked with sites containing red abalone middens on the Channel Islands, suggesting that distributions of intertidal abalone species shifted in response to lower-than-present water temperatures that occurred for a period during the Middle Holocene (Glassow et al. 1994). Second, even if the site is not as old as these characteristics imply, why was red abalone apparently available in significant quantities to the occupants of CA-SBA-699 and not to the occupants of other sites along the VAFB coast; in other words, what is unique about the intertidal and nearshore environments adjacent to the site that were favorable to red abalone? Third, what kinds of activities, aside from shellfish collecting, did the occupants of CA-SBA-699 undertake, and how did this site relate to others in a settlement system? With these questions in mind, on April 9, 1994, one of us (MAG), assisted by students from the University of California, Santa Barbara (UCSB), and members of the Lompoc Branch of the Santa Barbara County Ar-

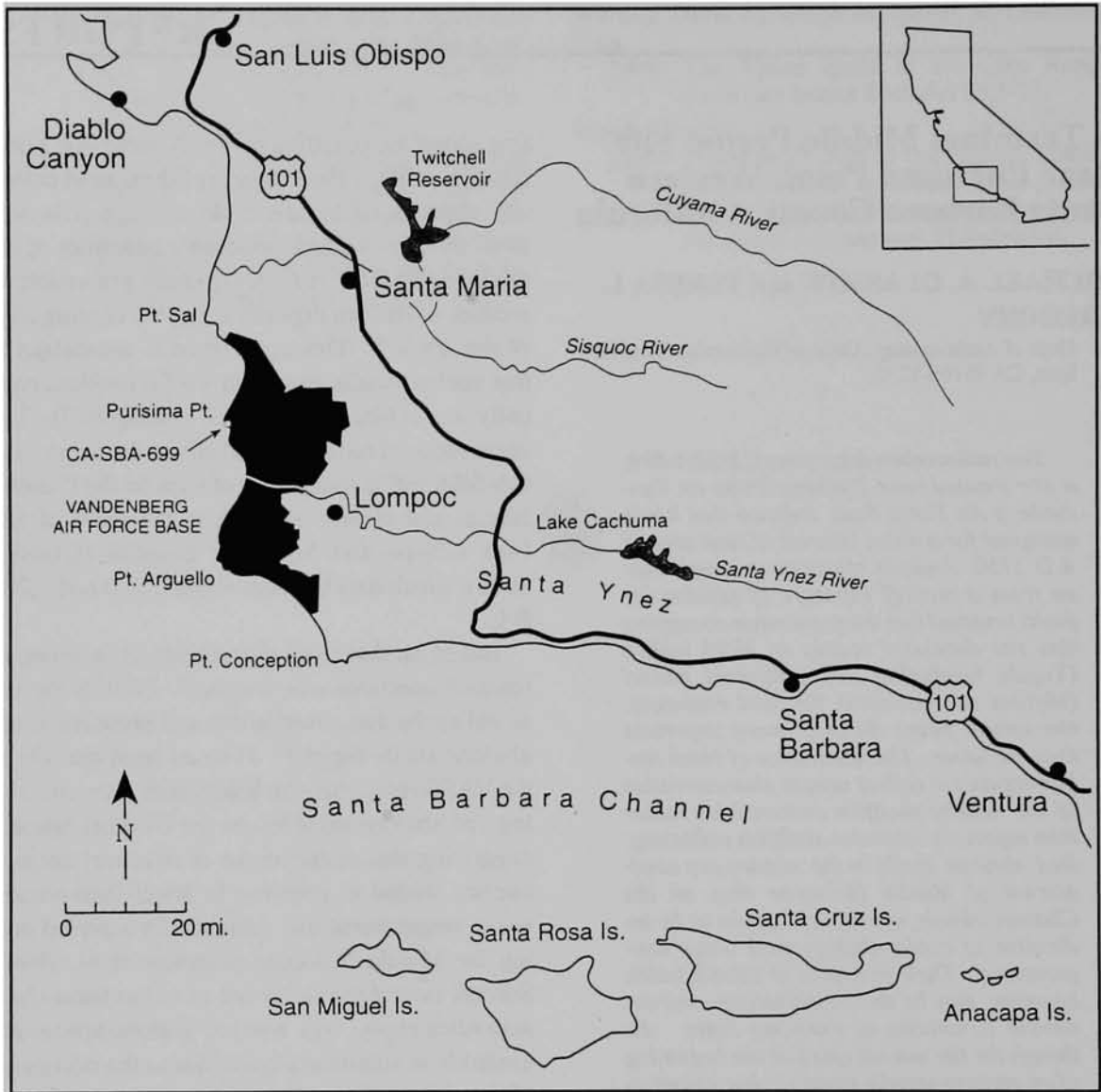


Fig. 1. Purisima Point vicinity, showing location of CA-SBA-699.

chaeological Society, collected a column sample from the bank of exposed midden.

The cultural deposits of CA-SBA-699 extend over an arc-shaped area about 70 m. along a north-south axis and from 15 to 50 m. along an east-west axis (Fig. 2). Much of the site is covered with introduced ice plant (*Carpobrotus edulis*), and the area directly east of the site is covered with coastal dune scrub. The site deposits rest on dune sand varying in thickness from virtual absence to ap-

proximately five m., and below this sand is Monterey shale bedrock. The midden deposits comprising the site appear to be less than a meter thick and are probably no more than half a meter thick throughout most of the site. The stratification of sediments in the immediate vicinity of the column sample is as follows.

A basal dune formation, the top of which is about three m. above Monterey shale bedrock, makes up the deepest stratum. The paleosol at the

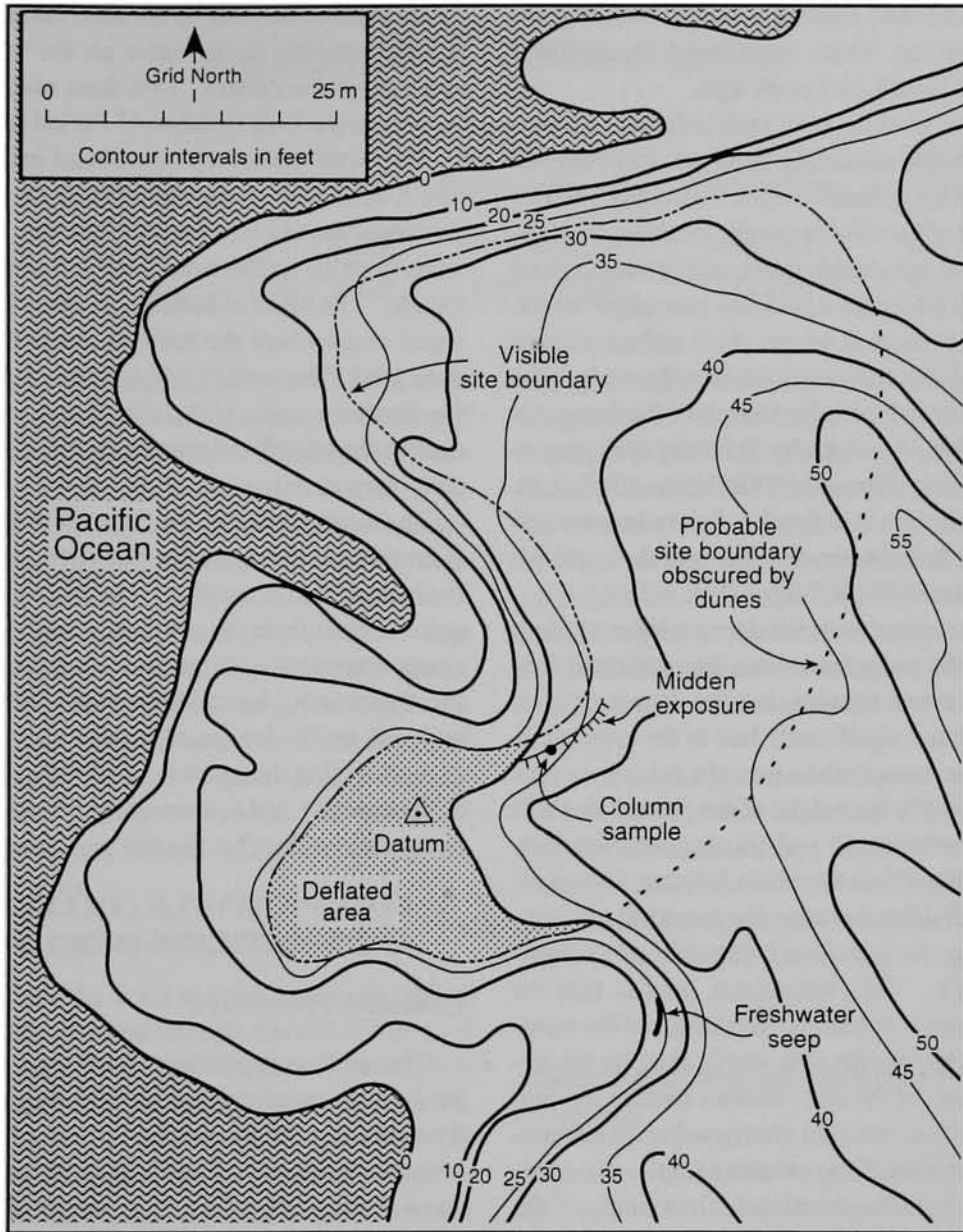


Fig. 2. CA-SBA-699, showing location of column sample.

top of this formation is about 75 cm. thick and is medium grayish brown in color. No archaeological midden is associated with this soil. This dune formation may be what Johnson (1991:A2-A4) classified as the Old Dune Formation, which he estimated to have formed sometime between 5,000 and 13,000 years ago.

A middle dune formation consists of tan sand about 1.5 to 2.0 m. thick resting on top of the basal dune formation. In the vicinity of the site, this stratum is capped by the midden, but south of the site, on the other side of an inlet, there appears to be a soil about 50 cm. thick that developed at the top of the formation. These sands may be what John-

son (1991:A2-A4) classified as the Intermediate Dune Formation, which he believed accumulated between 500 and 5,000 years ago.

The next stratum is an archaeological midden with a probable maximum depth of about one m. near where the column sample was taken. About five m. west of the column sample location, the midden becomes interbedded with nearly sterile dune deposits. This midden contains two major strata. The upper stratum is 44 cm. thick and consists of dense shellfish remains in a black soil matrix. The black color is undoubtedly a result of the dampness of the midden soil; when dry, it is very dark gray to grayish brown (Munsell 10YR 3/1 to 10YR 1/2). The lower stratum is noticeably lighter in color and also is quite damp; when dry, it is very dark grayish brown (Munsell 10YR 3/2 to 10YR 4/2).

Shellfish remains in the upper midden stratum reach densities more than twice the maximum density in the lower stratum, but the degree of shell fragmentation is significantly less in the lower stratum. Whole mussel valves from the column sample comprise 24.4% by weight of the mussel shells in the levels between 40 and 60 cm., whereas they comprise only 3% in the levels between 10 and 40 cm. The division between the two strata is relatively sharp, the transition being only a few centimeters thick. This distinctness implies that the lower stratum is not simply a product of the trampling of shells into the soft, sterile sand by the initial occupants of the site. Neither midden stratum has any obvious internal stratigraphic differentiation in the vicinity of the column sample. No obvious rodent disturbance exists in the vicinity of the column sample or along the length of the midden exposure.

An upper dune formation contains tan sand stabilized by introduced ice plant. It has a maximum thickness of about four m. and forms a steep-sided hummock over the midden due to the presence of inlets directly north and south. Presumably, this dune is not forming today, as the source for its sand is not apparent and it is sloughing away due to seacliff retreat where it has not been stabilized

by ice plant. The color of the sand comprising this dune formation is the same as the sterile dune sands below the midden. This dune sand apparently dates to the Late Prehistoric Period (see below).

The coastline is very convoluted in the vicinity of CA-SBA-699. A narrow inlet about 35 m. long penetrates the western margin of the site, and larger inlets form the northern and southern boundaries of the site. The heads of both larger inlets have freshwater seeps where the bedrock meets the capping dune sand. The seacliff is about nine m. high along the western margin of the site. The surf pounding against the seacliff and surging up the inlets is typically very strong.

The location selected for the column sample was in an area where exposed midden deposits are relatively dense and accessible. The midden surface is quite distinct from the overlying dune sand, and it slopes downward to the south at about a 10° angle. In other words, the midden appears to have accumulated on the lee (south) side of a dune slope, suggesting that the small inlet directly to the north of the exposure had not penetrated inland to its current extent at the time the site was occupied.

## COLUMN SAMPLE COLLECTING AND PROCESSING PROCEDURES

### Collection Procedures

The column sample was taken from a nearly vertical exposure of midden several meters upslope from the edge of the seacliff forming the western boundary of the site. The vertical exposure of midden is visible along only a 15 m. length of the southeastern extreme of a small inlet (Fig. 2). Excavation began by clearing the overburden from the top of the midden where the column sample was to be taken, and the exposed midden was trimmed slightly with a trowel to a vertical profile. However, the base of the midden was buried by dune sand that had sloughed from above, requiring that the lower part of the profile be exposed by digging a hole in the slough with a shovel. Because the sand was damp, it held a vertical wall easily. When the hole was dug, a large



**Table 1**  
**RADIOCARBON RESULTS FROM CA-SBA-699**

Lab No.	Column level	Measured <sup>14</sup> C age	Conventional <sup>14</sup> C age (corrected for fractionation only)	Calibrated age	1-sigma error range
Beta-92848	0-10 cm.	1,070 ± 60 B.P.	1,510 ± 60 B.P.	A.D. 1125	A.D. 1045-1210
Beta-94921	60-70 cm.	1,050 ± 70 B.P.	1,470 ± 70 B.P.	A.D. 1180	A.D. 1065-1260

shale slab was discovered at a depth of 83 cm. from the top of the midden. At this depth, the density of the shellfish remains decreased considerably compared to the upper levels. Because removal of the slab would have required more extensive excavation, it was left in place, so the presence of any midden below it remains unknown.

The column sample was 20 by 20 cm. in area and was excavated in 10 cm. arbitrary levels. Measurements were taken from the inside (southern) face of the column, resulting in the first level having a somewhat larger volume because the midden surface sloped up to the north. All of the soil from each level was collected and screened entirely in the laboratory.

#### Laboratory and Analytical Procedures

At UCSB, the dried samples were weighed by level and then screened through stacked 1/8-in. (2.6 mm.) and 1/16-in. (1.3 mm.) mesh. The residues collected in each screen were retained in their entirety, and 500 to 600 g. samples of sandy matrix that passed through the 1/16-in. screen were retained as soil samples. All the residues from the 1/8-in. screen were first sorted into major constituent categories, after which the shell portions were sorted by taxon, most to the species level. Bone was identified first by the general categories of sea mammal, fish, bird, and small fauna, and then identified to the most specific taxon possible.

Subsamples of residues from the 1/16-in. mesh from each level were also sorted. To assure representativeness, selection of each subsample entailed spreading out all the 1/16-in. residues from a level

and spooning portions from different areas until a 10-g. sample was obtained. As expected, fewer taxa of shellfish and bone could be identified in these subsamples than was possible with the use of 1/8-in. mesh.

Once sorting was completed, collections were cataloged. UCSB's Repository for Archaeological and Ethnographic Collections assigned accession number 563 to the column sample collections from CA-SBA-699. Data analysis was based on this catalog.

Two samples of mussel shell, each consisting of several valves, were submitted to Beta Analytic, Inc., for radiocarbon assay. Samples were obtained from the 0 to 10 and 60 to 70 cm. levels to date the earliest and latest occupations represented by the depth of the column sample.

## RESULTS

### Radiocarbon Dates and Refinement of Research Problems

As shown in Table 1, results of the analysis of the radiocarbon samples demonstrate that the two dates are statistically identical. In fact, the one-sigma error ranges of the dates substantially overlap. The similarity between the two dates implies that the 70 cm. of deposit represented by the column sample accumulated over a very short period of time, perhaps as short as several decades. The dates fall at the juncture between the Middle and Late periods as defined by King (1990:28, 39); in terms of the revised chronology proposed by Arnold (1992a:66, 1992b:131), they fall between the

Middle Period and the Middle-to-Late Period transition. The Late Period in Arnold's chronology does not begin until the late A.D. 1200s or early A.D. 1300s (in calibrated calendar years).

These dates are much later than originally suspected. The site is not of Middle Holocene age and therefore has no temporal relationship with the red abalone middens of the northern Channel Islands, thus answering the first research question (see above). The remaining two research questions are discussed below, along with an additional question: Is there evidence for subsistence stress and cultural disruptions that appeared to have occurred in the Santa Barbara Channel region at the onset of the Middle-to-Late Period transition?

### Representativeness of the Column Sample

A cautious position would be to assume that the single column sample on which the following analysis is based is representative of only those site deposits in the immediate vicinity of the column; that is, the southwestern part of CA-SBA-699. With no information regarding the nature of the deposits in other portions of the site, it is difficult to determine whether the entire site dates to the A.D. 1100s or whether the same kinds and proportions of constituents seen in the column sample are common in the rest of the deposits. Regardless of how representative the column sample may be, it is believed to be at least generally representative of the deposits in the southwestern part of the site that dates to the A.D. 1100s, and it can be reasonably assumed that the column sample contains evidence of subsistence patterns characteristic of the inhabitants of the site at that time. Furthermore, general consistency in the proportions of shellfish remains attributed to particular taxa throughout the 70 cm. of the column sample implies that subsistence behavior remained relatively unchanged during the interval of time that the southwestern part of the site was occupied.

### Characteristics of the Midden Constituents

As is typical of many sites in the VAFB region having a dune sand matrix, midden constituents are

in excellent condition. This is particularly true with regard to levels below 30 cm. from the midden surface. Many of the mussel valves are complete, and relatively delicate fish elements are intact. Charcoal occurs in nodules up to 10 mm. in diameter. This degree of preservation undoubtedly is related to the absence of rodent disturbance and burial of the archaeological deposits under dune sand. Other coastal sites in the region lacking a dune soil matrix contain more highly fragmented constituents.

Shell is by far the most abundant constituent throughout the levels (Tables 2 through 4). In all levels, the most abundant species are black turban (*Tegula funebris*) and California mussel (*Mytilus californianus*), which together account for more than 80% of the weight in five of the seven levels (Table 2, Fig. 3). The other taxa present in the shell assemblage are much less plentiful. With regard to variations between levels, the proportional representation of the shellfish taxa among the levels is relatively consistent except for the 30 to 40 cm. level, where black turban accounts for more than double the quantity of California mussel (Fig. 3). Of the less abundant shellfish taxa, several are noticeably more abundant in some levels than in others. Of these, brown turban (*Tegula brunnea*) is found in larger quantities in the lower levels, and purple sea urchin (*Strongylocentrotus purpuratus*) appears in larger quantities in the middle levels. A single whole shell of red abalone accounts for the relatively greater weight of shellfish remains from the 50 to 60 cm. level (Table 2). All other fragments of red abalone in the column sample levels are quite small.

Similar proportions of turbans (black and brown species combined) and California mussel are found in all levels of the 1/16-in. samples (Table 5). Relative to other species, fragments of sea urchin are very distinctive in the 1/16-in. samples, which accounts for the larger proportions of this taxon compared to its occurrence in the 1/8-in. samples. As expected, a high percentage of 1/16-in. material could not be identified, even with the aid of a 10-40X microscope.

Table 2  
WEIGHT IN GRAMS OF SHELLFISH REMAINS BY TAXON, 1/8-IN. PORTIONS

Taxon	Level (cm.)										Totals	Percent
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	Totals	Percent			
<i>Mytilus californianus</i>	310.46	254.68	697.40	558.00	350.10	187.01	216.69	2,574.34	36.67			
<i>Tegula funebris</i>	248.18	272.39	545.45	1,386.70	335.24	179.69	286.79	3,254.44	46.35			
<i>Tegula brunnea</i>	21.89	24.38	22.02	33.35	43.11	61.96	37.99	244.70	3.48			
<i>Strongylocentrotus purpuratus</i>	18.02	18.30	36.44	56.29	25.53	16.74	18.78	190.10	2.71			
chiton	15.87	20.05	34.10	27.31	25.23	15.03	18.51	156.10	2.22			
<i>Cryptochiton stelleri</i>	7.21	--	14.17	1.90	0.32	0.09	1.24	24.93	0.36			
crab	1.16	3.72	10.42	12.75	10.41	10.85	11.95	61.26	0.87			
limpet	3.83	4.76	10.86	29.88	8.13	4.23	6.18	67.87	0.97			
<i>Pollicipes polymerus</i>	7.12	8.71	12.98	21.01	11.28	8.10	9.08	78.28	1.11			
<i>Septifer bifurcatus</i>	3.92	6.92	7.56	3.48	1.76	7.54	12.97	44.15	0.63			
<i>Balanus</i> spp.	5.42	1.00	4.39	3.11	5.48	1.25	2.83	23.48	0.33			
<i>Haliotis cracherodii</i>	15.13	--	0.26	0.56	0.94	1.07	7.31	25.27	0.36			
<i>Haliotis rufescens</i>	5.12	--	17.71	0.38	1.06	81.57	2.48	108.32	1.54			
<i>Haliotis</i> spp.	--	--	1.90	0.75	--	0.24	1.84	4.73	0.07			
<i>Crepidula</i> spp.	1.16	1.00	2.03	8.14	2.49	1.65	0.77	17.24	0.25			
<i>Protothaca staminea</i>	--	--	--	0.44	--	--	--	0.44	0.00			
clam	0.07	0.47	1.07	--	--	--	0.10	1.71	0.02			
miscellaneous small gastropods	--	0.07	0.17	4.01	--	0.32	0.71	5.28	0.08			
unidentified	36.55	18.17	32.44	19.61	10.15	5.47	16.87	139.26	1.98			
<b>Totals</b>	<b>701.11</b>	<b>634.62</b>	<b>1,451.37</b>	<b>2,167.67</b>	<b>831.23</b>	<b>582.81</b>	<b>653.09</b>	<b>7,021.90</b>	<b>100.00</b>			



**Table 3**  
**WEIGHT AND NISP OF BONE CATEGORIES, 1/8-IN. PORTIONS<sup>a</sup>**

General Taxa	Level (cm.)							Total
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	
small fauna	0.80 (22)	0.77 (17)	0.72 (26)	1.55 (20)	1.61 (10)	0.94 (12)	2.18 (28)	8.57 (135)
fish	0.27 (8)	0.78 (20)	1.17 (35)	1.24 (41)	0.15 (10)	0.10 (10)	0.33 (7)	4.04 (131)
sea mammal	7.27 (1)	—	—	—	<0.01 (1)	—	0.41 (1)	7.68 (3)
bird	0.20 (1)	—	—	—	—	—	—	0.20 (1)
<b>No. of Burned Bones in General Taxa</b>								
small fauna	—	1	3	7	5	5	15	36 (26.7%) <sup>b</sup>
fish	1	3	2	1	3	1	2	13 (9.9%)
sea mammal	—	—	—	—	1	—	—	1 (33.3%)
bird	—	—	—	—	—	—	—	0 (0%)
<b>Specific Taxa (subdivi- sions of general taxa)</b>								
<i>Sylvilagus</i> spp.	—	0.21 (2)	0.01 (1)	0.85 (5)	0.03 (1)	0.52 (3)	0.26 (3)	1.88 (15)
<i>Lepus californicus</i>	—	0.18 (1)	0.03 (1)	0.03 (1)	0.31 (2)	—	—	0.55 (5)
unidentified small fauna	0.80 (22)	0.38 (14)	0.68 (24)	0.67 (14)	0.27 (7)	0.42 (9)	1.92 (25)	5.14 (115)
<i>Sebastes</i> spp.	0.11 (1)	—	—	0.32 (5)	—	—	—	0.43 (6)
Embriotocidae	—	0.01 (1)	—	0.07 (2)	—	0.03 (1)	—	0.11 (4)
Clupeidae/Engraulididae	—	—	—	—	—	0.01 (4)	—	0.01 (4)
<i>Ophiodon elongatus</i>	—	—	—	—	—	—	0.21 (2)	0.21 (2)
unidentified fish	0.16 (7)	0.77 (19)	1.17 (35)	0.85 (34)	0.15 (10)	0.06 (5)	0.12 (5)	3.28 (115)
<i>Zalophus californianus</i>	7.27 (1)	—	—	—	—	—	—	7.27 (1)

<sup>a</sup> Weight in g. NISP (number of identified specimens) in parentheses.

<sup>b</sup> Percent of category total in parentheses and italics.

In the 1/8-in. samples, all levels contain very low densities of bone, most of which is that of small fauna (Table 3). The bone in this category includes specimens identified as two different species of lagomorphs, as well as unidentified fragments that may be from rodents, lagomorphs, birds, reptiles, and/or amphibians. Bones of cottontail rabbits (*Sylvilagus* sp.) and black-tailed jackrabbits (*Lepus californicus*) are in almost every level. Nearly 27% of the bones in the small fauna category is burned, a much higher percentage than that in the fish category (Table 3). In the 60 to 70 cm. level, an unusu-

ally large proportion of unidentified small fauna bone consists of tiny fragments.

Only three sea mammal bones, each from a separate level, and a single bone identified as bird are in the assemblage. The single sea mammal bone in the 0 to 10 cm. level is an axis of a California sea lion (*Zalophus californianus*). It weighs 7.27 grams and accounts for 85% (by weight) of the bone in that level. This is the only large piece of bone in the column sample. The other two sea mammal bones are small fragments that could not be further identified.

**Table 4**  
**WEIGHT IN GRAMS OF FLAKES, STONE, AND CHARCOAL, 1/8-IN. PORTIONS<sup>a</sup>**

Category	Level (cm.)						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
undifferentiated flakes	12.76 (14)	0.30 (5)	31.32 (24)	14.23 (34)	6.96 (18)	4.56 (17)	35.02 (30)
gravel	44.17	122.51	121.19	38.22	207.78	7.46	81.36
stone with asphaltum	--	--	--	--	--	36.26 (1)	--
charcoal	3.72	3.56	7.42	9.23	4.28	2.60	3.67

<sup>a</sup> Quantities of flakes and stone with asphaltum in parentheses.

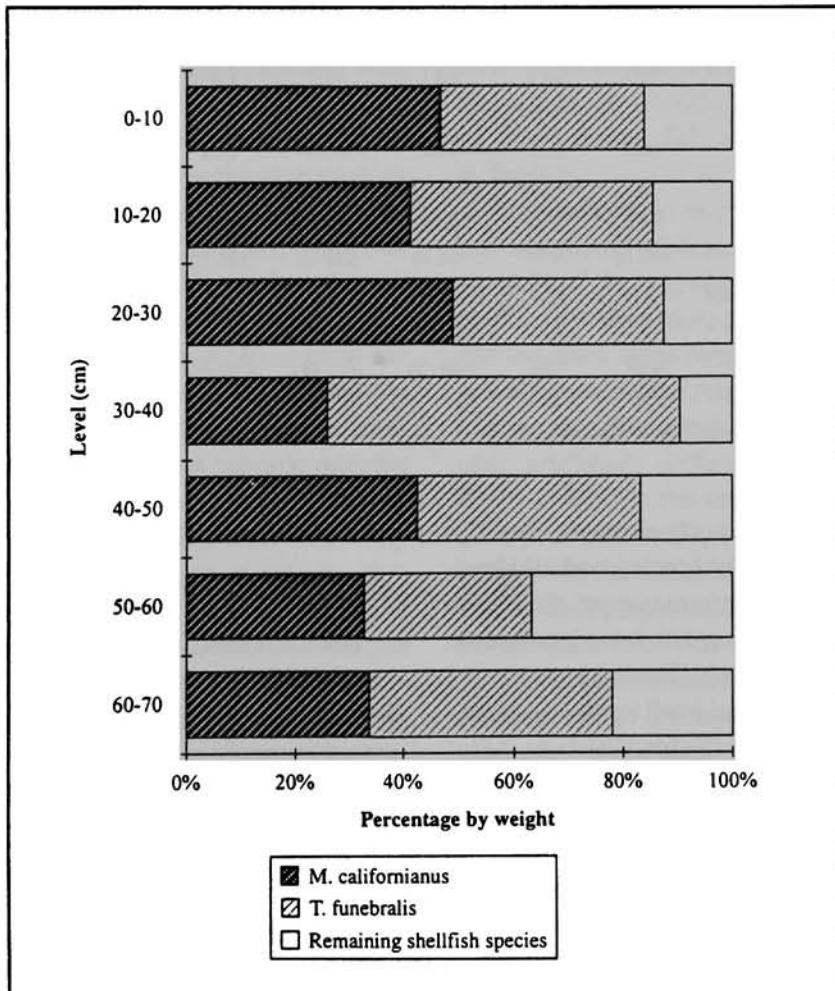


Fig. 3. Weight proportions by level of shellfish taxa.

**Table 5**  
**WEIGHT IN GRAMS OF CONSTITUENTS IN 10-GRAM SAMPLES, 1/16-IN. PORTIONS**

Taxon	Level (cm.)							Totals
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	
<b>Shell</b>								
<i>Mytilus californianus</i>	2.53	2.04	2.39	1.52	1.17	1.10	1.81	12.56
<i>Tegula</i> spp.	2.28	3.24	2.43	2.55	2.55	2.25	3.06	18.36
<i>Strongylocentrotus purpuratus</i>	2.21	2.04	2.01	2.16	2.23	2.49	1.46	14.60
<i>Septifer bifurcatus</i>	0.02	0.01	--	--	--	--	--	0.03
limpet	--	0.02	0.01	<0.01	0.01	<0.01	0.01	>0.05
<i>Pollicipes polymerus</i>	0.04	0.29	0.18	0.12	0.25	0.17	0.23	1.28
<i>Balanus</i> spp.	0.02	0.03	0.07	0.02	0.03	0.03	0.03	0.23
crab	0.03	0.07	0.01	0.01	0.05	0.08	0.02	0.27
<i>Haliotis</i> spp.	--	0.01	--	--	--	--	--	0.01
unidentified shell	2.31	1.79	2.57	3.28	3.24	3.34	2.89	19.42
<b>Totals</b>	<b>9.44</b>	<b>9.54</b>	<b>9.67</b>	<b>9.66</b>	<b>9.53</b>	<b>9.46</b>	<b>9.51</b>	<b>66.81</b>
<b>Other</b>								
gravel	0.27	0.19	0.11	0.09	0.16	0.13	0.18	1.13
undifferentiated flakes*	--	0.03 (4)	<0.01 (2)	<0.01 (1)	0.01 (3)	<0.01 (2)	0.01 (3)	>0.05 (15)
charcoal	0.13	0.10	0.13	0.14	0.15	0.19	0.14	0.98
<b>Unsorted Material</b>	<b>103.32</b>	<b>74.49</b>	<b>144.39</b>	<b>234.90</b>	<b>117.15</b>	<b>58.84</b>	<b>129.38</b>	<b>862.47</b>
percentage of total material sorted	9.7	13.4	6.9	4.3	8.5	17.0	7.7	--
Clupeidae/Engraulididae	--	--	0.01 (2)	--	<0.01	--	--	>0.01 (3)
unidentified bone	0.08	0.04	0.02 (3)	0.01 (4)	0.02 (3)	0.08 (14)	0.01 (2)	0.26 (53)

\* Flake and bone quantities in parentheses.

Fish vertebrae were the only elements identified to the level of genus and/or species, and all identified taxa are found in nearshore waters. Similar to some of the shellfish species, fish bone increases in quantity in the middle levels (Table 3).

The amount of charcoal in all levels is relatively small, as are quantities of flakes (Table 4). All of the flakes are of Monterey chert, available as beach cobbles and in bedrock lenses along the seacliff within several hundred meters from the site. The size of the flakes varies, with the largest approximately five cm. long. The only artifact in the column sample is an ovoid pebble covered with asphaltum found in the 50 to 60 cm. level. Apparently a tarring pebble, it is approximately five cm. long.

## DISCUSSION

### Site Activities and Settlement Context

Because collections from CA-SBA-699 include mainly dietary remains, site occupants during the middle to late A.D. 1100s appear to have been concerned primarily with subsistence activities, including food acquisition, preparation, and consumption. Food acquisition focused on collecting shellfish, fishing, and hunting (primarily rabbits). At least some of this food was consumed at the site, as indicated by the presence of burned bone, charcoal, heat spalls from rocks in the column sample, and fire-affected rocks observed on a deflated surface near the location of the column sample.

Shellfish collecting appears to have been concentrated on the middle and lower intertidal zones, where rocky shoals and bedrock shelves would have harbored California mussel and black turban, the two dominant species represented in the shellfish remains. Today, these intertidal habitats are extensive in the general vicinity of the site. The probable tactics of shellfish collecting are discussed below.

In contrast, fishing may not have been focused on these habitats. Surfperches (Embiotocidae) and sardines/anchovies (Clupeidae and Engraulidae) are the principal fishes represented among the relatively few fish bones identified to at least the family level. These fishes probably would have been most accessible from sandy beaches, and their small size suggests that they may have been captured with nets. Interestingly, the easiest fish to catch today with hooks and lines in the immediate vicinity of the site is cabezon (*Scorpaenichthys marmoratus*), as demonstrated by the fishing success of Lawrence Spanne while fieldwork was being undertaken at CA-SBA-699. In approximately five hours, Spanne caught six legal-size cabezons with four hook-and-line setups attached to bedrock protrusions at the edge of the seacliff. His lines were simple two-ply string, and his hooks were baited with abalone trimmings. No other species except cabezon took his hooks. If the inhabitants of CA-SBA-699 had been using similar gear while fishing from the rocky prominences at the western edge of the site, presumably they also would have caught cabezon, and their bones would be relatively prevalent in the site deposits.

Terrestrial hunting of lagomorphs undoubtedly took place in the brushlands directly east of the site. Curiously, no evidence of deer hunting was discovered in the column sample, even though deer are present today in the vicinity of the site. Deer bones also were not evident in the midden exposures near the column. Pinniped hunting and the capture of birds appear to have been minor pursuits.

The relative importance of shellfish, fish, land mammals, and sea mammals to the diet of the site

occupants may be estimated from weights of different categories of faunal remains. For the purpose of calculating dietary importance, the amount of shells and bone that passed through the 1/8-in. mesh and were collected in the 1/16-in. mesh were estimated based on the samples of sorted 1/16-in. subsamples, and these estimates were added to those derived from the 1/8-in. mesh samples. Considered in these calculations are the two most abundant species represented in the shellfish remains, California mussel and black turban, which together account for 83% of the total shellfish weight. Information in Tables 2, 3, and 5 was used to derive the ratios of 1/8-in. to 1/16-in. fractions of bone and shell, which are 1:0.20 and 1:0.06, respectively. Using these ratios, along with dry bone and shell weight to protein weight multipliers published by Erlandson (1991:98), the protein values of mussel, black turban, fish, and small fauna are shown in Table 6.

The total protein weights indicate that black turban contributed substantially more to the diet than mussel and that together these two items contributed many times more protein to the diet than did fish and small fauna combined. Pinniped meat also probably contributed relatively little to the diet, assuming that the complete vertebrae from the column artificially inflate the sea mammal bone weight. Despite the vagaries of this approach to dietary reconstruction, it is clear that shellfish collecting was the main focus of food acquisition activities while people resided at CA-SBA-699 during the middle to late A.D. 1100s.

Another activity represented in the column sample assemblage is knapping of flaked chert tools. However, flakes in the site deposits do not appear to be as dense as they are at many other sites in the VAFB region. None of the flakes is of a form unequivocally associated with biface reduction, nor do any flakes show obvious evidence of use as tools. Regardless, it seems likely that such tools were used to prepare fish and mammals.

The data from the column sample suggest that people occupied CA-SBA-699 mainly to collect

**Table 6**  
**PROTEIN VALUES<sup>a</sup>**

Faunal Category	Wt. of 1/8-in. Sample	Multiplier <sup>b</sup>	Wt. of Protein (1/8-in. sample)	Wt. of Protein (1/16-in. sample), based on ratio	Total Protein Weight
mussel	2,574.34	0.043	110.70	6.64	117.34
black turban	3,254.44	0.074	240.83	14.45	255.28
small fauna	8.57	2.100	18.00	3.67	21.67
fish	4.04	5.125	20.71	4.22	24.93

<sup>a</sup> Weight in g.

<sup>b</sup> Based on Erlandson (1991).

shellfish. Although evidence of food processing implies that people actually resided at the site (i.e., remained at the site for one or more nights), there is no clear evidence from the column sample or from surface observations that the site was more than a short-term residential base occupied to carry out activities primarily related to subsistence. The presence of freshwater seeps adjacent to CA-SBA-699 probably was an important reason why it was a focus of occupation. However, the site is quite similar in size and midden constituent contents to several others located at the edge of the seacliff directly south (e.g., CA-SBA-694, -698) (as observed by the senior author), implying that shellfish attached to intertidal rocks along the broken shoreline adjacent to this series of sites was another important attraction. Evidence that people resided at CA-SBA-699 implies that they traveled to the site a significant distance from another residential base. If they had come from nearby CA-SBA-224 or -225 (de Barros et al. 1994), the deposits at CA-SBA-699 undoubtedly would indicate day use rather than as a residence; that is, CA-SBA-699 would contain very little evidence, if any, of food processing. A plausible origin of the site residents would be a principal residential base located at least several kilometers inland.

#### **Red Abalone Exploitation in the Vicinity of CA-SBA-699**

CA-SBA-699 dates to a much later period than do sites with abundant red abalone shells located

on Santa Cruz Island and along the central California coast (Glassow 1993). In fact, CA-SBA-699 appears to be only the northernmost of a cluster of closely spaced sites containing noticeable quantities of red abalone shells. During site record updating in 1994, sites CA-SBA-694, -696, and -698, located within half a kilometer of CA-SBA-699, also were noted to contain red abalone shells, although California mussel clearly predominated at each. In association with the red abalone shells were black abalone and giant chiton shells. Today, red abalone is a subtidal species and would therefore not usually be available to shellfish collectors unless they dive for them, which is unlikely in light of the prevalence of dangerous surf.

The occurrence of red abalone shells in Middle Holocene sites of the Channel Islands correlates with a period during this time when cooler-than-present sea water temperatures allowed red abalone to inhabit the intertidal zone (Glassow 1993; Glassow et al. 1994). As noted by Kennett (1998:242), the sea water paleotemperature record of this region indicates that Santa Barbara Channel water temperatures also were especially cool during the time that CA-SBA-699 was occupied, so it is possible that red abalone had expanded into the intertidal zone at that time. However, if red abalone did not expand into the intertidal zone in response to cooler water temperatures, another explanation may account for their presence in the site deposits. Subtidal red abalone may become fortuitously available to collectors after strong storm surf has dislodged



them from their perches and washed them ashore. In fact, the vicinity of the site is known today as a locality where dislodged red abalone may be collected after heavy winter storms (L. Spanne, personal communication 1994). This historic phenomenon probably existed during prehistoric times as well. Both possibilities may depend on a distinctive shallow subtidal habitat near Purisima Point that harbors larger numbers of red abalone than elsewhere along the VAFB coast, although such variation has not been investigated.

### **CA-SBA-699 in the Context of the Middle-to-Late Period Transition**

On the basis of the chronological information acquired from Santa Cruz Island sites, the Middle-to-Late Period transition may be said to span the period between A.D. 1150 and 1300 (Arnold 1992a: 66-67, 1992b:134). Of course, even with the excellent stratigraphic integrity of island sites, the dating of this transitional period is necessarily approximate due to counting errors associated with radiocarbon dates, as well as errors associated with calibration. It is possible, for instance, that the beginning of the transitional period is closer to A.D. 1200 rather than A.D. 1150, based on the distribution of Santa Cruz Island dates (Arnold 1992a, 1992b).

Other archaeologists have used different dates for the beginning and end of the Middle-to-Late Period transition. For instance, Jones (1995:135), used a relatively broad interval, A.D. 1000 to 1250, in reference to the Monterey County coast, while Raab (1994:43) proposed that the transition in the Santa Barbara Channel region occurred between about A.D. 1100 and 1300. We use Arnold's proposed dating of the transition, which suggests that CA-SBA-699 was occupied either at the end of the Middle Period or at the beginning of the Middle-to-Late Period transition. Arnold (1992a:67) attributed site components with similar dates on Santa Cruz Island to the Middle Period, but too few dates exist from distinct stratigraphic contexts to know when the period of the transition actually began, which may not have been a discrete event in the first place.

With regard to sites dating within or near the Middle-to-Late Period transition in the VAFB region, de Barros et al. (1994:5-34) attributed a portion of the occupation of CA-SBA-224 to the transition on the basis of a calibrated radiocarbon date of A.D. 1160 (one-sigma error interval: A.D. 1060 to 1230). CA-SBA-224, a large site located several hundred meters southeast of CA-SBA-699, consists of deposits dating primarily to the Late Period. Because the CA-SBA-224 date is nearly identical to the two dates from CA-SBA-699, it is unclear whether the deposits at CA-SBA-224 associated with this date should be attributed to the end of the Middle Period or the beginning of the transition. In any regard, there are no data from the deposits associated with this date, so further comparisons with CA-SBA-699 are not possible.

Directly to the north and east of CA-SBA-699 is CA-SBA-225, an extensive site encompassing the lands in the immediate vicinity of Purisima Point (de Barros et al. 1994:5-94). The eight radiocarbon dates pertaining to this site do not include any that fall within or close to the Middle-to-Late Period transition as defined by Arnold (1992a, 1992b), but several of the discrete loci of midden deposits are of interest. Although not reported by de Barros et al. (1994), an analysis of column samples obtained in 1993 by de Barros' field team (J. Perry, personal communication 1998), as well as the senior author's field observations, indicate that some of the Middle and Late period deposits of CA-SBA-225 are similar to those of CA-SBA-699, in that turban and other shellfish species are as important, if not more important, than California mussel.

Beyond the general vicinity of Purisima Point, 11 sites in the VAFB region are associated with dates falling between A.D. 1100 and 1300, but the data available from these sites, which often are minimal, do not provide clear indication of a response to environmental conditions of the Middle-to-Late Period Transition. As a consequence, CA-SBA-699 cannot yet be understood in the context of regional processes.

### Evidence of Subsistence Stress Reflected in Shellfish Remains

The time period during which CA-SBA-699 was occupied (the end of the Middle Period) was one of apparent subsistence stress and social conflict in the Santa Barbara Channel region (Arnold 1992a, 1992b; Raab 1994; Arnold et al. 1997; Raab and Larson 1997). CA-SBA-699 yielded evidence that subsistence may have been similarly affected in the VAFB region. Specifically, subsistence stress in this region may have involved increasing dependence on shellfish collecting as other, higher ranked food resources such as land mammals became less available.

The unusually high proportion of black turban in the shellfish remains suggests that the site occupants were placing substantial pressure on the shellfish beds in the vicinity of the site, undoubtedly including Purisima Point. Shellfish remains in sites of the VAFB region typically consist of more than 90% mussel by weight, and proportions of less than 80% are unusual (Glassow 1996:124, 135). Mussel, of course, is the preferred intertidal shellfish species because of its great abundance, large size, and relatively rapid growth (Jones and Richman 1995), and smaller species such as black turban would not have been collected in large numbers unless mussel was being so intensively exploited that collection of smaller species was necessary to compensate for the depletion of mussel. Being a smaller mollusc, black turbans provide much lower meat yields per individual than an average-sized mussel. However, turbans also are very abundant in the intertidal zone near the site, and they would be a logical choice if mussel beds were being depleted. There is no evidence from the site that black turban became increasingly important through time, which is not surprising in light of the rather short period of site occupation.

Increasing intensity of mussel collecting is apparent in Late Period coastal sites on the southern portion of VAFB (south of the Santa Ynez River mouth). The Late Period deposits at these sites

contain higher proportions of black turban relative to mussel than earlier deposits at the same site, although mussel remained the dominant species (Glassow 1996:136). Moore (1988) also posited that shellfish collecting during the Late Period was intensive, basing his argument on the inferred small size of mussel shells from CA-SBA-1816, a coastal site in the southern sector of VAFB. However, his analysis did not include evaluation of mussel size from earlier deposits at the same locality, which would be necessary in light of the analysis discussed below (see Colten et al. [1997:7.22-7.24] for a study that demonstrates a decline in mussel size through time at a site in the VAFB region occupied close to 500 years earlier than CA-SBA-699).

If indeed mussel was being so intensively exploited that turbans became a viable alternative, the maximum size of mussel shells in midden deposits of CA-SBA-699 should be relatively small. Furthermore, following arguments made by Jones and Richman (1995; see also Jones 1995), there may be evidence that mussel beds were being "stripped" rather than "plucked." That is, mussel collecting tactics entailed acquiring all mussels with little regard to size, rather than selecting only the larger individuals. To evaluate these expectations, all whole mussel valves and fragments complete enough for their length to be measured were separated from each level of the column sample except the 0 to 10 cm. and 60 to 70 cm. levels, as complete valves in these levels had been removed for radiocarbon dating. The largest mussel valve was 5.7 cm. long, a relatively small size.

To determine whether stripping was the object of mussel collection, mussel valves first were grouped into two depth intervals, 10 to 40 cm. and 40 to 60 cm. Consistent with Jones and Richman's (1995: 48) procedure, lengths pertaining to each depth interval were plotted in 10 mm. intervals in the form of cumulative frequency curves (Fig. 4). Jones and Richman's curves represent the two shellfish collecting techniques mentioned above and two environmental settings: "pristine," where mussel beds

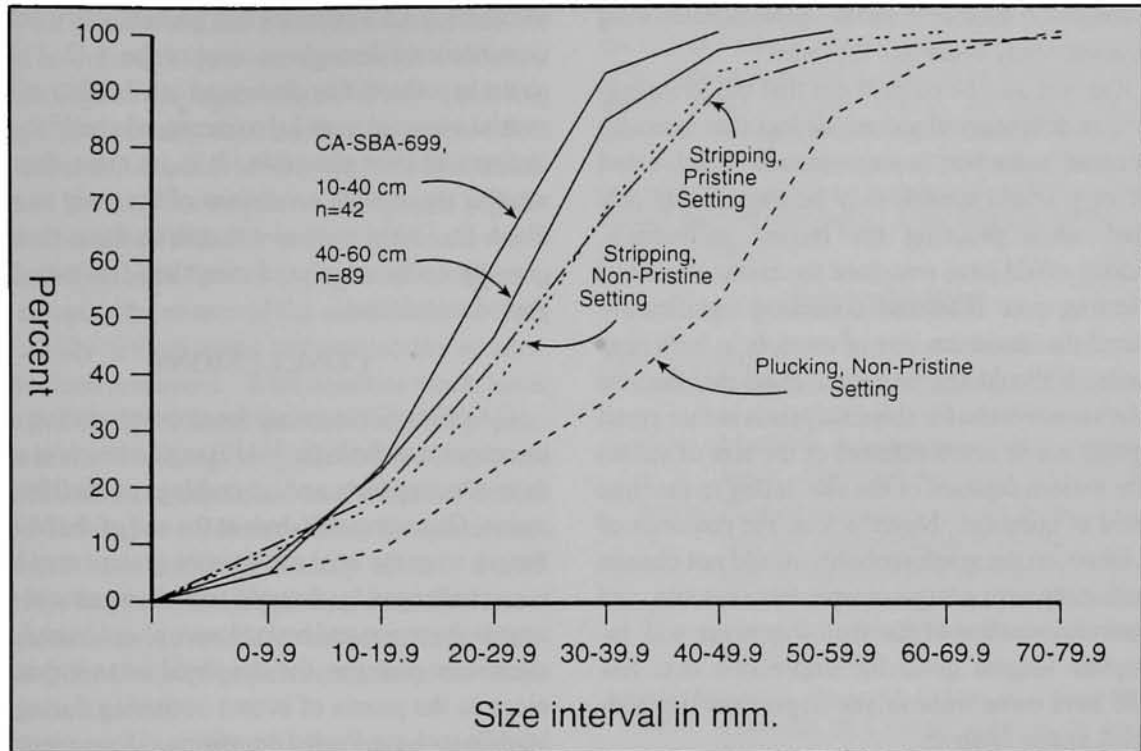


Fig. 4. Cumulative frequency curves of lengths of whole mussel valves from CA-SBA-699 compared to curves in Jones and Richman (1995).

had not been subject to collection, and “nonpristine,” where modern collecting had taken place. Included with the CA-SBA-699 data in Figure 4 are two curves characteristic of stripping and one characteristic of plucking. The curves representing the CA-SBA-699 mussel valves appear to reflect an extreme instance of stripping in that both are to the left of Jones and Richman’s stripping curves.

For several reasons, caution must be exercised in reaching a conclusion that the inhabitants of CA-SBA-699 were stripping mussel beds. Microenvironmental variations along the coast may be either conducive or adverse to mussel growth, and mussels may tend to be smaller in one locality than another only a few kilometers distant. This, in fact, appears to be the case along the north VAFB coast. A reconnaissance of the intertidal zone near CA-SBA-699 in March 1998 revealed that mussel lengths seldom exceeded 90 mm. and that an average size was substantially less. Furthermore, mus-

sel beds are in small, scattered patches and consequently in much lower abundance than is the case elsewhere along the VAFB coast. Black turbans are relatively abundant, approximating the abundance of mussel with respect to numbers of individual shellfish.

For reasons that are not readily apparent, mussels do not thrive in the vicinity of Purisima Point. One possibility is that the substrate is not stable enough for mussels to survive over the long term. The kind of experiments reported by Jones and Richman (1995) need to be carried out at mussel beds near CA-SBA-699 to demonstrate more rigorously the relationship between shellfish remains in the middens of sites such as CA-SBA-699 and the character of the local shellfish beds. Nonetheless, the senior author’s relatively casual observations in March 1998 clearly revealed that mussels growing in the nearby intertidal zone today could not support collection activities for very long before forc-

ing shellfish collectors to include other species such as the relatively abundant turban.

It should also be pointed out that the stripping-plucking dichotomy obscures the fact that intensity of mussel collection is a continuous variable and that very small mussels may be fortuitously collected while plucking the largest individuals. Plucking could have remained the tactic of mussel collecting even if intense collecting significantly reduced the maximum size of mussels in beds near the site. It should also be kept in mind that the size of the sample used for this analysis is rather small and may not be representative of the size of valves in the midden deposits of the site dating to the time period in question. Nevertheless, the positions of the curves on the graph probably would not change significantly with a larger sample from the site, and visual examination of the shell fragments with incomplete lengths gives the impression that few could have come from valves larger than those included in this analysis.

For the present, it may be concluded that there is no evidence from CA-SBA-699 of shellfish collecting so intense that the size of available mussels had declined and that the collection of large numbers of turban was a response to declining mussel size. Furthermore, the shellfish assemblage shows no obvious evidence of unusually intense shellfish collecting indicative of subsistence stress. Nonetheless, it is possible that the considerable importance of shellfish collecting relative to hunting mammals is a response to drought conditions at the onset of the Middle-to-Late Period Transition. If terrestrial protein sources declined in importance due to drought, for instance, shellfish may have been a viable alternative, assuming that intertidal shellfish were not indirectly affected by such a drought. The absence of deer bone in the CA-SBA-699 column sample may reflect their significantly decreased density during drought conditions, although without more subsistence data from CA-SBA-699 and other sites occupied at the same time, this idea is speculative. However, an analysis of southern California tree ring records (Larson and

Michaelsen n.d.) indicates that generally dry conditions occurred throughout most of the A.D. 1100s, so the hypothesis that decreased availability of terrestrial mammal meat led to increased shellfish collection is at least plausible. It is not clear, though, whether the drought conditions of the early to middle A.D. 1100s were as extreme as those that apparently occurred later, during the Middle-to-Late Period transition.

## CONCLUSIONS

CA-SBA-699 is among the more interesting sites investigated so far in the VAFB region because of its date of occupation and assemblage of shellfish remains. Occurring as it does at the end of the Middle Period, when the local subsistence system may have been challenged by drought and when cultural systems in the region and beyond were about to undergo significant changes, the site could be an important piece to the puzzle of events occurring during the Middle-to-Late Period transition. More pieces to this puzzle undoubtedly exist at other sites and site loci in the vicinity of Purisima Point.

For reasons yet to be fully understood, the intertidal and nearshore environments adjacent to Purisima Point appear to have certain characteristics unique to the VAFB coast. In particular, California mussel is not as abundant, nor do individual mussels grow to sizes typical elsewhere along the VAFB coast. In addition, red abalone is more prevalent today as well as at the time CA-SBA-699 and neighboring sites were occupied. Neighboring site CA-SBA-225 also contains shellfish assemblages with distinctive characteristics, including some loci containing unusually large quantities of giant chiton plates (*Cryptochiton stelleri*) and others with large quantities of littleneck clam shells (*Protothaca staminea*) (based on the senior author's observations in 1998). As a consequence, CA-SBA-225, CA-SBA-699, and sites immediately south of CA-SBA-699 all have special significance because of their potential to yield information on prehistoric shellfish collecting and dependence on various species of shellfish as food resources.



The Middle-to-Late Period transition has become an important issue among southern California archaeologists. Droughts identified in the tree-ring record undoubtedly resulted in subsistence stress and cultural disruption in many regions of California and beyond, but responses of regional populations must have differed in many significant ways, depending on such factors as degree of sociopolitical complexity, nature of the subsistence system, availability of fresh water, and availability of alternative food resources. With densities much lower than that along the Santa Barbara Channel, populations of the VAFB region appear to have been more mobile and more dependent on shellfish. Furthermore, the degree of sociopolitical complexity appears to have been significantly lower. Consequently, response to drought and manifestation of subsistence stress would be expected to have differed from those of populations along the Santa Barbara Channel.

To expand our understanding of the Middle-to-Late Period transition in the VAFB region and events leading up to it, thoroughly dated sites or site components representing clearly discrete segments of time need to be identified and studied. Because many of the coastal sites of the VAFB region were occupied over a relatively short period and because site deposits often are well stratified, the potential to develop an understanding of the relatively rapid cultural changes of this transition period is high. Our analysis of column samples from CA-SBA-699 may be seen as a demonstration of this potential, even though our conclusions necessarily must remain restricted in scope.

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