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## REPORT

## Filling the Gaps: CA-SMI-274, a 10,500-Year-Old Shell Midden on San Miguel Island

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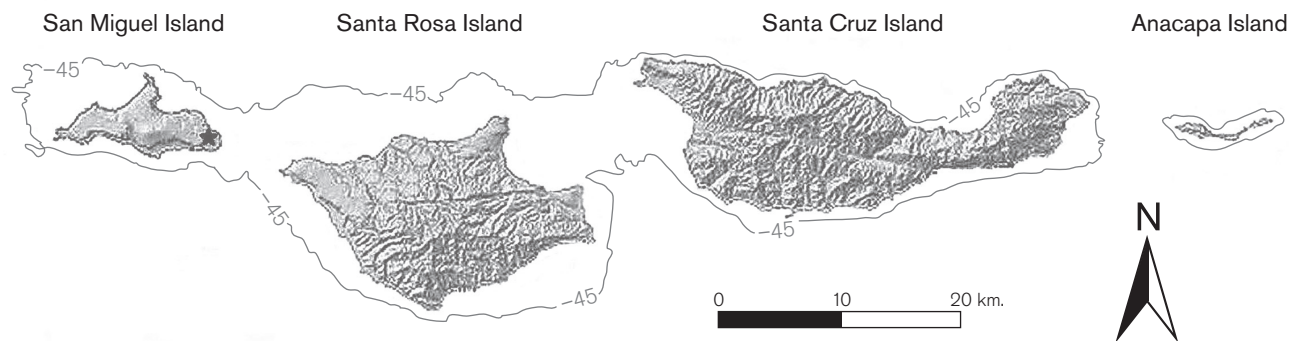
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*Despite dramatic growth in the number of Terminal Pleistocene and Early Holocene sites known from California's Northern Channel Islands, two substantial chronological gaps have remained for which no early sites had been found—one between ~10,000 and 11,400 cal B.P. and another between ~12,200 and 12,900 cal B.P. These gaps have led some scholars to propose that the Northern Channel Islands may have been abandoned by Paleo-coastal peoples for substantial periods, while others have suggested that the number of early sites is too limited*

*to be confident that the gaps are not due to sampling or preservation issues. Here we summarize what is known about CA-SMI-274, a San Miguel Island shell midden recently dated to ~10,500 cal B.P. The site fills a portion of the later gap and sheds some light on a previously unknown period in the deep archaeological history of the islands.*

Across the state of California, there are very few stratified archaeological sites securely dated to before 10,000 cal B.P. (Jones and Kennett 2012). Many of the known sites of this age are located on California's Northern Channel Islands (Fig. 1) and have been identified relatively recently (Erlandson et al. 2011; Johnson et al. 2002; Rick and Erlandson 2012). The Channel Islands have long been known for the intensity and antiquity of their human settlement (see Arnold 2000; Erlandson 1994; Glassow 1980; Heye 1921; Kennett 2005; Orr 1968; Rick et al. 2005; Rogers 1929; Schumacher 1877), but until recently we knew relatively little about the earliest islanders and their adaptations. The past decade has witnessed an intensification in the search for early Channel Island sites, and more than 60 Terminal Pleistocene and Early Holocene sites have been identified on the northern islands alone, with most being located on San Miguel and Santa Rosa islands (see Braje et al. 2013; Erlandson, Moss, and Des Lauriers 2008; Erlandson et al. 2011). Investigation of these sites has advanced

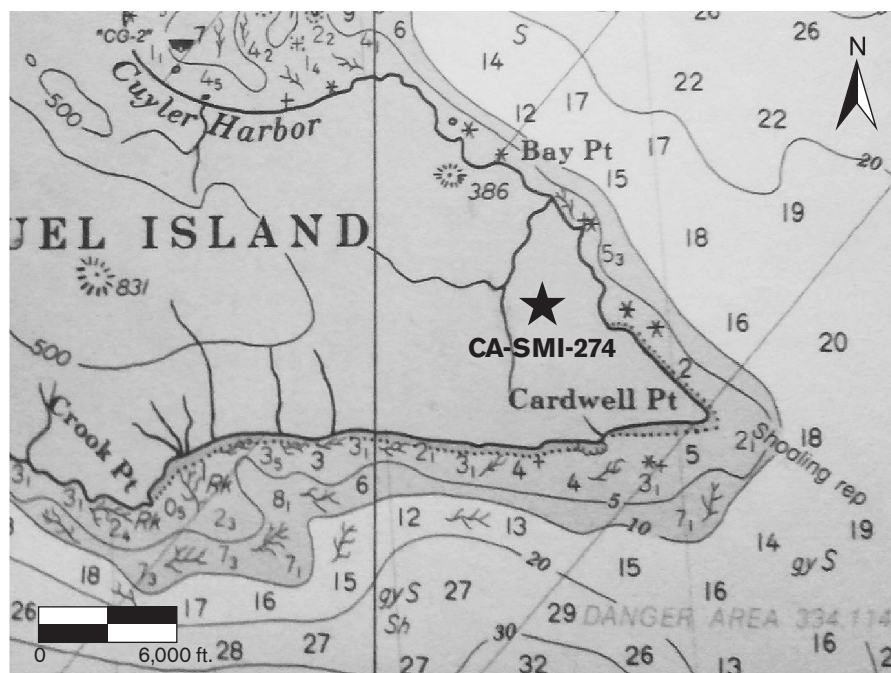


**Figure 1.** The Northern Channel Islands, showing the general location of CA-SMI-274 (black star) in relation to the modern geography and the ~45 m. bathymetric contour, which approximates the location of the paleoshoreline at 10,500 cal B.P. (adapted from Kennett et al. 2008).

our understanding of these early maritime peoples—including their technologies, settlement, and subsistence—but much remains to be learned about Paleocoastal lifeways. Although human occupation of the islands is thought to have spanned at least 13,000 years, for instance, questions remain about the permanence and nature of the earliest settlement. Were the islands occupied permanently and continuously, or were they abandoned at times or used only seasonally by early mainland peoples?

Recent research has begun to answer such questions and fill some of these spatial and chronological gaps. Numerous Paleocoastal artifacts (i.e., chipped stone crescents and stemmed points) found in museum collections have been studied, several early sites have been found and excavated on Santa Cruz Island (Glassow et al. 2008; Gusick 2012, 2013), and work at Terminal Pleistocene sites on San Miguel and Santa Rosa has broadened our understanding of the technologies and adaptations of Paleocoastal peoples (see Erlandson et al. 2011; Rick and Erlandson 2012).

Despite the rapid growth in the number of Paleocoastal sites identified on the Northern Channel Islands, two substantial temporal gaps have persisted, one between ~10,200 and 11,400 cal B.P. and another between ~12,200 and 12,900 cal B.P. (Jones and Kennett 2012; Kennett et al. 2008). For the past several years, members of the Paleocoastal Research Project have focused on surveys, <sup>14</sup>C dating, surface collections, and excavations that are shedding new light on the Paleocoastal period on the northern islands. In this paper, we report on a recently dated San Miguel Island site, CA-SMI-274, that fills a portion of the later gap and provides the first data about settlement and subsistence patterns during a previously unknown period in the archaeological history of the Northern Channel Islands.



**Figure 2.** Nautical chart of eastern San Miguel Island showing the general location of Willow Canyon and CA-SMI-274. The shoreline ~10,500 years ago was probably slightly beyond the 20 fathom line (from NOAA 1986 chart for San Miguel Passage, soundings in fathoms).

#### SITE LOCATION AND BACKGROUND

CA-SMI-274 is situated on northeastern San Miguel Island in Willow Canyon, the largest drainage on the island, about one kilometer from the point where Willow Creek currently flows into the sea (Fig. 2). Located along the main stem of Willow Creek where it divides into western and eastern forks, the site rests on a small knoll about 140–160 feet above sea level, on an ancient dune ridge that once crossed Willow Canyon. In its modern geographical context, the site would have provided access to freshwater, nearby chert sources, terrestrial plant resources, and a mix of nearshore marine habitats around the margins of eastern San Miguel, all located within 1–2 km. of the site. More than 10,000 years ago, however, when it appears that the site was first occupied, sea levels were probably 40–50 m. lower than at present (see Kennett et al. 2008; Muhs et al. 2012) and the distance to shorelines along the northeast coast may have been more than double what it is today.

First recorded by George Kritzman and Jim West (1966), CA-SMI-274 was one of 542 sites recorded on San Miguel by a team led by Charles Rozaire (1976) in the mid-1960s. Kritzman and West described the site as

a shallow and heavily eroded shell midden, “probably an old campsite” that “appears to have some antiquity.” They estimated the size of the site as 400 ft. (~120 m.) long and 150 ft. (~45 m.) wide, but noted that midden was observed in a “solidified thin layer” in a smaller (~2 x 3 m. wide) area marked by a light tan sandy soil. They noted the presence of hammer stones, a chopper, a core, and flaked stone tool-making debris. They made no mention of bone being observed at the site, but described the midden as consisting primarily of California mussel shells, with some red and black abalone, chitons, dogwinkle, and platform mussel. In the western site area, they also noted the presence of “a small 5' high shell mound covered with vegetation” and stated that with a little more erosion “the site will disappear.” This small shell mound has apparently disappeared, but remnants of the basal shell midden soil have survived.

George Toren and Rick Wessel of Greenwood and Associates next visited the site in 1977. They noted that most of the site (~70%) had been severely eroded to a caliche hardpan, with most of the rest covered with wind-blown sand (Greenwood 1978). Estimating the site size as 75 m. long (NW-SE) and 30 m. wide (NE-SW), they noted the presence of a sandstone slab, a large quartzite cobble core/chopper, numerous flakes of chalcedony, with others made from brown and black cherts, and andesite. They estimated that California mussels made up 99% of the shellfish remains, with smaller amounts of platform mussel, black abalone, small chitons, keyhole limpet, and dogwinkle. The only bone noted at the site was from historic sheep. Following Kritzman and West (1966), Toren and Wessel (in Greenwood 1978) mapped the location of CA-SMI-274 at an elevation of 185–205 ft. above sea level, placing it on a higher knoll to the southeast. However, the sketch map they drew—and the discovery of a site stake left behind by Rozaire’s crew—makes it clear that the site they visited and described was located on the lower ridge and knoll immediately above Willow Creek. In summarizing their work at CA-SMI-274, Greenwood (1978:160) noted that it was impossible to assess the age of the site from the non-diagnostic artifacts observed or from the cementation of the site soil, but she recommended that the site “should be examined and tested further for midden analysis and dating.”

In 2009, more than 30 years later, a University of Oregon team consisting of J. Erlandson, N. Jew, C. Billings,

and K. Hamm visited CA-SMI-274 as part of a program of site monitoring and assessment funded by Channel Islands National Park and the United States Navy. We found archaeological materials scattered over an area ~80 m. long and 40 m. wide, mostly capping an ancient linear dune ridge. Similar to previous assessments, we found the site to be heavily eroded, with many artifacts and shell fragments deflated onto bare caliche hardpan, but with patches of apparently intact shell midden still present atop the dune crest in the western area and on a north-facing slope in the northeast area. The artifacts we observed consisted mostly of tool-making debris and expedient flake tools of Cico chert, andesitic metavolcanics, and Monterey/Tuqan chert. Sources of both chert types are found nearby, including cobbles found in raised and modern beaches as well as occasional cobbles found in the dry bed of lower Willow Creek (see Erlandson et al. 1997; Erlandson, Braje, and Rick 2008). Also noted on the site surface were numerous California mussel shells, with much smaller quantities of black and red abalone, owl limpet (*Lottia gigantea*), Pismo clam (*Tivela stultorum*), and keyhole limpet (*Megathura crenulata*) (Erlandson and Jew 2012).

As part of our 2009 assessment, we collected California mussel shells from the intact remnants of the site on the crest of the ridge in the center of the western site area. These well preserved mussel shells were cleaned of adhering sediments, etched in a 10% hydrochloric acid solution to remove the outer 40–50 percent of the shell most susceptible to contamination or replacement with younger or older carbonates, and then submitted to AMS <sup>14</sup>C labs for dating. The first sample, dated by the Woods Hole National Oceanic Sciences AMS (N.O.S.A.M.S.) laboratory, produced an uncalibrated age of 9,760 ± 35 (OS-255083). Calibration of this date, including a 225 ± 35 adjustment for the local marine reservoir effect (ΔR), resulted in an estimated calendar range (at 2 sigma) of 10,510–10,250 cal B.P. A second shell sample was sent to the DirectAMS laboratory for independent confirmation and was dated to 9,950 ± 40 R.Y.B.P. (DAMS-1217-171), with an estimated calendar age of 10,720–10,480 cal B.P. A pooled mean of these two dates results in an estimated age of 9,850 ± 36 R.Y.B.P., with a calibrated age range of 10,550 to 10,450 cal B.P. Because there is some evidence that upwelling was less intense in the Santa Barbara Channel area during the very early Holocene (reducing

the  $\Delta R$  for marine samples; see Erlandson et al. 1996; Kennett et al. 1997), CA-SMI-274 may actually have been occupied a century or two earlier.

In 2012, to mitigate the loss of archaeological materials to severe erosion, Erlandson and K. Gill conducted a systematic surface reconnaissance of the site, collecting several artifacts from the site surface. These included four non-diagnostic biface preforms, two made from chalcedonic Cico chert and two from Tuqan/Monterey chert. This reconnaissance also noted numerous fragments of small calichified root casts (rhizoconcretions) littering the site surface, suggesting that some or all of the site had been covered by Holocene dune sand, probably until the historic period when the introduction of sheep led to overgrazing and severe soil and dune erosion on San Miguel Island (Erlandson et al. 2005; Johnson 1972). Despite such disturbance, patches of intact shell midden still exist at CA-SMI-274, although they continue to be impacted by erosion.

To help further document the nature of this ancient and significant site, Erlandson, A. Ainis, and K. Gill excavated a shallow 1 x 1 m. test unit (Unit 1) atop the knoll in the western part of CA-SMI-274 (Fig. 3). Essentially a surface scrape, Unit 1 encountered just over 10 cm. of intact shell midden soil, producing 109 liters of sandy soil that was screened over 1/8-inch mesh in the field. Laboratory analysis of the screen residuals from Unit 1 produced 16 chipped stone artifacts, including one possible flake tool of siliceous shale and an assortment of non-diagnostic tool-making debris made from Tuqan/Monterey chert (n=6), siliceous shale (n=3), Cico chert (n=4), and quartzite (n=1). Also recovered were very small amounts of charcoal, one small fragment of red ochre that may or may not be of natural origin, and land snail (*Helminthoglypta ayresiana*) shells that are almost



**Figure 3. K. Gill (left) and A. Ainis screening sediments from the shallow Unit 1 excavated in the western portion of CA-SMI-274. The east fork of Willow Canyon is seen in the background (facing south, 2012 photo by J. Erlandson).**

certainly of natural origin. Unit 1 also produced a variety of relatively well-preserved faunal remains, including small amounts of bone (1 unidentified burned bird bone, 1 fish otolith, and 3 small fragments of unidentified bone) and a much larger sample of marine shellfish remains, described below.

### SHELLFISH REMAINS

Considering the small volume of Unit 1, it yielded a relatively large sample of >1.7 kg. of marine shell, an assemblage dominated by shellfish from rocky intertidal habitats (Table 1). At least 21 discrete taxa and 262 individuals are represented in the sample, but California mussels contribute almost 93% of the recovered shellfish by weight and 64% by MNI. Black turban snails comprise the second most abundant taxon, making up 4% of shell weight and roughly 12% of shellfish MNI. Small amounts of black abalone, barnacle, crab, sea urchin, limpets, and other shellfish found in rocky intertidal areas make up most of the rest of the assemblage. Limpets contribute a total of 16% of the MNI represented, but consist almost entirely of small specimens that are probably incidental

**Table 1****SHELLFISH REMAINS FROM TEST UNIT 1, CA-SMI-274**

Taxon	MNI	MNI%	Wt. (g.)	Wt. %
<i>Balanus</i> spp. (Acorn barnacles, undif.)	4	1.5	16.7	1.0
<i>Chlorostoma funebris</i> (Black turban snail)	30	11.5	73.1	4.2
<i>Fissurella volcano</i> (Volcano limpet)	1	0.4	0.3	0.0
<i>Haliotis cracherodii</i> (Black abalone)	2	0.8	6.2	0.4
<i>Littorina</i> spp. (Periwinkles, undif.)	2	0.8	0.2	0.0
<i>Lottia conus</i> (Ribbed limpet)	3	1.1	0.1	0.0
<i>Lottia digitalis</i> (Fingered limpet)	3	1.1	0.6	0.0
<i>Lottia insessa</i> (Seaweed limpet)	13	5.0	1.0	0.1
<i>Lottia pelta</i> (Shield limpet)	4	1.5	0.1	0.0
<i>Lottia scabra</i> (Rough limpet)	8	3.1	0.2	0.0
<i>Lottia</i> spp. (Limpets, undif.)	10	3.8	0.5	0.0
<i>Mytilus californianus</i> (California mussel)	168	64.1	1,595.5	92.6
<i>Pollicipes polymerus</i> (Goose barnacle)	1	0.4	0.7	0.0
<i>Protothaca</i> spp. (Littleneck clams, undif.)	2	0.8	1.5	0.1
<i>Septifer bifurcatus</i> (Bifurcate mussel)	4	1.5	2.8	0.2
<i>Strongylocentrotus</i> spp. (Sea urchins, undif.)	1	0.4	2.5	0.1
Polyplacophora (Chitons, undif.)	2	0.8	0.3	0.0
Vermetidae (Worm shells)	–	–	0.1	0.0
Clam undif.	2	0.8	<0.1	0.0
Crab undif.	1	0.4	4.6	0.3
Gastropod undif.	1	0.4	0.1	0.0
Nacre undif.	–	–	11.2	0.7
Marine shell undif.	–	–	4.3	0.3
<b>Totals</b>	<b>262</b>	<b>100.0</b>	<b>1,722.8</b>	<b>100.0</b>

Notes: undifferentiated nacre refers to small nacreous fragments of mussel and/or abalone; one large *Protothaca* fragment is beach-rolled, with marine growth on the interior, suggesting that it was transported to the site incidentally; MNI values for general categories are only provided if from a different taxon than the others identified. MNI for bivalves was calculated using the highest number of sided umbos; MNI for gastropods was calculated using apices; an MNI of 1 was given to all other shellfish taxa with the presence of an identifiable fragment

midden constituents brought to the site as ‘riders’ on mussels and other larger edible shellfish (see Jones and Richman 1995). A single volcano limpet may be an exception, along with 13 seaweed limpets (*Lottia insessa*) that are typically found on the stipes and holdfasts of the feather boa kelp (*Egregia menziesii*), which are edible and may have been transported to the site. A few small clam or gastropod fragments were also recovered.

The dominance of California mussels is relatively common in Terminal Pleistocene and Early Holocene shellfish assemblages (Erlandson et al. 2011; Rick and Erlandson 2012:95) on the Northern Channel Islands, as is the relative dearth of vertebrate remains. The California mussel shells recovered in Unit 1 are relatively

fragmented, but shell thicknesses and hinge sizes suggest that most valves were medium-sized, with some evidence for both larger and smaller individuals. Several whole black turban shells, as well as estimated mean weight (total weight/MNI) of turban shells (2.44 g.) suggest that the harvested turban snails were relatively small.

**DISCUSSION AND CONCLUSIONS**

The diversity of the shellfish assemblage, along with the presence of numerous small and light-weight land snail shell, shellfish, charcoal, and bone fragments, suggests that the assemblage from the basal soil in Unit 1 at CA-SMI-274 represents a relatively intact remnant of a shell midden deposited during a relatively brief occupation about 10,500 years ago. The assemblage recovered, especially the artifact and vertebrate remains, is relatively small and it is possible that some of the materials on the site surface may derive from one or more later occupations of the site. However, no demonstrably younger artifacts (mortars, pestles, etc.) have been found during four separate reconnaissance episodes at the site, or in the small-scale excavations reported on here. The dearth of vertebrate remains is also generally consistent with Early Holocene sites on San Miguel Island. Portions of the shell midden are embedded in an ancient and semi-cemented dune soil. The presence of abundant caliche root cast fragments on the site surface also suggests that much of the site was covered by younger dune sand until relatively recently.

Dating to ~10,500 cal B.P., CA-SMI-274 is a rare example of an archaeological site in California occupied prior to 10,000 years ago. Occupied when sea levels were ~40–50 m. lower than present, CA-SMI-274 was probably located several kilometers from contemporary coastlines. Our data provide further evidence that California mussels and other intertidal shellfish were key resources for Paleocoastal peoples on western Santarosae Island.<sup>1</sup> The site location some distance from the coast and adjacent to the largest drainage on San Miguel Island also suggests a concern for access to fresh water, although plant foods and chert tool-stone sources were also present in the general vicinity.

CA-SMI-274 adds to the growing and substantial number of Paleocoastal sites identified on the Northern Channel Islands, contributing to one of the longest and

most complete sequences of maritime adaptations known from the New World. Dating to the earliest Holocene, the site extends the record of essentially continuous human occupation on the islands to at least 10,500 years. More importantly, the site appears to help fill a key gap in an even longer cultural sequence, a period from about 10,000 to 11,400 cal B.P. for which there had been no clear evidence for human occupation on the islands. Because the site fills a portion of a significant gap in the Paleocoastal occupation of the Northern Channel Islands, we are planning additional data recovery to expand the artifact, faunal, and paleobotanical samples from the site.

Finally, Erlandson and Moss (1999; see also Braje et al. 2005) argued that  $^{14}\text{C}$  dating should be more widely used as a systematic reconnaissance tool, a technique that helped identify CA-SMI-274 as a significant archaeological site dating to ~10,500 cal B.P. We have now used such techniques for nearly 20 years on San Miguel Island, where roughly 80 percent of the recorded Native American shell middens have yet to be dated. The percentage of undated shell middens on Santa Rosa, Santa Cruz, and most of the other Channel Islands is considerably higher. Given the number of Channel Island sites that have yet to be recorded or dated, the large number of Paleocoastal sites identified in recent years, and the fact that the coastlines where Paleocoastal peoples would have spent most of their time have been submerged by rising seas, we will not be surprised if the human occupation of the Northern Channel Islands was essentially permanent and continuous for 13,000 years or more.

## NOTES

<sup>1</sup>During the last glacial period lowered sea levels resulted in a large contiguous landmass, including all four Northern Channel Islands, known as Santarosae Island.

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