

REASSESSING HUMAN SETTLEMENT ON THE SOUTH COAST OF SAN MIGUEL ISLAND, CALIFORNIA: THE USE OF ^{14}C DATING AS A RECONNAISSANCE TOOL

Todd J Braje^{1,2} • Jon M Erlandson^{1,3} • Torben C Rick⁴

ABSTRACT. California's San Miguel Island contains over 600 archaeological sites, some occupied as early as 12,000 yr ago and most located along the island's north coast. Archaeologists have long believed the south coast to have been marginal or largely uninhabited. Burial of some landforms by sand dunes deposited after historical overgrazing, the lack of systematic survey, and a dearth of radiocarbon dating have also contributed to an underestimation of the intensity of human land use along the south coast of San Miguel Island. Our recent reconnaissance and dating of shell middens on the island's south coast indicate more intensive occupation than previously thought, with numerous south coast sites spanning at least the past 9000 yr, and demonstrate the utility of combining systematic archaeological reconnaissance and radiometrics in reconstructions of human settlement and historical ecology in coastal environments.

INTRODUCTION

San Miguel Island, the westernmost of California's Northern Channel Islands (Figure 1), contains hundreds of archaeological sites and a nearly continuous record of human occupation spanning at least the past 11,000 to 12,000 calendar years. Along with over a dozen shell middens dating between about 10,500 and 8000 BP (Erlandson et al. 1996; Erlandson and Moss 1996), a stratified occupational record spanning virtually the entire Holocene has been assembled from sites located on the northeast and northwest coasts of the island. Archaeological studies of these well-preserved shell middens—including extensive radiocarbon dating, detailed faunal and technological analyses, and changes in average shellfish size measurements—can help elucidate the human history of the island, the historical ecology of the region, and the changing nature of human impacts on local marine and terrestrial environments (see Erlandson et al. 2004, forthcoming; Rick and Erlandson 2003).

Archaeological studies have been conducted on San Miguel since the late 1800s, and the island was intensively surveyed for archaeological sites during the 1960s, 1970s, and 1980s (Glassow 1980; Greenwood 1978, 1982; Rozaire 1978). Until recently, however, archaeological investigations had been conducted almost exclusively along the island's north coast, where numerous large, multi-component shell middens have been the focus of research. In contrast, relatively little is known about the human use of the south coast, long considered to have been sparsely populated (e.g. Kennett, forthcoming; Rogers 1929:266).

After recent summaries of the historical ecology of the island (Erlandson et al. 2004, forthcoming; Rick and Erlandson 2003), it became clear that we needed to better understand the antiquity and nature of the human use of south coast land and seascapes, and to compare such patterns to what we know from the much better documented north coast. During the last 2 yr, therefore, we have revisited many of the known archaeological sites along the south coast, recorded numerous previously undocumented sites, and initiated a program of systematic ground reconnaissance and ^{14}C dating to document the chronology and nature of human settlement in the area. In this paper, we summarize the results of recent reconnaissance and dating efforts along San Miguel Island's south coast, where we have found a much longer and more extensive record of human occupation than previously recognized, including archaeological sites that span much of the Holocene. Our work illustrates the potential and importance of using ^{14}C dating as a survey tool in reconstructing the human occupational history in coastal and other erosional environments (see Erlandson and Moss 1999).

¹Department of Anthropology, University of Oregon, Eugene, Oregon 97403-1218, USA.

²Corresponding author. Email: tbraje@uoregon.edu.

³Email: jerland@uoregon.edu.

⁴Department of Anthropology, Southern Methodist University, Dallas, Texas 75275-0336, USA. Email: trick@smu.edu.

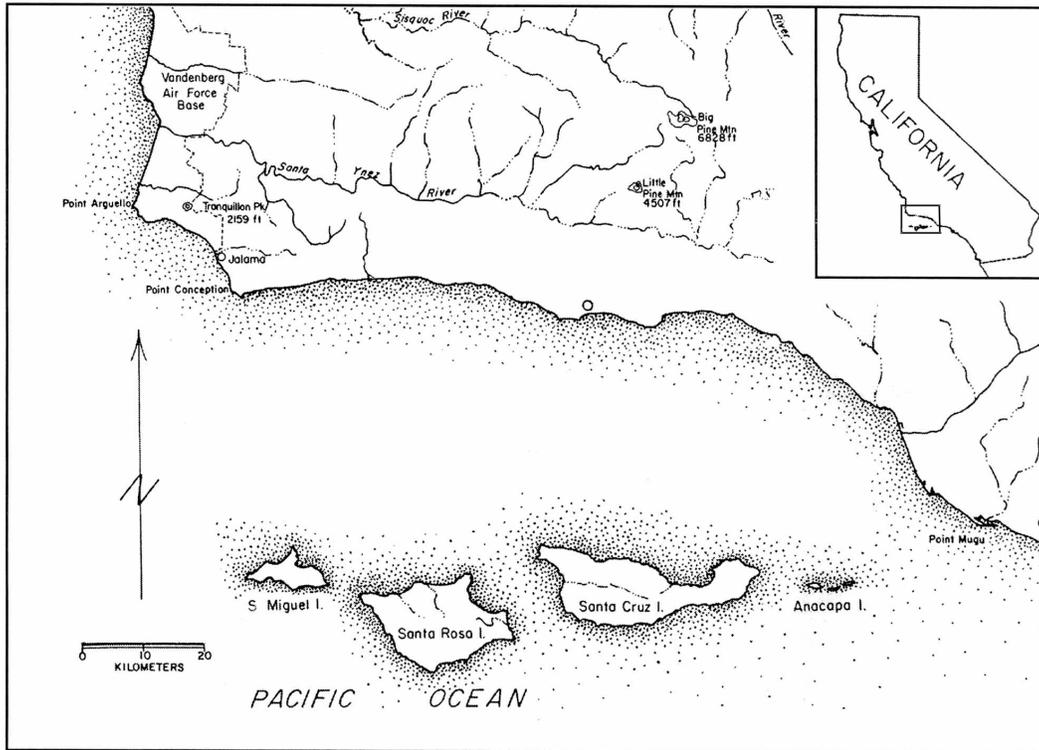


Figure 1 Location of San Miguel Island and the Santa Barbara Channel area

Environmental and Cultural Background

San Miguel is located about 40 km off the Santa Barbara coast. A maximum of about 17 km long and 8 km wide, it encompasses an area of approximately 37 km². The island landscape is dominated by tablelands, raised marine terraces, rolling hills, and shifting dune fields deposited and redeposited by strong northwesterly winds that blow almost continuously off the North Pacific. Two small peaks, Green Mountain and San Miguel Hill, rise from the central mass of the island, reaching elevations of 249 m and 253 m, respectively. The coastline consists of 43 km of rocky shoreline interspersed with sandy beaches. Although the endemic terrestrial flora and fauna are depauperate, the island is surrounded by extensive kelp forests and other marine habitats that support diverse and highly productive populations of marine fishes, shellfish, sea mammals, and sea birds.

San Miguel has a Mediterranean climate with relatively mild temperatures (11.9 to 15.5 °C) throughout the year. The island's climate is heavily influenced by an upwelling of cool oceanic currents, powerful winds, and heavy coastal fog. Rainfall averages just 35.5 cm/yr, falling mostly between January and March, and perennial freshwater sources are limited in number, size, and quality. The island contains only 3 substantial drainages, none of which are located on the south coast (see Kennett 1998), but several springs of marginal quality have been mapped in the area.

The Northern Channel Islands have been separated from the California mainland throughout the Quaternary, although they coalesced into a single landmass (Santarosae) during the last glacial (Jugger and Johnson 1980; Orr 1968). Once thought to have been colonized by humans relatively recently, we now know that the Northern Channel Islands were first settled at least 12,000 to 13,000

calendar years ago (Erlandson et al. 1996; Johnson et al. 2000). San Miguel is one of four Northern Channel Islands occupied historically by the Chumash Indians, and archaeological evidence suggests that the larger Santa Barbara Channel region was occupied by the Chumash and their ancestors for millennia—possibly throughout the Holocene. By about AD 1000, the coastal Chumash had developed a complex and sophisticated maritime society, organized in a number of relatively large villages and towns led by hereditary chiefs, with extensive craft-specialization and regional trade networks facilitated by the production and use of a shell bead currency (see Arnold 1992, 2000; King 1990). First contacted by Europeans in AD 1542–3, when 3 Spanish ships commanded by Juan Rodriguez Cabrillo wintered on San Miguel, the Island Chumash may have been impacted early by Old World diseases (Erlandson and Bartoy 1995; Erlandson et al. 2001). Nonetheless, historical accounts suggest that they were thriving when the Spanish first settled Alta California in AD 1769. By about AD 1822, however, the last of the Island Chumash had been removed to Spanish missions or towns on the mainland.

Starting in the mid-1850s, overgrazing by sheep and other livestock introduced by American ranchers resulted in severe vegetation stripping, dune destabilization, and soil erosion (Johnson 1980; Rick and Erlandson 2003), rendering San Miguel Island into a “sand waste.” During the mid-1900s, the island was also used as a bombing range by the US military. With the removal of livestock, the cessation of bombing, and careful management by the US Navy and National Park Service, the island’s vegetation is now undergoing a dramatic recovery. Preliminary observations suggest that the hydrology of the island (dune aquifers) may also be recovering and that freshwater sources may have been more abundant and reliable prior to European contact.

The “Marginal” South Coast

Our understanding of San Miguel Island archaeology has been hindered by the differential intensity of archaeological investigations on the north and south shores of the island. Conclusions concerning the limited nature of human occupation along the south coast were formed early and have changed little over the past 75 yr. Investigation by antiquarians in the late 1800s and early 1900s focused on the excavation of numerous cemeteries, nearly all of which were located along the north coast of the island (e.g. Heye 1921: Plate II). D B Rogers (1929) of the Santa Barbara Museum of Natural History conducted the first reasonably thorough shoreline survey in the 1920s, systematically walking the perimeter of the entire island. As Figure 2 shows, he recorded extensive aggregations of archaeological sites on the north coast, but he found little evidence of occupation on the south coast. Rogers (1929:266) concluded that the “southern shore of the island had, broadly speaking, been unpopular with the Indians as a residential site.”

From 1963 to 1966, an intensive survey of the island by archaeologists from the Los Angeles County Museum of Natural History was directed by Rozaire and Kritzman. Of the 542 sites recorded, only about 60 were located along the south coast (Rozaire 1978). Subsequent survey work has been conducted by Greenwood (1978, 1982), Glassow (1980), Kennett (1998), and ourselves (e.g. Erlandson 2001; Rick and Erlandson 2004), bringing the total number of recorded sites to 608. Of these, only 67 (11%) are located along the south coast. Our recent work, however, like Glassow’s 1980 survey, demonstrates that large numbers of archaeological sites remain undocumented and unrecorded on the south coast of San Miguel Island.

Investigations over the past 30 yr have also yielded over 200 ¹⁴C dates from island archaeological sites. Until recently, however, only 1 south coast site had been dated, a deeply buried “red abalone” midden near Crook Point that Glassow (1980) dated to about 6000 yr ago. The dearth of dated sites has seriously hindered our ability to understand the antiquity and chronology of human settlement, subsistence, and demography along the south coast.

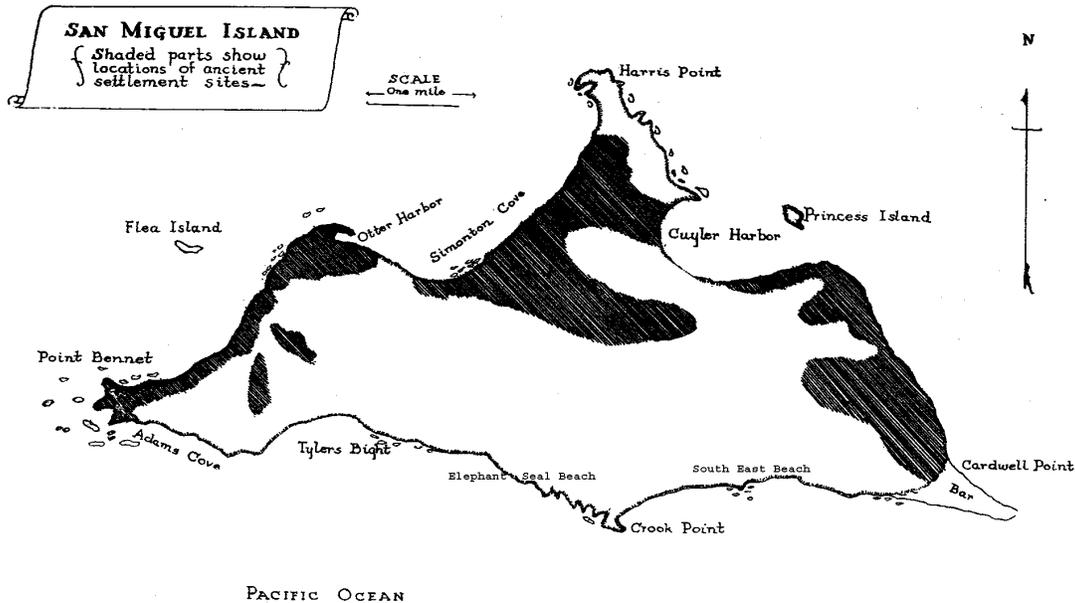


Figure 2 Rogers' (1929) map of the distribution of archaeological sites on San Miguel Island

The view that the south coast of San Miguel Island was not heavily used contrasts with the occupational record for extensive and permanent settlement of the southern coastlines of Santa Rosa and Santa Cruz islands, which included at least 5 relatively large historic Chumash villages (see Kennett, forthcoming). Moreover, the south coast of San Miguel offers several major advantages to people on both the land and the sea. First, it is relatively sheltered from the strong northwesterly winds and ocean swells that sweep the island most of the year. Several sources of freshwater have also been identified, including springs in the Crook Point area and intermittent streams or seeps much more widely available. Finally, the south coast also contains extensive rocky intertidal, kelp forest, and shallow rocky reef habitats that support an abundance of marine resources.

Some hints of the possibility of extensive and intensive human settlement along the southern boundary of San Miguel Island have emerged over the years. For instance, site records prepared by Kritzman, Rozaire, and Greenwood refer to several locations containing human burials. The presence of burials and associated midden deposits suggests a degree of sedentism that seems more consistent with village occupations than with relatively brief or specialized logistical use of the area. In 1980, Glassow identified 22 previously unrecorded archaeological sites in a systematic survey of 2 quarter-mile-wide transects that ran north-south across sections of the south coast east of Crook Point. If the total number (15) of south coast sites recorded for these 2 transects is representative of the entire south coast, as many as 255 sites may be present along the 14 km of coastline from Cardwell Point to Point Bennett.

METHODS

For more than a decade, University of Oregon archaeologists have been engaged in an intensive study of the archaeology and historical ecology of San Miguel Island, work that has also assisted the National Park Service in managing and interpreting the cultural and natural resources of the island. In 2000 and 2001, as part of a search for early sites on San Miguel, Erlandson visited and dated shell

middens associated with 2 small rockshelters overlooking the southwest coast and conducted a preliminary reconnaissance of some south coast springs.

From 2002 to 2004, as part of a project to assess the condition of eroding and endangered sites on San Miguel and Santa Rosa islands, we visited scores of recorded sites located in various areas on San Miguel Island and collected numerous ^{14}C samples to help develop a chronology of island site occupation, environmental changes, and human demography (Rick and Erlandson 2004). We selected several discrete study areas of the island for relatively intensive site assessment work, including the Crook Point, Tyler Bight, and Point Bennett areas along the southern shoreline. Prior to the 2002–4 field work, we conducted background research on the nature of known south coast sites, including the compilation of information on their location, size, structure, and contents, as recorded by various archaeologists during visits over the past 40 yr.

For our current work, we defined the south coast area as extending from Point Bennett on the west to Cardwell Point on the east, and including all land located between the ocean and the rim of the steep southern escarpment, which varies from about 80 to 170 m in elevation. Following our background research, we used pedestrian survey techniques to relocate the known sites selected for condition assessments, mapped their locations using Global Positioning System technology, documented the current condition of the sites, and, wherever possible, collected organic samples from erosional exposures for ^{14}C dating. In the process of relocating known sites in our survey areas, we also found numerous Native American shell middens that had not been documented. Many of the previously recorded sites had also badly eroded in the roughly 20-yr period since they were recorded, suggesting this area is relatively dynamic.

RESULTS AND DISCUSSION

In relocating several south coast sites chosen for assessment, we found at least 22 shell middens that had not been recorded. The previously recorded and newly discovered sites ranged from small rock shelters to large open sites and appear to encompass a range of site types from short-term camps or shellfish processing locations, to seasonal encampments, to villages with substantial midden deposits and human burials.

One of our south coast survey areas was near the southwest end of the island, from Adams Cove to Tyler Bight. Here, high on the bluffs overlooking the southwest coast, the badly eroded remnants of 3 shell middens (CA-SMI-575, -577, and -578) were evaluated. In this windswept region, where a vast area has been largely denuded of soil, we found isolated soil islands containing shell midden deposits of low to moderate density. Well-preserved shells from these middens were recently dated to about 8800, 8700, and 1160 cal BP (Table 1). In response to erosion caused by seals and sea lions hauling out on CA-SMI-602 at Adams Cove, Walker et al. (2000) also investigated this sizeable shell midden, dating it between about AD 1500 and 1800. Over the years, a number of human burials have eroded out of this site and Walker et al. (2000) tentatively identified the remains of a house floor. More recent examination of CA-SMI-602 by Erlandson and Rick identified at least 8 large house depressions, confirming that a substantial Chumash village existed along the southwest coast during Protohistoric and early Historic times (Rick 2004). Another large site (CA-SMI-520) near the west end of Tyler Bight contains multiple occupational components, including discrete shell middens dated to about 5860 and 3300 yr. We also dated shell middens located in 2 small rock shelters (CA-SMI-516 and -573) situated high on the escarpment overlooking Tyler Bight—one to Protohistoric times, the other to about 2400 yr ago.

Table 1 Radiocarbon dates from the south coast of San Miguel Island, California.

| Site# ^a SMI- | Material ^b | Lab # | Provenience | ¹⁴ C age | Uncorrected ¹⁴ C age | ¹³ C/ ¹² C adjusted | Age range (cal BP, 1 σ) | Approximate location |
|----------------------------|-----------------------|-------------|-------------------------------------|---------------------|------------------------------------|--|------------------------------------|-------------------------|
| 188 | Mc | Beta-180767 | Base of midden (25 cm bs) | 6050 \pm 90 | 6400 \pm 90 | 6400 \pm 90 | 6725–6490 | Crook Point |
| 190 | Hr | Beta-180768 | Upper 10 cm in 30 cm midden | 1670 \pm 60 | 2110 \pm 60 | 2110 \pm 60 | 1515–1345 | Crook Point |
| 192 | Hr | Beta-180769 | 10 cm surface midden | 1380 \pm 60 | 1810 \pm 60 | 1810 \pm 60 | 1235–1055 | Crook Point |
| 232 | Hr | Beta-180770 | East gully wall, near base | 1370 \pm 60 | 1810 \pm 60 | 1810 \pm 60 | 1230–1060 | South East Beach |
| 232 | Mc | OS-44639 | Unit 1, Column sample | N/A | 1910 \pm 30 | 1910 \pm 30 | 1280–1200 | South East Beach |
| 516 | Hc | Beta-145312 | Cave mouth, 35–40 above bedrock | 430 \pm 60 | 860 \pm 60 | 860 \pm 60 | 320–250 | Elephant Seal Beach |
| 516 | Hc | Beta-145313 | Cave mouth, 70 cm above bedrock | 520 \pm 90 | 950 \pm 90 | 950 \pm 90 | 470–280 | Elephant Seal Beach |
| 520 | Mc | OS-37736 | Surface | N/A | 3630 \pm 25 | 3630 \pm 25 | 3330–3220 | Tyler Bight |
| 520 | Hr | Beta-171805 | Surface | 5250 \pm 80 | 5680 \pm 80 | 5680 \pm 80 | 5920–5720 | Tyler Bight |
| 557* | Hr | UCR-1831 | Exposure, 5 m | 5525 \pm 130 | 5955 \pm 130 | 5955 \pm 130 | 6280–5960 | South East Beach |
| 557 | Hr | OS-44640 | Bulk Sample 1 | N/A | 6310 \pm 35 | 6310 \pm 35 | 6400–6565 | South East Beach |
| 573 | Cr | Beta-145316 | 2–3 cm bs in overhang | 2520 \pm 90 | 2950 \pm 90 | 2950 \pm 90 | 2610–2320 | Tyler Bight |
| 575 | Mc | OS-42695 | Soil island SE of Pt. Bennett trail | N/A | 1830 \pm 25 | 1830 \pm 25 | 1220–1120 | Tyler Bight |
| 577 | Mc | OS-42737 | SE most intact soil island | N/A | 8540 \pm 35 | 8540 \pm 35 | 8910–8760 | Tyler Bight |
| 578 | Mc | OS-42738 | Site adjacent to eagle nest | N/A | 8500 \pm 40 | 8500 \pm 40 | 8870–8700 | Tyler Bight |
| 602* | Mc | Beta-098743 | Unit 2, 39 cm | 460 \pm 60 | 900 \pm 60 | 900 \pm 60 | 400–260 | Adams Cove |
| 602* | Mc | Beta-098744 | Unit 5, 48 cm | 650 \pm 60 | 1100 \pm 60 | 1100 \pm 60 | 530–450 | Adams Cove |
| 602* | Mc | Beta-114533 | Unit 2, 10 cm/Stratum A | 310 \pm 60 | 730 \pm 60 | 730 \pm 60 | 270–80 | Adams Cove |
| 602* | Mc | Beta-098742 | Unit 5, 10 cm | 650 \pm 70 | 1100 \pm 70 | 1100 \pm 70 | 530–440 | Adams Cove |
| 608 | Mc | OS-44638 | Unit 1 Bulk sample | N/A | 9200 \pm 50 | 9200 \pm 50 | 9800–9440 | Elephant Seal Beach |
| 608 | Mc | Beta-180771 | Gully wall, SE site area | 8020 \pm 80 | 8430 \pm 80 | 8430 \pm 80 | 8900–8575 | Elephant Seal Beach |
| JPI1 | Mc | OS-43079 | Dune paleosol | N/A | 1680 \pm 30 | 1680 \pm 30 | 1040–950 | Tyler Bight |
| SC2 | Hr | Beta-183156 | Gully wall, NW site area | 5650 \pm 60 | 6090 \pm 60 | 6090 \pm 60 | 6340–6210 | Elephant Seal Beach |
| SC22 | L | Beta-190678 | Surface | 4670 \pm 50 | 5080 \pm 50 | 5080 \pm 50 | 5280–5040 | Crook Point area |
| SC64 | Cr | Beta-195745 | Southern loci, E gully wall | 6240 \pm 80 | 6670 \pm 80 | 6670 \pm 80 | 7020–6800 | Crook Point area |

^a * Denotes sites dated by previous researchers.

^b Mc = *Mytilus californianus*; Hr = *H. rufescens*; Hc = *H. cracherodii*; Cr = *Cryptochiton stelleri*; L = *Lottia gigantea*.

A second focus of our reconnaissance and dating program was located near Crook Point on the south-central coast. Here, several sites had been described that reportedly contained burials. In relocating 11 previously recorded sites in this area, we traversed a series of arroyo complexes in the Crook Point area and discovered at least 13 unrecorded shell middens, many of them buried sites exposed only in gully walls. These buried shell lenses varied in depth and composition, but consisted mostly of California mussel (*Mytilus californianus*) and abalone (*Haliotis* spp.). What is most surprising is not the density or composition of the deposits but that shell lenses were found in every arroyo and were highly visible from the gully walls. Many of these unrecorded shell middens were rapidly eroding, spreading the deposits up to 100 m or more from their likely places of origin.

Unlike the north coast, at least some of the sites we have found—including several of the most substantial shell middens—are not located adjacent to the modern shoreline. Instead, they are located along the northern margin of the coastal plain, near the base of the steep escarpment that separates the south coast from the tablelands of the island's interior. These locations offer greater protection from the northwesterly winds and better access to freshwater sources. In addition to the 5 ¹⁴C dates obtained by Glassow (1980) and Walker et al. (2000) for 2 south coast sites, we have added another 20 dates from 15 sites. Although there are several gaps in the sequence, we now have dates ranging from over 9400 cal BP to Protohistoric and Historic times (about AD 1540 to 1820). Three sites have been dated to the Early Holocene, six to the Middle Holocene, and eight to the Late Holocene.

Our recent research suggests that human use of San Miguel's south coast by the Chumash and their ancestors was more extensive than previously thought and began more than 3000 yr earlier than previously documented. One reason that few sites have been recorded in the area may be that portions of the coastal plain were blanketed historically by dune sand deposited after historical overgrazing destabilized the island's extensive dune fields (see Erlandson et al., forthcoming). Our recent work shows that thick layers of sand cover some portions of the south coast and that numerous shell middens have been identified eroding from paleosols exposed in gullies that are cutting through this sand overburden. Thus, other sites may only have been exposed by the recent downcutting, headward erosion, and expansion of the numerous gully complexes that dissect the coastal plain along the south coast. Also contributing to the limited number of recorded sites, however, is the longstanding historical perception that the south coast was less heavily occupied, which has resulted in more cursory reconnaissance efforts by archaeologists, almost no systematic excavations of south coast sites, and only limited ¹⁴C dating.

CONCLUSIONS

The north coast of San Miguel Island was probably the primary focus of settlement by the Chumash and their ancestors. Our recent research suggests, however, that the south coast of the island was more intensively settled than previously recognized and that such settlement began at least 9000 yr ago. Lingering preconceptions about the marginality of the south coast are contradicted by the number and variety of site types present in the area, the antiquity of human settlement, and the productivity of its intertidal, kelp forest, and other habitats. Unfortunately, these preconceptions have limited the amount of systematic survey, excavation, and ¹⁴C dating done along the south coast, contributing to the marginalization of that area by archaeologists. We believe the presence of several springs, the shelter provided from the strong northwesterly winds and swells, and the productivity of nearshore resources all indicate the south coast to have been considerably more attractive to coastal foragers than previously believed.

Ironically, although erosion has exposed many of the newly identified sites, such erosion also threatens their continued existence. Virtually all the south coast sites we have examined are in danger of being lost to rapid coastal erosion, slope wash and gullying, or the effects of seals or sea lions hauling out on them. Protected for decades under sheets of sand stripped off windward north coast landforms and deposited on the lee side of the island, the exposure and rapid erosion of many south coast sites now requires a timely response to survey the expanding gully systems, sample the identified archaeological deposits, and secure material for ^{14}C dating and other analyses. We now are conducting such survey, sampling, dating, and analyses to help understand the history of the human use of the south coast, the historical ecology of its unique ecosystems, and the impacts that humans have had on them.

Around the world we are rapidly losing valuable archaeological, historical, and ecological data sets to erosion and other destructive processes at an alarming rate. As one response to such problems in coastal areas, Erlandson and Moss (1999) advocated the systematic collection and dating of organic samples during survey projects to help facilitate site management, prioritize sites for further research, and aid in a variety of regional research projects. They demonstrated, for instance, how ^{14}C dating of numerous sites can help identify and explain changes in local environments as well as human settlement, demography, and social organization within a region through time (see also Erlandson et al. 2001). By applying such methods to the archaeological record of the south coast of San Miguel Island, we have also demonstrated their effectiveness in rapidly illuminating the long history of human settlement in a poorly known area.

ACKNOWLEDGMENTS

Our research was supported by Channel Islands National Park (Grant #CA8120-00-007), the Western National Parks Association, the US Navy, the National Science Foundation, the Foundation for Exploration and Research on Cultural Origins, and the University of Oregon. We thank Ann Huston, Georganna Hawley, Kelly Minas, Bob DeLong (NMFS), Steve Schwartz, and Ian Williams for their time and support. We are also grateful to Doug Kennett, the editors, and an anonymous reviewer for their comments and assistance in the final revisions and production of this paper.

REFERENCES

- Arnold JE. 1992. Complex hunter-gatherer-fishers of prehistoric California: chiefs, specialists, and maritime adaptations of the Channel Islands. *American Antiquity* 57(1):60–84.
- Arnold JE. 2000. The origins of hierarchy and the nature of hierarchical structures in prehistoric California. In: *Hierarchies in Action: Cui Bono?* Carbondale, California: Center for Archaeological Investigations. p 221–40.
- Erlandson JM. 2001. The search for early shell middens on San Miguel Island, California. Unpublished report submitted to The Foundation for the Exploration and Research on Cultural Origins and Channel Islands National Park.
- Erlandson JM, Bartoy K. 1995. Cabrillo, the Chumash, and Old World diseases. *Journal of California and Great Basin Anthropology* 17(2):153–73.
- Erlandson JM, Kennett DJ, Ingram BL, Guthrie DA, Morris DP, Tveskov MA, West GJ, Walker PL. 1996. An archaeological and paleontological chronology for Daisy Cave (CA-SMI-261), San Miguel Island, California. *Radiocarbon* 38(2):355–73.
- Erlandson JM, Moss ML. 1996. The Pleistocene-Holocene transition along the Pacific Coast of North America. In: Straus L, Eriksen B, Erlandson J, Yesner D, editors. *Humans at the End of the Ice Age: The Archaeology of the Pleistocene-Holocene Transition*. New York: Plenum. p 277–302.
- Erlandson JM, Moss ML. 1999. The systematic use of radiocarbon dating in archaeological surveys in coastal and other erosional environments. *American Antiquity* 64(3):431–43.
- Erlandson JM, Rick TC, Kennett DJ, Walker PL. 2001. Dates, demography, and disease: cultural contacts and possible evidence for Old World epidemics among the Island Chumash. *Pacific Coast Archaeological Society Quarterly* 37(3):11–26.
- Erlandson JM, Rick TC, Vellanoweth RL. 2004. Human impacts on ancient environments: a case study from California's Northern Channel Islands. In: Fitzpatrick

- SM, editor. *Voyages of Discovery: The Archaeology of Islands*. Westport, Connecticut: Praeger. p 51–83.
- Erlandson JM, Rick TC, Estes JA, Graham MH, Braje TJ, Vellanoweth RL. Forthcoming. Sea otters, shellfish, and humans: a 10,000-year record from San Miguel Island, California. In: Garcelon D, editor. *Proceedings of the Sixth California Islands Conference*.
- Glassow MA. 1980. Recent developments in the archaeology of the Channel Islands. In: Power DM, editor. *Proceedings of a Multidisciplinary Symposium*. Santa Barbara: Santa Barbara Museum of Natural History. p 79–99.
- Greenwood RS. 1978. Archaeological survey and investigation: Channel Islands National Monument, California. Volumes I and II [manuscript on file]. Santa Barbara: Department of Anthropology, University of California, Santa Barbara.
- Greenwood RS. 1982. Archaeological survey on San Miguel Island Channel Islands National Monument California. Volumes I and II [report on file at the Central Coast Information Center]. Santa Barbara: Department of Anthropology, University of California, Santa Barbara.
- Heye G. 1921. Certain artifacts from San Miguel Island, California. *Indian Notes and Monographs* 7(4):1–211. New York: Museum of the American Indian, Heye Foundation.
- Johnson DL. 1980. Episodic vegetation stripping, soil erosion, and landscape modification in prehistoric and recent historic time, San Miguel Island, California. In: Power DM, editor. *The California Islands: Proceedings of a Multidisciplinary Symposium*. Santa Barbara: Santa Barbara Museum of Natural History. p 103–21.
- Johnson JR, Stafford Jr TW, Ajie HO, Morris DP. 2000. Arlington Springs revisited. In: Browne D, Mitchell K, Chaney H, editors. *Proceedings of the Fifth California Channel Islands Symposium*. Santa Barbara: Santa Barbara Museum of Natural History. p 628–32
- Juger A, Johnson DL. 1980. Was there a Quaternary land bridge to the Northern Channel Islands? In: Power DM, editor. *The California Islands Symposium: Proceedings of a Multidisciplinary Symposium*. Santa Barbara: Santa Barbara Museum of Natural History. p 33–9.
- Kennett DJ. 1998. Behavioral ecology and the evolution of hunter-gatherer societies on the Northern Channel Islands, California [PhD dissertation]. Santa Barbara: University of California, Santa Barbara.
- Kennett DJ. Forthcoming. *The Island Chumash: Behavioral Ecology of a Maritime Society*. Berkeley: University of California Press. 310 p.
- King CD. 1990. *Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region Before AD 1804*. New York: Garland Publishing.
- Orr PC. 1968. *Prehistory of Santa Rosa Island*. Santa Barbara: Santa Barbara Museum of Natural History.
- Rick TC. 2004. Daily activities, community dynamics, and historical ecology on California's Northern Channel Islands [PhD dissertation]. Eugene: University of Oregon.
- Rick TC, Erlandson JM. 2003. Archaeology, ancient human impacts on the environment, and cultural resource management on Channel Islands National Park, California. *CRM: The Journal of Heritage Stewardship* 1(1):86–9.
- Rick TC, Erlandson JM. 2004. Archaeological site assessments on San Miguel and Santa Rosa Islands, Channel Islands National Park, California. Department of Anthropology, University of Oregon. Report submitted to Channel Islands National Park.
- Rogers DB. 1929. *Prehistoric Man on the Santa Barbara Coast*. Santa Barbara: Santa Barbara Museum of Natural History.
- Rozaire CE. 1978. *Archaeological Investigations on San Miguel Island, California*. Los Angeles: Los Angeles County Museum of Natural History.
- Walker PL, Kennett DJ, Jones TL, DeLong R. 2000. Archaeological investigations at the Point Bennett Pinniped Rookery on San Miguel Island. In: Browne D, Mitchell K, Chaney H, editors. *Proceedings of the Fifth California Channel Islands Symposium*. Santa Barbara: Santa Barbara Museum of Natural History. p 628–32.