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### **Journal of California and Great Basin Anthropology**

#### **Title**

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#### **Permalink**

<https://escholarship.org/uc/item/3tr0272x>

#### **Journal**

Journal of California and Great Basin Anthropology, 35(2)

#### **ISSN**

0191-3557

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#### **Publication Date**

2015

Peer reviewed

## Rethinking the Antiquity of Bedrock Mortars on the Central California Coast

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*Previous assessments of the age of bedrock mortars (BRMs) on the central California coast have limited them to post cal A.D. 1250 contexts. Recent investigations from a single-component late Middle Period site with associated bedrock mortars (CA-SLO-5) on the San Luis Obispo coast, and the stratigraphic position of a bedrock mortar cup beneath dated midden residues at Swordfish Cave (CA-SBA-503) in northern Santa Barbara County, indicate that these features were used as early as 1,385 cal B.C. and that their overall age encompasses the late Early, Middle, Middle-Late Transition, and Late/Early Historic periods in this region.*

As ubiquitous and unimpressive as they often seem, bedrock mortars (BRMs) are clearly significant archaeological features in California. While they may have been used to process any number of different plant (and occasional small animal [Yohe et al. 1991]) resources, bedrock mortars can be linked to a greater or lesser degree with the acorn economy throughout virtually all of Native California (McCarthy 1993; McCarthy et al. 1985). While such resources as agave, salmon, mesquite, and deer may have been more important in some regional economies at certain times, the acorn was the single, defining food resource of pre-contact California, and intensification of its exploitation was a major factor in late Holocene prehistory (Basgall 2004; Bettinger 2015)—especially in central California where oak woodland dominates most of the vegetative landscape (Kuchler 1977). Even in regions where the plant component of the diet probably featured many non-acorn foods (see Gill 2013; Glassow 1996; Wohlgemuth 2010), bedrock mortars still connote relatively intensive

food processing by women (see Jackson 2004), another hallmark of Native California at the time of contact.

Despite such importance, bedrock mortars are notoriously difficult to place in time because they can rarely be directly dated, forcing us instead to rely on their association with time-diagnostic artifacts and/or dates obtained from adjacent domestic or subsistence debris (Haney 1992; Stevens 2002). Complicating the reliance on association is the fact that many bedrock mortars were not always located within or immediately adjacent to settlements, but instead were stationed away from residential sites—sometimes within a short walk, but in other cases at great distances. Such isolated milling stations were apparently created to facilitate field processing away from the home base. In some parts of central California, particularly the Sierra Nevada foothills and the South Coast Ranges, bedrock mortars are as likely to be found adjacent to residential sites as they are as isolates. This leads to one of the two major challenges in dating BRMs: uncertainty about the actual association between the residential sites and mortar outcrops. Association is very much a judgment call, but when it can be established, the second challenge is defining a relatively restricted time of occupation for the adjacent residential site. Multi-component sites with long histories of occupation provide little help in narrowing the range of time when such features were used. Well-dated single-component sites are potentially much more useful if they can be confidently associated with a BRM feature.

Dates assigned to the earliest mortars and pestles in California have long been in the range of ca. 5,000 years for the San Diego region (Warren 1964, 1968), Santa Barbara Channel (Glassow 1996), and northwestern California (Fredrickson 1984). Most of the discussions of early mortar technology do not explicitly distinguish portable from bedrock mortars; however, D. L. True (1958, 1980; True and Waugh 1981) excluded bedrock mortars from his Pauma complex (ca. 5,500–1,000 B.C.) in northern San Diego County and only included them in the San Luis Rey I and II complexes (A.D. 1400–1750) (Laylander 2012). This chronological assignment is consistent with the observation that these features were part of Late/protohistoric/ethnographic cultural complexes in many parts of California, where they are often associated with sites containing arrow points and/or ceramics. Indeed a relatively “late” date in the range

of ca. A.D. 500–1000 is generally assigned to the initial appearance of BRMs in most regions (see Haney 1992:102–103; Hull 2007; Jackson 2004; Moratto 1984), and it is not unlikely that many if not the majority of bedrock mortars in California post-date A.D. 1000. Still, some researchers have raised the possibility that BRMs were in fact present at least a little earlier. In the Sierra Nevada, for example, Gortner (1986) and Leftwich (2010:41) have suggested the possibility that bedrock mortars began to be used between 500 B.C. and A.D. 500, while Stevens (2002) proposed, albeit very cautiously, that BRMs may have been used in the lower elevations of the Sierra Nevada as early as 4,000–3,500 years ago. Stevens based his assessment on obsidian hydration readings from associated artifacts, and also suggested that a more intensive use of mortars was later—ca. 1,500 years ago.

In their 2007 assessment of the age of BRMs on the central coast, Jones et al. fell in line with most prior thinking and assumed that these features post-dated cal A.D. 1250, although that chronological assignment was accompanied by only a minimal discussion of the associations used to establish that date. Here we revisit the issue, first by briefly reviewing the logic behind the initial Late Period dating, which relied on solid associations between BRM features and Late/ethnographic or archaeological sites in southern Monterey County, but also included a case in which an apparent association between BRMs and a Middle Period component was overlooked. Following review of the earlier interpretations, we discuss new findings from recent excavations that clearly demonstrate an earlier date for the appearance of BRMs on California's central

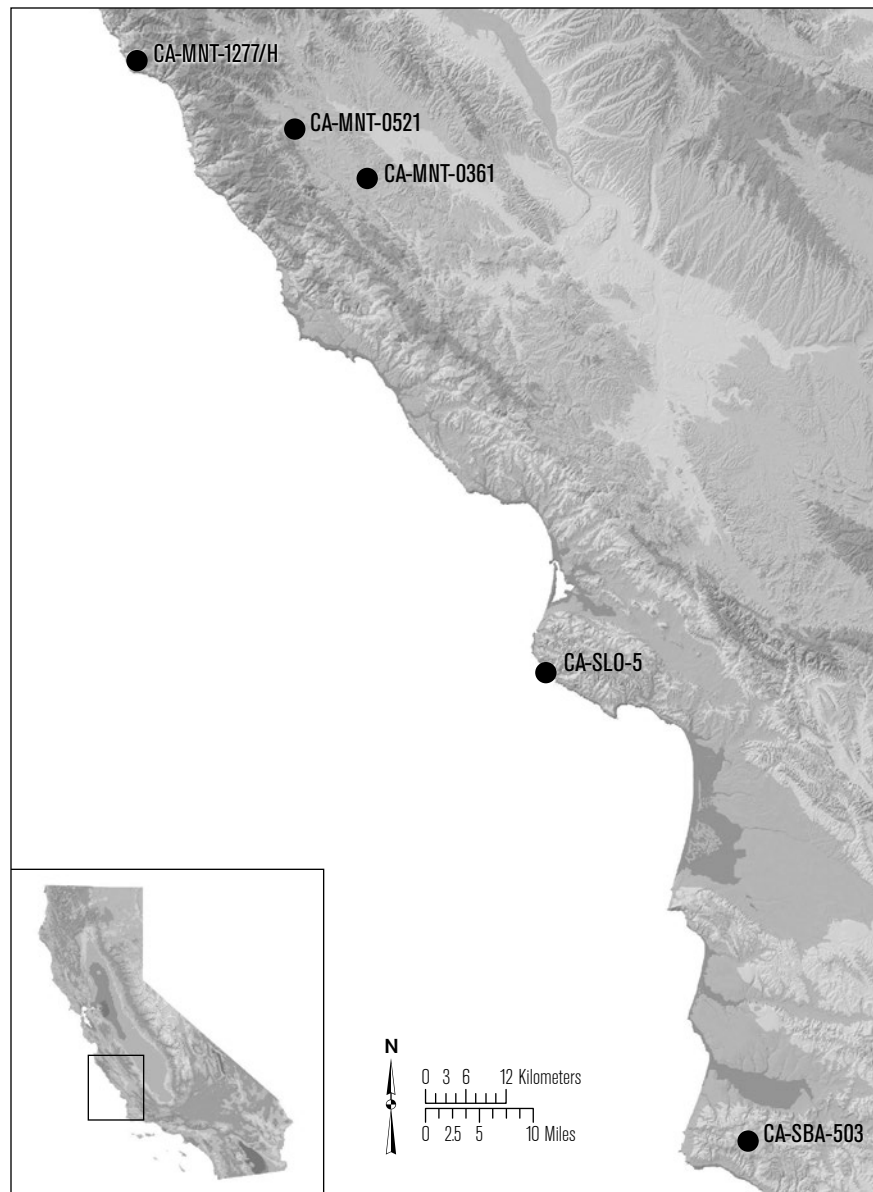


Figure 1. Sites mentioned in text.

coast. Associated dates from CA-SLO-5 on the Pecho coast (Fig. 1) demonstrate bedrock mortar use during the late Middle Period, while Swordfish Cave (Lebow et al. 2015) in northern Santa Barbara County has produced compelling stratigraphic evidence for the use of bedrock mortars 3,500 years ago. In the present discussion we follow the central coast chronological framework, in which the Early Period dates between 3,500 and 600 cal B.C. and the Middle Period dates between 600 cal B.C. and cal A.D. 1000 (Jones et al. 2007). We have not attempted an exhaustive regional review of bedrock

mortar sites as others have done elsewhere (e.g., Haney 1992; Stevens 2002), but have instead concentrated only on a few key datum points that indicate that these features on the south central coast have a greater antiquity than previously thought.

### THE PREVIOUS CASE FOR LATE PERIOD BEDROCK MORTAR CHRONOLOGY ON THE CENTRAL CALIFORNIA COAST

#### *Ethnographic/Late Prehistoric Associations*

During a field class in 1984, student surveyors from a U.C. Santa Cruz methods class located and recorded an expansive midden deposit with an associated outcrop bedrock with two mortar cups in Landels-Hill Big Creek Reserve on the Big Sur coast, Monterey County. The site was designated as CA-MNT-1277/H by the Northwest Information Center (Jones et al. 1989). Subsequent research into the ethnographic field notes of John Peabody Harrington indicated that the site was associated with the Salinan placename of *matilce* (Rivers and Jones 1993). Excavation of 8.5 m.<sup>3</sup> from this site in 1990 showed that the deposit averaged 100 cm. in depth. Radiocarbon dates from between 20 and 100 cm. all fell within the Late Period (Table 1), and recovery of Desert Side-notched projectile points and glass trade beads confirmed Late Prehistoric and post-contact (ethnographic) site use (Jones 2003).

Confirmation of a Late Period/early historical use of mortars was obtained from CA-MNT-361, a bedrock mortar site in the interior of Monterey County and within Fort Hunter Liggett, which was investigated in 1993 under the direction of Brian Wickstrom. Excavation of deposits immediately adjacent to the outcrop revealed two subsurface concentrations of charcoal, ash, fire-affected sandstone, and fire reddened soil. An informal cobble pestle was also found below the two hearth features. Flotation analysis showed that the charred remains included acorns, pine nuts, and buckeyes. Radiocarbon analysis of oak (Beta-69620) and buckeye (Beta-69621) charcoal samples from Feature 1 yielded dates of 80+/-90 years B.P. and 140+/-60 years B.P. (Table 1). The former date undoubtedly reflects a down-mixing of the modern debris noted on the site surface, while the latter suggests use in the early post-contact era (Jones 2003).

While these were the only solid associations between Late/ethnographic residential deposits and BRMs that Jones et al. considered in 2007, they seemed sufficient to link bedrock mortars with Late and early post-contact times, given the general consensus that these features date to this time period in most of California. However, it should be further noted that many single-component Late Period sites on the central coast that have been investigated—especially in southern Monterey County—have no obviously associated BRMs, and instead have produced hopper mortars and/or bowl mortars (Jones 2003). Bedrock mortars were clearly used during the Late Period on the central coast, but they were by no means the only groundstone processing tools.

#### *An Association Overlooked: Findings from CA-MNT-521*

The assumption that BRMs were restricted to the Late Period led to important findings from CA-MNT-521 being overlooked or misinterpreted. CA-MNT-521 is a predominately Middle Period midden site within Fort Hunter Liggett in southern, interior Monterey County. Four bedrock mortar outcrops with a total of 32 cups were located immediately adjacent to the midden. This site was extensively tested (24.9 m.<sup>3</sup>) in 1995 and reported on in 1998 (Jones and Haney 1997). It was found to have a mean depth of ca. 110 cm., and eight radiocarbon dates from a range of horizontal and vertical proveniences were obtained from samples of marine shell, non-human bone collagen, and charcoal. One of these, from a depth of 80–90 cm., suggested that use of the site began as early as 6,300 years ago (Table 1), but the other seven dates all fell between 1,600 cal B.C. and A.D. cal 1060. There was no radiocarbon evidence for an occupation after cal A.D. 1060, and no Late Period projectile points or shell beads were recovered. A single steatite disk bead, most commonly found in Late Period components in this area (but by no means a secure temporal marker), was thought to be the only possible evidence for post-Middle Period occupation. However, the bedrock mortars were nonetheless ascribed to the Late Period. A more parsimonious interpretation would have accepted the bedrock mortars as features associated with and used during the Middle Period occupation. The latter conclusion seems even more appropriate in light of the more recent findings discussed below.

Table 1

CORRECTED AND CALIBRATED<sup>1</sup> RADIOCARBON DATES FROM SITES MENTIONED IN TEXT

Site	Unit	Depth (cm.)	Laboratory Number	Material	Measured Radiocarbon Age (B.P.)	Conventional Radiocarbon Age (B.P.)	2 Sigma Probability
CA-MNT-361	TEU 1	20–30	BETA-69620	Charcoal	140 ±	–	A.D. 1810
CA-MNT-361	TEU 1	20–30	BETA-69621	Charcoal	80 ±	–	Modern
CA-MNT-521	TEU 1	90–100	BETA-85227	<i>Mytilus californianus</i>	3,530 ± 70	3,950 ± 70	1,830–1,430 cal B.C.
CA-MNT-521	TEU 2	20–30	BETA-85228	<i>Haliotis</i> sp.	1,180 ± 120	1,620 ± 180	cal A.D. 710–1390
CA-MNT-521	TEU 2	110–120	BETA-86484	Deer bone collagen	1,590 ± 60	1,650 ± 60	cal A.D. 252–306 cal A.D. 312–549
CA-MNT-521	TEU 8	30–40	BETA-85229	<i>Haliotis</i> sp.	2,040 ± 90	2,460 ± 100	70 cal B.C. – cal A.D. 40
CA-MNT-521	TEU 8	70–80	BETA-86485	Clam shell bead	3,440 ± 60	3,860 ± 60	1,690–1,350 cal B.C.
CA-MNT-521	TEU 8	80–90	BETA-85230	<i>Haliotis</i> sp.	5,660 ± 60	6,090 ± 60	4,420–4,080 cal B.C.
CA-MNT-521	TEU 11	80–90	BETA-85231	<i>Haliotis</i> sp.	3,250 ± 60	3,700 ± 60	1,490–1,140 cal B.C.
CA-MNT-521	TEU 13	70–80	BETA-86486	Bear bone collagen	2,680 ± 70	2,710 ± 70	1,000–780 cal B.C.
CA-MNT-1277/H	1	10–20	BETA-43120	<i>Haliotis</i> sp.	660 + 70	1,020 ± 70	cal A.D. 1440–1720
CA-MNT-1277/H	1	80–90	BETA-43119	<i>Haliotis</i> sp.	560 + 70	990 ± 60	cal A.D. 1460–720
CA-MNT-1277/H	4	90–100	BETA-46058	<i>Haliotis</i> sp.	540 + 60	1,100 ± 70	cal A.D. 1440–1590
CA-SBA-503	N101/E104	8–15	BETA-131741	Shell	360 ± 60	810 ± 70	cal A.D. 1535–1910
CA-SBA-503	N101/E103.3	25	BETA-131738	Shell	400 ± 40	820 ± 40	cal A.D. 1620–1880
CA-SBA-503	N101.6/E101	60	BETA-131736	Charcoal	2,570 ± 40	2,570 ± 40	810–560 cal B.C.
CA-SBA-503	N101/E106	132	BETA-132514	Charcoal	2,550 ± 50	2,570 ± 50	820–540 cal B.C.
CA-SBA-503	TEU 3	50	BETA-133231	Charcoal	3,300 ± 50	3,320 ± 50	1,725–1,500 cal B.C.
CA-SBA-503	N105/E106	64	BETA-131735	Charcoal	3,310 ± 40	3,310 ± 40	1,685–1,505 cal B.C.
CA-SBA-503	N101/E106	154	BETA-131737	Charcoal	3 320 ± 40	3 300 ± 40	1,680–1,500 cal B.C.
CA-SBA-503	N101/E106	180	BETA-131739	Charcoal	3,340 ± 40	3,340 ± 40	1,725–1,520 cal B.C.
CA-SBA-503	TEU 3	85	BETA-107189	Charcoal	3,430 ± 60	3,350 ± 60	1,755–1,500 cal B.C.
CA-SBA-503	TEU 3	86	BETA-107190	Charcoal	3,320 ± 60	3,300 ± 60	1,705–1,430 cal B.C.
CA-SBA-503	TEU 4	94	BETA-107191	Charcoal	3,170 ± 60	3,210 ± 60	1,615–1,385 cal B.C.
CA-SLO-5	1	0–10	BETA-358275	<i>Haliotis cracherodi</i>	1,340 ± 30	1,780 ± 30	cal A.D. 860–980
CA-SLO-5	1	50–60	BETA-358276	<i>Haliotis rufescens</i>	1,360 ± 30	1,810 ± 030	cal A.D. 760–1000
CA-SLO-5	8	10–20	BETA-358277	<i>Haliotis rufescens</i>	1,380 ± 30	1,820 ± 30	cal A.D. 750–990
CA-SLO-5	8	34	BETA-358278	<i>Haliotis rufescens</i>	1,350 ± 30	1,790 ± 30	cal A.D. 780–1010
CA-SLO-5	8	60–70	BETA-358279	<i>Haliotis cracherodi</i>	440 ± 30	1,860 ± 30	cal A.D. 710–940
CA-SLO-5	8	80–90	BETA-358280	<i>Haliotis rufescens</i>	1, 260 ± 30	1,700 ± 30	cal A.D. 890–1100

<sup>1</sup>Samples from Monterey and San Luis Obispo counties calibrated with CALIB 7.0 and regional Delta R correction value of 290±35 (Ingram and Southen 1996); shell samples from CA-SBA-503 used a correction value of 225 ± 35.

## NEW FINDINGS

## CA-SLO-5

CA-SLO-5 is a relatively small shell midden with two bedrock mortar outcrops (each with three mortar cups) situated on the so-called “Pecho Coast” of San Luis Obispo County (Fig. 2). The name “Pecho,” derived from the local Mexican land grant, was used by the first archaeologist to record sites on this coast, Arnold Pilling (Pilling 1951), who documented CA-SLO-5 in 1947. The site is currently on lands held by Pacific Gas

and Electric for the Diablo Canyon Nuclear Power Plant. It is situated on the shoreline 2 km. north of the power plant and remnants of the more well-known site of CA-SLO-2 investigated by Greenwood (1972), and discussed more recently by Jones et al. (2008). CA-SLO-5 was re-surveyed and re-recorded by Applied EarthWorks (Price et al. 2006), who also obtained two radiocarbon dates from shell samples.

Test excavations were completed at CA-SLO-5 in the spring of 2013 by field class students from



**Figure 2. California Polytechnic State University San Luis Obispo student, Karlee Forbis, next to bedrock mortar at CA-SLO-5. The outcrop on which the mortar is located is surrounded by midden deposit.**

California Polytechnic State University as part of an ongoing program of erosion salvage along the Pecho coast that has also included work at CA-SLO-9 (Coddling et al. 2009), CA-SLO-1366/H (Coddling et al. 2013), and CA-SLO-1370/H (Hadick et al. 2012). At CA-SLO-5, students excavated a total of twelve  $1 \times 2$  m. units along the site's eroding edge. Sediments from eleven units were dry-sorted in the field, while one unit was subjected to water-screening. Sorting of the materials from the wet-screened unit is ongoing. The midden deposit proved to be relatively shallow; several units were terminated 50 cm. below surface while the deepest extended to only 80 cm. A total of six shell samples from a range of depths and unit proveniences was submitted to Beta Analytic for radiocarbon analysis, supplementing the two dates obtained previously by Applied EarthWorks (Table 1). The eight dates show a remarkably tight range, indicating a relatively brief occupation of only ca. 300 years between cal A.D. 700 and 1000. At 2 sigma the maximum span of

occupation is from cal A.D. 710–1100; the minimum is cal A.D. 890–940. The shell beads (limited to saucer variants) and projectile points (featuring large, non-arrow types) recovered are consistent with a pre-Late occupation. Unlike many sites on the Pecho coast (e.g. CA-SLO-2, -585 [Jones et al. 2009], and -1366/H) that show evidence of repeated occupations throughout much of the Holocene, CA-SLO-5 appears to represent a discrete, single-component occupation dating only to the late Middle Period. Furthermore, there is no reason to think that the bedrock mortar features, one of which is surrounded by the midden deposit, are not contemporaneous with the adjacent subsistence debris and the radiocarbon results obtained from it. This means simply that the BRMs at CA-SLO-5 date to the late Middle Period.

#### *Swordfish Cave (CA-SBA-503)*

Swordfish Cave (CA-SBA-503) is a relatively well-known and significant rock art site in the eastern portion of Vandenberg Air Force Base (AFB) in northern Santa Barbara County (Fig. 1). Pictographs within the cave were noted as early as the 1930s and were featured in Campbell Grant's 1993 review of Chumash rock paintings. Although famous for its rock art, studies by Applied EarthWorks recently found that Swordfish Cave also contains buried midden residues indicating a residential occupation during the late Early Period.

Prompted by rapidly deteriorating artwork (Hyder et al. 1996), in the late 1990s the U.S. Air Force initiated a long-term program to ameliorate conditions that were adversely affecting the rock art. The first step in that program was to test the cave to determine whether it contained an archaeological component, an effort that revealed three occupation periods, with a substantial archaeological deposit immediately atop bedrock (Lebow and Onken 1997). In consultation with the Santa Ynez Band of Chumash Indians, Vandenberg AFB continued the rock art program, using archaeological data recovery excavations to support stabilization measures (Lebow et al. 2005; Lebow et al. 2015).

A single mortar hole was discovered in the bedrock floor of the cave's western lobe during data recovery excavations (Fig. 3). Designated Feature 9, the top of the mortar hole in the cave's bedrock floor was discovered in excavation unit N104/E102 at a depth of 89 cm. below the surface of the cave sediments; the bottom was 100 cm.



**Figure 3.** Mortar in the bedrock floor of Swordfish Cave.

below surface. The stratum that covered bedrock and the feature, IIa, was intact, and was marked throughout the cave by high concentrations of cultural materials that reflected a residential occupation.

Eleven radiocarbon dates were obtained from the cave, nine from samples of charcoal and two from marine shell (Table 1). Seven of the 11 age determinations dated the initial period of cave occupation, which began when the cave's bedrock floor was completely exposed. All seven samples dating the initial occupation period are indistinguishable at 2 sigma, strongly indicating that occupation(s) occurred between 1,755 and 1,385 cal B.C., the maximum 2 sigma range of all seven dates. Six of the seven samples are indistinguishable at 1 sigma, suggesting that the initial cave occupation occurred between 1,625 and 1,540 cal B.C. The bedrock mortar was clearly associated with this initial period of occupation. These data from Swordfish Cave indicate that BRMs were in use by the end of the Early Period on the south-central coast.

## DISCUSSION AND CONCLUSION

Previous estimates for the age of bedrock mortars, which at best were overly conservative, restricted these features to post-cal A.D. 1250 contexts, even when there were compelling data from a site in southern Monterey County (CA-MNT-521) that suggested they were used earlier. A tight set of dates obtained from a small shell midden with associated BRMs at CA-SLO-5 on the Pecho Coast of San Luis Obispo County indicates a use of BRM's between cal A.D. 700 and 900. A single

mortar cup uncovered at the base of stratified deposits within Swordfish Cave on Vandenberg AFB had to have been created no later than 1,385 cal B.C. Together, the CA-SLO-5 and CA-SBA-503 findings clearly indicate that BRMs were in use by at least the end of the Early Period on the central coast, and that their overall age encompasses the late Early, Middle, Middle-Late Transition, and Late/Early Historic periods.

This is not to say, of course, that bedrock mortars were used in great numbers at this point in time in this region, but it does put developments on the central coast more in line with the rest of central California. In the Central Valley, acorn intensification—marked by an increasing use of portable mortars and pestles—is thought to have begun during the Middle Period (Basgall 2004), although the full conversion to acorn economies was not completed until later. On the central coast, portable mortars are known to occur as early as the Early Period, and become more abundant during the Middle Period. It now appears that both portable and bedrock mortars were used as early as the late Early Period. Regional researchers need to be more alert to the possibility that mortar features could be associated with Early Period deposits and not automatically dismiss them as Late Period features.

## ACKNOWLEDGEMENTS

Excavations at CA-SLO-5 were supported by P.G. & E, and we are sincerely grateful for the assistance of Mike Taggart and Sallie Krenn in helping to facilitate all phases of that effort. Excavations at Swordfish Cave were funded by Vandenberg Air Force Base. Cultural resources staff at the Base that provided valuable support, direction, and insight included Larry Spanne, Bob Peterson, and James Carucci. The Santa Ynez Band of Chumash Indians was also instrumental in the excavations.

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