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Archaeology in the Forgotten Peninsula: Prehistoric Settlement and Subsistence Strategies in Northern Baja California

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The Baja California peninsula is one of the least known archaeological regions in North America, yet it has the potential for illuminating a number of important theoretical issues, including problems of the evolution of social complexity among coastal hunters and gatherers. In 1995, an archaeological survey in the San Quintín-El Rosario region on the Pacific coast of northern Baja California resulted in the collection of data from 89 sites within the project area, as well as eight prehistoric and three historical sites located outside the project area. A total of 21 radiocarbon assays documented the presence of human occupation in the region to ca. 4,995 to 4,790 B.C.

*The preliminary data suggest that the settlement pattern in the Rio Rosario Valley was extremely mobile and dispersed, and not semisedentary and concentrated as the mission documents suggest. The high level of settlement mobility and low levels of population aggregation are indicated by various lines of archaeological evidence, and a hypothesis is advanced linking the impermanence of settlement to limits in terrestrial resources, particularly the local staple plant food, the coastal agave (*Agave shawii*). This raises issues regarding the role of marine and terrestrial resources in prehistoric coastal adaptations, not only on the Pacific coast of Baja California but in southern Alta California and elsewhere.*

THE naturalist and writer Joseph Krutch (1961) dubbed Baja California "the forgotten peninsula," a phrase that neatly characterizes archaeological knowledge of the region. This is not to imply that no fieldwork has been done there, but until recently, only five subregions in the 1,000-mile-long peninsula have seen focused archaeological research (Laylander 1992), making prehistoric Baja California one of the least known regions in North America. This situation is now rapidly improving as a number of recent projects have advanced archaeological knowledge of Baja California (Ritter 1995). In the northern portion of the peninsula, the Instituto Nacional de Antropología e Historia has sponsored excavations at Bahía de los Angeles, a program of salvage excavations north of Ensenada at the Bajamar development, and is initiating an ambitious multiyear program of excavations at the Dominican missions (J. B.

Patterson, personal communication 1997; C. González, personal communication 1997).

At the southern end of the peninsula, Mexican and foreign archaeologists have conducted surveys and limited test excavations with a common focus on prehistoric settlement and subsistence systems (Fujita 1988, 1995; Carmean and Molto 1991; Molto and Kennedy 1991; Carmean 1994a, 1994b; Molto and Fujita 1995). In the Sierra de San Francisco, located in the northern portion of Baja California Sur, the Proyecto Arte Rupestre Baja California Sur, directed by Maria de la Luz Gutiérrez and Justin Hyland, has documented the Giant Mural rock art and the obsidian quarry located at Valle del Azufre, as well as the discovery of an obsidian fluted projectile point (de la Luz Gutiérrez and Hyland 1994a, 1994b; Hyland and de la Luz Gutiérrez 1995a, 1995b; Shackley et al. 1996). Continuing his investigations of

more than 20 years, Eric Ritter has conducted research on the western shore of the Sea of Cortez at Bahía de la Concepción, Bahía de los Angeles, and Bahía de las Animas (Ritter 1979, 1985, 1995; Ritter et al. 1994). In the vicinity of San Quintín, archaeological research has been limited to brief, incompletely reported excavations conducted by Malcolm Rogers in the 1920s (Rogers 1967:23, 38, 95), Carl Hubbs' collection of radiocarbon samples from archaeological middens as part of his paleoclimate project of the 1950s (Hubbs et al. 1965), and a few site records from the El Rosario Valley.¹

Nevertheless, knowledge of prehistoric Baja California remains extremely patchy. Each of these research areas is separated by literally hundreds of square miles of archaeological terra incognita. Current archaeological knowledge of Baja California roughly approximates the research situation in Alta California in the 1930s; that is, basic chronologies exist only in outline, systematically obtained survey data are few, and excavations are limited to a handful of sites.

Yet, the archaeology of Baja California has the potential for illuminating a series of important theoretical issues, including food collecting strategies and the development of social complexity (Yellen 1977; Binford 1980; Winterhalder and Smith 1981; Kelly 1983, 1992, 1995; Bettinger 1991; Smith and Winterhalder 1992; Feinman 1995). More specifically, the Pacific coast of Baja California is an ideal region for examining theories about the development of coastal adaptations and maritime economies (e.g., Osborn 1977; Perlman 1980; Yesner 1980, 1987; Koyama and Thomas 1981; Bailey and Parkington 1988), particularly when compared to models proposed for southern Alta California.

In brief, such models argue that the development of high levels of sedentism and population density, emergent nonegalitarian social distinctions, economic specialization, interregional exchange systems, and other indications of social complexity were shaped by the significance of

marine resources in coastal Alta California (Glassow 1980, 1992, 1996; Arnold 1987, 1990, 1992a, 1992b, 1995; Glassow and Wilcoxon 1988; Glassow et al. 1988; Jones 1991, 1992, 1996; Raab 1992; Raab and Yatsko 1992; Erlandson 1994; Raab et al. 1995). The Pacific coast of Baja California poses an interesting comparative case where marine resources were abundant, yet native societies apparently did not achieve the sociopolitical complexity recorded for ethnohistoric groups like the Gabrieleño, Chumash, or other coastal populations to the north. In addition to its intrinsic interest, Baja California poses an intriguing counter-test, what Diamond (1997:424) recently called a "natural experiment" in which new insights are achieved "by comparing systems differing in the presence or absence (or strong or weak effect) of some putative causal factor." Yet the potential insights such a comparison could produce are precluded by the lack of systematically obtained archaeological data from Baja California.

In 1995, the Proyecto Arqueológico San Quintín-El Rosario (PASE) conducted a program of archaeological survey in northern Baja California (Fig. 1). The survey was designed to collect basic data about site densities and distributions and to explore preliminary hypotheses regarding prehistoric settlement mobility, population aggregation, and resource use. The survey covered a 3% random sample of a 630 km.² project area and recorded data on 89 sites within the sample, as well as 11 sites outside the sample. Radiocarbon assays from stratigraphic exposures provided an initial set of absolute dates for the region, and a mapping program produced comparative data on the spatial organization of prehistoric sites. Finally, the mapping of two Spanish mission sites and the recordation of several historical period rancherías provided data on the colonial and republican periods (also see Gasco 1996; Moore and Gasco 1996). The issues, methods, preliminary results, and implications for future research of the 1995 investigations are discussed below.

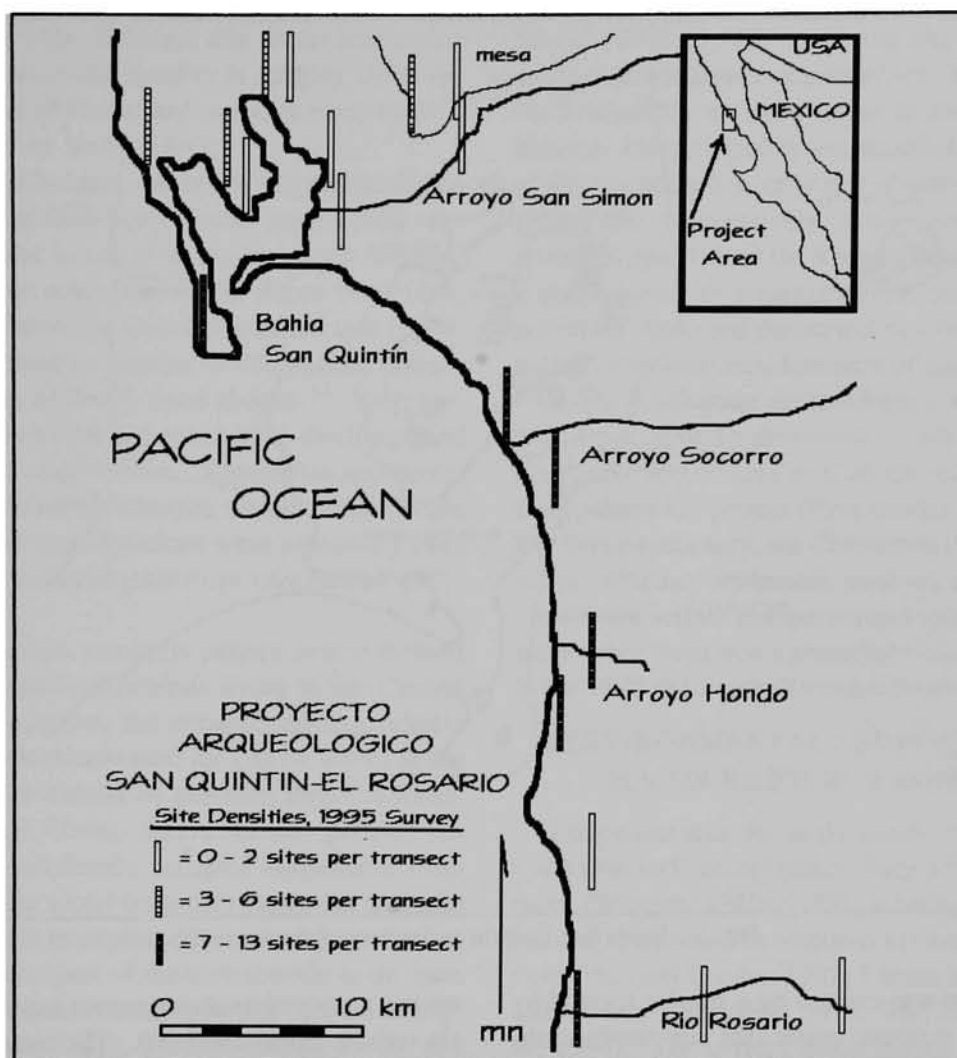


Fig. 1. Proyecto Arqueológico San Quintín-El Rosario, project area and 1995 survey transects.

PROJECT AREA AND MODELS OF ETHNOHISTORIC SETTLEMENT

Located on the Pacific coast approximately 200 km. south of the international border, the project area is defined by two topographic features presumably important to prehistoric human populations, Bahía San Quintín and the Valle del Rosario (Fig. 1). The southern boundary is formed by the southern slope of the Valle del Rosario, the largest freshwater drainage within 100 km. In wetter than average years (e.g.,

1995), the Rio Rosario flows year-round, and in average rainfall years, subterranean water follows the course of the river during the late summer and fall.

North of the Valle del Rosario is a region of mesas and uplifted marine terraces deeply incised by arroyos, some—including Arroyo Hondo and Arroyo Socorro—containing seasonal and/or subterranean water sources. The northern boundary is the area around Bahía San Quintín (Fig. 2), the largest protected embayment between Ensenada de Todos Santos and Laguna Manuela. Bahía

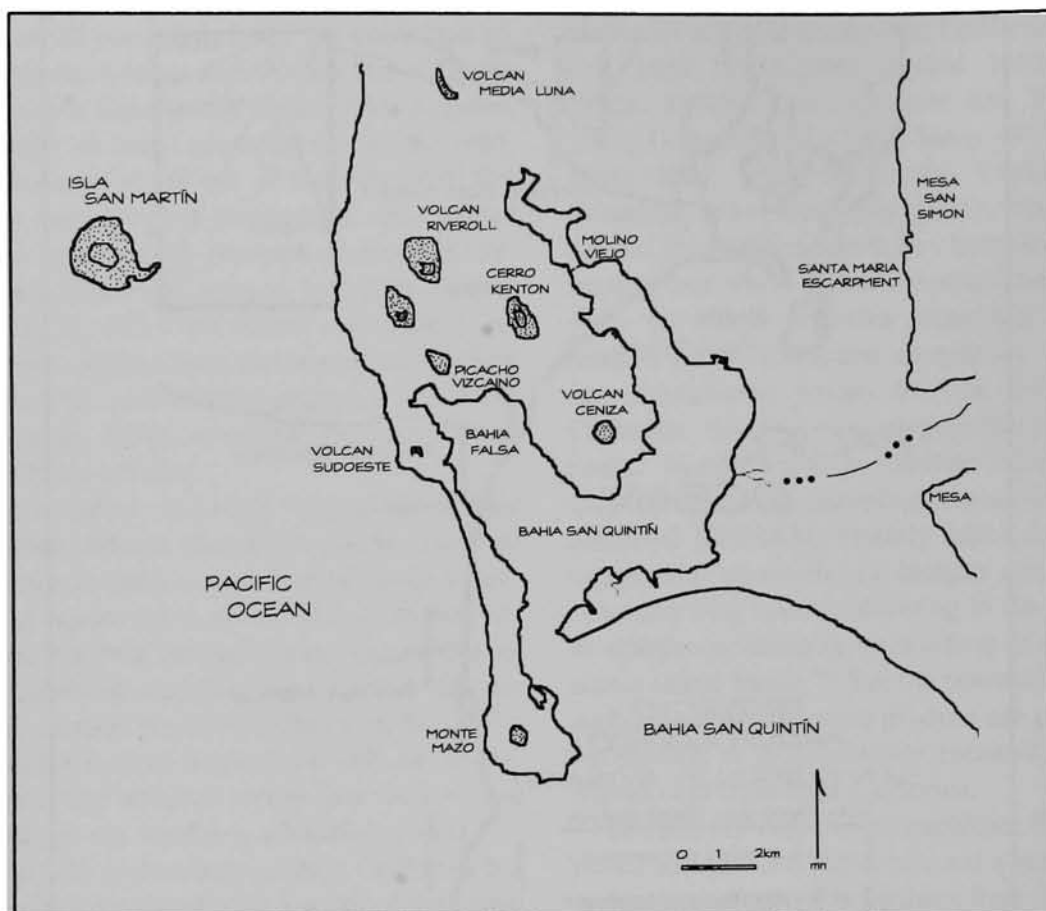


Fig. 2. Bahía San Quintín and principal features.

San Quintín was created by a barrier formed by a chain of volcanic cones that run north-northwest to south-southeast; the volcanic cones slow coastal erosion and anchor longshore sand deposits (Woodford 1928; Gorsline and Stewart 1962). The long, narrow arm of the western peninsula is a tombolo created by unconsolidated, sandy beaches and dunes that have formed a 10-km. long sand spit between Volcán Sudoeste and the low lava cone of Monte Mazo.

Ethnohistoric data suggest that two hypothetical models characterize settlement patterns in the project area; the mobile ranchería pattern and the semipermanent ranchería pattern. These models express differences in the multidimensional phenomenon of hunter-gatherer mobility as tentatively reconstructed from ethnohistoric sources; they

are not proposed as dichotomous states of a single variable (Kelly 1992:50). The mobile ranchería model posits a highly mobile, socially fluid, foraging band that fluctuated in settlement location, group size, and composition (Aschmann 1967:122-125). Ranchería size fluctuated in response to availability of food resources and water; during the course of the year coresiding social units may have ranged from a single nuclear family to 20 to 50 families (Aschmann 1967:120-123, 148-149). Owen (1965) and Aschmann (1967:123) suggested that ranchería membership was based on patrilineal kinship and not solely coresidence. Mobility was generally high in aboriginal Baja California; writing of the Pericu far to the south, the Jesuit Jakob Baegert (1952) stated that a family might change its campsite

100 times a year, although this seems like an exaggeration since this number is roughly twice the highest level of residential mobility cited by Binford (1980) or Kelly (1995).

Of the Cochimí, the Jesuit Miguel del Barco simply noted that "they readily moved their rancho with the intent of going to search for their sustenance in other places" (del Barco 1988:188), and the Dominican Luis Sales stated that (1959: 35), "the need to wander to obtain food obliges them to not establish fixed abodes."² Such mobile rancherías lacked substantial dwellings and nonresidential structures. Rancherías apparently had well-defined territories within which people moved, and some locations were repeatedly used for inter-ranchería gatherings (Aschmann 1967: 125).

The mobile ranchería pattern is best defined for ethnohistoric Cochimís living in the Central Desert; in contrast, the semipermanent ranchería model is best documented for groups living in the mountainous interior of northern Baja California (Hinton and Owen 1957). In this pattern, the ranchería recurrently occupies a particular location. Smaller social units may range out from the principal site to exploit different resource zones, but they spend part of the annual cycle in the base camp, a pattern recorded for the Kiliwa (Meigs 1939; Mixco 1983), Tipai (Luomala 1978), and Paipai (Hicks MS, 1959; Owen 1965). Such settlements may have had more substantial dwellings, storage facilities, and nonresidential architecture similar to those described for Alta California (Aschmann 1967:109-110).

Based on analysis of baptismal registers from the Mission Nuestra Señora de El Rosario, it is estimated that the area supported a population of approximately 700 to 900 individuals at ca. A.D. 1770 (Moore and Norton 1992). The Spanish sources refer to the rancherías associated with place names (such as Viñadaco, Socorro, Santo Tomás, and Santa Rosa) as if they were relatively permanent communities concentrated along the lower Valle del Rosario and Arroyo Socorro.

Meigs (1935:41, 49) suggested that rancherías were semipermanent communities, tethered by the availability of fresh water in the Valle del Rosario, and the mission was established because of the concentration of potential converts (Sales 1959:149). Alternatively, it is possible that the apparent sedentism of the Rosario rancherías was a consequence of missionization, producing an artificially dense and permanent population in the region only after establishment of the mission.

Without adequate archaeological data, it has been impossible to determine which model applies to the project area or if an alternative settlement pattern was present (for a similar problem in San Diego prehistory, see Christenson [1992:223-225]). Whether settlement patterns represented mobile rancherías, semipermanent rancherías, or some other form was a principal issue addressed in the 1995 fieldwork discussed below.

ENVIRONMENTAL SETTING AND MAJOR RESOURCE ZONES

The project area sits on the border between the California and Sarcophyllous Desert biotic provinces (Wiggins 1980:21-22), a border that presumably fluctuated in response to climatic variation (Fritts and Gordon 1982; Larson et al. 1989; Larson and Michaelsen 1990; Van Devender et al. 1994). The current biotic border reflects an interface of modern rainfall systems (Mosiño Alemán and Garcia 1974). As in Alta California, winter cyclonic storms drop precipitation along the Pacific coast between mid-December and March, with an annual average of 168 mm. at Ensenada (Department of Commerce 1965), decreasing southward to 132 mm. at San Quintín (Cooper 1967:101) and to 100 mm. or less south of El Rosario (Roberts 1989:17). The southern Central Desert is affected by late summer and autumn storms (*chubascos*) that form off the Pacific coast of mainland Mexico and track northward up the Gulf of California, although *chubascos* rarely reach the project area, which receives more than 70% of its rainfall during the winter (Aschmann

1967:3). Rainfall in the project area tends to be low, with large monthly standard deviations during the brief rainy season.

Rainfall variation undoubtedly influenced a number of resources essential to foragers, the most obvious being drinking water. Freshwater sources include the Rosario River, seasonal surface water and more permanent underground sources along major arroyos (e.g., Socorro, Hondo, San Simón), brackish near-coastal upwellings of subterranean water (*batiquitos*) in the dune fields south of El Pabellón, and small catch basins (*tinajas*) located in volcanic flows and clay pans that temporarily hold rainwater. These freshwater sources vary in quality, volume, and reliability. For example, in 1602, members of the Vizcaíno expedition were led to wells dug into the outflow of the Arroyo San Simón—marked on the expedition's charts as a "pozo de agua dulce"—where they obtained fresh water in October, seven months after the rainy season (de la Ascención 1929:198-200). In contrast, clay pans and *tinajas* dry within weeks after a winter storm. Even relatively permanent springs could fail, like the one near Mission Nuestra Señora de El Rosario, which stopped flowing in 1802, forcing relocation of the mission (Meigs 1935:22).

Terrestrial Food Resources

Terrestrial food resources in the project area were widely spread, and varied in density and predictability. Commenting on the abundance of game near Bahía San Quintín, Vizcaíno (1992:157) related that "This place is very comfortable for it has a large valley surrounded by lagoons, and in them there are many fish, ducks, and herons, and a woods with rabbits and deer." Cottontails and jack rabbits are widespread, particularly in the coastal sagebrush communities that cover stabilized sand dunes. Burned rabbit bone has been observed in archaeological deposits, but mule deer are rare and no large terrestrial faunal remains have been observed in archaeological contexts to date. Other small game, including liz-

ards, snakes, burrowing rodents, and insects, were consumed in the project area as they were elsewhere on the peninsula (Sales 1959:33; Aschmann 1967:94-96; del Barco 1988:205-206).

Seed-bearing annuals—collectively but imprecisely called *bledo* in the mission accounts—may have been collected in the project area, as they were elsewhere on the peninsula (Aschmann 1967:86-87). The fruits and seeds of the larger cacti (*Lemaireocereus turberi*, *Machaerocereus gummosus*, *Opuntia* spp., *Pachycereus* spp.) were valued on the peninsula, but these species are not generally found in the project area (Roberts 1989), although a few isolated specimens may represent survivors of earlier drier periods.

The most important terrestrial food was the coastal agave, *Agave shawii* (Fig. 3), one of 16 agave species found in Baja California (Gentry 1978). The importance of agave was noted by Vizcaíno (1992:157), who remarked that "Their ordinary meal is mezcal root because there is a great quantity of maguey." Describing experiences further south in Cochimí territory, del Barco (1988:121-125) made detailed observations on agave procurement and preparation. According to del Barco (1988:122), "The agave is not eaten raw . . . but only after it is cooked, and all this work, which is only done by the women, is done in the following manner." Del Barco (1988) described how women left their *ranchería* or *pueblo* in the morning, and after arriving at the stands of agave, each woman went her own way to collect mescales. After digging up the plant and trimming the root with a flake tool, "then they search for more: and each women returns in the afternoon with 8 or 9 agaves, carried in her carrying net—and that's a good load! Sometimes she will walk one or two leagues, adding to this load [of agaves] firewood to cook them" (del Barco 1988:123). Del Barco observed that the agave were roasted in a mound of firewood and stones, located a little distance away from the *ranchería*, where the agaves were roasted for at least 24 hours, but more frequently for approx-



Fig. 3. *Agave shawii*.

imately 36 hours. He concluded that, "Taken from the roasting pit and allowed to cool, the woman has food for her family for three days, more or less, depending on the number of people in it" (del Barco 1988:124).

A 1994 botanical census of agave in the project area indicates that *Agave shawii* densities are extremely high, similar to densities for domesticated agave (Parsons and Parsons 1990). Agave counts tabulated for three one-hectare survey areas indicated densities from 74,500 to 122,400 plants per km.², of which a small fraction—1,100 to 2,300 per km.²—would be suitable for consumption at any given time, representing a "standing crop" (Moore and Vasquez n.d.). Since agave grows slowly and is destroyed when it is collected, the sustainable yield of the plant would be somewhat lower than this. Based on del Barco's

accounts, and assuming that agave was consumed daily, then a family's annual consumption would equal approximately 900 plants. Using the lowest estimate of agave yields (1,100 per km.²) and assuming a human population of 700 to 900 individuals (again, reconstructed from mission documents by Moore and Norton [1992]) or roughly 150 to 200 families, it is estimated that there was sufficient agave within the project area to support a human population 500% higher than estimated for A.D. 1770. Yet, human population apparently did not aggregate into large settlements, an issue discussed in more detail below.

Marine Food Resources

Coastal and nearshore marine resources are abundant in the project area. Extensive sandy beaches are currently commercially fished for Pismo clams (*Tivela stultorum*), as they were historically (Alpin 1947). Numerous headlands provide habitats for California mussels (*Mytilus californianus*), limpets, black abalone (*Haliotis cracherdoii*), and other rocky shore shellfish species (Morris et al. 1980). Bahía San Quintín has a protected muddy bottom that supports various fish, shellfish (*Ostrea* sp., *Chione* sp.), crustaceans and migratory waterfowl.

When his expedition sailed into Bahía San Quintín in 1602, Vizcaíno (1992:156) noted, "We anchored and then more than 20 canoes of Indian fishermen came alongside in peace. . . . They fished with hooks that seemed to be spines of some tree and lines of maguey fiber twisted and better twined than ours, and they fished with such facility that within two hours they filled their canoes." According to the priest on the expedition, the canoes were "balsas of reeds" (de la Ascención 1929:198), and although these small watercraft were primarily used for nearshore fishing, they were sufficiently seaworthy that people could paddle to Isla San Martín, approximately five km. offshore, where the Cabrillo expedition saw signs of occupation in October 1542 and the Cermeño expedition observed set-

tlements in 1595 (Wagner 1929:83, 162-163).

Establishing the age of Bahía San Quintín is important for understanding coastal adaptations in the project area, given the well-documented importance of bays and estuaries for early coastal settlement in southern Alta California (Erlandson 1985, 1988, 1994; Colten 1989; Erlandson and Colten 1991). Gorsline and Stewart (1962) reconstructed the Pleistocene and Holocene history and geomorphology of Bahía San Quintín. Observing that the Santa Maria escarpment was "an old sea-cliff cut at a shoreline approximately 10 to 15 meters higher than present" (Gorsline and Stewart 1962:290), they contrasted this with the absence of evidence of higher sea levels on the volcanic cones, in that "[t]he cones are in various stages of erosion, but most are relatively fresh in appearance. No apparent terraces of wave-cut benches are in evidence on any of the cones and marine deposits are absent" (Gorsline and Stewart 1962:290-291). They further suggested that the volcanic cones postdated the Pleistocene high stand (of ca. 130,000 to 120,000 years ago) and that the volcanism commenced prior to the beginning of the rise in sea levels, which they dated to 18,000 to 20,000 years ago, and continued into the last three millenia (Gorsline and Stewart 1962:294, 296).

Radiocarbon dating of Pleistocene estuarine deposits has confirmed that the basic topography of Bahía San Quintín has been in place since the Upper Pleistocene (see Fig. 4); these deposits were observed, although not dated, by Hubbs et al. (1965). During low tides, the Pleistocene deposits are visible as a stratum of quiet water clams, dominated by the mud-burrowing gaper (*Tresus nuttallii*) and Washington clam (*Saxidomus nuttallii*). The many unopened shells mark this as a natural deposit, not an archaeological midden. Two samples taken from the western bay margin directly opposite Molino Viejo (UTM 597220E/3373260N) produced dates (adjusted for the reservoir effect of 225 ± 35 years) of $33,710 \pm 550$ RCYBP (Beta-87486) and $40,260 \pm 810$

RCYBP (Beta-87488). Similarly, a deposit located south of Muelle Viejo produced a date (adjusted for the reservoir effect) of $38,910 \pm 1130$ RCYBP (Beta-87497).

Despite the fact that sea levels have fluctuated over the last 40,000 years, the absolute dates suggest that the protective barrier of volcanic cones had formed sometime between 130,000 and 41,000 years ago; that is, after the eustatic high stand that cut the Santa Maria escarpment and before the Late Pleistocene bay deposits dating between 38,000 and 41,000 years ago. Since modified by coastal erosion, the volcanic cones were established long before the first humans entered Baja California, creating rocky, coastal habitats on their seaward flanks; the presence of two dated archaeological deposits (PASE-13, PASE-87-St. C; see Table 1) superpositioned over volcanic layers suggests that major volcanism ended before 6,000 years ago. As eustatic sea levels rose during the Holocene, protected bay habitats formed in the lee of the volcanic cones, creating quiet water resource zones available to prehistoric foragers.

Summary

Although sound quantitative data are lacking for most resources in the project area, the basic patterns appear to be that (a) plant resources are adequate, but dispersed and unvaried (i.e., predominantly *Agave shawii*), (b) marine resources represent the major protein source, almost certainly more important, abundant, and predictable than terrestrial fauna, and (c) permanent freshwater sources (surface and subterranean flows) are limited, although temporary sources (catch basins, tinajas, and batiquitos) are widespread. Although the distribution and nature of resources largely determine hunter-gatherer settlement patterns, those relationships are unclear, leading to two competing models of prehistoric settlement patterns. The 1995 survey was designed to collect data regarding prehistoric settlement patterns and subsistence strategies.

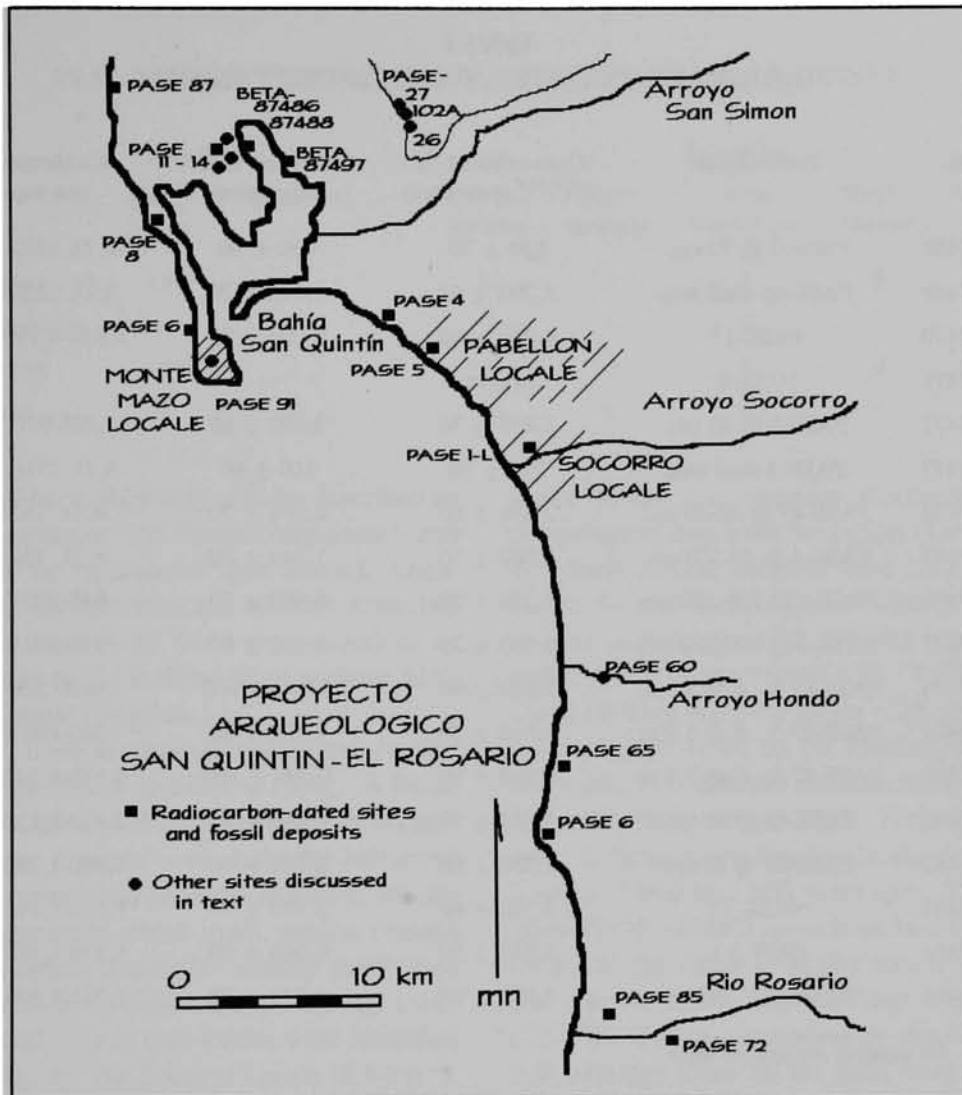


Fig. 4. Locations of radiocarbon dated components, locales, and sites discussed in text.

SURVEY STRATEGIES AND PRELIMINARY RESULTS

In 1995, approximately 3% of the project area was surveyed based on a systematic random sample (see Fig. 1). The project area was divided into four zones—the western San Quintín basin (200 km.²), the eastern San Quintín basin (200 km.²), the lower Valle del Rosario (80 km.²), and the intervening coastal zone (150 km.²)—and sampling units were chosen from each zone. The

sampling units were quadrats 4 km. long and 250 m. wide (1 km.²), oriented north-south in reference to the Universal Transverse Mercator (UTM) grid. Sampling units were selected randomly based on UTM coordinates, and located on the ground with a Garmin 75 Global Positioning System. Sample units were surveyed by two- or three-person teams in transects with 50 to 75 m. intervals. Between late June and mid-August 1995, 19 units were surveyed and 89 archaeological sites were encountered within the sample. In

Table 1
RADIOCARBON DATES, PASE PROJECT AREA^a

Lab No.	Provenience	Conventional ¹⁴ C (¹³ C/ ¹⁴ C corrected)	Reservoir Effect Adjustment	Calibrated at one sigma
Beta-87468	PASE-2 @ 70 cm.	850 ± 70	630 ± 80	A.D. 1635-1740
Beta-87469	PASE-65 shell lens	1,290 ± 60	1,070 ± 70	A.D. 1220-1430
Beta-87470	PASE-13	6,610 ± 80	6,390 ± 90	4,995-4,790 B.C.
Beta-87471	PASE-8	modern	--	--
Beta-87472	PASE-8 @ 85 cm.	3,410 ± 70	3,190 ± 80	1,135-910 B.C.
Beta-87473	PASE-5 shell lens	730 ± 50	510 ± 60	A.D. 1710-1950
Beta-87474	PASE-47 @ 20-30 cm.	2,290 ± 60	2,070 ± 70	A.D. 150-475
Beta-87475	PASE-6 @ 80-100 cm.	1,760 ± 70	1,540 ± 80	A.D. 780-970
Beta-87476	PASE-6 @ 180-200 cm.	3,280 ± 70	3,060 ± 80	945-790 B.C.
Beta-87477	PASE-6 @ 200-220 cm.	3,300 ± 70	3,080 ± 80	975-800 B.C.
Beta-87478	PASE-87 St. A @ 1.1 m.	2,160 ± 90	1,940 ± 100	A.D. 370-595
Beta-87479	PASE-87 St. B @ 3.2 m.	2,810 ± 70	2,590 ± 80	380-190 B.C.
Beta-87480	PASE-87 St. C @ 7.6 m.	6,220 ± 90	6,000 ± 100	4,555-4,345 B.C.
Beta-87481	PASE-85 @ 60 cm.	4,480 ± 50	4,260 ± 60	2,470-2,230 B.C.
Beta-87482	PASE-85 @ 35 cm.	4,050 ± 60	3,830 ± 70	1,900-1,720 B.C.
Beta-87483	PASE-72	3,790 ± 60	3,570 ± 70	1,575-1,415 B.C.
Beta-87484	PASE-1-L	3,530 ± 50	3,305 ± 60	1,270-1,100 B.C.
Beta-87485	PASE-4 @ 140 cm.	4,840 ± 60	4,620 ± 70	2,915-2,845 B.C.

^a All samples are marine shell.

addition, three historical sites, eight prehistoric sites, and three locales (see below) were recorded outside the sample units. Sites were recorded and sketch mapped on standard survey forms, they were photographed, and stratigraphic exposures with suitable radiocarbon materials were noted. Potentially diagnostic artifacts were collected and are curated at the Instituto Nacional de Antropología e Historia's Centro Sub-Regional in Ensenada, Baja California.

Site densities varied from 0 to 13 sites per km.², with an sample average of 4.58 and standard deviation of 3.72. Extrapolating from the

sample data, an estimated total universe of 3,000 to 4,000 sites is located in the project area. Sites tend to fall into a small set of descriptive categories—base camps, locations, and locales—although this is a preliminary taxonomy that undoubtedly will be revised in light of additional data (see Table 2).

Base camps contain evidence of food preparation (e.g., manos, metates, fire-cracked rock clusters, hearths, shell, bone, and/or pottery) and of tool manufacture and/or curation (e.g., finished artifacts, cores, hammerstones, debitage). Base camps can be open or can be associated

Table 2
PRELIMINARY TAXONOMY FOR SITES IN 1995 SAMPLE SURVEY

	Open Base Camps		Locations				Isolates
	Short-Term	Ephemeral	Shell Midden	Lithic Scatters	Lithic Workshops	Rock-shelter	
single	13	26	10	1	3	0	2
multicomponent	6	2	2	1	0	1	0
unknown	10	3	4	1	2	0	0
Total	29	31	16	3	5	1	2

with rockshelters; they may also be described as “single component” or “multicomponent” and “short-term” or “ephemeral” (see below). Locations reflect the procurement of lithic materials (e.g., lithic scatters or lithic workshops) or of food resources (e.g., shell middens without additional artifactual materials.)

Finally, there are archaeological zones called “locales” (see Moore and Gasco 1996). A locale is defined as an area of recurrent human occupations that are directed toward similar extractive tasks. This pattern may produce an area of several square kilometers in which small, similar clusters of archaeological materials—usually small shell middens with lithic debris and occasional metates—are found. Three such locales were identified in 1995 (Fig. 4): the Socorro Locale (4.8 km.²), the Pabellon Locale (12 km.²) and the Monte Mazo Locale (1.65 km.²). In each locale, the densities of these archaeological clusters are extremely high; for example, an arbitrarily defined 50 m. x 50 m. unit in the Pabellon Locale contained five shell midden clusters ranging from seven to 20 m. in diameter. Due to the size and density of materials within these locales, only relatively small sections could be mapped, but they illuminate important issues about prehistoric settlement patterns.

Chronology

Eighteen radiocarbon assays and a small number of sites with temporally diagnostic pro-

jectile points and ceramics represent the first chronological data from the region (Table 1; Fig. 4). Radiocarbon samples were collected from sea cliffs and arroyo banks with good stratigraphic exposures. All samples were marine shells; assays were corrected for ¹³C/¹²C and adjusted for local reservoir effect (225 years ± 35) and calibrated based on the Pretoria Calibration Procedure. Two tentative inferences can be drawn from the radiocarbon dates. First, the oldest dates indicate an occupation in the region by at least ca. 5,000 to 4,500 years ago. These dates (Beta-87470, -87480) come from two sites on the flanks of the volcanic cinder cones, suggesting that volcanic activity had stabilized sufficiently to allow for human occupation by that time. Second, although there are no dates from the fourth millennium B.C., there is a relatively continuous sequence of dates from ca. 2,915 to 2,845 B.C. to the historical period; no obvious hiatuses appear in this limited set of dates, although additional dates are required to confirm this.

More problematic are the “temporally diagnostic” projectile point styles located in the project area (Fig. 5). All of the points are from surface contexts, and they approximate well-documented, but controversially dated, Great Basin point styles (Thomas 1981; Holmer 1986; Flenniken and Wilke 1989; Bettinger et al. 1991; Wilke and Flenniken 1991; Carmean 1994b; Koerper et al. 1994; O’Connell and Inoway

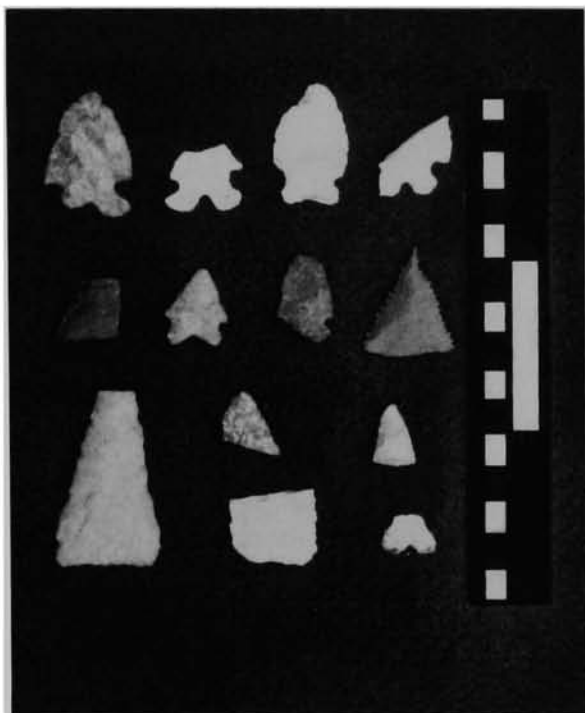


Fig. 5. Projectile points recovered from the project area. Top row, left to right: PASE-27, PASE-102-A, PASE-13, PASE-26. Second row, left to right: PASE-82, PASE-27, PASE-23, PASE-13. Third row, left to right: PASE-26, PASE-13. Bottom row, left to right: PASE-101-A, PASE-13, PASE-26. (Scale in cm.)

1994). Only a small number of projectile points were observed in the 1995 survey (eight complete and seven fragments); of those, five of the complete points correspond to Elko series (see Thomas 1981; Holmer 1986:101-105; cf. O'Connell and Inoway 1994:167). Given the small number of points recovered from the project area and the chronological complexities within the Great Basin as well as in coastal Alta California (Koerper et al. 1994), it is not wise at this time to assign even an approximate date to sites based on "diagnostic" projectile points. However, sites with Elko series points (e.g., PASE-26, -27, and -102A; see Fig. 4) also exhibit lithic materials that apparently are exotic to the project area, including obsidian, white chalcedony/chert, and

brown chalcedony. Represented only by finished Elko series points and small tertiary flakes, the materials probably come from the interior of the Baja California peninsula and may represent the seasonal migrations of interior groups rather than exchange. This hypothesis awaits further testing.

To date, the only other possible chronological marker is a utilitarian, undecorated coil-made brownware with micaceous sand temper, varying in thickness from four to 14 mm. and ranging in color from red (2.5YR 4/6), to reddish brown (2.5YR 5/6) or orange (2.5 YR 6/6). Based on rim sherds, vessel forms represent tecomates, bowls, ollas, and a comal (Fig. 6). Although roughly similar pottery styles are found in pre-Hispanic contexts in the Paipai and Kiliwa regions to the north (Rogers 1936; Hicks 1959), the only pottery so far found in the PASE project area is from historical sites; the two mission sites located in the Valle del Rosario, and PASE-5, where a radiocarbon sample (Beta-87473) removed from a shell lens produced a calibrated date (at one sigma) of A.D. 1710 to 1950. This pottery lacks the vegetal fiber temper that Ritter et al. (1994:17) suggested may be diagnostic of the early historical period in the central and southern peninsula. Instead, the pottery seems to be a postcontact ware, although drawn from indigenous rather than Spanish ceramic traditions. The apparent absence of precontact ceramics indicates that storage vessels were not produced in the San Quintín-El Rosario area; thus, this has implications for understanding prehistoric settlement and subsistence.

Prehistoric Settlement Patterns and Intrasite Structure

Based on stratigraphic exposures and surface indications, the majority of the sites (63%) appears to represent single occupations, 14% seems to be multiple occupation sites, while for the remaining 23% of the sites it could not be determined if they were single or multiple occupations.³ All of the multiple occupation sites are

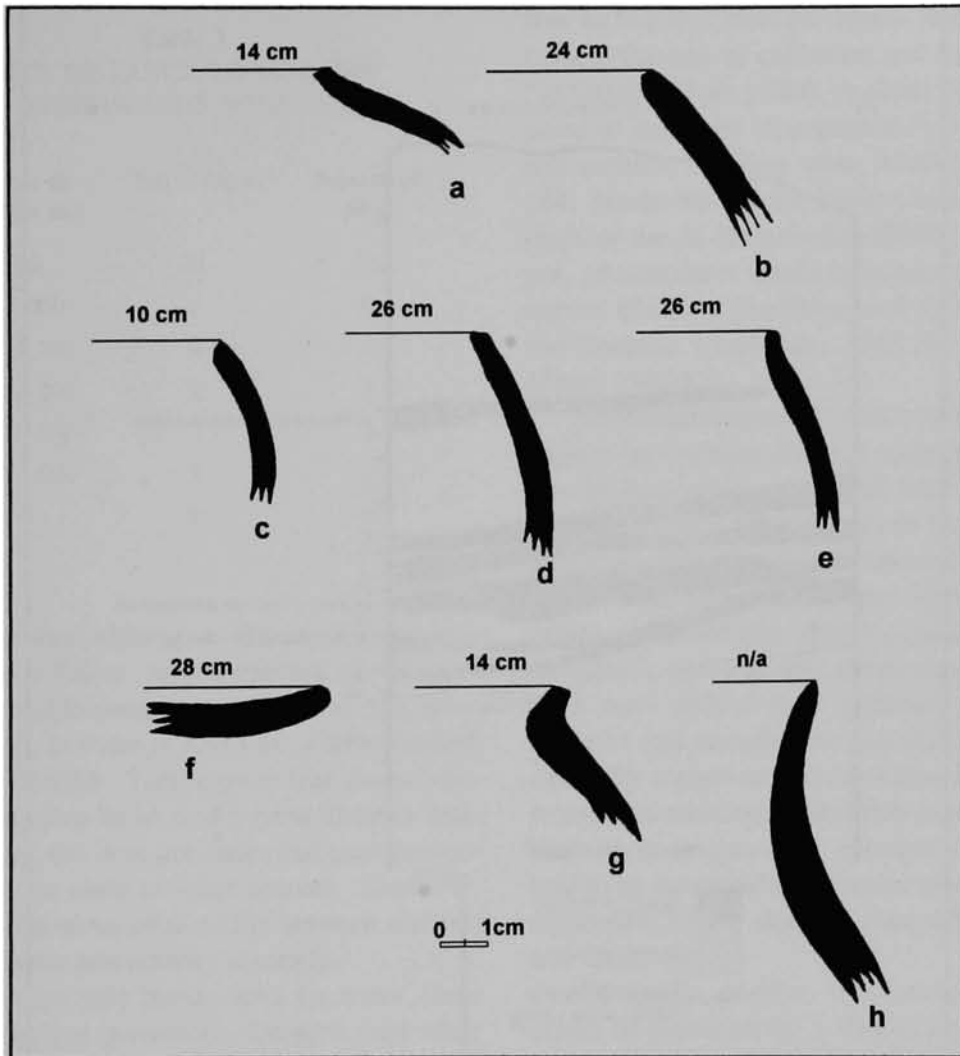


Fig. 6. Ceramic rim profiles, PASE-5: (a-b) tecomates; (c-e) incurving bowls; (f) comal; (g-h) ollas with outcurving rims. The measurements represent estimated rim diameters (not available for Fig. 6h).

marked by discontinuous occupations separated by stratigraphic hiatuses. None exhibits thick, continuous midden deposits, and the shell middens usually contain a high proportion of whole valves unfractured by trampling (for a review of trampling, see Nielsen [1991]).

For example, PASE-6 is a large site partially exposed in an approximately 80 m. long sea cliff profile in which numerous occupational strata were visible, each separated by strata of dune sand marking abandonment of the site (Fig. 7).

Absolute dates from the profile suggest that the hiatuses ranged from relatively brief periods to rather lengthy abandonments. Two dates from this site— $3,300 \pm 70$ RCYBP (Beta-87477) and $3,280 \pm 70$ RCYBP (Beta-87476)—indicate that Strata VIII and X are essentially contemporary, although they are separated by a layer of dune sand two to six cm. thick; note that the fire-burned lens indicates that the surface of Stratum X was at least briefly exposed. In contrast, an absolute date from Stratum II ($1,780 \pm 70$

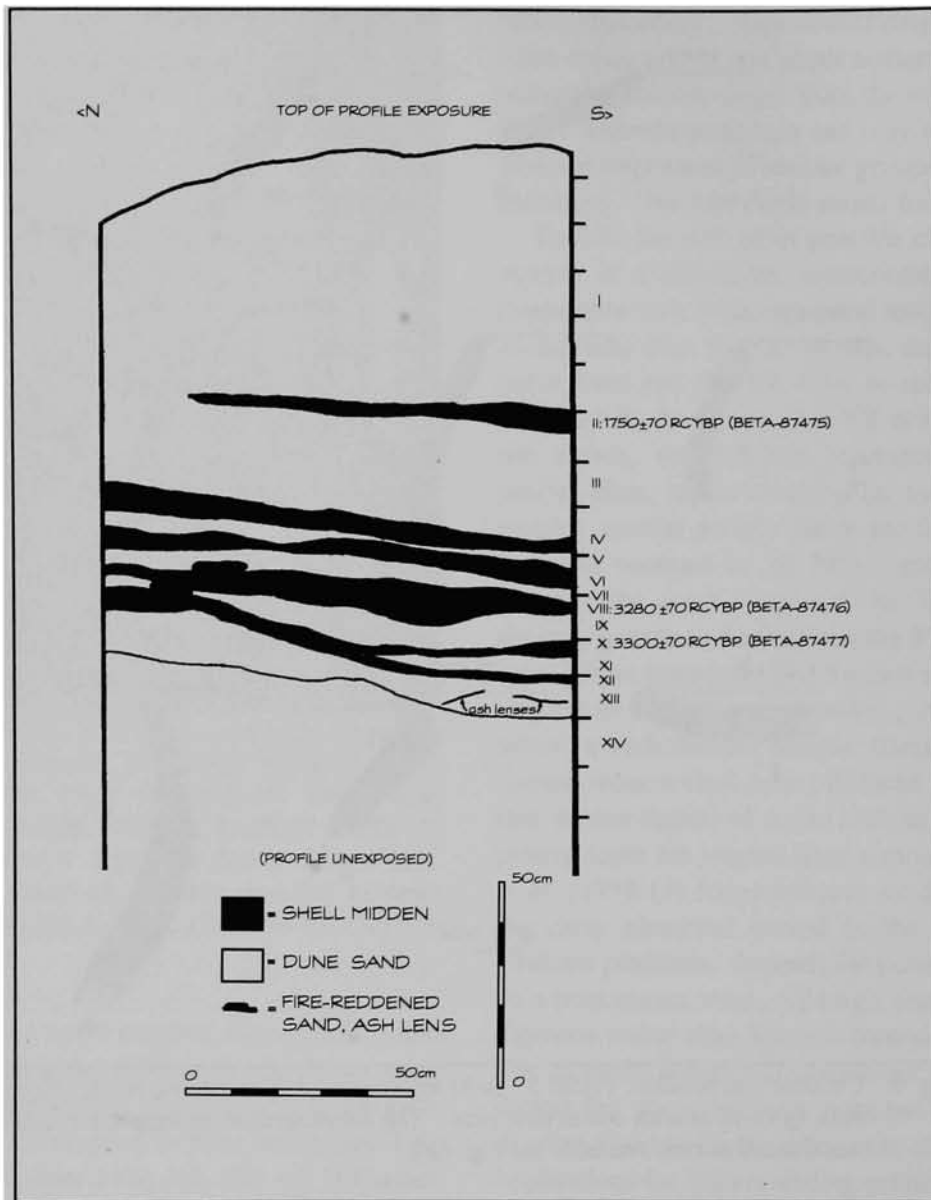


Fig. 7. Stratigraphic profile, PASE-6.

RCYBP [Beta-87475]) suggests a hiatus of several centuries. To date, middens with stratigraphy that might suggest a continuous or long-term occupation have not been observed. Current data suggest very low levels of sedentism, probably in response to the widespread distribution of critical terrestrial resources.

Site location is not restricted by proximity to modern freshwater surface sources, and site densi-

ties are not appreciably greater on the margins of the Río Rosario than elsewhere in the project area. Only 30% of the sites ($n = 26$) are within one km. of an identifiable water source (Table 3). There is no apparent relationship between distance to water and site area (Pearson's $r = -0.017$), although a slender relationship appears to exist between distance to water and whether sites represent single or multiple occupations. For

Table 3
SITE DISTANCE TO MODERN
FRESHWATER SOURCES

Distance to Water (in m.)	No. of Sites	Percent of Sites
0-500	21	24
500-1,000	5	6
1,000-1,500	0	0
1,500-2,000	2	2
2,000-2,500	3	3
2,500-3,000	1	1
3,000+	57	64

multicomponent sites ($n = 12$), average distance to water is 6,108 m., with a standard deviation of 4850; for single-component sites ($n = 55$), average distance to water is 7,473 m. with a standard deviation of 4266. This suggests that single-component sites may be located a great distance from fresh water, but does not mean that multicomponent sites are close to water sources. Similarly, there is no obvious relationship between distance to fresh water and activity diversity.

Given the daily human need for water, these data imply that prehistoric foragers used other water sources, such as subterranean flows, seasonal catch basins or pans, or permanent sources that are now dry. Since many of these sources were not permanent, foragers would have been constrained by the seasonal or ephemeral availability of fresh water, so one would expect that such sources would have been particularly stressed during periods of extended drought. Perhaps water containers were used to extend the foragers' range away from water sources similar to those described for the Seri, who transported water "sometimes five to ten or more kilometers away" (Felger and Moser 1985:79). In his 1895 and 1896 expeditions among the Seri, McGee (1898:182) noted that Seri camps were located

four to 12 miles from permanent water, and calculated the cost of collection and transportation "at \$10 or \$12 per gallon, or about the wholesale price of the finest champagnes." Yet, the Seri had ceramic carrying ollas (McGee 1898:182-184; Bowen and Moser 1968) which the inhabitants of the El Rosario-San Quintín region did not, so containers would have been restricted to animal bladders like those used by the Seri and the Cochimí (Aschmann 1967:59; Felger and Moser 1985:81).

The impermanence of fresh water may partly explain the evidence for high mobility. The settlement data point to an overall high level of settlement mobility, although we can distinguish between sites that seem to be ephemeral base camps versus short-term base camps. Ephemeral base camps consist of thin, discrete clusters of shell, stone tools, and debitage; short-term base camps have more diffuse shell middens, display evidence of tool manufacture and maintenance, occasionally contain metates, and may include food remains in addition to shellfish (e.g., fish, rabbits). In the project area, ephemeral base camps tend to be associated with locales where there are numerous, small, discrete occupations (Moore and Gasco 1996).

Of course, similar archaeological patterns could be produced by a single, large-scale, simultaneous occupation of an area or by fewer brief but recurrent encampments. To explore this issue, intrasite spatial patterning was analyzed at two different sites, one with only an ephemeral water source (Monte Mazo Locale), the other with a seasonal water supply (PASE-60 at Arroyo Hondo). The Monte Mazo Locale is on a low volcanic cinder cone that anchors the southern end of a tombolo stretching 11.5 km. south from the mainland. The tombolo is densely covered with archaeological deposits, but the southern flank has a particularly high concentration of sites, including several small rockshelters (PASE-91). This area lacks permanent freshwater sources, and since the small landform is

separated from the mainland, it has no subterranean water or even seasonal surface flows. The only known water sources are small catch basins naturally present in nearby lava boulders (Fig. 8). In April 1996, a survey of these tinajas determined that they have a combined volume of less than 78 liters. This volume of water would be available for human consumption only if the total average annual precipitation (approximately 130 to 150 mm.) fell during a single storm and no water was lost to evaporation. If a daily consumption of one liter of water per person per day is assumed, then at maximum, 11 people could live at the Monte Mazo locale for a week.

Not surprisingly, the archaeological deposits at Monte Mazo represent ephemeral base camps distributed apparently randomly across the landform (Fig. 9). A nearest neighbor analysis of the clusters (Kintigh 1990) produced a coefficient of 0.92, close to the coefficient's random value of 1.0. Such randomness would be expected if an archaeological deposit was created by repeated, short-term, and independent occupations, each established without regard for previous encampments. As Kintigh (1990:167-174) has shown, the nearest neighbor coefficient may be more useful as a relative, rather than an absolute, index of clustering, so it is instructive to compare the Monte Mazo data with another site located near a more reliable, seasonal water source, PASE-60 (Fig. 10). In the initial survey during July 1995, PASE-60, an open base camp located in Arroyo Hondo, was recognized as possibly exhibiting a higher degree of site structure than many other sites, with clusters of grinding slabs, lithic workshop areas, a possible agave roasting pit, and loci with different types of shellfish species (an eastern area dominated by *Tivela stultorum* with a few other species versus a western area where *Mytilus californianus* and other rocky shore species were more prevalent). This first impression was substantiated by more intensive mapping in February 1996, and by a nearest neighbor analysis that produced a coefficient of 1.29, which



Fig. 8. Measuring small catch basins (tinajas) at the Monte Mazo Locale.

indicates a relatively greater degree of intrasite structure than the random encampments of the Monte Mazo locale.

Based on the data from these two sites, they are interpreted to represent two different settlement strategies, an ephemeral camp (Monte Mazo) and a short-term base camp (Arroyo Hondo). These two site types appear to be broadly represented in the settlement data, although the precise percentage of sites in each category cannot be accurately estimated from the small sample. For example, much like the Monte Mazo Locale, the Pabellon Locale is characterized by an estimated several hundred ephemeral camps; in contrast, similar to Arroyo Hondo, the margins of the lower Valle del Rosario contain more internally structured, short-term base camps indicated by the presence of cached metates, piles of

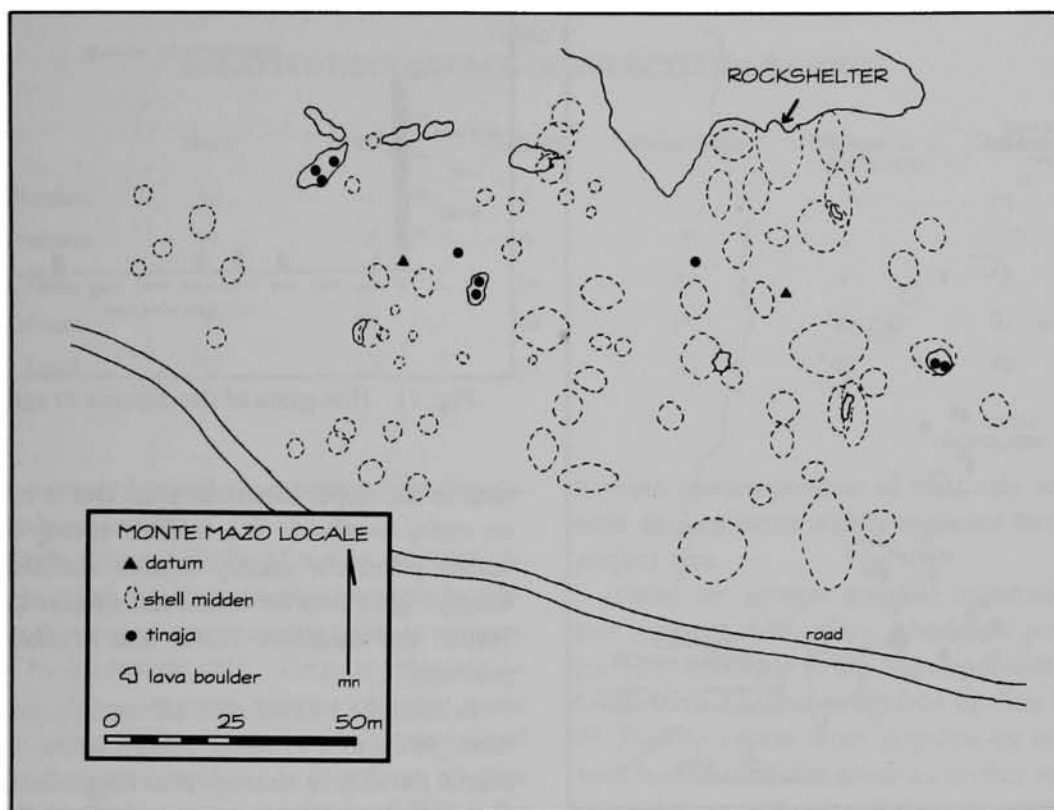


Fig. 9. Map of the Monte Mazo Locale.

fire-cracked stone, discrete zones within the site, and shellfish from a variety of coastal habitats, perhaps indicating greater residential permanence. More research is required to explore these patterns in greater detail.

Resource Procurement Patterns

The data on resource procurement are more suggestive than conclusive, indicating patterns that need to be corroborated by additional quantitative data. The presence of *Agave shawii* is one factor in the determination of site location (Fig. 11). As mentioned above, *A. shawii* is widespread, growing on the mesas and coastal terraces as well as on the terraces of the Valle del Rosario. *A. shawii* does not grow in the Rosario floodplain, in the active dunes of the Pabellon Locale, or on the lava flows associated with the cinder cones, including the Monte Mazo Locale.

Nonetheless, over half of the sites in the sample ($n = 58$) are within one km. of a current stand of *A. shawii*. This almost certainly reflects a strategy of residential, rather than logistical, mobility (Binford 1980).

Based on current evidence, shellfish was apparently the principal source of animal protein. The majority of sites recorded in 1995 contains open coast shellfish, particularly Pismo clam (*Tivela stultorum*) and California mussel (*Mytilus californianus*); estuarine species are underrepresented (Table 4). The data in Table 4 are qualitative and based on surface observations, not quantified excavated materials. However, Pismo clams and California mussel dominate the molluscan assemblage; at most sites in the sample, oysters (*Ostrea* sp.) and clams (e.g., *Chione* sp., *Protothaca staminea*) are absent, and this is true even of sites adjacent to Bahía San Quintín.

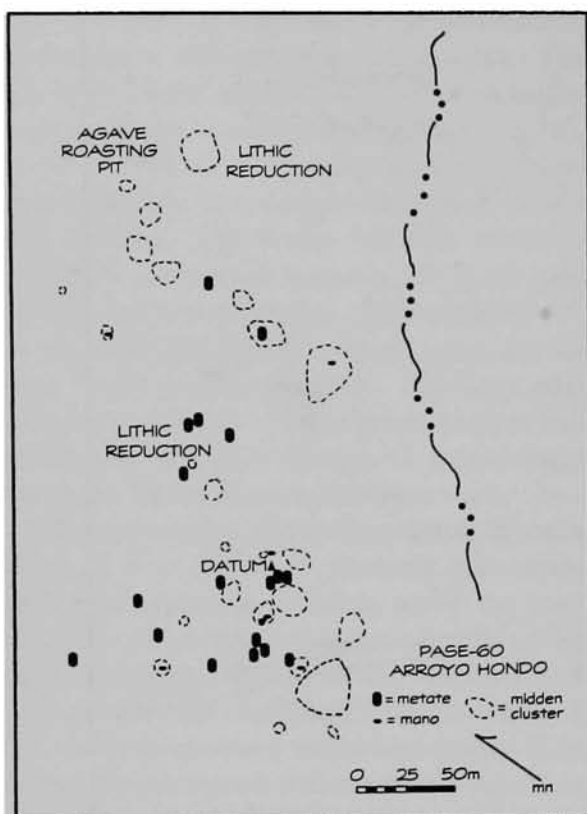


Fig. 10. Map of PASE-60, Arroyo Hondo.

For example, one cluster of sites (PASE-11 through -14) located less than one km. from the bay contained predominantly *Tivela stultorum* and *Mytilus californianus*, the closest sources for which are five km. to the southwest; only one site, PASE-14, contained a small amount of *Ostrea*. Although the data are preliminary, there is an obvious preference for open coast molluscs. Since Bahía San Quintín provided a habitat suitable for protected bay species, their near absence in the middens must be explained. Pismo clam is a relatively large, high-quality clam whose location is extremely predictable—on sandy beaches at low tides in water that is mid-calf in depth. Informal interviews with clam diggers in March 1997 indicated that three men collected 120 medium to large sized Pismo clams in about four hours of work during low tide. Similarly predictable, the California mussel grows in dense colo-

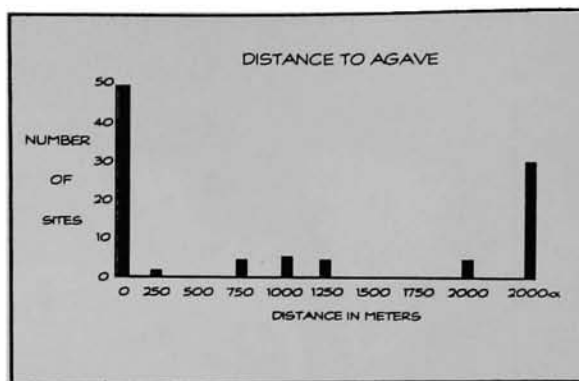


Fig. 11. Histogram of site distance to agave.

nies in the upper intertidal zone and is exposed on rocky headlands at low tide. It may be that search effort for muddy bottom shellfish was simply higher than for open coast species (Serena 1980), and therefore *Tivela* and *Mytilus* were preferred.

In sum, the limited data on resource procurement points to a foraging pattern based on residential mobility, a strategy also suggested by the settlement data. Sites are near principal food resources—agave and shellfish. Shell assemblages tend to reflect the closest available coastal habitat, with the significant qualification that easily accessible, open coast species are selected over protected bay shellfish species. This preference contrasts with the pattern Colten (1989) described for the Goleta Slough region in Santa Barbara County, where *Mytilus californianus* and *Tivela stultorum* were relatively abundant in Early Period sites, but decreased in importance as *Chione*, *Ostrea*, and *Protothaca* dominated Middle and Late period assemblages. After considering alternative hypotheses to account for this shift, Colten (1989:208-209) proposed that the shift in molluscan species reflects environmental changes associated with the final stages of sea level rise and the creation of protected estuaries after ca. 6,000 B.P. Colten (1989:211) noted that, "Given the broad impact of sea level change we should expect to find similar patterns of shellfish remains from sites in a wider region, at least

Table 4
RELATIVE OCCURRENCE OF SELECTED MOLLUSCS

	<i>Tivela</i>	<i>Mytilus</i>	<i>Haliotis</i>	<i>Protothaca</i>	<i>Chione</i>	<i>Ostrea</i>
abundant	46	16	1	--	--	--
common	14	16	4	5	1	--
rare	5	16	14	23	4	4
absent	20	37	66	57	80	81
Total	85	85	85	85	85	85

along protected coastlines where productive estuaries have formed."

While Colten (1989) did not have Baja California in mind, his hypothesis is potentially relevant to the project area, although this is not supported by the current data. There is currently no evidence for increasing reliance on quiet water species, since Pismo clam and California mussel are the dominant molluscs at sites from all time periods, including those postdating 6,000 B.P.; i.e., after sea levels reached their modern levels (Table 5). It is possible that differences in search time and yield make *Tivela stultorum* and *Mytilus californianus* preferable to *Chione* spp. or other bay species. Resolution of this issue requires better quantitative data in order to explore chronological changes in subsistence practices; however, at present, there is no indication of major temporal shifts in molluscan resources.

SUMMARY AND DISCUSSION

There is a striking difference between the settlement data discussed above and the ethnohistoric descriptions from the late eighteenth century (Meigs 1935; also see Libros de Bautismos, Misión de Nuestra Señora de El Rosario, 1774-1868⁴). The mission accounts describe the rancherías as if they were relatively permanent settlements clustered along the Rosario River and Arroyo Socorro (Meigs 1935; Massey 1949:301; Moore and Norton 1992); in contrast, the pre-

historic pattern consists of relatively impermanent encampments widely scattered through the project area.

There are several possible explanations for this apparent shift. First, aboriginal population probably decreased in the late eighteenth century as epidemics spread north into the San Quintín-El Rosario region from populations in contact with Jesuit-established missions further south; for example, an epidemic affected the region from 1760 to 1765, years before the Spanish were in sustained local contact (Jackson 1981a, 1981b, 1984; Moore and Norton 1992; Moore and Gasco 1993). Thus, a change in settlement patterns may have reflected a broader demographic restructuring associated with the indirect introduction of diseases.

Second, historical factors may have caused an increase in sedentism. The establishment of Misión Nuestra Señora de El Rosario reorganized settlement patterns, concentrating previously dispersed populations. As an example, it has been documented that natives from an area covering an estimated 2,920 km.² came to the Valle del Rosario to be baptized within 18 months of the establishment of the mission (Moore and Norton 1992:207-209). Further, the Dominicans may have overstated the degree to which "rancherías" represented places rather than social units, a Eurocentric interpretation that Meigs (1935) unreflectively perpetuated (Moore and Gasco 1993).

Table 5
QUALITATIVE DATA ON SELECTED MOLLUSCAN
SPECIES FROM DATED COMPONENTS

Lab No.	Site	Date	<i>Tivela</i>	<i>Mytilus</i>	<i>Haliotis</i>	<i>Ostrea</i>	<i>Protothaca</i>	<i>Chione</i>
87468	PASE-2	A.D. 1635-1740	--	A ^a	--	--	R	--
87469	PASE-65	A.D. 1220-1430	A	C	--	--	--	--
87473	PASE-5	A.D. 1710-1950	A	R	R	--	R	--
87475	PASE-6	A.D. 780-970	A	--	C	--	--	--
87478	PASE-87	A.D. 370-595	--	A	--	--	--	--
87474	PASE-47	A.D. 150-475	A	--	--	--	--	--
87479	PASE-87	380-190 B.C.	C	A	R	--	R	--
87476	PASE-6	945-790 B.C.	A	--	C	--	--	--
87477	PASE-6	975-800 B.C.	A	--	C	--	--	--
87472	PASE-8	1,135-910 B.C.	--	A	R	--	--	--
87484	PASE-1-L	1,270-1,100 B.C.	A	--	--	--	--	--
87483	PASE-72	1,575-1,415 B.C.	--	C	R	--	--	--
87482	PASE-85	1,900-1,720 B.C.	--	A	--	--	R	--
87481	PASE-85	2,470-2,320 B.C.	--	A	--	--	R	--
87485	PASE-4	2,915-2,845 B.C.	A	--	C	--	--	--
87480	PASE-87	4,555-4,345 B.C.	A	--	--	--	--	--
87470	PASE-13	4,995-4,790 B.C.	C	R	--	--	--	--

^a A = abundant; C = common; R = rare; -- = absent.

It is therefore possible that the historical concentration of settlements in the Valle del Rosario is an exclusively postcontact phenomenon.

Based on current archaeological data, however, pre-Hispanic settlement strategies were highly mobile, populations were widely distributed, and residential patterns were extremely fluid. The evidence from the 1995 research supports the mobile ranchería model. To date, no evidence for continuous or long-term residence has been found in the project area, although—to reiterate—the survey consists of a small sample of the project area. Rather, the 1995 data suggest a prehistoric pattern in which settlement was extremely mobile, with numerous brief encamp-

ments created by small residence groups, such as nuclear or small, extended families.

The preliminary data pose more questions than they resolve, but some basic theoretical issues are relevant. For example, given the general importance of marine resources in creating situations for relatively high population densities, potential sedentism, and other dimensions of social complexity, a basic question emerges: Why did these patterns apparently not develop in the San Quintín-El Rosario region? As Arnold (1995) recently discussed, the favorableness of a coastal environment for the development of social complexity depends on a number of variables in addition to marine biomass, including the di-

versity of marine habitats, physical access to coastal resources, the sophistication of maritime technologies, and so on. Yet, there is no obvious constraint to such developments in the San Quintín-El Rosario regions: marine biomass is sufficient to be commercially exploited; marine habitats are as diverse as in southern Alta California; there is ready physical access to beaches, bays, and open ocean; and Spanish sailors were impressed with aboriginal fishing technologies, as noted above. The marine habitats in the project area pose no obvious limits to the development of greater sedentism, higher population density, specialization, or any of the other features found among maritime societies further north.

Probably the limits to such developments were terrestrial, not marine. Casteel (1979) proposed a carrying capacity model in which human population density is determined by basic vegetative biomass, a model he applied to data for the Central Desert. Basing his estimate of terrestrial biomass on data derived from other arid regions and assuming a 90% loss of energy across trophic levels, Casteel (1979) argued that foragers in the Central Desert could sustain densities of 0.96 persons per mi.² (one person per 2.6 km.²). This value compared closely with precontact period population densities estimated by Aschmann (1967:178) for the Central Desert, which ranged from 0.97 to 1.12 persons per mi.² Casteel (1979:91) concluded that his model was an "acceptably accurate measure of human carrying capacity in arid desert environments."

Casteel's model illuminates the relative difference between arid terrestrial and rich marine habitats: given the 630 km.² in the project area, an estimated sustainable population—according to Casteel's model—would be 240 individuals, approximately one-third of the estimated A.D. 1770 population of 700 to 900, itself probably a reduction from precontact levels. One plausible conclusion is that these higher than expected populations indicate the significance of marine resources. But the greater productivity of marine

resources did not produce higher levels of settlement permanence nor were they sufficient causes for the evolution of sociopolitical complexity.

Rather, the hypothesis herein is that limited freshwater and dispersed, nonstorable plant foods (especially *Agave shawii*) restrained sedentism and population aggregation, instead selecting for a mobile strategy. The distance between permanent water sources and the absence of large ceramic containers suggest that settlement in much of the project area was necessarily short-term. Perhaps even more significant, the nature of *A. shawii* selected against the use of collecting strategies, while the low levels and unpredictability of rainfall indicate that no other plant food was as abundant or reliable. Given the slow growth of agave and its innate nonresponsiveness to intensification, this essential staple set limits on human sedentism and population aggregation in the project area. At least in Baja California, since *A. shawii* is widespread, is available year-round, and is not stored but collected as needed (as the ethnohistoric accounts indicate), and since collection of the plant requires its destruction, procurement of agave selects for a foraging strategy. The settlement patterns indicate that *A. shawii* procurement was not intensified or made more efficient through the economics of scale or by developing logistical strategies, which is reflected in the settlement patterns.

This contrasts with the exploitation of different agave species by other Native American groups. For example, *A. desertii* was logistically exploited by the Cahuilla, who sent small groups of males to collect the plant during the winter and spring when the basal rosette and leaves were richest in sap, and when other plant resources were limited and stored plant foods (e.g., acorns) were diminishing (Bean and Saubel 1972: 31-35). Although agave was a major food for many desert-oriented Cahuilla, the most sedentary Cahuilla communities were those who relied on dense groves of oaks or mesquite to provide their staple plant food (Bean and Saubel 1972:

108). For those Cahuilla communities, agave was exploited logistically as an important but supplemental food. On the coast of Baja California, as elsewhere in the peninsula, agave was the primary food staple.

Agave does not store well in a humid coastal environment unless ceramic storage vessels are used, and even in drier regions, special steps were taken to prevent mildew from spoiling the cakes. For example, among the Cahuilla, "Roasted stalks and leaves [of *Agave desertii*] were pounded into cakes, dried in the sun, and stored in *hermetically sealed pots*" (Bean and Saubel 1972:34; emphasis added). The Seri similarly stored sun-dried cakes made from the leaf bases of *A. subsimplex* Trel., a species closely related to *A. desertii* (Felger and Moser 1985:225-227), which like other plant foods "were kept in large pottery vessels or ollas. . . . These vessels had pottery, rock, or clamshell (e.g. *Laevicardium elatum*) lids sealed with creosote lac" (Felger and Moser 1985:91; emphasis added). Barrows (1900:66) reported that boiled and dried agave flowers could be preserved for five years, and alleged in a 1958 lecture that he had kept a stalk for 60 years and "still found it edible" (Bean and Saubel 1972:34), a statement some might find questionable. There is more complete documentation that agave cakes were stored in sealed ceramic vessels to prevent mildew, presumably even more of a problem in the higher humidity of the Pacific coast of Baja California than for the interior Cahuilla or the Sonoran Seri. In sum, the nature of *A. shawii* and the lack of an adequate storage technology may account for the apparent foraging strategy indicated by the settlement data.

Although additional fieldwork is necessary to substantiate these preliminary findings and clarify other issues, the PASE 1995 investigations point to a theoretical counter-example to explanations proposed for the evolution of social complexity in coastal environments in southern Alta California, a "natural experiment" to recall Diamond's

(1997:424) phrase (see above). Given the small sample size, additional survey is essential to determine if the preliminary estimates of site density and distributions are accurate.

Further absolute dates are necessary to determine if pre-5,000 B.C. deposits exist in the project area and to identify any large-scale abandonments of the region, such as during the drought believed to have occurred ca. A.D. 1120 to 1250 (e.g., Euler et al. 1979). Although paleoenvironmental data for Baja California cannot be extended back to the twelfth century A.D., one could predict that such a widely experienced drought would have consequences for the San Quintín-El Rosario project area. If this drought were accompanied by a dramatic increase in sea temperatures along the California Bight (Pisias 1978; cf. Salls 1992:162-163), then such changes could disrupt marine ecosystems, triggering reorganization of marine-based economies, as Arnold (1987, 1992a, 1992b) and Larson and Michaelson (1990) argued for Island Chumash populations in the Santa Barbara Channel (however, Raab et al. [1995] proposed an alternative view). If such environmental changes did occur, then one might expect a major abandonment of the San Quintín-El Rosario region dating to ca. A.D. 1100 to 1250, a hiatus potentially identifiable with an expanded suite of absolute dates.

CONCLUSION

A great deal of research remains before such issues can be addressed with any confidence; however, the relevance of such research for understanding the evolution of social complexity among coastal hunter-gatherers is clear. Additional research issues, such as long-term adaptations to environmental change, the archaeology of Spanish colonialism, and other problems, are similarly relevant for understanding the prehistory of the region. A deeper knowledge of the prehistory of Baja California has theoretical and substantive implications for regions outside the peninsula, and ongoing investigations in the San

Quintín-El Rosario region and in other portions of Baja California are transforming the forgotten peninsula into a significant area for understanding the prehistory of western North America.

NOTES

1. Site records were originally curated by the University of California, Los Angeles, Archaeological Survey; they are currently housed at the Department of Anthropology, California State University, Dominguez Hills.

2. The following translations are mine from Miguel del Barco's 1988 *Historia Natural y Crónica de la Antigua California*, edited by Miguel Leon Portilla and published by the Universidad Nacional Autónoma de México; and from Luis Sales' 1959 *Noticias de la Provincia de Californias*, published by Editorial Jose Porrua Turanzas, Madrid.

3. For example, isolated artifacts, single-event core reductions, and low density lithic scatters are assumed to represent "single occupations."

4. Copies of the *Libros de Bautismos, Misión de Nuestra Señora de El Rosario, 1774-1868*, were obtained through the kindness of Fr. Charles Hess, Archivist, St. Albert's College, Oakland, California, on file at California State University, Dominguez Hills.

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