Extensive Prehistoric Settlement Systems in Northern Baja California: Archaeological Data and Theoretical Implications from the San Quintín–El Rosario Region

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Abstract

The Proyecto Arqueológico San Quintín–El Rosario conducted three field seasons (1995, 1998, 1999) of systematic archaeological survey on the Pacific coast of northern Baja California. Based on a probabilistic sampling strategy of 10% of the 640 square kilometer survey area, the investigation documented 275 archaeological sites within the sample and another 15 sites outside the sample. Radiocarbon samples from 59 archaeological contexts indicate human occupation of the region from 7000 BP and continuing to the Historic Period. Settlement data and a variety of artifactual materials are interpreted as indicating a high degree of settlement mobility in which the Pacific coastal zone was only one region in a larger, transhumant settlement system that encompassed interior and Gulf of California habitats. This model interprets the archaeology of the San Quintín–El Rosario region as reflecting a "desert adaptation" to coastal resources rather than a maritime adaptation like that hypothesized for coastal zones in southern Alta California.

Introduction

"It is virtually axiomatic in anthropology," Jarvenpa and Brumbach (1988:598) observe, "that settlement systems, or the spatial arrangements of people vis-à-vis resources, are a fundamental expression of adaptive processes." In this view, the archaeological evidence of the distribution of settlement and subsistence activities reflects a "settlement system" which, as Flannery (1976:162-163) described, is distinct from a "settlement pattern":

> A *settlement pattern*, as the name implies, is the pattern of sites on the regional landscape; it is empirically derived by sampling or total survey, and is usually studied by counting sites, measuring their sizes and the distances between them and so on. A *settlement system*, on the other hand, is the set of "rules" that generated the pattern in the first place. It cannot be empirically derived, but at least some of the rules can be deduced by simulation or the use of probabilistic models. Indeed, we have put the term "rules" in quotation marks because, as will be stressed later, it is meant not in a jural or deterministic sense but a probabilistic one (emphasis, added).

The "rules" of a hunting-gathering settlement system incorporate individuals' decisions about "alternative choices tied to variables such as seasonality, proximity to settlements, transportation technology, sexual division of labor, and ideational factors. Expanding this argument…socio-spatial organization in general reflects community-wide solutions to certain behavioral and environmental dilemmas" (Jarvenpa and Brumbach 1988:601). Understanding hunting-gathering settlement patterns requires delineating the different dilemmas of adaptation, and this perspective illuminates the following analysis of archaeological data from northern Baja California (Fig. 1).

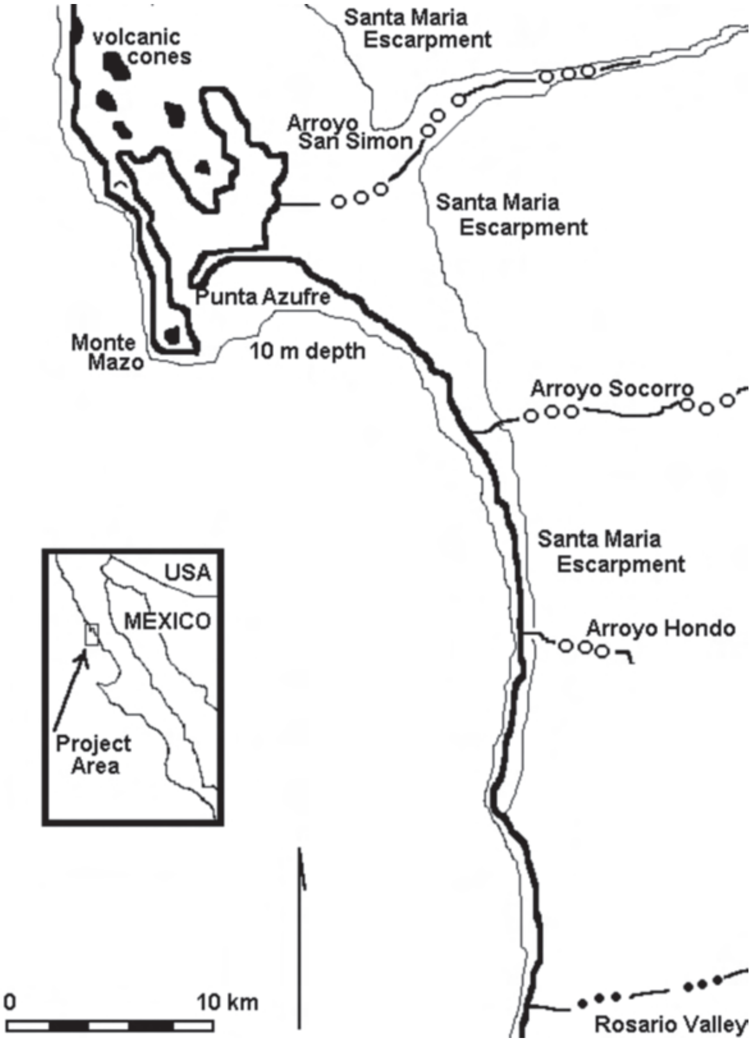

Fig. 1. PASE Project Area and Major Topographic Features.

A probabilistic archaeological survey of the San Quintín–El Rosario region of the Pacific coast of Baja California documented a prehistoric settlement pattern consisting of high site density, short settlement duration, and chronological stability over 7,000 years. These data lead me to propose a hypothesized settlement system characterized by a high-level of residential mobility and short-term, but recurrent, occupation of the project area—a strategy in which desert collectors utilized the Pacific coastal zone as one element of an extensive and transhumant adaptation. In the following I summarize the results of the Proyecto Arqueológico San Quintín–El Rosario and then outline a model characterizing the settlement system that reflected the behavioral and environmental dilemmas of hunter-gather adaptations in this region—one that differed from better known coastal adaptations in southern Alta California (e.g., Arnold 1987, 1990, 1992a, 1992b, 1995; Christenson 1992; Colten 1989; Erlandson 1985, 1988, 1994, 1997; Erlandson and Colten 1991; Erlandson and Glassow 1997; Glassow 1980, 1996, 1997; Glassow and Wilcoxon 1988; Glassow, Wilcoxon, and Erlandson 1988; Jones 1991, 1992 1996; King 1971, 1990; Masters and Gallegos 1997; Raab 1992, 1997; Raab and Yatsko 1992). Unlike areas of southern Alta California where it is hypothesized that rich coastal habitats were the locations for the evolution of sedentism, high population densities, and other dimensions of "complexity," such developments did not occur in this portion of northern Baja California—posing important issues regarding intensive vs. extensive subsistence and settlement systems (Beaton 1991; Glassow 1997).

The Proyecto Arqueológico San Quintín–El Rosario: Project Area and Methods

Beginning in 1992 with ethnohistoric investigation into indigenous demography during the Colonial period (Gasco 1996; Moore and Gasco 1993; Moore and Norton 1992), the Proyecto Arqueológico San Quintín–El Rosario (PASE) completed three seasons of archaeological survey in 1995, 1998, and 1999. The survey covered a 10% sample of the 630 sq. km project area and recorded data on 275 sites within the sample survey and 15 additional sites (Moore 2000a, 2000b; Moore and Gasco 1997, 2001).

The project area is defined by two major habitat zones of presumed importance to prehistoric foragers—San Quintín Bay and the Rosario River Valley—and the intervening coastal zone. At the northern end of the project area, San Quintín Bay is a large tidal embayment formed by a protective barrier of volcanic cinder cones (Woodford 1928). The bay provides habitat for various quiet-water shellfish species (e.g., *Chione* spp., *Saxidomus nuttalli*), fish species, and migratory waterfowl (Fig. 1). The bay is the major feature of the San Quintín Valley. The eastern edge of the San Quintín Valley is defined by a steep terrace, known as the Santa Maria Escarpment (Gorsline and Stewart 1962), that rises some 100 m. The southern project area is defined by the Rosario River Valley, the largest freshwater drainage within 100 km. The Rosario drainage system runs from the Pacific Ocean inland for more than 40 km, branching into smaller arroyos that drain the western slopes of the Sierra San Pedro Martir and the Sierra Santa Isabel. Finally, a coastal terrace between San Quintín Bay and the Rosario Valley fronts the Pacific Ocean, and is sliced by arroyos, some with seasonal surface and subterranean water sources (e.g., Arroyo San Simon, Arroyo Socorro, Arroyo Hondo [Trupp n.d]). Extensive sandy beaches and rocky headlands provide habitats that are extremely rich in marine resources (e.g. Aplin 1947).

The project area was divided into four sampling strata of unequal sizes: (1) the western San Quintín Bay zone (200 sq. km); (2) the eastern San Quintín Bay zone (200 sq. km); (3) the coastal terrace zone (80 sq. km); and (4) the Rosario River Valley (150 sq. km). A 10% sample was surveyed in each of these strata (Fig. 2), employing survey quadrants that were 4 by 0.25 km in size (1 sq. km). Survey quadrants were randomly chosen, established on the ground using a hand-held GPS, and surveyed by teams of 2 to 3 archaeologists. Sites were recorded using site forms developed for PASE and photographed. Natural and artificial exposures with potential for radiometric samples were identified, and samples were collected. Surface artifacts were inventoried, photographed, and in some cases collected (e.g., projectile points, ceramic sherds, groundstone artifacts). All collections and copies of technical reports are curated with the Instituto Nacional de Antropología e Historia, Centro Regional Baja California.

PASE Settlement Patterns: Overview of Results

The resulting data provide a very complete archaeological record for the PASE project area. Some basic components of the settlement pattern include:

Archaeological Site Density and Distribution. Site density averages 4.37 sites per sq. km, with individual quadrant densities ranging from 0 sites to 14 sites per sq. km (Fig. 2). In the statistical sample, 39.7% of the sample units (n=25) have 0 to 2 sites per sq. km, 34.9% of the units (n=22) have 3 to 6 sites per sq. km, and 25.4% of the sample units (n=16) have 7 to

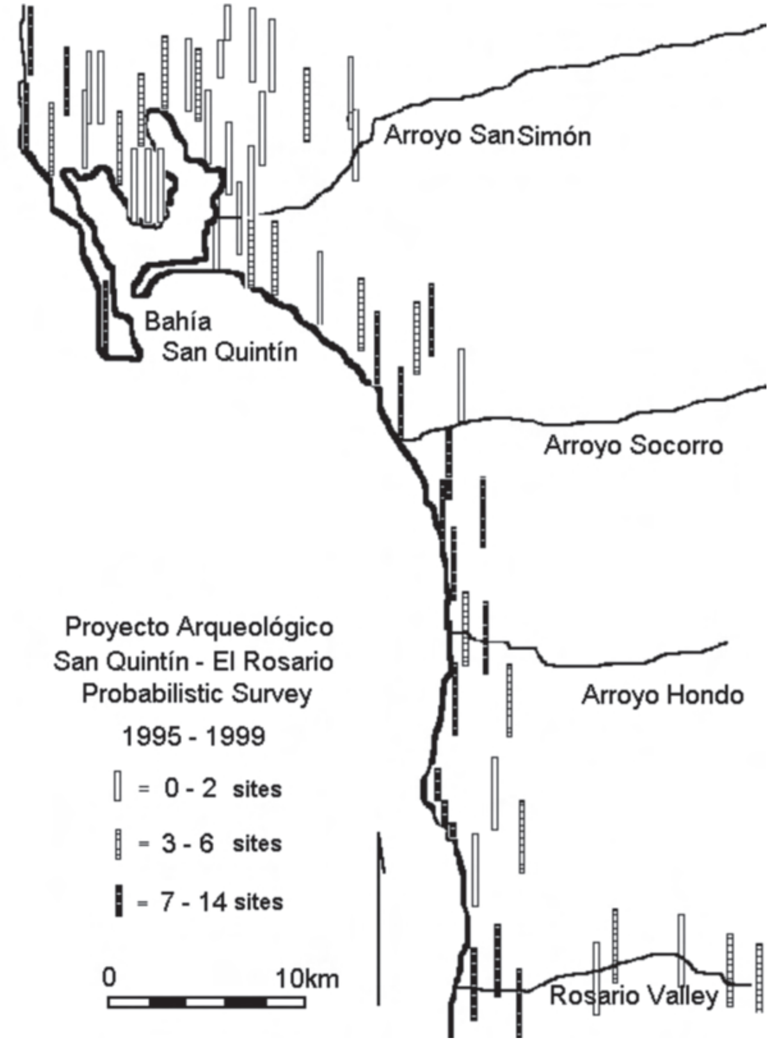

Fig. 2. PASE Project Area, Survey Transects, and Site Densities.

14 sites per sq. km. Extrapolating from these sampled variations in site densities to the 630 sq. km of the sampling universe, an estimated 1,780 to 4,060 sites are located in the entire project area.

Site densities are highest in areas within 2 km of the open ocean; site densities are lowest in the eastern San Quintín Bay stratum. Sites are not clustered near the Rosario River or near San Quintín Bay. Sites are not concentrated near permanent sources of freshwater.

Four areas contain nearly continuous deposits stretching over large areas of low diversity archaeological materials; these are referred to as *locales* (Fig. 3). A locale is defined as an area of recurrent human occupations that are directed to similar extractive tasks (Moore 1999:27). Locales appear to reflect repeated, short-term occupation of a landscape by small foraging groups rather than contemporary occupations by large populations. For example, the Pabellon Locale, covering an area of 12.5 sq. km, contains hundreds of small deposits (100 to 400 sq. m) of moderate density middens of Pismo clam (*Tivela stultorum*), with low density of flakes and cores from locally available grayish black basalt. A similar pattern is indicated for another locale at the end of an 11.5 km long tombolo

Fig. 3. Locations of Radiocarbon-Dated Components.

anchored by the low cinder cone, Monte Mazo (Fig. 3; Moore 1999:31-33). The Monte Mazo locale lacks permanent sources of freshwater, yet has a high density of very small archaeological deposits including several small rock shelters. The archaeological materials suggest Monte Mazo was occupied recurrently by small groups of prehistoric foragers, a common pattern in the San Quintín–El Rosario project area.

Evidence for Settlement Redundancy. Based on surface remains there is a relatively low level of variation in the human activities associated with the archaeological sites. In an analytical sense, there is a high degree of redundancy in the archaeological record. Essentially the archaeological record is the product of two activities, shellfish collection and stone tool manufacture and/or maintenance. The majority of sites are open base camps (n=162) indicated by evidence for food collection and preparation and tool manufacture. Other types of sites include shell middens with lithic debitage but without evidence of extensive tool manufacture (n=39) and shell middens without lithic debitage (n=39). Lithic workshops (i.e., sites with hammers, cores, and debitage; n=17) and lithic scatters (i.e., sites with only debitage; n=11) comprise the remaining classes of sites, with rare examples of agave processing sites (n=4), isolated artifacts (n=2), and a single rockshelter. The archaeological sites neatly fit Binford's (1980) notions of "base camp" and "locations," and suggest a pattern of residential mobility.

Evidence for Site Permanence. Approximately 40% of all sites appear to reflect single occupations, 14 % were multicomponent sites, and the permanence of occupation could not be determined for 46 % of the sites (Table 1). The multicomponent sites were not occupied continuously, but rather were abandoned for undetermined periods. There is no evidence of prehistoric structures or architectural features (e.g., rock rings) that are widely observed from Baja California and Sonora, such as those reported for the Bahía de la Concepción and Bahía de los Angeles regions (Ritter 2000), for San Esteban Island (Bowen 2000), for the Mesa San Carlos region (Christian and Cordy-Collins 1986: 78-79) and other locations along the Pacific coast of the mid-peninsula (Rozaire 1964; Tuohy 1984), or recently discovered on Cedros Island (M. DesLauriers, personal communication). Rather, the PASE settlement data seem analogous to those described by Ritter for the Laguna Guerrero Negro, Laguna Manuela, and Laguna Ojo de Liebre in which a broadly dispersed occupation along the coastal zone where "family and small multi-family groups clustered for short periods of time" (Ritter 2000:17). The lack of well-developed archaeological strata and the scarcity of non-portable artifacts and features such as large metates, hearths, and storage facilities all suggest relatively short-term occupations within the PASE project area.

Chronological Evidence. Based on 59 radiometric dates from archaeological contexts (Fig. 4), Native American occupation of the PASE area began by at least 5300 BC and continued into the historic period (Table 2). A possible gap in the dates at circa 4200–3400 BC may reflect the consequences of the Altithermal, but is just as likely the product of chance radiocarbon sampling. While other regions of western North America exhibit the impacts of Altithermal aridity and other periods of sustained drought including decreased population or abandonment such as that documented for ca. AD 1000-1200 (Euler et al. 1979; Larson and Michaelsen 1990; Larson, Michaelsen, and Walker 1989), similar settlement hiatuses are not indicated for the San Quintín–El Rosario region. Later periods for which drought has been reconstructed are not marked by gaps in the radiocarbon record. For example, six radiocarbon dates fall within the AD 980-1250 period known as the Medieval Climatic Anomaly which in southern Alta California was associated with drought, decreased terrestrial resource productivity, and high marine resource productivity (Jones et al 1999; Kennett and Kennett 2000; Raab and Larson 1997). In fact, it may be that coastal zones like the

Table 1. Site taxonomy and occupational durations of sites in sample survey.

	Single Occupation	Multiple Occupation	Undetermined	Total
Open Base Camp	52	28	82	162
Shell midden with lithic debitage	19	8	12	39
Shell midden	22	2	15	39
Lithic workshop	9	-	8	17
Lithic scatter	5	1	5	11
Agave processing	-	-	4	4
Isolated artifact	2	-	-	2
Rockshelter	-	1	-	1

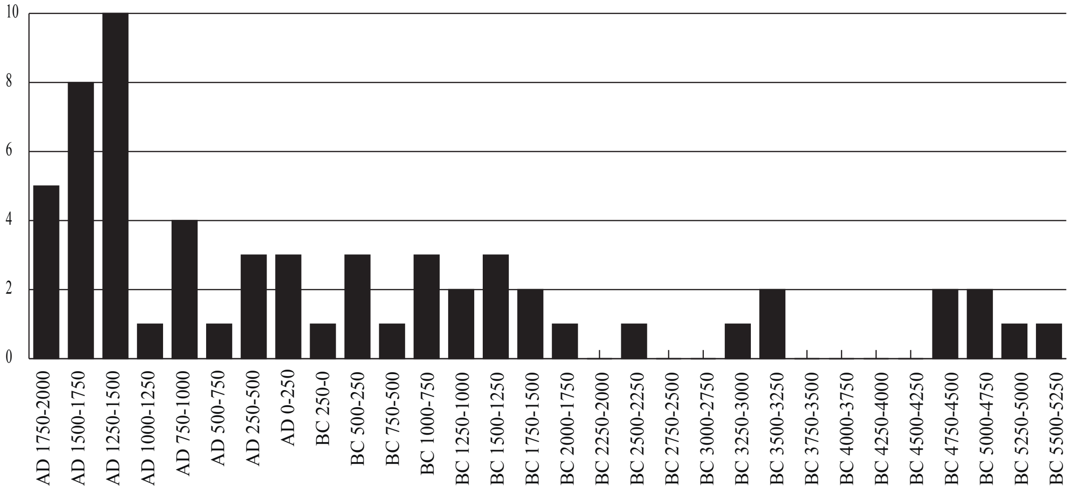

Fig. 4. Histogram of Radiocarbon Dates

PASE project area were more desirable during this period given the availability of marine resources.

Local Geomorphology and Dated Archaeological Components. The apparent increase through time in the number of dated components probably reflects local geology, the dynamics of coastline erosion, and our biased selection of radiometric samples from exposed sea cliff profiles, rather than an actual population increase or intensified occupation within the PASE project area. For reasons outlined below, much of the current coastline contains relatively late exposures, with the oldest landforms limited to wave-resistant basalts in the northern part of the project area. Radiocarbon samples collected from sea cliff profiles are biased towards post AD 1000.

With a single exception (i.e., PASE 13), the earliest dated components come from profiles located on steep cliffs of volcanic basalts in the northern project area. Based on field inspections and geological maps of the project area (CETENAL Carta Geológica "Lazaro Cardenas" HIIB64), these basalt cliffs are the eastern remnant of a volcanic cone steeply cut by wave erosion. Four of the oldest dated deposits (PASE 87, 137, 184 and 185) are from virtually identical sites located on the steep volcanic cliffs northeast of San Quintín Bay. The four sites have radiocarbon dates from the seventh millennium BP (e.g., PASE 137-Sample 1, 6900 ± 100 RCYBP, 5490-5315 BC; PASE 87 at 7.6m, 6000 ± 100 RCYBP, 4555-4345 BC). Given the precarious locations of these earliest sites, I assume that human beings entered the region when the coast was further west prior to 5500 BC. Assuming a rough symmetry for the remnant volcanic cone, a pattern evident for the extant cones in the San Quintín group, the landform probably extended at least 500-1000 m further west than at present. Less resistant, sedimentary conglomerates and dune fields characterize the coast south of San Quintín Bay (e.g. CETENAL 1977, Cartas Geológicas "Lazaro Cardenas" HIIB64, "Venustiano Carranza" HIIB74 and El Rosario HIIB84). This coastline has eroded more rapidly than the basalt cliffs located in the northern project area, removing a swath of coastal terrace that probably was several kilometers wider during the Pleistocene. In their early geological overview of the San Quintín region, Gorsline and Stewart (1962:290) observed that the Santa Maria escarpment was "an old sea-cliff cut at shoreline approximately 10 to 15 meters higher than present" which was associated with a Pleistocene high stand of ca. 130,000-120,000 BP. This sea-cliff can be followed for over 30 km south from San Quintín. Using the old sea-cliff as a baseline, the coast from San

Table 2. PASE Radiocarbon Dates

Site	Sample No.	Conventional C14 13/12 corrected	Adjusted for reservoir effect	Calibrated at 1 sigma
PASE 1-L	Socorro Beta 87484	3530 ± 50	3305 ± 60	1270–1100 BC
PASE 2	Beta 87468	850 ± 70	630 ± 80	AD 1635–1740
PASE 2	Beta-123974	190 ± 50	---	AD 1660–1690, 1735–1815
PASE 4, lowest stratum	Beta 87485	4840 ± 60	4620 ± 70	2915–2845 BC
PASE 5	Beta 87473	730 ± 50	510 ± 60	AD 1710–1950
PASE 8, 0-5 cm	Beta 87471	modern		
PASE 8, 85 cm	Beta 87472	3410 ± 70	3190 ± 80	1135–910 BC
PASE 6, 80-100 cm	Beta 87475	1760 ± 70	1540 ± 80	AD 780–970
PASE 6, 180-200 cm	Beta 87476	3280 ± 70	3060 ± 80	975–800 BC
PASE 6, 200-220 cm	Beta 87477	3300 ± 70	3080 ± 80	975–800 BC
PASE 13	Beta 87470	6610 ± 80	6390 ± 90	4995–4790 BC
PASE 44	Beta-123970	5080 ± 70	4860 ± 80	3325–3060 BC
PASE 47, 20-30 cm	Beta 87474	2290 ± 60	2070 ± 70	AD 150–475
PASE 65	Beta 87469	1290 ± 60	1070 ± 70	AD 1220–1430
PASE 72	Beta 87483	3790 ± 60	3570 ± 70	1575–1415 BC
PASE 87, 1.1 m	Beta 87478	2160 ± 90	1940 ± 100	AD 370–595
PASE 87, 3.2 m	Beta 87479	2810 ± 70	2590 ± 80	380–190 BC
PASE 87, 7.6 m	Beta 87480	6220 ± 90	6000 ± 100	4555–4345 BC
PASE 85, 60cm	Beta 87481	4480 ± 50	4260 ± 60	2470–2320 BC
PASE 85, profile 2	Beta 87482	4050 ± 60	3830 ± 70	1900–1720 BC
PASE 115	Beta-123968	700 ± 70	480 ± 80	AD 1720–1950
PASE 122	Beta-123960	3990 ± 70	3770 ± 80	1855–1640 BC
PASE 122	Beta-123961	3890 ± 70	3670 ± 80	1705–1510 BC
PASE 151	Beta-123963	3810 ± 70	3590 ± 80	1615–1420 BC
PASE 151	Beta-123964	1370 ± 70	1150 ± 80	AD 1200–1315
PASE 151	Beta-123965	710 ± 50	490 ± 60	AD 1740–1950
PASE 137	Beta-123966	7120 ± 90	6900 ± 100	5490–5315 BC
PASE 137	Beta-123967	2990 ± 70	2770 ± 80	715–395 BC
PASE 177	Beta 123969	5130 ± 70	4910 ± 80	3355–3115 BC
PASE 184	Beta-123962	6080 ± 80	5860 ± 90	4400–4235 BC
PASE 185	Beta-123971	6400 ± 80	6180 ± 90	4765–4545 BC
PASE 185	Beta-123972	6470 ± 70	6250 ± 80	4825–4665 BC
PASE 185	Beta-123973	1810 ± 60	1590 ± 70	AD 730–895
PASE 186	Beta-135798	680 ± 60	---	AD 1410–1485
PASE 186	Beta-135799	1550 ± 100	1330 ± 110	AD 985–1205
PASE 190	Beta-135800	3680 ± 70	3460 ± 80	1470–1300 BC
PASE 201	Beta-135801	910 ± 60	690 ± 70	AD 1530–1680
PASE 202	Beta-135802	890 ± 60	670 ± 70	AD 1545–1685
PASE 217	Beta-135803	990 ± 60	770 ± 70	AD 1475–1635
PASE 219	Beta-135804	580 ± 50	---	AD 1310–1365, 1380–1415

Table 2. PASE Radiocarbon Dates (continued)

PASE 219	Beta-135805	760 ± 60	540 ± 70	AD 1680–1885, 1945–1950
PASE 219	Beta-135806	910 ± 60	690 ± 70	AD 1480–1715
PASE 219	Beta-135807	920 ± 60	700 ± 70	AD 1525–1675
PASE 219	Beta-135808	920 ± 60	700 ± 70	AD 1525–1675
PASE 227	Beta-135809	2530 ± 60	2310 ± 70	45–AD 105 BC
PASE 227	Beta-135810	3320 ± 40	3100 ± 50	975–840 BC
PASE 235	Beta-135811	2350 ± 60	2130 ± 70	AD 145–330
PASE 235	Beta-135812	2460 ± 70	2240 ± 80	AD 25–210
PASE 246	Beta-135813	1180 ± 60	960 ± 70	AD 1330–1445
PASE 246	Beta-135814	1290 ± 60	1070 ± 70	AD 1275–1385
PASE 249	Beta-135815	1890 ± 60	1670 ± 70	AD 665–785
PASE 249	Beta-135816	2710 ± 60	2490 ± 70	325–100 BC
PASE 249	Beta-135817	2750 ± 70	2530 ± 80	355–145 BC
PASE 265	Beta-135818	2320 ± 70	2100 ± 80	AD 170–385
PASE 266	Beta-135819	1720 ± 60	1500 ± 70	AD 815–990
PASE 268	Beta-135820	1370 ± 70	1150 ± 80	AD 1190–1310
PASE 278	Beta-135821	1360 ± 60	1140 ± 70	AD 1215–1310
PASE 278	Beta-135822	1330 ± 60	1110 ± 70	AD 1170–1405
Bahia Antígua	Beta-87486	33290 ± 520	33710 ± 550	
Bahía Antigua	Beta-87487	38470 ± 1070	38910 ± 1130	
Bahia Antígua	Beta-87489	39850 ± 770	40260 ± 810	

(Note: all samples were marine shell except BETA-123974 and BETA-135804, which were charcoal.
Sample BETA-135798 was subject to an extended count.)

Quintín Bay south to the Rosario Valley is approximately 15 km farther east than the coastline immediately north of San Quintín Bay. This difference in the coastline suggests higher rates of coastal erosion in the southern portions of the PASE project area. This is indicated by the dates of deposits exposed in sea cliff profiles. As stated above, the oldest dated deposits (5500-4000 BC) are perched on resistant basalt cliffs in the northern project area. In contrast, the oldest sea cliff profiles in the unconsolidated sediments and cobble deposits date to circa AD 1000-1800 (Table 3). The resistant rock of the San Quintín volcanic cones and Monte Mazo creates a local eddy that scours the coastline and redeposits sediments to create the vast dune fields of the Pabellon Locale and the sand spit across San Quintín Bay that terminates at Punta Azufre (Fig. 1). This eddy has had a significant impact on the preservation of ancient landforms and archaeological sites.

Another major change in the topography was the relatively late creation of San Quintín Bay, possibly dating to after 5000 BP. The San Quintín volcanic cones forming the protective barrier have "no apparent terraces of wave cut benches" (Gorsline and Stewart 1962:290), suggesting the volcanic cones formed after the Pleistocene high stand of ca. 130,000-120,000 (Moore 1999: 24). The volcanic cones were in place before 38,000-40,000 BP based on three radiometric dates of a fossil deposit called "Bahia Antigua" (33710 ± 550, 38910 ± 1130, 40260 ± 810 RCYBP, adjusted for reservoir effect). The Bahía Antigua deposit may

Table 3. Dates of Sea Cliff Exposures, PASE Project Area.

Sites North Of Remnant Volcanic Cone				
Site	Sample No.	Conventional C14	Adjusted for reservoir effect	Calibrated at 1 sigma
PASE 217	Beta-135803	990 ± 60	770 ± 70	AD 1475–1635
PASE 219	Beta-135804	580 ± 50	--	AD 1310–1365, 1380–1415
PASE 219	Beta-135805	760 ± 60	540 ± 70	AD 1680–1885, 1945–1950
PASE 219	Beta-135806	910 ± 60	690 ± 70	AD 1480–1715
PASE 219	Beta-135807	920 ± 60	700 ± 70	AD 1525–1675
PASE 219	Beta-135808	920 ± 60	700 ± 70	AD 1525–1675
Sites On Remnant Volcanic Cone				
PASE 137	Beta-123966	7120 ± 90	6900 ± 100	5490–5315 BC
PASE 185	Beta-123971	6400 ± 80	6180 ± 90	4765–4545 BC
PASE 185	Beta-123972	6470 ± 70	6250 ± 80	4825–4665 BC
PASE 184	Beta-123962	6080 ± 80	5860 ± 90	4400–4235 BC
PASE 87, 7.6 m	Beta 87480	6220 ± 90	6000 ± 100	4555–4345 BC
PASE 87, 3.2 m	Beta 87479	2810 ± 70	2590 ± 80	380–190 BC
PASE 87, 1.1 m	Beta 87478	2160 ± 90	1940 ± 100	AD 370–595
Site On Monte Mazo Tombolo				
PASE 6, str.VIII	Beta 87476	3280 ± 70	3080 ± 80	975–800 BC
PASE 6, str. II	Beta 87475	1760 ± 70	1540 ± 80	AD 780–970
Sites South Of San Quintín Bay				
PASE 4, terminal stratum	Beta 87485	4840 ± 60	4620 ± 70	2915–2845 BC
PASE 5	Beta 87473	730 ± 50	510 ± 60	AD 1710–1950
PASE 246	Beta-135813	1180 ± 60	960 ± 70	AD 1330–1445
PASE 246	Beta-135814	1290 ± 60	1070 ± 70	AD 1275–1385
PASE 2	Beta 87468	850 ± 70	630 ± 80	AD 1635–1740

(Note: sites are listed from north to south.)

correspond to a mid-Wisconsin high stand (Inman 1983: 8), but as sea levels dropped to their late Pleistocene lowstand at circa 18,000 BP, San Quintín Bay would have drained. San Quintín Bay is extremely shallow, with current depths of 0.9 to 6.8m (Defense Mapping Agency 1988). It is possible that San Quintín Bay did not exist until the Middle Holocene as sea levels rose to within 2 to 4 meters of current levels at circa 5,000-3,000 BP (Inman 1983:9). This rise may account, in part, for the scarcity of estuarine species in early shell middens. For example, PASE 13 is located 700 m from the western side of San Quintín Bay and produced a radiocarbon date of 6610 ± 80 BP, 4995-4790 BC, yet the shellfish present consists exclusively *Tivela stultorum* and *Mytilus californianus* taken from open coastlines located 5 km or more to the west. There is currently no available body of information for reconstructing of coastal paleoenvironments of the

San Quintín–El Rosario region, but these preliminary inferences suggest some of the potential impacts that Holocene changes in coastal topography may have had on the archaeology of the PASE project area.

Settlement Systems in the San Quintín–El Rosario Region: A Partial System

The available evidence suggests the San Quintín–El Rosario region was only one sector in an extensive transhumant adaptation that encompassed the breadth of Baja California (Moore 2000a,b, 2001). As a descriptive model, I propose that from the early Archaic until the late Prehistoric period three conditions were met: (1) human settlement systems reflected residential mobility and the exploitation of resources that was, expanding on Binford's (1980) terms, logistic at the regional level but expedient at the local level; (2) population was maintained well below the maximum density sustainable in the environment; and (3) subsistence strategies incorporated a complex mosaic of environmental zones between the Pacific Ocean and the Sea of Cortez.

Basic to this model is the notion that while native peoples adapted to the coastal zones of Baja California, they did so as "desert foragers" rather than as "maritime hunters and gatherers," at least in the central portion of the peninsula. I suggest that this strategy represents a settlement system developed by social actors in their efforts to adapt to dispersed terrestrial and marine environments, but first I wish to summarize the specific elements of the model.

Survey data indicate a settlement pattern of brief and episodic occupations. To reiterate, no evidence of permanent prehistoric settlement has been found in the San Quintín–El Rosario project area. Despite data on 290 sites, no evidence for permanent settlement has been found in the region. Certain sites and locales were occupied repeatedly but none continually.

Resource collection was regionally logistic but locally expedient. Prehistoric populations understood the spatial and temporal distribution of resources, but there is little evidence that the resources were transported in any quantity from the locations where they were obtained. Apparently, this strategy was generalized to quite different resources including shellfish, plant foods, and lithic resources. The molluscan assemblages at sites reflect immediately available species. Sites near sandy beaches contain Pismo clams; sites near rocky coasts are dominated by California mussel, limpets, and other rocky coast species. Quiet water species are virtually absent; for example, Chione is present at only 10 of the 275 sites in the sample and is nowhere dominant. At sites located slightly inland and equidistant to sandy beaches and rocky shorelines, the molluscan assemblage is similarly balanced—again reflecting an expedient strategy based on proximity and ease of collection.

The acquisition of lithic resources is similarly expedient; materials for scrapers, flake tools and large bifacial tools are made from locally available basalts present as cobbles in sedimentary deposits (Moore and Gasco 2001:26-34). Over 95% of all lithic artifacts observed were made from locally available materials. Imported obsidian is relatively rare; only 13 of 275 sites within the sample contain obsidian debitage (discussed further below). The only tool class that seems to be dominated by non-local materials are the 19 projectile points from 11 sites that were made from very fine-grained basalt (n=7), chert (n=6), quartzite (n=4), and obsidian (n=1). Of the 17 lithic workshops found, nine were "single-event" workshops resulting from the reduction of a single core, while the intensity of use at eight lithic workshops could not be determined. Thus, even where lithic procurement was localized by the availability of sources, the pattern seems to have been expedient rather than intensive and logistically organized.

A similar pattern is suggested by the evidence for plant food collection, although the data are somewhat less direct since plant remains were not recovered during the survey. Based on ethnohistoric accounts the major plant food was coastal agave, *Agave shawii* (Wagner 1929; Aschmann 1967; del Barco 1988; Gentry 1978; Vizcaino 1992). Indirect evidence for plant collection and processing agave was found at eleven sites including PASE 106, located on a mesa thickly covered with agave. Discovered during a sample transect survey, PASE 106 consists of six circular cobble platforms interpreted as agave roasting platforms based on replicative experiments conducted in 2001 (Fig. 5). The site also has extremely large flake tools interpreted as agave "cleavers," used to cut the thick, thorny leaves of the agave (Fig. 6). These tools apparently were made at the location where the agave was collected, and abandoned there. Three other sites (PASE 145, 285, and 288) have agave "cleavers" and agave roasting platforms, while another seven sites (PASE 139, 141, 142, 143, 176, 180, and 279) have roasting platforms, assorted flake tools and lithic debris, but no obvious "cleavers."

I interpret these patterns of procuring shellfish, lithic materials, and agave as reflecting the same basic strategy. Aware of the basic locations of desired resources, desert collectors occupied those regions and exploited nearby resources expediently. Resources were transported only short distances from where they were obtained. The most readily available resource was selected. Little effort was invested in extractive technology, storage, or curation. There were no efforts at "intensification."

Population density was maintained well below carrying capacity. As discussed previously (Moore 1999), human population density was maintained significantly below carrying capacity—at least based on comparisons of estimated protohistoric population (Moore and Norton 1992) and the food available from the local stands of coastal agave. Agave densities in the project area are extremely high, similar to densities for domesticated agave (Parsons and Parsons 1990). Agave counts tabulated for three one-hectare survey areas indicated densities of 74,500 to 122,400 plants per sq. km, of which a fraction—1100 to 2300 per sq. km—would be suitable for consumption for at a given time, representing a "standing crop" (Moore and Vasquez n.d.). Since the agave grows slowly and it is destroyed when it is collected, the sustainable yield of the plant would be somewhat lower than this. Harvesting pressures can be estimated from observations made by the 18th century Jesuit, Miguel del Barco (1988 [ca. 1770-1780]: 121-125), who made astute notes on agave procurement and preparation, although writing about Cochimí practices south of the San Quintín–El Rosario region. "The agave is not eaten raw," del Barco wrote, "…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 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, del Barco added (1988[ca. 1770-1780]: 123), "then they search for more: and each women returns in the afternoon with 8 or 9 agaves." Del Barco observed that the agaves were roasted for at least twenty-four hours and more frequently two nights and a day, and concluded, "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 Barco1988 [ca. 1770-80]: 124). Based on del Barco's observations and assuming that agave was eaten daily, a family's annual consumption equaled approximately 900 plants. Using the lowest estimate of agave yields (1100 per sq. km) 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 AD 1770. Nutritional

Fig. 5: *Agave shawii* and roasting platform, Mesa Seis Hermanos.

Fig. 6: Agave cleaver.

analysis of cooked samples of *A. shawii* indicates a caloric value of 98.7 kcal/100gm, roughly equivalent to boiled white potatoes (Vickery 1999). Field estimates suggest that the large heads of *A. shawii* weigh range from about 5 to 10 kg, even after they are trimmed of their leaves. Assuming that cooking would reduce weight by 50% because of moisture loss, a single cooked coastal agave would have a minimum of 20,000 to 25,000 calories, sufficient to meet a 2000 daily caloric requirement for something like 10 to 12.5 person-days. While these estimates are very approximate, they are conservative and suggest that prehistoric population was far below carrying capacity of the San Quintín–El Rosario region (cf. Casteel 1979; Moore 1999:37). *A. shawii* is widely distributed in the coastal zone, available year-round, acquired when needed, and processed with tools and facilities made at the location where the plant is collected. The availability and reliability of the plant resource is not increased by intensification, food storage, or major technological investments. In this, coastal agave differs from other plant resources, such as acorns, that are seasonally available, are readily stored, and require specialized tool kits (Moore 1999).

To summarize, I interpret the relatively high density of archaeological sites in the San Quintín–El Rosario region as reflecting repeated, short-term occupations over some seven millennia. This is indicated by the absence of permanent settlements, the expedient pattern of resource collection, and the low population density. If accurate, this pattern can be understood as part of a broader adaptation to the breadth of the Baja California peninsula.

Transhumant Mobility in Northern Baja California: A Model

As noted above, I suggest that the archaeological data from the San Quintín–El Rosario region reflect only one part of a cross-peninsular transhumant adaptation. Confirmation and/or revision of this model awaits additional data from the interior and Gulf of California regions east of the San Quintín–El Rosario project area, data from surveys tentatively slated over the next five years. Until future data are available, it is useful to summarize the current data supporting this model.

(1) *Molluscan assemblages from interior oasis sites suggest that prehistoric populations moved between the Gulf of California and the Pacific Ocean*. For example, PASE 186 is located 38 km from the Pacific Coast and 70 km from the Sea of Cortez on the edge of a an oasis in Arroyo San Juan de Dios, part of the Rosario River drainage system. The site covers an area of approximately 160 m by 60 m and consists of a moderately dense scatter of lithic debris, fire-altered rock and a low density of shell. The molluscan assemblage is predominantly characterized by Pacific coast species, specifically *Mytilus californianus* and *Tivela stultorum*, but there are also rare fragments of *Trachycardium panamense* that is found in the warmer waters of the Gulf of California. Two radiocarbon samples from PASE 186 point to post AD 1000 occupations—AD 985 to 1205 (Beta 135799; 1550 ± 100 RYBP) and AD 1410 to 1485 (Beta 135798; 680 ± 60 RYBP)—dates generally corroborated by the presence of a Desert Side-notched point.

Very casual observations at sites in the interior zones may suggest that PASE 186 is not an anomaly. For example, a site, named Las Pintas del Moral for its petroglyph panels, is located on a small oasis approximately 28 km from the Pacific and 85 km from the Gulf of California. Like PASE 186, the site contains a low-density shell midden with predominantly *Mytilus californianus* and a few pieces of *Trachycardium panamense*. No dates are available for Las Pintas del Moral, but surface indications suggest a relatively important site, with 10 metates, 22 manos, obsidian flakes, basalt flakes and cores, and additional lithic debris. Interestingly, the petroglyphs seem to be in the same pecked style documented for the site of Las Pintas some 70 km further south (Garvin 1978) and at Mesa San Carlos (Christian and Cordy-Collins 1986). Another site at El Rincon is associated with a small, blue palm oasis in the central portion of the peninsula, 50 km from the Pacific Ocean and 64 km from the Gulf of California. The site contains a low-density shell deposit in which *Trachycardium* sp. is more common than the rare fragments of *M. californianus* and extremely small *T. stultorum*. The site at El Rincón is relatively small (approximately 100 m by 50 m) with metates, manos, and lithic debris of fine grain black basalt and abundant obsidian flakes from an undetermined source.

The varying proportions of Pacific coast and Gulf of California mollusks at these interior sites probably reflect the movement of people across the peninsula. It is conceivable that this pattern reflects trade and exchange, but that seems less probable given the other evidence for high mobility.

(2) *Obsidian in the San Quintín–El Rosario region originated from sources along the Gulf of California and may indicate cross-peninsular migrations.* As mentioned above, only 15 of the 275 sites recorded in the San Quintín–El Rosario probabilistic survey have obsidian flakes or small cores (PASE 13, 19, 26, 29, 102, 138, 151, 161, 206, 241, 249, 268, and 282); two other sites located outside the sample (PASE 185 and 186) also have obsidian. This obsidian comes from three sources located between San Felipe and Arroyo Matomí, and also from a fourth source whose location is undetermined (Table 4). In 1998 and 1999 24 obsidian samples were analyzed by Dr. M. Steven Shackley (1998a, 1998b) using the energy dispersive xray fluorescence (edxrf) analysis. The export of these samples was authorized by the Coordinación Nacional de Asuntos Jurídicos, Instituto Nacional de Antropología e Historia.

Table 4. XRF analysis and obsidian sources.

Site	Sample	Rb	Sr	Y	Zr	Nb	Source
PASE 102	102-1	138	61	33	215	14	Puerto el Parral
PASE 138	138-1	135	57	35	210	13	Puerto el Parral
PASE 151	151-1	134	59	38	205	10	Puerto el Parral
PASE 151	151-2	111	37	32	136	11	Arroyo Matomí
PASE 151	151-3	156	65	34	222	17	Puerto el Parral
PASE 151	151-4	136	59	38	216	12	Puerto el Parral
PASE 151	151-5	162	71	40	241	14	Puerto el Parral
PASE 151	151-6	138	62	33	209	10	Puerto el Parral
PASE 151	151-7	142	65	37	222	17	Puerto el Parral
PASE 151	151-8	142	61	36	215	12	Puerto el Parral
PASE 151	151-9	127	61	33	200	11	Puerto el Parral
PASE 151	151-10	161	73	40	233	13	Puerto el Parral
PASE 161	161-1	149	69	35	223	12	Puerto el Parral
PASE 185	185-1	88	117	53	413	15	Unknown
PASE 186	186-1	133	64	36	212	14	Puerto el Parral
PASE 186	186-2	141	67	36	219	15	Puerto el Parral
PASE 186	186-3	134	65	37	213	14	Puerto el Parral
PASE 206	206-1	157	42	37	123	9	San Felipe?
PASE 241	241-1	135	64	35	215	15	Puerto el Parral
PASE 249	249-1	127	60	34	205	14	Puerto el Parral
PASE 249	249-2	135	63	35	216	15	Puerto el Parral
PASE 249	249-3	121	58	31	192	14	Puerto el Parral
PASE 268	268-1	101	38	32	140	9	San Felipe
PASE 282	282-1	108	40	33	142	10	San Felipe

(Note: data in bold are from sites with C14 dates; see Table 5.)

A sample from PASE 151 came from a source in Arroyo Matomí located due east of the project area and near the Gulf of California. Another sample recovered from PASE 185, comes from an unidentified sample ‘Unknown Source B.’ Three samples, from PASE 268, PASE 282 and possibly the one from PASE 206, appear to derive from a source located near San Felipe. The remaining 19 samples from PASE 102, PASE 138, PASE 161, PASE 151 (n=9), PASE 186, PASE 241 and PASE 249 (n=3) all come from a source that was originally dubbed ‘Unknown Source A’ but has now been identified as the ‘Puerto El Parral’ source located approximately 100 km east of the San Quintín–El Rosario project area. Located in the Sierra Santa Isabel, the obsidian source is an eroded surface deposit consisting of relatively small nodules averaging 5-7 cm in maximum length. There is no evidence of trenching like that described by Shackley, Hyland, and Gutiérrez (1996) for the Valle del Azufre source located in Baja California Sur. The small nodule size may account for the relative scarcity of obsidian in the San Quintín–El Rosario project area; perhaps this obsidian was preferred only after the introduction of the bow and the development of smaller, arrow points. Yet, the Puerto El Parral obsidian is found at sites with pre-AD 1000 radiocarbon dates such as PASE

151 and PASE 249, although the association between C14 samples and the obsidian is uncertain. Even more provocative, perhaps, is the presence of obsidian at PASE 13, which dates to ca. 4995-4790 BC. While the PASE 13 obsidian has not be subjected to edxrf analysis, given the geology of the peninsula it is quite likely that it comes from sources along the Gulf of California, and is certainly non-local. It is conceivable that the obsidian was obtained through some form of exchange networks, but I think it was more likely acquired during seasonal movements between the Gulf, the interior and Pacific coast zones. If the obsidian and C14 date are truly associated at PASE 13, which is far from certain, this might suggest that the extensive, cross-peninsular settlement system was established by the Middle Holocene and endured. Clearly, additional data are required to verify this hypothesis.

Conclusion

I have summarized some of the basic results of an archaeological survey in the San Quintín–El Rosario region of the Pacific coast of Baja California. The data suggest a settlement pattern characterized by a high density of short-term occupations, many located away from permanent sources of fresh water and none exhibiting evidence for sustained residence. It is possible that this settlement pattern was in place by circa 5000-4500 BC. There is no evidence of major abandonments of the region until the historic period. Resource procurement seems based on a regionally logistic but locally expedient strategy, a strategy applied analogously to shellfish, lithic resources, and coastal agave. Population was significantly below carrying capacity. Finally, the settlement pattern in the PASE project area points to a settlement system that encompassed other areas of the Baja California peninsula. Rather than exclusively focused on the coastal zone, prehistoric foragers apparently utilized the breadth of the peninsula, a pattern roughly analogous to the seasonal movements suggested for the Kiliwa (Mixco 1983:4-5), Tipai (Hohenthal 2001: 73-76. 148-150), and Paipai (Hicks 1963:201-212).

Without significant levels of archaeological investigations along the Gulf of California and the interior sierra of the peninsula, it is impossible to characterize this larger settlement system. Obviously, additional archaeological data are required from the PASE project area and adjacent regions. Further survey is necessary to corroborate or revise the transhumant settlement pattern outlined above. Excavated data are essential to explore issues of subsistence and settlement with greater chronological and quantitative controls. There is much work to be done.

Nonetheless, it is clear that archaeological data from Baja California can contribute to broader discussions regarding prehistoric adaptations to coastal environments (Bailey and Parkington 1988; Kelly 1995; Koyama and Thomas 1981; Yesner 1980, 1987). If the above transhumant model is correct, the PASE project data suggest an “extensive” settlement system rather than a coastal adaptation based on “intensifica-

Table 5. Radiocarbon dates for PASE sites with obsidian.

Site	Obsidian Sources	(calibrated, one sigma)
PASE 13	unanalyzed	4995–4790 BC
PASE 151	Puerto El Parral, Arroyo Matomí	1615–1420 BC, AD 1740–1950
PASE 185	unknown source	4825–4665 BC, 4765–4545, AD 730–895
PASE 186	Puerto El Parral	AD 985–1205, AD 730–895
PASE 249	Puerto El Parral	355–145 BC, 325–100, AD 665–785
PASE 268	San Felipe	AD 1190–1310

tion" that is reasonably well-documented for much of coastal Alta California. For example, Erlandson (1997:10) writes:

> While many of California's coastal populations seem to have relied heavily on shellfish and plant foods during the Early Holocene, the intensity of marine fishing, sea and land mammal hunting, and plant food collecting all appear to have increased during the Middle and Late Holocene. Within this general pattern, however, there is a tremendous amount of detail—and probably variation on the local and regional levels—that remains to be sorted out. In years to come, some of the major tasks faced by California's coastal archaeologists will be to flesh out such generalities, to identify variations or exceptions in the archaeological record of coastal subsistence, and to explore the relationships between environmental variation, human population levels, developments in maritime (and other) technologies, and societal organization.

Despite its preliminary status, archaeological evidence from the PASE project area and other regions of Baja California contributes to this research agenda (Fujita 1995; Laylander 1992; Ritter 1979, 1985, 1995, 2002; Ritter et al. 1994). At a very fundamental level, the data discussed above pose an important research question: Why did intensification occur in some portions of coastal California, but apparently not in others, including parts of Baja California where adaptations were extensive? In turn this suggests the importance of understanding coastal adaptations within broader patterns of human action—the resolution of "behavioral and environmental dilemmas" to recall Jarvenpa and Brumbach's phrase (1988:601). Based on current data from the PASE project area, some of the relevant dilemmas include the spatio-temporal occurrence of seasonal and ephemeral water sources, the limits to intensification posed by plant and animal food resources, and social dynamics associated with a low-density and dispersed human population. Future research in Baja California will further understanding of these and other theoretical issues regarding hunter-gatherer adaptations in coastal environments.

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