Life on the edge: early maritime cultures of the Pacific Coast of North America

Jon M. Erlandson, Madonna L. Moss, Matthew Des Lauriers

Abstract

A variety of evidence suggests that the Americas may have been colonized, at least in part, by maritime peoples moving around the North Pacific Rim near the end of the Pleistocene. Understanding the geography of late glacial and early postglacial landscapes and the antiquity of human societies along the Pacific Coast continues to be a challenge, however, due to geological dynamics associated with glaciation, tectonics, submergence of coastal lowland landscapes by rising postglacial seas, and coastal erosion. Nonetheless, archaeological research has pushed back the antiquity of human settlement along the Pacific Coast of North America to the terminal Pleistocene or early Holocene, providing important new data on the nature of the earliest coastal peoples in the Pacific Northwest, Alta California, and Baja California. In this paper, we summarize what is known about the earliest peoples of the Pacific Coast of North America and evaluate the current viability of the coastal migration theory via a Pacific Rim route. Archaeological evidence now shows that Palaeocoastal peoples occupied each major region of the Pacific Coast by at least 13,000–11,500 calendar years ago (cal BP) (13–11.5 ka), essentially contemporaneous with Clovis and Folsom peoples of the interior. Although it is too early to conclude that the initial human colonization of the Americas took place via a migration by maritime or coastal peoples, it seems increasingly likely that such a migration played a role in the early peopling of the Americas.

1. Introduction

Deep human histories—those written primarily from archaeological, anthropological, and geological evidence—have long been dominated by terrestrial narratives. For decades prevailing anthropological theory has proposed that widespread coastal adaptations and maritime lifeways only developed in the last 10,000 to 15,000 years (e.g., Washburn and Lancaster, 1968; Osborn, 1977; Yesner, 1980), as part of a larger reorganization of human economies associated with the “broad-spectrum” and agricultural revolutions. In a book about hominin migrations, for instance, Gamble (1994) listed ten major habitat types encountered by our ancestors as they spread around the world, none of which was coastal or aquatic. Regular reminders from geoscientists that sea level rise since the Last Glacial maximum (LGM) had submerged ancient coastlines and associated lowland landscapes—geographic changes that may have obscured or destroyed much of the evidence for earlier coastal settlement—were generally ignored and sporadic cases of marine or aquatic resource use by Pleistocene peoples (i.e., Garrod et al., 1928; Waechter, 1964; Volman, 1978) were dismissed as rare and largely irrelevant to prevailing paradigms.

Doubts about such paradigms have grown as archaeological evidence for earlier coastal settlement, aquatic resource use, and maritime migrations has emerged (Erlandson, 2001; Bailey, 2004; Erlandson and Fitzpatrick, 2006). This includes evidence for widespread coastal settlement in southern Africa during the Middle Stone Age (e.g., Klein, 1999; Parkington, 2004; Marean et al., 2007), Middle Palaeolithic peoples around the Mediterranean (e.g., Garrod et al., 1928; McBurney, 1967; Stiner, 1994; Barton et al., 1999), the settlement of Flores by Homo erectus (Morwood et al., 1998), and the maritime colonization of Australia, western Melanesia, and East Asian islands by anatomically modern humans (Homo sapiens sapiens) between about 50 and 35 ka (see Erlandson, 2001).

Reflecting the anthropological theory that dominated the 20th century, most archaeologists saw the initial colonization of the Americas as a strictly terrestrial enterprise, with small hunting bands trekking across the frozen plains of Beringia near the end of the Pleistocene and following an interior “ice-free corridor” southward into the heartland of North America. These Palaeoindians were seen primarily as big game hunters who settled the Pacific Coast only after large game animals were hunted out of interior areas, people migrated down river valleys to the western
edge of the continent, then gradually adapted to life by the sea. The maritime peoples who occupied much of the Pacific Coast when Europeans first explored the area were thought to have developed in just the last few thousand years. For the “Clovis First” model that dominated American archaeology until recently, the Pacific Coast was largely irrelevant to the peopling of the Americas, a marginal continental edge settled relatively late in the process of human expansion into this New World. Such views were bolstered by AMS 14C dating of several purportedly “Pleistocene” human skeletons from coastal California—Del Mar, La Jolla, Laguna, Los Angeles, Angeles Mesa, and Sunnyvale—all of which were shown to be Holocene in age (e.g., Bada et al., 1984; Taylor et al., 1985; Stafford et al., 1987; Erlandson et al., 2007b).

For decades, an alternative “coastal migration theory” has proposed that early coastal or maritime peoples may have followed North Pacific shorelines from northeast Asia into the Americas. First fully articulated by Fladmark, 1979 (see also Dixon, 1993; Erlandson, 1994; Gruhn, 1994), the coastal migration theory was relatively marginal ground for American archaeologists until recently, even as geological evidence grew that a coastal route was geographically feasible as early as 16 ka (all dates given in this form are cal BP). Recent archaeological and geological research has transformed the coastal migration theory from marginal to mainstream. This scientific transformation has been fueled by a variety of evidence, including: (1) growing knowledge of the presence of maritime peoples in eastern Asia before the LGM; (2) the increasing antiquity of human settlement and maritime activity along the Pacific Coast of the Americas (e.g., Erlandson et al., 1996; Keefer et al., 1998; Sandweiss et al., 1998; Johnson et al., 2002; Jones et al., 2002); (3) widespread (but not unanimous) scholars’ acceptance of pre-Clovis occupations (> 14 ka) at Monte Verde near Chile’s Pacific Coast (see Dillehay, 1997; Meltzer, 1997); (4) geological evidence that the ice-free corridor was not open or suitable for human occupation until about 13 ka while the Northwest Coast of North America was habitable at least two millennia earlier (Mann and Hamilton, 1995; Mandryk et al., 2001; Clague et al., 2004).

These discoveries have not proven that coastal peoples were among the first to colonize the New World, but they have returned the Pacific Coast of North America to centre stage in debates about the peopling of the Americas. From Alaska to Baja California, this shift has rejuvenated and expanded the search for early Pacific Coast archaeological sites. Despite major geological obstacles—including sea level rise, coastal erosion, and landscape changes we discuss below—scholars have continued to push back the antiquity of coastal settlement in many areas, and to flesh out our understanding of early maritime peoples along the Pacific Coast. In this paper, we summarize the archaeological evidence for the antiquity and nature of early coastal settlement and maritime activity from Alaska to Baja California, focusing on recent research on Palaeo-coastal sites securely dated to the Terminal Pleistocene and Early Holocene, between about 13 and 9 ka. First, we provide some environmental background to contextualize our study and examine some of the global, regional, and local processes that affect the preservation and visibility of archaeological sites in coastal settings.

2. Environmental context

Our study area along the Pacific Coast of North America, stretching for roughly 6000 km from the Gulf of Alaska to the southern tip of Baja California, encompasses almost 40 degrees of latitude and a remarkable amount of environmental variation (Fig. 1). Terrestrial environments along the Pacific Coast vary from tundra in the far north, to the dense temperate rain forests of the Pacific Northwest, to the arid desert landscapes of southern and Baja California. The geography of this vast coastal region is united, however, by its mountainous terrain, its location adjacent to the ameliorating influence of the vast Pacific Ocean, and the curvilinear nature of a coastline that has offered no significant physical barriers to migrations or information exchange by maritime peoples since shortly after the end of the Last Glacial.

Compared to many regions of the world, the Pacific Coast of North America is tectonically active, with relatively high geographic relief and narrow continental shelves, and a stacking of resources from multiple marine, freshwater, and terrestrial ecosystems in proximity to the coastline itself (Erlandson and Moss, 1996, p. 278). Another common feature of Pacific Coast environments is the diversity and productivity of marine resources available to maritime peoples. Virtually the entire coast is characterized by significant marine upwelling, with nutrient-laden oceanic currents supporting highly productive marine food webs. North America’s Pacific Coast also offers an essentially continuous mosaic of rocky intertidal, shallow rocky reef, kelp forest, sandy nearshore, and estuarine ecosystems, with a variety of habitats that support similar suites of resources. From Alaska to Baja California, these include (or once included): seals, sea lions, sea otters, and cetaceans; abalones, mussels, clams, sea urchins, and limpets; rockfish, sharks and rays, tunas, sardines, and other fish; seabirds, shorebirds, and waterfowl; and a variety of edible seaweeds. This wealth of marine resources, especially when combined with shallow plants and animals available in adjacent terrestrial and freshwater ecosystems, helped sustain the relatively dense aggregations of hunter-gatherers who lived along much of the Pacific Coast when Europeans first explored the area from the 16th to 18th centuries AD.

Despite broad similarities in coastal ecosystems along the western edge of North America, significant regional and temporal variation existed in the diversity, productivity, and accessibility of marine and terrestrial resources. In the marine realm, these differences result primarily from variability in coastal upwelling, water temperature, coastline type, freshwater or estuarine input, wave energy, tidal amplitude, and other factors. On land, biological and ecological differences are driven primarily by broader climatic factors, especially latitudinal variation in rainfall and temperature patterns. This environmental variation along the Pacific Coast—including the distribution or availability of freshwater, terrestrial and aquatic plants and animals, and key minerals—led to differences in human adaptations on a variety of scales. Since the end of the Last Glacial, changes in the geography, climate, and ecology of various areas along the Pacific Coast have also influenced the development and demography of human populations up and down the coast, as well as the preservation and visibility of the archaeological sites that early coastal peoples left behind.

3. Archaeological preservation and visibility in coastal environments

The notion that maritime societies developed only recently in human history—along the Pacific Coast and around the world—has its roots in anthropological interpretations of archaeological records strongly structured by the fact that global sea levels have risen an average of roughly 120 m (~400 feet) since the end of the LGM. In discussing the archaeological implications of this, Erlandson (2001) noted a strong global correlation between the antiquity of coastal settlement and the gradient of the adjacent continental shelf (see also Waseklov, 1987; Richardson, 1998). Coasts characterized by broad and shallow shelves have generally seen substantial lateral movement of the shoreline during the last 20 ka—sometimes on the order of hundreds of kilometres. Steep bathymetry limits lateral movement of the coast as sea level rises, however; so older coastal sites remain in proximity to modern coastlines (see also Bailey and Flemming, 2008; Bicho and Haws, 2008). This geographic correlation helps explain the relatively great
antiquity of shell middens and other coastal sites along much of the Pacific Coast of North America, especially compared to the Atlantic or Gulf coasts of North America, where the continental shelves of the trailing plate edge are much broader.

Despite the relatively steep bathymetry of much of the Pacific Coast, many coastal areas have experienced lateral shoreline movements of tens of kilometres over the last 15 ka. Sea level rise and marine erosion have undoubtedly submerged or destroyed many early sites, and very few areas are likely to retain evidence of Pleistocene coastal occupations along modern shorelines. The entire south coast of Beringia has been submerged, for instance, from near the base of the Kamchatka Peninsula to Bristol Bay. This vast gap in the archaeological record, precisely where the earliest evidence of a coastal migration into the Americas theoretically should be located, will be exceedingly difficult to fill because the appropriate shorelines are now located in deep water, far from land, in the Bering Sea where wave energies are exceedingly high.

Once portrayed as a harsh and relatively unproductive area for human habitation (e.g., Hopkins et al., 1982), recent research suggests that the south coast of Beringia may have been "geomorphically complex during the late glacial, with hundreds of islands located just off a coast riddled with bays and inlets" (Brigham-Grette et al., 2004, p. 59). During the summer months, such convoluted coastlines—when combined with the low gradient of the Beringian platform—may have offered broad expanses of productive intertidal and nearshore habitats for early maritime peoples to hunt, forage, and gather in. Even covered with sea ice much of the year, the south coast of Beringia would have provided rich habitat for seals, walrus, and a variety of other marine organisms. Erlandson et al. (2007a) have argued that much of Beringia's south coast may have supported productive kelp forests after the end of the LGM.

Recent study of deep-sea sediment cores from the far northwestern Pacific suggest that three periods of warmer sea surface temperatures occurred after the end of the LGM (ca 18.2–17.2 ka, 16.8–16.3 ka, and 16.2–14.7 ka), events that may have reduced seasonal sea ice cover, increased human access to intertidal and nearshore habitats, and facilitated the migration of maritime peoples around the North Pacific (Sarnthein et al., 2006). Along the margins of the northeast Pacific, outer coast areas from the Alaska Peninsula to Puget Sound appear to have been largely deglaciated by about 15–16 ka and supported a relatively diverse and productive array of marine and terrestrial resources, including bears and other mammals (see Heaton and Grady, 1993; Mann and Hamilton, 1995; Ward et al., 2003).

Up and down the Pacific Coast, regional variation in geography, tectonics, and glacial history have had a powerful influence on the differential preservation and visibility of early archaeological sites. Some of these taphonomic issues are discussed in the summaries of the archaeology of each region that follow, but general patterns are worth noting here. From south central Alaska to Puget Sound, for instance, regional glacial history has had a major effect on coastal landscapes and the archaeological record since the LGM, with isostatic and eustatic adjustments contributing to change in shoreline location and the conformation of coastal landscapes. From Vancouver Island to the northern California Coast, the unique tectonic history of the Cascadia Subduction Zone—where large subduction earthquakes every few centuries have caused widespread subsidence and erosion—has also shaped the geomorphological and archaeological records. South of Cape Mendocino, much of the Alta and Baja California Coast is affected by tectonic uplift, but sea level rise and coastal erosion since the end of the LGM have been the dominant geological forces shaping coastal landscapes and the archaeological record.

Given the difficulties posed by the Pacific Coast's history of glaciation, sea level rise, marine erosion, and landscape change, recent research has focused on finding early archaeological sites in settings where evidence of coastal or maritime occupations might be expected. These strategies include study of: (1) offshore islands where boats were required for human colonization; (2) coastlines with very narrow continental shelves; (3) northern shorelines uplifted by isostatic rebound after deglaciation; (4) caves or stone sources that provided shelter or raw materials valued by early coastal peoples; (5) springs that attracted humans away from now submerged shorelines in arid landscapes; (6) the margins of estuaries that formed inland extensions of the sea as global sea levels were rapidly rising; and (7) the vast underwater landscapes submerged by rising seas.

4. The Northwest Coast

In the thickly forested landscapes that characterize most of the Northwest Coast of North America, the search for early coastal sites (Fig. 2, Table 1) is especially complicated due to regional and local variations in the history of glaciation, isostatic and tectonic movements, sea level changes, and marine erosion. As acidic soils also tend to form under the coniferous forests of the Pacific

![Fig. 1. Map depicting the study area along the Pacific Coast of North America and the approximate extent of the North American ice sheet at the glacial maximum, with insets indicating areas depicted in Figs. 2-4. Drawn by G.N. Bailey.](Image 151x544 to 435x727)
Northwest, the preservation of shell and other faunal remains found in many early Pacific Coast sites is relatively rare. From northern California to southern British Columbia, where the effects of glaciation and isostatic adjustments are less pronounced, a long history of massive and episodic subsidence earthquakes (and associated marine erosion) within the Cascadia Subduction Zone may have destroyed most early coastal sites (Erlandson et al., 1998). Further north, however, especially along the convoluted and protected coastlines of southeast Alaska and northern British Columbia, a number of recent discoveries hint at the presence of an ancient maritime tradition that spans more than 10 ka.

4.1. Northern Northwest Coast

In Southeast Alaska, the earliest coastal sites include Early Holocene occupations at Ground Hog Bay 2, Hidden Falls, and Chuck Lake 2 (Ackerman et al., 1979; Davis, 1989; Erlandson and Moss, 1996; Moss, 1998, 2004). At these sites early maritime activities are attested to by the settlement of islands, the presence of obsidian artefacts from the Suemez Island source located on the outer coast, and the dearth of terrestrial alternatives. At Chuck Lake on the karstic Heceta Island, a roughly 8.8 ka shell midden and microblade component provides direct faunal evidence of intertidal foraging, fishing, and sea mammal hunting, including a unilaterally barbed bone point (Ackerman et al., 1985; Okada et al., 1989, 1992). Human skeletal remains and artefacts were found by palaeontologists at On Your Knees Cave (49-PET-408) on Prince of Wales Island in 1996. Later archaeological excavations at the site documented the presence of microblade technology in a well-defined occupation dating to about 9.3 ka, and a possible bifacial industry that may be a millennium older (Fedje et al., 2004). The younger component produced faunal remains from a variety of marine animals and isotopic study of the human bone revealed a strong marine signature, confirming the maritime nature of early human settlement in the Alexander Archipelago. Ancient DNA extracted from a human bone sample allowed genetic comparison to modern and ancient DNA sequences from Native Americans, revealing a link to Pacific Coast populations in North and South America (Kemp et al., 2007).

In northern British Columbia, Canadian scientists have combined detailed reconstruction of ancient coastal landscapes with archaeological studies to document an impressive array of early coastal sites dated between about 11.5 and 9 ka. Underwater work documented the presence of a submerged coastal landscape...
off Haida Gwaii (Queen Charlotte Islands) flooded by rapidly rising seas about 10 ka. Here Josenhans et al. (1997) identified ancient river channels, a delta, and remnants of a submerged forest roughly 50–60 m below modern sea level. Auger sampling of the sea floor along this submerged river channel even produced a basalt flake over 11.5 ka if it came from an intact soil or site (Fedje and Chris-tensen, 1999; Fedje et al., 2004).

On Haida Gwaii, numerous ‘intertidal’ sites have been identified along the modern coastline or on elevated beaches (i.e., Skoglund’s Landing site, see Fladmark, 1990), but their age, structure, and economic orientation remained poorly understood. Fedje and Mackie, 2005 have shown that these intertidal sites span much of the Holocene, but they identified intact remnants of several early sites that help clarify the antiquity and nature of maritime peoples of the northern Northwest Coast. Many of these sites have been impacted by marine erosion, but excavations in intact remnants of several early sites suggest that they represent a widespread maritime tradition extending back at least 10.6 ka, with the use of boats and harpoons and an economy based on seal and sea otter hunting, fishing, shellfishing, and other coastal activities.

One of these intertidal sites is Kilgii Gwaay, located near the southern end of Haida Gwaii (Fedje et al., 2004, 2005a,b,c). Here a large assemblage of stone, bone, wood, and woven artefacts was recovered from a waterlogged stratum dated to about 10.6 ka (9400 14C yr). The artefacts from Kilgii Gwaay include almost 4000 chipped stone specimens, over 100 pieces of worked wood, and several bone tools. The chipped stone assemblage lacks any hint of a microblade industry, but includes a biface fragment, a unifacial stemmed point, numerous flake tools, cores, and core tools. Bone tools include several perforators, a heavy percussor, and a small unilaterally barbed point. The perishable artefacts consist mostly of withies and wood-working debris, but wooden stakes and wedges, braided twine, wrapped sticks, a two-part haft, and several possible points were recovered (Fedje et al., 2005b, p. 198; figures 11.6 and 11.7). Faunal remains are also well-preserved in the intact site areas, including numerous bones of black bear (Ursus americanus), harbour seal (Phoca vitulina), sea otter (Enhydra lutris), rockfish (Sebastes spp.), dogfish (Squalus acantius), lingcod (Ophiodon elongatus), cabezon (Scorpaenichthys marmoratus), greenling (Hexagrammos spp.), Cassin’s auklet (Psychorhynchus aleuticus), and short-tailed albatross (Phoebastria albatrus). Smaller numbers (<10) of bones from other marine vertebrates were recovered, including river otter (Lutra canadensis), northern sea lion (Eumetopias jubatus), skate (Raja spp.), halibut (Hippoglossus stenolepis), salmon (Oncorhynchus spp.), sculpin (Cottidae), and other fish, seabirds, and waterfowl. Shellfish remains, mostly California mussels (Mytilus californianus), were also present. As Fedje et al. (2005b, p. 203) noted, the early occupants of Kilgii Gwaay practised “a fully developed maritime adaptation in one of the most rugged environments on the coast of the Americas”.

Some of the rockfish and halibut specimens weighed over 15 kg and are found in fairly deep water. This requires quite sophisticated fishing gear and most likely a boat of some type. The large numbers of harbour seal, as well as the presence of river and sea otter, supports the focus on marine resources. The birds also tend to be marine species, with the possible exception of the geese. For example, albatross are unlikely to be found on shore and must have been hunted from a boat (Fedje et al., 2005b, p. 201).

Another important early site is the deeply stratified and multi-component Richardson Island site, located on the southeast coast of Haida Gwaii. Excavations in the basal Component 1, dated between about 10.6 and 10 ka (9300–8900 14C yr), identified a living surface associated with hearths, postholes, chipped stone artefacts, and

### Table 1

<table>
<thead>
<tr>
<th>Site name</th>
<th>General location</th>
<th>14C age (cal BP)</th>
<th>Site description or contents</th>
<th>Primary references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundhog Bay 2 Hidden Falls (49-SIT-119)</td>
<td>Chilkat Peninsula, Glacier Bay, AK</td>
<td>9200 cal BP</td>
<td>Lithic site on raised beach</td>
<td>Ackerman et al., 1979</td>
</tr>
<tr>
<td>On Your Knees Cave (49-PET-408)</td>
<td>Prince of Wales Island, AK</td>
<td>9200–10,000 cal BP</td>
<td>Lithic site on elevated landform</td>
<td>Davis, 1989</td>
</tr>
<tr>
<td>Chuck Lake 1</td>
<td>Heceta Island, AK</td>
<td>~8800 cal BP</td>
<td>Shell midden with fish remains, harbed bone harpoon point</td>
<td>Fedje et al., 2005c, pp. 204–211</td>
</tr>
<tr>
<td>Richardson Island</td>
<td>Richardson Island, SE Haida Gwaii</td>
<td>9590–8490 cal BP</td>
<td>Projectile point bases possibly associated with bear bones</td>
<td>Fedje and Mathewes, 2005, p. 149</td>
</tr>
<tr>
<td>K1 Cave</td>
<td>Morebsy Island, Haida Gwaii</td>
<td>10,950–10,400 cal BP</td>
<td>Intertidal and raised beach components</td>
<td>Fedje et al., 2005a, pp. 178–180</td>
</tr>
<tr>
<td>Werner Bay stone tool</td>
<td>Juan Perez Sound, Haida Gwaii</td>
<td>~10,000 BP</td>
<td>Basalt flake recovered from ~50 m below sea level on drowned fluvial terrace</td>
<td>Fedje et al., 2005a, pp. 178–180</td>
</tr>
<tr>
<td>Gaadu Din Cave</td>
<td>Huxley Island, Haida Gwaii</td>
<td>10,500–10,000 cal BP</td>
<td>Projectile points and flakes associated with bear bones</td>
<td>Fedje and Mathewes, 2005, p. 149</td>
</tr>
<tr>
<td>Gaadu Din Cave 2</td>
<td>Huxley Island, Haida Gwaii</td>
<td>11,030 cal BP</td>
<td>Projectile point 5 m away from dated charcoal, with additional flakes below Intertidal wet site with 4000 stone tools, abundant organic remains</td>
<td>Fedje et al., 2005b, pp. 187–203</td>
</tr>
<tr>
<td>Kilgii Gwaay Wet Site</td>
<td>Ellen Island, Haida Gwaii</td>
<td>9450–9400 cal BP</td>
<td>Shell midden ~4 m asl</td>
<td>Cannon, 2000, p. 72</td>
</tr>
<tr>
<td>EI-18</td>
<td>Hunter Island, central B.C. Coast</td>
<td>9490 BP</td>
<td>Lithic site with faunal remains</td>
<td>Carlson, 1996; Cannon, 2000</td>
</tr>
<tr>
<td>Namu</td>
<td>Fitz Hugh Sound, central B.C. Coast</td>
<td>~10,500 cal BP</td>
<td>Lithic site with faunal remains</td>
<td>Carlson, 1979, 2003</td>
</tr>
<tr>
<td>Bear Cove</td>
<td>NE Vancouver Island, B.C.</td>
<td>9000–5000 cal BP</td>
<td>Shell midden</td>
<td>Matson, 1976</td>
</tr>
<tr>
<td>Glenrose</td>
<td>Lower Fraser River, B.C.</td>
<td>~8500 BP</td>
<td>Shell midden</td>
<td>Fedje et al., 2005b, pp. 187–203</td>
</tr>
<tr>
<td>Indian Sands</td>
<td>Curry County, Oregon</td>
<td>~8500–8400 cal BP</td>
<td>Deflated shell midden associated with numerous flaked cobble tools</td>
<td>Moss and Erlandson, 1998; Davis, 2006a</td>
</tr>
</tbody>
</table>
small amounts of calcined bone (Fedje et al., 2004). Chipped stone artefacts include leaf-shaped bifaces, abundant bifacial tool-making debris, and unifacial tools (scraper planes, spokeshaves, gravers, etc.), but no microblade technology. Component 2, dated between about 10 and 9.5 ka (8900–8500 \(^{14}\)C yr), contains an early microblade technology widely identified in northern Northwest Coast sites beginning around 10,000 \(\pm\) 250 cal BP (\(\sim\)9000 \(^{14}\)C yr). Small amounts of calcined animal bone were identified at the Richardson Island site—mostly rockfish—indicating an economy at least partly maritime in character.

A similar sequence has been identified at the multicomponent site of Namu, where a basal component dated between about 11.2 and 10.2 ka (9700–9000 \(^{14}\)C yr) has produced leaf-shaped bifaces, numerous cobble choppers and other core tools, and expedient unifacial flute tools (Carlson, 1996, 1998). After about 10 ka microblade technology also appears in the stratified sequence at Namu. The earliest cultural component at Bear Cove has produced a rich faunal assemblage with abundant marine and land mammals, rockfish and cod, but spans a considerable duration, from 9 to 5 ka (Carlson, 1979, 2003). The well-documented Glenrose Cannery site in the lower Fraser Valley has also produced early Holocene dates (Matson, 1976).

Cannon (2000) has also reported a \(^{14}\)C date of \(\sim\)11,400 cal BP (9940 \(\pm\) 50 RYBP) for charcoal retrieved from near the base of a shell midden (E1Ta-18) on Hunter Island along the central British Columbia Coast. Only preliminary data have been reported for this site, but if the age of the charcoal accurately reflects the antiquity of human occupation, it is one of the earliest shell middens along the Pacific Coast of North America.

4.2. Southern Northwest Coast

The record of early human settlement along the southern Northwest Coast—from the Canadian border to northern California—is different from areas to the north and south. There are no well documented Early Holocene sites along the Washington Coast, only one from the Oregon Coast, and none from the northern California Coast. The dearth of early southern Northwest Coast sites led some archaeologists to propose that humans developed coastal or maritime lifeways relatively late in the area (e.g., Ross, 1990; Lyman, 1991; Lightfoot, 1993; Hildebrandt and Levulett, 1997). Others have attributed the lack of early sites to the lower intensity of research in the area (Jones, 1992) or to the unique geological dynamics of the Cascadia Subduction Zone, which corresponds closely to the area where early sites are rare (Moss and Erlandson, 1998). Once thought to be aseismic, the Cascadia Subduction Zone is now known to be struck every few centuries by very large earthquakes where a deadly combination of subsidence and tsunamis affect large portions of the coast (see Atwater, 1987; Darienzo and Peterson, 1990). The combination of episodic subsidence earthquakes, tsunamis, landslides, and coastal erosion provides further evidence to support the presence of a terminal Pleistocene component at 35CU67C to be an Early Holocene site.

Early Holocene occupations have also been proposed for several other Oregon Coast sites (e.g., Takelkaith Landing, Neptune, and Blacklock Point) over the years, but the precise age and cultural associations of these sites remains poorly documented (see Moss and Erlandson, 1995, 1998; Erlandson and Moss, 1996). Recently, Hall et al. (2005) reported a possible terminal Pleistocene or Early Holocene occupation at 35CS58, a lithic site located near Bandon on the south-central Oregon Coast. Their evidence—a single chipped stone artefact found below a Middle-to-Late Holocene occupation layer—seems more likely to result from animal burrowing or other stratigraphic mixing (see Moss et al., 2006).

5. The California Coast and the Channel Islands

As is the case further north along the coast, there are currently no serious candidates for pre-Clovis occupations in California that have not been examined and rejected by most scholars. Clovis-like fluted points have been found on the coast and in the interior, but most are isolated finds without stratigraphic, artefactual, or faunal associations (Rondeau et al., 2007). Fluted points from coastal sites show that some Palaeoindians were familiar with California’s coastal landscapes, but none of these specimens have been reliably dated (Erlandson et al., 2007b). Without good chronological data for California’s fluted points, it is even conceivable that Clovis peoples originated along the Pacific Coast, then moved into the continental interior (Erlandson, 1994, p. 268). It seems more likely, however, that Clovis-like points in California were left by later Palaeoindians spreading westward from the interior of North America.

Although their relationship to the makers of these fluted points remains unclear, scores of shell middens and other coastal sites from the California Coast have been dated between about 13–9 ka, nearly all of them from south of the San Francisco Bay area (Erlandson and Moss, 1996; Erlandson et al., 2007b) (Fig. 3). These include mainland sites such as Duncan’s Point Cave on the Sonoma Coast, CA-SLO-2 and Cross Creek in San Luis Obispo County, CA-SBA-931 on Vandenberg Air Force Base, CA-ORA-64 on Newport Bay, Agua Hedionda (CA-SDI-210) in the San Diego area, and many others (see Table 2). Along the mainland coast, many early sites contain abundant shellfish remains and grinding stones (manos and metates), suggesting an economy dominated by the intensive use of shellfish and small seeds (Erlandson, 1994; Jones et al., 2002).

Some researchers have proposed a “pre-milling” Palaeocoastal occupation of the mainland coast prior to 9 ka (Moratto, 1984; Erlandson, 1994), but recent work at the Cross Creek site suggests that the use of milling stones may extend back to 10 ka or more (Jones et al., 2002). Projectile points and fishing equipment are rare in most mainland Palaeocoastal sites, but occasional bones of fish,
sea mammals, seabirds, and land mammals hint at a broader economy, including maritime capabilities more clearly expressed in early Channel Island sites (see below).

Especially impressive clusters of early sites have been documented along the mainland coast in the San Diego, Santa Barbara, and San Luis Obispo areas (see Jones, 1991; Erlandson, 1994; Erlandson and Moss, 1996; Bertrando and Levulett, 2004), many associated with extinct estuaries created by rapid sea level rise during the terminal Pleistocene and Early Holocene. Simple Olivella shell beads, made by grinding or chipping the spire off these small marine snails, have been found in many early coastal and interior sites dated between about 11–9 ka (see Erlandson et al., 2005b; Fitzgerald et al., 2005), showing that trade networks existed between California’s Palaeocoastal peoples and their interior neighbours at the end of the Pleistocene. Chipped stone crescents have also been found in some mainland Palaeocoastal sites, as have leaf-shaped bifaces, numerous core tools, and hammer stones (Erlandson, 1994). The presence of multiple components and heavy soil mixing by gophers and other burrowing animals at most mainland sites limits the chronological resolution with which many early assemblages can be interpreted, but it seems likely that bone gorges, boats, and other maritime technologies were also used by mainland Palaeocoastal peoples.

California’s Channel Islands, located between 20 and 98 km offshore, provide the earliest definitive evidence for the presence of maritime peoples along the Pacific Coast (Erlandson et al., 1996; Rick et al., 2001; Johnson et al., 2002; Erlandson, 2007). The earliest sites are Arlington Springs (CA-SRI-173) on Santa Rosa Island and Daisy Cave (CA-SMI-261) and Cardwell Bluffs (CA-SMI-678/679) on San Miguel island, where terminal Pleistocene occupations show that Palaeoindians used seaworthy boats to colonize the islands by at least 13–12 ka.

The Arlington Springs site was discovered in 1959, when Orr (1968) found human bones eroding from a thin palaeosol exposed near a spring in Arlington Canyon. The palaeosol formed in a stratified sequence of arroyo fill sediments 11 m below the modern surface. A $^{14}$C date on charcoal found near the bones of Arlington Man suggested that he died about 10,000 RYBP, an age later supported by a date on human bone of 10,080 ± 810 RYBP (Berger and Protsch, 1989: 59), with a calibrated age of about 12 ka. More recent AMS dating of collagen extracts from the bones of Arlington Man produced dates ranging from about 11,000 to 6600 RYBP, but Johnson et al. (2002: p. 543) argued that the oldest (~13 ka) is the most likely age of Arlington Man. A more conservative view is that he died sometime between about 13 and 12 ka, especially if he consumed some marine resources (as seems likely on the Channel Islands) as no marine reservoir effect has been applied in calibrating the dates on human bone collagen (Erlandson et al., 2007b). However, recent AMS dates on charcoal and mouse bones from the palaeosol in which Arlington Man’s bones and small amounts of chipped stone tool-making debris were found suggest an age close to 13 ka (Stafford et al., 2008).

More evidence for a terminal Pleistocene settlement of the Channel Islands comes from Daisy Cave (CA-SMI-261) on San...
Table 2

Palaeocoastal sites (≥9000 years cal BP) along the Alta California Coast

<table>
<thead>
<tr>
<th>Site name</th>
<th>General location and context</th>
<th>$^{14}$C age (cal BP)</th>
<th>Site description or contents</th>
<th>Primary references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duncan's Point Rock Shelter (CA-SON-348/H)</td>
<td>Sonoma County Coast</td>
<td>~ 9500 (1 date)</td>
<td>Stratified shell midden with basal deposits</td>
<td>Schwaderer, 2002</td>
</tr>
<tr>
<td>Lodge Hill (CA-SLO-369)</td>
<td>Cambria</td>
<td>~ 9100 ± 100</td>
<td>Multicomponent shell midden</td>
<td>Parker, 2004</td>
</tr>
<tr>
<td>Cross Creek Site (CA-SLO-1797)</td>
<td>San Luis Obispo County, near palaeoestuary</td>
<td>10,300–9000 cal BP</td>
<td>Multicomponent estuarine shell with milling tools, etc.</td>
<td>Jones et al., 2002</td>
</tr>
<tr>
<td>Diablo Canyon (CA-SLO-2)</td>
<td>San Luis Obispo County, near mouth of Diablo Canyon</td>
<td>~ 10,000 cal BP</td>
<td>Stratified shell midden, with basal deposits containing human burials, crescents, milling tools</td>
<td>Greenwood, 1972</td>
</tr>
<tr>
<td>CA-SLO-585</td>
<td>San Luis Obispo County, in Diablo Canyon area</td>
<td>~ 9000 cal BP</td>
<td>Stratified shell midden with early basal component</td>
<td>Greenwood, 1972</td>
</tr>
<tr>
<td>CA-SLO-832/1420</td>
<td>San Luis Obispo County, in Pismo Beach area</td>
<td>~ 9900–9200 cal BP</td>
<td>Shell midden</td>
<td>Jones et al., 2002</td>
</tr>
<tr>
<td>Surf Site (CA-SBA-931)</td>
<td>Knoll overlooking mouth of Santa Ynez River, N. Santa Barbara, CO</td>
<td>~ 9500 cal BP</td>
<td>Shell midden dominated by California mussels</td>
<td>Glassow, 1996</td>
</tr>
<tr>
<td>Honda Canyon Site (CA-SBA-530)</td>
<td>Coastal terrace, N. Santa Barbara County</td>
<td>~ 9000 cal BP</td>
<td>Dense shell midden</td>
<td>Glassow, 1996</td>
</tr>
<tr>
<td>Arlington Springs Man (CA-SRI-173)</td>
<td>NW coast of Santa Rosa Island, near mouth of Arlington Canyon</td>
<td>~ 13,000–12,000</td>
<td>Scattered bones of “Arlington Man” found in arroyo fill ~ 11 m below surface</td>
<td>Orr, 1968; Johnson et al., 2002</td>
</tr>
<tr>
<td>Arlington Point (CA-SRI-6)</td>
<td>NW coast of Santa Rosa Island, just east of Arlington Canyon</td>
<td>~ 9300 cal BP</td>
<td>Buried shell midden exposed in sea cliff, black abalones and mussels dominate, with fish bone, and expedient stone tools</td>
<td>Erlandson et al., 1999</td>
</tr>
<tr>
<td>Garanon Canyon (CA-SRI-1)</td>
<td>NW coast of Santa Rosa Island, near freshwater source</td>
<td>~ 9200 cal BP</td>
<td>Low density shell midden dominated by CA mussel shells</td>
<td>Erlandson and Morris, 1992</td>
</tr>
<tr>
<td>Daisy Cave (CA-SMI-261)</td>
<td>Northeast coast of San Miguel</td>
<td>11,600–8500 cal BP</td>
<td>Stratified midden with terminal Pleistocene and Early Holocene strata. Faunal remains, bone gorges, shell beads, sea grass cordage in Early Holocene strata</td>
<td>Erlandson, 2007; Rick et al., 2001</td>
</tr>
<tr>
<td>Cardwell Bluffs (CA-SMI-678/679)</td>
<td>Island, cave and rock shelter site</td>
<td>(shell, charcoal, bone dates)</td>
<td>Low density shell midden, with red abalone shells and numerous bifaces, crescents, extensive lithic scatter</td>
<td>Erlandson, unpublished data</td>
</tr>
<tr>
<td>Seal Cave (CA-SMI-604)</td>
<td>Harris Point area, north coast of San Miguel Island</td>
<td>~ 10,100–9000 cal BP</td>
<td>Stratified shell midden with rocky shore shellfish, fish remains, bone gorge</td>
<td>Rick et al., 2003</td>
</tr>
<tr>
<td>CA-SMI-522</td>
<td>Pt Bennett area, western San Miguel Island</td>
<td>~ 12,000–11,600 cal BP</td>
<td>Low density shell midden with basal deposits</td>
<td>Erlandson and Rick, 2002</td>
</tr>
<tr>
<td>CA-SMI-608</td>
<td>South coast of San Miguel Island west of Crook Point</td>
<td>(shell, charcoal dates)</td>
<td>~ 9700–8600 cal BP</td>
<td>Shell midden with two loci; diverse technological assemblage (gorges, <em>Olivella</em> beads, bifaces, etc.)</td>
</tr>
<tr>
<td>Bath Beach Site (CA-SMI-507)</td>
<td>Northwest Coast of San Miguel, Bath Beach Springs area</td>
<td>~ 9400–9000 cal BP</td>
<td>Large shell midden, largely deflated, with numerous leaf-shaped bifaces, and other stone tools</td>
<td>Erlandson et al., 2008</td>
</tr>
<tr>
<td>Running Springs West (CA-SMI-548)</td>
<td>Northwest coast of San Miguel, on bluffs next to freshwater spring</td>
<td>~ 9600 cal BP</td>
<td>Small shell midden dominated by rocky coast shellfish remains</td>
<td>Erlandson et al., 2004a</td>
</tr>
<tr>
<td>RS Cliffs (CA-SMI-610)</td>
<td>Northwest coast of San Miguel, near spring complex</td>
<td>~ 9250 cal BP</td>
<td>Low density shell midden dominated by California mussel shell</td>
<td>Erlandson, unpublished data</td>
</tr>
<tr>
<td>Busted Balls I (CA-SMI-606)</td>
<td>Busted Balls Cove, NW coast of San Miguel Island</td>
<td>~ 9200–9000</td>
<td>Low density shell midden near spring; multiple small midden loci with heavy focus on shellfish (mussel) collecting</td>
<td>Erlandson et al., 2004b</td>
</tr>
<tr>
<td>La Brea Woman (CA-LAN-159)</td>
<td>La Brea Tar Pits, Los Angeles</td>
<td>(shell, charcoal dates)</td>
<td>~ 10,200 cal BP</td>
<td>Human skeleton with associated <em>Olivella</em> beads</td>
</tr>
</tbody>
</table>

(continued on next page)
Miguel Island, first occupied about 11.5 ka. Overlooking a rugged stretch of rocky coast, Daisy Cave is a narrow fissure about 11 m long and 1–2 m wide associated with a small rock shelter and a dense shell midden on the slope in front of the cave. The cave provides shelter from strong winds that buffet San Miguel much of the year. Because offshore waters drop off relatively steeply, Daisy Cave also remained relatively close to the coast throughout the Holocene. The unique combination of shelter and proximity to the sea attracted people to Daisy Cave for more than 11 ka. Terminal Pleistocene occupation of the cave was limited, but a thin soil horizon known as Stratum C produced a few chipped stone artefacts associated with a small assemblage of shellfish remains (Erlandson et al., 1996; Rick et al., 2005). Despite the limited nature of the occupation, the assemblage shows that Palaeocoastal peoples foraged for red abalones, mussels, turban snails, and other shellfish in rocky intertidal habitats and that Palaeoindians were building for Clovis hunters, but observation of Pleistocene megafaunal knowledge of early settlement along the Pacific Coast of North America is supported by recent archaeological research in Baja California. Just a decade ago, Baja California was a virtual black hole in our knowledge of early settlement along the Pacific Coast of North America, with only one poorly documented site dated to the Early Holocene (Erlandson and Moss, 1996). Until recently, areas along the Gulf of California Coast (see Davis, 1968; Ritter, 1976, 1979, 1985, 2006) and the Sierras (Gutiérrez and Hyland, 2002) had seen more archaeological research than the Pacific Coast. In the last decade, however, several teams working on or near the Pacific Coast have identified terminal Pleistocene and Early Holocene shell middens with assemblages reminiscent of Palaeocoastal sites in Alta California (Fig. 4, Table 3).

The origins of these coastal or maritime peoples remain obscure, but here again the earliest widely accepted archaeological materials in the area are Clovis-like fluted points that are probably terminal Pleistocene in age. Lacking associated 14C dates, these fluted points have been recovered from the surface of several peninsular sites (Aschmann, 1952; Gutiérrez and Hyland, 2002; Hyland, 2006). Baja California may seem an unlikely place for Clovis hunters, but observation of Pleistocene megafaunal remains can be traced back to Jesuit missionaries of the mid-18th
century, who reported the remains of probable proboscideans near modern-day San Ignacio in the Central Sierras (del Barco 1789 (1988)) where several fluted points have been found (Gutierrez and Hyland, 2002). Another fluted point was found recently at the Arce-Meza site (PAIC-70) on Isla Cedros which was connected to the mainland until about 10 ka but is now located about 23 km offshore (Des Lauriers, 2006a). At the Arce-Meza site, large bifaces, unifacial scrapers, a variety of expedient flake tools, and large amounts of debitage were observed on the surface.

Except for the fluted point, similar lithic assemblages have been documented at the Richard’s Ridge (PAIC-49) and Cerro Pedregoso.

---

Table 3

<table>
<thead>
<tr>
<th>Site name</th>
<th>General location</th>
<th>(^{14})C age (cal BP)</th>
<th>Site description or contents</th>
<th>Primary references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrigo de los Escorpiones</td>
<td>West Coast between Punta Santo Tomás and Cabo Colonet</td>
<td>8870–8040 (16 dates)</td>
<td>6.5 meter deep shell midden deposit, with marine fauna, bone tools, fish hooks, and large leaf-shaped points</td>
<td>Gruhn and Bryan, 2002</td>
</tr>
<tr>
<td>Rock Shelter</td>
<td></td>
<td>10,120 ± 40 (1 date)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abrigo Paredón</td>
<td>Laguna Seca Chapala, Northern Central Desert</td>
<td>9070 ± 60 BP</td>
<td>Small rock shelter on pluvial lake shoreline</td>
<td>Gruhn and Bryan, 2002</td>
</tr>
<tr>
<td>Punta Prieta Rock Shelter</td>
<td>Near Pacific Coast, ~110 km North of Guererro Negro</td>
<td>8890 ± 60 BP</td>
<td>Date on “cache of 15 turban shells”</td>
<td>Davis, 2003</td>
</tr>
<tr>
<td>Richard’s Ridge (PAIC-49)</td>
<td>Isla Cedros, Pacific Coast Central Peninsula</td>
<td>12,100 cal BP</td>
<td>Dense shell midden with diverse lithic assemblage</td>
<td>Erlandson and Moss, 1996</td>
</tr>
<tr>
<td>Cerro Pedregoso (PAIC-44)</td>
<td>Isla Cedros</td>
<td>10,095 ± 30 BP (charcoal)</td>
<td>Dense, stratified shell midden with extensive lithic assemblage and faunal assembly dominated by a nearly exclusive maritime focus</td>
<td>Des Lauriers, 2006a,b</td>
</tr>
<tr>
<td>Covacha Babisuri</td>
<td>Isla Espiritu Santo, southern Sea of Cortez, Baja California Sur</td>
<td>10,000–8600 BP</td>
<td>Stratified rock shelter deposit, with anomalously old dates (fossil shell?)</td>
<td>Fujita, 2006, pp. 85–86</td>
</tr>
<tr>
<td>Costa Baja Rock Shelters</td>
<td>Baja California Sur, ca 5 km north</td>
<td>10,520 ± 30 BP (shell)</td>
<td>Two neighbouring rockshelters</td>
<td>Fujita, 2006, pp. 85–86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9870–8300 BP (11 dates)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Fig. 4. Map of Baja California showing the location of Palaeocoastal sites. See Table 3 for site details. Redrawn by G.N. Bailey from an original by M. des Lauriers.
(PAIC-44) sites on Cedros, stratified shell middens dated to the terminal Pleistocene and Early Holocene. Radiocarbon dates on marine shell and charcoal from midden deposits at Cerro Pedregoso range from about 11.8 to 9.1 ka, while a single mussel shell from Richard’s Ridge has been dated to ~12,100 ± 150 cal BP. These two sites have produced large and small bifaces, centripetal cobblecores, ground stone tools, and flaked tools made from Pismo clam (Tivela stultorum) shells (Des Lauriers, 2006a,b), as well as diverse faunal assemblages. At Cerro Pedregoso, the fauna is dominated by marine shellfish, bony and cartilaginous fish, sea turtle (cf. Caretta sp.), Guadalupe fur seal (Arctocephalus townsendii), and sea birds, along with quantities of sea grass and other carbonized marine floral remains. Isla Cedros has endemic populations of pygmy mule deer (Odocoileus hemionus cerrosensis) and brush rabbit (Sylvilagus bachmani cedrosensis), but only one rabbit bone was recovered from excavations, compared to over 1000 identified bones of marine vertebrates.

While these localities are the first for which radiocarbon dates confirm such an early occupation on Isla Cedros, at least five other sites on the island have similar surface manifestations, lithic assemblages, and shellfish assemblages. Like the terminal Pleistocene and Early Holocene sites on the Northern Channel Islands, the Isla Cedros materials indicate a strong focus on the exploitation of a diverse range of marine and littoral resources from a very early date (Des Lauriers, 2006a). Here, too, the strong emphasis on marine resources and relatively intensive early occupation of Isla Cedros suggest a population familiar with coastal settings and aquatic resources.

Several other Baja California sites dating to the Early Holocene or terminal Pleistocene have been identified in the past decade. These sites are spread along the 1600 km length of the peninsula, and most are in the early stages of research, mirroring the general archaeological situation in the region. Currently, most early peninsular sites are located near the coast and have strong emphases on littoral resources (Gruhn and Bryan, 2002; Fujita, 2006). One exception is the “interior” site of Abrigo Paredón (Gruhn and Bryan, 2002; Davis, 2003), which dates as early as 9070 ± 60 RYBP. This site, which lies on the shoreline of a small pluvial lake basin about 50 km from both the Pacific and Gulf of California coastlines, has a relatively shallow (~50 cm) deposit dominated by lithicdebitage, limited quantities of small mammal (i.e. Lepus sp.) bone, and some Pacific Coast shellfish remains (Gruhn and Bryan, 2002).

At the coastal rockshelter of Abrigo de los Escorpiones, Gruhn and Bryan (2002) uncovered a stratified shell midden at least 5.6 m deep. With basal deposits dating between about 10 and 9 ka, faunal remains suggest a strong focus on the collection of rocky-shore shellfish. One 14C date exceeds 10,000 RYBP, but Gruhn and Bryan (2002) cite a more conservative age estimate, based on a consideration of the context for each sample and issues of stratigraphic integrity. Further excavations are planned to seek deposits pre-dating 9 ka (Gruhn and Bryan, 2002).

Another early site is located on Espiritu Santo Island in the Sea of Cortez, just inside the southern tip of the peninsula (Cabo San Lucas). At the Covacha de Babusiri rockshelter, Fujita (2006) excavated a stratified deposit with cultural materials dating to at least 10,000 RYBP. Shells recovered below the 10,000 year old level produced dates in excess of 30 ka, but these anomalously old dates may indicate the use of fossil shell by the terminal Pleistocene occupants of the shelter. Similar to Isla Cedros, Espiritu Santo was probably connected to the mainland during the LGM, but had become an island by the time these coastal peoples settled there. Here, the early occupation of an island, one with very few terrestrial resources, also suggests an initial occupation of the peninsula by people familiar with the exploitation of marine resources.

6. Conclusions

Geological and archaeological data suggest that the distribution and abundance of early archaeological sites along various segments of North America’s Pacific Coast are strongly influenced by the unique geological history of each region. Despite the challenges posed by postglacial sea level rise, coastal erosion, glaciation, and tectonics, recent archaeological research along the Pacific Coast has identified important sites that shed considerable light on the antiquity and nature of early human settlement along the western edge of North America. In the Pacific Northwest, California, and Baja California, archaeologists have now identified evidence for the maritime settlement of islands by at least 11.5 ka. In California, Palaeocoastal peoples used seaworthy boats to settle the Northern Channel Islands as early as 13 ka, roughly contemporary with Clovis (see Waters and Stafford, 2007). Such discoveries, along with doubts about the availability of the interior ice-free corridor until approximately 13 ka, have pushed a coastal migration theory to the forefront of the debate about how and when the Americas were first colonized. The coastal migration theory has also gained credibility in recent years because of evidence for Pleistocene seafaring in eastern Asia (Erlandson, 2002; Fedje et al., 2004) and early occupations along the Pacific Coast of South America (e.g., Dillehay 1997; Keef er et al., 1998; Richardson, 1998; Sandweiss et al., 1998).

Erlandson et al. (2007a) proposed that kelp forests along North Pacific coastlines may have provided a “kelp highway” for maritime peoples migrating from northeast Asia into the Americas, with a similar suite of marine resources, reduced wave energy, and holdfasts for boats along a linear migration corridor entirely at sea level. Whether such a coastal migration actually took place—or represented the earliest colonization of the American continent—has yet to be demonstrated, but a variety of archaeological, anthropological, geological, and genetic evidence suggests that such a scenario is increasingly likely (Erlandson, 1994, 2002; Dixon, 1999; Fedje et al., 2004; Kemp et al., 2007). When, how, and from where the first maritime peoples first reached the Pacific Coast remains uncertain. The Monte Verde site is not universally accepted, and the presence of fluted Clovis-like points in coastal areas from Washington to Baja California leaves open the possibility that the early maritime peoples in the area are descended from Palaeoindians armed with a fluted point technology. With the antiquity of maritime settlement along various areas of the west coast pushed back to between at least 13 and 11.5 ka, however, it is now clear that models featuring a late settlement of the west coast and a gradual development of maritime capabilities are no longer viable.

By about 10 ka, archaeological evidence from all three geographic areas of the Pacific Coast demonstrates that coastal peoples had used seaworthy boats and other maritime technologies for more than a millennium. In all three areas, geography, faunal remains, or isotopic evidence indicate that these Palaeocoastal peoples: (1) used boats to explore and colonize offshore islands; (2) actively hunted, fished, and foraged in marine ecosystems; and (3) had economies that were fully maritime—with a majority of their calories or protein derived from marine resources. By 10 ka, Palaeocoastal peoples along the Pacific Coast had developed the earliest examples of several maritime technologies known in the New World, including barbed bone harpoons in the Pacific Northwest, bone gorge fishhooks on the Channel Islands, early cordage and basketry made from sea grass, and shell beads traded to interior peoples. This represents a much more sophisticated maritime adaptation than most scholars would have considered possible a decade or two ago. Because even earlier coastlines lie deeply submerged and largely unexplored offshore, understanding the origins of these maritime Palaeocoastal peoples is a challenge that requires a systematic archaeological search of the drowned terrestrial landscapes that flank the Pacific Coast of North America.
Acknowledgments

An early draft of this paper was presented by J.M.E. at the 2006 CALPE conference sponsored by the Gibraltar Museum. Jacob Bartruff of Eridu Consulting kindly drafted Fig. 2. We thank Todd Braje, Daryl Fedje, Terry Jones, Quentin Mackie, Judith Porcasi, and Torben Rick for assistance in compiling data on early Pacific Coast sites. We are also indebted to Clive Finlayson, Geoff Bailey, Darren Fa, Rick for assistance in compiling data on early Pacific Coast sites. We finally acknowledge the contributions of the many scholars whose research has added to our understanding of the archaeology and palaeoecology of the Pacific Coast of North America.

References


Fujita, H., 2006. The Cape region. In: Laylander, D., Moore, J.D. (Eds.), The Prehistory of Baja California: Alternatives in the Archaeology of the Forgotten Peninsula. UBC Press, Burnaby, B.C.


