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## From Asia to the Americas by boat? Paleogeography, paleoecology, and stemmed points of the northwest Pacific

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## ABSTRACT

Rising postglacial seas have flooded the world's continental shelves, limiting our ability to reconstruct human migrations, the history of settlement along Pleistocene coastlines, and the antiquity of coastal shell middens. This includes the southern coast of Beringia, where dramatic landscape changes make it difficult to test the coastal migration theory, which proposes that Upper Paleolithic peoples followed Pacific shorelines from northeast Asia to the Americas. To help overcome such problems, this paper discusses the paleogeography and paleoecology of Late Pleistocene North Pacific coastlines, then examines Pacific Rim technologies for possible evidence of a coastal migration. By  $\sim 16,000 \pm 1000$  cal BP, the Pacific Rim was a plausible migration route, entirely at sea level, with rich and diverse resources from both marine and terrestrial ecosystems. Within this vast region, scattered Late Pleistocene technological assemblages that include leaf-shaped bifaces and stemmed projectile points found in coastal or peri-coastal sites from Japan and Kamchatka to western North America, and much of South America may support the idea that a coastal migration contributed to the peopling of the Americas.

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### 1. Introduction

Shell middens are rich sources of data on the history of coastal peoples and the ecosystems in which they lived, hunted, fished, and died. Once viewed as markers of postglacial economies associated with the broad-spectrum and agricultural revolutions (Cohen, 1977; Bailey, 1978), coastal shell middens now have an antiquity at least an order of magnitude greater than once believed (see Erlandson, 2001; Parkington, 2003; Mearns et al., 2007). A growing body of genetic and archaeological evidence suggests that coastal and maritime migrations played an important role in hominin dispersals, especially the spread of anatomically modern humans (*Homo sapiens sapiens*) from Africa to Eurasia, Island Southeast Asia to Australia and Oceania, and possibly from East Asia into the Americas (Erlandson, 2002; Wells, 2002).

Shell middens are commonly studied to elucidate the history of Holocene maritime societies, but their potential is much more limited for the roughly 90 percent of the Pleistocene when sea levels were significantly lower than today (Bailey et al., 2007). With global sea levels rising  $\sim 120$  m over the past 20,000 years, in fact, the

archaeological record of Pleistocene maritime adaptations and migrations is deeply flawed and those shell middens now located on land may represent just the tip of a proverbial iceberg. It can also be expected that Late Pleistocene migrants along coastal zones were few in number, left comparatively ephemeral evidence of their earliest presence, and that most of those sites not lost to sea level rise and coastal erosion may be buried beneath alluvium, volcanic ash, loess or dune deposits, and debris left behind by later peoples. Around the North Pacific, archaeologists searching for Late Pleistocene or Early Holocene coastal sites must make special efforts to find such early occupations, including excavating well below the base of more recent shell middens that may obscure smaller and earlier sites in optimal locations (see Martindale et al., 2009).

Such problems are particularly applicable to the peopling of the Americas, which recent genetic evidence suggests occurred between  $\sim 18,000$  and 13,000 years ago (see Perego et al., 2009), when global sea levels were between  $\sim 120$  and 50 m below present. During this period, rising seas flooded the vast central Beringia region—a broad lowland plain that once connected Northeast Asia to North America. Unfortunately, any direct evidence for human migrations through south-central Beringia, by land or by sea, is now submerged on the floor of the Bering and Chukchi seas, leaving scientists to connect the dots between distant archaeological sites in Northeast Asia and North America. **With the south coast of Beringia submerged, how can the coastal migration theory be tested?**

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First, areas adjacent to Beringia can be studied for evidence of Pleistocene seafaring, coastal settlement, or maritime migrations, especially in areas where steep bathymetry has limited the lateral extent of postglacial marine transgressions and early coastal or peri-coastal sites are more likely to be found (Erlandson, 2001:322). In the absence of shell middens, evidence for early seafaring or maritime adaptations can be inferred from the human colonization of islands not connected to adjacent continents during the Pleistocene (Erlandson, 2002), or in the presence of coastal trade goods (shell beads, tool-stone, etc.) in interior sites, where they indicate ancient connections to coastal peoples or ecosystems (e.g., Dillehay et al., 2008). Punke and Davis (2006) also argued for searching productive coastal drainages such as the Columbia River, where early maritime peoples may have followed rivers rich in fish and other resources deep into interior regions where rising seas had less effect on the local geography. Finally, genetic, osteometric, and ecological data can provide valuable insights into the feasibility of early coastal migrations and adaptations (see Mandryk et al., 2001; Manley, 2002; Field and Mirazon Lahr, 2005; Bulbeck, 2007; Erlandson et al., 2007; Kemp et al., 2007).

This paper uses some of these methods to examine the possibility that coastal peoples from East Asia contributed to the peopling of the Americas by following the shorelines of the Pacific Rim. The focus is on three primary lines of evidence: (1) the ecological potential of Pacific Rim coastlines to support human migrants during the Late Pleistocene; (2) the paleogeography of the northwest Pacific, including the Kuril Islands and Kamchatka Coast, shortly after the Last Glacial Maximum (LGM) to explore the feasibility of a coastal migration; and (3) the distribution of early chipped stone technologies as possible evidence for an early (terminal Pleistocene) coastal migration.

## 2. Background

From Japan to Tierra del Fuego, the Pacific Rim extends for thousands of kilometers, a potential migration corridor that lies entirely at sea level and would have provided access to a variety of terrestrial, marine, and other aquatic resources. Until recently, archaeologists paid limited attention to reconstructing Pleistocene coastal ecosystems—including those of southern Beringia—probably because boats, seafaring, and coastal adaptations were thought to be Holocene developments. As evidence for Pleistocene fishing, seafaring, and maritime migrations has grown, however, interest in the nature of ancient coastal ecosystems has also increased (Bailey et al., 2007; Bulbeck, 2007; Erlandson et al., 2007).

Theories about the peopling of the Americas have long been dominated by land-locked models, in which terrestrial hunters marched across Beringia near the end of the Pleistocene, through an interior 'ice-free corridor', and onto the central plains of North America, then spread slowly from 'sea to shining sea' where they gradually learned to fish. Fladmark (1979) posed the first serious challenge to this scenario, suggesting that a coastal route may have been more conducive to a human migration from Asia to the Americas. Later, growing evidence for early seafaring and shell middens around the Pacific Rim led others (see Erlandson, 1994, 2002; Dixon, 1999; Fedje et al., 2004) to further explore the coastal migration theory, including the ecology of North Pacific coastlines. This includes the 'kelp highway hypothesis', which proposes that productive nearshore kelp forests from Japan to Baja California facilitated the migration of maritime peoples along a route that provided access to a similar suite of marine resources, reduced wave energy, and hold-fasts for boats (Steneck et al., 2002; Erlandson et al., 2007).

From northern Japan, through the Kuril and Aleutian island chains, and down the Pacific Coast of North America as far as Baja California, productive kelp forests provided three-dimensional

habitat for a rich assemblage of similar organisms, including seals and sea otters and a variety of seabirds, fish, shellfish, and seaweeds. The linear nature of the coastal route and the similar ecology of kelp forest and estuarine habitats would have provided little ecological resistance to the spread of early maritime peoples around the North Pacific Rim. On the coast of Central America, nearshore kelp forests would have given way to a mosaic of estuaries, mangrove swamps, and coral reefs, before kelp forests were found again along much of the Andean Coast (Steneck et al., 2002; Erlandson et al., 2007). After the LGM, rapidly rising seas would have flooded numerous coastal drainages, creating estuaries that would have provided ecological 'sweet spots' (Bulbeck, 2007) with protected and productive waters for coastal migrants. In this sense, the kelp highway may be described more accurately as a 'Pacific Rim Highway', where coastal zones offered a diverse array of plant and animal foods from marine, estuarine, riverine, and terrestrial ecosystems.

## 3. From East Asia to Beringia

### 3.1. Evidence for seafaring and maritime migrations in the Western Pacific

In the 1980s, long-distance seafaring was thought to have developed in just the past 10,000 years or so (Erlandson, 2001). The first evidence for Pleistocene seafaring came from greater Australia, a continent colonized by humans about 50,000 ± 5000 years ago via a series of marine voyages, some of them ~80–100 km long (e.g., Roberts et al., 1994; Turney et al., 2001). By 1990, the discovery of Pleistocene shell middens on New Ireland, New Britain, and the Solomon Islands showed that seafaring peoples had settled islands in Western Melanesia almost 40,000 years ago, a migration that required additional voyages of equal or greater lengths. Discovery of the Minotogawa Man skeleton on Okinawa showed that seafaring Upper Paleolithic peoples also reached the Ryukyu Islands between Taiwan and Japan as much as 35,000 years ago (Oda, 1990; Matsu'ura, 1999), with voyages of up to 150 km (Erlandson, 2002:71). Artifacts made from obsidian found on Kozushima Island off eastern Honshu have also been found in interior Upper Paleolithic sites in Japan, demonstrating that Pleistocene peoples used boats to access offshore islands and their resources. The length of voyages to Kozushima varied depending on sea level, but would have been roughly 25 km during the LGM (~25,000–15,000 cal BP; see Tsutsumi, 2007:183).

Evidence for Upper Paleolithic seafaring in the Ryukyu Islands and southern Japan indicates a commitment to maritime lifeways and coastal subsistence, suggesting that the lack of Pleistocene shell middens may be due to postglacial sea level rise and coastal erosion. By the LGM, seafaring peoples in Japan were also on the verge of relatively cool ocean waters and diverse marine habitats that may have encouraged the spread of coastal settlements further north. After the LGM ended, rapid sea level rise submerged the land bridge connecting Japan to Sakhalin and the Asian mainland. It also substantially reduced the land area available to Upper Paleolithic peoples and effectively increased their population density (see Aikens and Higuchi, 1981). By ~15,500 cal BP, late Upper Paleolithic peoples in Japan—the Incipient Jomon—were adapting to these dynamic early deglacial conditions through sedentism, economic intensification, and technological changes that included the development of some of the world's earliest pottery. They made distinctive 'tanged' (stemmed) points, some with barbed shoulders (Nagai, 2007). More than a thousand of these points have been found in Incipient Jomon sites throughout Japan and on Sakhalin Island, where they are often associated with leaf-shaped bifaces and/or microblades, and in later sites with early pottery.

The geographic and demographic changes caused by rapid sea level rise after the LGM may have 'pushed' maritime peoples to



**Fig. 1.** The geography of the North Pacific region, showing island arcs, continental shelves, and the now submerged central Beringia region (adapted from Environmental Graphics (1992), scale = 1:10,100,000).

migrate northward through the Kuril Islands, to Kamchatka and the southern shores of Beringia. Simultaneously, climatic amelioration and the warming of northeast Pacific waters early in the deglacial (Sarnthein et al., 2006) may have 'pulled' maritime peoples northward towards Beringia. Alternatively, but seemingly less likely, cold-adapted coastal peoples capable of living and hunting in seasonal sea ice conditions of the North Pacific may have migrated towards Beringia's south coast during the LGM.

### 3.2. Beringia, the Kurils, and Kamchatka: geography, paleogeography, and archaeology

Compared to the northwest coast of North America, there has been relatively little discussion of coastal paleoenvironments and the feasibility of a maritime migration from East Asia to the south coast of Beringia. Until recently, the few portrayals of LGM or early deglacial conditions in southern Beringia described an unglaciated but frozen and relatively bleak coast (see Hopkins et al., 1982), inhospitable for early human habitation. Recent reconstructions are far less forbidding (e.g., Brigham-Grette et al., 2004; Sarnthein et al., 2006), suggesting that sea ice was less prevalent by ~18,000 cal BP and that Beringia's south coast was evolving rapidly, but highly convoluted and studded with hundreds of low islands (see Manley, 2002). Convoluted coastlines provide relatively protected and productive waters for coastal foragers and seafaring peoples, including extensive intertidal and shallow reef habitat for collecting shellfish, fishing, and hunting.

Compared to Japan or the west coast of North America, relatively little is known about the archaeology and paleogeography of coastal Kamchatka and the Kuril Islands, which may have served as a maritime approach from Japan to Beringia. The Kurils appear to have been a largely unglaciated biotic refugium during the LGM, but coastal

waters in the northwest Pacific were probably locked in sea ice much of the year. Recent geological evidence from seafloor cores in the northwest Pacific suggests that three major warming intervals occurred in the area after ~18,000 years ago: from 18,200 to 17,200 cal BP, 16,800 to 16,300 cal BP, and 16,200 to 14,700 cal BP (Sarnthein et al., 2006). These warmer periods reduced the extent and duration of seasonal sea ice and may have facilitated the spread of maritime peoples around the North Pacific (Erlandson et al., 2008b:2234). (Fig. 1)

Consisting of more than 56 islands and numerous smaller islets, the Kuril Archipelago forms a graceful arc stretching for 1200 km from the northern tip of Hokkaido to the southern tip of the Kamchatka Peninsula (Fig. 2). With a combined land area of ~15,600 km<sup>2</sup> and over 2400 km of coastline (Pietsch et al., 2003:1298), the Kurils separate the Sea of Okhotsk from the Pacific Ocean. Largely volcanic in origin, they were created by subduction of the Pacific Plate into a deep submarine trench that borders the east side of the island arc. At least 160 volcanoes exist on the Kurils, at least 40 of which are still active (Pietsch et al., 2003), and regular eruptions have covered large portions of the islands with thick layers of lava, tuffs, and tephra (see Snow, 1897; Braitseva et al., 1995; Bulgakov, 1996). The area is also extremely active tectonically, with a long and regular history of earthquakes, tsunamis, and coastal erosion (MacInnes et al., 2009). The combination of postglacial sea level rise, active volcanism, frequent earthquakes and tsunamis, high wave energy, and coastal erosion may have seriously compromised the preservation and visibility of older archaeological sites on the islands (Fitzhugh et al., 2004:95).

Today, the distances between the 16 main islands in the Kuril Archipelago range from 2 to 76 km (Table 1). The longest and the most formidable gap is between Bussol Strait and Chirpoy and



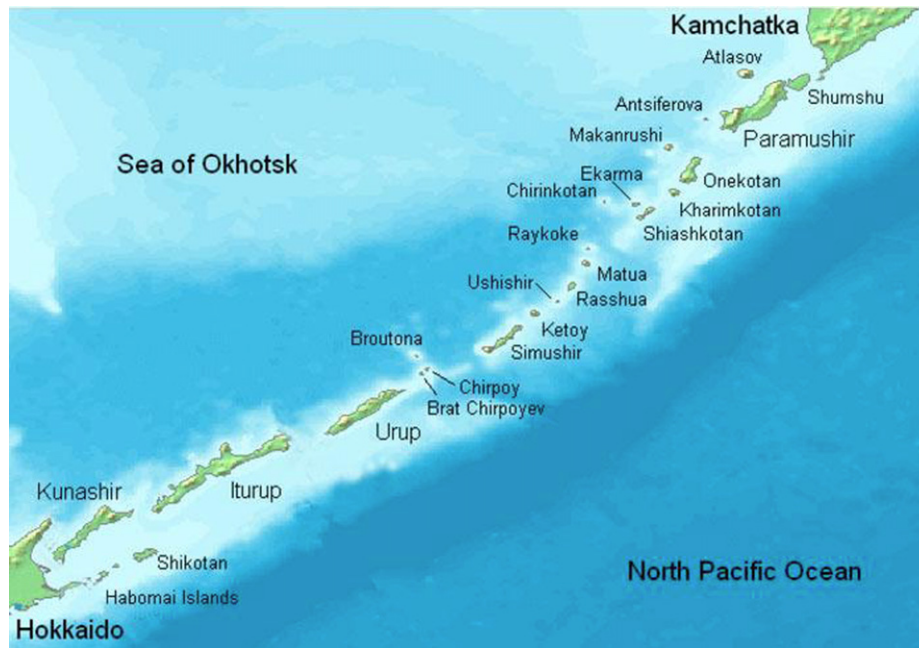


Fig. 2. Modern geography of the Kuril Islands (downloaded and adapted from <http://japanfocus.org/-kimie-hara/3170>).

Simushir islands, a major biogeographic boundary marked by a deep submarine channel that funnels much of the circulation between the Pacific Ocean and the Sea of Okhotsk. During the LGM, with global sea levels ~120 m lower than today, the number of islands in the Kuril chain was reduced (Fig. 3), habitable land area increased, and fewer and shorter voyages would have been required to migrate through the archipelago. With heavy winter sea ice, people may even have been able to reach some of the islands without using boats, just as arctic peoples travelled across the Bering Straits in winter historically (see Bockstoce, 2009:249). At this time, Hokkaido, Sakhalin Island, and the southernmost Kurils (Habomai, Shikotan, and Kunashir) were joined as a single, relatively mountainous, land mass that could have been settled by incipient Jomon peoples without boats. The southern tip of the Kamchatka Peninsula was also joined to the northern Kuril Islands of Shumshu and Paramushir, and the southern Kuril Islands of Urup, Chirpoy, Brat Chirpoyev, and

Broutona may have been united into a single larger island (Pietsch et al., 2003:1300). The distances between the remaining islands were also reduced from the modern geography, but a voyage of ~66 km was still required to cross Bussol Straits.

During and shortly after the LGM, even more than today, the deep Bussol Strait was the primary source of circulation between the Pacific and the Sea of Okhotsk, where strong currents may have complicated sea crossings (see Snow, 1897). Still, seafaring peoples overcame strong currents and made longer voyages in settling Okinawa, western Melanesia, and Australia 35,000–50,000 years ago, suggesting that maritime Upper Paleolithic peoples may have been capable of crossing Bussol Strait.

As potential stepping stones for maritime peoples migrating from Japan to southwest Beringia, the Kuril Islands may provide a key testing ground for the coastal migration theory. Terrestrial resources would have been limited on the Kurils—especially in the central

**Table 1**  
Modern and Early Deglacial (~17,000 cal BP) geography of the Kuril Islands.

Island or Land Mass	Modern Geography			17 ka		Comments
	Voyage (km)	Island Size	Island Ht (m)	Voyage (km)		
1 Hokkaido, Japan	16	–	–	0		Connected to 2 at LGM?
2 Kunashir, SK	19	1490	1822	17		Connected to 1 at LGM?
3 Iturup, SK	37	3200	1634	29		
4 Urup, SK	29	1450	1426	28		New island between 4/5?
5 Chirpoy, SK	67	37	749	66		Deep strait with biogeographic boundary between 5/6
6 Simushir, CK	19	353	1539	14		
7 Ketoi, CK	25	73	1172	20		
8 Ushishir, CK	16	5	401	0		Connected to 9 at LGM?
9 Rasshua, CK	30	67	948	9		Connected to 8 at LGM?
10 Matua, CK	18	52	1446	18		
11 Raikoke, CK	76	5	551	62		Two new islands in between
12 Shiashkotan, NK	29	128	944	8		
13 Kharimkotan, NK	15	68	1157	13		
14 Onokotan, NK	54	425	1324	30		
15 Paramushir, NK	2	2053	1816	0		Connected to 16/17 at LGM
16 Shumshu, NK	11	388	189	0		Connected to 15/17 at LGM
17 Kamchatka Peninsula	–	–	–	–		Connected to 15/16 at LGM

Notes: Modern island heights (maximum elevation above sea level) and size (km<sup>2</sup>) from Tomilov (n.d.); SK = Southern Kurils; CK = Central Kurils; NK = Northern Kurils.



Fig. 3. Geography of the Kuril Islands and Sea of Okhotsk area during the Last Glacial Maximum (adapted from Pietsch et al., 2003).

oceanic islands—but kelp forests were luxuriant and sea otters, multiple pinniped and cetacean species, marine and anadromous fish (salmonids, halibut, etc.), seabirds and waterfowl, shellfish and seaweeds were all available to varying degrees across the archipelago (see Snow, 1897). Fitzhugh et al. (2004:95) suggested that various parts of the Kuril chain may not have been occupied continuously by humans for more than ~2500–4200 years. Relatively little archaeology has been done in the islands (e.g., Baba, 1934; Zaitseva et al., 1993; Fitzhugh et al., 2002), but recent efforts by Fitzhugh et al. (2004, 2007) and others (e.g., Yanshina et al., 2009; Vasilevski et al., 2010) have begun to flesh out a basic chronology and culture history of the islands from the Middle Holocene on. The Late Pleistocene and Early Holocene paleogeography, paleoecology, and archaeology of the archipelago are poorly known, however, and the oldest well-dated sites on the Kurils are only ~7500–8000 years old. Recent research at the Yankito I and II sites on Iturup found Early Jomon pottery and stone tools associated with charcoal samples AMS  $^{14}\text{C}$  dated between ~8000 and 7600 cal BP (Yanshina et al., 2009). Fitzhugh et al. (2007:166) also described a microblade-bearing component at the undated and

heavily disturbed Trudnaya I site on Paramushir Island (connected to the Kamchatka Peninsula in the early deglacial) that could represent an even earlier occupation. Finally, Yanshina et al., 2009:32 noted that surface artifacts of “Upper Paleolithic appearance” have been found on the Kurils, although not yet in stratified or well-dated contexts.

For now a Late Pleistocene maritime migration through the Kuril Islands remains purely hypothetical, but much more research is required to determine if Upper Paleolithic peoples settled the islands. If maritime peoples migrated northward through the Kurils during or shortly after the LGM, they would have reached the western shores of the Kamchatka Peninsula, where the Pacific Coast is marked by steep bathymetry, high wave energy, and a mountainous and exposed coastline. Here, too, little is known about the late Pleistocene history of this remote and rugged coast, but the steep bathymetry suggests that there is some potential for early coastal sites to be preserved. The Ushki Lake 7 site, located along the Kamchatka River some distance from the modern coast, has produced leaf-shaped bifaces and bifacially-flaked stemmed points in a cultural component once thought to be over 16,000 years old,

but now dated to ~13,000 cal BP (Dikov, 1979; Goebel et al., 2003). Powers (1996:234) argued that the Ushki 7 assemblage may share maritime links to the Incipient Jomon of Japan rather than interior regions of Siberia (see below).

The absence of Pleistocene middens from the coastlines of Japan, Northeast Asia, and Beringia, despite substantial evidence for seafaring in Japan, suggests that the coastal archaeological record may be affected by a variety of geological processes (postglacial sea level rise, marine erosion, volcanism, earthquakes and tsunamis, etc.) as well as limited research in key areas such as the Kurils and Kamchatka. Other than the Kurils, moreover, there are also very few islands in the northwestern Pacific that were within the expected range of Late Pleistocene seafarers. The Commander Islands are ~175 km from Kamchatka, for instance, and an even wider gap separates them from the westernmost Aleutian Islands. The size of these water gaps, especially considering the difficulty of navigating open ocean waters of the Bering Sea or far Northwest Pacific in small boats, suggests that any maritime migration from Northeast Asia to North America followed the southern shoreline of Beringia rather than the Aleutian Island chain. Unfortunately, a swath of southern Beringia (including its dynamic south coast) roughly 1500 km long and ~500 km wide has been submerged by postglacial sea level rise, creating a yawning central gap between early sites on either side of the North Pacific Rim.

#### 4. Stemmed points around the Pacific Rim

Acknowledging a variety of problems with the Late Pleistocene archaeological records of North Pacific coastlines, the evidence for technological similarities in Upper Paleolithic and early Paleoindian stone tool traditions around the Pacific Rim can be examined. Archaeologists seeking links between Clovis and possible precursors in Siberia have long compared diagnostic elements of stone tool assemblages (projectile point types, blades, microblades, etc.) and other technologies. For western North America, Beck and Jones (2010) argued that early stemmed points were technologically distinct from Clovis, Folsom, and other Paleoindian points, hypothesizing that they may have been related to a coastal migration from northeast Asia into the Americas. Dikov (1979) also proposed technological links between stemmed points from Ushki Lake and early Pacific Northwest sites, but believed these were the results of an interior migration. Could the Late Pleistocene stemmed points in the Japan's Incipient Jomon, at Ushki Lake, and the Pacific Northwest all have a common origin in a coastal migration around the Pacific Rim? Given the submergence of Late Pleistocene coastlines, is there hope of finding evidence linking these far-flung traditions? Perhaps, if migrating coastal peoples also followed productive rivers into the continental interior, where the technological evidence for their presence is more likely to be preserved than in coastal areas.

The following sections briefly review the evidence for stemmed points in Late Pleistocene and Early Holocene coastal or riverine sites of the Pacific Rim. A full description of these point types and their contexts is beyond the scope of this paper, but all these early stemmed point traditions are broadly similar in size and shape. Recognizing that stone tool traditions found over such a vast area and several millennia should exhibit considerable diversity, a summary is presented of what is known about the distribution and dating of broadly similar stemmed point traditions. It is suggested that they may be linked as part of a wider migration, cultural, and information corridor around the Pacific Rim.

##### 4.1. Korea, Japan, and the Russian Far East

On the Korean Peninsula, stemmed points have been found in Upper Paleolithic sites dated between about 35,000 and 15,000 years ago (Seong, 2008). Stemmed and barbed points were found at the

Suyanggae site (Nelson, 1993:47–48), for example, in a component that also contained microblades. These Korean Upper Paleolithic points—generally ~6–10 cm long with relatively long stems—are usually produced on thin flakes with only marginal retouching. Because of their antiquity, however, they may be logical precursors to the more finely-made stemmed points found in terminal Pleistocene sites in Japan and around much of the Pacific Rim.

In Japan, stemmed (or 'tanged') points are an important time marker for the late Upper Paleolithic or Incipient Jomon period (see Aikens and Higuchi, 1981), dated between about 15,500 and 13,800 cal BP (Ono et al., 2002; Tsutsumi, 2007). These points are generally thin and delicately made, usually less than 7 cm long, and often have long stems and prominent barbs. Over 1500 of these tanged points have been recovered in Japan (see Nagai, 2000, 2007), where they are often associated with leaf-shaped bifaces, and less frequently with microblades or linear relief pottery.

Tanged points similar to those from Incipient Jomon sites have been found on Sakhalin Island (Nagai, 2007), once part of a land bridge connecting northern Japan to the Asian mainland. In Horizon 1 at the Ogonki V site on Sakhalin, located about 90–100 km inland, three stemmed points were found associated with microblades and microcores, along with a salmon-shaped burin and exotic amber pebbles that may link the site to the coast (Vasilevski, 2005:432–435).

At Ushki Lake 7, Dikov (1979) found ~30 bifacially-flaked stemmed points in a stratum initially dated to ~16,000 cal BP but later redated by Goebel et al. (2003) to ~13,000 cal BP. This component lacks microblades but contains "simple flake and blade tools and small bifacial points and knives" (Goebel et al., 2003:504). According to Powers (1996:234) the Ushki Lake assemblage is "an anomaly for the Siberian Upper Paleolithic" with relationships to Japan, possibly via a "direct maritime connection through the Kuril Islands."

##### 4.2. Northwestern North America

From Kamchatka to the Northwest Coast of North America, there is a wide gap in the distribution of early coastal sites and stemmed points corresponding to the drowned southern coast of Beringia. The size of this gap may worry skeptics, but it is not significantly larger than the gaps between early Siberian, Alaskan, and Clovis sites that are routinely linked in models of terrestrial migrations from Siberia through Beringia and the 'ice-free corridor'. The coastal gap is easier to explain as it corresponds to the submerged south shore of Beringia, the Aleutians where no evidence of Pleistocene human occupation has been found, and the heavily glaciated coastlines of south-central and southeast Alaska.

Along the highly dynamic coastlines of northwestern North America, there is still only limited evidence for terminal Pleistocene human occupation and those sites that have been identified have produced relatively small assemblages of formal tools (see Fedje et al., 2004; Fedje and Mathewes, 2005; Erlandson et al., 2008b). The oldest sites in this area often contain leaf-shaped bifacial points, some with subtle shoulders and stems, followed by a later appearance of microblades. On the southern Northwest Coast, from southern Vancouver Island to Northern California, very few early sites have been identified on the coast, probably due to coastal erosion and a long history of massive subsidence earthquakes and tsunamis within the Cascadia Subduction Zone (Erlandson et al., 1998, 2008a).

Stemmed points have been found in several riverine sites of the Pacific Northwest dated between ~14,500 and 12,500 cal BP (Beck and Jones, 2010:101; Faught, 2008), however, especially near large drainages such as the Columbia and Klamath rivers. The large rivers of the Pacific Northwest—rich in anadromous fish such as salmon, sturgeon, eulachon, and eels—may have provided productive aquatic migration corridors that coastal peoples followed deep into the interior of the Intermountain West. One early stemmed point in



the Pacific Northwest was found beneath the skull of the Buhl burial in Idaho dated to ~12,600 cal BP, which appears to be very similar to stemmed points from Ushki Lake. Excavations at Oregon's Paisley Caves add to the evidence for the antiquity of stemmed points in the Far West. In pre-Clovis deposits yielding human coprolites (with traces of human DNA) and artifacts dated between ~14,500 and 14,000 cal BP (Jenkins, 2007; Gilbert et al., 2008), the base of an obsidian stemmed point was recovered from strata dated to over 14,000 cal BP. The basal strata at Paisley Cave have produced no fluted points, blades, or other Clovis-like artifacts, supporting the hypothesis that stemmed points predate fluted points in the Pacific Northwest (see Beck and Jones, 2010).

#### 4.3. Alta and Baja California

The southern coast of Alta California has one of the longest and the most continuous records of coastal settlement in the New World, including Channel Island shell middens that are among the oldest in North America (Rick et al., 2005; Erlandson et al., 2008b). The Northern Channel Islands, separated from the adjacent mainland throughout the Quaternary, were first settled by maritime Paleo-Indians at least 13,000 years ago. Until recently, relatively little was known about the technologies of these Paleocoastal island peoples, but stemmed points and crescents similar to those found throughout the far western United States have recently been identified in early island sites. Delicately barbed and stemmed points were collected from the Channel Islands by antiquarians in the late 19th and early 20th centuries (e.g., Heye, 1921:Plate XXXIX and XLII), but due to their refined flaking, small size, and a lack of specific provenience, these 'Channel Island Barbed' (CIB) points were long thought to be Late Holocene in age (Justice, 2002:263–265). Glassow found three CIB points at CA-SCRI-109 on Santa Cruz Island in a shell midden stratum dated to ~8400 cal BP (Glassow et al., 2008), however, and others were recognized in Paleocoastal shell middens on San Miguel Island dated between 12,000 and 8400 cal BP (Erlandson and Braje, 2008; Erlandson and Jew, 2009; Braje, 2010). Chipped stone crescents have been found with stemmed points at several of these sites, an association common to many early sites in the western United States, which Beck and Jones (2010) link to a coastal migration from Northeast Asia into the Americas.

Baja California has seen much less archaeological research than Alta California, but a growing interest in the coastal migration theory has resulted in research that has identified several terminal Pleistocene or Early Holocene shell middens located on or near the coastlines of the peninsula (see Erlandson et al., 2008b). On Cedros Island off Baja California's Pacific Coast, work by Des Lauriers (2006) has revealed a long history of human occupation by maritime hunter-gatherers, including two stratified shell middens (PAIC-44 and -49) containing the remains of shellfish, marine mammals, and sea turtles dated between about 12,000 and 9300 cal BP. At PAIC-44, located adjacent to a freshwater spring and a source of tool-stone that attracted Paleocoastal people into the interior, Des Lauriers recovered hundreds of bifaces, including a basally-thinned contracting-stem point and a weakly shouldered point. According to Des Lauriers (2006:265–66), these relatively small and "well-thinned" stemmed points may have been used in marine hunting. Because Cedros Island was connected to the mainland until the Early Holocene, its settlement did not require boats, but marine resources dominate the faunal assemblages and the diversified nature of marine subsistence suggests a fully maritime adaptation.

#### 4.4. South America

The authors are less familiar with the South American record, but a review of the literature shows that early stemmed points and

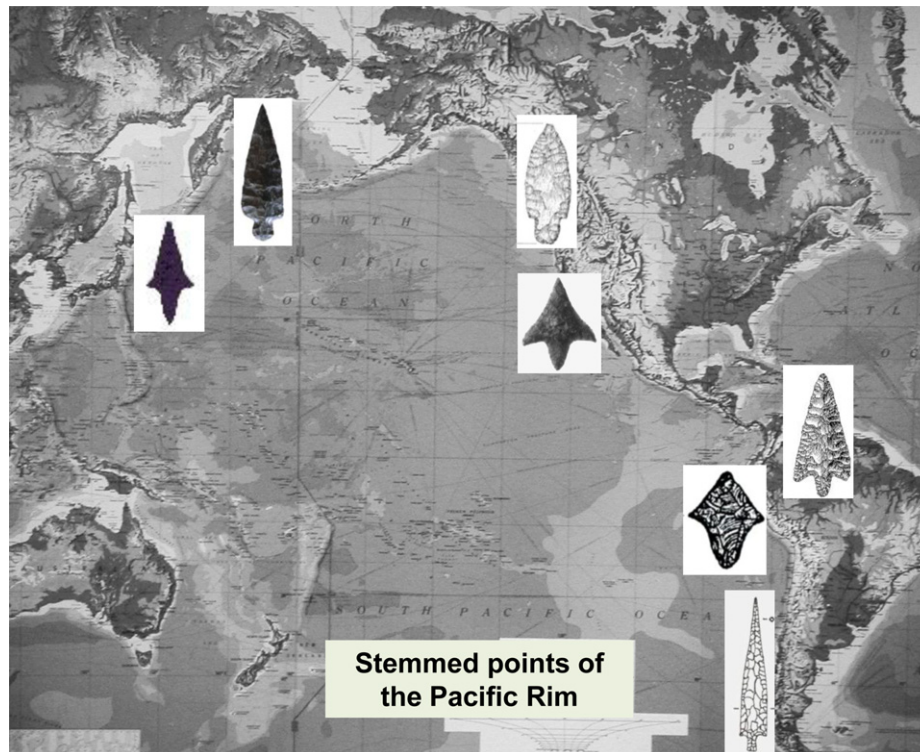
leaf-shaped bifaces have been identified from the Pacific Coast of Ecuador, Peru, and Chile, as well as much of the remainder of the continent (Roosevelt et al., 2002). The Monte Verde II site near the Chilean Coast produced two leaf-shaped bifaces in contexts dated to ~14,000 cal BP (Dillehay et al., 2008; Erlandson et al., 2008a), but this small sample may not be representative of the larger technological tradition they are associated with (see Erlandson and Jew, 2009). Stemmed 'fishtail' points, some with fluted bases, are also widely distributed in Central and South America, and those found in datable contexts appear to be between about 14,000 and 11,000 years old (Bruhns, 1994:48; Roosevelt et al., 1996). Along the Andean Coast of Peru, a small stemmed point was found in terminal Pleistocene contexts at the Quebrada Jaguay site (Fig. 4; Sandweiss et al., 1998). Both fishtail and Paiján points have been found in terminal Pleistocene contexts along the coastal plain of northern Peru (Scheinsohn, 2003:346; Maggard, 2010), some of the Paiján points have barbed shoulders and contracting stems. In northern Chile's Atacama Desert, stemmed "Punta Negra points" were described by Lynch (1986:154–155) as thin and finely-flaked with long, parallel-sided stems. The Salar de Punta Negra sites, located near ancient lakes and wetlands, were also investigated by Grosjean et al. (2005:645), who recovered five Punta Negra points from contexts dated between ~12,600 and 10,200 cal BP.

Early projectile points with distinctive barbs and contracting stems have also been found in Columbia, Venezuela, Guyana, and Brazil (Barse, 1997:1949; Roosevelt et al., 2002). At Pedra Pintada in the Amazon Basin, a stemmed point preform was recovered from deposits dated between ~13,000 and 12,000 cal BP (Roosevelt et al., 1996). If all these South American stemmed point traditions have a common technological source, their widespread distribution suggests that early coastal migrants may have crossed the narrow Isthmus of Panama and spread down both the Atlantic and Pacific coasts, as well as up major river systems.

### 5. Summary and conclusions

For decades, prominent marine scientists have warned about the effects of postglacial sea level rise on coastal archaeological records (e.g., Emery and Edwards, 1966; Shackleton et al., 1984; Shepard, 1964) but many archaeologists working in coastal areas or theorizing about the history of coastal fishing, maritime adaptations, and seafaring have ignored such warnings (see Parkington, 1981; Erlandson, 1994; Bailey et al., 2007; Mearns et al., 2007 for significant exceptions). Understanding the deep history of shell middens, fishing societies, and maritime migrations requires a careful consideration of the effects of sea level fluctuations and coastal landscape change on local and regional archaeological records. This includes the strong possibility in many parts of the world that those sites now located on land may not fully represent maritime migrations, coastal settlements, or fishing economies that existed prior to sea levels approaching their modern levels roughly 6000 years ago. Under these circumstances, great caution should be exercised in evaluating the antiquity of coastal occupations or evidence for early maritime migrations.

Such issues are especially problematic for the peopling of the Americas, which current genetic and archaeological data suggest took place shortly after the end of the LGM, when global sea levels were as much as 120 m below present. This discussion has tried to circumvent some of the problems created by postglacial sea level rise and coastal landscape change by considering the paleoecological and paleogeographic context of Late Pleistocene shorelines of the Pacific Rim, as well as the possible archaeological implications of the distribution of broadly similar Late Pleistocene technological traditions from Japan, Kamchatka, the Pacific Northwest, California, and South America. Some may argue that there has been too heavy a focus on projectile points as markers of human



**Fig. 4.** Stemmed points of the Pacific Rim (clockwise from left: Incipient Jomon tanged point, ~15,500–13,000 cal BP; stemmed points from Ushki Lake, ~13,000 cal BP and the Buhl burial, ~12,500 cal BP; Channel Island Barbed, ~12,000–8400 cal BP; Lower Amazon, ~12,500 ± 500 cal BP; Quebrada Jaguay, ~12,400–10,500 cal BP; and Paijan, ~12,000–9500 cal BP. Base map adapted from *Environmental Graphics* (1992), scale = 1:10,100,000).

migrations into the Americas, but temporally diagnostic point types continue to be central to archaeological chronologies. Ignoring the similarities in Late Pleistocene technologies from around the Pacific Rim is not the answer, especially when a growing body of evidence supports the hypothesis that the Pacific Coast served as a migration corridor for humans during the Late Pleistocene.

Given the global rise of sea levels since the LGM, as well as the tectonic, volcanic, glacio-eustatic, and erosional history of Pacific Rim coastlines, a dearth of Pleistocene shell middens should not automatically be interpreted as a lack of evidence for maritime migrations or coastal settlement. In Northeast Asia and the Americas, there continue to be large gaps in the archaeological evidence for Late Pleistocene settlement, in both interior and coastal regions. Due to the submergence of coastlines around the world, early coastal sites are particularly difficult to find. Along the Pacific Coast, however, early sites have been found in formerly glaciated areas where isostatic rebound has preserved ancient shorelines, where steep bathymetry has limited lateral movements of postglacial shorelines, and where springs or other natural features pulled people inland from shorelines now long submerged. On San Miguel and Santa Rosa islands, where the latter two conditions apply, more than 30 archaeological sites dated between ~13,000 and 8500 years ago have been identified, many clustered near interior freshwater and tool-stone sources. The earliest Northern Channel Island sites show that the archipelago was settled by seafaring Paleocoastal peoples about the same time as Clovis peoples occupied interior regions of North America and the earliest shell middens date to ~12,000 cal BP (Erlandson et al., 2011).

There are no known Pleistocene shell middens in the Ryuku Islands or Japan, but the evidence for island colonization or visitation during the LGM demonstrates that maritime and seafaring peoples were present in East Asia, near the western end of what has been called the kelp highway (Steneck et al., 2002; Erlandson et al., 2007).

In Korea, Japan, and on Sakhalin Island in the Russian Far East, late Upper Paleolithic or Incipient Jomon peoples were using stemmed points and leaf-shaped bifaces ~15,000 years ago, when rapid sea level rise was flooding productive coastal lowlands, increasing human population densities, and stimulating major cultural and environmental changes. Along with a warming of the Northwest Pacific that began ~18,000 years ago (Sarnthein et al., 2006), these ecological and cultural events may have stimulated an expansion of maritime peoples from northeast Asia to Beringia and, ultimately, down the Pacific Coast of the Americas. The evidence for such a migration may have been largely submerged by rising sea levels, but recent research has identified genetic, osteometric, and technological evidence that may support the coastal migration theory (Kemp et al., 2007; Perego et al., 2009; Beck and Jones, 2010).

Across the Pacific from Japan, for instance, evidence from Paisley Caves suggests that Western Stemmed Point-makers were present in central Oregon prior to 14,000 years ago. Numerous crescents and stemmed points found in sites on California's Northern Channel Islands dated as early as 12,000 years ago argue for close technological links with the interior Western Stemmed Point tradition. Such discoveries add a technological component to the wider reevaluation of traditional terrestrial models for the Pleistocene colonization of the Americas. They also contribute to a transformation of the Pacific Coast and the broader Pacific Rim from an area peripheral to Paleoindian studies to one central to current theories and debate about the peopling of the New World. The evidence now suggests that the peopling of the New World was a complex process that involved multiple migrations, probably by both land and sea.

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