

Archaeology: North America

Employing High-Resolution Bathymetric Data to 1 Infer Possible Migration Routes of Pleistocene Populations

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Using high-resolution mapping data, it is feasible to evaluate possible movement patterns of human groups over the landscape, including over terrain now submerged to appreciable depths by rising sea level. Earlier analyses typically made use of modern physiographic features, that is, land above modern sea level, or used shorelines extrapolated from sea-level curves and bathymetric data similar to the ETOPO1 data presented here (e.g., Anderson and Gillam 2000; Gillam et al. 2006; Lambeck et al. 2002). The ETOPO1
4 database provides elevation and bathymetric data resampled to form a 1-minute grid for much of the planet, with cells nominally 1.85 km on a side, and vertical resolution nominally on the order of a meter (effective horizontal resolution is typically 4 km for bathymetry and 2 km for terrain; vertical accuracy is highly variable for shallow water, depths less than 200 m, owing to errors in sea-surface satellite altimetry measurements; Amante and Eakins 2009). In the Arctic, isostatic impacts are also a concern, but this is primarily a problem adjacent to massive glaciers (e.g., the mountainous area of southwestern Alaska and the Canadian coastline, south of our study area) and less impact is expected for the largely unglaciated Beringia landmass and corresponding shoreline. Despite these caveats, when coupled with data detailing ice sheet and periglacial lake locations that may have served as barriers to movement (e.g., Dyke 2004), such landscape reconstructions can offer in-

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sights into possible migration pathways taken by human groups exploring and colonizing new lands (e.g., Anderson and Gillam 2000; Gillam et al. 2007).

The ETOPO1 data format employed was the ASCII Grid (.asc), a raster grid that has an attribute in the table that equates to elevation in meters where the value zero represents the current sea level. The elevation dataset was processed with the ESRI ArcGIS® software to perform all transformations and displays. To produce the paleocoastlines the selected depth from zero is added to the elevation raster set (e.g., Gillam et al. 2006). Therefore a -120-m paleocoastline is derived by adding 120 to the elevation attribute.

These datasets offer insight into patterns of human colonization and movement in many areas. Examining the northern Pacific ocean floor, for example, reveals the existence of chains of archipelagoes along the southern coast of Beringia at the Last Glacial Maximum and for thousands of years afterwards until well into the Holocene (Anderson 2010; Brigham-Grette et al. 2004:37–39; Erlandson et al. 2007, 2008; Fedje et al. 2004; Manley 2002) (Figure 1a). These same maps suggest that the Aleutians would have been far easier to colonize moving westward from the Alaska Peninsula than eastward from Kamchatka, because even with greatly lowered sea level wide open water gaps (>100 km) were still present, particularly in the western part of the chain. Southern Beringia, in contrast, was flanked by dozens of small islands and a highly irregular and indented coastline, an environment encouraging if not mandating both water travel and maritime subsistence (Brigham-Grette et al. 2004; Erlandson et al. 2007, 2008). By the time early human populations passing through these archipelagoes reached and rounded the Alaska Peninsula and headed south along the Pacific Northwest coast, they would likely have been thoroughly adapted to a maritime way of life (e.g., Dixon 1999). Local populations may have existed in such areas in isolation from earlier Asian progenitors, a “standstill” suggested by both genetic and linguistic data (e.g., Nichols 1990, 2002, 2008; Tamm et al. 2007; see also Anderson 2010)

Merging terrestrial and bathymetric elevation data can also suggest how the settlement of other regions may have proceeded during periods of lowered sea level. In the northern Caribbean, for example, the greatly enlarged Bahamian shelf would have facilitated movement from Florida to Cuba and on to Hispaniola, with only comparatively minor open water gaps (Figure 1B). Movement into the northern Caribbean and Cuba from Central America would have also been facilitated by lowered sea levels, via the greatly enlarged Yucatan Peninsula and the peninsula formed to the northeast of Honduras and Nicaragua, the latter making Cuba within fairly easy reach via a series of islands to Jamaica. Large portions of the Caribbean may well have been settled in the late Pleistocene, even though little artifactual evidence for such a possibility currently exists. Likewise, if people were crossing the north Atlantic or south Pacific during the height of the last ice age, scenarios proposed by some scholars (e.g., Bradley and Stanford 2004; Stanford and Bradley 2002; Wyatt 2004), the distances would have been somewhat lessened by the existence of now-submerged islands. Similar approaches have been used to map hominin dispersals in the Old World (Field et al. 2006), another example of the wide array of possible applications.

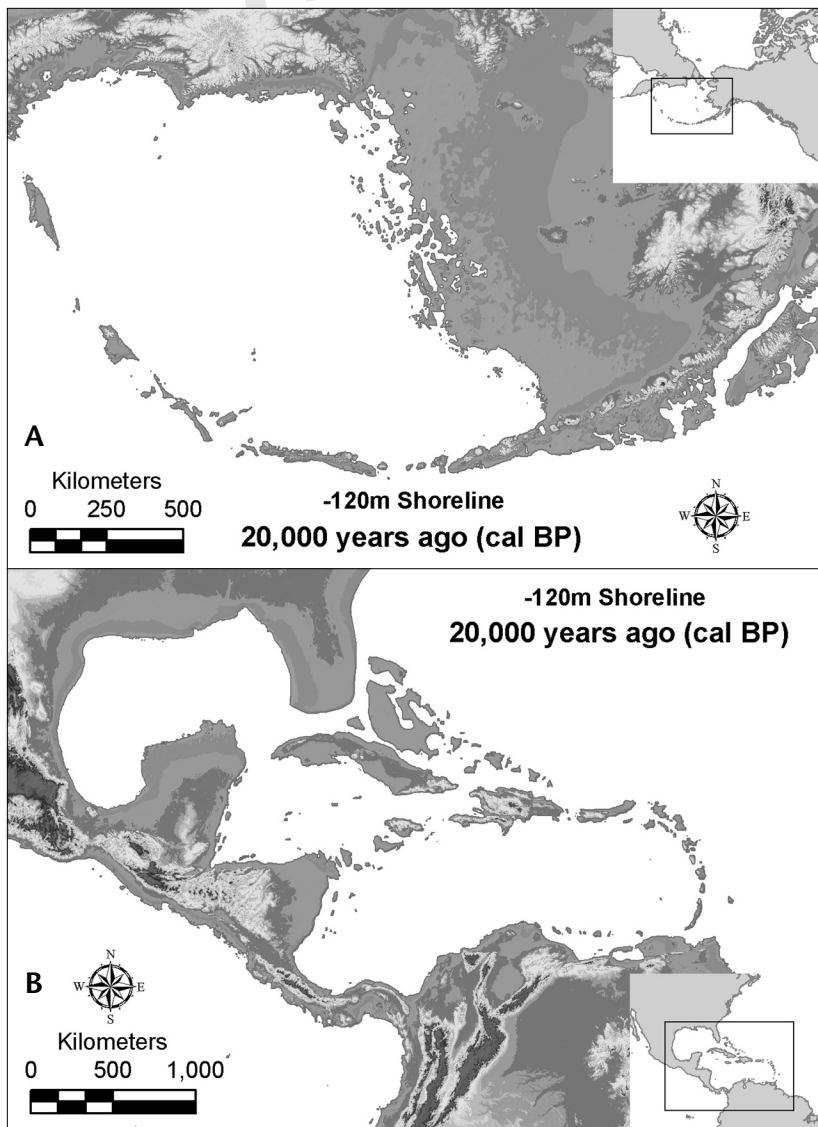


Figure 1. **A**, the island archipelago of southern Beringia and the Aleutians ca. 20,000 CALYBP, based on sea-level data in Manley (2002) and Lambeck et al. (2002), elevation/bathymetric data from Amante and Eakins (2009), and a mapping approach adapted from Manley (2002) and Brigham-Grette et al. (2004:38.); **B**, the Caribbean and Gulf of Mexico ca. 20,000 CALYBP, based on bathymetric and elevation data in Lambeck et al. (2002), and elevation/bathymetric data from Amante and Eakins (2009).

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