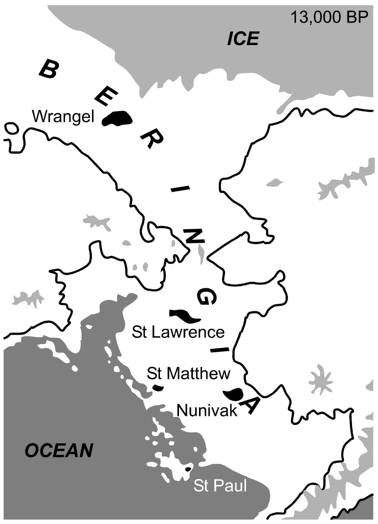
f32 Land bridges < sea level lowering, isthmus rising >



The Pole at last!!! The prize of 3 centuries. ... I cannot bring myself to realize it. It seems all so simple and commonplace.

—Robert Peary quotes his dairy entry for that day in his subsequent memoir *The North Pole*, 1910, but likely it was a lie (*vera* Andreas Schroeder, 1997).[1]

Beringia The Bering strait between North America and Asia has to its south the Bering sea and to its north the Chukchi sea. These shallow (less than 100 m deep) seas are Holocene inundations of a Pleistocene 1,500 km wide land bridge. Erik Hultén to honor Vitus Jonassen Bering coined the name Beringia for that land, which was fully emergent when sealevels were lower by ~130 m during Pleistocene glacial maxima.[2] What was Beringia like? What came to cross it? Not forests apparently. So different are the forests of Siberia (in which white spruce survived the last ice age)[3] and Alaska that evidently no mingling of their stands occurred during the Pleistocene. That botanical determination was made in 1937 by Hultén. His vision of a treeless Beringia has since been corroborated (see below).

In the 1960s, the area of Beringia was extended by general usage to include north-east Siberia and western Alaska. What animals did Beringia support? Alaskan gold diggings yielded bones, at all levels of the Pleistocene, of mammoths, horses, bison and other ungulates. Today, treeless Arctic moss and shrub vegetation on permafrost can support only lemmings, lichen-grazing caribou, and willow-browsing moose. Pollens shed are of grass, sedge, heath, willow, and tundra shrubs. To sustain during Pleistocene glacials populations of grazing animals and their predators, a Beringia of 'mammoth-steppe' was envisaged. But, Beringian lowland Pleistocene peats (cored from now sea-covered bogs) have pollen distributions typical of existing mesic tundra (***Footnote f32.1***) of Arctic Alaska. Beringian upland Pleistocene peats (in exposed bogs) have contrastingly greater amounts of pollen of sage *Artemisia*.[4] That Arctic sage is consistent, according to Paul Colinvaux, with more exposed conditions of these, then, uplands. Also, beetle studies indicate persistent mesic tundra.[5] However, Duane G. Froese finds that where today is found spruce forest and moss (that through summer keep the ground frozen at shallow depth), "fossil arctic ground-squirrel middens and buried vegetation indicate the presence of cryoxerophilous (steppe-tundra) vegetation growing on well-drained [loessal soils] with deep active layers (seasonal thaw depths during cold intervals of the Pleistocene)."[6]

Just south of Alaska, Daryl W. Fedje and Heiner Josenhans in 2000 found off the coast of the Queen Charlotte Islands, a stone tool, dredged from 53 m below sea level. Elsewhere from there, in the drowned world of former river valleys, floodplains, and ancient lakes, are recovered a pine tree stump and other woody debris that carbon-14 date to 12,200 YBP.[7]

Humans who walked to cross Beringia must have done so before 11,000 (calendar) years ago. Thereafter, the last land bridge was no more due to rising sealevels. Thorny questions are: when did humans *first* cross and *how many emigrations* are indicated by artifacts that predate the Clovis diaspora 11,000 years ago in the Americas? Climate amelioration for the area had last begun (from the evidence of beetle studies) 14,000 years ago. In detail, Scott A. Elias reports that insect evidence for the climate then is of summer temperatures substantially warmer than now. The last glacial was at its greatest chill 19,000-26,500 years ago.[8] In the Americas, the oldest known artifacts and other evidences of human occupation are assigned a provisional age of 33,000 years old.[9] ❑

Footnote f32.1 Mesic tundra

The *mesic* (i.e. moderately moist) tundra is all the northland lying poleward of the limits of tree growth where Sun is continuously below the horizon in winter and above it in summer. In most Arctic-lowland areas, the freezing coldness is relieved for at least one month in each year when the mean temperature stays above the freezing point (in the ground below, permafrost is ever, however). Aridity is then relieved briefly by thaw and sometimes even rain (hence mesic tundra—unlike the tundra of Antarctica where it never rains).

Boggy peat soils of the northerly Arctic tundra support sedges and *Eriophorum* ("cotton grass" not a true grass), and areas of mosses including *Sphagnum*.[10] More elevated rocky areas support only lichens.

Across the southerly Arctic tundra, boggy peat tundra vegetation is between islands' slightly elevated sites (often only 15 to 60 cm higher) that support low willows, true grasses, such as *Arctophila* and *Arctagrostis*, and rushes. Also here, on the sands and gravels of riverbanks, grow higher-willows, grasses, and flowering plants of the sunflower and legume families.

Tundra insects, which include (tormenting) mosquitoes and (maddening) blackflies, and spiders are dark in color to absorb sunlight to keep their bodies warm. Other Arctic animals are the Arctic hare, wolf, fox, collared lemming, polar bear (chiefly along coasts), short-tailed weasel, caribou, and musk-ox. The last mammoth (island-pygmy species), due to range shrinkage as Beringia flooded, died in St. Paul Island refugia some 2000 years after the 10,000 YBP extinction of mainland mammoths.[11] Their ancestors could have witnessed the passing by of the ancestors of paleoindians who would develop the technology (Clovis industry) implicated in that.[12]

Panama Decimation extinctions of South American indigenous marsupials that bottomed about half a million years ago began two and a half million years before when North American placentals could enter South America via a tectonically raised land bridge—the Isthmus of Panama—that came into being then. It allowed for the migration of animals that had long evolved separately. The ecological change wrought was profound. In competition with arriving placentals, South American marsupials went into slow a decline of diversity by extinctions. Emigration in the reverse direction also occurred (***Figure f32.1***). An exceptional marsupial that moved to live successfully in North America is the opossum *Didelphis virginiana*. The opossum is a "living fossil" as its features are little different from those of the earliest marsupials.[13]

Steven Stanley

The rise of the Isthmus of Panama resulted in the Atlantic becoming relatively saltier than the Pacific. Dry trade winds, which blow west off the Sahara Desert, evaporate water of the Atlantic ocean. The salt is left and the wind-borne moisture rains out mostly into the Pacific ocean. The isthmus blocked the ocean current that formerly would have flowed west from Africa to Asia. The last two effects could have triggered the Ice Ages and this could have been a major factor in the emergence of humans. **Steven Stanley**, in his book *Children of the Ice Age*, advances this hypothesis.[14] ❑

Figure f32.1 [15]
The landbridge provided by the Isthmus of Panama, completed about 3 Ma, allowed an exchange of terrestrial and freshwater "invaders." Prior to this, South America had been an island continent for 70 million years and on it had evolved specialized mammalian faunas of marsupials, edentates, unique ungulates, and rodents.

In the marine realm, a surge in the diversity of Caribbean molluscs has been ascribed by Jeremy B. C. Jackson in 1993 to upwelling in the Caribbean area of nutrients that, before the isthmus emergence, had escaped at depth through to the Pacific.[16]