GIS-Based Paleotopographic Reconstructions of the Queen Elizabeth Islands at 8500 ^{14}C yr B.P.

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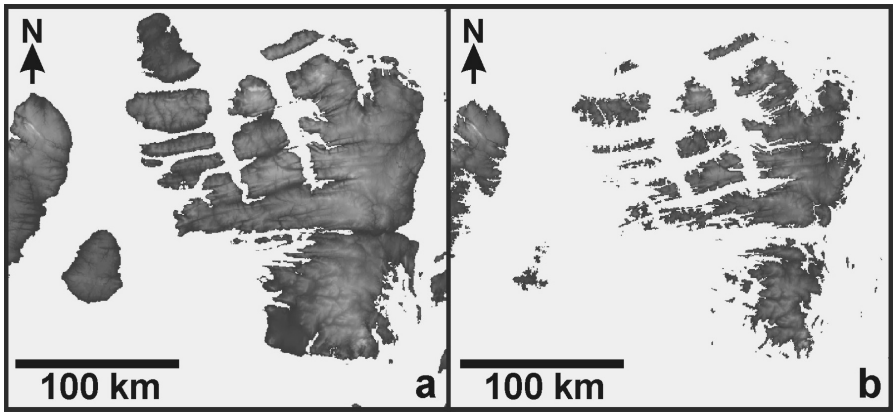
Until ~11,000 ^{14}C yr B.P., the Queen Elizabeth Islands of the Canadian High Arctic were covered by the Innuitian Ice Sheet and by the northernmost extent of the Laurentide Ice Sheet. The loading of the crust by these ice masses resulted in glacio-isostatic subsidence, most notably in the eastern part of the archipelago. Gradual deglaciation of the region was accompanied by differential glacio-isostatic rebound, with areas of greatest rebound corresponding to areas of greatest prior loading and subsidence. Changes in the effects of glacial loading and unloading, combined with changes in the volume and loading effects of regional sea water, progressively transformed the paleogeography of the region during deglaciation. In this research, geographic information system (GIS) software was used to reconstruct the topography (including bathymetry) of the Queen Elizabeth Islands at 8500 ^{14}C yr B.P. Both moderate-resolution (1 arc minute per pixel) and high-resolution (3 arc seconds per pixel) databases of paleotopography were created by subtracting interpolated isobase data (derived from England et al., 2006) from databases of modern topography. These paleotopographic databases were used to generate cartographic visualizations and to quantify aspects of the forms and extents of straits and major islands. The greater elevations and steeper slopes of the peripheries of large eastern islands such as Ellesmere and Devon resulted in surface areas at 8500 ^{14}C yr B.P. that were only ~8% less than at present, despite the concentration of glacial loading here. The lower elevations and slopes of islands in the central part of the archipelago facilitated the substantial and even complete submergence of landmasses below sea level at 8500 ^{14}C yr B.P. For example, Bathurst Island had a surface area that was ~45% less than that of today, and islands including Loughheed, Graham, and Byam Martin were almost entirely submerged below the surface of an open sea at this time. The geometries of local straits were correspondingly expanded relative to modern times, with flow routes in many cases defined by much larger cross-sectional areas than today.



a: Modern extents of Bathurst Island, Byam Martin Island, and easternmost Melville Island. b: Above-water extents of the same landmasses at 8500 ^{14}C yr B.P.