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Paleogeography and paleoenvironments of southwestern Baffin Island (Nunavut, Canada): post-glacial isostatic uplift and isolation of Nettilling Lake from marine influence

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Although signs of recent climate change are more compelling in circumpolar regions, we have limited knowledge of Arctic climates and environments and their past variability. In order to better understand and anticipate the extent and nature of future changes in the Arctic, it is necessary to increase our capacity to model past environmental changes. Instrumental monitoring using high technology in circumpolar regions has been implemented only over recent decades. Hence, to extend the climate record in time, we use a multi-proxy paleolimnological approach to study the sedimentary records preserved in Nettilling Lake, the largest lake in the Canadian Arctic Archipelago. The main objective is to reconstruct the postglacial environmental history of the Nettilling Lake watershed using biological and geochemical proxies.

Nettilling Lake, Baffin Island, has a surface area of 5,541 km2 and a maximum depth of 65 m. Its basin has undergone postglacial marine invasion following the last deglaciation due to isostatic subsidence exerted by the Laurentide Ice Sheet. The glacio-isostatic uplift of the region resulted in the establishment of a freshwater lake between ca. 6000-6500 B.P. as established by radiocarbon dating. Biostratigraphic and geochemical analyses were completed on two sediment cores, one from a lagoonal system in the northwestern part and another from the eastern part of the Lake. The sediment records clearly document the marine-lacustrine transition through paleosalinity shifts inferred from the chemistry of the cores, and the composition of fossil diatom and foraminifer assemblages. Remains of fossil chironomid larvae first appeared in the record after basin isolation and the establishment of freshwater conditions. Precise radiocarbon dating of the isolation contacts helps refine regional glacio-isostatic rebound and the duration and extent of the postglacial marine phase. Post-glacial marine regression and the associated changes in paleosalinity are also reflected in the core sedimentology and geochemistry analyzed using a Multi Sensor Core Logger and a microfluorescence scanner. Shifts in Ca/Ti, Cl, indicating paleosalinity and Si/Ti, indicating paleoproductivity, reflect the end of marine influence and the establishment of the oligohaline conditions. Furthermore, low Mn/Fe ratios indicate strong anoxic conditions in the lower water column during the saline to freshwater transition.