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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

Biljana Narancic (1), Reinhard Pienitz (1), Pierre Francus (2), Nicolas Rolland (1), and Anne-Marie Wagner (1)

(1) Laboratoire de Paléoécologie Aquatique (LPA), Département de Géographie, Centre d'Études Nordiques (CEN). Université Laval, Québec, G1V 0A6, Canada, (2) Institut National de la Recherche, Eau-Terre-Environnement, Québec, G1K 9A9, Canada; GEOTOP Research Center, Montréal, H3C 3P8, Canada

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 polar regions has been implemented only over recent decades (Pienitz et al., 2004). Hence, to extend in time the climate record, we use a multi-proxy paleolimnological approach to study the sedimentary records preserved in Nettilling Lake located on Baffin Island the largest lake in the Canadian Arctic Archipelago.

Nettilling Lake has an area of 5.541 km2 and a maximum depth of 65 m (Oliver, 1964). 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 around 5000 years BP (Jacobs et al., 1997). Nettilling Lake remains a scientific frontier for researchers, mainly due to the inaccessibility of the area and the lack of available data. To date, only one exploratory study by Oliver (1964) has focused on the limnological conditions and bathymetry of the lake, and our research aims at providing deeper insights into the history of paleoenvironmental changes in this remote Arctic region.

Biostratigraphical and geochemical analyses were completed on two sediment cores, one from a lagoonal system in the northwestern part of Nettilling Lake and another from the eastern part of the Lake. The sediment cores from the lagoonal system clearly document the marine-lacustrine transition through shifts in paleosalinity inferred from the composition of fossil diatom assemblages. Fossil chironomid larvae first appeared in the record after basin isolation and the establishment of freshwater conditions. Precise radiometric dating of the isolation contacts helps refine regional glacio-isostatic rebound and the duration and extent of the postglacial Tyrrell Sea marine phase. Post-glacial marine regression and the associated changes in paleosalinity are also reflected in the sediment core sedimentology and geochemistry analysed using a Multi Sensor Core Logger and a microfluorescence scanner.

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