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Long-term monitoring of Nettilling Lake, central Baffin Island, Nunavut

Reinhard Pienitz (Université Laval, Centre for Northern Studies)

Featured story location on map: 6

Lake sediments can provide long-term paleoclimate (past climate) records that can be used to place recent observed climate changes into context and help forecast future conditions. Reinhard Pienitz and his research team are using lake sediment records to reconstruct the climate history of the Foxe Basin region of Nunavut. Such records are limited in this area, which lies in a transitional position between High Arctic areas that are seeing stronger changes in environmental conditions in recent decades and eastern subarctic areas that have experienced more stable conditions.

The research team has completed work on 15 lakes on Southampton Island, the Melville Peninsula, the Foxe Peninsula and Baffin Island since 2004. Their recent focus has been on Nettilling Lake, Baffin Island, which is the largest freshwater ecosystem of the Canadian Arctic Archipelago. They have examined the physical, chemical and biological characteristics of lake sediment cores from various depths to determine the climate history of the study area since the end of the last ice age. The team has also collected water samples to understand and monitor the current state of this huge freshwater ecosystem.

Through this work, Pienitz and his collaborators have developed a new type of proxy (indirect) climate record that uses oxygen isotopes (different forms of oxygen) from microscopic algae fossils (diatoms) in the lake's sediments. The cell structure of diatoms reflects water chemistry when they lived. Consequently, their fossils can provide a record of environmental conditions, as shown through fluctuations in the amount of the oxygen-18 isotope present in the fossils. This novel approach to oxygen isotope records has allowed the team to reconstruct lake conditions (water salinity and temperature) and the air temperature of the study area back to when the lake was connected to the ocean, prior to post-glacial uplift of the land. The diatom oxygen isotope record also complements and corroborates the other proxy records of environmental changes developed from the sediments of Nettilling Lake. These proxy records include a record of past lake conditions indicated by changes in diatom assemblage composition (types and abundances of diatom species).

Recent results of this study confirm and add detail to the documented history of deglaciation and subsequent land uplift of southwestern Baffin Island. These paleoclimate records also show strong correspondence with documented melt rates from nearby Penny Ice Cap. Pienitz plans to develop a larger regional network of study sites to document past climate variability in the Foxe Basin area. This research will allow for comparisons to be made with paleoclimate records from other regions to examine differences and causes of climate variability over time. It will also provide useful information for modelling climate and understanding potential changes to northern freshwater bodies in the future.



Researchers prepare to do sediment and water sampling work on Nettilling Lake, Baffin Island.

“Knowledge of how these fragile ecosystems respond to natural and human pressures will allow us to be better prepared for and adapt to climate change and put us in a better position for well-informed decision-making with respect to sustainable development in the North.”

– Reinhard Pienitz