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Paleoenvironmental reconstructions of Nettilling Lake area (Baffin Island, Nunavut): A multi-proxy analysis.

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The paleoclimate and paleolimnological history of several Arctic regions remains poorly known. This is the case for the area around Nettilling Lake (Baffin Island, Nunavut), the largest lake of the Canadian Arctic Archipelago. To reconstruct the past environmental history of this area, a highly innovative multi-proxy approach combining physical, magnetic, chemical and biological properties preserved in lake sediments was used. One particular goal of this study was to investigate the possible coupling between sedimentation processes observed in the lake and melt rates of nearby Penny Ice Cap.

A 1-m long sediment core was retrieved from a small bay in the northeastern part of Nettilling Lake during the summer of 2010. This sampling area was chosen based on the hypothesis that incoming glacial meltwaters from Penny Ice Cap would leave a strong climate-modulated signal that would be reflected in the sedimentary sequence. The core was analyzed by both non-destructive (X-radiography (X-ray), microfluorescence-X (μ-XRF), magnetic susceptibility) and destructive (Loss On Ignition, grain size, water content, thin sections, diatoms) techniques. Radiometric AMS 14C and 210Pb/137Cs age determinations, as well as paleomagnetic measurements, were used to develop the core chronology, yielding an estimated bottom age of approximately 1365 AD. The sedimentation rate (0.15 cm.yr-1) in Nettilling Lake was found to be high compared to other Arctic lakes, due to inputs of highly turbid meltwaters from Penny Ice Cap with high suspended sediment loads. Significant correlations were found between geochemical profiles of elements linked to detrital inputs (Si, Ti, K, Ca) and melt rates from Penny Ice Cap since the 19th century. This suggests that variations in detrital elements in Nettilling Lake sediments might be used as an indirect indicator of regional climate fluctuations (e.g., summer temperatures) that determine glacier melt rates.