

Holocene deglaciation and environmental history of Washington Land and Warming Land, north-western Greenland

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Sediment sequences from two small lakes on ice-free peninsulas in north-western Greenland, adjacent to the Nares Strait, separating Greenland from Ellesmere Island, form the basis for studies of immigration and persistence patterns of terrestrial plants and animals following the last deglaciation. The sediment records, collected as part of the icebreaker-based Ryder19 expedition in 2019, have been rigorously dated and analysed, combining biostratigraphic and geochemical methods.

A 203-cm long sequence from Ringed Plover Lake, Warming Land (269 m a.s.l., 81°48'N, 53°19'W), spanning the last c. 2300 years, consists of banded to laminated silt and clay (TOC content 1–5%) with bryophyte layers (Wangritthikraikul 2023). Although not reaching back to the local deglaciation, this record provides evidence of distinct fluctuations in the deposition of terrestrial macroscopic plant remains, such as *Salix arctica* and *Dryas integrifolia* as well as *Cenococcum geophilum* fungal spores, which reflect centennial-scale fluctuations in catchment runoff and erosion, mediated by precipitation and snowmelt intensity. Additional insight into these climate-related processes is provided by accompanying changes in the sediment concentrations of aquatic bryophytes, mineral grains coarser than 250 µm, chironomid head capsules, as well as by C/N ratios and key element contents and ratios obtained by X-ray fluorescence (XRF) core scanning. An extended period of generally mild and humid conditions after about 1500 cal. BP was succeeded by a shift to colder and drier climate around 400 cal. BP, likely associated with the Little Ice Age. Subsequently, an anomalous warming and wetting trend across recent decades is captured by some of these parameters.

A 186-cm long sequence from Red-Throated Loon Lake, Washington Land (186 m a.s.l., 80°35'N, 61°59'W), spanning the last c. 7300 years, consists of about 50 cm of clay overlain by silty gyttja (TOC content 8–15%) with organic detritus (Frisendahl 2023). Representing continuous sediment deposition since the local deglaciation, this record shows clear imprints of ice-proximal conditions with high suspension load in the water column until about 5500 cal. BP. Thereafter, aquatic productivity and catchment mineral weathering increased substantially, reaching maximum levels under relatively mild and humid climatic conditions, followed by declining trends after 3000 cal. BP. Together with XRF, TOC and C/N ratio variations, a sparse pollen record demonstrates early dominance and subsequent continuity of *Salix arctica* since the deglaciation, as well as millennial-scale changes in catchment soil and vegetation development. Ostracod remains in the sediments contribute to the environmental reconstruction, and the presence of coprophilous fungal spores (*Sporormiella* sp.) indicates the local presence of muskox at least during the last 3300 years.

These unique sediment records, deposited near the likely postglacial entry point of terrestrial biota to ice-free areas of northern Greenland are now subjected to palaeogenetic analyses, targeting key plant and animal species for a more holistic view of Holocene ecosystem dynamics in Arctic Greenland.

References

- Frisendahl, K., 2023: Holocene environmental history of Washington Land, NW Greenland: a study based on lake sediments. MSc. thesis, Dept of Geology, Lund University, <http://lup.lub.lu.se/student-papers/record/9133002>
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