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Late Holocene glacier and climate reconstruction from proglacial records in Vatnsdalur, northern Iceland.

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The Arctic region is experiencing surface air temperature increase of twice the global average. To better understand Holocene Arctic climate variability, there is the need for continuous, high-resolution palaeoclimate archives. Sediment cores from proglacial lakes can provide such climate archives, and have the potential to record past environmental change in detail.

Vatnsdalur, a valley in northern Iceland, hosts small, climatically sensitive cirque glaciers that became independent from the Iceland Ice Sheet after its retreat following the Last Glacial Maximum (c. 15 ka BP). Importantly, this region is located at the confluence of warm water and air masses from the south and cold polar water and air masses from the north, making it highly sensitive to North Atlantic and Arctic climate change. However, at present the region is highly understudied, lacking any high-resolution climate reconstructions.

To address this, we combine geomorphological mapping with the first high-resolution analysis of proglacial lake sediments, to thoroughly examine northern Iceland Late Holocene environmental change.

Field mapping supplemented by high-resolution drone data was used to characterise catchment geomorphology, including seven Holocene moraines. A sediment core (SKD-P1-18) from proglacial lake Skeiðsvatn, Vatnsdalur, was analysed for sedimentological (dry bulk density, loss-on-ignition, grain size), geophysical (magnetic susceptibility) and geochemical (X-ray fluorescence core scan, 2 mm resolution) parameters.

We identify three main sedimentary facies from these analyses, indicating variations in glacial input and catchment environmental conditions. Radiocarbon dating of lake macrofossils, supplemented by tephrochronology, provides a chronological framework. Catchment point samples, also analysed using the above analytical techniques, were used for sediment fingerprinting to disentangle non-glacial from glacial end-members.

Our results indicate the disappearance and reformation of small, climatically sensitive cirque

glaciers in Vatnsdalur during the Holocene. We interpret the data to show an abrupt return to a glaciated catchment. Our results fill a geographical gap of high-resolution proglacial sediment studies in the Arctic-North Atlantic region.