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The deglacial dynamics of the Laurentide and Cordilleran ice sheets in the Mackenzie Mountains, Northwest Territories, Canada

Benjamin J Stoker¹, Martin Margold¹, Duane G. Froese², and John C. Gosse³

¹Charles University, Faculty of Sciences, Department of Physical Geography and Geoecology, Czechia (ben.stoker18@hotmail.com)

²Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Canada

³Department of Earth Sciences, Dalhousie University, Halifax, Canada

The northwestern sector of the Laurentide Ice Sheet coalesced with the Cordilleran Ice Sheet over the southern Mackenzie Mountains, and with local montane glaciers along the eastern slopes of the Mackenzie Mountains. Numerical modelling studies have identified rapid ice sheet thinning in this region as a major contributor to Meltwater Pulse 1A. Despite advances in remote sensing and numerical dating methods, the configuration and chronology of the northwestern sector of the Laurentide Ice Sheet have not been reconstructed in detail. The last available studies date back to the 1990s, when field surveys and mapping from aerial imagery were used to reconstruct the glacial history in the Mackenzie Mountains. Cross-cutting relations between glacial landforms and a series of ³⁶Cl cosmogenic nuclide dates were used to propose a deglacial model involving a significant readvance of the Laurentide Ice Sheet in the region. However, the chronological evidence supporting the readvance is uncertain because the individual ages are few and poorly clustered. Here we present an updated map of the glacial limits during the local Last Glacial Maximum and the recessional record in the Mackenzie Mountains, based on glacial geomorphological mapping from the ArcticDEM. We provide sixteen new ¹⁰Be dates from four sites that were previously glaciated by the Laurentide Ice Sheet to constrain the deglacial sequence across the region. These dates indicate ice sheet detachment from the eastern Mackenzie Mountains at ~16 ka as summits in the mountain front became ice-free. The Mackenzie Valley at ~ 65 °N became ice-free at ~ 14 – 13 ka, towards the end of the Bølling-Allerød warm period. Combining these dates with existing ¹⁰Be dates, these chronological constraints on the deglaciation of the Laurentide Ice Sheet allow us to reinterpret landform relations in the Mackenzie Mountains in order to reconstruct the ice sheet retreat. Our reconstruction provides updated constraints on the LGM extent, and the timing and pattern of deglaciation in the Mackenzie Mountains. This new understanding is useful to future efforts to quantify past sea-level contributions from the western Laurentide Ice Sheet.