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The deglaciation of the northwestern Laurentide Ice Sheet in the Mackenzie Mountains

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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. Recent 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 has not been reconstructed in detail. The last available studies date back to the 1990s, where field surveys and mapping from aerial imagery were used to reconstruct the Last Glacial Maximum glacier extents in the Mackenzie Mountains. Cross-cutting relationships between glacial landforms and a series of ^{36}Cl cosmogenic nuclide dates were used to propose a deglacial model involving a significant ice readvance 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 Last Glacial Maximum glacial limits and the recessional record in the Mackenzie Mountains, based on glacial geomorphological mapping from the ArcticDEM. Sixteen new ^{10}Be dates from four sites that were previously glaciated by the Laurentide Ice Sheet constrain the deglacial sequence across the region. These dates indicate ice sheet detachment from the eastern Mackenzie Mountains at ~16 ka as summits became ice-free. The Mackenzie Valley at ~ 65 °N became ice free at ~ 13 – 14 ka, towards the end of the Bølling-Allerød warm period. These chronological constraints on the deglaciation of the Laurentide Ice Sheet allow us to reinterpret landform relationships in the Mackenzie Mountains to reconstruct the ice sheet retreat pattern. Our updated model of the LGM extent and timing of deglaciation in the Mackenzie Mountains provides important constraints for quantifying past sea level contributions and numerical modelling studies.