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The configuration, sensitivity and rapid retreat of the Late Weichselian Icelandic ice sheet.

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ABSTRACT

The fragmentary glacial-geological record across the Icelandic continental shelf has hampered reconstruction of the volume, extent and chronology of the Late Weichselian ice sheet particularly in key offshore zones. Marine geophysical data collected over the last two decades reveal that the ice sheet likely attained a continental shelf-break position in all sectors during the Last Glacial Maximum, though its precise timing and configuration remains largely unknown. Within this context, we review the available empirical evidence and use a well-constrained three-dimensional thermomechanical model to investigate the drivers of an extensive Late Weichselian Icelandic ice-sheet, its sensitivity to environmental forcing, and phases of deglaciation. Our reconstruction attains the continental shelf break across all sectors with a total ice volume of 5.96 x 105 km^3 with high precipitation rates being critical to forcing extensive ice sheet flow offshore. Due to its location astride an active mantle plume, a relatively fast and dynamic ice sheet with a low aspect ratio is maintained. Our results reveal that once initial ice-sheet retreat was triggered through climate warming at 21.8 ka BP, marine deglaciation was rapid and accomplished in all sectors within c. 5 ka at a mean rate of 71 Gt of mass loss per year. This rate of ice wastage is comparable to contemporary rates observed for the West Antarctic ice sheet. The ice sheet subsequently stabilised on shallow pinning points across the near shelf for two