



Iceshelf instability and the collapsing NW margin of the Laurentide Ice Sheet: core evidence from Viscount Melville Sound, Arctic Canada

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Recent work in the western Canadian Arctic Archipelago has seen a dramatic re-evaluation of the timing and extent of Late Wisconsinan glaciation by a primarily cold-based Laurentide Ice sheet. This has included the occupation by ice of formerly-considered ice free terrain and the extension of grounded ice from the main channels of the Northwest Passage, westwards onto the Beaufort Sea continental shelf. Nonetheless, while the pattern of ice extent and initial retreat is now well constrained, significant questions remain regarding the main phase of ice retreat southeastwards onto mainland Canada and the stability of the retreating margin in response to ameliorating climate and sea-level change.

Earlier terrestrially-based research along the Victoria, and Melville Island coasts of Viscount Melville Sound have demonstrated the retreat of grounded glacial ice from this >105 000 km² basin by ~13.5 cal ka BP followed by the re-establishment of a floating iceshelf impinging on the coasts of Viscount Melville Sound ~10.9 cal ka BP. Molluscan chronologies suggest the establishment of the iceshelf was extremely rapid, persisting for some 800 years, and subsequently undergoing an equally rapid collapse.

This new and ongoing study investigates a series of Geological Survey of Canada / ArcticNet piston cores from the central part of Viscount Melville Sound, considered to have been beneath the short-lived ice shelf, thus permitting a detailed examination of the potential mechanisms and dynamics of iceshelf formation and collapse. Analyses of ice-rafted debris (IRD), coupled with micropalaeontological and chronostratigraphic investigation; data suggest a rapid ice advance into Viscount Melville Sound consistent with terrestrial interpretations. The presence of “rain-out tills” and IRD indicative of a Victoria Island / M’Clintock Channel origin is considered a result of deposition from a debris-rich tongue of floating glacial ice associated with streaming ice exiting M’Clintock Channel, permitting the on-shore rafting of ice and emplacement of coastal till sequences and iceshelf moraines. The rapid transition from sub-iceshelf sediments to ice proximal to distal sediments is also consistent with terrestrial evidence for the rapid retreat of the Viscount Melville Sound Iceshelf. AMS ¹⁴C-dated benthic foraminifera from above the iceshelf-marine transition provide a minimum age on iceshelf collapse of ~9.0 cal ka BP. Age-depth model projections below the lowermost core date assuming enhanced ice-proximal sedimentation rates permit an approximate iceshelf collapse date similar to that indicated by terrestrial sequences.

This ongoing study contributes towards an improved understanding of the glaciological constraints placed on the streaming of ice from M’Clintock Channel into the Sound and the resulting draw-down and destabilization of the NW sector of the Laurentide Ice Sheet. Furthermore, emerging foraminiferal, diatom, and biogeochemical data provide valuable insights into the deglacial and postglacial history of the western sector of the Northwest Passage.