



Deglacial History and Paleoceanography of the Umanak System, West Greenland

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A record of Greenland Ice Sheet (GIS) and ice-stream history, ice-sheet ocean interactions and paleoclimate from the Last Glacial Maximum to present is preserved in the sediments of the Umanak fjord, shelf trough and trough mouth fan system of central West Greenland. The objective of this study is to document the timing and rate of ice retreat and the role of the West Greenland Current (WGC) in initiating or sustaining ice retreat. During cruise JR175 of the UK ship RRS James Clark Ross in 2009, sediment cores and geophysical data were collected from the Umanak System to document the glacial history of the area.

SWATH bathymetry data show that the GIS extended to the shelf edge via an ice stream in the Umanak System during the Last Glacial Maximum (LGM). Three sediment cores, located on the upper slope (VC46), outer shelf (VC45) and inner shelf (VC42) of the Umanak Trough capture the progressive retreat of the Umanak Ice Stream (UIS) from its greatest extent on the shelf edge to the inner shelf. Evidence used to determine changes in environmental conditions as the core sites transitioned from subglacial to ice-proximal to marine conditions after the LGM include foraminiferal assemblage analyses, lithofacies changes, mineralogy and IRD. The sediment sequence in the cores is comprised of basal diamictons that represent either glacial debris flows or glacial till that transition to stratified and massive pebbly mud to an upper bioturbated unit. Radiocarbon dates on foraminifers and molluscs constrain the timing of these changes.

Preliminary foraminiferal assemblage analyses in context of lithofacies changes demonstrate a change from ice-proximal to ice-distal conditions across the shelf trough. Radiocarbon dates indicate that the UIS had retreated from the shelf edge by 14,880 cal kyr BP (VC45) and ice-distal conditions were established on the mid-shelf by 11,350 cal kyr BP (VC43). By 8480 cal yr BP, the UIS had retreated from the inner shelf. Foraminiferal assemblages with distinct Atlantic Water associations are found in the bioturbated mud unit 18 cm above the glacial debris flow deposit in VC46. This evidence of Atlantic Water carried in the WGC precedes lithological evidence of ice stream retreat from the shelf edge (an influx of coarse IRD beginning 62 cm above the first Atlantic Water assemblage) indicating the presence of the WGC at the shelf edge prior to initial deglaciation. Both the slope and outer shelf were deglaciated and strongly influenced by the WGC at 14,070 cal kyr BP, as evidenced by a correlative Northern Baffin Bay detrital carbonate event dated in two of the cores. The radiocarbon dates provide the minimum age of ice retreat and the foraminiferal assemblages indicate the retreat of the UIS was pre-dated by the presence of the WGC in the Umanak Trough.