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Timing and frequency of glacigenic debris flows on the Bear Island Fan

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Trough Mouth Fans represent one of the most significant deposition systems for sediment on the planet. Trough mouth fans are found in front of bathymetric troughs that extend across continental shelves to the shelf break. It is along these troughs that large volumes of subglacial sediment are transported by fast flowing ice streams. Following initial deposition, glacially derived sediment is then often re-mobilised and re-deposited down the continental slope via gravity flow processes. Glacigenic debris flows are among the most significant of these processes, often occurring on slopes with gradients of <10. These flows commonly occur in lobes with characteristic lengths (30 – 200 km), widths (2 – 10 km) and thicknesses (10 – 50 m). The stacking of these lobes provides a significant proportion of the material making up trough mouth fans. Despite processes of sedimentation and sediment reworking being long established for these systems they are incompletely understood and there has been little work specifically dating individual events. We therefore have little information regarding the frequency of these events. This is especially true on more distal parts of trough mouth fans. Instead work has focussed primarily on upper areas of trough mouth fans in an attempt to precisely date ice retreat from these features.

The Bear Island Trough Mouth Fan is situated in front of the Bear Island Trough in the Barents Sea. The cross shelf trough is about 150 km wide and 500 m deep at its mouth and served as a major drainage pathway for the Barents Sea Ice Sheet. The fan covers an area of 125,000 km2 and extends from the continental shelf edge at water depths of about 500 m to over 3000 m water depth in the Lofoten Basin. Previous studies using GLORIA have shown debris flows radiating out from near the top of the fan, extending to near its base, whilst 3.5 kHz sub-bottom profiler records show these lobes to be staked. Some dates have been produced from hemipelagic material above these events and from within the material interpreted as massive diamicton. This work attempts to broaden our understanding of these flow processes on the Bear Island Fan.

We present data from piston cores recently collected along the northern margin of the Bear Island Fan. Thought to be the location of the most recent debris flow activity, radio-carbon dating of these cores shows the timing of the most recent glacigenic debris flows and frequency of these events. The frequency and timing of these events is then linked to suggested activity of the Barents Sea Ice-Sheet. This provides useful insights for both sediment transport beneath ice streams, the history of deglaciation and possible triggering mechanisms for these events.