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Glacimarine sedimentary processes and depositional environments in Disko Bay, West Greenland

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A 3.5 kHz sub-bottom profiler survey in and around Disko Bay in 2009 penetrated significant thicknesses of unconsolidated sediments. Given low modern sedimentation rates, these thick sediment packages are inferred to be glacimarine deposits delivered during deglaciation from the Last Glacial Maximum (LGM). Sediment thicknesses and volumes in three glaciated areas, Disko Bay, southern Vaigat and Egedesminde Trough, are fully constrained for the first time; however, the largest thicknesses (256 m) and volumes (c. 32 km^3), and the widest variation in acoustic character was observed in Disko Bay adjacent to the mouth of Jakobshavn Isfjord. Here we present acoustic profiles from the study area (Disko Bay, the southern Vaigat, the Egedesminde Dyb trough), interpret the acoustic stratigraphy in terms of deglacial sedimentary processes, and present quantitative information on deglacial sediment volumes and fluxes. For the palaeo-Jakobshavn ice stream, which is known to have stabilised at the fjord-entrance sill, a sediment flux of 1.6-3.6 $\times$ $10^7 m^3$ a^{-1} is estimated. Assuming a flux at the upper end of this range for the Torssukatak fjord system requires the grounded ice margin to be stable for c. 450 years during retreat in order produce the volume of glacimarine sediments that we observe. The high sediment fluxes we calculate suggest that meltwater was readily available at the base of the outlet glaciers during deglaciation, even during periods of quasi-stability. Overall our results highlight similarities in deglacial sedimentary processes across the study area, when the margins of retreating glaciers supplied large volumes of sediment to the marine environment from sediment-laden meltwater plumes and melting icebergs. However, it also highlights the importance of local factors, such as bedrock morphology, on sedimentation patterns.