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Recent glacially influenced sedimentary processes on the East Greenland continental margin and deep basin

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The East Greenland continental margin and basin studied in this work is delimited by the Jan Mayen (SW) and the Greenland Fracture Zone (NE) and covers from the upper slope, at 1200 m water depth to the deep basin at depths of more than 3700 m. Based on a dataset including new and published data (swath bathymetry, backscatter mosaics, very-high resolution TOPAS profiles, the IBCAO bathymetric chart, GLORIA side-scan sonar mosaics and sediment information), this work focuses on the analysis of the recent sedimentary processes along the East Greenland margin and basin. The results are interpreted in relation to studies from adjacent areas and are used to assess previous hypothesis about the extent of the East Greenland Ice Sheet during the Last Glacial Maximum.
The studied area is characterized by a 120-300 km wide continental shelf reaching depths of 300-350 m. It is dissected by N-S to NW-SE-oriented glacial troughs, more evident towards the south. The continental slope is 20-80 km wide and extends to depths of 2500-3000. It connects, at the northern part of the study area, with a gentle 60 km wide continental rise reaching depths of 3500 m. On the slope, erosion and transport sedimentary processes predominate. On the southern area, off the mouth of the Kong Oscar Fjord glacial trough, erosion and transport occur in the form of turbidite systems that develop basinwards to a network of channel-levee systems with sediment wave fields on the levees. Locally on the southern area but more generally on the northern area, erosion and transport occur in the form of slides and debris flows, developing slide scars on the slope and vertically stacked depositional lobes on the continental rise. This fact may be explained by the deposition of a large amount of unconsolidated sediment eroded from the wide continental shelf during glacial times, and the subsequent occurrence of unstability processes, probably triggered by the relatively high seismicity due to the proximity of the Greenland Fracture Zone. The relatively gentle gradient of the continental rise on the northern area would favour the deposition of sedimentary lobes. In contrast, the lower amount of glacially supplied sediment from the narrower southern continental shelf would be channelized in turbidite systems.
The basin extends to depths of 3700 m and is characterized by distal turbidite channel systems and associated depositional lobes, and NE-SW-oriented, structurally controlled volcanic edifices. The most outstanding one is the Vesteris Seamount, with a relief of 2850 m. The major recent turbidite depocenters are identified at depths >3500 m in the basin. Depocenters are controlled by the presence of volcanic edifices, and occur at a more distal position regarding older debris flow deposits previously identified in airgun seismic profiles. Thys may suggest a more northern position for the sediment source area of recent deposits, probably related to higher seismicity.
This scenario agrees with the hypothesis of an East Greenland Ice Sheet reaching the outer continental shelf and the fast flow of ice streams during the Last Glacial Maximum. The glacigenic sediment supplied to the slope would undergo different mass wasting processes depending on the physiographic setting, sediment supply and seismogenic activity. Debris flows occur preferentially on the northern areas, where the continental shelf is wider, the continental rise is gentler and the seismicity rate is higher, while turbidity currents dominate on the southern areas. Fast-flowing ice streams have been documented at the northern Fram Strait area, further supporting this interpretation.