Geophysical Research Abstracts
Vol. 18, EGU2016-13311-1, 2016
EGU General Assembly 2016

Evolution of a trough-fan system: Scoresby Sund fjord, central-east Greenland

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The continental shelf along the east margin of Greenland is shaped by several, glacially carved transverse troughs that constitute the oceanward extension of the major fjords. Scoresby Sund is the most prominent fjord of central-east Greenland and separates Liverpool Land, to the north, from Blosseville Kyst to the south. Offshore of Scoresby Sund a large glacial trough mouth fan (TMF) has been built through successive phases of glacial advances. Morpho-structural and seismo-stratigraphic analyses of the Scoresby Sund TMF have been done using all Multichannel Seismic (MCS) profiles available in the area. The ODP site 987 of the leg 162 is located in the abyssal plain offshore of Scoresby Sund and was used for age estimations.

The width of the continental shelf in the study area ranges from a 65 km narrow part along the Blosseville Kyst to 120 km off Scoresby Sund. The average water depth is shallower than 300 m, deepening to 600 m along Scoresby Sund glacial trough. Oceanwards a steep slope, seafloor falls into the 2250 m deep abyssal plain of the south Greenland Sea. The sedimentary cover displays maximum thickness along the middle continental shelf (2.8 s TWTT on average). Seven major stratigraphic discontinuities could be identified within the sedimentary record. They restrict eight major seismic units, named from 8 to 1, in upward stratigraphic order. The distribution and seismic facies of these units reveal the evolutionary sequence of the study area from early Cenozoic to Present. The lowest unit, Unit 8, is post-basalt to middle-late Miocene age and represents a pre-glacial depositional stage when tectonic events controlled the sedimentation. Deposition of Unit 7 occurred by late Miocene, revealing glacial-related deposits and ice-stream along Scoresby Sund fjord. Unit 6 was formed during early Pliocene by glacial advance over the continental shelf leading to strong erosive surfaces in the shelf area and Mass Transport Deposits (MTDs) in the northern abyssal plain. The thin Unit 5, formed by late Pliocene, is related to retreat of the ice in the study area despite of the regional glaciated context. Unit 4, likely deposited during late Pliocene to Pleistocene, displays progradations along the shelf edge and MTD's in the abyssal plain which indicate a return to an active Scoresby Sund ice-stream and intense glaciation of the hinterland. Units 3 and 2 were formed during early Pleistocene and reveal a continued glacial advance over the continental shelf, but little activity of the Scoresby Sund ice-stream. From late Pleistocene to Present Unit 1 indicates major sedimentary input from the Scoresby Sund ice-stream and the presence of an important ice sheet which occasionally reaches the continental shelf edge. The presence of contourite-like deposits intercalating with the MTDs in the three upper units may suggest a major interaction between the along- and down-slope processes during the Quaternary period.