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Sedimentary response to ice stream advance and retreat on the Storfjorden Trough Mouth Fan (NW Barents Sea), during Late Weichselian

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This seafloor morphological study of the Storfjorden Trough Mouth Fan (TMF) (offshore Svalbard, NW Barents Sea) is based on new multibeam bathymetry and chirp sub-bottom profiler data acquired in 2007 during the BIO Hespérides cruise SVAIS that provides an unprecedented image of the sedimentary processes that accompanied the last advance and retreat of the Storfjorden Ice Stream. Compared to other glacial-marine sedimentary systems (such as the adjacent Bjørnøyrenna TMF), the Storfjorden TMF system is small and associated to a relatively small terrestrial ice sheet, approximately 40.000 km2, with local provenance from Svalbard and the Spitsbergen Bank. Due to this short distance from the ice source to the calving areas and the resulting short residence time of ice in the ice sheet, therefore the glacio -marine system of the Storfjorden reacts rapidly to climatic changes.
The Storfjorden continental slope is characterized by three depositional lobes, produced by focused sedimentation at the terminus of ice streams that have changed their location with time. The superficial morphology features associated to the two northernmost lobes are straight gullies in the upper slope, and debris lobes starting from the midslope onwards. The seafloor expression of the southernmost lobe, adjacent to the much smaller Kveithola TMF, demonstrate almost no gully incisions and is dominated by the widespread occurrence of small-scale submarine landslides. The subbottom profiles illustrate that sediment failures occurred throughout the Late Neogene evolution of the southern Storfjorden and Kveithola margin, including large-scale mass transport deposits of up to 200 m thick. Seismic facies of the Neogene sequence shows an alternation of glacigenic debris flows and laminated sediment drape inferred to be plumites. Gullies incising glacigenic debris flows at the surface and subsurface and are filled by an interglacial drape sequence. The gullies are formed during each deglaciation phase, most likely by the erosive action of short-lived high density currents originated by sediment-loaded subglacial melt water discharge.At the outer continental shelf of the southernmost lobe a striking fresh linear straight, which has a width of 1, 5 kilometres and cut the morainal deposits. These features are interpreted as mega-scale glacial lineations, which are tentatively attributed to mega-iceberg scours. These lineations are witness the latest advances of the Storfjorden ice streams before the final retreat which was located at the southernmost lobe. One of the main pre-conditioning factors to slope instability on the southern part of the Storfjorden TMF is identified as high sedimentation rate plumites deposited on the middle-upper continental slope by glacial melt water plumes.
This study is part of the SVAIS project (funded by the Spanish IPY), that has a main objective to improve the understanding and the relationship between sedimentation and ice sheet dynamics under natural climatic changes.