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Submarine landslides in Spitsbergen fjords

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Fjords are areas that can be exposed to repeated submarine mass wasting, and more than 50% of the depositional sequences can be reworked occasionally. The largest and most frequent slope failures occur typically in relation to the advance and retreat of grounded ice. However, also areas not directly affected by ice can be exposed to slope failure. We provide an overview of mass-transport deposits (MTDs) from the Isfjorden fjord system, the largest fjord system on Spitsbergen. We discuss pre-conditioning factors, trigger mechanisms and the potential of MTDs as indicators for the activity of tidewater and terrestrial glaciers.

Slides, slumps, debris-flow deposits and turbidites have been observed. We distinguish three 'types' of MTDs: 1) 'Glacigenic MTDs', including muddy debris-flow lobes, as well as thin sandy MTDs deposited in front of or beneath glaciers; 2) 'Fluvial MTDs', including sandy turbidites and other MTDs originating from slope failures beyond river mouths; 3) 'Other MTDs', i.e. deposits related to failures on slopes that are neither supplied with sediments from glaciers nor from rivers. Such deposits include sediment lobes (debris flows or slumps) and slides.

The available data indicate that mass wasting in the Isfjorden area commenced shortly after the deglaciation of the mouth of the trunk fjord around 14,100 cal. years BP. The most frequent pre-conditioning factors and trigger mechanisms are probably high sediment supply and earthquakes related to isostatic adjustments. However, marked changes in the slope gradient (related to bedrock or moraine ridges) also affect the stability of the fronts of tidewater glaciers and the positions of grounding lines, thus influencing the locations of sediment sources and, in consequence, the distribution of glacigenic MTDs. In addition to providing information about the dynamics of marine-terminating glaciers, submarine MTDs occasionally also provide information about the dynamics of terrestrial glaciers during the Holocene.