

Modern large submarine slides on continental margins: a case study on the Antarctic Peninsula margin, the Gebra Slide

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The high-tech evolution of the last few decades made it possible to push economic activity to the deeper offshore marine domain – with the development of sea harbours, platforms in the open sea, offshore petroleum industry, etc. The construction of bottom-mounted engineering structures, pipelines and communication cables was carried out with the help of a whole battery of sea floor survey methods: navigation technology, echo-sounding, side-scan sonar, seismic profiling and coring. In this way geologists and engineers learned about the very dynamic geologic processes acting on continental slopes and their morphologic expression on the seafloor. In the mean time, they began to appreciate that submarine slope instability is a widespread phenomenon in a variety of offshore environments (from shallow water to the deep ocean floors) and variable dimensions (up to $2 \cdot 10^4$ km³ of demobilized material). In the presented work we want to focus on large scale instability events, which form an important element in the redistribution of marine sediments from the continent towards the deeper basin and in the constitution of continental slope topography. Since the Late-Quaternary significant sections of the world's continental margins have been affected by these giants slides/slumps.

Analysis of the conditions that cause submarine slope instability is a difficult task; the effective failure often depends on a complex interaction of variables. The basic conditions for any slope failure exist when stresses exerted on the sediment are sufficient to exceed the sediment strength. This can be the result of stress increases, strength reduction, or a combination of the two. Various trigger mechanisms have been proposed to initiate sliding. (1) Earthquakes or (2) surface water waves may be sufficient for failure where the sediment strengths are low. (3) Rapid sedimentation in front of e.g. river mouths clearly favour the build-up of excess pore pressures and subsequent sediment failure, particularly in fine-grained sediment deposits. (4) Seepage of shallow gas has the same effect. Other mechanisms are dealing with an oversteepened margin in offshore delta areas and canyon heads (5) or erosion at the toe of the slope (6).

High-latitude continental margins, which have been influenced by an ice sheet during the last glacial maximum seem to be particularly prone to instabilities – for example the east Canadian continental slope and the Norwegian-Svalbard Sea margin. The Storegga Slide along the Norwegian margin blanks the seafloor over an area of 112.500 km² and has a total volume of about 5600 km³. Here, we present the first reported Late-Quaternary slide on the glacial margins of Antarctica: the Gebra Slide. Multibeam bathymetric EM12/EM1000 data reveal the slide scarps in the present day seafloor over a length of 30 km, ranging from 1500 m to 2000 m of water depth on the lower slope of the Antarctic Peninsula Slope. The slide scarp area is about 230 km². Based on seismic airgun profiling an associated mobilized sediment deposit (a debris flow) could be mapped in the deeper basin over an area of 315 km² and with a volume of 20 km³. Interpretation of the seismic stratigraphy puts the age of sliding near 14.000 B.P. – around the end of the last glacial maximum. Triggering of the slide was probably favoured by the combined effect of earthquake activity and an increased sediment influx in front of a glacial trough.