Dynamic and Timing of the Yermak/Hinlopen Slide, Arctic Ocean

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Abstract
Based on integrated interpretation of acoustic (PARASOUND), detailed bathymetric and seismic data of the shelf north of Spitsbergen, the published extend of the submarine Yermak Slide (Charvis et al., 1999) has been refined. Key profiles across the margins of the slide have been sampled for sedimentological characterization and dating of the submarine slide. ARS radioactivity dating of sediments in the Northern Hemisphere, also achieved by selected key cores, allowed a detailed characterization of the age of the Yermak Slide. The data gives evidence of one large scale failure event at the termination of the Yermak Slide shelf during MIS 5.3. The first event was followed by repeated minor events. The submarine megabase developed into a submarine deltaic complex with tens of megabase reaching extensions of up to 9 km and a relief of more than 300 m above the surrounding seabed. The slide’s debris spread in a semi-enclosed Sophie Basin and finally spread out into Nansen Basin. First calculations on the slide’s area of more than 10,000 km² and its volume of app. 1,000,000 km³ puts the Yermak Slide among the largest exposed submarine slides worldwide.

The synthesis of already existing AWI data (bathymetry, PARASOUND, seismic) revealed a comprehensive base and has been the basis for expeditions ARK-XX/3 (2004-06) and ARK-XX/4 (2005-06). In this paper, the “Polarstern” cruise, RV “Polarstern” (2004-06), described in the target area north of Spitsbergen. During ARK-XX/3 additional detailed bathymetric and shallow seismic surveys (PARASOUND) data have been obtained in key profiles as well as 36 sediment cores – 18 priority cores recovered on key basins and key transects of the Yermak Slide area. Core logging as well as core sampling was performed, and core imaging was directly performed within a recovery survey of RV “Polarstern” in cooperation with selected corings. Dating of microfossils from key cores with highest priority has been accomplished. Ongoing sedimentological investigation include stable isotope samples of neogloboquadrins, pachydermis and XRF scanning of selected cores.

Results
The slide extent of the Yermak Slide has been revised. It extends further west within Sophie Basin than what has previously been reported by Charvis et al. (1999). The Yermak Slide developed out into Nansen Basin between Polarstern and the adjacent shelf south of Nordaustlandet. The overall extent is not known yet since extensive information of its distal part does not exist. Thus the total area affected by the slide might extend 10,000 km². The slide developed a consistent margin face extending within the Sophie Basin. The margin face has been successfully cored through resulting in tepeeagic disconformities. The slide related turbidite sequence. Application of the joint factor has been designed to ensure the recovery of enough detailed microfacies. A large field of joint blocks characterize the inner slide debris within Sophie Basin. Individual blocks reach extensions of more than 4 km while standing up to 300 m above the surrounding seabed, surrounding debris. The integrated interpretation of geophysical and core data allows a preliminary, large slide summary: The slide consists of one major event dated back into MIS 3 repeatedly followed by minor events visible as debris flows in hypsometric lines on the main debris body. The sediment evolution of the first main event was controlled through several stages. As a consequence, compressional and extensional features are present in the sediments of the Sophie Basin. The sedimentological characterization of the submarine landslide includes development of debris flows, turbidity and debris avalanches with a number of mega blocks reaching extensions of more than 4 km and a relief of more than 300 m. The timing around 30 ky BP coincides with the transition of the Kipps Stadial. Intersedimentation and circulation of large blocks (Margulinski et al., 1998) and the build-up phase of the Svalbard-Barents Sea-Loe-Dietrich. The slide occurred during culminating phase and a period of presumably increasing glacio-tectonic activity, decay and internal physical appearance point to a technically induced partial shelf collapse.

Acknowledgements

References

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