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3D Seismic Imaging of Submarine Slide Development on the Western Svalbard Margin

M. Vanneste (1), C. Berndt (2), J. Mienert (1)

(1) Department of Geology, University of Tromsø, Dramsveien 201, N-9037 Tromsø, Norway (maarten.vanneste@ig.uit.no),(2) Challenger Division for Seafloor Processes, Southampton Oceanography Centre, Empress Dock, Southampton, SO14 3ZH, UK (cbe@soc.soton.ac.uk)

Within the EUROMARGINS project "Slope stability on Europe's passive continental margins" we acquired high-resolution EM300 bathymetry as well as high-resolution 3D seismic data west of Prince Karl's Foreland (W-Svalbard, R/V Jan Mayen cruise July 2004). The swath bathymetry covers about 1500 km2 and images the shelf and upper slope of this margin, which is characterised by the presence of a glacial fan that developed at the mouth of the Kongsfjord cross-shelf trough during ice stream advances. The trough mouth fan shows evidence of mass wasting processes of different scales and moraine ridges near the shelf break. Based on multibeam seabed images, we selected the shelf-slope transition from 150 to 470 m water depth south of the Kongsfjord cross-shelf trough as a specific target area for the deployment of a new high-resolution 3D seismic acquisition system. The seismic data cube is approximately 1.25 km x 16 km. The multibeam data show four distinct arcuate escarpments with variable height and dip suggesting structural deformation. The three deepest escarpments occur in water depths between 320 and 420 m (SW of the survey area) and have slope angles ranging from 12 to 25 degrees. The lowermost escarpment is several tens of meters high. The area between the two lowermost escarpments is characterised by elongated depressions, separated by ridges, but oblique to the escarpments. These structures are typically 1 km long, up to 100 m wide, and about 10 m deep, and could be due to erosion underneath the ice sheet at peak glacial times. The central part of the study area shows several lineations and smaller-scale morphological features. From the 3D seismic data, we infer that the upper sediment unit, which is characterised by low-reflectivity chaotic reflections, possibly represents glacigenic sediments. The underlying reflections are subparallel, discontinuous, and have vari-

able amplitude. The lowermost escarpment forms the landward boundary of a trough, filled in with undisturbed and stratified sediments, and hence, it probably represents an area of recent preferential deposition. The 3D data set illustrates that the escarpments connect to listric normal faults. These seem to detach on the most landward fault, which gently dips underneath the lowermost escarpment. In the distal part this underlying fault terminates in several compressional toe-thrusts. This setting suggests gravitational downslope mobilization, accommodated by slight rotation. A second set of faults lies in the deeper part of the sub-surface ($>$ 100 meter below seafloor), of which some connect to the shallow normal faults described above. This implies that the faults have been recently active, so they should be taken into account for structural restoration of the shallow faulting.