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The stability and morphology of the south Storegga Slide headwall influenced by rapidly deposited laminated plume sediments of late Late Weichselian age

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Recent studies, discussing the failure mechanism and the development of the Storegga Slide, agree on that the slide was most likely triggered by a strong earthquake in a an area ca. 150-200 km downslope from the present headwall and it developed as a retrogressive slide 8200 cal years BP (Haflidason et al. 2004; Bryn et al. 2005). The break-up of the sediments continued upslope until the soil strength became strong enough to slow down the mobility of the slide blocks and to stop the slide process where the headwall met consolidated glacial deposits close to the shelf edge. The consolidation of the sediments along the 300 km long Storegga Slide headwall is found to be associated with the advance of the Scandinavian ice sheet to the shelf edge during the last glacial maximum (Bryn et al. 2005). Recent studies, based on high resolution profiling (TOPAS), multibeam mapping and gravity cores, have however revealed that at least along the southern part of the Storegga Slide headwall area (50-100 km) consist the headwall sediments of 20-40 m thick units of laminated plume deposits. The laminations are interpreted to be marine varves likely representing a summer winter cycle. Fall-out from sediment plumes containing meltwater and suspended mud is considered to be the dominant sedimentation process, and resulted in the formation of thick laminated deposits dated to approximately 19 cal ka, i.e. from the first stages of the retreating glacier period. The stability, consistency and thickness of the laminae suggest the source of the meltwater to be the Norwegian Channel Ice Stream. The shear strength values of these units varies uniformly between 15-20 kPa for the clay layers with spikes up to over 150 kPa for the sandy layers. The typical value of shear strength for the sand is around 30-40 kPa. Both the clay and sandy layers exhibit approximate uniformity with respect to shear strength. The shear strength values show that these

laminated sediments have not been over-consolidated by overridden glacier, but that the high shear strength values can be explained by the grain size distribution and the physical properties of the sediments. The stability of these sediments is further confirmed by the downslope extent of sediments blocks (up to 25-30 m) with preserved internal layering from this southern part of the Storegga Slide headwall area. The observation that high-shear strength normally consolidated sediments resisted erosion from the developing headwall complements the general picture of a headwall which was controlled by glacially overridden and overconsolidated sediments.

References

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