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Outer shelf cracking influencing slope stability and gas blowouts on the Norwegian margin

J. Mienert (1), C.-P. Garcia (1), H. Haflidason (2), M. Vanneste (1)

(1) Department of Geology, University of Tromsø, Dramsveien 201, N-9037 Tromsø, Norway (juergen.mienert@ig.uit.no), (2) Department of Earth Science University of Bergen Allégt. 41 N-5007 Bergen, Norway

Outer shelf cracks and elongated gas blow out features have been first discovered along a 40 km long section of the U.S. Atlantic margin. Her, individual cracks are several km long, 1km wide and up to 50 m deep (Driscoll et al., 2000, Hill et al., 2004). The cracks and depressions seem to be caused by "gas blow outs" related to the release of shallow trapped gas. The precise age of the blowouts and the origin of the gas remains unknown, but post-LGM formation of the blowout features suggest that ocean warming triggered methane hydrate dissociation processes.

The fact, that the gas hydrate outcrop zones of the largest gas hydrate provinces in Europe are on the Norwegian-Barents-Svalbard (NBS) margin makes the U.S. Atlantic margin – Norwegian Atlantic margin reaction of potential gas hydrates fields to post-Last Glacial Maximum (LGM) climate conditions particularly important for studies of submarine slope failures, i.e. geohazards. The NBS margin is not only an important gas hydrate province but also an area where numerous seeps are documented, and we thus know that there is gas migration in the sediments. In particular the area, where the theoretical outcrop zone of the base of the gas hydrate stability zone (BGHS) and the geophysical evidence as a bottom simulating reflector (BSR) lies, we observe outer shelf cracking, gas blow outs, shallow faulting and fluid escape features such as pockmarks in sediments.

Our presentation will draw attention (1) to a system of cracks associated with high pockmark density "gas blowout" features along the northern extension of the giant and retrogressive Storegga slide on the Mid-Norwegian Margin and (2) to a system of potential large blowout features and shallow faults influencing slope failures on the W-

Svalbard margin. On the Mid-Norwegian margin a 50 km long and up to 3 km wide zone of approx. 10 m deep depressions occur. They line up with the northern edge of the Storegga headwall elongating in N-S direction. Within the uncertainty of the BGHS modelling the approx. 50 ms TWT cracking zone corresponds well to the belt of the BGHS outcrops, where they intersect the upper continental slope. Radiocarbon age dating of the cracking reveals the same age on the main crack as the Storegga Slide event, but due to the ^{14}C dating uncertainties it remains unknown whether the cracking predates, occurs at the same time, or postdates the Holocene giant submarine sliding event. The cracks are associated with fluid escape indicated by pockmarks typically 50-300 m in diameter and 1-5 m deep. On the W-Svalbard margin outer shelf post-LGM faulting and large depressions occur. The depressions have a diameter of 6 -10 km and a depth of up to 100 m but also smaller depressions ($<$20m) exist. The presented post-LGM formation of cracks, faults and gas blow out features along U.S. and Norwegian Atlantic margin outer shelf areas may be the result of a time-dependent response of ocean clathrate reservoirs to climate change and therefore a “climate induced geohazard”.