

Wiggled surface around the top of gas hydrate stability zone in the northeastern Sakhalin Slope, Okhotsk Sea: Is this present-day example for slope failure initiation associated with gas hydrate dissociation?

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Abstract

One of important geological process related to the gas hydrate in the continental margins is the slope failure induced from increase of slope instability due to gas hydrate dissociation. The continental margins has experiences long-term global warming up to now since the Last Glacial Maximum and accordingly the gas hydrate stability zone (GHSZ) in there has shrunk. However, very few candidate sites for slope failure associated with gas hydrate dissociation have been found on the present-day ocean floor. In the northeastern Sakhalin Slope (Okhotsk Sea) numerous gas hydrate-related manifestations on and below the seafloor as well as in the water column have been reported. The bottom of the GHSZ estimated with 35 mK/m in geothermal gradient is consistent with the observed bottom-simulating reflector (BSR) depths on continental slope. From several sparker seismic profiles across the continental slope we found that the BSR depth shoals toward the shore and finally intersects the seafloor nearly at the top of the GHSZ, and also that wiggled surface only occurs in the limited interval around the top of the GHSZ. We speculate the wiggled surface stems from deformation related with gas hydrate dissociation at the top of gas hydrate stability zone. This is because internal sedimentary features are not consistent with those of well-reported sedimentary wave, and sedimentary strength of the sediment core retrieved from the shallower depth than the top of the GSHZ is significantly higher than that from the deeper. At this stage limitation in observation, i.e., low resolution of the sparker seismic profile and small number of sedimentary strength measurements, cannot lead us to the firm conclusion, however, further surveys unravelling characteristics of such wiggled surface may provide a good chance to understand the nature of ongoing slope failure process associated with shrink of the gas hydrate stability zone.

Keywords: gas hydrate dissociation, sediment strength, slope failure, Northeastern Sakhalin Slope, Okhotsk Sea