Effect of cohesion between sedimentary layers on water film formation in submarine landslides

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Over the past decades, submarine landslides have been reported in various sea areas. Submarine landslides can be larger in scale than landslides on land. Physical measurements of submarine landslides at the seafloor are not easy to conduct, largely because of the relevant scales and locations. This makes it difficult to understand the mechanism of seafloor destabilization. A possible triggering mechanism to destabilize the submarine sediments is the elevated pore-fluid pressure which is formed at sediment layer interfaces and can reduce their shear strength. Kokusho et al. (2000) proposed a water film effect and its mechanism on lateral flow with less frictional resistance to explain large-scale submarine landslides. Elger et al. (2018) discuss the relationship between submarine landslides due to the elevated pore pressure and gas hydrate system. Their study showed that the reduced permeability due to gas hydrate increases pore pressure, and it transfers to the shallower layer interface through the pipe structure. In both studies, elevated-pore pressure is formed at sedimentary interface where there is a permeability contrast. However, although the actual submarine ground may have been consolidated by compaction and diagenesis, limited studies have been conducted to investigate the effect of the degree of consolidation at the sediment layer interface on the formation of water films.

In this study, we conducted a series of experimental tests to observe the effect of a cohesion between layers on water film formation. Portland cement was used to change the cohesion of the sediment interface. We observed a clear relationship between the amount of Portland cement and pore pressure at which the water film was formed. This indicates that the degree of solidification (consolidation/ diagenesis) of sedimentary layers may have a significant effect on the occurrence of submarine landslides.

[Reference]
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