Analogue Experiments of Submarine Slides at Accerationary Prism

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Submarine slides cut off submarine cables and damage platforms for digging oil and gas. Furthermore, submarine slides involving methane hydrate bearing sediments release enormous quantities of methane to the ocean and atmosphere. In addition, submarine slides above the buried hydrate bearing sediments also enhance gas emissions from the seafloor by decreasing the confining pressure. Therefore we need to study submarine slide mechanisms for disaster prevention, resource development, and earth environment. The triggers of slides are thought to be heavy raining and earthquake in addition to geologic factors and topographic factors. Geologic factors are rock properties and faults, and topographic factors are slope shape and angle. However, there is no influence of raining for the submarine slides. Therefore, submarine slides seem to depend only on geologic and topographic factors. Here we try to reveal mechanisms of submarine slides due to tectonic process forming an accretionary prism via analogue model experiments.

Using analogue model experiment, we can observe the forming process in a laboratory and clarify some major factors which influence to the process. In this study, we simulated a slope slides due to thrust displacements. We piled dry sands as sedimentary layers, and then simulated a slope by compressing and lifting the layers. Also, we recorded step by step images using several digital cameras in order to analyze the particle movement via particle image velocimetry (PIV). We could estimate velocity and shear strain of each point by tracing mass of particles between each image.

A slope was formed by hanging wall lifting due to thrust displacement. The slope was composed of two parts; the lower slope was surface of sliding sediments, whereas the upper slope was surface of dragged part of the layers on the hanging wall. Although slides occurred on the whole slope, mechanisms of the lower slope are different from those of the upper. On the lower slope, sliding sediments were parts of shear deformation by folding movement. Therefore the slides on the lower slope seem to be occurred by the shear deformation. On the other hand, large slides periodically occurred on the upper slope, and the slides depended on the slope dip. The slides on the upper slope periodically occurred when the dip was beyond specific angle. These observations demonstrate that key factors in slope slide are shear deformation within accretionary prism and the dip of slope. Furthermore, we also focused on the movement and deformation of slope slide sediments.