

Slumping and dewatering structures in continental slope: Fluid migration in high methane flux area

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It is very important issue in submarine hydraulics and drilling engineering to understand the fluid migration under the ground. In the three-dimensional seismic data from Sanriku Basin off Shimokita Peninsula (METI fundamental seismic survey 2007 "Sanriku-oki 3D"), typical deformations by slumping and its related dewatering structures were widely observed. This study aims to analyze the distribution and morphology of these structures and to extend the knowledge with respect to submarine mass movements, fluid migration below the seafloor and the formation of pressure compartment.

The slumpings in the survey area are mostly considered to be layer parallel slip and are generally categorized into imbrication type and chaotic type. The dewatering structures were observed as widespread parallel dike type and local pipy type. The imbrication type slump sediments indicate repeated duplex structure which is formed by basal layers of the displaced mass cut at equal intervals. The dewatering structure of the parallel dike type generally intrudes into overlying imbrication type slump sediments from the bottom of the slump body where the dikes uprise at the ramps of the imbrication fault blocks and cut the inclined blocks vertically. For that reason, the parallel dikes strike perpendicular to the slip direction of the slumping. The fact that the parallel dikes strike varying with the slumping direction indicates the direction of the parallel dike type dewatering is not controlled by the tectonic stress field in this area. The appearance of the parallel dike type dewatering structure is very like the parallel dewatering structure in Izaki, Nichinan Group in Kyushu where there are various kinds of dewatering structures. The parallel dewatering structure in Izaki also indicates direction perpendicular to the paleo-current in the formation. The both parallel dike dewatering structures are in quite different scale, however, they are likely to have formed in the same sort of circumstances.

The pipy type of dewatering structures uprises from the top of the slump sediments vertically intruding into the stratified overlying layers. This indicates a possibility that the slump sedimentary body may work as a buffer to accumulate formation fluid, where the leaked fluid forms pipy dewatering structure toward the upper layers when over the allowable value.

It is known that there is very high methane flux in the survey area. Judging from that the dewatering structures generally indicate whitened (damped) amplitude anomalies, these structures are likely related to formation fluid involving some gas phase. So, further analyses and consideration are needed to understand the relation among slumping, dewatering, methane hydrate and other hydrocarbon gases.

Keywords: 3D seismic survey, Sanriku-oki, slump, dewatering structure, methane hydrate