Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

HDS28-01 Room:104 Time:May 23 16:15-16:30

New perspective of submarine landslide

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Submarine landslide is motived for disaster prevention in recent. However, detailed slip monitoring at deep seafloor is much harder than the on-land situation. In most cases, even the tomographic change before and after the landslide event has not been estimated. And the basic conditions including soil mechanics and pore fluid pressure are not uncertain under deep sea water. The pore fluid pressure and seismic acceleration are believed as major trigger for slipping, and pore fluid pressure may concern with rain precipitation on landslide. Submarine sediment is saturated with water and the mechanism of pore fluid rise is uncertain in sub-seafloor. This presentation review the previous studies of surface sediment movement, ground deformation based on science-technology viewpoint, and shows new perspective of submarine landslide.

Keywords: Submarine landslide, Soil mechanics, Simulation

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HDS28-02 Room:104 Time:May 23 16:30-16:45

A hyposesis of the Senoumi submarine megaslide in Suruga Bay in Japan

Kyoji SASSA[1*], HE, Bin[2], STRASSER, Michael[3], MIYAGI, Toyohiko[4], FURUMURA, Takashi[5], SAKAI, Shinichi[6], SHINOHARA, Masanao[6], KONAGAI, Kazuo[7], OSTRIC, Maja[2], SETIAWAN, Hendy[2], TAKARA, Kaoru[2], NAGAI, Osamu[1], DANG Quang Khang[1], YANAGISAWA, Hideaki[4], YAMASHIKI, Yousuke[2]

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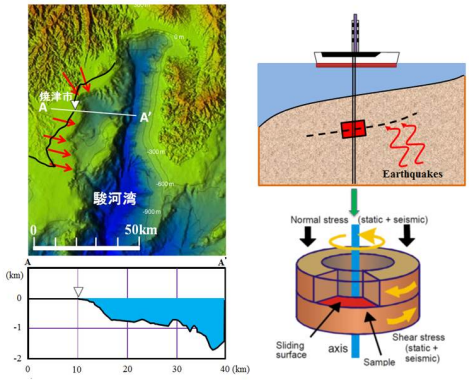
only in Japanese

Keywords: submarine landslide, IODP, undrained ring sher test, simulation



Japan Geoscience Union Meeting 2013
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HDS28-03 Room:104 Time:May 23 16:45-17:00

Submarine landslides in an active forearc basin (Eastern Nankai Trough area)

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Most of landslide analyses in offshore regions have been spotted in passive continental margins, where glacial-interglacial interaction could activate submarine landslides. These previous studies commonly focus on morphometric feature and distributional pattern of submarine landslide itself, and less on its structural and stratigraphical conditions. Understanding such geological knowledge on landslide regions would be helpful for geohazard assessment and resource development, especially in plate convergent zones. In this meeting, we present seismic and balanced cross sections of mass transport deposits in a Pleistocene forearc basin along the Eastern Nankai Trough to discuss tectono-stratigraphic impact on active-forearc landslides. This study was financially supported by METI and MH21 Research Consortium.

Keywords: submarine landslide, forearc basin, 3D seismic analysis, balanced cross section, Eastern Nankai Trough area

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HDS28-04 Room:104 Time:May 23 17:00-17:15

Submarine landslide identified in MD179 cores from shallow gas hydrate area of Joetsu basin, eastern margin of Japan Sea

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Gas hydrate is exposed on a sea floor and is hosted in a shallow depth of sediments in the Joetsu Basin, the eastern margin of the Japan Sea. Linear arrangement of pockmarks and mounds, 50 to 500 m in diameter and 10 to 50 m high and deep, respectively, are identified on both Joetsu knoll and Umitaka spur in the Joetsu Basin. Seismic profiles of these topographic highs reveal gas chimney structure, an effective conduit for the migration of deep-seated gases, develops below the pockmarks and mounds, and the depth of bottom simulating reflectance is estimated to be situated around 100-150m on the spur and knoll. Pockmarks and mounds should have been related to formation and dissociation of gas hydrate. Whereas Un-named ridge situated northeast of the Umitaka spur shows no such characteristic landforms (Matsumoto, 2009; Matsumoto et al., 2009).

Sediment cores are recovered from the Joetsu knoll, Umitaka spur and Un-named ridge during the cruise of R/V Marion Dufresne in 2010 to examine the occurrence and nature of gas hydrate and its surrounding sediments. Bioturbated layers interbedded with thinly laminated (TL) layers, both of which consists of silty clay, are the main constituents of the sediment cores. Blocks or fragments of gas hydrate, carbonate nodules and thin laminations of sand occur in some cores. The repeated bioturbated and TL layers are a diagnostic feature of the Quaternary sediments of the Japan Sea, and the TL layers substitute for marker beds with a help of tephras. Detailed observation of the TL layers makes it easy to recognize landslide horizons in the Japan Sea, in addition.

The recovered sediment is, although, mostly disturbed by tilted horizons, faults, slump folds and breccia except that from the Un-named ridge. The tilted horizons are the most common disturbance of sediments and faults follow them. Slump folds are almost limited to the MD179-3296 that is cored at a pockmark on the Umitaka spur. Detailed examination of TL layers clarified that the TL layers occur in order and a disturbance of sediment is limited in many cores. MD17-3317, which is targeted at a pockmark on the Joetsu knoll, is the most severely disturbed core and consists of breccia originated from repeated debris flow.

Timing and trigger of the submarine landslides are hardly clarified in most cases. Among them, breccia of MD179-3299 that occurs in the upper portion of TL2, the characteristic sediment of the last glacial maximum (LGM) in the Japan Sea, is interpreted as follows. Carbon isotopic analyses and an occurrence of a specific foraminifer strongly suggest a release of methane had occurred around that horizon. And this release of gas caused by the lowered sea level as much as 120 m during the LGM probably led the debris flow on the Umitaka spur.

The thick breccia of MD179-3317 and tilted horizon of MD179-3301 had been formed after the LGM when the global warming had rapidly progressed and sea level had been rising. The Clathrate Gun Hypothesis (Kennett et al., 2002) may be applied to this event. This hypothesis predicts that gas hydrate is unstable at the very time when the interstadial interval had started, and the dissociation of gas hydrate by the warming resulted slope failure such as slump, debris flow and turbidity current.

Seismic activity is another factor that should be considered, because the Joetsu basin is situated in the midst of tectonically active area of the eastern margin of Japan Sea. The Un-named ridge has no physiological sign of release of gas hydrate, and therefore the fault of MD179-3312 will be the case.

Acknowledgement

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References

Kennett, J.P., et al., 2002. Am. Geophys. Union, 210p.
Matsumoto, R., 2009. J. Geogr., 118, 7-42.
Matsumoto, R., et al., 2009. J. Geogr., 118, 43-71.

Keywords: submarine landslide, gas hydrate, Joetsu Basin, Japan Sea, last glacial maximum

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Mass-transport-dominated sedimentation in a foreland basin, Hidaka Trough

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Mass transport is an important process of sediment redistribution from shallow to deep sea basins. It is vital to understand this process for disaster prevention and protection of economic interests in coastal and offshore areas. We describe mass-transport-dominated sedimentation in an active foreland basin, the Hidaka Trough, which developed from collision between the northeastern Japan arc and the Kuril arc. The basin is deformed by east–west compression associated with large, frequent earthquakes. The trough is filled with thick sediments, ranging from coal-bearing Cretaceous terrestrial strata to modern diatomaceous hemipelagic mud and volcanic ash. Bottom-simulating reflectors and the distribution of mud volcanoes, pockmarks, and acoustic wipe-out zones on the seismic records suggest the presence of subsurface gases in the sediments. The basin features stacked mass transport deposits (MTDs), but no channel–levee systems have developed. The MTDs are relatively thin and are derived from three sides of the basin margin. Initiation of submarine slope failure in this area may be controlled by multiple factors that increase driving forces and decrease resistance of the slopes. The driving forces include oversteepening of the margin slope as a result of thrusting and folding, and additional downslope gravitational acceleration caused by cyclic shaking during earthquakes. Decreased resistance in the slopes may be caused by the accumulation of excess pore water pressure driven by a high sedimentation rate, gas hydrate dissociation accompanying changes in sea level or temperature, and liquefaction in coarse-grained beds during earthquakes.

Keywords: Mass transport, submarine landslide, foreland basin, active margin, gas hydrate

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3D structural analysis of large-scale submarine landslide on a very gentle continental slope off Shimokita Peninsula

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Submarine landslides can be found even on very low angle slope well below the angle of response, and are often greater in size and migration length than onshore landslides. Morita et al. (2011) analyzed METI's 3D seismic data 'Sanrikuoki 3D' obtained off Shimokita Peninsula, and found a number of large-scale submarine landslide deposits in the Pliocene and upper formations. The slump deposits features generally indicate layer-parallel slip on a very gentle and flat continental slope, and often exhibits imbrication structure formed by repeated thrusting of slided sedimentary sheets and related dewatering structure standing on the slip planes. In order to clarify the deformation and fluid migration systems, we have proceeded further analysis of the 3D seismic data and have outlined the morphostructure of slump deposits. Characteristics of the internal structure and dewatering structure are considered to be associated with the slumping system occurring on such very gentle and flat continental slope. In addition, gas hydrate BSR (Bottom Simulating Reflector) is prominently recognized within the slump layers, whereas BSR is not clear in surrounding normal formation. This means that there is a good contrast of acoustic impedance at the depth of the BSR, and gas hydrate may accumulate within the slump deposits, relatively easier than in surrounding formation. This may suggest a typical fluid migration system in the sedimentary basin. In this session, we introduce latest results of structural analysis especially with respect to distribution and morphology of the submarine landslides in the survey area.

Keywords: submarine landslides, 3D seismic data, high methane flux, Shimokita Peninsula