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

HDS28-P01 Room:Convention Hall Time:May 23 18:15-19:30

Evidence for Mass Transport Deposits at the IODP JFAST-Site in the Japan Trench

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Several studies indicate that the 2011 Tohoku-Oki earthquake (Mw 9.0) off the Pacific coast of Japan has induced slip to the trench and triggered landslides in the Japan Trench. A major effort in marine geosciences is currently to better understand these processes, including detailed mapping and coring landslides at the trench as well as Integrated Ocean Drilling Program (IODP) drilling (Japan Trench Fast Earthquake Drilling Project, JFAST) to recover the shallow fault zone.

Here we report sediment core data from the rapid response R/V SONNE cruise (SO219A) to the Japan Trench, evidencing mass transport deposits (MTD) in the uppermost section drilled at the IODP JFAST-site. A 8.7 meter long gravity core (GeoB16423-1) recovered from ~7000 meter water depth reveals a 8 m sequence of semi-consolidated mud clast breccias embedded in a distorted chaotic sediment matrix. The MTD is covered by a thin veneer of 50 cm hemipelagic, bioturbated diatomaceous mud. This stratigraphic boundary can be clearly distinguished by using physical properties data from Multi Sensor Core Logging and from fall-cone penetrometer shear strength measurements. The geochemical analysis of the pore-water shows undisturbed linear profiles measured from the seafloor downcore across the stratigraphic contact between overlying younger background-sediment and MTD below. This indicates that the MTD at the JFAST-site is older than the Tohoku-Oki event, and that the investigated section has not been affected by sediment destabilization triggered by the slip-to-the-toe Tohoku-Oki earthquake event. Instead, we report an older landslide which occurred in the relatively young geological past between 700 and 10,000 years ago, implying that submarine mass movements along the Japan Trench are frequent processes.

Keywords: Japan Trench, Mass Transport Deposit, Tohoku-Oki Earthquake, IODP-JFAST, geochemistry, physical property

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Identifying mass transport deposits using magnetic fabric analysis: An example from Nankai Trough

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Submarine landslides are a potential hazard to coastal areas all over the world. Studyies of mass transport deposit (MTD) contribute to understanding the nature and process of the submarine landslides. Scientific drilling provides material containing a historical record of the seafloor environment, however, there is not always enough sediment to recognize MTDs by visual information.

We applied magnetic fabric analysis to the drilled cores to examine the potential of magnetic fabrics in identifying MTDs. Among the sites drilled in the framework of the Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) of the Integrated Ocean Drilling Program, multiple occurrences of MTDs were observed in the recovered cores. We focused on Sites C0008 and C0018 of the slope sediments in the footwall of the megasplay faults. Magnetic fabric analysis was performed with the recovered cores in the MTDs. The shape parameter (T) and the orientation of the axes of magnetic ellipsoids, distinctively scattered in MTDs, suggest mobilization

and/or resedimentation during the formation process. Downward increments in the parameter L near the bottom of MTDs may result from the shear localization near the basal sliding plane. By contrast, the results from the sediments described as a mass transport complex at Site C0008 showed the opposite trend, suggesting a different dynamic process during transportation. Our results show the magnetic fabric analysis is potent in describing MTDs and their internal structures. This may extend the methodology in describing MTDs and the discussion on their dynamic process.

Keywords: Submarine landslide, D/V Chikyu, NanTroSEIZE, Accretionary Prism, Megasplay fault, IODP Expeditions 316 and 333

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Research activities for future scientific drilling in large submarine landslide group in Sanrikuoki Basin

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A great number of large slump deposits have been identified in the Pliocene and younger formations in the north Sanrikuoki Basin off Shimokita Peninsula, NE Japan. The slump units and their slip planes have very simple and clear characteristics, such as layer-parallel slip on very gentle slope, regularly imbricated internal structure, widespread dewatering structure, and low-amplitude slip plane layer. So, we recognize the large slump deposits group in this area is an appropriate target for a scientific drilling to determine ”Submarine Landslide Mechanism”, that is one of the subjects on the IODP new science plan for 2013 and beyond. In 2012, we started some research activities to examine the feasibility of the future scientific drilling.

The slump deposits were recognized basically by 3D seismic analysis. Further detailed seismic analysis is being performed for better understanding of geologic structure of the sedimentary basin and the slump deposits, that is to extract suitable locations for drill sites.

Typical seismic features and some other previous studies imply that the formation fluid in this study area is strongly related to natural gas, of which condition is strongly affected by temperature. So, detailed heat flow measurement is going to be performed in the study area. For that purpose, a long-term water temperature monitoring system was deployed on the seafloor in October, 2012. The collected water temperature variation will be applied to precise correction of heat flow values, which will be measured next year. Vitrinite reflectance analysis is also being carried out using sediments samples recovered by IODP Expedition 337, which is conducted in a part of the study area from July through September in 2012. The values of vitrinite reflectance will be available for modeling thermal history in the sedimentary basin.

In September, a science meeting and a field trip were held in Miyazaki Prefecture. These are aimed at identifying the issues for planning the scientific drilling and at developing a science community on this subject. At the field trip, we observed typical geologic structures related to slumping and dewatering in Nichinan Group, which are good onshore objects so as to share the aspects of the slump deposits in the Sanrikuoki Basin among the community.

This study uses the 3D seismic data from the METI seismic survey ”Sanrikuoki 3D” in 2008. The seismic analysis, the vitrinite reflectance analysis, and the science meeting and the field excursion in Miyazaki were supported by the foundation of feasibility studies for future IODP scientific drillings by JAMSTEC CDEX.

Keywords: submarine landslide, slump, layer-parallel slip, dewatering, slip plane, IODP

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Detailed topography and geologic architecture of the submarine landslides in the Jan Mayen Ridge, north Norway

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This paper deals with the detailed topography and the geologic architecture of a large submarine landslide in the Jan Mayen Ridge. The Jan Mayen Ridge, being a continental sliver, is ˜250 km long in N-S direction with a flat plateau of ˜800 m in water depth standing on an abyssal plane of 2500-3000 m in water depth. There is only a large submarine landslide scar of ˜50 km wide in the central east side. In the central east side, the internal geologic architecture is characterized by an Eocene-Oligocene sedimentary sequence, which tilts eastward. This sedimentary sequence is cut by large normal faults, that have formed by the spread of the Norwegina-Greenland Sea since 20 Ma. The wasted mass of the large submarine landslide could slip down along the bedding plane and/or the normal faults dipping to east. Thus, the slide form a big spoon-shaped basin. The slide scar was collapsed retrogressively to make a small spoon-shaped basin on the upper part of the big basin. There are long channels from the retrogressive slide scars to the lower basin. The retrogressive slides would continue to discharge progressively gravity flows to make the long channels on the basin after the large submarine landslide occurred. On contrary to the slide region, the sedimentary sequence has a large anticline in an east foot of the ridge in other regions. This anticline could be an obstruction to a large submarine landslide. Thus, the geologic architecture plays an important role in the formation mechanism of a large submarine landslides in the Jan Mayen Ridge.

Keywords: Submarine landslide, Norway, Jan Mayen Ridge