

Submarine methane hydrates and geologic structures over marine methane hydrate system off Joetsu, eastern margin of the Japan Sea.

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Active marine natural methane hydrate systems and related phenomena on and near seafloor are identified at off Joetsu, southern part of the eastern margin of the Japan Sea (Matsumoto et al., 2005, Matsumoto and Ishida, 2006a,b). In this area, large pockmarks and mounds, 20 to 50m in depth and 200 to 500 m in diameter, have been observed on a small ridge, both Umitaka Spur and Joetsu Knoll, at water depth of 900 to 980m, associated with fault systems. METI 2D/3D seismic survey 'Sadooki-Nansei' was carried out in 2001, and METI exploratory well 'Sado Nanseioki' was drilled in 2004 at the Umitaka Spur (Monzawa et al., 2006, Muramoto et al., 2007). Seismic records show BSR distributions at the Umitaka Spur and the Joetsu Basin area, and this indicates existence of submarine natural methane hydrates. Geochemical study for carbon isotope ratio of the methane gas that were included in the subbottom methane hydrate samples recovered from shallow sediments below seafloor suggested thermogenic origin, and indicated that deeper gas migrated upward to the seafloor and formed shallow methane hydrate (Monzawa et al., 2006, Muramoto et al., 2007)

Our research group have been conducting integrated survey including echo-sounding, precise bathymetric, sampling, geological and geochemical, seismic, electrical resistivity, macro- and micro-biological, seafloor camera observation survey since 2004 with T/V UMITAKA-MARU of Tokyo University of Marine Science and Technology, R/V NATSUSHIMA and KAIYO of JAMSTEC. Many gas plumes in seawater were observed by echo-sounder and many natural methane hydrate samples were recovered by piston corer just below seafloor at near mounds on the top of the Umitaka Spur and the Joetsu Knoll, and it was first hydrate samples at the Joetsu knoll region. Seafloor outcropping natural methane hydrates were observed and collected first time around Japan at both Umitaka Spur and Joetsu Knoll using with ROV Hyper-Dorphan of JAMSTEC.

High resolution single channel seismic survey were conducted in NATSUSHIMA NT07-20 cruise to obtain high resolution and high density seismic records. Total survey lengths were about 100n.miles (204km), and main survey lines were set in the orthogonal direction of the geologic structures, such as, east-west direction in The Umitaka Spur, northwest-southeast direction in the Joetsu Knoll. Many survey lines were set just above the pockmarks or mounds, and/or hydrate sampling locations. Our seismic records suggest many geologic features as follows:

1) 'Gas column structures' that indicate fluid migration from deeper zone up to seafloor are recognized just below pockmarks, mounds, and seafloor methane seepage and shallow natural methane hydrate locations, in both Umitaka Spur and Joetsu Knoll. 'Gas column structures' are continued in same direction of the pockmarks and mounds, and in the Joetsu Knoll 2 parallel rows are recognized.

2) BSR on the seismic profiles are recognized at 0.2-0.25sec below seafloor in both Umitaka Spur and Joetsu Knoll, and this is the first report about the BSR in the Joetsu Knoll.

3) Topography and geologic structure of both Umitaka Spur and Joetsu Knoll show asymmetric feature, and it seems thrust faults at the western margin of the Umitaka Spur and the southeastern margin of the Joetsu Knoll. The age of formation of the Joetsu Knoll is younger than that of the Umitaka Spur, based on the transect seismic survey line through the two ridges.