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P-wave velocity features of Methane Hydrate-Bearing turbidity sediments sampled by Pressure Core Tool

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Turbidity sediments around the production test site at Daini-Atsumi knoll were deposited under channels and lobes of a submarine fan environment. It implies that sediments contain property difference caused by depositional environment, fundamentally. In addition, MH crystals among sediment grains overprint their original physical properties. Thus, difficulties in MH reservoir arise in clarifying the properties of MH-bearing sediments and normal sediments from logging data. To analyze their physical properties, core samples of MH-bearing sediments were taken at the first offshore production test site using a wireline tool called the hybrid pressure coring system (Hybrid PCS), which prevents dissociation of MH in the sampled cores.

Nondestructive, high-pressure analyses were conducted in both the 2012 summer drilling campaign and the 2013 winter collaboration study. To handle Hybrid PCS cores during the pressure coring campaign in the summer of 2012, a pressure core analysis and transfer system (PCATS) was installed on the research vessel Chikyu (Yamamoto et al., 2012). The measurements can be taken at the in situ water pressure at depth without causing any core destruction or MH dissociation. In January 2013, GT, USGS, AIST, and JOGMEC researchers conducted a collaborative study. In this study, the pressure core characterization tools (PCCTs) developed by GT also measured P-wave velocity of MH-bearing sediments.

In the PCATS analysis, the results showed a difference of more than 1,200 m/s in P-wave velocities between the MH-bearing sandy and muddy layers. This difference in P-wave velocities was confirmed by PCCTs measurements. Also, P-wave velocity of a turbidite interval tend to decrease upward as same as grading of a turbidite. The result implies that MH concentration is related with pore size of sediments.

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Keywords: Gas hydrate, P-wave velosity, Turbidite, Pore-filling type, Grain size distribution