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

MIS26-06 Room:202 Time:May 22 10:15-10:30

Estimate of interval velocity of sediment between the seafloor and BSR in Joetsu Basin, eastern margin of the Japan Sea

Shusaku Goto[1*], Sumito Morita[1], Manabu Tanahashi[1], Toshiya Kanamatsu[2], Akihiro Hachikubo[3], Satsuki Kataoka[4], Hideaki Machiyama[2], Masataka Kinoshita[2], Makoto Yamano[5], Osamu Matsubayashi[1], Ryo Matsumoto[6]

[1]GSJ, AIST, [2]JAMSTEC, [3]Kitami Institute of Technology, [4]Hakodate National College of Technology, [5]ERI, Univ. Tokyo, [6]Meiji University

Joetsu Basin is one of the areas where gas hydrate studies have been conducted intensively in the world. Previous studies conducted in Joetsu Basin (Matsumoto et al., 2009; Saeki et al., 2009) indicated that seismic velocity of sediment above bottom-simulating reflectors (BSRs) is lower than sound velocity of seawater (ca. 1500 m/s). These studies suggested that such low velocity of sediment could be explained by an existence of gas in the sediment. To investigate an existence of gas in sediment above BSRs in Joetsu Basin, we estimated interval velocity of sediment above BSRs from heat flow and BSR depth data in this basin.

We measured heat flows at seven stations in Joetsu Basin in June 2010 during the MD179 Japan Sea Gas Hydrates cruise. The measured heat flows ranged from 84 to 90 mW/m2. Because of discrete heat flow data, we calculated a 2D-steady state thermal structure model along a 2D seismic profile from the heat flow data and the borehole physical properties data in the basin, and then calculated heat flow distribution at the seafloor of the model. The heat flow calculated from the thermal structure model well explains the heat flows measured at the seafloor. We also calculated heat flows from BSR depths (hereafter called ”BSR-derived heat flows”). The estimated BSR-derived heat flows are significantly lower than heat flows at the seafloor predicted from the thermal structure model. We estimated interval velocity of sediment above BSRs by matching BSR-derived heat flows to heat flows at the seafloor predicted from the thermal structure. The estimated interval velocity ranged from 1100 to 1600 m/s. Sediment interval velocity that is lower than sound velocity of seawater could be explained by an existence of gas in the sediment, supporting the results of Matsumoto et al. (2009) and Saeki et al. (2009). The survival of gas above BSR is explained by water depletion as a consequence of formation of gas hydrate and strong capillary forces of the muddy sediment under an environment of high-methane flux, as speculated by Clennell et al. (1999).

This study is supported by MH21, Research Consortium for Methane Hydrate Resources in Japan.

References

Clennell, M.B., Hovland, M., Booth, J.S., Henry, P., Winters, W.J., 1999. Formation of natural gas hydrates in marine sediments 1. Conceptual model of gas hydrate growth conditioned by host sediment properties. Journal of Geophysical Research 104, 22985?23003.

Matsumoto, R., Okuda, Y., Hiruta, A., Tomaru, H., Takeuchi, E., Sanno, R., Suzuki, M., Tsuchinaga, K., Ishida, Y., Ishizaki, O., Takeuchi, R., Komatsubara, J., Freire, A.F., Machiyama, H., Aoyama, C., Joshima, M., Hiromatsu, M., Snyder, G., Numanami, H., Satoh, M., Matoba, Y., Nakagawa, H., Kakuwa, Y., Ogihara, S., Yanagawa, K., Sunamura, M., Goto, T., Lu, H., Kobayashi, T., 2009. Formation and collapse of gas hydrate deposits in high methane flux area of the Joetsu Basin, eastern margin of Japan Sea. Journal of Geography (Chigaku Zasshi) 118, 43-71 (in Japanese with English abstract).

Saeki, T., Inamori, T., Nagakubo, S., Ward, P., Asakawa, E., 2009. 3D seismic velocity structure below mounds and pockmarks in the deep water southwest of the Sado Island. Journal of Geography (Chigaku Zasshi) 118, 93-110 (in Japanese with English abstract).

Keywords: thermal structure, heat flow, BSR, interval velocity, Joetsu Basin