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## Pore water geochemistry associated with biogeochemical processes in shallow sediments in the Japan Sea

Hitoshi Tomaru<sup>1\*</sup>, Yasuyuki Muramatsu<sup>2</sup>, Hiroya Anzai<sup>2</sup>, Glen Snyder<sup>3</sup>, Akihiro Hachikubo<sup>4</sup>, Katsunori Yanagawa<sup>1</sup>, Ryo Matsumoto<sup>1</sup>

<sup>1</sup>University of Tokyo, <sup>2</sup>Gakushuin University, <sup>3</sup>Rice University, <sup>4</sup>Kitami Institute of Technology

Pore waters were collected from the shallow sediments along the eastern margin of the Japan Sea during the intensive piston coring expedition by R/V Marion Dufresne in 2010 (MD179 Japan Sea Gas Hydrates). Samples were collected from the high methane potential area off Joetsu, Niigata (Umitaka Spur and Joetsu Knoll region) where shallow-deep gas hydrate system has been developed, from the central Toyama Trough, west of Sado Island, from the ridge flank, southwest of the Henashi-zaki Peninsula, near the Tsugaru Strait, and from the west of Okushiri Island. Concentrations of alkalinity, H<sub>2</sub>S, major anions and cations, and delta<sup>13</sup>C<sub>DIC</sub> values were preliminary analyzed in order to assess the biogeochemical processes associated with shallow diagenesis of organic matter, i.e. solid organic matter in sediment and methane dissolved in pore water. Concentrations of dissolved sulfate, an important oxidant for organic matter oxidation near the seafloor, decrease linearly to ~0 mM in the upper 2 to 10 m below seafloor (mbsf) at all sites, indicating upward methane flux is generally high in the entire research area including the sites away from gas venting/gas hydrate occurrences. Alkalinity is an indicative of products from organic matter oxidation, increasing rapidly downward to the SMI. H<sub>2</sub>S is also produced during organic matter oxidation, increasing up to 5 mM near the SMI. Concentrations of Ca and Mg simultaneously decrease with depth due to carbonate precipitation that is encouraged by alkalinity increase. delta<sup>13</sup>C<sub>DIC</sub> values show negative peaks of 0 to -20 per-mil around the SMI, <sup>13</sup>C-depleted methane from deep sediments is responsible mainly for organic matter oxidation at the SMI.

There are two modes of organic matter oxidation (sulfate reduction) between the seafloor and SMI; ordinary oxidation of sedimentary organic matter and anaerobic oxidation of methane. Because 1 mole sulfate reduction results in 2 moles alkalinity increase in the former state and results in 1 mole increase in the latter state, gradient of sulfate reduction vs. alkalinity increase that is compensated with Ca and Mg changes can point to the mode of organic matter oxidation. Our results indicate that the ordinary oxidation of sedimentary organic matter is dominant just below the seafloor (DeltaSO<sub>4</sub><~10 mM), and the anaerobic oxidation of methane thereafter. Degradation of organic matter in the shallow sediments is a result of combined biogeochemical processes and plays an important role in shallow carbon cycle system in marine environments.

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