

Geochemistry of methane in surface sediment of shallow gas hydrate deposits in the Oki Trough and Joetsu Basin, Japan Sea

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Shallow gas hydrate deposits have been developed, often accompanying subsurface gas chimney structures and gas seepage on the seafloor, in the Oki Trough and Joetsu Basin areas in the Japan Sea. High gas concentration, mainly methane, is a key for characterizing and constraining the reaction and behavior of carbon in the seafloor~sub-seafloor environments. Here we present the analytical results of sulfate concentration and isotopic composition and concentration of gases dissolved in pore waters collected from the intensive shallow gas hydrate coring program in 2015 (PS15) in order to discuss the biogeochemical processes around the sulfate-methane interfaces (SMI) in these fields.

The depths of SMI are shallow and $\delta^{13}\text{C}$ values of methane below the SMI are high in the Joetsu Basin compared to the Oki Trough, reflecting that higher methane flux is caused by higher contribution of thermogenic gas. The $\delta^{13}\text{C}$ values show negative peaks around the SMI, which are relatively large in the Joetsu Basin, reflecting the carbon recycling between anaerobic methane oxidation and microbial methane production around there. The rapid decreases of $\text{C1}/(\text{C2}+\text{C3})$ ratios around the SMI are also caused by the anaerobic oxidation of methane. The $\text{C1}/(\text{C2}+\text{C3})$ ratios are entirely high in the Joetsu Basin, resulting mainly from ethane enrichment in the Oki Trough. Differences of gas source is one of the important factors controlling shallow biogeochemical processes.

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