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Characteristics of hydrate-bound hydrocarbons retrieved from southern Lavrentyev seabed fault, the Sea of Okhotsk

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We report molecular and isotopic compositions of hydrate-bound hydrocarbons in the new seepage sites of offshore Sakhalin Island, the Sea of Okhotsk. More than ten gas seep sites have been discovered since 1990s in the north area of Lavrentyev Fault and hydrate-bearing sediments were recovered (Ginsburg *et al.*, 1993; Hachikubo *et al.*, 2010). These sites often accompany with gas plumes from the sea floor and gas hydrates exist in a shallow sediment layer. Recently, Sakhalin Slope Gas Hydrate (SSGH) project was started from 2007 and we retrieved sediment cores from the southern area of Lavrentyev Fault during the SSGH09 and SSGH10 cruises in 2009-2010. We obtained the samples of hydrate-bound gas and dissolved gas in pore water on board, and we measured molecular and stable isotope compositions of them. Empirical classification of the methane stable isotopes; delta ¹³C and delta D according to Whiticar *et al.* (1986) and Schoell (1988) indicated their microbial origin via carbonate reduction. Profiles of methane concentration in the pore water suggested a shallow SMI (sulfate-methane interface). SMI depth was estimated as 30-50cm from the sea floor in the case of hydrate-bearing cores, and around 2m from the sea floor in the case of gas-rich cores. Molecular compositions of hydrate-bound gas were almost the same in both northern and southern areas of Lavrentyev Fault. Stable isotope compositions of hydrate-bound gas were concentrated in the range of -204.6 permil to -196.7 permil for delta D and -66.0 permil to -63.2 permil for delta ¹³C in the north area (Hachikubo *et al.*, 2010). On the other hand, both isotopes were more depleted in the south area about 6 permil in ¹³C and 7 permil in deuterium, respectively, suggested much more active microbial processes in the shallow sediment. Isotopic difference in delta D between hydrate-bound and dissolved gases was about 5 permil at several sites, indicating that the gas hydrates formed from the current gas in pore water (Hachikubo *et al.*, 2009).

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