...surface sediments obtained from ...d, Sea of Okhotsk - Molecular and isotopic signatures of hydrate-bound hydrocarbons -

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Near-surface gas hydrates exist in the seepage sites of offshore Sakhalin Island, the Sea of Okhotsk. These sites often accompany with gas plumes from the sea floor. We investigated the molecular and stable isotope composition of hydrate-bound and dissolved hydrocarbons in pore water in subsurface sediments. More than ten gas seep sites have been discovered since 1990s in the north area of Lavrentyev seabed fault (NE Sakhalin Island) and hydrate-bearing sediments were recovered by using a gravity corer. Recently, Sakhalin Slope Gas Hydrate (SSGH) project was started in 2007 and we retrieved hydrate-bearing sediment cores from the southern area of Lavrentyev Fault in 2009-2011. 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; $\delta^{13}C$ and δD indicated their microbial origin via carbonate reduction. Profiles of methane concentration in the pore water suggested a shallow SMI (sulfate-methane interface) and high methane flux from the deep sediment layer. 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 methane were concentrated in the range of -204.6‰ to -196.7‰ for δD and -66.0‰ to -63.2‰ for $\delta^{13}C$ in the north area. On the other hand, both isotopes were more depleted in the south area about 6‰ in ^{13}C and 7‰ in deuterium, respectively, suggested much more active microbial processes in the shallow sediment. $\delta^{13}C$ of hydrate-bound ethane was also depleted in the south area, whereas that in the north area distributed in the range of -40‰ to -30‰. We conclude that the origin of hydrate-bound gas is mainly microbial and small amount of thermogenic gas mixes with microbial gas in the north area of Lavrentyev Fault.