海底・湖底におけるメタン生成環境の比較　ーオホーツク海、日本海およびバイカル湖の例ー

Comparison of methane generation between submarine and sublacustrine environments - the Sea of Okhotsk, Japan Sea, and Lake Baikal -

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In the framework of international collaboration SSGH (Sakhalin Slope Gas Hydrate, 2007-2015) and MHP (Multi-phase Gas Hydrate Project, 2009-2018), Environmental and Energy Resources Research Center, Kitami Institute of Technology has collected many gas samples from submarine and sublacustrine environments where near-surface gas hydrate exists. In this report, we focus on more than 3,000 data of sediment gas using a headspace gas method, and discuss the environments of methane generation under sea and fresh waters.

The sediment gas, mainly dissolved gases in pore water, was obtained by the headspace gas method. 10 mL sediment was sampled from the sediment core by a plastic syringe (volume: 5 mL) and put into a 25 mL vial. 10 mL NaCl aqueous solution (saturated) was introduced into the vial by using a micropipette and sealed employing a butyl rubber septum to make a headspace. To avoid any changes in the headspace, the headspace part was flushed by helium. We measured the molecular and isotopic compositions of headspace gases using gas chromatograph and CF-IRMS in our laboratory.

Methane δ^{13}C in almost all samples are plotted between -100‰ and -40‰ in both submarine and sublacustrine environments. On the other hand, distribution of CO_2 δ^{13}C in marine and sublacustrine environments are different with each other: the former between -60‰ and +20‰ and the latter between -20‰ and +30‰. Light CO_2 in the sea-bottom sediment are produced by an oxidation of light methane around the SMI depth, so-called a methane recycling process (Borowski *et al.*, 1997).

Our data includes not only the field of microbial methane, but also thermogenic methane in both marine and sublacustrine enviroments. Positive relations of δ^{13}C between methane and CO_2 were found in both environments (submarine: Tatar Trough, sublacustrine: Kukuy, PosolBank, and Kedr mud volcanoes). CO_2 δ^{13}C with thermogenic methane was larger than that with microbial methane, suggesting the existence of microbial effects even in the thermogenic gas.

Reference

Borowski WS, Paull CK, Ussler W III (1997) Carbon cycling within the upper methanogenic zone of continental rise sediments; an example from the methane-rich sediments overlying the Blake Ridge gas hydrate deposits. Mar Chem 57: 299-311

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