

## Characteristics of seep gas retrieved in the ROV expedition off Abashiri, the Sea of Okhotsk

\*Akihiro Hachikubo<sup>1</sup>, Keito Kakizaki<sup>1</sup>, Jumpei Matsuda<sup>1</sup>, Kinji Hyakutake<sup>1</sup>, Masaaki Konishi<sup>1</sup>, Hirotohi Sakagami<sup>1</sup>, Hirotsugu Minami<sup>1</sup>, Satoshi Yamashita<sup>1</sup>, Kenji Nishina<sup>2</sup>

1. Kitami Institute of Technology, 2. Geological Survey of Hokkaido, Hokkaido Research Organization

Many gas plumes ascending from the sea floor have been discovered off Abashiri, the Sea of Okhotsk. In the OS249 cruise using TS Oshoro-maru, we found a large seabed mound with active gas plume in 2012. Natural gas hydrates were recovered in the NT13-20 and C020 cruises using RV Natsushima and TS Oshoro-maru, respectively, at the gas plume site. Hydrate-bound gas was mainly methane, and small amount of hydrogen sulfide was detected. Molecular and isotopic compositions of hydrate-bound hydrocarbons suggested microbial origin. However, nobody checked the difference between hydrate-bound gas and the seep gas. In this study, we developed a gas sampling tool and got the seep gas using a remotely operated vehicle (ROV, KAIYO3000) belonging to Kaiyo Engineering Co. Ltd.

The gas sampling tool is composed of pressure chamber (volume: 75mL), ball valve, and large funnel. Opening and closing processes of the ball valve can be operated by a manipulator of ROV. The 1KY17 cruise was executed on July 2017 off Abashiri, where gas hydrates were recovered in the previous cruises. We obtained four gas samples from two gas-seepage sites. Sediment cores close to the gas vent points were also obtained using a push corer to check sediment gas dissolved in pore water, and measured their gas profiles by a headspace gas method.

Molecular and isotopic compositions of hydrocarbons of the seep gases were almost the same as those of the hydrate-bound gas, whereas hydrogen sulfide was not detected, suggesting that hydrogen sulfide generated by a process of anaerobic oxidation of methane (AOM) mixed with the seep gas ascending from deeper sediment layer. Depth of SMI (sulfate-methane interface) close to the seep point was less than 2cm. Concentration of methane in the sediment cores was 1-10mM, while those of CO<sub>2</sub> and hydrogen sulfide were around 1mM at the depth from 2cm to 22cm.  $\delta^{13}\text{C}$  of CO<sub>2</sub> distributed between -60‰ to -40‰, indicating that large amount of light methane in the seep gas is oxidized beneath the sea floor.

Keywords: gas hydrate, Sea of Okhotsk, remotely operated vehicle, gas origin