

## Gas hydrate survey at the gas seepage area off Abashiri, the Sea of Okhotsk

\*Yuki Moriya<sup>1</sup>, Hiromi Kimura<sup>1</sup>, Akihiro Hachikubo<sup>1</sup>, Satoshi Yamashita<sup>1</sup>, Hirotoshi Sakagami<sup>1</sup>, Masaaki Konishi<sup>1</sup>, Hirotugu Minami<sup>1</sup>, Yasuhito Uchida<sup>2</sup>, Hiroshi Yamaguchi<sup>3</sup>

1. Kitami Institute of Technology, 2. Research Institute of Energy, Environment and Geology, Hokkaido Research Organization, 3. Kushiro Fisheries Research Institute, Hokkaido Research Organization

In the framework of collaboration between Kitami Institute of Technology and Hokkaido Research Organization, we have conducted research cruises off Abashiri (the Sea of Okhotsk) to investigate near-surface gas hydrates at the sea floor where active gas seepage exists. HKS16, HKS17, HKS18, HKS19, and HKS20 cruises were conducted using RV Hokushin-Maru (255t) of the Kushiro Fisheries Research Institute. We successfully retrieved gas hydrate crystals in the HKS18 cruise (September, 2018) at the new place. Although we could not get sediment cores because of bad weather condition at the HKS19 cruise (September, 2019), we got gas-rich sediment cores at the HKS20 cruise (September 2020). In the HKS20 cruise, two study sites located about 5 km east (site A) and 8 km southeast (site B) from the gas hydrate site of HKS18, respectively.

Because the tidal current speed reached  $4 \text{ km h}^{-1}$  and made the coring operation difficult, we used a hydrostatic corer optimally tuned for a small vessel and a transponder to understand exact position of the corer in the HKS20 cruise. We obtained nine sediment cores, including two gas-rich cores. Sediment gas samples were obtained by a headspace gas method. Molecular and isotopic compositions of gas samples were measured using a gas chromatograph and an isotope ratio mass spectrometer, respectively.

The depths of sulfate-methane interface (SMI) in HC2006 (site A) and HC2010 (site B) cores were around 10 cm and 50 cm, respectively, indicating high gas flux.  $C_1 / (C_2 + C_3)$  of headspace gases in the above two cores distributed between 6,100 and 37,000 below these SMI depths, and those of other sediment cores were less than 1,000, suggesting that the size of gas seepage was small and they are in the oxidation layer above the SMI depth. Concentration of  $C_2$  in the HC2010 core was one order larger than that of HC2006 core, although both study sites located on the same ridge.  $C_1 \delta^{13}\text{C}$  and  $\delta \text{D}$  of these cores concentrated -70‰ and -185‰, respectively. These molecular and isotopic compositions of sediment gases suggested microbial origin via  $\text{CO}_2$  reduction.  $\text{CO}_2 \delta^{13}\text{C}$  of these cores were small (around -40‰), indicating that  $\text{CO}_2$  is also oxidized from  $\text{CH}_4$  simultaneously by microbial processes.

Keywords: gas hydrate, the Sea of Okhotsk, gas origin