Characteristics of natural gas hydrates retrieved from Tatarsky Trough, off the south western Sakhalin Island

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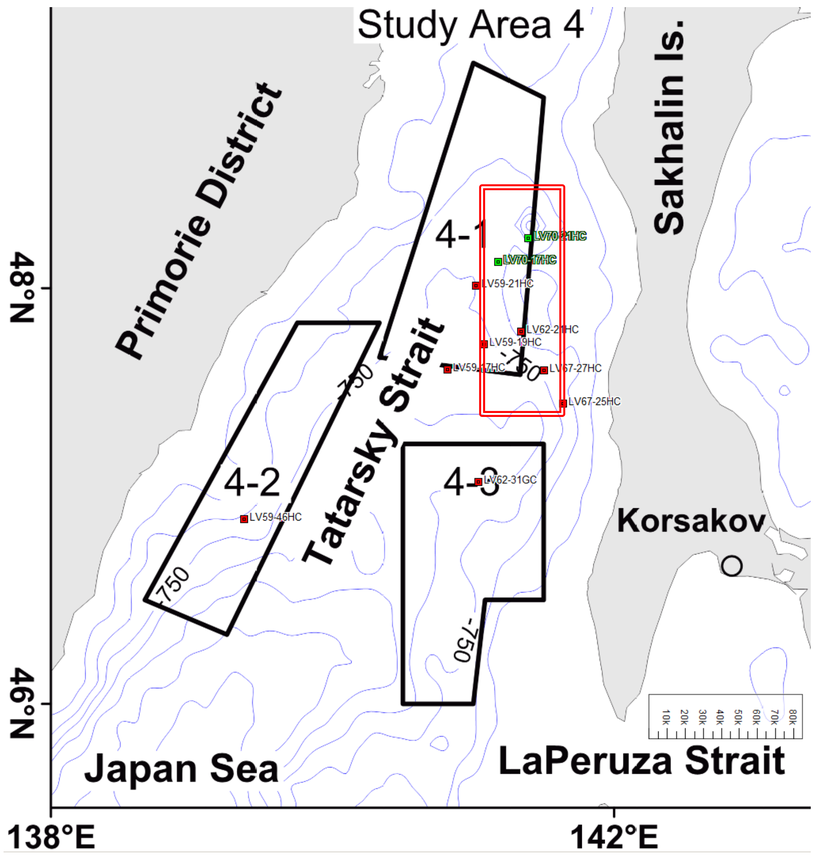
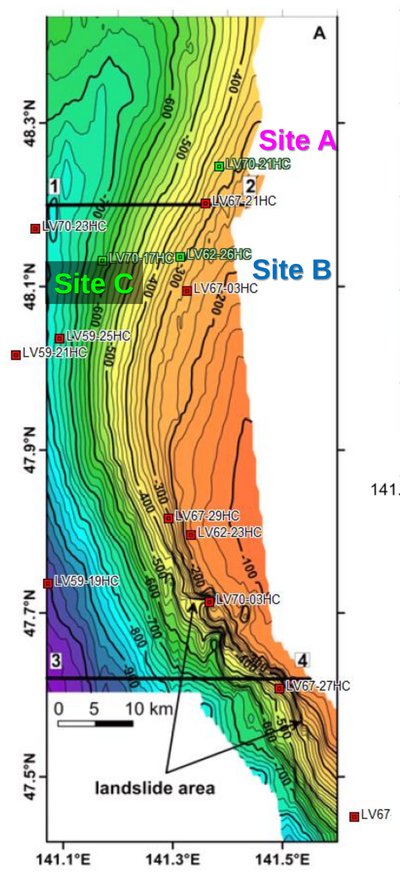
Summary

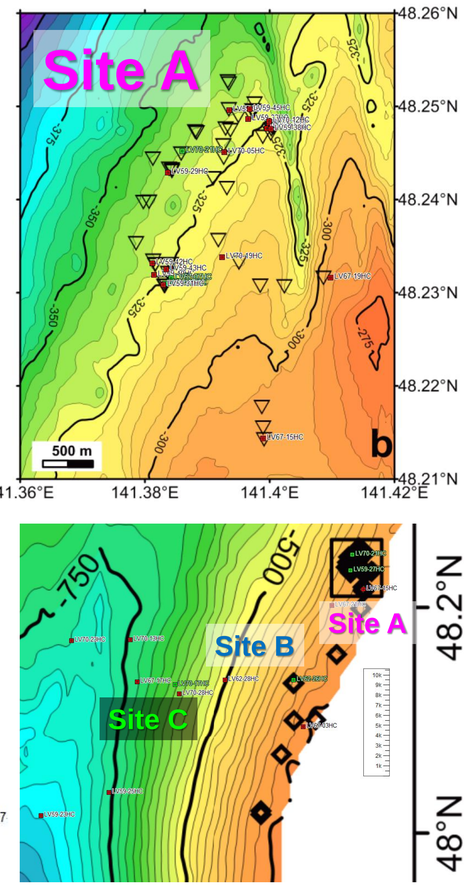
Gas hydrates have been recovered off Sakhalin Island in the framework of Sakhalin Slope Gas Hydrate (SSGH) project onboard *R/V Akademik M. A. Lavrentyev*. In this report, we would like to focus on the characteristics of gas hydrate retrieved from the Tatarsky Trough, off the south western Sakhalin Island. In the recent three cruises (2012-2015), we discovered a lot of gas plumes ascend from the sea floor, where hydrocarbon gases were rich in the sub-bottom sediment. Gas hydrate crystals in sediment cores were recovered from the sites of gas plumes, where water depth was only 322 m and the pressure of water was close to the equilibrium pressure of methane hydrate in sea water.

Calorimetric and Raman spectroscopic analyses were done for the gas hydrate samples. Dissociation heat of gas hydrates was almost the same as that of pure methane hydrate. Raman spectra showed that the hydrate crystals belonged to the cubic structure I, and the hydration number was estimated about 6.0. Ethane and hydrogen sulfide were also detected in the Raman spectra, indicating that these gases were encaged with methane in the crystal. We obtained hydrate-bound and headspace gas samples on board and measured their molecular and stable isotope compositions. According to an empirical classification of the methane stable isotopes, $\delta^{13}C$ and δD of the headspace gases indicated that the methane in the study area was mainly microbial origin via carbonate reduction; however, methane in some sediment cores showed larger $\delta^{13}C$ and δD, suggesting their thermogenic origin. We retrieved three sediment cores with gas hydrate at the same site, and their $\delta^{13}C$ of hydrate-bound methane were from -47.5‰ to -41.6‰. On the contrary, a hydrate-bound microbial methane ($\delta^{13}C$: -68.6‰) was obtained only 12 km apart from the above thermogenic site.

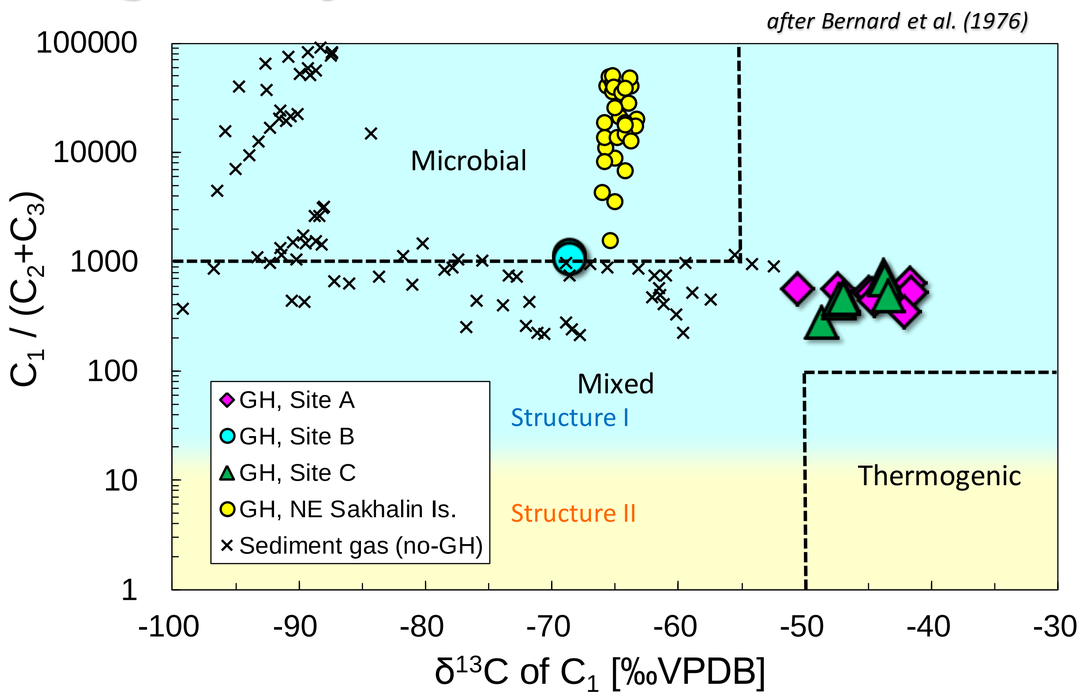
Keywords: gas hydrate, stable isotope, Raman, thermogenic methane

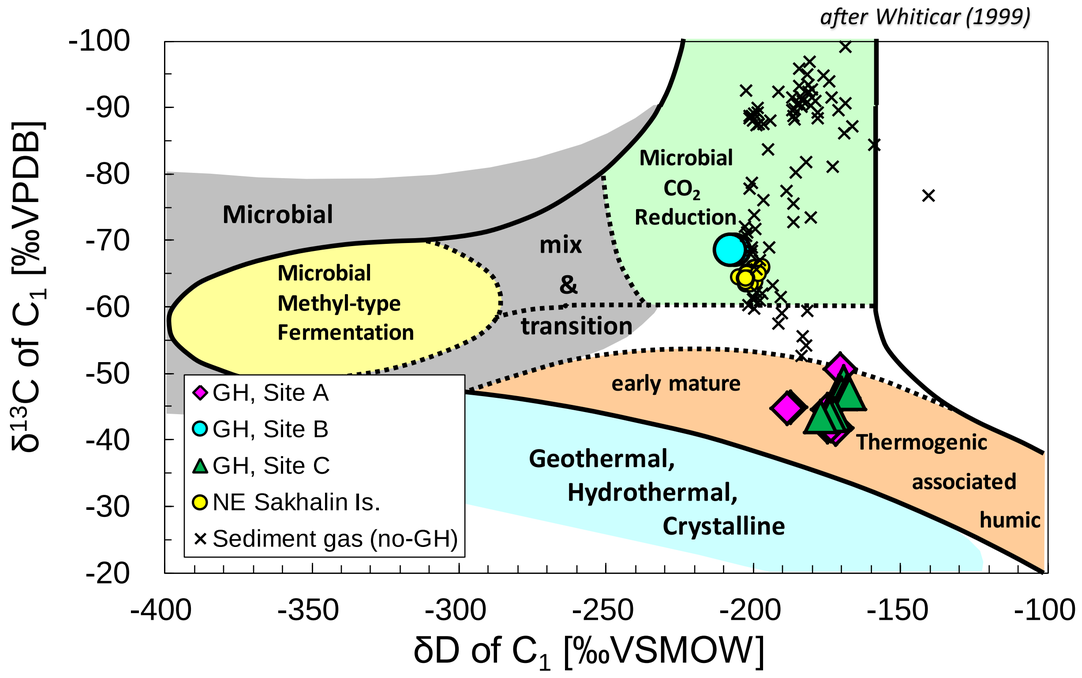


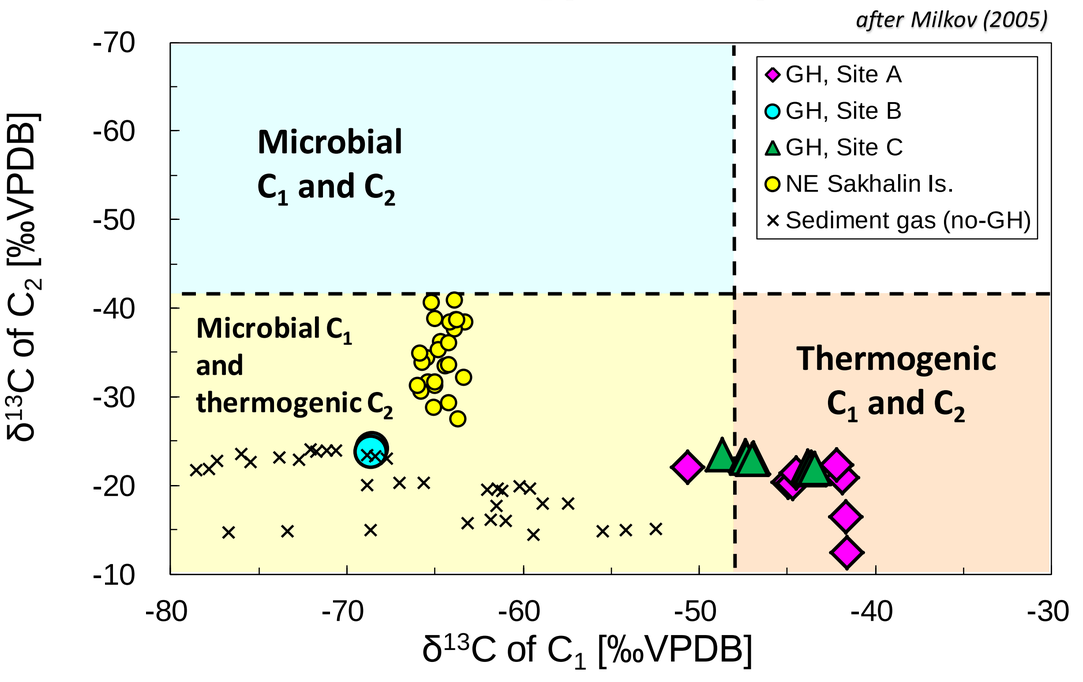




Origin of hydrocarbons







Headspace gas of GH cores