

## Calorimetric measurement and Raman spectroscopic analysis of natural gas hydrates in the Sea of Okhotsk

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Seven seepage structures were discovered in the CHAOS1 and CHAOS2 cruises offshore the northeast of Sakhalin Island, the Sea of Okhotsk. We obtained samples of natural gas hydrate and analyzed dissociation heat and hydration number using calorimeter and Raman spectrometer. The hydration numbers of the samples were estimated as  $6.19 \pm 0.02$  from the Raman spectra of C-H stretching mode and a thermodynamic calculation described by Sum *et al.*. Heat flow calorimetry revealed that dissociation heat of the natural samples was  $18.1 \pm 0.3$  (kJ mol<sup>-1</sup>) (from hydrate phase to gas and ice phases) and  $55.4 \pm 0.4$  (kJ mol<sup>-1</sup>) (from hydrate phase to gas and water phases), respectively, which agree fairly well with those of literature values. Raman spectra also revealed that molecules of hydrogen sulfide were encaged in both large and small cages.