

# Diversity, distribution, and potential activity of methanogens in deep subsurface sediments from a marine methane hydrate area

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Methane hydrate is a clathrate compound in which a large amount of methane is trapped within a crystal structure of water. It forms where a high concentration of methane is dissolved in water under low-temperature and high-pressure conditions. Global occurrence of methane hydrate is therefore restricted to deep-sea and polar continental sediments. The size of marine methane hydrate reservoir is estimated to be larger than those of other natural gas resources, and many countries have been seeking for its possibility as future natural gas resource. In Japan, the production test of marine methane hydrate was carried out in early 2013 in the eastern Nankai Trough, where the volume of methane in the hydrate is estimated to be about 40 Tcf in total and 20 Tcf in the hydrate concentrated zones.

In order to develop and improve the technology for exploration and assessment of marine methane hydrate accumulations, we need to understand their formation processes, which begin with the methane production in marine subsurface. It is often the case that methane in marine methane hydrate, including those in the eastern Nankai Trough, is mostly microbial in origin. However, it remains unclear what kind of methanogens are present, where they mainly live, how fast they produce methane, and what controls the rate. To address these issues, we have been conducting research to measure potential activity of methane production using <sup>14</sup>C-tracers, to measure polar lipid biomarkers specific to methanogens [1], and to analyze microbial community structures in core sediment samples obtained from drilling in the area of methane hydrate distribution in eastern Nankai Trough. In this paper, we will show the results and their implications for the process of marine methane hydrate formation.

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[1] Oba *et al.* (2015) *Org. Geochem.* **78**, 153-160..