

Isotopic and microbial compositions of carbonate nodules from sea bottom sediments in the Japan Sea

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Carbonate precipitates on sea bottom sediments and shallow core in methane seep areas are often associated with methanogens. Anoxic methane oxidization is a particularly important metabolism for carbonate precipitation in terms of raising local alkalinity and supersaturation. We recovered carbonate nodules from sea bottom sediments from Umitaka Spur, Joetsu Knoll and Akita offshore during an expedition for gas hydrate in the Japan Sea in August-October 2013. We investigate microbial metabolisms for carbonate precipitation based on textural observation, isotopic measurement, and gene analysis.

Many specimens appear grapestone textures consisting of aggregated small nodules, which indicate multiple generation of carbonate precipitation. Aragonite needles are commonly observed on outer margin and in pore spaces in the grapestone. Core part of the nodules are often black color due to concentration of organic substance. Isotopic compositions were measured for sub-samples that were micro-drilled from the section of the nodules. Some of the Umitaka specimens exhibit large variation in carbon isotope, which generally decrease from core to margin. Methanogenesis is only accountable microbial processes for the highest values up to +12 permil. This metabolism can separate organic carbon into ¹³C-depleted methane and ¹³C-enriched carbon dioxide species. On the other hand, nodules from Joetsu and Akita are relatively homogenous and very low (-45 to -60 permil) in carbon isotope. This indicate that carbonate carbon in the nodules was largely originated from methane. Gene analysis for an Umitaka specimen extracts many sulfate reducers, but no methanogens. This specimen was calcified by sulfate reduction of organic matter.

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