

Microdolomitic evidence for deep biosphere contained inside of the saline inclusions within Japan Sea massive gas hydrate

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Spherical aggregates of microdolomite were recently discovered within massive gas hydrate recovered from Joetsu Basin sediments, Sea of Japan. The dolomite is only found within the hydrate and not in surrounding sediments, and the salt exclusion caused by hydrate growth is apparently sufficient to initiate dolomite precipitation within hydrate fluid inclusions. These conditions have led to a depletion in oxygen-18 within the dolomite aggregates, as well as a carbon isotopic composition similar to that of deeply-sourced dissolved inorganic carbon. The grains themselves are commonly around 20-50 microns in diameter, and are present as single grains or are grouped as paired dumbbell structures, or in chains or cauliflower shapes. The grains contain voids which enclose saline water, gas, and organic matter presumably from the time of active hydrate growth. The residual saline water within the voids is enriched in sodium, chloride, and strontium. The primary trapped gas is carbon dioxide, and the methane content is below detection in the voids, suggesting that methane oxidation was ongoing even after the void material was isolated from the surrounding hydrate waters by dolomite growth. Preliminary work with fluorescent dye indicates the preservation of microbial DNA within the voids of the microdolomite aggregates. Ongoing research will focus on the relationship between hydrate growth in marine sediment and the microbial communities hosted within. This study was conducted under the commission from AIST as a part of the methane hydrate research project funded by METI (the Ministry of Economy, Trade and Industry, Japan).

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