

Microdolomites are not MDACs: microbially-derived carbon source for microcrystalline dolomite found within massive gas hydrates and implications for the shallow marine carbon cycle

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Methane derived authigenic carbonates (MDACs) are commonly found associated with both active and remnant submarine seeps and, under favorable conditions of pressure and temperature, are also found in close contact with marine methane hydrate. Recently, we have discovered microdolomitic aggregates inside of massive Japan Sea gas hydrates. These are fundamentally different, both in chemistry, stable isotopic composition and growth habit to the MDACs encountered outside of the hydrates. Phylogenetic analysis of microbial DNA within the dolomites reveals primarily Bacterioidetes, bacteria whose principal energy source is the degradation of complex macromolecules such as oils. Actual analysis of the oils found inside of the Sea of Japan gas hydrate confirms that they are biodegraded during burial. Previous investigations of MDACs have focused on ANME methane oxidizers (ANME) and sulfate reducing bacteria (SRB) as the primary drivers for MDAC precipitation in shallow sediment. The discovery of microbial dolomites inside saline gas-hydrate inclusions opens up a number of research avenues and applications such as: Mars-analogue studies, microbial remediation of marine oil-spills, and investigations into the role of shallow marine microbes in the conversion of organic carbon into dissolved inorganic carbon. This study was conducted under the commission from AIST as part of the methane hydrate research project funded by the Ministry of Economy, Trade and Industry, Japan. Ongoing work is being carried out thanks to a Grant-in-aid provided by the Japan Society for Promotion of Science and the Japanese Ministry of Education, Culture, Sports, and Technology (Kaken Project # 17K05712).

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