

## Dolomite formation catalyzed by sulfate-driven anaerobic oxidation of methane

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Laboratory syntheses of stoichiometric and ordered dolomite at Earth-surface conditions have not succeeded. However, dolomite has been discovered among the authigenic carbonate minerals forming by sulfate-driven anaerobic oxidation of methane (SD-AOM) at marine cold seeps. To study the formation mechanism of dolomite, we investigated seep carbonates from the Shenhu area and the Southwest (SW) Taiwan basin of the northern South China Sea [1].

The dolomites represent Ca-dolomite and weakly ordered dolomite in Shenhu and SW Taiwan samples, respectively. The Ca-dolomite is mostly composed of dolomite structure, only a few domains show Mg-calcite structure. Weakly ordered dolomite, containing less MgCO<sub>3</sub>, shows heterogeneously distributed domains of Mg-calcite and dolomite structures. Positive correlations between the Mg/Ca mole ratios, cerium anomalies, Nd<sub>N</sub> to Yb<sub>N</sub> ratios, and <sup>13</sup>C-depletion indicate that the incorporation of Mg<sup>2+</sup> into carbonate lattice was promoted by SD-AOM. We suggest that the catalytic effects of dissolved sulfide and extracellular polymeric substances (EPS) are the most plausible factors favoring the formation of dolomite at seeps [2, 3]. The firstly formed Ca-Mg carbonates might be disordered nano-crystals [2, 3]. Their MgCO<sub>3</sub> contents are positively correlated with the concentration of sulfide and EPS, which reflects the intensity of SD-AOM. After growth, recrystallization, and maturation, Ca-Mg carbonates with high MgCO<sub>3</sub> contents turned into Ca-dolomite, whereas those with relatively less MgCO<sub>3</sub> transformed into weakly ordered dolomite.

Our study contributes to the understanding of the relationship between carbonate phases of seep deposits and the status of cold-seep activity.

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