

Mg isotope composition in hermatypic and deep-sea corals

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Biogenic skeletons are well known for strong vital effects with respect to traditional isotopes such as oxygen and carbon. These outcomes throw a common recognition that biomediated chemical processes obey not thermodynamic equilibrium but strong kinetics. The Mg/Ca ratio of biogenic carbonates is used as a proxy to reconstruct physicochemical co-precipitation conditions. However, the relationship between the Mg/Ca ratios and the physicochemical condition is inconsistent among different taxa and inorganic experiments. Recently, isotopic fractionation of divalent cations has made a great progress in understanding the chemical and biochemical processes during biomineralization. It is still a hot topic whether and how magnesium isotope fractionation is driven by inorganic chemical reaction and/or by vital effect. In this study, we perform high-precision Mg isotope measurements of carbonate skeletons using MC-ICP-MS to assess physicochemical controlling factors in different biota of two genus of hermatypic coral, *Acropora* sp. and *Porites* sp., and five species of deep-sea coral, *Corallium* sp., *C. japonicum*, *C. konjoi*, *Paracorallium elatius*, *Keratoisis* sp. Consequently, isotopic compositions of biogenic carbonates are consistently lighter than that of seawater with different degrees. Moreover, three-isotope systematic of Mg (mass numbers 24, 25, and 26 with relative abundance of 78.99, 10.00, and 11.01%) was applied to the samples to understand the isotopic partitioning process. The differences in isotopic partitioning for equilibrium and kinetic reaction are governed by the mass-dependent fractionation laws. Although deep-sea corals precipitate calcium carbonate slowly more than approximately 2 orders of magnitude relative to shallow-dweller hermatypic corals, the co-precipitation of Mg into skeletons of deep-sea coral are strongly affected by the kinetic chemical reaction in contrast to hermatypic corals and foraminifera whose carbonates are precipitated under close to equilibrium chemical reaction.