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Oxygen and Carbon Isotopes of Cold-water Corals——Reconstructing Paleotemperature changes and Calcification Mechanism

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Cold-water corals represent an intriguing paleoceanographic archive with a great potential to reconstruct high-resolution paleoenvironmental changes. Compared to those of shallow-water corals, proxies derived from cold-water corals have been complicated by biologically mediated vital effects. The oxygen and carbon stable isotope compositions of cold-water coral skeletons are more depleted than the expected carbonate-seawater equilibrium values by ~4–6‰ and ~10‰, respectively. Therefore, it is necessary to correct for the vital effect before using $\delta^{18}O$ as a temperature proxy. $\delta^{18}O$ and $\delta^{13}C$ of cold-water corals exhibit strong linear correlations after adjusting for ambient seawater $\delta^{18}O$ and $\delta^{13}C$ values. The $\delta^{18}O$ intercepts of this linear regression were found to be correlated with water temperatures. This so-called 'intercept method' can therefore be used to reconstruct temperatures variations of intermediate and deep oceans. Moreover, sampling along the growing bands of cold-water corals can provide samples to generate temperature sequences. After that, three geochemical models have been proposed to explain the $\delta^{18}O$ and $\delta^{13}C$ depletion of cold-water corals. However, none of them can explain the behavior of all geochemical parameters. In future, more analyses and experiments at micro-scales are required to adjust these geochemical models or propose new ones.