

Clumped isotopes of paired dolomite and calcite examining Cambrian-Ordovician seawater oxygen isotope

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The secular change of seawater oxygen isotope ($\delta^{18}\text{O}$) in Phanerozoic remains a matter of debate. Either the $\delta^{18}\text{O}$ value of seawater during Cambrian-Ordovician either drops dramatically or it remains relative constant ($\sim -2\text{‰}$). Possible interpretations are that seawater temperatures were significantly higher than at present or there has been an intense interaction of seawater with ocean crust, or alteration by post-depositional processes. Carbonate clumped isotope thermometer (Δ_{47}) of paired dolomite and calcite, separated by acetic acid buffered leaching method, offers a framework for evaluating the post-depositional alteration and also can be used to further constrain the seawater $\delta^{18}\text{O}$ value during the early Phanerozoic. Petrographic and geochemical evidence indicate the separated dolomite and calcite experienced closed-system recrystallization in burial stage. While the separated dolomite formed from normal seawater, the separated calcite is a product of early meteoric diagenesis. A water-rock reaction model is used to simulate the pathway of Δ_{47} values in closed-system recrystallization and constrain the seawater $\delta^{18}\text{O}$ value. A negative $\delta^{18}\text{O}$ value (-8‰) of seawater is able to explain all the meteoric calcite values, but these are inconsistent with the marine dolomite, which argues against a drop of the $\delta^{18}\text{O}$ value of Cambrian-Ordovician seawater. In contrast, using a constant seawater $\delta^{18}\text{O}$ value (-2‰) is comparable to the measured Δ_{47} values of marine dolomite supporting an invariable $\delta^{18}\text{O}$ value in Cambrian-Ordovician seawater. This study shows an example of how to reconstruct primary $\delta^{18}\text{O}$ value using altered clumped isotopes of carbonates and sheds light on the fidelity of geochemical signals in marine dolomite.