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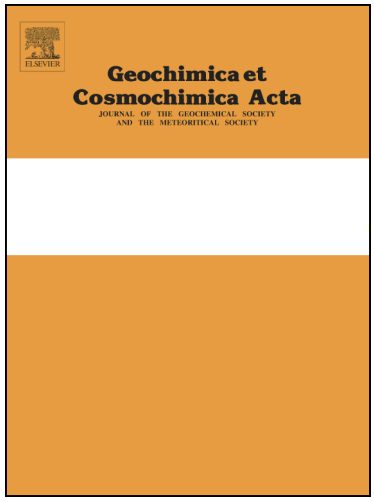

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Impacts of pH and [CO_3^{2-}] on the incorporation of Zn in foraminiferal calcite

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Abstract

The trace elemental composition of foraminiferal shell calcite is known to reflect the environment in which the shell was precipitated. Whereas conservative elements incorporated in foraminiferal shell carbonate reflect factors such as temperature (Mg), carbonate chemistry (B) and salinity (Na), the nutrient type elements (Ba, Cd, and possibly Zn) are useful tools to reconstruct biogeochemical cycling and past ocean circulation. Still also nutrient-type elements will be most likely influenced by factors other than their relative concentrations. Culturing benthic foraminifera under controlled carbonate chemistry conditions allows for disentanglement of impacts of different parameters of the carbon system on the elemental composition of foraminiferal calcite. Here we show that zinc incorporation in cultured specimens of the benthic foraminifer *Ammonia tepida* is correlated to changes in carbonate ion concentration ([CO_3^{2-}]). By modeling activities of different chemical species of Zn in seawater over a range of [CO_3^{2-}], we suggest that Zn^{2+}, rather than other relatively abundant Zn-species (e.g. $ZnCO_3^0$ and $ZnHCO_3^+$) is taken up during biomineralization. Our results suggest that foraminiferal Zn/Ca might be especially useful when combined with other [CO_3^{2-}] proxies, enabling reconstruction of past seawater element concentrations. Conversely, when the nutrient-type element

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