

Oxygen isotope and Mg/Ca ratio of high magnesium calcite of benthic foraminifera as a proxy for water temperature

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Although metal/Ca or oxygen isotopes ($\delta^{18}\text{O}$) of organic precipitated calcium carbonate (calcite and aragonite) of marine species have been used to estimate paleotemperature, the relationships between components of large benthic foraminiferal shells (high-magnesium calcite) and seawater temperature has yet to be established. We investigated the possibility as a proxy for seawater temperature through culture experiments of three species of reef-dwelling large benthic foraminifera in a laboratory. Three species found commonly in the western Pacific were selected including perforate species *Calcarina gaudichaudii*, and imperforate species *Amphisorus kudakajimensis*. All of them are host to algal symbionts. They grew sufficiently during culture experiments and showed a maximum in terms of shell length and weight at 27°C and 29°C while they were significantly small at 30°C. Mg/Ca ratios of three species in similar range showed high correlation to water temperature, suggesting Mg/Ca ratios as a precise proxy for paleo-temperature in shallow-reef environment. In terms of $\delta^{18}\text{O}$, *C. gaudichaudii* showed strong correlation versus temperature while $\delta^{18}\text{O}$ of *A. kudakajimensis* showed less significant correlation possibly caused by poor growth of unhealthy individuals. The trends in the temperature and oxygen isotope ratios were similar for both species, suggesting the potential of oxygen isotope ratios in the tests of reef-dwelling foraminifera as a paleo-thermometer. Species-specific calibration may be necessary for the use of $\delta^{18}\text{O}$ of reef-dwelling large benthic foraminifera as a proxy of paleo-temperature.

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