Abstract

This study is fundamentally focused on a simple, but relatively unpondered problem: the coral $\delta^{18}O$ temperature sensitivity ($dG/dT$). Previous paleotemperature studies of corals have involved the use of either: 1) the calcites $\delta^{18}O$ temperature sensitivity for mollusks (Epstein et al., 1953) or 2) the slope value ($AG_{\text{AT}}$) obtained by comparing annual temperature extrema versus annual $\delta^{18}O$ extrema in the annual growth bands of coral skeletons. Because both perspectives involve the use of different values for the thermal sensitivity of the coral skeleton, significant discrepancies may be obtained while reconstructing oceanic paleotemperatures. In order to solve this problem, a field calibration was conducted by comparing the $\delta^{18}O$ composition of coral skeletons of Porites lobata with sea surface temperature (SST). A paleotemperature equation for $P.$ lobata was determined by comparing the sclerochronologically determined monthly skeletal $\delta^{18}O$ values with monthly SST values for the Costa Rican coast. Additionally, when $\delta^6$W effects were considered in the coral skeletons, it was found that Porites yields a temperature dependent $\delta^{18}O$ isotopic fractionation between 0.222 and 0.2359 WC. This study reveals that the thermal sensitivity of the coralline aragonite is slightly larger than that for mollusks calcite. Therefore, future oceanic paleotemperature applications that involve corals should avoid the use of the thermal sensitivity of the $\delta^{18}O$ of biogenic calcite, as has been done in the past. The use of the slope value proposed here may also eliminate the common problem of the seasonal AFC not matching the A($\delta^{18}O$-6W) observed in the coral skeletons.

Keywords

corals, marine geochemistry, stable isotopes, paleoceanography.