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Calcium isotopes in corals – influence of temperature and calcification rate

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Corals are the most important producers of aragonite on earth. Consequently, they play an important role in the global calcium cycle. Knowledge of Ca isotope fractionation in coral skeletons is vital for understanding calcium isotope fluxes in the oceans. Published reports on the Ca isotopic composition of coral skeletons are ambigous and nothing is known about controlling factors like temperature, light, pH or growth rate.

We used skeletons of the reef coral *Acropora* sp., cultured under controlled conditions in the laboratory of the Centre Scientifique de Monaco (Reynaud-Vaganay et al. 1999). Environmental conditions were kept constant except for temperature, which was varied in several experiments between 21˚C and 29˚C. For comparison we also investigated samples of a *Pavona clavus* coral from Galapagos, which grew at water temperatures between 22 and 27 ˚C.

Cultured and wild corals show $\delta^{44/40}$Ca values identical within statistical uncertainties. The $\delta^{44/40}$Ca values are correlated with temperature. The regression line slope is 0.02 permil*$^{\circ}$C^{-1}, identical to the published values for *O. universa* (Gussone et al. 2003). However, the coral samples are enriched in $\delta^{44/40}$Ca by 0.5 permil compared to inorganic and sclerosponge aragonites.This offset can be explained by the influence of calcification rate on Ca isotope fractionation in carbonates(Lemarchand et al., 2004).

The aragonite fractionation line used for comparison with the coral values is based on inorganic precipitates and sclerosponges, both with extremely slow calcification rates. Applying the fractionation-growth rate dependence of Lemarchand et al. (2004) to our data, we find that the significantly faster precipitation rates of reef corals can

quantitatively explain the higher coral $\delta^{44/40}$Ca values compared to the other aragonite materials. With that the coral data are in line with the hypothesis that Ca isotope fractionation in $CaCO_3$ is controlled by mineralogy (Gussone et al, this conference) in addition to precipitation rate effects (Lemarchand et al., 2004). The invariance of the temperature-fractionation relation, despite variable growth rates and biologically influenced calcification, can provide useful insights into biocalcification mechanisms of corals and other organisms.

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