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Oxygen isotope fractionation of coral skeleton is strongly impacted by kinetic process: an inherent coral feature

A. Juillet-Leclerc (1), C. Rollion-Bard (2), and S Reynard ()

(1) LSCE, CNRS, Gif sur Yvette, France, (2) CRPG-Nancy, (3) CSM Monaco

Although grown under constant conditions, d18O of cultured Acropora measured at micrometer size scale show variability up to 5 per mil. By deciphering isotopic signature of the two crystalline forms recognized in the coral skeleton, it appeared that COC (center of calcification, massive crystals) and fibers aragonite was not deposited following identical process. Indeed, COC d18O are the lowest values, almost constant while fiber d18O are scattered. Such an isotopic distribution could be a common characteristic to all coral genera.

High scattering of fiber isotopic data can only be explained by kinetic deposition. The COC deposition mechanism remains still obscure. However, according to the interpretation of isotopic data in kinetics term, COC could be precipitated following the highest degree of isotopic and thermodynamic disequilibrium while fibers experienced all kinetic conditions.

We verified that the crystals named fusiform crystals by Gladfelter (1982) are corresponding to COC. By trusting author assumption we infer that each crystalline form is associated with a specific growth mode following perpendicular axis and governed by different deposit processes. All Scanning Electron Microscope (SEM) and Field Emission Scanning Electron Microscopy (FESEM) investigations converge to demonstrate that each crystal type and thus mineral precipitation process is associated to different chemical organic environment.

These conclusions shed new light on the vital effects observed on data time series used in paleoclimatology.