Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11311

Do corals really use amorphous calcium carbonate (ACC) to build their skeletons?

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Contemporary scleractinian coral skeletons are composed of the calcium carbonate ($CaCO_3$) mineral aragonite. The mineralogy of the skeleton is the fundamental basis of developing paleoproxies—based on element partitioning between seawater and aragonite—and understanding coral calcification responses to ocean acidification—based on the declining supersaturation of aragonite in seawater. However, some recent studies have proposed that, rather than corals directly precipitating aragonite, corals precipitate amorphous calcium carbonate (ACC) particles that are stuck together before transforming into aragonite. If true, this proposed mechanism would up-end decades of paleoclimate research that is rooted in applying aragonite-seawater partitioning coefficients to ancient coral skeletons, and it would fundamentally alter projections of how coral calcification is sensitive to ocean acidification. Testing this new hypothesis is challenging, owing to the claims that (1) the ACC particles are micron-scale or smaller, (2) they are only found at the outermost surface of skeleton that is covered by coral tissue, and (3) the transformation from the ACC particles to aragonite occurs on a timescale of hours. These claims preclude techniques such as mass spectrometry and XRD from being used to test for the presence of the ACC phase. We propose that the technique most suitable for answering this question is *in vivo* Raman spectroscopy. This approach includes several characteristics that make it ideal for resolving this ongoing debate: (1) Raman spectroscopy can unambiguously distinguish between ACC and aragonite, (2) the laser beam inciting Raman scattering can be focused to a micron-scale volume, (3) high-quality spectra are generated in a matter of seconds, and (4) it can be applied to living corals to characterize the most recently formed skeleton without harm to the organism or alteration of the specimen. Here, we will present the results of replicated *in vivo* Raman spectroscopy analyses aimed at testing whether ACC particles serve as a step in the coral skeleton-building process.