Aragonite precipitation in coral cell cultures

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The mechanistic aspects of coral calcification at the molecular, cellular, and tissue levels are poorly understood. In this study, we examine calcium carbonate precipitation using novel coral tissue cultures ("nano-polyps"). Our goal has been to establish a cell culture system that facilitates calcification at a cellular level, while simultaneously allowing in-vitro manipulations of the calcifying fluid, thereby enabling us to study the biomineralization process and its implications for coralline geochemical proxies. To date, we have maintained viable cell cultures from symbiont-bearing corals for up to 8 weeks. Using a seawater-enriched medium with a carbonate saturation state similar to open ocean surface waters (aragonite saturation state Ω_{arag} ~4), the primary tissue culture assembles nano-polyps that produce extracellular organic matrix (EOM) and precipitate aragonite crystals. EOM contains several proteins previously identified in coral skeleton. The extracellular aragonite crystals, from 1 to 10 μm in length, originate from the nano-polyps and are identified by their distinctive elongated crystallography and X-ray diffraction pattern. In contrast, no inorganic $CaCO_3$ production occurs in control experiments. Under these experimental conditions, the EOM and aragonite crystal production from nano-polyps is apparently independent of photosynthetic rates. Our results demonstrate that the nano-polyps aggregated from primary coral tissue culture function from a biomineralization perspective similar to whole coral, therefore providing a novel tool for investigations of the calcification mechanisms.