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Towards improved coral-based geochemical proxies: separating the organic matrix from aragonite

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Scleractinian coral skeletons are dominantly composed of aragonite, but also contain an intracrystalline organic fraction which makes up 1-2% of the coral skeleton by weight. The organic fraction, termed the 'organic matrix' (OM), is composed of polysaccharides, proteins, and lipids, which facilitate biomineralization. The presence of OM complicates the application of coral-based proxies. It has been demonstrated with microanalysis studies that the coral OM is intimately associated with the coral aragonite phase, making it nearly impossible even with microanalysis techniques to avoid the organic matrix completely [1]. It is well understood that certain trace elements are preferentially enriched in OM-rich regions of the coral skeleton. Recent research has found that carbonate and organic fractions of corals have heavier K isotopes being observed in the carbonate fraction [2].

This study aims to develop a methodology for separating the OM from the aragonite fraction of bulk coral samples with an ultimate goal of characterizing trace element and isotope compositions of each phase. While there are existing methods for isolating OM for biochemical characterization, we extended these separations to be trace-metal clean, and tested methods to minimize exchange of metals between OM and aragonite during separation and dissolution. This approach includes using different solutions for skeletal dissolution, and purposeful rinses to replace or remove organic-bound trace elements, followed by measurement of various element/Ca ratios and K isotopes in our separated carbonate and OM fractions.

Preliminary results indicate that we were able to create full separation between organic matrix and coral carbonate. We find that carbonate and organic fractions have distinct 41K ratios, generally consistent with results described in Li et al. (2022). These results show potential for measuring the trace metal geochemistry of organic matrix and coral aragonite independently. We expect this approach to lead to a better understanding of the trace element composition of coral OM, as it has potential to improve coral-based proxies by removing the OM component and minimizing geochemical variability attributed to vital effects.

[1] Drake et al. (2020), *Global Change Biology* 26, 31-53.

[2] Li et al. (2022), *Earth and Planetary Science Letters* 581, 117393.