Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19721

Understanding Nitrogen Incorporation into Skeletons of Scleractinian Coral from Field Data and Laboratory Experiments

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Coral skeleton-bound nitrogen isotopes (CS-$\delta^{15}N$) have become widely applied in palaeo-climatological research to record the $\delta^{15}N$ of source-water nitrogen (N), and to infer changes in N sources to reef ecosystems across space and time. However, the processes that determine N incorporation into the skeleton and their effect on interpretations of CS-$\delta^{15}N$ are still poorly understood. In this multi-year project, we intend to investigate these processes with a two-step approach. First, we characterise the natural variabilities of $\delta^{15}N$ in coral tissue, skeleton, and symbiodiniaceae by using coral samples spanning three species from three Western Pacific islands across two seasons. We then set up a tracer experiment using ^{15}N-labelled nitrate in incubated and wild coral samples to trace N incorporation into the skeleton of *Porites spp*. Our natural variability results show that the spatial changes in the $\delta^{15}N$ of coral tissue, symbiodiniaceae, and skeletal N are overall determined by the environmental N sources. Although seasonal changes in the CS-$\delta^{15}N$ of *Porites spp*. are clearly visible, we find no apparent seasonal changes in the tissue or symbiodiniaceae $\delta^{15}N$ from all three species including *Porites spp.* This may suggest that coral tissue N has a longer residence time than the skeletal N, and is in line with recent labelling studies that demonstrate long residence times for coral tissue N as a whole. The apparent seasonal CS-$\delta^{15}N$ changes and its correlation with environmental N sources then call for a direct pathway for N incorporation into the skeleton. We additionally show preliminary results from the ^{15}N-labelled nitrate labelled experiment.