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Coral nitrogen isotopes as a symbiosis proxy: An experimental study

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The isotopic composition of skeleton-bound organic nitrogen ($^{15}N/^{14}N$ ratio, or $\delta^{15}N$) in fossil corals has been used to study the origin and evolution of the symbiotic relationship between scleractinian corals and Symbiodiniaceae algae and has dated the evolution of coral symbiosis to at least 200 million years ago. These methods assume that as a result of internal nitrogen recycling and minimal ammonium excretion, symbiotic corals lack the typical 3 – 4‰ $\delta^{15}N$ trophic enrichment observed in animals (e.g., asymbiotic corals). Thus, symbiotic corals are expected to have a lower $\delta^{15}N$ than asymbiotic corals living in the same environments. However, this premise has not been sufficiently tested in modern settings. In a laboratory experiment, we investigated the $\delta^{15}N$ differences between the symbiotic and aposymbiotic branches in the same colonies of the facultatively symbiotic coral *Oculina arbuscula*. We found that the $\delta^{15}N$ of the symbiotic branches, among 4 different genotypes and across two different experiments, are consistently lower than that of the corresponding aposymbiotic branches. These results provide modern evidence supporting the use of $\delta^{15}N$ as a proxy for identifying coral symbiosis in the past, especially when multiple species of corals were present in the same environments.