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Understanding stable carbon isotopes in marine biogenic archives: the role of environment and biology

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Marine biogenic archives (e.g., carbonates and organic skeletal materials) accrete incrementally and preserve geochemical signatures that are used to reconstruct past ocean and carbon cycle changes. This information is particularly useful in pre-instrumental times and data-sparse regions. However, the interpretation of geochemical signals in these archives is often complicated by biological processes that can obscure primary environmental signatures.

Here, we compile a global database of published $\delta^{13}C$ time series from different taxa of marine biogenic archives, including coralline algae, scleractinian corals, proteinaceous corals, bivalves, and sclerosponges, all which can span the past several centuries. This synthesis enables an evaluation of the relative roles of environmental and biological controls on carbon isotope variability in marine carbonates and organic skeletons. We assess the extent to which these records capture environmental variability driving ambient dissolved inorganic carbon $\delta^{13}C$ including water mass mixing, upwelling, and the $\delta^{13}C$ Suess effect. We also evaluate the role of taxa-specific biology including different modes of acquiring carbon and vital effects during synthesis of the biogenic archive. Our results highlight the importance of disentangling environmental and biologicals effects when using biogenic archives to reconstruct carbon cycle perturbations in the recent past.