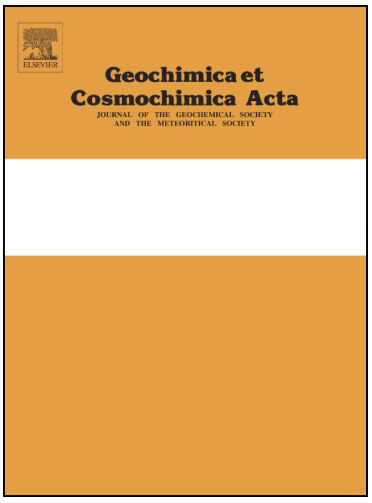

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Modeling the effects of diagenesis on carbonate clumped-isotope values in deep- and shallow-water settings

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Abstract
The measurement of multiply isotopically substituted ('clumped isotope') carbonate groups provides a way to reconstruct past mineral formation temperatures. However, dissolution-reprecipitation (i.e., recrystallization) reactions, which commonly occur during sedimentary burial, can alter a sample's clumped-isotope composition such that it partially or wholly reflects deeper burial temperatures. Here we derive a quantitative model of diagenesis to explore how diagenesis alters carbonate clumped-isotope values. We apply the model to a new dataset from deep-sea sediments taken from Ocean Drilling Project site 807 in the equatorial Pacific. This dataset is used to ground truth the model. We demonstrate that the use of the model with accompanying carbonate clumped-isotope and carbonate $\delta^{18}O$ values provides new constraints on both the diagenetic history of deep-sea settings as well as past equatorial sea-surface temperatures. Specifically, the combination of the diagenetic model and data support previous work that indicates equatorial sea-surface temperatures were warmer in the Paleogene as compared to today. We then explore whether the model is applicable to shallow-water settings commonly preserved in the rock record. Using a previously published dataset from the Bahamas, we demonstrate that the model captures the main trends of the data as a function of burial depth and thus appears applicable to a range of depositional settings.

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