

Uranium concentration variability in aragonitic stalagmites as a proxy for seasonal hydroclimate

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Aragonitic stalagmites can yield extremely high precision dates due to the high distribution coefficient of uranium in aragonite. Here, we use high-resolution ICP-MS derived trace element data from stalagmites sampled from Yok Balum Cave, Belize, to demonstrate a pervasive prior aragonite precipitation control on uranium concentrations in the stalagmites. The data, produced on the same powders as the stable isotope ratios, provide critical information regarding the seasonality changes that affected the study site. The monthly-scale correlation between carbon isotopes and uranium in particular is a powerful diagnostic tool for the amount and seasonality of prior aragonite precipitation driven by variable rainfall amounts. Like the carbon isotope record, the uranium concentration record indicates that failure of the summer rains, probably linked to southward migration of the Intertropical Convergence Zone, has driven the drying trend in Belize over the last century.

Combined with the amenability of aragonitic stalagmites to uranium-series dating, and the high resolution afforded by modern microanalytical techniques, our results suggest that uranium concentrations in aragonitic stalagmites are a particularly powerful tool that can provide information regarding seasonality shifts that are otherwise difficult to ascertain.