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Controls on trace elements in stalagmites derived from *in situ* growth in a Chinese cave

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Stalagmites provide powerful archives for paleoclimate with potential for seasonal resolution and precise chronology. Most published stalagmite records have focused on δ¹⁸O as a proxy for past change, but δ¹⁸O responds to multiple variables, particularly temperature, rainfall source, and rainfall amount. Separating these effects to provide unambiguous information about the past environment can be difficult, and there is a need for additional proxies that provide complementary information and allow deconvolution of the controls on δ¹⁸O. Trace-element concentrations show significant variability on all timescales in stalagmites, but the controls on trace elements are complex and no reliable trace-element proxies have yet been developed.

In this study we present data from drip waters and for calcites grown on glass plates under these drips to assess the controls on trace-element incorporation into stalagmites. The work was conducted in Heshang Cave in Central China, a site of existing paleoclimate work to reconstruct the Asian monsoon on millennial [1] to seasonal [2] timescales. Glass plates were replaced monthly for more than two years from January 2005 – a period that captures the unusually low summer rainfall of 2006 and therefore allows separation of the effects of temperature and drip-rate on stalagmite chemistry.

The mass of carbonate grown on the plates peaks in the summer months, regardless of the year, indicating the dominant influence of temperature rather than drip rate on growth. Changes in drip-water chemistry are relatively small during the year in this cave, but carbonate trace-element concentrations vary reflecting temperature-dependant distribution coefficients, the mass of calcite precipitated, and the growth rate. These effects can be separated to derive understanding of trace-element incorporation into stalagmites. These results will be compared to those from other caves, and from other carbonate-precipitating systems.