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Travertine laminae formation in Honey Creek within the Arbuckle Mountains of Oklahoma

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Seasonal changes in biological activity are suggested to cause the deposition of laminated travertine*, which are seen in both modern and ancient deposits. As deposition occurs, the seasonal changes may affect the stable isotopic and elemental signatures of the laminae. Here we present data from travertine samples collected on experimental substrates (glass slides) over four seasons (May 2016 to May 2017) in Honey Creek within the Arbuckle Mountains of Oklahoma where modern cool, freshwater fluvial "tufa" deposits are forming. Ambient water temperature was recorded hourly using an Onset HOBO temperature logger throughout the duration of the experiment. Water samples and other in situ data were collected seasonally and analyzed at several locations within Honey Creek as well as in a spring fed tributary to determine seasonal aqueous chemistry and identify factors influencing travertine precipitation. It was clear that travertine precipitated much faster on the experimental substrate during the warm season than during the cold season, suggesting travertine deposition and its clumped isotope-derived temperature could exhibit a bias to warm seasons.

Variations in the clumped isotope compositions (D_{47}) of the precipitated carbonate were consistent with the temperature logger data, and varied from 0.740‰ in winter to 0.680‰ in summer and fall, reflecting a change of temperature from ~7ºC to ~23ºC. The calculated water $d^{18}O$ values changed from -6.1‰ in winter to -4.6‰ in summer and fall. In order to identify the controlling factors on calcium isotopic fractionation during formation of travertine laminae or any potential seasonal variations, stable calcium isotopes and Sr concentrations will be presented from the same carbonate samples and waters that were analyzed for clumped isotopes and $d^{18}O$.

* first described as "travertine stromatolites"
Utech (M.S. Thesis, 1988); Chavetz et al. (1991)