Speleothem Sr/Ca and Mg/Ca Timeseries: An Updated Hydrologic Interpretation

D.M. TREMAINE[1]

[1]Department of Earth, Ocean, and Atmospheric Science & NHMFL, Florida State University, Tallahassee, FL 32301, USA, tremaine@magnet.fsu.edu

Trace element records in speleothems are commonly interpreted as weather-induced hydrologic conditions in the epikarst (e.g., dripwater residence times, prior-calcite-precipitation or PCP). But these records are difficult to quantify without *in situ* calibrations between cave hydrology and calcite chemistry. In this study at Hollow Ridge Cave (HRC) and Dragon's Tooth Cave (DTC) in Marianna, Florida (USA), cave dripwater, bedrock, and modern calcite (farmed seasonally *in situ*) were collected along with continuous rainfall amount and drip and ventilation rates [1, 2]. Anions, cations, and trace elements were measured to examine the relationships among rainfall, drip chemistry and calcite chemistry [2]. Sr/Ca and Mg/Ca ratios were used as diagnostic indicators of water source. Dripwater Mg/Ca and Sr/Ca ratios are distinct at each drip site and fall on coherent mixing lines between three geochemical endmembers; rainwater, dissolved limestone, and dissolved dolomite (Figure). Farmed calcite cation/Ca ratios faithfully track seasonal variations in dripwater chemistry for Na, Mg, Sr, Ba and U. However, trace element calibrations are unique to each drip site / speleothem pair regardless of proximity, suggesting that individual speleothems are not necessarily whole-cave hydrologic proxies.

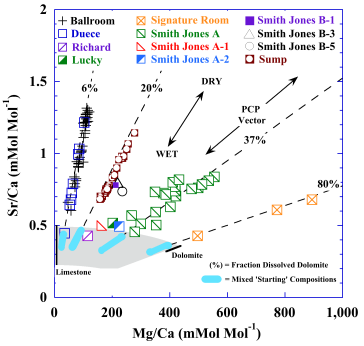

Figure: Dripwater Sr/Ca vs. Mg/Ca ratios. The Sr/Mg slope at each drip site reflects mixing between rainwater and dissolved bedrock limestone or dolomite. Dry period (increases in) PCP drives hydrochemistry out along vectors. Wet period (decreases in) PCP drives hydrochemistry down toward dissolved bedrock composition.

[1] Tremaine *et al* (2011) *Geochim. Cosmochim. Acta* **75**, 4929-4950 [2] Tremaine and Froelich (2013) *Geochim. Cosmochim. Acta* **121**, 522-545