South American Hydroclimate Change on Millennial and Orbital Timescales: Insights From 70,000 Year Amazon and Andes Speleothem Records

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The Amazon Basin is an ideal location for testing the Held and Soden hypothesis[1], which holds that wet regions should get wetter in response to global warming. In part to test this idea, we have extended the existing cave record from Paraiso Cave[2] (4.07°S, 55.45°W) beyond 45 ka. The full record[3] now covers 70 ka, allowing us to investigate 9 additional millennial scale events, as well as events that correlate with the MIS 4/3 transition.

The new record has $\delta^{18}O$ values ranging between -3 and -6‰ and for overlapping sections replicates the old record. The most prominent events in the extended record are a pluvial anomaly between 47.0 and 48.9 ka, correlative with Heinrich Stadial 5, and a negative shift accompanying the MIS 4/3 transition between 65 to 60 ka. Our stable isotope findings record a previously observed[2] millennial scale anti-phased relationship between Amazon rainfall on one hand, and Asian Monsoon strength and Greenland temperature on the other. On the orbital scale, we see correlative shifts between Amazon rainfall and atmospheric CO_2, consistent with the Held and Soden idea. New trace metal data gives us a secondary proxy for local hydroclimate conditions to pair with our $\delta^{18}O$ record. Preliminary analysis shows strong co-variation between Sr/Ca and Mg/Ca ratios in our samples (R^2=0.5427), making them ideal[4] for indicating prior calcite precipitation resulting from aridity. The trace metal data generally support our interpretation of the $\delta^{18}O$ record, indicating that local moisture availability varies in concert with overall rainfall patterns.

Another aim of this project is to deepen our understanding of moisture recycling and transport from the Amazon basin to the rest of tropical South America. To this end, we have extended the Huagapo Cave (11.27°S; 75.79°W) record[5] from the Peruvian Andes to match the length of our Amazon record, and will similarly pair stable isotopes and trace metal data. Together, these robust records will shed light on phenomena such as the South American precipitation dipole.

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