Speleothem-based Evidence for the 8.2 kyr Event on the California Coast

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An abrupt cooling event at 8.2 ka punctuates the relative stability of the Holocene record of Greenland air temperature. Stalagmite $\delta^{18}O$ records from China and Oman document an interval of weakened monsoon and increased aridity with a double-plunging structure also centered around 8.2 ka. Brazilian speleothem $\delta^{18}O$ records indicate enhanced monsoon precipitation, pointing to rapid teleconnections between the North Atlantic region and monsoon systems influenced by the Intertropical Convergence Zone. Although there is evidence for reduced sea surface temperatures off of the northern California coast at this time, a dearth of regional paleoclimate records of sufficient resolution to capture this event precludes our ability to determine its influence on western North American climate. Here we present a sub-annually resolved record of trace element variations from a speleothem from White Moon Cave that captures the time interval surrounding 8.2 ka and documents the response of coastal California climate to this period of abrupt change.

Speleothem SC-1 grew between 8.7 ± 0.03 and 7.1 ± 0.03 ka in White Moon Cave in the Santa Cruz Mountains. The sample grew relatively fast (75 to 100 μm/year) and confocal laser fluorescent microscopy reveals annual banding throughout the sample. Laser-ablation ICP-MS measurements of trace elements (Mg, Sr, Y, Ba, U) were conducted at sub-annual resolution. Sr and Ba display a strong positive correlation and likely record prior calcite precipitation, while Mg and U are negatively correlated. Mg, Sr, and Ba display annual periodicities. Sr and Ba decrease sharply (within ~ 10 years) at 8.24 ka, within dating error of a $\delta^{18}O$ increase in stalagmite HS-4 from Heshang Cave, China. Mg concentrations also fall sharply ~ 10 years after the decline in Sr and Ba. Sr concentrations increase at 8.15 ka, and Mg rises at 8.13 ka. Preliminary measurements also indicate more negative $\delta^{18}O$ in SC1 at this time. The nature of changes in SC-1 elemental concentrations around 8.2 ka display the same 2-pronged structure noted in speleothem records from China and Brazil and indicate that climate at this time became wetter with increased North Pacific sourced moisture, further suggesting that rapid teleconnections exist between the North Atlantic region and climate on both sides of the Pacific.