Multi-Cave Stalagmite Records of Deglacial Climate in California

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Records of past precipitation response in the American Southwest, including California, to warmings and coolings of the last deglaciation are important as baseline values for how precipitation patterns and source in this drought-prone region will change with future warming. Here we present two, U-Th calibrated, multi-proxy stalagmite records from central Sierra Nevada (CA) caves, spanning 19.1 to 10.6 ka, that document contemporaneous changes in precipitation with shifts in North Atlantic regional climate. These records document colder and wetter conditions during stadials, including Heinrich 1, the Older Dryas, and the Intra-Allerød Cold Period, and warmer and drier conditions during the Bølling and Allerød interstadials. Shifts to colder wetter conditions are indicated by abrupt decreases in $\delta^{18}O$, $\delta^{13}C$, $^{87}Sr/^{86}Sr$ and minima in Mg, Sr, and Ba concentrations. Interstadials are marked by increases in $\delta^{18}O$, $\delta^{13}C$, $^{87}Sr/^{86}Sr$, and elevated elemental concentrations recording enhanced prior calcite precipitation in the epikarst under drier, warmer conditions. Rapid growth in one stalagmite permits consideration of lead-lag relationships between California hydroclimate and North Atlantic climate events.

In order to investigate climate dynamics governing precipitation in the American Southwest in response to abrupt warmings and coolings of the past deglaciation, we are carrying out a paleoclimate model-data comparison for the Younger Dryas stadial (12.2 Ka) and Bølling interstadial (14.4 Ka). Greater modeled wind velocity, water vapor transport, storminess, and precipitation indicate that the Pacific winter storm track was likely more intense during the Younger Dryas cold period than during the Bølling warm interval. Our results further suggest an intensification of the Pacific winter storm track rather than southward shift during cold periods. The integrated speleothem proxy records and climate model results suggest the hydrological response in this region is likely reduced winter precipitation during global warming, with clear implications for projected continued warming.