Control on millennial scale events (H-events) inferred from triple oxygen isotope ratios of speleothems from a Northeast Indian cave

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The carbonate $^{17}$O anomaly ($\Delta^{17}$O) has recently been developed as a geochemical proxy for estimating the relative humidity of moisture at the source point of evaporation, which can be a vital tool in paleoclimate research. Speleothem $\Delta^{17}$O variability in particular may provide a quantitative constraint on moisture regimes at millennial and orbital timescales—far longer than can be addressed by analyzing $^{17}$O in other materials, such as tree rings. Modern observations and calibration studies have established a robust negative correlation between the $\Delta^{17}$O ($^{17}$O excess) of rainfall and relative humidity, so that $\Delta^{17}$O is enhanced during arid conditions at the moisture source. Herein, we report novel triple oxygen isotope data across the Last Glacial in speleothems collected from Cherrapunji Cave, northeastern India. Triple oxygen isotope measurements were obtained by an O$_2$-CO$_2$ Pt-catalyzed oxygen-isotope equilibration method. Preliminary results suggest lower $\Delta^{17}$O in speleothems during cold periods (e.g. Heinrich Events), which would imply higher relative humidity over the oceanic moisture source. Importantly, higher source relative humidity does not necessarily imply changes in precipitation amount at the cave site. While it is possible that a substantial geographic shift in the moisture source region (or additional contributions from secondary sources) could obfuscate the $\Delta^{17}$O signal, we argue that this explanation is unlikely for our study site. Alternatively, we cannot exclude the effects of excessive moisture recycling in the tropical ocean, which can enhance the $^{17}$O anomaly in cloud vapor (particularly if combined with large temperature swings) and thereby alter speleothem $\Delta^{17}$O. To refine our interpretation of the $\Delta^{17}$O signal in Cherrapunji Cave samples, we investigate multiple cold periods, as well as coeval samples from the Asian Summer Monsoon region. Finally, we compare our results with novel data from westernmost Asia, where temperature variations during cold events are more likely to be accompanied by large shifts in predominant moisture source, due to the migration of wintertime westerlies.