

## A Multi-Proxy Speleothem Record of Southeast Asian Monsoon Variability Since 46 kyr BP

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Despite significant advances in our understanding of tropical Indo-Pacific and monsoon climate variability on orbital to millennial timescales, we still know very little about the range and mechanisms of variability in the Southeast Asian monsoon (SEAM) region. To address this need, we have developed a new, decadal-resolved speleothem  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  record from three overlapping stalagmites collected from Tham Mai (TM) Cave in Northern Laos (N20°45.24', E102°39.09'; elevation 360 m). The speleothem records span the period from 46 kyr BP to the present and the age models are constrained by 35 U-Th dates. The orbital and millennial scale  $\delta^{18}\text{O}$  variability is remarkably similar to other Asian speleothem records, with a strong precessional signal and clear  $\delta^{18}\text{O}$  increases during Heinrich Stadials 1-5, the Younger Dryas, and the 8.2 kyr event. The strong similarity of speleothem  $\delta^{18}\text{O}$  records across the broad Asian monsoon region, in locations with quite different rainfall climatology, suggests that variations in upstream rainout and Indian monsoon strength are the dominant mechanism explaining orbital and millennial scale precipitation  $\delta^{18}\text{O}$  variability.

In contrast to  $\delta^{18}\text{O}$ , TM speleothem  $\delta^{13}\text{C}$  may be more reflective of local hydroclimate. The  $\delta^{13}\text{C}$  record shows the largest positive excursions during HS1, suggesting dry conditions with increased prior calcite precipitation and/or decreased soil respiration during these events. Interestingly, the  $\delta^{13}\text{C}$  data suggests that SEAM precipitation remained relatively unchanged during the Younger Dryas, and actually increased during the 8.2 kyr event. This variable response to high-latitude abrupt climate events suggests a fundamental difference in SEAM response to various abrupt climate events, perhaps dependent on glacial boundary conditions such as sea level or ice sheet size. In addition to stable isotope data, we will present  $^{14}\text{C}$ ,  $^{234}\text{U}/^{238}\text{U}$ , and climate model results to provide additional support for the inferred hydroclimate changes.