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The ultimate flood recorder: flood-deposited sediments preserved in stalagmites

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Shallow, dendritic cave systems in close association with the modern water table are commonly prone to flooding during high recharge events. The nature of the flooding involves numerous recharge points but few discharge points in the groundwater system, creating a condition of slow back flooding in the cave. Fine clays and silts may be suspended during the back flooding, which then coat bedrock and speleothem surfaces that are inundated by the flood waters. After flood waters recede, a thin, clay-rich layer representing the flood event may be preserved by the subsequent resumption of speleothem growth, which traps the detrital layer in calcite. Stalagmites that grow nearly continuously for long periods of time may thus preserve a detailed flood record for thousands of years.

Our example of this phenomenon comes from the mid-continent of North America, where high-precision U-Th dating provides a high resolution flooding chronology for the Holocene. Stalagmite CC-99-12-B was deposited at the fast average deposition rate of 68 mm per thousand years, and nineteen U-Th dates reveal an unusually uniform rate of deposition throughout the past 8,000 years. Millennial-scale cyclicity is a dominant feature in the stalagmite flood record. Furthermore, long-term variability of warm ENSO (El Niño) periods as modeled by Clement et al. (2000) shows a close correlation to the millennial-scale flooding frequency recorded in Crevice Cave. In modern times, El Niño increases precipitation in Missouri by enhancing moisture transport from the Gulf of Mexico, thereby generating increased storm potential during late fall and winter. To the best of our knowledge, ours is the most complete and best-dated long-term record of ENSO behavior for the North American mid-continent. Significance of these correlations may lead to predictions of frequency and magnitude of flooding for periods of warm ENSO-dominated climates, including the coming mil-

lennium.

Reference: Clement *et al*. (2000). *Paleoceanography* **15-6**: 731-737.