

A precisely-dated, composite stalagmite record of Indian summer monsoon variability from Siddha Baba cave, central Nepal, for the last 2700 yr

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The Indian summer monsoon (ISM), which today supplies ~75% of annual precipitation to South Asia, has been reconstructed across previous centuries using a variety of hydroclimate-sensitive proxies. In some of these cases, ISM variability far exceeds that observed in the century-and-a-half-long instrumental record. Understanding the origins of these events is best addressed by developing a wide-ranging, multi-proxy network of high-resolution ISM reconstructions. In Nepal, ISM variability has been examined through tree rings, glacial ice, and lake sediments, but no stalagmite isotopic records of ISM rainfall have yet been published.

Here we present a sub-decadally-resolved, precisely-dated, composite aragonite stalagmite record of ISM variability from Siddha Baba cave, central Nepal, for the last 2.7 kyr. A rainwater sampling program near the cave site, and a published study from Kathmandu (Adhikari et al., 2020), 150 km to the southeast, reveal that rainfall amount explains little of the observed variance in $\delta^{18}\text{O}$ values. Local hydroclimate is thus reconstructed from stalagmite $\delta^{13}\text{C}$ values, which we interpret as reflecting prior aragonite precipitation driven by changes in effective precipitation above the cave.

ISM variability is apparent across a number of time scales, including centennial periods of reduced or enhanced rainfall coincident with societally-relevant precipitation regimes identified at other sites across South Asia. These include the Neo-Assyrian drought in the eastern Mediterranean and Middle East (2.7-2.5 kyr BP; Kathayat et al., 2019), the Maurya Empire (2.1-1.9 kyr BP), and the Guge Kingdom (0.9-0.3 kyr BP) pluvials in India and Tibet (Kathayat et al., 2017). A secular shift toward drier conditions since 0.5 kyr BP in the Siddha Baba record tracks the $\delta^{18}\text{O}$ records from Dasuopu glacier, Nepal Himalaya, and Sahiya cave, North India. Numerous multidecadal oscillations are also evident, including markedly wetter conditions during the 18th century, in the late Little Ice Age, apparent in the Dasuopu and Sahiya records.

References

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