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Duration and structure of drier conditions in Central China during the 8.2 kyr event

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The response of the Asian Monsoon to the abrupt Northern Hemisphere cooling of the 8.2kyr event has been unclear. A comprehensive survey of monsoon records found no conclusive evidence for a response (Morrill et al. 2003) but more recent records identifies a period of drier conditions at this time (Wang et al. 2005; Hu et al. 2008). Understanding the magnitude and duration of this drier event in more detail is important to assess the response of the monsoon to climate change during a period of climate similar to today's.

In this study, we have characterized the 8.2 kyr event in Central China at sub-annual resolution using a stalagmite from Heshang Cave in the middle reaches of the Yangtze Valley (30.44N, 110.42E). Detailed U/Th chronology confirms the age of the event, while clearly resolved annual bands allow the duration to be precisely constrained. The thickness of these annual band decreases markedly from more than 0.2mm to approximately 0.1mm for a period of 130 years, consistent with significant drying during this period. Electron-probe mapping at seasonal resolution shows the highest Mg/Ca values of the entire Holocene exactly concordant with this slower stalagmite growth, as would be expected from an increase in prior-calcite-precipitation driven by lower rainfall. Approximately 900 stable-isotope samples were micromilled at a 40 micron resolution across the event giving an average resolution of appromimately 0.3 years. The oxygen isotope composition increases by 1.5permil over the first 30 years of the event and, after a brief excursion, then increases by a further 0.5permil into a 66 year long central portion during which all measured proxies suggest extreme dry conditions. The end of the event is then abrupt, with all proxies showing a return to wetter conditions in only a few years. Detailed comparison of the timing and duration of this new sub-annual resolution record with those from elsewhere allows an assessment of the linkages between the North Atlantic region, where the event is believed to originate, and the Asian Monsoon, and of the far field effects of this event more generally.

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Wang, Y.J. et al., 2005. The Holocene Asian monsoon: Links to solar changes and North Atlantic climate. Science, 308(5723): 854-857.