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Timing of the 8.2 ka cooling event inferred from δ^{18}O records of three stalagmites from Brazil, China and Oman

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The 8.2 ka event, a major Holocene cooling episode, has been well documented in central Greenland ice core records. The causes, extent, and geographical correlations of this event are still a matter of debate, mainly due to the difficulty of precise dating of climate anomalies around this time. The records from the central Greenland ice cores contain synchronous proxy anomalies of the event, such as rises in dust, K^+, and Ca^{2+} and a drop in methane, which likely link the event to the Asian Monsoon. Using U-series dating techniques, we dated the 8.2 ka event precisely using three stalagmites from Dongge Cave, China (D4, 25º17'N, 108º5'E), Padre Cave, central Brazil (PAD07, 13º13'S, 44º3'W) and Hoti Cave, Oman (H14, 23˚05'N, 57˚21'E). The dating errors are about 20 years. The Asian Monsoon changes recorded by Dongge and Hoti δ^{18}O excursions have broad similarities. The Dongge record shows a weak monsoon interval between 8.22 and 8.08 ka BP and the Hoti record has a monsoon de-

crease at $\sim$8.2 ka BP, followed by a hiatus (dry) until $\sim$8.05 ka BP. Similar to the Greenland records, the amplitude of δ^{18}O change of the 8.2 ka event (near 1 per mil) is approximately half the amplitude of the Younger Dryas (YD) cooling event in the Dongge record. As previously documented, the Asian Monsoon is anti-phased with central Brazil precipitation for major events during the last glacial period, including climate changes associated with the YD, Dansgaard-Oeschger, and Heinrich events. We demonstrate similar anti-phased relationship for the 8.2 ka event as well, based on the comparison of the Padre record with the Dongge and Hoti records. The Padre δ^{18}O record shows a short-lived high precipitation interval centered at $\sim$8.17 ka BP, with a δ^{18}O amplitude of $\sim$1.2 per mil, also approximately half of the YD amplitude in the region. The timing of the Padre 8.2 ka event is synchronous within dating errors with Greenland ice core records. In particular, the event's timing of 8.17 $\pm$0.02 ka BP is consistent, within comparable errors ($\sim$20 years), with those recently precisely constructed from NGRIP and GRIP (ss09sea), and inferred from correlation between the GRIP ^{10}Be and tree ring Δ^{14}C records. Our results indicate that the onset of the 8.2 ka event occurred at $\sim$8.2 ka BP in Asia, central Brazil and Greenland synchronously within $\sim$20 years, supporting the global extent and atmospheric transmission of the event and, thus, suggesting a strong sensitivity and linkage within the climatic system. The anti-phased relationship between the Asian Monsoon and central Brazil precipitation is analogous to the relationship observed for the YD. Thus, it is plausible that the event is tied to North Atlantic thermohaline circulation changes, which affect North Atlantic climate, which, in turn affects ITCZ position, resulting in the observed low-latitude precipitation patterns.