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Vegetation dynamics, corresponding climate change and Indian Summer Monsoon variability during the Middle-to Late Holocene from the Core Monsoon Zone, India: Reflection of the 8.2 ka event?

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A B S T R A C T

We provide records of the Indian Summer Monsoon (ISM) variability since ca. 8220 cal yr BP from the Core Monsoon Zone (CMZ), India. The study revealed that between ca. 8220 and 7600 cal yr BP, tree savannah vegetation occupied the landscape under a cool-dry climate, indicating a reduced ISM rainfall. This phase of harsh climate broadly coincides, rather overlaps with the global "8.2 ka cooling event" of the North Atlantic. Visual inspection of the pollen diagram, however, does not reveal a clear signal of the '8.2 ka' event. Lack of robust chronology, coarse sampling resolution (4 cm intervals), pollen preservation bias, and 'insensitive' vegetation response to the most severe Holocene cooling event in the Northern Hemisphere could be cited as plausible reasons for the non-detection of the global '8.2 ka event'. The ISM gradually evolved during ca. 7600–4980 cal yr BP, ca. 4980–3775 cal yr BP, ca. 3775–920 cal yr BP, and ca. 920 –145 cal yr BP, which likely supported open forest vegetation, open-mixed tropical deciduous forests, mixed tropical deciduous forests, and dense mixed tropical deciduous forests, respectively, around the study area. A relatively less intensified ISM rainfall since ca. 145 cal yr BP to the present was suggested, which likely supported mixed tropical deciduous forests in a warm and a relatively less humid climate, around the landscape of the study area in the CMZ, India.

1. Introduction

The Holocene experienced significant climate change and/or variability (Mayewski et al., 2004), which, whether persistent or short term, secular or abrupt, had large impacts on human societies, vegetation and ecology (Cullen et al., 2000; Yasuda et al., 2004; Buckley et al., 2010; Kennett et al., 2012; Liu et al., 2012). Moreover, the occurrence of abrupt climate change (ACC) or rapid climate change (RCC) events, such as the Heinrich 1 event, the Younger Dryas event, and the 8.2 ka event (ka = thousand years before present [B.P.], where present is 1950 CE) and the 4.2 ka event, which were driven by large-scale reorganizations of the atmospheric and oceanic circulation, disrupted the trend of increasing global temperatures since the Last Glacial Maximum (LGM) (Broecker, 2003; Bakke et al., 2009; Sun et al., 2018). The ISM during the Middle Holocene (Northgrippian Age: 8.2–4.2 kyr BP) was asynchronous (Gupta et al., 2020), which could be due to the different responses of the two branches of the ISM (the Bay of Bengal: BoB and the Arabian Sea: AS branches) and to changes in the moisture source and position of the Inter Tropical Convergence Zone (ITCZ) (Fleitmann et al., 2003; Prasad et al., 2014). The 8.2 kyr BP is a prominent, centennial-scale, abrupt cooling event (the "8.2 ka event"), which stratigraphically marks the end of the Greelandian (11.7–8.2 kyr BP; Early Holocene) and the beginning of the Northgrippian (8.2–4.2 kyr BP; Middle Holocene) (Walker et al., 2012, 2018, 2019), due to the global or near global expression of the cited event (Alley et al., 1997; Cheng et al., 2009; Domínguez-Villar et al., 2009). The cause of this prominent cooling has been linked to a glacial outburst flood of freshwater from Lake Agassiz thorough the Hudson Bay into the North Atlantic (Matero et al., 2017; Cheng et al., 2009; Bauer et al., 2004). Freshening of the North Atlantic may have resulted in diminished production of North Atlantic Deep Water (NADW) and a weakening of Atlantic Meridional Overturning Circulation (AMOC) (Barber et al., 1999; Bond et al., 2001; Kleiven et al., 2008). The resulting decrease in ocean heat transport caused a southward shift of the ITCZ and weakening of monsoons in the

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