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Fingerprints of Climate Change in the Detrital-Zircon U-Pb Record of the Deep-Sea Bengal Fan?

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The Himalayan-sourced Ganges-Brahmaputra river system and the deep-sea Bengal Fan represent Earth's largest sediment-dispersal system. Recent work has developed a detrital-zircon (DZ) U-Pb provenance record from the Bengal Fan, from cores collected during IODP Expedition 354 located 1350 km basinward of the shelf margin. This dataset consists of 25 DZ samples from Early Miocene to Middle Pleistocene medium- to fine-grained turbidite sand, as well as samples from the modern Ganges and Brahmaputra Rivers, which serve as benchmarks against which the older record can be compared. These data record the strong tectonic and climatic forcing associated with, and inherent to, the Himalayas and Ganges-Brahmaputra system: after up to 2500 km of river transport, and 1350 km of transport by turbidity currents, the DZ U-Pb record faithfully represents Himalayan and Tibetan sources.

Here we discuss possible signals of climate change within the Plio-Pleistocene part of the DZ U-Pb record. First and foremost, present-day sediment transfer to the land-sea boundary is closely coupled to the monsoon. However, for large rivers with broad shelves, delivery of sand to the deep sea is limited during global interglacial sea-level highstands like that of the Holocene, hence the sand-rich turbidite record is biased towards glacial periods when rivers extended across the shelf in response to climate-forced sea-level fall, and connected directly with slope canyons and the shelf margin. Second, sandy turbidites of the Bengal Fan displays the same DZ age populations and U-Pb age peaks that are present in modern river samples, but their proportions are significantly different. Pleistocene Bengal Fan data include (a) higher proportions of the <300 Ma population from Tibet, (b) higher proportions of the ca. 400-600 Ma population, which can be derived from Tibet and/or the Greater Himalaya Sequence, and (c) lower proportions from the Lesser Himalaya Sequence and/or peninsular India. We speculate these differences reflect contrasts in the loci of sediment production in the modern interglacial climate with strong monsoon rains, vs. a glacial climate where monsoon strength may be reduced and erosion is strongly tied to higher-elevation cold-climate and glacial processes.