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What has driven a late Miocene drop in clumped isotope temperatures of detrital calcite in Himalayan river systems?

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Variations in composition and texture of detrital records, preserved in the Himalayan foreland basin and the Indus and Bengal fans, potentially record stages in the evolution of the orogen, the Indian Summer Monsoon climate, and regional ecology. However, the interpretation of these records is challenging, as sediment properties change in response to variations in provenance, hydrological sorting, weathering intensity, addition of mineral and organic material, and post-depositional alteration. To address some of these challenges, we analyzed the mineral and 'clumped' isotope compositions of detrital carbonate in modern Ganga River sediments and in early Miocene to Holocene Bay of Bengal turbidite deposits. We demonstrate that variation of clumped and oxygen isotope values of detrital calcite in Himalayan river sediments is controlled by the mixing proportions of Himalayan-derived lithic carbonates and authigenic calcite precipitated in the river system. Clumped isotope temperature values and calcite-to-dolomite ratios in Bengal-Fan turbidite deposits drop in the late Miocene, indicating an increase in the relative contribution of authigenic calcite. This variation cannot derive from a decrease in the carbonate clumped isotope temperatures of endmember sources, as it requires impossibly 'hot' authigenic or lithic calcite during the Miocene. This variation also cannot derive from an increase in weathering intensity, as turbidite K/Si* values – which approximate weathering intensity, remain invariable since the mid Miocene. The drop in detrital calcite clumped isotope temperatures is therefore likely to reflect some combination of an increase in the supply of authigenic calcite and a decrease in the supply of lithic calcite. Such variation may be driven by increased production and erosion of authigenic carbonates, and/or decreased Himalayan erosion rate, or variation in the erosional pattern and carbonate sediment provenance in the Himalaya.