U-series comminution ages constrain Quaternary sediment transport times to the Bengal Fan

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Understanding the extent and rate at which sedimentary cycles respond to large shifts in the climate system is critical due to the interplay among continental erosion, the regulation of atmospheric CO_2 concentration, and climate. Quantifying these interactions is challenging on geologic timescales as it is increasingly understood that geomorphic systems exhibit a buffered and delayed response to changing environmental conditions. In this work, we use the uranium-series comminution age (CA) technique [1] to explore how sediment transport times of the Ganges-Brahmaputra system have varied over the last 180 Ka. This emerging geochronometer is based on the time-dependent depletion of ^{234}U relative to ^{238}U in silt and clay-sized grains as a result of α-recoil [1] and quantifies the timescale of sediment production, storage, and transport, prior to deposition. The CA can be used in concert with isotopic provenance indicators, such as Sr and Nd isotopes, to track variations of both sediment source and transport time. We present a first set of ($^{234}U/^{238}U$), ε_{Nd}, and $^{87}Sr/^{86}Sr$ isotopic ratios of sequentially leached sediment core samples of the Bengal Fan. Using the CA model, we determine transport times of 10-100's Kyrs, with the longest transport time (approaching 1 Myr; the limit of the method) occurring within an interglacial period. We interpret this trend to represent a greater contribution of 'young' freshly comminuted material to the sediment load during glacial periods and/or mobilization of 'old' continental deposits during interglacial periods. Analysis of modern surface sediment throughout the catchment is necessary to determine where sediment storage is occurring, and for how long. Overall, this work provides quantitative evidence that sediment routing, prior to deposition at the Bengal Fan, varied over the Quaternary and in response to glacial-interglacial climate perturbations, and, more generally, suggests that the CA technique can provide unique information about large-scale sediment transport systems.

[1] DePaolo et al. (2006) *EPSL* **248**, 394-410.