Uranium isotopes constrain sediment transport times to the Bengal Fan

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We are using the uranium-series comminution age (UCA) technique to characterize large-scale sediment transport associated with uplift and rapid erosion of the Himalaya, the largest and one of the most significant sources of sediment on the modern Earth and one that has been argued to both modify global climate and respond to changes in climate. The UCA geochronometer is based on the time-dependent depletion of ^{234}U relative to ^{238}U in silt-sized and smaller sediment grains as a result of α-recoil. The UCA provides a measure of the source-to-sink sediment transport timescale. Our objective is to determine whether transport time varies through glacial cycles.

We applied the UCA technique to a 250 ka record of hemipelagic sedimentation in the Bengal Fan at 8°N in the Bay of Bengal (BoB) using IODP Exp. 354 Core U1452. We measured ($^{234}U/^{238}U$), ε_{Nd}, and $^{87}Sr/^{86}Sr$ on bulk and sequentially leached sediment. Measured ($^{234}U/^{238}U$) varies from 1.03 to 0.90, ε_{Nd} varies from -10.5 to -15.7, and inferred transport times vary from <50 ka to >500 ka. Low ($^{234}U/^{238}U$) ratios and low ε_{Nd} values tend to occur during interglacials. Although changes in sea level can cause sediment redistribution within the fan and so contribute to the variability, if the record documents variation within the Ganges-Brahmaputra sediment transport system, then there are longer transport times during interglacial periods. The greater interglacial transport times may indicate (i) mobilization of 'old' continental deposits, due to a more intense Indian Summer Monsoon, (ii) changes in the sediment generation process (e.g., glacial abrasion), and/or (iii) changes in the loci of erosion. Deciphering these signals is important for interpreting chemical weathering signals recorded in the Bengal Fan on geologic timescales.

Ongoing work aims to address intrafan variability using samples from IODP Exp. 354 Cores U1450, U1451, U1453, and U1455 that span a 320 km E-W transect at 8°N. We also report on geochemical and sampling strategies that may increase applicability of the UCA technique.