Clumped isotope compositions of detrital carbonates in the Himalayan River system – 2) The Cenozoic river

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The Ganges and Brahmaputra rivers deliver sediments from the Himalaya to the Bay of Bengal, where they are further distributed by turbidite currents. The flux of weathering associated with this process has been hypothesized to drive Cenozoic global cooling. Here, we estimate the extent of weathering in the river-system using clumped ($T\Delta_{47}$) and oxygen ($\delta^{18}O$) isotope analyses of detrital calcite in Oligocene to Pleistocene Bengal-Fan turbidites from IODP Exp. 354. Measured $\delta^{18}O$ and $T\Delta_{47}$ values range -13.5 to -10‰ (VPDB) and 5-127°C, respectively, and are negatively correlated. A similar correlation has been observed in detrital calcite from modern Ganges sediments, and interpreted to reflect the mixing of two end-member components (Ponton et al., 2019): 1) Himalayan carbonate formations altered in elevated burial temperatures, and 2) Secondary calcite, precipitated in the floodplain. We also observe a positive correlation between calcite $T\Delta_{47}$ values and the calcite to dolomite ratio in turbidites. This trend can be explained if the abundance of the Tethyan calcite end-member has been primarily controlled by the extent of kinetically-limited carbonate mineral dissolution, while the abundance of river-precipitated calcite has remained relatively constant. $T\Delta_{47}$ values of detrital calcite in turbidite deposits decrease from 124-127°C during the Oligocene and Mid-Miocene to 88-101°C in the Late-Miocene, to 5-62°C during the Pleistocene. We attribute this time-variation to a >4 times increase in the extent of calcite dissolution during sediment transport, and suggest that it has been driven by longer river-transport times and/or increased calcite dissolution rates in the river system.

Ponton C., Ryb U., Eiler J. M., France-Lanord C., Yoshida K., 2019: Clumped isotope compositions of detrital carbonates in the Ganges-River-system – 1) The Modern river, Goldschmidt Meeting, Barcelona.