Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30661

Coupled radiogenic Nd and Hf isotope signatures of clays across the Ganges River sediment cascade

SOHINI BHATTACHARJEE[1,2,3], **ED HATHORNE**[1], RASMUS THIEDE[2], ANJA CONVENTZ[1], RAJIV SINHA[4] AND MARTIN FRANK[1]

[1]GEOMAR Helmholtz Centre for Ocean Research Kiel
[2]University of Kiel
[3]University of Potsdam
[4]Indian Institute of Technology Kanpur

The weathering of silicate rocks removes CO_2 from the atmosphere-ocean system on geological timescales but where exactly these reactions occur along river systems is poorly constrained. Here we examine the coupled Nd-Hf isotope signatures of clays deposited along the Ganges River sediment cascade by comparing a core from the floodplain at Kanpur [1], surface sediment samples from the Bay of Bengal shelf, and a marine sediment core from near the mouth of the Ganga-Brahmaputra [2]. The deviation of the Hf isotope compositions from the array defined by global river clays reflects the intensity of silicate weathering (ΔεHf clay) [3]. Over last 100 kyrs ΔεHf clay increases along the sediment cascade, with the floodplain samples exhibiting a range of from -6 to +2, while the marine sediment ΔεHf clay values were between +2.5 and +4. ΔεHf clay values from a short shelf sediment core (30 m water depth) are intermediate ranging between -1 and +2 suggesting part of the weathering signal is acquired in the delta and other sources with more intense weathering must also contribute. ΔεHf clay values from both terrestrial and marine sediment cores display a temporal pattern of variability similar to the record of South Asian Monsoon intensity inferred from the reconstructed $d^{18}O$ of seawater and dD of leaf waxes [2]. This suggests a strong link between hydroclimate and silicate weathering across this region. In the floodplain core, changes in the source provenance of the clays, as recorded by their Nd isotope signatures, are tightly coupled to variations in silicate weathering intensity. This contrasts with the marine sediment core where changes in the source provenance of the clays follow a glacial-interglacial pattern, indicating either a sea level or global climate influence on changes in sediment transport to the lower shelf. This demonstrates the utility of ΔεHf clay signals to record changes in weathering intensity in different environments while directly accounting for shifts in sediment source provenance.

[1] Rahaman, W., *et al.* (2009). *Geology* **37**, 559–562

[2] Wang, Y. V. *et al.* (2022) *Proc. Natl. Acad. Sci. U.S.A.* **119**, e2107720119

[3] Bayon *et al.* (2016) *EPSL* 438, 25