Middle to late Miocene radiogenic isotope record of South Asian monsoon induced erosion and its link to global climate and tectonics

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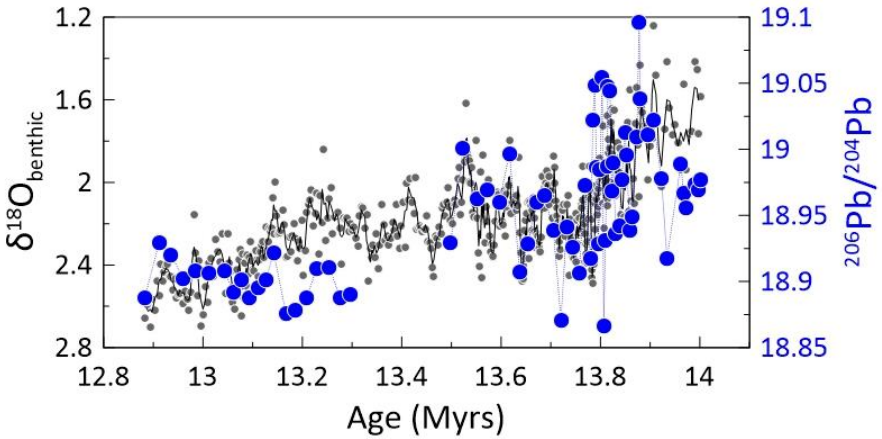
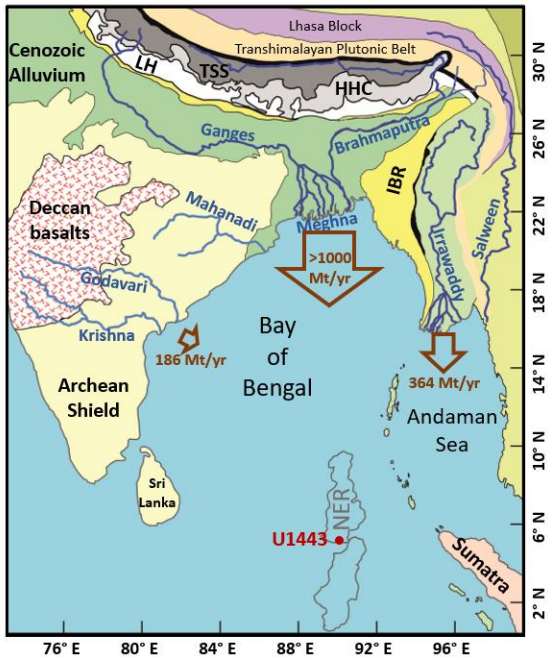
Tectonics and regional monsoon strength control weathering and erosion regimes of the watersheds feeding into the Bay of Bengal, which are important contributors to global climate evolution via carbon cycle feedbacks. The detailed mechanisms controlling the input of terrigenous clay to the Bay of Bengal on tectonic to orbital timescales are, however, not yet well understood.

We produced orbital-scale resolution clay radiogenic isotope records for IODP Site U1443 across five key climatic intervals of the middle Miocene (15.8 – 9.5 Ma) as well as a 100 kyr resolution record for the late Miocene (9-5 Ma).

Radiogenic Sr, Nd, Hf and Pb isotope compositions of detrital clays reflect rock type and age and can be used as tracers of provenance and weathering regime.



Radiogenic Pb isotope compositions of U1443 clays compared to the benthic $\delta^{18}O$ signal over the major middle Miocene cooling at ~13.9-13.8 Ma. The Pb isotope record shows fluctuations on orbital timescales and the isotope variations closely follow the benthic $\delta^{18}O$ curve in the older part until 13.5 Ma.



Map of the Bay of Bengal modified from Ali et al. (2020). The major continental river systems are indicated as well as the major geological units, which are the sources of sediments recorded at Site U1443.

Results

- Contributions from different erosional sources remained remarkably consistent during the Miocene, despite major tectonic reorganizations in the Himalayas.
- On orbital timescales, marked fluctuations of all three isotope systems reflect climatically driven shifts in monsoon strength.
- Elevated $^{87}Sr/^{86}Sr$ between 6 and 5 Ma was likely related to increased chemical weathering intensity as a result of exposed continental shelves at lowered sea level and of C4 plant expansion.
- Coupled clay Nd-Hf isotope compositions recorded chemical weathering intensities likely related to periods of extreme seasonal precipitation brought by the monsoon rains.