
Did erosion rates increase in the Himalaya from the Plio-Pleistocene boundary to modern times?

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Abstract

The multi-millennial sediment transport from the Himalayan source to the foreland is associated with million years of lag-time, caused by transient burial in the mountain valleys and in the Siwaliks. The intermediate storage of sediment modifies the concentration of cosmogenic radionuclides, as well as the estimation of the erosion rate. In this study, we estimate paleo-erosion rates of the Himalaya using paired cosmogenic radionuclide (¹⁰Be and ²⁶Al) concentrations from 56 drill core samples and 7 riverbed samples from four major Himalayan-River basins. We emphasise that neglecting the burial-correction while estimating paleo-erosion can lead to a systematic overestimation of erosion rates.

We observe that in the (paleo-)Sutlej basin, erosion rates increase from ~ 0.07 mm/y at 2.95 Ma to 1.79 mm/y at present. The paleo-Yamuna records a rise from ~ 0.2 mm/y at 3.3 Ma to 1.9 mm/y at 0.6 Ma. Similarly, the Ganges basin shows an increase from ~ 0.24 mm/y at 3.7 Ma to 2.04 mm/y at 0.9 Ma, while the Kosi basin exhibits the strongest acceleration, from ~ 0.12 mm/y at 4.42 Ma to 4.37 mm/y in modern samples. The increasing trend of the erosion rate remains unchanged, when production rates are calculated with the 25th or 75th percentile of elevation.

We attribute the increase of erosion rates to the transition from the fluvial to the glacial regime during Late-Cenozoic times. Additionally, the strengthened seasonality of the south-east Asian monsoon and the waxing and waning of the Pleistocene glaciation possibly have led to higher erosion rate in the Himalaya after ~ 2 Ma.

Keywords: Paleoerosion rate, Burial dating

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