

Decoding the role of Late Quaternary climate and vegetation in the evolution of Indo-Gangetic plain, India

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The Indo-Gangetic plain formed in response to flexural subsidence of the Indian plate in front of Himalayan. Interplay between tectonics and climatic forces at spatial and temporal scales controls the weathering and erosion of sediments. The fluvial processes affected by the climate and tectonics are sediment flux, river discharge, base level and channel migrations that shape the landscape dynamics in a catchment area. At present sediments in the Indo-Gangetic plain is sourced from the Himalaya and Peninsular India. The sediments from the Himalaya and Peninsular have a different $^{87}\text{Sr}/^{86}\text{Sr}$ ratio and ϵNd , which could be used to quantify the change in sediment source over time. In this direction, two fluvial cores were raised by drilling from the proximity to the Himalayan (Jhusi core) and the Peninsular (Betwa core) source in the Indo-Gangetic plain. For the first time, the $^{87}\text{Sr}/^{86}\text{Sr}$, $^{143}\text{Nd}/^{144}\text{Nd}$ isotopic ratios in bulk silicate fraction, bulk $\delta^{13}\text{C}$ values of organic matter (OM), $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values in soil carbonate (SC) was measured to constraint the effect of climate variability on sediment supply and depositional environment. The chronology of the sediment cores is constrained by optically stimulated luminescence (OSL) dating methods.

The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio and ϵNd values suggest that the provenance of sediments was a mixture of Peninsular and Lesser Himalaya (LH) during ~51.5 to 25.6 ka supported by fluctuating rainfall conditions. The source changed to the Peninsular at Betwa and the LH at Jhusi area during the beginning of last glacial maximum (LGM). During the Holocene, a period of high rainfall, the source of sediments was Higher Himalaya (HH) at the Jhusi and Peninsular for the Betwa region. The compilation of available records suggests that the area dominated by Peninsular rivers received sediment supply from Peninsular region whereas landscape dominated by Himalayan rivers indicates LH source at the beginning of LGM. The probable reason was high glacial cover during the beginning of LGM over the HH, which reduces sediment supply. Therefore, this study demonstrates the cumulative role of landscape, climate and glaciation in controlling the provenance of sediments of the Indo-Gangetic plain.