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Cosmogenic nuclide-derived basin-wide erosion and palaeo-erosion rates from the Ganges headwaters, Indian Himalaya

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Erosion rates in the Himalayan orogen are amongst the highest in the world. Based on the spatial coincidence of high erosion rates and active tectonic structures or pronounced topographic transitions, several studies have suggested feedback processes between focused erosion and the locus of tectonic activity in this region. Because such erosion-tectonics linkages are usually accompanied by localized enhanced precipitation or runoff, they are also coupled to the present-day climate. It is well known, however that climatic conditions in the Himalaya have strongly varied in the past, both in magnitude and spatial extent, which may have been accompanied by changes in erosion rates. Therefore, understanding linkages between tectonics, climate and erosion requires thorough assessment of temporal variations in climate and their effect on erosion rates.

Here, we report 30 new basin-wide erosion rates from the Pabbar, Tons, and Yamuna catchments in western Garhwal, Indian Himalaya, and assess the erosion processes in this part of the Himalaya. All three southward draining rivers are located next to each other and share similar climatic gradients, are of similar size, and expose similar rock types. In addition, ubiquitous fill terraces in all three catchments attest to river aggradation, which presumably ended in the early Holocene, when incision into these deposits started. We collected most of our samples from the active channels of these three rivers and their tributaries. In order to obtain palaeo-erosion rate estimates during the time of aggradation, we also collected samples from fresh road cuts in the sandy layers of the fill terraces. Our data provide new insights into the spatiotemporal variability of erosion along the monsoon-dominated steep southern front of the Himalaya.