



Where does all the gravel go? Abrasion-set limits on Himalayan gravel flux

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Rivers sourced in the Himalaya carry some of the largest sediment loads on the planet, yet coarse gravel in these rivers vanishes within approximately 20-40 kilometres on entering the Ganga Plain. Understanding “where the gravel goes” is crucial to forecasting the response of rivers to large pulses of sediment triggered by earthquakes and storms. Through an analysis of fan geometry, sediment grain size and lithology, we demonstrate that gravel flux from rivers draining the central Himalaya with contributing areas spanning three orders of magnitude is approximately constant. Furthermore, we show that the distance to the gravel-sand transition is independent of total sediment flux and water discharge, where subsidence rates are comparable. Findings from our lithology-dependent abrasion model reveal that abrasion of gravel during fluvial transport can explain this observation; most of the gravel sourced from more than 100 km upstream is converted into sand by the time it reaches the Plain. Our results also suggest that over the length scale of large trans-Himalayan rivers, abrasion facilitates the downstream translation and dispersion of earthquake generated sediment. Increased sediment delivery to channels (e.g. following large earthquakes or storms) will only result in an additional pulse of gravel reaching the Plain if sediment delivery occurs within less than ~ 100 km upstream of the mountain front or is sourced in highly resistant lithologies.