Persistence of lithological signals in river profiles: implications for interpreting tectonics from topography.

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Convex-up channels incising uniform lithology upstream of an active fault are typically interpreted as recording an increase in the displacement rate on the fault. The inflexion point along the river profile (knickpoint) would represent the boundary between a steep section upstream of the fault (adjusted to the new throw rate) and a less steep section upstream representing the “relict” landscape that has not yet responded to the change in throw rate. The rivers draining the southern part of the Shillong Plateau, a block of raised topography made of basement rocks in the Himalayan foreland, exhibit such features, with a clear “wave of incision” propagating northwards from the edge of the plateau visible in the topography. Researchers have interpreted this wave of incision as the result of an increase in throw rate on the Dauki fault which bounds the plateau to the south, with implications for reconstructing the partitioning of strain in the Eastern Himalaya since the Miocene. We use river profiles and geological relationships to show that the low relief plateau is a topographic expression of a re-exposed basement palaeosurface following the stripping of sedimentary cover by scarp retreat. We show that initiation of the wave of incision does not require surface rupture on the Dauki Fault or an increase in fault slip rate at the end of the Miocene: the observed spatial pattern of steepness is a function of a dynamic landscape response to the erosion of layered lithology with contrasting erodibility. This works highlights that near-horizontal lithological contacts can strongly influence river profiles and topography, even when the contacts are no longer physically preserved. River profiles in locations where strong contrasts in rock resistance to erosion exist, or have existed, cannot be interpreted as simple records of uplift.