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# Tectonic-erosion coupling? The erosional response to India-Asia collision

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In order to use the detrital record as an archive of hinterland evolution, we need to understand the erosional response to tectonics. Collision of India and Asia at ca 50 Ma [1 and refs therein] resulted in the subsequent development of the Himalayan orogen. What was the erosional response to this event? Most basins into which Himalayan detritus may have been deposited have now been researched at least at reconnaissance level. The conclusion reached is that, as yet, there appears to be no evidence of substantial detritus eroded from the southern flanks of the rising Himalayan mountain belt prior to $\tilde{4}0$ Ma, 10 My after collision. In the Indus suture zone basin, detritus is predominantly sourced from the Trans-Himalayan arc of the northern, Asian plate, rather than the Himalaya to the south [2, 3]. In the peripheral foreland basin, the oldest substantial Himalayan-derived detritus is dated at <40 Ma [4]. To the west, in the Katawaz remnant ocean basin and offshore Indus Fan, earliest Himalayan derived deposits are poorly dated, insubstantial, and/or predominantly derived from north of the suture zone rather than the rising Himalayan thrust belt to the south [5, 6]. In the east, earliest Himalayan-derived material is dated at 38 Ma in the Bengal remnant ocean basin [7], and "post-Paleocene" in the Bengal Fan [8 and refs therein]. Paleogene sediments of the Sunda Arc accretionary prism, originally thought to be offscraped Himalayan-derived Bengal Fan [9, 10] are now shown to be predominantly derived from the arc to the east [11, 12].

What could be reason for this $\tilde{1}0$ My delay between collision and first documented products of erosion from the mountain belt? The delay has been explained by suggesting collision occurred considerably later than commonly believed [13]. However, this is at variance with provenance data which show that material of Asian origin was deposited on the Indian plate by 50 Ma [14, 15] A second possibility is that Palaeogene Himalayan-derived detritus may lie beneath the overthrust fold-thrust belt. A third possibility is that the time gap does in fact represent a true delayed response to erosion after collision. This idea is consistent with the evidence of a transition from slow to exponentially increasing accumulation rates in offshore basins adjacent to the Himalaya around the start of the Oligocene. A 10 million year delayed response to erosion following India-Asia collision has been ascribed to either climatic causes or subdued topography in the early stages of collision, the result of a number of proposed mechanisms [16-18]. Given the bedrock evidence for metamorphism in the Himalaya that requires early crustal thickening [19, 20], we would favour those models that allow early crustal thickening, but retard erosion or uplift, if indeed early erosion was negligible.

Such a study illustrates how the detrital record can inform and constrain models of crustal deformation, but also serves to show how incomplete our understanding of the principles of tectonic-erosion coupling currently stand.

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