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Deciphering the record of Nanga Parbat syntaxial exhumation preserved in the Indus Fan sedimentary archive by detrital rutile U-Pb analysis

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Around the Nanga Parbat massif in the west and the Namche Barwa massif in the east, the trend of the Himalayan orogen exhibits an abrupt strike change from roughly E-W to N-S, forming two structural syntaxes. Within each syntaxis, exposed crystalline basement of the underthrust Indian plate exhibits metamorphism up to granulite-facies grade, and records some of the fastest exhumation rates on Earth (up to c. 10 mm/a), together with Plio-Pleistocene mineral (re)crystallisation and cooling ages (Bracciali et al., 2016; Crowley et al., 2009). The proposed cause(s) of this deep, rapid exhumation are controversial, and include: (1) structural buckling of a pre-existing indentor on the Indian plate (Burg et al., 1997); (2) geometrical stiffening driven by subduction geometry (Bendick & Ehlers, 2014); (3) focusing of exhumation by surface processes such as the capture of the major trans-Himalayan Indus and Yarlung-Tsangpo drainages (Zeitler et al., 2001); and (4) orogen-parallel strain partitioning (Whipp et al., 2014). Distinguishing between these hypotheses can in part be achieved by constraining the onset rapid syntaxial exhumation.

Here, we report the first detrital rutile U-Pb data from the Indus catchment system: both from offshore samples collected during IODP expedition 355, and also from modern river sediment, which we use for source-area characterisation. We compare these data with previously reported zircon U-Pb data, and also with data from the Bengal Fan (Najman et al., In Press), and discuss the implications of these results for the exhumation history of the syntaxes. We consider the implications for future large-scale detrital provenance studies.

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