



Plio-Pleistocene exhumation of the eastern Himalayan syntaxis and its domal ‘pop-up’

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The eastern termination of the Himalayan orogen at the southern margin of the Tibetan Plateau forms a syntaxial antiform that folds the suture zone between the Indian and Asian plates and is characterised by 10 to < 1 Ma dates of various geo- and thermo-chronometers. These document Late Miocene to Pleistocene structural, metamorphic, igneous and exhumation events and a recent history of very rapid cooling. The northern third of the syntaxis corresponds to a steep domal ‘pop-up’ structure bounded by the India–Asia suture on three sides and a thrust zone to the south.

One of the major rivers of the eastern Himalaya–Tibet region, the Yarlung Tsangpo, dissects the eastern syntaxis. The river becomes the Brahmaputra River in the Indian foreland basin before emptying into the Bay of Bengal. Exceptionally high relief and one of the deepest gorges on Earth have developed where the river’s tortuous route crosses the Namche Barwa–Gyala Peri massif (> 7 km in elevation) in the core of the syntaxis. Downstream of the gorge very high erosion rates contribute ~ 50% of total detritus to the sediment load of the river.

The initiation of the exceptional exhumation has been attributed either to the extreme erosive power of a river flowing across a deforming indenter corner and the positive feedback that would establish between the two, or to subduction geometry of a stiffened indenter corner. It has also been suggested that the growth of the antiformal structure and the exhumation of its high grade metamorphic core resulted from buckling as a means to accommodate shortening in the indenter corner.

In this study [1] we provide new chronological data on the bedrock of the eastern syntaxis and its erosion products to date the inception of very rapid uplift and erosion and discuss its cause, with the ultimate aim to reconstruct the structural and exhumation history of the syntaxis. We use U-Pb zircon and rutile, white mica Ar-Ar and fission track zircon dating of bedrock, modern sediments and Neogene paleo-Brahmaputra deposits of the Surma Basin (Bangladesh) to document source rock crystallization and cooling events from > 700°C to ~ 250°C as well as numerical modelling of heat flow and erosion.

Based on our and other published data we show that: i) the detrital age signature of the modern syntaxis is unique within the eastern Himalayan region; ii) the rocks within the domal pop-up were >500°C only 1–2 Ma; iii) up to ~20 km of rock were eroded during the Pleistocene from the domal core of the syntaxis; iv) the Yarlung Tsangpo is antecedent and subsequently distorted by the developing antiform; v) the Neogene Surma Basin does not record evidence of rise and erosion of the domal pop-up until latest Pliocene–Pleistocene time; vi) glacial processes likely enhanced focused erosion in the syntaxial region to keep pace with rapid rock uplift.

[1] Bracciali, L., Parrish, R.R., Najman, Y., Carter, A., Wijbrans, J.R. and Smye, A., Plio-Pleistocene exhumation of the eastern Himalayan syntaxis and its domal ‘pop-up’, under review in *Earth-Science Reviews* (invited contribution).