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Recent Kinematics and long-term Exhumation History of the central Himalaya (Nepal) from numerical Modelling of *in-situ* and detrital Thermochronology Data

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Unravelling the kinematics and exhumation history of the Himalaya, the largest mountain belt on Earth and the largest provider of sediments to the world's oceans, has important implications for our understanding of mountain building processes, the interaction between tectonics, climate and erosion, as well as seismic risk assessment. We explore the capacity of thermochronological data to quantitatively constrain the kinematics of the central Himalaya at two different time scales: we use a transect of newly acquired *in-situ* apatite fission-track (AFT) ages across the central Nepal Himalaya to place constraints on the kinematics of the mountain belt over the last few million years, and we extract the kinematic and exhumation history of the belt since ∼20 Ma from a dataset of detrital zircon fission-track (ZFT) and mica Ar-Ar (MAR) thermochronology collected within the orogenic Siwalik deposits of central and western Nepal. To do so, we employ a newly developed 3-D thermal-kinematic model, based on the *Pecube* code, which allows the prediction of thermal histories and thermochronological ages for rocks exhumed along crustal-scale faults of any geometry. The model tracks the distribution of thermochronological ages at the surface throughout the model run, thus allowing comparison with both the *in-situ* and the detrital thermochronological record.

The central Himalaya underwent a major transition at ∼15-20 Ma, from an Early

Miocene phase characterised by localised exhumation in the Higher Himalayan crystalline belt along the Main Central Thrust (MCT) to a steady-state forward-propagating system in the Late Miocene-Pliocene. Detrital thermochronology records this transition as a major phase of exhumation; a significant proportion of both detrital ZFT and MAR single-grain ages falling within this age range throughout the stratigraphic sections. Our modelling of the detrital data aims at understanding this phase of rapid exhumation and the associated controls (climatic, tectonic?) on the change in kinematics. In recent years, controversy has arisen about the recent kinematics of the central Himalaya, with some authors arguing for Plio-Pleistocene reactivation of the MCT, possibly driven by climatically enhanced exhumation of the Himalayan topographic front. AFT ages increase linearly from ≤ 1 Ma in the MCT zone to 5-10 Ma in the outermost part of the Lesser Himalaya, without any sharp transition. Fitting the observed AFT-age pattern, using our themal-kinematic model with exhumation occurring simultaneously along several thrust faults, requires only minimal, if any, reactivation of the MCT.