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Structure and propagation sequence of the western Nepal fold-and-thrust belt: new insights from field mapping, thermochronology and numerical modelling.

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The Karnali region of western Nepal shows several anomalous features in terms of structural evolution and topography with respect to neighbouring transects in the central Nepal and Kumaong Himalayas. This area is, therefore, of major importance to understand the recent structural and tectonic evolution of the Himalaya. Several important aspects of the structural evolution of the western Nepal Himalaya, including the location and shape of major structures such as the Main Central Thrust (MCT), the existence and location of a crustal-scale ramp on the Main Himalayan Thrust (MHT) or the number of thrust sheets north of the Lesser Himalaya Duplex remain heavily discussed. Previous work has mainly focused on the northernmost part of the Karnali transect and very little data is currently available on the southern part of the cross-section comprised between the Dadeldhura klippe and the Main Frontal Thrust.

Recent fieldwork along the Karnali valley has allowed us to collect new samples and structural data. Here, we report Raman Spectroscopy on Carbonaceous Matter (RSCM), Ar/Ar Muscovite, Apatite Fission-Track and petrologically derived thermo-barometric data in order to further constrain the structure and evolution of the western Nepal Himalaya. To support our interpretation of the data, we have also performed numerical simulations using a 2D thermo-mechanical model in order to test the physical and mechanical plausibility of various geometries and thrust kinetics.

Preliminary results suggest that: (1) The Dadeldhura klippe has been isolated from the High Himalaya by underplating of the Lesser Himalaya duplex rather than by forward propagation of thrusting. Similarly, the Ramgarh Thrust seems to be an underplated thrust inherited from a previous episode of deformation of the range, rather than the result of forward propagation of thrusting; (2) Formation of the klippe and the width of the range are functions of the viscosity contrast between the underthrusting Indian plate and the Tibetan plateau; (3) The existence and location of the MHT ramp is time dependant as, in our preferred scenario, the ramp is formed on the front of the accreting wedge and then advected beneath the wedge. In this framework, the ramp location is a function of the degree of evolution of the collision zone rather than a permanent feature of the thrusting system; (4) Ramp underplating leads to periodic and thus transitional relief increase; (5) Our thermochronological data suggest that western Nepal is currently in a state of equilibrium between underplating along an MHT ramp in the south and classical imbricate-fan overthrusting in the MCT zone.