Abstract

A system of successively forming north-dipping crustal-scale thrusts, extending along the Himalayan arc, and merging at depth into the Main Himalayan Thrust (MHT), have accommodated most of the convergence between the Indian and Eurasian tectonic plates since at least the early Miocene. While deformation of the Himalayan fold-and-thrust belt is well documented over recent (≤ 102 yr), Holocene (103-4 yr) and Myr (≥ 106 yr) timescales, almost no quantitative data are available to constrain sub-Quaternary (104-5 yr) deformation, despite the proposal that deformation rates vary episodically over geological timescales and that there is out-of-sequence activity of some faults. Filling this timescale gap is thus crucial to better understand Himalayan tectonics that underpin seismic hazard models in this densely populated region.

In this PhD thesis, I first start by optimising and validating the luminescence thermochronometry method, in order to be able to have accurate constrains on rock thermal history. I then present an extensive new dataset of more than 100 luminescence thermochronometry samples to provide a new perspective on Late Pleistocene exhumation (timescales of 104 to 105 years), a timescale until now largely inaccessible to other techniques, by offering high-resolution constraints of rock cooling histories within the upper kilometres of the Earth's crust. The samples, distributed across the hinterland (High Himalaya) and the foothills (Sub-Himalaya) of the Himalayas, were specifically selected to resolve deformation across the main geological structures shaping the Himalayan orogen, namely the Main Frontal Thrust (MFT), and the Main Central Thrust (MCT).

Results show that although the faults of the Sub-Himalayan fold-and-thrust belt are active during the late Quaternary, movements are also recorded in the High Himalayas on the same timescale, which may indicate tectonic activity of the Main Central Thrust (MCT), potentially endangering an entire population.