Direct dating of fault slip in the Himalayan orogen

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Around half of the India–Eurasia convergence has been accommodated by movement of rocks along ductile shear zones and semi- to brittle thrust faults in the Himalaya. Over the last 30 Ma, these structures rooted on the Main Himalayan thrust (MHT), have developed in sequence toward the foreland. Rupturing of locked portions of the MHT on the 'critical zone' along the ramp has caused the region's most devastating earthquakes, including the magnitude-7.8 Gorka earthquake. Constraining the rates of movement along the surface expressions of the MHT is critical for comprehending the temporal distribution of fault-displacements within the frontal Himalaya at geological timescales, yet has only been previously inferred by indirect methods.

This project aims to directly date major movements on fault surfaces in the frontal part of the Himalayan orogen. We investigate the surface expressions of the MHT in the eastern Himalayan regions of Sikkim and Bhutan. We use petrographical, microstructural, and stable isotopic tools to characterise authigenic clays formed within fault gouges and fault-related calcite veins and slickenfibres. K-Ar dating of clays, and U-Pb dating of calcite, are used to reconstruct an integrated displacement history along these first-order structures. Reconstruction of the space-time distribution of major seismic events at geological timescales will help to inform earthquake hazard assessments in the region today.