Shedding light on the Main Central Thrust Controversy, Sikkim Himalaya

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The Main Central Thrust (MCT) is generally defined as a major orogen-parallel thrust fault or zone which separates the Greater Himalayan Sequence (GHS) from the Lesser Himalayan Sequence (LHS), each with distinctive geochronological and chemical signatures (Parrish and Hodges, 1996). The MCT plays a pivotal role in tectonic models such as channel flow (Beaumont et al. 2001) and wedge extrusion (Kohn, 2008), but its location is in dispute in many transects (Searle et al. 2008) and poorly known in some areas. There is therefore a crucial gap in our knowledge of this thrust, especially in the east of the orogen. Sikkim presents a nearly-unique exposure of the MCT, thereby allowing an in-depth study of it in three-dimensional space (Fig. 1). As with other traverses across the Himalaya the precise location of the MCT in Sikkim remains equivocal, essentially because it has been difficult to identify structural discontinuities across a region of widespread ductile deformation (Gupta et al. 2010) and to distinguish between the lower GHS and LHS on lithological grounds.

The LHS is a Palaeoproterozoic sequence that has been intruded by ~1.8 Ga granites, whereas the GHS is a Neoproterozoic +/- Early Palaeozoic sequence, typically intruded by ~500 Ma granites (Parrish and Hodges, 1996). On the basis that these major lithological packages are now largely juxtaposed by movement on the MCT, the LHS-GHS boundary can be 'mapped' using isotope geochemical/geochronological data. In the first part of this study, we collected samples from the wide zone of ductile deformation in Sikkim broadly coinciding with the MCT.

LA-MC-ICPMS U-Pb zircon crystallisation ages were obtained from several orthogneiss and metasedimentary samples. The data indicate that the rocks from within the 'MCT zone' in Sikkim are all of LHS affinity with either crystallisation ages ~1.8Ga or detrital zircon provenance >1.7 Ga. Four samples indicate Tertiary (36-11Ma) ages of metamorphism or anatexis.

In a latter stage of the study we aim to compare P-T-t-d paths in the more clearly defined 'MCT zone', and integrate this with the tectonics to obtain a clearer understanding of the movement of the MCT.

The new data outlined in this study allows the MCT, as currently recognised in Sikkim, to be characterised as a package of rocks of Lesser Himalayan affinity that have been deformed by movement on the thrust into a zone of ductile deformation, several kilometres thick. This zone was later folded into the distinctive antiformal structure of the Teesta dome (Fig. 1).

A combination of poor exposure and a lack of consistent definition of the MCT have left the precise location and nature of the MCT in Sikkim somewhat enigmatic. This new data provide the first U-Pb zircon geochronology study of the Sikkim orthogneisses and allows confident extrapolation into Sikkim of the MCT zones from both east and west. This work will build upon other studies of the Sikkim Himalaya (Catlos et al. 2004 and Dasgupta et al. 2009) to produce a more informed understanding of the MCT.

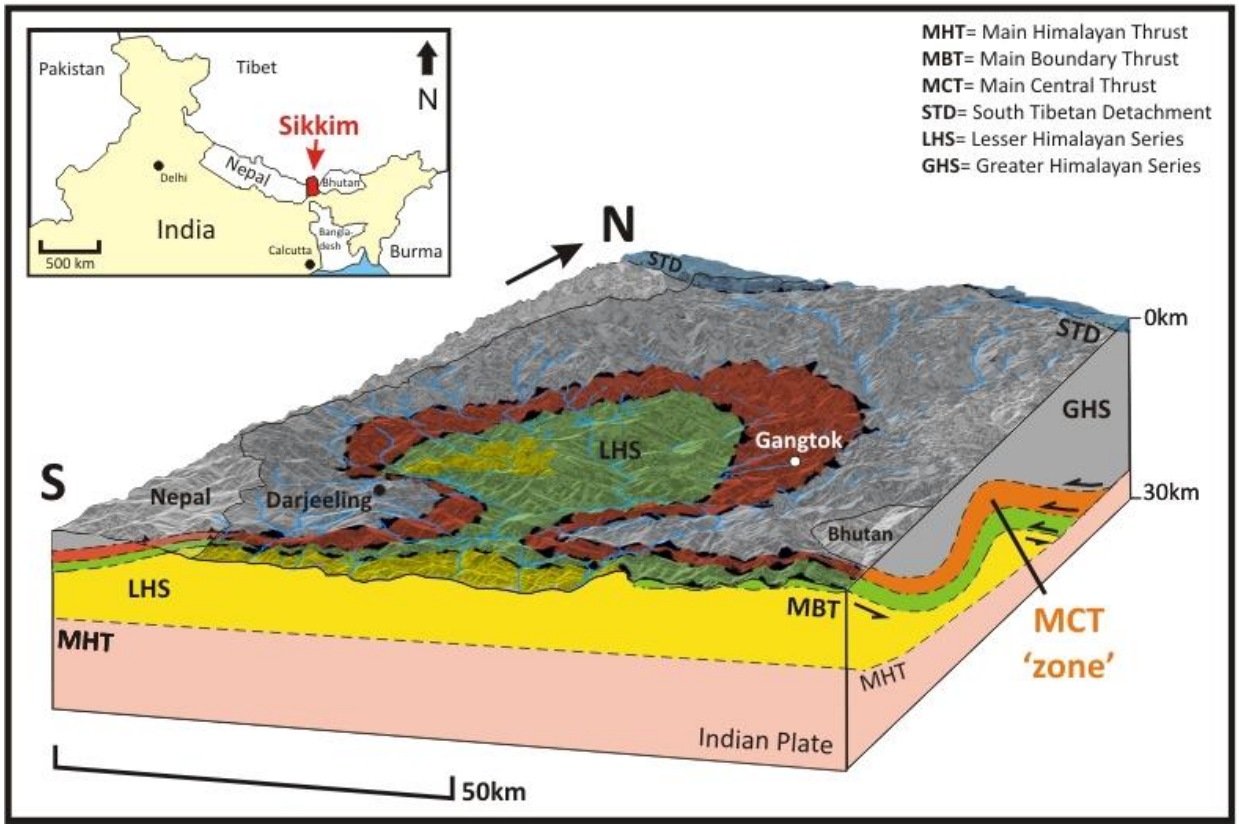

Figure 1: 3D cross section of Sikkim, NE India, with draped geological map. Geology from Goswami (2005). Schematic cross section view shows the deformation of the thrusts into the Teesta dome. Inset shows location of Sikkim.

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