



Geometry and Kinematics of the Darjeeling – Sikkim Himalaya, India: Implications for the Evolution of the Himalayan Fold-Thrust Belt

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In the Darjeeling – Sikkim Himalaya the Main Central thrust (MCT) system has translated the Greater Himalayan hanging wall rocks over large distances so that Greater Himalayan rocks are exposed within 7 km of the mountain front. The sub-MCT Lesser Himalayan duplex is composed of two duplex systems and has a more complex geometry than in other parts of the Himalayan fold-thrust belt. Within the duplex, a foreland-dipping component and reactivation of the roof thrust resulted in large southward translation of the overlying MCT sheets in this region. The growth of the duplex resulted in a plunge culmination that manifests itself as a broad N-S trending structural high in this region; this is not a “river anticline” as its trace lies west of the Teesta river.

A transport parallel balanced cross section constructed across this region suggests a total minimum shortening of ~502 km (~82%) south of the South Tibetan Detachment system (STDS). The Lesser Himalayan duplex accommodates nearly half of this total shortening. In this region, the average long-term shortening rate is estimated to be ~22 mm/yr. Comparison of available shortening estimates from different parts of the Himalayan arc show regional variations in shortening, but it is difficult to evaluate the primary cause for this variation; however, shortening in the Himalayan fold - thrust belt (FTB) is highest in the middle of the Himalayan arc (western Nepal) and progressively decreases towards the two syntaxes. Although, the width of the Lesser Himalayan belt decreases in the eastern Himalaya, the Lesser Himalayan shortening percentage remains approximately similar to that in both eastern and western Nepal Himalaya, where the belt is widest. In addition, the shortening accommodated within the Lesser Himalayan duplex progressively increases from the western to the eastern Himalaya. Thus, the width of the original Lesser Himalayan basin may have played an important role in partitioning the shortening in the Himalayan FTB.

The retrodeformed cross section in the Darjeeling – Sikkim Himalaya region provides insights into the palinspastic extent of the Gondwana basin of Peninsular India, suggesting that this basin extended ~150 km northward of the present northernmost exposure of Gondwana rocks in this region.