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Strain localization along the Main Boundary Thrust (MBT) zone in the Eastern Himalaya: insights from field and experimental studies

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The southward tapering Himalayan tectonic wedge is sliding over the upper boundary of the subducting Indian crust that act as the basal low angle detachment fault, known as the Main Himalayan Thrust (MHT). It is now established that at least four crustal-scale south verging thrust faults, such as Main Central Thrust (MCT), Daling Thrust ($\sim$ Ramgarh Thrust $\sim$ Shumar Thrust) (DT), Main Boundary Thrust (MBT) and Main Frontal Thrust (MFT), have emerged from the MHT, striking the entire length of Himalayan mountain belts. These structures accommodated hundreds of kilometers of crustal shortening since India-Asia collision and eventually, juxtaposed different tectono-metamorphic rocks in their hanging wall.

Field investigations reveal increased number of thrust faults towards the frontal Himalayan mountain belts and their spacing between the successive thrusts are relatively small in contrast to the hinterland part of the mountain belt. For example, in the Eastern Himalayan belt the MBT zone in the Lesser Himalayan Sequence is marked by several such closely spaced thrusts. The present work is aimed to delineate factors that likely to have influenced for the development of such high frequency thrusting. Employing the model of Coulomb Wedge Theory (CWT), several researchers have shown that spacing between two consecutive thrusts is a function of basal friction and pore fluid pressure ratio. However, this model does not explain the cause of closely spaced thrust localization towards the frontal mountain belts during the wedge growth. Our present study using field relations and physical modeling shows that relative strength difference between the basal low angle detachment fault and the interface-strength of the varying lithology of the cover rocks has a major role for such thrust localization with narrow thrust spacing. Moreover, our findings may become useful for structural interpretation for the localization of Main Boundary Thrust zone in the frontal Himalayan mountain belts.