Himalayan Tectonic Model and the Great Earthquakes: an Appraisal

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The best known conceptual tectonic model of the Himalayan Seismic Belt (HSB) suggests that the Basement Thrust Front (BTF) lies beneath the Main Central Thrust (MCT) with a prominent 'ramp'. The 'ramp' is viewed as a geometrical asperity that accumulates the stress due to the Himalayan collision tectonics, and it has been suggested that the past great earthquakes occurred on the plane of detachment. The plane of detachment is the interface between the Indian shield and the Himalayan sedimentary wedge, also known as the Main Himalayan Thrust (MHT).

The recent earthquake data of the local permanent and temporary networks and a re-examination of source processes of the great earthquakes in the Himalaya, however, do not support this model for the entire HSB. The four known instrumentally recorded great (M~8.0-8.7) earthquakes in the foothills Himalaya in India, from west to east, the 1905 Kangra, 1934 Bihar, 1897 Shillong and the 1950 Assam earthquakes occurred by different tectonic processes, and possibly none can be explained as a plane of detachment earthquake; each occurred in its own unique complex tectonic environment. The 1905 as well as the 1934 great event may have a deeper source to the south of the MBT, the 1897 great event is argued to be a shield earthquake rather than a Himalayan earthquake and it occurred by pop-up tectonics of the Shillong plateau, and the 1950 great event is argued to be caused by transform tectonics in the eastern syntaxis zone rather than by thrusting on the plane of detachment.