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A future big one in the North-West Himalayan syntax ?

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Over the last millions years, the crustal shortening across the Himalaya of the Indian Kashmir have been accommodated by three sub-parallel emerging thrusts: the Main Boundary Thrust (MBT), the Medlicott-Wadia Thrust (MWT) and the Main Frontal Thrust (MFT). The alternate occurrence of in sequence and out of sequence deformational patterns at the historical time-scale confirm that the seismogenic activity can shift from one thrust to a sub-parallel one, connected at depth to the same main décollement. In such a sismo-tectonic context, a fundamental issue is to identify the structures absorbing the most part of the deformation and to quantify the shortening rates through them. This yields important implications in terms of seismogenic potential and natural hazard for the densely populated region.

We studied the geometry of the alluvial terraces and fans across the three main thrusts (MBT, MWT and MFT) in order to quantify the amount of cumulated Late Quaternary deformation. Then we dated these markers to estimate slip rates along these thrust faults. The main result is that all the deformation since at least $\sim$15 ka is absorbed on the two most external thrusts (i.e. MWT and MFT), with rates in the order of 1cm/yr, while the regional segment of the Main Boundary Thrust is no more active.

We excavated a paleoseismological trench across the MWT, the only active structure reaching the surface. Our analysis of the deformations within the alluvial-colluvial material coupled with 14C dating suggests that the most recent event is ascribed to the last strong Kashmiri earthquake (1555). The ruptures associated with this event, as well as those associated to at least two older events, show minimum co-seismic displacements of several meters. This portion of the MWT shows litho-structural analogies – steep ramp and old cratonic basement at the hanging-wall – with the Balakhot Bagh Fault (Pakistan) affected by Mw 7.6 event in 2005. However, in Indian Kashmir, the five centuries seismic gap over a 100-km segment, the slip rate across the fault and the amplitude of the co-seismic paleo-displacements, all converge for the possibility of an even greater magnitude on this fault in the next decades.