Why and How the 8th October 2005 Kashmir Earthquake (Mw 7.6) and Its Aftershock Sequence Triggered?

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Recent occurrence of the great killer giant 2005 Kashmir earthquake (Mw 7.6) and its aftershock sequence in the Pakistan – Kashmir Himalayan Front baffled geoscientists to unravel the cause of genesis of the earthquake and its aftershock sequences. Analyses of the Harvard Centroid Moment Tensor (CMT) focal mechanism solutions of the 8th October 2005 Kashmir mainshock and the 28th December 1974 Pattan mainshock (M 5.9) and their aftershocks revealed a fair amount of tectonic deformation and seismicity behavior at Indus – Kohistan Seismic Zone (IKSZ) in northwestern Pakistan – Kashmir Himalayan front. The Kashmir earthquake may have occurred on the unaffected southern segment by rupturing the IKSZ after a gap of 31-years. The CMT solutions of both 1974 Pattan and the 2008 Kashmir earthquake showed similar nodal planes and indicated positive slip with predominantly disposed northeast-dipping thrust faults. The northeastern elevated Hanging wall of the IKSZ is found to have slipped up by about 1.5 – 1.9m above the southwestern footwall during the 2008 Kashmir earthquake. The depth section of the seismic events indicated that all the epicenters are confined in a zone between plastic decollement and ductile basement, having a different rheological behavior in rock type. Our study suggests that the 2008 Kashmir mainshock and its aftershock sequence might have occurred due to the release of accumulated stress resulted from thrust produced by the southwestward leading-front of overthrusted high-hydrothermal fluid-rich mid-crustal rocks. In addition differential sediment loads on the decollement due to major river incisions and high crustal exhumation rate along anomalous topographic rise of Hazara – Kashmir syntaxis, IKSZ and Indus syntaxis might have also contributed to the genesis of earthquakes. Further study on 3-D seismic tomography in future may shed important light on structural heterogeneities that could have strong bearing on seismogenesis besides regional tectonic stress alone.

Keywords: The 2005 Kashmir earthquake; IKSZ; Hydrothermal Fluids; Mid-crustal rocks