Geophysical Research Abstracts
Vol. 15, EGU2013-588-1, 2013
EGU General Assembly 2013
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Composite mesoscopic and magnetic fabric reveals superposed folding in the High Himalayan Crystallines along the Satluj and Bhagirathi valley, NW Himalaya, India

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Abstract

The present study deals with granitic gneisses of the High Himalaya Crystallines (HHC) from frontal and oblique thrust ramps of the Main Central Thrust (MCT) along the Satluj and Bhagirathi valley, NW Himalaya. The High Himalayan Crystallines (HHC) are bounded by two major tectonic units i.e. MCT at the bottom and South Tibetan Detachment (STD) at the top. Here we present mesoscopic and magnetic fabric anisotropy of granitic gneisses and associated leucogranites of the HHC.

The mean magnetic susceptibility (K_m) value of the samples from both the valleys show dominance of paramagnetic mineralogy (K_m $<$500 μSI) whereas, degree of magnetic anisotropy (P$\prime$), which is an indicator of intensity of deformation (P$\prime$) is high ($>$1.15) for all the samples and it does not show any linear relationship with the corresponding mean magnetic susceptibility (K_m)values. The gneissic samples from the Satluj valley show large variation in their Km and P$\prime$ values in comparison to the Bhagirathi valley samples. The magnetic susceptibility value is low whereas P$\prime$ values are higher near the thrust/shear zones. The Km values are very low in Bhagirathi valley as compared to the Satluj valley but the P$\prime$ values are slightly higher in the Bhagirathi valley. The leucogranite within the HHC of both of the valleys have high P$\prime$ value. The high values of P$\prime$ with low Km $<$500μ SI in the vicinity of thrust zone is an indicator of the intense deformation. The Jelinek plot shows that most of the samples have a strong oblate fabric. Only samples that are furthest from the MCT, have prolate fabric. Comparison of mesoscopic and magnetic fabric suggests interference of mild superposed deformation with upright superposed folds over pre-existing early folds. At many sites magnetic lineation demarks intersection of mesoscopic and magnetic foliations with gentle to moderate plunge and random bearing that indicate superposed deformation. K1 does not reveal any consistent thrust related transport direction, moreover, the gentle to moderate plunges of magnetic lineations reveals that thrusting is not the controlling factor at late stages of deformation. AMS combined with additional strain analysis reveal that pure shear is slightly higher in the frontal ramp part of the MCT than the oblique part. Superposed folding is also more widespread in the frontal parts. It is concluded that curved geometry of the MCT, consisting of frontal and oblique ramps plays a critical role in the structural evolution of the HHC. This further suggests a greater role of folding (pure-shear dominant deformation) as compared to thrusting (simple-shear dominant deformation).