# Implication of mylonitic microstructures and apatite fission track dating studies for the geotectonic evolution of the Chiplakot Crystalline Belt, Kumaon Himalaya, India

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In Kumaon Himalaya, the Higher Himalayan Crystalline (HHC) extends southward over the Lesser Himalayan meta-sedimentary zone (LHSZ) and forms several nappes: the Chiplakot Crystalline Belt (CCB), Askot, Almora, Lansdown, Champawat and Chamoli-Baijnath nappes (Valdiya 1980, Srivastava and Mitra 1994, 1996). The Main Central Thrust (MCT) underlies these allochthons, but it is named differently at the base of different nappes. Out of these nappes, the CCB is a unique one having special tectonic setting. The CCB mainly consists of lower amphibolite to green schist facies of mylonitised biotite gneiss and porphyroblastic augen gneiss with bands of amphibolite. It occurs within the LHSZ and is bounded by both NE-dipping South Chiplakot Thrust (SCT) at the base and the North Chiplakot Thrust (NCT) at the top. The NCT and the SCT are interpreted as the part of the MCT along which the CCB is rooted within the HHC zone and emplaced over the LHSZ (Valdiya 1980). Despite intensive study of the structural and tectonic evolution of the HHC sequence, but no significant study has been made so far to understand the geotectonic evolution of the CCB.

Geological setting and structural analysis of the CCB and its surrounding rocks reveal a large N-vergent overturned isoclinal synformal folding of the CCB. The dominant penetrative fabric in the CCB reflects the ductile stage exhumation of the CCB along the core of the fold as top-to-SW shear zone (Kumar and Patel in press). This shearing was responsible for differential palaeo-topography across the CCB.

The fabric and minor structures that reveal the geometric and kinematic evolution of this shear zone are described, analyzed and presented in detail. Incipient fabrics and structures are developed in the whole CCB but more intensely developed toward middle of the CCB. Kinematic indicators confirm consistent top-to-SW shearing along this zone. Microstructural analysis of the constituent minerals demonstrates that deformation mechanism is not uniform throughout the CCB but varies from the boundaries toward the middle of the CCB. Quantitative analysis of grain-scale geometries across the CCB reveals that the deformation is spatial and temporally concentrated along the middle zone of the belt. We interpret the middle of the CCB as the central part of the broad shear zone along which the upper part of the CCB is thrust over the basal part of the CCB. The shear zone is developed through the axial zone of the overturned isoclinal synformal fold and then progressively developed outwards by further superposition of shear and flattening strain during which time the whole CCB became a broad shear zone.

The Apatite Fission Track (AFT) dating of the CCB and the HHC rocks shows differential exhumation history. The results indicate that the HHC forming the hanging wall of the MCT cooled below the closing temperature of apatite FT at $1.65 \pm 0.18$ Ma. The FT apatite ages of the CCB along Kali-Darma valleys are older than the HHC but appear to fall in two distinct groups. In the northern part of the CCB the weighted mean of FT apatite age is $9.60 \pm 0.14$ Ma while in the southern part it is $14.10 \pm 0.07$ Ma. It confirms that the differential paleotopography caused by top-to-SW thrusting at the middle of the CCB played major role for different erosive denudation and hence exhumation of the CCB. It also appears that the HHC has exhumed rapidly than the CCB due to repeated reactivation of the MCT coupled with rapid erosive denudation.

The widespread presence of extensional structures indicates that extension was not limited to localized deformation, but affected the whole CCB and overprints the contractional Himalayan deformation. The extensional deformation was related to tectonic loading and uplift of the Himalaya (Patel et al. 1993).

## References

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