Pan-African Magmatism and Himalayan Collisional Tectonism

Sandeep Singh[1]

[1] Department of Earth Sciences, IITRoorkee, Roorkee – 247 667, India, sandpfes@iitr.ernet.in

The Himalayan orogenic belt provides unique opportunity to investigate the Cenozoic collision and crustal shortening of a remobilised Proterozoic basement and cover sediments within a major northeast-dipping 15 -20 km thick intracontinental ductile shear zone. The remobilized Proterozoic basement has been exposed as the Himalayan Metamorphic Belt (HMB) and has been thrust south-westward over the Lesser Himalayan sedimentary sequence along the Main Central Thrust (MCT) and its various splays, e. g. the Jutogh/Vaikrita Thrusts etc. Just north of this major tectonic boundary a granite belt is exposed from Pakistan to eastern Nepal as independent isolated plutons occurring as tabular concordant sheet within the Himalayan Metamorphic Belt (HMB). These bodies have almost similar tectonic, petrographic and geochemical characters in distinct tectonic zone as elongated medium to large size intrusive bodies within low to medium grade metamorphic rocks, absolute ages around 500 Ma, high Sr ratios around 0.72, marginally well foliated, coarse grained gneissose bodies having undeformed massive to porphyritic core, development of thermal contact areoles, presence of abundant metasedimentary xenoliths, and is superposed by Himalayan deformation and metamorphism.

The Pan-African magmatism has been a known phenomenon in Himalaya. The southern limit of this magmatism is Main Central Thrust (MCT). This magmatism represent a part of large thermo-magmatic episode and is associated with a mega-zone of crustal extension, thinning and melting of the lower crust. The magmatism has been recognized from three different regions within the Himalaya; (i) The Lesser Himalayan Granite Belt (LHGB), (ii) Granites at the northern limit of Higher Himalayan Crystallines (HHC) and (iii) North-Himalayan Granite Belt comprises of a series of domes.

These granitic belts are S-type peraluminous, porphyritic in character with discontinous gneissoe and non-gneissic bodies and accompanied by post-magmatic deformation leading to development of mylonitic fabric along their margins. An attempt has been made to date the LHGB (Mandi and Dalhousie body) as well as North-Himalayan Granite Belt (Jispa body). The Mandi and Dalhousie bodies are intruding within the Jutogh Group of rocks. Mandi body has the development of foliation paralleling the main foliation of the schist and psammite sequences. Within the country rock the presence of tight fold having flame-type hinge developed during the D1-pre-Himalayan deformation on lithological/metamorphic banding S0. This deformational phase is missing within the Mandi Granite body. This indicate that the granite body is having only main Himalayan fabric development and the country rock has two fabrics causing the main fabric as a composite fabric. Out of these two fabrics one is pre-Mandi Granite fabric. The date of Mandi Granite indirectly tells about the timing of the formation of the fabric which was already there at the time of crystallization of Mandi Granite (i.e. 469 ± 8 Ma U-Pb SHRIMP age). It has aalso been observed that Mandi body do not inherit any older zircon whereas Dalhousie Body show single population for the body to be 463 ± 8 Ma (U-Pb SHRIMP age) with older inherited near-concordant cores scattered with ages ranging from about 1200 Ma to 700 Ma without clear peaks indicating involvement of mid to late Proterozoic crust. However, Jispa body having TIMS U-Pb lower intercept age to be 457 ± 41 Ma having upper intercept at ~2500 Ma.

These ages substantiate that there has been a wide magmatic activity around Cambro-Ordovician time which can be attributed to Pan African orogeny. These magmatic ages have coeval Pan-African garnet ages along the Himalaya ranging from 548 ± 24 Ma (Alakhnanda Valley) to 436 ± 8 Ma (Barun Gneiss) as well as several unconconformities in the Lesser and the Tethyan Himalaya, including a distinct angular relationship between the Cambrian and Ordovician sequences in the Tethyan part and folded Cambrian sediments sealed by Ordovician strata.

Cite as: Singh, S., 2014, Pan-African Magmatism and Himalayan Collisional Tectonism, in Montomoli C., et al., eds., proceedings for the 29th Himalaya-Karakoram-Tibet Workshop, Lucca, Italy.