Geological and tectono-metamorphic characterization of the Himalayan metamorphic core (HMC) in the Mugu Karnali valley (Western Nepal, Central Himalaya)

Salvatore Iaccarino[1], Chiara Montomoli[1], Rodolfo Carosi[2], Hans-Joachim Massonne[3], Antonio Langone[4], Dario Visonà[5]

[1] Dipartimento di Scienze della Terra, Univ. of Pisa, Italy, iaccarino@dst.unipi.it
[2] Dipartimento di Scienze della Terra, Univ. of Torino, Italy
[3] Institut für Mineralogie und Kristallchemie, Univ. of Stuttgart, Germany
[4] C.N.R. Istituto di Geoscienze e Georisorse, U.O.S. Pavia, Italy
[5] Dipartimento di Geoscienze, Univ. of Padova, Italy

The Himalayan range, extending over 2500 km, has played a central role in shaping our understanding of the orogenesis by colliding continental plates (*e.g.* Kohn, 2014). Several first order geodynamic processes, currently among the major topics of geosciences, like syn-compressional extension, feedback relations between climate and tectonics, rheological implications and exhumation consequences in response to crustal melting, have been developed starting from studies of the Himalayas (*e.g.* Jamieson and Beaumont, 2013).

In this contribution we present the structural and tectono-metamorphic evolution of the Himalayan metamorphic core (HMC) in the Mugu Karnali valley, in Western Nepal, where very few geological data are currently available in the literature (see Montomoli et al., 2013 and references therein). Along this transect a complete and quite well-exposed cross section of the belt, starting from the Lesser Himalayan Sequence (LHS) up to the Tethyan Sedimentary Sequence (TSS), is present. The LHS is characterized by poorly deformed very low-grade metamorphic quartzites, graphitic schists, chlorite-bearing phyllites, and dolomitic marbles. Meso- and microscopic investigations reveal that the main foliation, S2, is a crenulation cleavage since an older foliation is recognized within the microlithons and within intertectonic porhyroblasts. Approaching the tectonic contact of LHS and Greater Himalayan Sequence (GHS), the Main Central Thrust (MCT), we observe an increase of deformation, with developing S-C-C' fabrics in the chlorite-bearing phyllites and L, L>S tectonites in the quartzite layers, as well as, an increase of metamorphic grade with a sporadic appearance of garnet in the pelitic layers just before the MCT. The MCT in this transect, is neither a sharp fault nor a protolith boundary, but a large (kilometre thick) ductile shear zone affecting both quartzites and phyllites of the LHS and high-grade metamorphic rocks (up to the kyanite zone) of the GHS (Carosi et al., 2007).

According to Larson and Godin (2009) the GHS has been subdivided into two portions, the lower GHS (GHS_L), composed of locally anatectic metapelites (garnet zone up to sillimanite zone), orthogneisses, and minor garnet-bearing calcsilicates and amphibolites, and an upper portion (GHS_U) with migmatized para- and orthogneisses and high grade calcsilicates with olivine. The main foliation in the GHS is S2 with an older foliation observable within the microlithons and only sporadically preserved within the porphyroblasts in the highest grade samples. Both GHS and LHS main foliations are folded by late kink-like folds with subvertical axial planes, without developing a clear axial plane foliation and mineral re-crystallization/re-orientation. Moreover, a several km-sized leucogranitic body, the Mugu granite, intruded the migmatitic portion of the GHS_U and likely the base of the TSS. Several magmatic "*textures*" have been observed in the field ranging from equigranular to porphyric.

At the base of the TSS we observed boudinage on orthogonal outcrop surfaces, suggesting a strain pattern typical of field I of Ramsay and Huber (1983). Moreover, the presence of monoclinic structures like flanking folds and asymmetric boudins, coexisting with orthorhombic structures like symmetric boudins, suggest a general flow deformation regime. Near the base of the TSS a very high temperature gradient is suggested by the rapid passage from calcsilicate occasionally with some wollastonite to low grade fossiliferous meta-limestone.

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More than two hundred samples were collected for optical and microstructural studies. Representative samples along the whole section were selected, ranging from garnet-chlorite-bearing rocks (>500°C, 0.8 GPa) up to kyanite/sillimanite-bearing migmatites (*c.* 750°C, 1.1-0.7 GPa) for a detailed petrological characterization, combining pseudosection modeling, trace element thermometry (*e.g.* Zr-in-rutile thermometry, Tomkins et al., 2007), as well as multi-equilibrium thermobarometry (MET) approach. Monazite geochronology is in progress, in order to obtain time constraints for the evolution of these rocks. Preliminary data for samples from different structural position (*i.e.* GHS_L vs GHS_U) reveal a diachronic mineral equilibration within the GHS and support the occurrence of a tectonic and metamorphic discontinuity.

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