Geological map of the Eastern Nepal Himalaya

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We present a geological map of a sector of the Himalaya in Eastern Nepal, from the Rolwaling Himal to the border with Sikkim. The map has been drawn on the basis of original geological mapping, structural and petrological investigations along several cross sections, variably integrated with published data. According to the major subdivision proposed for the Himalaya, the geological setting of the Eastern Nepal Himalaya is characterized by a few major lithotectonic units striking E-W and separated by tectonic contacts, north-dipping at a regional scale. From lower to upper structural levels (and from south to north) these are the sub-Himalaya, the metamorphic Lesser Himalayan Sequence (LHS) and Greater Himalaya sequence (GHS), and the Tibetan Sedimentary Series.

The LHS typically consists of grey to pale-green fine-grained quartz-sericite schists, slates and phyllites, showing m-scale intercalations of either massive quartzites (±Grt ±Ctd) and chlorite-sericite schists. Graphite-rich schists occur mainly in the lower structural levels. Cm-scale intercalations of garnet-amphibole quartzites are also observed. In the upper structural levels, peculiar two micas augen-gneiss occurs, marking an abrupt change in lithology. The augen-gneiss contains metric to plurimetric layers of Phl- ± Ky-bearing phyllonite and chloritoschist, likely representing the product of a metasomatic transformation of the granitic protolith along shear zones.

The overlying GHS has been subdivided in two different domains considering lithological, structural and metamorphic criteria.

The lower domain (GHS-L) consists of two micas + Grt (± St, ± Ky) coarse-grained micaschist and gneiss. These rocks are associated to metric to decametric thick levels of two-micas quartzitic gneiss, Grt + Zo granofels and small lenses of impure marbles (± Phl, ± Wm). Locally, they host intercalations of phyllitic Ank-bearing micaschist (+ greenish Bt). Moving toward their uppermost levels, the GHS-L consists of Bt (± Grt, ± Sil) gneiss showing local evidence of partial melting and a pervasive growth of late Wm flakes.

The upper domain of the GHS (GHS-U) partially corresponds to the High Himalayan Crytallines of various authors and consists mainly of Grt + Bt + Kfs + Ky/Sil anatectic paragneiss, reported as Barun Gneiss by Lombardo et al. (1993). In its central and upper portions, the Barun Gneiss is associated with a fine-grained Kfs + Bt + Sil ± Grt paragneiss (reported as Black Gneiss by Lombardo et al., 1993), showing Sil + Qtz nodules up to few cm in size. Up section, the GHS-U anatectic paragneisses are characterized by Crd-bearing assemblages and record a progressive decrease of peak-pressure conditions upward. The GHS-U contains also large bodies of Bt ± Sil ± Grt anatectic augen-gneiss, whose occurrence significantly increases toward the upper structural levels. Metric to plurimetric thick layers of calc-silicate granofels and impure marbles (Di + Pl + Qtz ± Kfs ± Scp) are also widespread. Large bodies of leucogranites and a network of pegmatitic dikes are notably intruded in the middle-upper levels of the GHS-U.

The Main Central Thrust zone, notably one of the major features of the Himalaya system, is here indentified as a km-thick highly sheared zone involving rocks of the upper LHS and the lower GHS-L. Across this zone, structural observations integrated with petrography, mineral chemistry, and petrologic modeling revealed the juxtaposition of rock packages characterized by different P-T evolution and T/depth gradients. A similar setting suggests an imbricate nature of the MCTZ, thus emphasizing the complexity of tectonic processes operating during the exhumation of the metamorphic units in the Himalaya.

The graphical editing of the geological map is also supported by suitable databases where all the represented geological features (i.e. geological units, boundaries, foliations, samples, …) are stored and harmonized using standard criteria in order to describe their typology and quality.

References

Lombardo,B., Pertusati, P. and Borghi, A.,1993, Geology and tectono-magmatic evolution of the eastern Himalaya along the Chomolungma-Makalu transect. In: (Eds) Treloar P.J. and Searle M.P., Himalayan Tectonics. Geological Society of London, Special Publication, 74, 341–355.

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