Understanding the origins of Eo- and Neohimalayan granitoids in Eastern Tibet

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The magmatic history of the eastern Himalaya is only now being studied to the extent that the rest of the range has been documented but has already revealed several surprises. Perhaps the most paradoxical occurrences are the Eocene igneous complexes which outcrop within the Tethyan Himalaya. In context of a N-S transect from the Main Central Thrust (MCT) to the Indus Tsangpo suture (ITS), we have studied two of these centers, the Dala igneous complex and the Yala-Xiangbo granitoids, and conclude that they arose from very different processes.

The Dala granitoids formed from Gangdese-type magmas that assimilated approximately 50% crustal material from the Greater Himalayan Crystallines (GHC) and/or Tethyan Himalayan Sequence (THS) prior to emplacement at relatively shallow crustal levels. In contrast, the Yala-Xiangbo granitoids are a series of leucocratic sills, dykes and small plutons that, although structurally similar to the North Himalayan granites (NHG), were emplaced 15 to 30 m.y. earlier. The Dala granitoids, in particular, represent a mode of Eocene magmatism undocumented elsewhere in the Himalaya.

Also observed are anatectic granitoids similar to the High Himalayan Leucogranites (HHL) and North Himalayan Granites (NHG) commonly found across the Himalayan Arc. The Miocene Arunachal Leucogranites (AL) and Tsona Leucogranites (TL) outcrop, respectively, within the Arunachal Greater Himalayan Crystalline (GHC) sequence and adjacent the South Tibetan Detachment. They are equivalent to the HHL in terms of emplacement style and structural position. While the Tsona leucogranites formed by vapour-absent melting of nearby units, as has been generally documented for the HHL, the Arunachal leucogranite suite formed by a combination of both vapour-absent muscovite melting and vapour-present melting of the Lesser Himalayan series. Although once the preferred model for Himalayan leucogranite formation, vapour-present melting of Himalayan sequences has since been largely abandoned in favour of vapour-absent melting of micas to explain the genesis of the HHL and NHG. We suggest that vapour-present melting may be more widespread in the Himalaya than currently thought.

We conclude that by ca. 45 Ma, thickened THS metasediments were already in the hanging wall of the main Himalayan decollement. During the Eohimalayan episode, the eastern Himalaya experienced amphibolite-grade metamorphism and localised peraluminous granitoid magmatism. Subsequently, a period of tectonic quiescence occurred in the northern Himalaya simultaneous with shortening occurring further south. The Neohimalayan history of the eastern Himalaya is similar to other parts of the range where deformation and magmatism were intimately associated in the frontal part of the range. Exhumation in the North Himalaya appears to have largely been driven by thrusting along the ITS.

The results of this study suggest that the prevailing view of post-collisional granitic magmatism, developed largely from investigations in the central Himalaya, does not well-describe the easternmost segment of the Himalayan Arc. Particularly puzzling is the origin of Eocene igneous complexes which outcrop within the Tethyan Himalaya, as the heat source needed to generate Eohimalayan peraluminous magmatism (and regional metamorphism) in the eastern Tethyan Himalaya is not predicted by existing models. However, tomographic images reveal a persistent lithospheric weakness, coincident with the Ninety East Ridge, which intersects the eastern Himalaya beneath our study area. This feature may have localized heat-flow and magmatism beneath the eastern Himalaya throughout the Tertiary.