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Eohimalayan NE-directed tectonism in the NW Himalaya: Implications for the kinematic evolution of the High Himalayan Crystalline of Zanskar

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In the central parts of the Himalayas, the High Himalayan Crystalline (HHC) high-grade rocks are exhumed in the frontal part of the range, as a consequence of a tectonic extrusion controlled by combined thrusting along the Main Central Thrust (MCT) and extension along the South Tibetan Detachment System (STDS). In the NW Himalaya, however, the hanging wall of the MCT in the frontal part of the range consists of low-grade metasediments, whereas the HHC high-grade rocks are exposed in a more internal part of the orogen as a large scale dome structure called the Gianbul dome. Another striking feature of the HHC in NW Indian Himalaya is the occurrence of NE-vergent folds and thrust faults that clearly contrast from the SW-directed folding and thrusting that characterize the Himalayan orogeny since the continental collision between India and Asia 55 Myr ago. Two competing interpretations have been put forward to explain the occurrence of these uncommon NE-verging structures. A first set of interpretations argues that this unusual vergence relates to local heterogeneities of the deformation during to the main SW-directed folding phase (e.g Frank et al., 1987). However, based on structural interference patterns, Steck et al. (1993) contrastingly conclude that these NE-directed structures predate the predominant SW-verging Himalayan deformation and are related to an early NE-directed Eohimalayan tectonic event associated with the emplacement of the so-called Shikar Beh nappe.
New structural and geochronological data reveal that these unusual NE-verging structures result from a NE-directed propagation of crustal deformation that initiated 53 Myr ago. As such, the numerous structures showing a top-to-the NE sense of shear observed in Upper Lahul (NW India) cannot just be seen as local heterogeneities of the main SW-verging deformation but rather as evidence of a predominant Eohimalayan deformation manifested by folding and thrusting toward the NE. Although the origin of this Eohimalayan event remains unclear, the intracontinental overburden of about 30 km generated by the resulting Shikar Beh nappe could have prevent the extrusion of the high grade metamorphic rocks of the HHC in the frontal part of range along the MCT such as observed in most of Himalayan section. On the other hand, the weakness generated in the upper crust by the presence of NE-directed thrust faults at the front of the Shikar Beh nappe may have facilitated the exhumation of the high-grade rocks of the HHC in a more internal part of range as a large scale dome structure. The Shikar Beh nappe appears thus to have play a major role in the kinematic evolution of this portion of the Himalaya and its emplacement constitutes a major event in the early history of the Himalayan orogeny. The results of this study clearly identify that Eohimalayan NE-directed crustal thickening and thrusting are responsible for the contrasting geologic structures and metamorphic zonation observed in the northwestern part of the Himalaya of India.

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