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Himalayan basement rocks experienced superposed folding during the Orogeny: insights from integrated mesoscopic and magnetic fabric analysis

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There are numerous studies that attempted to quantify the amount of crustal shortening caused by the India-Eurasia collision that resulted in the Himalayan Orogeny. However, there has been a marked difference between shortening estimated from volumetric analysis and that estimated from cross-section balancing technique. Amount of shortening ascertained from cross-section balancing has generally been significantly lower than that of volumetric analysis. One plausible explanation for this discrepancy is that the cross-section balancing technique considers only the supra-crustal rocks of the Himalaya and its basement rocks have either not been considered or their deformation history has not been taken into account. Hence, deformation history of the Himalayan basement rocks is of paramount importance before any estimation of crustal shortening can be made. The Paleo-Proterozoic Wangtu-Gneissic Complex (WGC) forms the basement of the Himachal Lesser Himalaya, and is bounded by the Vaikrita Thrust (VT) and the Munsiari Thrust (MT) in its northeast and southeast flanks respectively. The WGC shows evidences of type-1 superposed folding, in which the D1 and D2 folds are mutually orthogonal to each other and the late D2 folds are related to the doming of the WGC. It also developed composite mesoscopic and magnetic fabric, which is nearly concordant near VT and MT and are of two types in the interior parts: (i) magnetic lineation demarks the intersection of mesoscopic and magnetic foliation indicating superposed deformation and (ii) scattered distribution of magnetic lineation due to D2 folding on initially curved and non-cylindrical D1 surface. 40Ar–39Ar dating of biotite from one site from the core of WGC gives an age of 9.3 $\pm$ 0.3 (2σ) Ma. It is inferred that the doming of the WGC took place at $\sim$9 Ma. Our study demonstrates that the WGC has experienced superposed deformation and along-strike stretching near VT, instead of large scale thrust controlled transport. It also signifies that superposed folding and ductile deformation of the basement rocks has to be taken into account before any estimation of crustal shortening is made in the Himalaya.