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Strain partitioning within thrust sheets of tectonic windows: Insights from eastern Himalaya

Jyoti Das and Kathakali Bhattacharyya
Indian Institute of Science Education and Research Kolkata, Department of Earth Sciences, Mohanpur, India (jyotida1@gmail.com)

In a fold-thrust belt (FTB), penetrative strain within thrust sheets vary in its magnitude, orientation and type. Addressing variation in magnitude and orientation of strain from major thrust sheets in a FTB, both along the transport direction and along-strike, enable us to understand the complexity of strain partitioning during orogeny. Tectonic windows provide an opportunity to understand the impact of footwall structures on finite strain geometry and orientations of the overlying thrust sheets. In this study, we investigate how penetrative strain is partitioned from the internal to the external major thrust sheets in the Siang window in far-eastern Arunachal Himalayan FTB. We also compare these results with similar thrust sheets from well preserved tectonic windows in the eastern Himalaya, i.e., the Teesta window of the Sikkim and Kuru Chu window of the Bhutan Himalayan FTB.

We conduct finite strain analysis on quartz grains using R_f-φ, normalized Fry and Shape Matrix Eigenvector methods. The studied lithologies are gneiss for the internal Pelling-Munsiari-Bomdilla thrust (PT) sheet, while quartzite and sandstone dominantly comprise the external Main Boundary thrust (MBT) and the Main Frontal thrust (MFT) sheets. The rocks north of the PT sheet are not accessible. Results from this study indicate that all the studied rocks record an overall flattening strain. Magnitude of the finite penetrative strain decreases from the internal PT sheet to the external MBT, MFT sheets in the Siang window. The long axes of the finite strain ellipsoids (X) generally have a low plunge and vary in bearing, irrespective of the structural positions of the different thrust sheets. Finite strain ellipses are folded along with the thrust sheets indicating that the penetrative strain developed prior to folding of the thrust sheets. The results also indicate that the footwall structures affect the strain geometry in the interior part of the Himalayan wedge. The grain scale shortening percentage is highest for internal PT sheet and it progressively decreases towards the external MFT sheet. The results indicate greater contribution of thrust-parallel stretch than thrust-perpendicular component, in both internal and external thrust sheets in the Siang window. Preliminary results also suggest that the strain magnitude and grain-scale shortening percentage are the lowest, and orientations of X-axes are more variable with respect to the regional transport direction in the far-eastern Siang window as compared to the other westerly lying regional transects of the Himalayan FTB.