



Symmetric and near-symmetric objects in ductile shear zones- examples from Higher Himalaya, Bhagirathi section, India

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Ductile shear zones contain numerous asymmetric fabrics/structures/clasts/ objects of three overall geometries viz. sigmoidal, lenticular and parallelogram-shaped (Mukherjee, 2011). These indicate the shear sense of the rock, and have been reviewed from time to time by other authors and myself. By contrast, there has been no concise study or review of symmetric and near symmetric objects within ductile shear zones. This work studies morphologies of such symmetric objects from the Bhagirathi river section in the Higher Himalaya (HH), India. The HH in this section began top-to~SW compressional ductile shear at ~ 25 Ma. This was followed by intervals of extrusion by channel flow alternating with critical taper spreading from ~ 18 Ma onwards. During its two pulses/phases of channel flow, two sub-zones of extensional ductile top-to~NE shear developed (Mukherjee, in press). Mesoscopic near symmetric objects in the HH are of the following types. (A) Isolated objects- most often lenticular/elliptical, but rarely sub-circular, rectangular or rhombic. (B) Gently curved quartz veins. (C) Warped NE dipping main foliations. (D) Nearly uniformly thin quartzofeldspathic foliations that bulge locally into sub-circular or sub-elliptical shapes. Most of the fractures inside clasts are irregular and their geometries do not conclusively indicate any shear sense. In general these fractures are confined to within the (harder?) clasts, very gently curved, sub-parallel to each other, and are at high angle with ~ NE dipping main foliations defined within mylonitized host rocks. This probably indicates (local?) brittle-ductile extension parallel to the main foliation. Notice that (a) one common explanation for the evolution of S-fabrics is that they rotate towards parallelism with the C-planes as the intensity of shear increases; and (b) lenticular clasts in mylonitized gneiss have classically been called 'augens'. In both these cases, a low-angle S-fabric and 'augen' may not indicate a clear shear sense.

References

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