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Quantification of competency contrast from refraction of shear-induced micro-fractures, Gangori Shear Zone, Bhagirathi river section, NW IndianLesser Himalaya

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We study the meta-greywacke of Rautgara Formation, Garhwal Lesser Himalaya, India. The focus is on the micro-fractures which cut the flaky-mineral rich cleavage (c-) and porphyroclast-rich microlithon (m-) domains of a disjunctive foliation. Although the rock does not show shearin meso-scale, shadow zones and tails of the quartz porphyroclasts exhibit a top-to-SW ductileshear. Kinematic vorticity number, calculated by porphyroclast aspect ratio method,from ~ 80 semi-elliptical quartz porphyroclastsis ~0.8 (i.e. 59% simple shear). Our observationsmatchthe results of previousanalogue- and analyticalmodels for different types of prototype rocks.For example:1. higher competency contrast between c- and m-domains favors extension fracturesover shear fractures (extension fractures tend to develop more in m-domains whereas the shear fractures in c-domains);2. angle (Θ) between fracture and 'layer normal' is higher in less-competent layers;3. dominant simple shear gives rise to P-brittle planes at an acute angle to the shear direction (Y-plane); and 4. stress drop during fracturing may inhibit slip along shear-induced fractures.Our calculations indicate that the rheological contrast (derived from the variation of Θ) refractsthe shear-induced fracture at the domain boundaries. Θ measured in 15 successive c-and m-domains shows thatthe most viscous m-domain is ~24 times more viscous than the lowest viscous c-domain. Additionally, out of eight c-layers, the most viscous c-domain has a viscosity 3.4 times more than the least viscous c-domain.Similarly, out of seven m-layers, the most viscous m-domain has a viscosity 4 times more than the least viscous m-domain.