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GEOSITES

Opposite ductile shear senses (Tso Morari Dome, Ladakh Himalaya, India)

Kinematic indicators from within the Tso Morari Gneiss (India) display opposite senses of shear. The winged inclusion at the center has rotated dextrally (Grasemann and Dabrowski 2015), whereas the sigmoid clast to its right shows sinistral shear (Passchier and Trouw 2005). The rotation axis is perpendicular to the plane of observation. Moreover, the quartz fish (Mukherjee 2011a) to the extreme right indicates top-to-right (down) shear (fig. 1.29 of Mukherjee 2013). Here, the term "winged inclusion" is preferred over "rolling structure" since the wings look like preexisting, i.e., have not been derived from the periphery of the elliptical clast by grain size reduction or recrystallization (Van Den Driessche and Brun 1987). Although top-to-right shear seems dominant, whether top-to-left shear indicates a possible "back-rotation" is indeterminate.

The photograph was taken from the northern boundary of the Tso Morari Dome (TMD), which is a well-established shear zone (Chatterjee and Jagoutz 2015; Epard and Steck 2008; Mukherjee 2011b; Mukherjee and Mulchrone 2012). Thus, the winged inclusions that usually develop by intense strain (Hanmer and Passchier 1991) justifies. de Sigoyer et al. (2004) reported opposite shear from the TMD, but not from a single outcrop, as this one. However, Steck et al. (1998) did observe both top-to-NW & top-to-SE at some places and attributed the latter to dextral transpression parallel to the Indus Suture. Opposite shear has also been reported from many shear zones in the world (Mukherjee and Koyi 2010; Mukherjee 2013), and decoding those will be useful to understand collisional tectonics (Mukherjee et al. 2013, 2015). Symmetric structures (Mukherjee 2016) in ductile shear zones neither indicate shear sense therefore nor reverse shear. The foliation planes are sub-horizontal (220°/15°NW). North direction is toward right. Width of view: ~7 cm. Location: 33.23702199N, 78.36122001E, near Sumdo, Ladakh, state: Jammu & Kashmir, India.

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