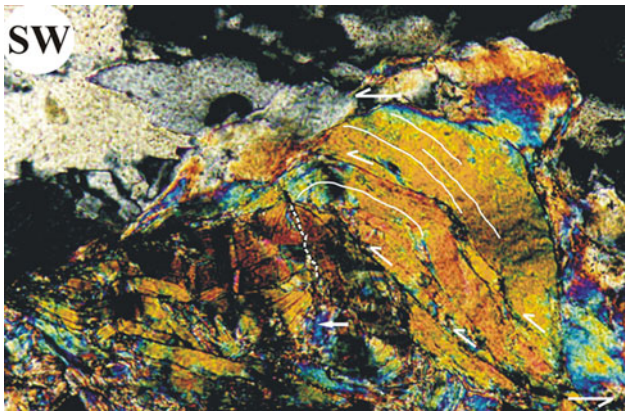
Int J Earth Sci (Geol Rundsch) (2012) 101:503
DOI 10.1007/s00531-011-0738-z

GEOSITES

A micro-duplex



The photomicrograph (cross-polarized light) shows a 2 mm wide part of a thin-section cut perpendicular to the primary brittle shear plane and parallel to slikenlines in mylonitized gneiss from near the Zanskar Shear Zone, Padam, western Indian Himalaya. Asymmetrically stacked muscovite grains interpreted as indicative of a top-to-SW sense of brittle shearing. In the absence of any other 'markers', the interpretation is based solely on the overall geometry of stacked grains, which is similar to the stacking of litho-units on larger scales in general (e.g., McClay and Insley 1986 and references therein), and also from other sections of the same shear zone (Mukherjee and Koyi 2010a, b). It should be noticed that the quartzo-feldspathic matrix, presumably more rigid, shows no evidence of thrusting. The smooth and straight margins of the muscovite grains indicate mechanical stacking rather than grain boundary migration that would result in irregular margins (Jessel 1987). The deciphered shear sense matches with those given by mesoscopic duplexes and thrust slices in the field scale (e.g., the supplementary field photograph). The core of the duplex structure (full arrow) shows extensive recrystallization of muscovite grains possibly during brittle shear. The exact mechanism of recrystallization is beyond the scope of this Geosite. The inclined white dashed line defines the northeasterly dipping axial trace of the anticlinal folded muscovite grains. Kinking is more prominent to the *left* of the axial trace. To its *right*, individual muscovite grains are thrust over each other and show curved (001) cleavage traces. Mica grains defining foliation planes are most vulnerable to duplex movement and can often be seen at very high magnifications. This seems to be the second report of a microscopic asymmetric duplex, see fig. 16.8 of Fossen (2010). Three phase of metamorphism that the Higher Himalayan Shear Zone enjoyed has been reviewed by Yin (2006).

Acknowledgments Chris Talbot (retired from Uppsala University) and Pritam Nasipuri (Tromso University) annotated the text and suggested improvement. Wolf-Christian Dullo suggested the addition of a supplementary field photograph.

References

Fossen H (2010) Structural geology. Cambridge University Press, Cambridge, p 316

Jessel MW (1987) Grain boundary migration microstructures in naturally deformed quartzite. J Struct Geol 9:1007–1014

McClay KR, Insley MW (1986) Duplex structures in the lewis thrust sheet, crowsnest pass, rocky mountains, Alberta. Canada. J Struct Geol 8:911–922

Mukherjee S, Koyi HA (2010a) Higher Himalayan Shear Zone, Sutlej section—structural geology & extrusion mechanism by various combinations of simple shear, pure shear & channel flow in shifting modes. Int J Earth Sci 99:1267–1303

Mukherjee S, Koyi HA (2010b) Higher Himalayan Shear Zone, Zanskar section—microstructural studies & extrusion mechanism by a combination of simple shear & channel flow. Int J Earth Sci 99:1083–1110

Yin A (2006) Cenozoic tectonic evolution of the Himalayan orogen as constrained by along-strike variation of structural geometry, extrusion history, and foreland sedimentation. Earth-Sci Rev 76:1–131

Electronic supplementary material The online version of this article (doi:10.1007/s00531-011-0738-z) contains supplementary material, which is available to authorized users.

S. Mukherjee (✉)
Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai 400076, Maharashtra, India
e-mail: soumyajitm@gmail.com

Received: 26 July 2011 / Accepted: 12 November 2011 / Published online: 12 January 2012