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Two new ductile microscopic shear sense indicators from the Oman Mountains

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The new shear sense indicators were observed in two different tectonic settings. The first one occurs in mylonitized Jurassic limestone on the northern flank of the Jebel Akhdar Dome (eastern Oman Mountains) and is associated with top-to-the-NNE extension. The second one was discovered in mylonitized plagiogranite (trondhjemite) with vertical to subvertical foliation and strike-slip deformation within harzburgite of the Semail Ophiolite in Wadi Fizh (northwestern Oman Mountains).

The carbonate mylonite displays shear planes, in thin, flat and parallel laminations with a compositional aspect as there are alternations between pure calcite laminae and dark laminae of accumulated limestone impurities (iron compounds, clay). Despite the fact that the carbonate mylonite is associated with extension, the shear sense criterion is linked to top-to-the-NNE microthrusts, involving shortening of the dark laminae. The thrusts form an acute angle in relation to the lamination. Thrusting between segments of these, microthrusts created pull-aparts whose voids remained temporarily open cavities but were eventually filled with drusy calcite cement. The shear sense is revealed by (1) the shortening and related imbrication of the thrust laminae, (2) the pull-apart structures and (3) drag folds at either end of the microthrusts. The shear is also confirmed by independent ductile and brittle macroscopic shear sense criteria in the same outcrop, such as drag folds, Riedel shears and mineral steps. These new shear sense fabrics measure approximately 0.5mm in width and 1mm in length.

The mylonitized granite contains large (2mm long axis) plagioclase porphyroclasts. We encountered a rotated plagioclase crystal whose twin lamellae have been dragged by the rotational motion during high-temperature conditions. Drag folds occur on either end of the lamellae/crystal. As a result an “S” shape is produced by counterclockwise rotation and sinistral shear, respectively. The observed shear sense is confirmed by synthetically sheared K-feldspar and feldspar porphyroclast systems. “Z” shapes are expected to develop in case of opposite rotation and shearing.