

Two-phase shear within a core complex mylonite zone: The Northern Snake Range Décollement, Nevada

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The relationship between low-angle detachment faults and the mylonitic rocks in their footwalls is unclear. At present two hypotheses exist: (1) Mylonite zones reflect deformation directly related to exhumation along a single detachment fault; or (2) They are a more general feature of the extending middle crust that is “captured” and exhumed by a detachment. Each hypothesis has distinct implications for expected kinematic indicators: (1) A dominant shear sense coupled with slip on a detachment fault; or (2) Varying directions and senses of displacement through time and space.

The Northern Snake Range Décollement (NSRD) in eastern Nevada is a classic Basin and Range low-angle domiform detachment with a well-documented top-east sense of displacement. However, structural observations suggest that the 100 m-thick mylonite zone has experienced both top-east and top-west phases of shear.

Our study focuses on an exposure of the mylonite zone on the eastern side of the Northern Snake Range where rheological contrasts between mylonitized calcareous units and deformed mafic dikes provide good strain markers and kinematic indicators. East-directed shear is indicated by an east-dipping mylonitic fabric, east-vergent folds and east-asymmetric porphyroclasts. Paleomagnetic analyses indicate that the mafic dikes have been rotated top-east, while in high-strain zones they form east-asymmetric boudins. These structures are cut and overprinted by meter-scale west-dipping shear-bands, which in places coincide with east-directed shear zones, producing complicated structures including dikes that have been boudinaged and then folded.

Our observations suggest that the mylonite zone might not be directly related to NSRD slip, but could instead represent a captured feature of the extending middle crust that has accumulated displacement from faults with varying senses of displacement over time.