GSA Connects 2022 meeting in Denver, Colorado

Paper No. 217-8
Presentation Time: 10:10 AM

DUCTILE STRAIN IN THE FOOTWALL OF THE NORTHERN SNAKE RANGE METAMORPHIC CORE COMPLEX, EASTERN NEVADA, USA: IMPLICATIONS FOR ITS STRUCTURAL EVOLUTION

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The geometry and magnitude of finite strain in the ductile footwalls of metamorphic core complexes are important parameters for testing the predictions of models of extension, yet are often difficult to quantify due to the rare preservation of deformed markers. The footwall of the Northern Snake Range core complex in eastern Nevada preserves a coherent stratigraphy of ductilely thinned Neoproterozoic-Cambrian metasedimentary rocks that are exposed over a 30 km transport-parallel distance, and thus provides an important opportunity to quantify footwall strain. We measured strain ellipsoids from stretched detrital quartz grains and ribbons in 45 samples that span the full exposed distance of the ductilely sheared footwall of the master detachment fault (the Northern Snake Range décollement), and we combined our data with 11 published strain ellipsoids. On the eastern side of the range, where recrystallization limits the preservation of detrital quartz grains, we estimated finite strain by comparing the attenuated thicknesses of Neoproterozoic-Cambrian rock units to their regional stratigraphic thicknesses.

Our data demonstrate a dramatic gradient in ductile strain in the transport direction, from 39% subhorizontal extension and 32% subvertical thinning at the western flank of the Northern Snake Range to 450-1440% extension and 81-94% thinning at the eastern flank. The footwall underwent 18-20 km of cumulative ductile extension, which is equivalent to 38-43% of the 47 km of total extension accommodated on brittle structures. Kinematic vorticity estimates from published quartz petrofabrics define an eastward-increasing component of top-to-the-ESE simple shear.

Our data are compatible with a rolling hinge model of extension, where displacement on a low-angle, upper-crustal, brittle detachment fault system was fed downward to a zone of distributed, simple shear-dominant, top-down-to-ESE ductile shearing beneath the quartz crystal-plastic transition. The progressive eastward translation and brittle thinning of the hanging wall resulted in the eastward migration of exhumation of footwall rocks. Migrating exhumation may in part be responsible for the eastward-increasing finite strain gradient, as footwall rocks in the eastern part of the range experienced a longer strain history.

Session No. 217

T39. New Insights into the Evolution and Geodynamics of Metamorphic Core Complexes in North America and Around the World
Wednesday, 12 October 2022: 8:00 AM-12:00 PM

507 (Colorado Convention Center)

Geological Society of America *Abstracts with Programs.* Vol 54, No. 5
doi: 10.1130/abs/2022AM-378756

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