
26-26 - DEFORMATION KINEMATICS AND TEMPERATURE CONDITIONS OF THE DAKOTA TECTONIC ZONE WITHIN THE LITTLE ELK GRANITE IN THE BLACK HILLS NEAR NEMO, SOUTH DAKOTA



Thursday, 16 May 2024



9:00 AM - 5:30 PM



Grand Ballroom (Davenport Grand Hotel)

Booth No. 47

Abstract

Precambrian rocks in the Black Hills record multiple tectonic processes, including suturing of the Wyoming and Superior cratons from ca. 1.740-1.715 Ga. To date, studies focused on this suturing event have primarily focused on prograde metamorphism and structures that record shortening between the cratonic blocks. However, a strike-slip shear zone subparallel to the shortening structures, named the Dakota Tectonic Zone (DTZ), has also been documented but is poorly understood. We examined intracrystalline deformation and associated microstructures in oriented thin sections of the Little Elk Granite (2.560 Ga mylonitized augen gneiss) within the mapped domain of the DTZ to further document how the strike-slip deformation fits into the Precambrian structural evolution of the Black Hills. At the outcrop scale, the Little Elk Granite contains two types of fabrics. Fabric type 1 is an augen gneiss fabric characterized by alignment of ~1-5 cm K-feldspar crystals that is interpreted to have formed during emplacement of the Little Elk Granite. Fabric type 2 cross-cuts the augen gneiss fabric and is characterized by comminution of the large K-feldspar grains within mylonitic shear zones. Whereas the type 1 fabric is folded throughout the field area, the type 2 shear fabric is consistently oriented at ~150/70°SW and contains a down-dip stretching lineation. Oriented thin sections cut perpendicular to foliation and parallel to lineation contain broken feldspar crystals that in some cases also exhibit undulose extinction. Domains between paired fragments of broken feldspar crystals are filled in with equant polycrystalline quartz aggregates and are regularly oriented at a high angle (>45°) to the shear foliation. Quartz-rich domains in the type 2 fabric generally display undulose extinction and dynamic recrystallization textures. Kinematic indicators from asymmetric strain shadows associated with feldspar porphyroclasts and asymmetrically folded micas yield dominantly top-to-the-left sense of motion, but top-to-the-right shear sense is also common (46%). The sum of microstructural data from the Little Elk Granite suggests that the DTZ is an upper greenschist facies (~300-450°C) left-lateral pure shear dominated transpression zone that likely formed late in the suturing of the Wyoming and Superior cratons.

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