
26-27 - KINEMATIC ANALYSIS OF LITTLE ELK GRANITE SHEAR ZONES, BLACK HILLS SOUTH DAKOTA



Thursday, 16 May 2024



9:00 AM - 5:30 PM



Grand Ballroom (Davenport Grand Hotel)

Booth No. 48

Abstract

The Black Hills of western South Dakota and eastern Wyoming were uplifted as a result of the Laramide orogeny occupying the suture between the Wyoming and Superior Cratons. Two exposures of Archean orthogneiss, the Bear Mountain Terrane and the Little Elk Granite (LEG), represent the oldest rocks exposed in the Precambrian core of the Black Hills and offer the opportunity to study tectonic processes involved in forming the Laurentian craton. This study presents new structural field data (orientation of foliation planes, stretching lineations, and cross cutting relations; $n=270$ measurements) along a ~5 km transect that record the deformation history of the LEG. Two dominant fabric types were found in outcrop: augen gneiss (type 1) and mylonitized granite (type 2). The type 1 fabric is characterized by 1-5 cm K-feldspar crystals aligned to give top-down or “normal” sense of shear, small-scale folding of the fabric, and is cross-cut by aplite dikes in multiple sites. The type 2 mylonitic fabric overprints the type 1 fabric and intensifies from east to west along the transect, resulting in a loss of the type 1 fabric. The stretching lineation in the type 2 fabric plunges down dip with shear sense indicators observable in outcrop. Both fabrics display a NW/SE striking and ~70°SW dipping foliation at every site. Yet, subtle folding of the type 1 fabric at some sites causes it to be crosscut by the type 2 fabric. Based on the high-temperature deformation features in the type 1 fabric and the cross-cutting relationship with aplite dikes, we interpret that the type 1 fabric formed during emplacement of the granite. Assuming the LEG has not experienced significant tilting since emplacement, the top-down shear sense recorded by alignment of K-feldspar may suggest emplacement of the LEG into an extensional setting. Our observations of the type 2 fabric, including down-plunge stretching lineations and opposing shear sense indicators support previous interpretations of transpressional deformation within the LEG and metasedimentary rocks sheared along its western margin. With the new data describing shear zone kinematics in the LEG, we interpret that the type 1 fabric formed prior to suturing of the Wyoming and Superior Cratons and the type 2 fabric formed during craton suturing.

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