

37-7 - INVESTIGATION OF TOURMALINE-MINERALIZED MIRRORED BRITTLE FAULTS FROM WEST ANTARCTICA USING $\delta^{18}\text{O}$ (QZ-TUR), TOURMALINE $^{40}\text{Ar}/^{39}\text{Ar}$ THERMOCHRONOLOGY, AND BRITTLE KINEMATIC ANALYSIS

 Friday, 17 May 2024
 9:00 AM - 1:30 PM
 Grand Ballroom (Davenport Grand Hotel)

Booth No. 7

Abstract

Brittle faults are widespread but rarely exposed in Marie Byrd Land, a part of the West Antarctic rift system, owing to enhanced erosion of zones of cataclasis by the regional ice sheet. Tourmaline-mineralized faults discovered at three locations in the Ford Ranges constitute a new record of fluid-rock interactions in this region of extended crust. Tourmaline resists re-equilibration, even during metamorphism, thus strongly aligned tourmaline from high-angle faults at Mt. Douglass, Mt. Dolber, and Lewisohn Nunatak likely contain direct records of fault-hosted fluids and timing of fault movements. The faults form an array oriented NNW-SSE and WNW-ESE, which displays brittle kinematic criteria indicating normal-oblique and strike-oblique displacement. Mirrored fault surfaces suggest formation during seismic slip.

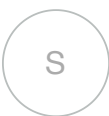
Tourmaline is concentrated within a 2 to 4 mm zone bordering the fault planes. Petrography and EMPA analyses show unzoned tourmaline, with the dravite variety at Lewisohn Nunatak and schorl at the other two sites. Fluid inclusions in dravite are tubular (A-axis-parallel), 10 to 15 μm , and up to 25 μm , in length, containing gas and fluid phases. Fluid inclusions in schorl are C-axis-parallel and breached. Tourmaline $\delta^{18}\text{O}$ ratios ($n=4$) range from 9.2 to 10.4 ± 0.1 ‰ VSMOW (average 9.7‰, s.dev. = 0.7). Paired quartz yield $\delta^{18}\text{O}$ values of 11.1 to 10.3 ± 0.1 ‰, and $\Delta\text{Qtz-Trm}$ values between 1.3 and 2.0. Brittle microfractures in parallel arrays, evident in thin section, indicate tensile opening along ENE-WSW axes, in accordance with outcrop evidence.

The strong preferred orientation and uniform mineral composition of tourmaline indicate syntectonic growth of tourmaline along fault planes. $\Delta\text{Qtz-Trm}$ values suggest equilibration between host-rock quartz and tourmaline was not achieved, likely due to rapid tourmaline precipitation. Relative isotopic homogeneity between sites suggests similar fluid conditions across the region, for crust underlying a minimum area of 2000 km^2 . Preliminary results of tourmaline $^{40}\text{Ar}/^{39}\text{Ar}$ dating indicate broadly Cretaceous timing for fault-related fluid flow. Ongoing work seeks to determine the temperature of mineralizing fluids and evaluate whether the brittle array localizes geothermal heat beneath the contemporary icesheet.

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