268-6 - Booth No. 231: RHEOLOGY OF COEVAL MYLONITE AND PSEUDOTACHYLYTE IN THE BRITTLE-DUCTILE TRANSITION OF THE BLACK BELT SHEAR ZONE, SOUTHERN CALIFORNIA BATHOLITH

Wednesday, September 25, 2024

8:00 AM - 5:30 PM

Hall D (Anaheim Convention Center)

Booth No. 231

Abstract

We investigate the deformation conditions of coeval mylonites and pseudotachylytes (pst) exposed in the brittle-ductile transition (BDT) in the Black Belt Shear Zone (BBSZ) in the Southern California Batholith using SEM (Scanning Electron Microscope) imaging, and Electron Backscatter Diffraction (EBSD) analysis. We selected four representative samples along a strain gradient of the BBSZ. The BBSZ is a transpressional shear zone developed within hornblende and biotite tonalites and diorites. The shear zone is discontinuous over a ~ 1.5 - 2 km wide zone, and kinematic indicators show oblique top-to-SW, sinistral-reverse to thrust-sense motion. Metamorphic titanite grains aligned within the mylonitic fabric date the deformation to ~ 83 Ma.

SEM and EBSD data show mm-thick seams of pst contained within and parallel to mylonitic foliation, and mutually overprinting relationships between brittle and plastic deformation. We observe a brittle overprint of mylonitic fabric in sample 46 and fractured porphyroclasts reworked into mylonitic fabric in samples 45 and 47. EBSD maps from sample 45 and 47 show decreasing modal percentages of hydrous mafic minerals (biotite and hornblende) in the mylonites with proximity to pst seams, suggesting these melted to form pst. In pst seams, there are embayed and rounded/elliptical plagioclase survivor clasts and acicular and aligned biotite microlites parallel to mylonitic fabric (45 & 47). EBSD maps show pst survivor clasts with the same shear sense as the mylonitic fabric, suggesting co-development. Pole figures show weak CPO in hornblende and plagioclase of sample 46. Samples 45 and 47 have no CPO present in plagioclase, however samples 45, 46, and 47 show strong CPO patterns for quartz that are consistent with prism <*a*> slip.

We interpret dislocation creep as the deformation mechanism accommodating plastic deformation in host mylonites. Quartz CPO patterns provide evidence of mylonitic deformation at temperatures ~ 600° C, and the presence of plagioclase survivor clasts as evidence of pst temperatures of ~1100°C. The kinematically consistent sense of shear between pst and host mylonitic fabrics suggests coeval development that indicate shifts from brittle to ductile deformation. Our results suggest periodic pst-generating events involving melting of hydrous mafic minerals aided the development of coeval mylonites and pst in the BDT.

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