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GSA Connects 2021 in Portland, Oregon

Paper No. 35-9
Presentation Time: 3:50 PM

LINKING REGIONAL TECTONICS WITH MICROSTRUCTURAL FABRICS USING ELECTRON BACKSCATTER DIFFRACTION AND CRYSTALLOGRAPHIC VORTICITY AXIS ANALYSIS IN THE GREBE SHEAR ZONE, FIORDLAND, NEW ZEALAND

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Shear zones can record the spatial and temporal evolution of kinematic deformation in the lithosphere, but how strain changes and propagates is still poorly understood. We use integrated fieldwork and microstructural analysis via Electron Backscatter Diffraction (EBSD) to investigate the kinematic deformation geometry of the southernmost section of the Grebe Shear Zone (GSZ) located in the Lake Hauroko region of Fiordland, New Zealand. The GSZ is a long-lived, intra-arc transpressional shear zone mainly active in the Cretaceous (ca. 125 - 116 Ma) that overprints a major crustal-scale structural and isotopic boundary.

Deformation fabrics observed in mylonitic tonalites and granodiorites exhibit NNE-SSW strikes and steep dips to the east at Lake Hauroko and to the west at Caroline Peak (~6km south of Lake Hauroko). Folded foliations and S-C mylonitic fabrics show apparent normal or reverse-sense, dip-slip movement that varies according to shear zone dip, and overall strike-slip, sinistral movement. Lineations are oblique to both strike-slip and dip-slip components of shear, which is consistent with transpression. In quartz we observe dynamic recrystallization (DRX) via grain boundary migration and in plagioclase we observe DRX via bulging grains and subgrain rotation. Quartz *c*-axis crystallographic preferred orientation plots and inverse pole figure maps indicate that the basal <a> slip system is active. These data imply a wide range of temperature conditions (400 - 600°C) during deformation. Crystallographic vorticity axis analysis from single-phase plots of quartz, plagioclase, and biotite are used to interpret strain evolution over time due to their differing rheological properties. Plagioclase and quartz record signatures of both triclinic simple shear and monoclinic pure shear-dominated deformation. Biotite, which can record most recent kinematics, records monoclinic pure shear-dominated deformation.

From these results and we interpret that strain in the GSZ evolved over time from triclinic simple shear to monoclinic pure shear-dominated deformation. Integrating our findings with previous studies from northern portions of the GSZ and structurally related shear zones in Fiordland show similar changes in kinematic deformation geometry over time in different crustal elevations.

Session No. 35

T6. Hot Rocks: High-Temperature Microstructures from Mantle to Surface
Sunday, 10 October 2021: 1:30 PM-5:30 PM

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