

T43C-0448 - Competing Influence of Compositional Variability and Metamorphism on Strain Localization in a Lower-Crustal, Transpressional Shear Zone, Fiordland, New Zealand



Thursday, 12 December 2019



13:40 - 18:00



Moscone South - Poster Hall

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Abstract

Over 500 km² of rock exposure in Fiordland, New Zealand records strain localization processes accompanying the formation of a steep, transpressional shear zone within the root of a Cretaceous continental magmatic arc. Here, we pair field observations with microstructural and petrographic analyses of the George Sound shear zone (GSSZ) to investigate how metamorphism and compositional variability influenced shear zone evolution in the lower continental crust.

The northern portion of the 50 km-long GSSZ deforms a monzodioritic pluton where superposed mineral fabrics record a narrowing of the shear zone width over time. Early stage deformation was accommodated mostly by dynamic recrystallization of pyroxene and plagioclase, forming a steep zone of coarse, gneissic foliations over 10 km wide. Subsequent deformation created a 2 km-thick zone of mylonite containing fine-grained plagioclase, hornblende, biotite, and quartz. The latter three minerals formed during the hydration of older minerals, including igneous pyroxene. The change in mineralogy and grain size also produced thin (< 1 mm), weak layers that localized deformation in shear bands in the highest strain zones. The southern ~35 km of the GSSZ deforms a heterogeneous section of granite, diorite, and metasedimentary rock. In this area, the hydration of igneous assemblages also is pervasive but is not restricted to high-strain zones. Instead, the shear zone branches into four ≤1 km-wide strands that closely follow lithologic contacts. The thinnest branch occurs at the contact of a coarse-grained, dioritic pluton and a fine-grained granitic pluton.

These patterns suggest that the factors that controlled strain localization in the GSSZ vary along its length. In the north, where its host rock is homogeneous, retrograde metamorphism helped localized strain into shear bands at the micro scale, mirroring a narrowing at the km scale. In the south, lithologic contacts created weak zones that appear to have superseded the effects of metamorphism, creating a series of thin, branching high-strain zones. These results suggest that the rheology of lower-crustal shear zones also varies significantly along their length and over time. Both of these factors can be used to generate improved models of continental deformation.



CONTACT US

2000 Florida Ave. NW,
Washington, DC 20009
Phone: +1 202 462 6900
Toll Free: 800 966 2481
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