217-5 - VERTIGO: MAKING SENSE OF DISEQUILIBRIUM AT THE BRITTLE-DUCTILE TRANSITION

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507 (Colorado Convention Center)

Abstract

In detachment shear zones the geochemical record is often difficult to interpret because, despite being at “elevated temperatures,” the ductile portion of a shear zone is still an exhumational (retrograde) structure, and so the thermal driving force for reaction and equilibration is lacking. Instead, reaction progress may be controlled by factors that can vary at a fine scale, such as the availability and composition of fluids as well as strain. In such settings, disequilibrium is the rule rather than the exception.

Here, we document the microtextural, microchemical, and isotopic consequences of the waning stages of ductile deformation on quartzites and micaceous kyanite quartzites of the Raft River detachment shear zone. Microtexturally, disequilibrium in quartzites is reflected by unannealed quartz microstructures such as undulose extinction, deformation lamellae, chessboard structures, and poorly defined quartz c-axis cross-girdles. Microchemically, in kyanite-quartzites, disequilibrium is reflected in CL-zoned kyanite that preserves a clear history of fracture, overgrowth by new more CL-active kyanite, and subsequent fracture with either quartz or muscovite precipitation. Similarly, in muscovite-poor quartzites, muscovite exhibits major and trace element zonation patterns consistent with syndeformational overgrowth on older (detrital?) muscovite cores. In contrast to these strongly zoned minerals, in relatively muscovite-rich kyanite quartzites, individual muscovite grains exhibit little zoning. These microchemical variations in muscovite parallel variations in the $^{40}Ar/^{39}Ar$ signatures. Our published $^{40}Ar/^{39}Ar$ data show single step ages as old as 150 Ma in samples with chemically zoned muscovite, consistent with preservation of not only chemical but also argon isotopic relicts in muscovite cores. In contrast, preliminary new data from the kyanite quartzites yield only Miocene $^{40}Ar/^{39}Ar$ step ages—consistent with complete destruction of detrital grains and the presence of only syndeformational muscovite. Taken together, the data highlight the varying response of different mineral, chemical and isotopic systems in a tectonically exhuming shear zone.

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