A mélange of subduction temperatures: Zr-in-rutile thermometry and the nature of the slab-mantle interface

SARAH C. PENNISTON-DORLAND[1], MATTHEW J. KOHN[2], AND PHILIP M. PICCOLI[1]

[1]Department of Geology, University of Maryland, College Park, MD 20742, (*email: sarahpd@umd.edu)

[2]Department of Geosciences, Boise State University, Boise, ID 83725

In many subduction mélanges, a weak matrix with clays, micas or serpentine is thought to foster chaotic mixing and dismemberment of lithologically and metamorphically disparate rocks along the slab-mantle interface over scales of 10s of km. Progressive metamorphism of matrix can form rheologically stiffer amphibole and pyroxene, decreasing the scale of flow within mélange. This process could potentially result in a less diverse range of metamorphic conditions experienced by rocks within an individual tectonic unit. The Catalina Schist, CA, provides a rare opportunity to study this process because blocks and matrix within each tectonic slice appear to have experienced similar metamorphic conditions. High-precision Zr-in-rutile thermometry was applied to samples of metasedimentary and metamafic rocks from the amphibolite facies and epidote-amphibolite facies of the Catalina Schist to see whether all samples within a given facies record the same peak metamorphic temperatures (*T*), as expected for progressive matrix stiffening.

In amphibolite-facies samples maximum Zr contents of rutile cluster in each sample and range between 320 and 545±38 ppm (2σ). Calculated maximum *T* (at P = 1 GPa) range from 655 to 700±8ºC (2σ). Epidote-amphibolite facies samples contain maximum Zr contents ranging from 85 to 150±36 ppm. Calculated maximum *T* ranges from 559 to 596+19/-25ºC. These narrow *T* ranges contrast, for example, with the Franciscan, where block and mélange matrix temperatures range from 250ºC to 700ºC. These data support the hypothesis that progressive metamorphism reduces scales of flow within mélange. Despite the narrow ranges, estimated *T* in the amphibolite facies are statistically different from each other, suggesting some degree of mixing even at the peak of metamorphism.