Geophysical Research Abstracts
Vol. 20, EGU2018-15596, 2018
EGU General Assembly 2018

Strain localization in granulite-facies, oxide-bearing mylonitic gabbros from the Atlantis Bank oceanic detachment fault system, Southwest Indian Ridge (IODP Expedition 360)

Gustavo Viegas (1), Luiz Morales (2), Paula Cassemiro (1), and Raylline Silva (1)
(1) University of Brasília, Institute of Geosciences, Brasilia, Brazil , (2) Scientific Center for Optical and Electron Microscopy, ETH Zurich

The Atlantis Bank oceanic core complex formed during exhumation along an oceanic detachment fault system at the Southwest Indian Ridge (SWIR). The strain regime along the detachment was partitioned between ductile, brittle-ductile and brittle deformation. IODP Expedition 360 cored 789 m of lower crustal rocks consisting of olivine-gabbro, oxide-gabbro and gabbro at Hole U1473A. Crystal-plastic deformation is pervasive throughout the core, with brittle-ductile structures partially overprinting the fabric at shallower levels. Decimeter-wide shear zones observed below 600 mbsf consist mainly of clinopyroxene and olivine porphyroclasts embedded in a fine-grained, recrystallized plagioclase matrix; clinopyroxene clasts are commonly mantled by rims of recrystallized pyroxene and olivine, while the trace of the foliation is defined by trails of a polyphase fine-grained mixture comprising recrystallized pyroxene, olivine, amphibole and Fe-Ti oxides. The microstructure can be divided into three domains based on the degree of recrystallization/segregation of phases during deformation: 1) rigid porphyroclasts, defined by clinopyroxene ($\pm$ orthopyroxene) and locally olivine which can reach up to 1 mm, 2) fine-grained ($\sim$ 20 μm) recrystallized rims of pyroxene, olivine and minor Fe-Ti oxide, and 3) fine-grained ($\sim$ 30 μm) recrystallized, monomineralic plagioclase bands. Pyroxene porphyroclasts are commonly bent and crosscut by microfractures filled with olivine$\pm$Fe-Ti oxide; this mixture is also observed as mantling grains along the porphyroclasts' margins. The presence of Fe-Ti oxides results in the development of trails of a recrystallized mixture that progressively grades from the fringes of the clasts to the foliation planes, suggesting a possible rotation/stretching shear component associated with recrystallization. The monomineralic recrystallized plagioclase matrix shows curved straight grain boundaries and homogeneous grain size, with several bulges and pins observed at grain edges. These preliminary results suggest that strain is initially accommodated in the fine-grained plagioclase matrix via a combination of grain boundary migration and subgrain rotation. Fe-Ti oxide-rich, melt/fluid percolation results in the development of interconnected layers in the fine-grained polyphase mixture, which promotes weakening mainly via diffusion and dissolution-precipitation creep during reaction-softening processes. The rheological behaviour of the SWIR crust may be drastically affected by melt/fluid percolation throughout shear zones, ultimately leading to strain localization and weakening in initially dry, strong mechanical layers of the lithosphere.