Geophysical Research Abstracts
Vol. 18, EGU2016-14569, 2016
EGU General Assembly 2016

Effects of fluid-assisted diffusion on texture strength in a mylonitised metagabbro

Joseph Gardner, John Wheeler, and Elisabetta Mariani

Department of Earth, Ocean and Ecological Science, University of Liverpool, Liverpool, United Kingdom (jgardner@liv.ac.uk)

Most rocks are polyphase materials yet many studies of rock texture tend to isolate the behaviour of individual phases. Characterisation of interaction between phases can yield useful information about the deformation behaviour of real rocks. Our work focuses on a broadly two phase mixture of albite and clinozoisite in mylonitised metagabbros, and how these two phases may have interacted to create, maintain and/or weaken the variable strength CPOs observed in each phase. Intriguingly, the rocks have deformed primarily by diffusion-accommodated processes, which are traditionally thought to weaken or destroy an existing CPO. Our data suggest that diffusion can preserve strong textures.

Plagioclase in metamorphosed gabbros from a km-scale extensional shear zone in the NW Italian Alps (Gressoney Shear Zone) has undergone (to a first order) breakdown to albite (Ab) + clinozoiste (Cz) at greenschist facies. Grain size reduction via nucleation of product grains, plus the effects of Zener pinning, lead to an average grain size of <50 μm in the matrix (promoting grain size sensitive creep). As clinozoisite is heterogeneously distributed in the matrix this study compares grain morphology of each phase in regions of variable Cz-content to determine any influence Cz volume fraction may have exerted on grain size/shape and grain boundary evolution. A key question is why CPO domains in albite should retain discrete boundaries if deformation is primarily diffusion accommodated. We have used electron backscatter diffraction (EBSD) to characterise texture within each phase.

Matrix albite exhibits CPO domains that form discrete bands. These domains do not correlate to any recognised slip systems in plagioclase, so are thought to have been inherited from parent grains and subsequently modified by fluid assisted diffusion plus grain boundary sliding. Albite precipitates in pressure shadows and fractures show it was the more mobile phase and deformed by pressure solution. Clinozoisite grains are new so their strong CPOs cannot have been inherited; instead they are thought to have behaved as rigid bodies and rotated into parallelism due to their relatively high aspect ratios (generally $\sim$3-4). The Cz grains form strain caps around Cpx porphyroclasts showing they were (largely) insoluble during pressure solution. Albite grain morphology becomes more interstitial closest to porphyroclasts suggesting local high stresses around the clasts drove dissolution. Precipitate that fills pressure shadows may thus be locally derived. Pressure shadows have tails that streak through the matrix as single phase albitic layers; grain size in these layers is commonly >100 μm, which suggests grain growth elsewhere in the matrix was indeed inhibited by the presence of a second phase.

Discrete CPO bands vary in size. Variations in grain and grain boundary characteristics between domains are being quantified to investigate whether the way an inherited orientation relates to L-S sample geometry may have had any control over degree of dissolution (implied from grain morphology) within domains. Whether volume fraction of Cz in (what remains of) each domain has influenced dissolution will also be characterised by quantifying grain shape, orientation and distribution of phases in individual domains.