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Eclogitization kinetics of continental granulites : quantification and implications

Marie Baisset[1], Loic Labrousse[1], and Alexandre Schubnel[2]
[1]ISTeP, Sorbonne Université, 75005 Paris, France
[2]Laboratoire de Géologie, CNRS UMR 8538, Ecole Normale Supérieure, 75005 Paris, France

When implicated in convergence zones, granulites of the lower continental crust are expected to eclogitize at depth.When exposed in the field such units show a bimodal rheological behavior between fracturing of the protolith rock (granulites) and ductile flow of the transformed parts (eclogites). It seems therefore that a competition exists between the rate at which the rocks are loaded in stress and the rate at which they transform, i.e. the overall eclogitization kinetics. The aim of the work presented here is to quantify the kinetics of the metamorphic reactions involved in eclogitization by estimating the reaction rates in plagioclase-bearing assemblages submitted to different P-T conditions over different time spans. For this, experiments have been performed in piston-cylinder apparatus on aggregates derived from natural granulites. Special attention is paid to the location where nucleation starts and how it propagates in and between the grains. In this prospect, the presence of garnet and cpx in the plagioclase matrix is a first order control on the reaction process. This work follows previous experimental studies (e.g. Shi et al., 2017, Incel et al., 2018) which show that reaction-enhanced embrittlement may be key for fracturing at high pressure. It has been proposed that transient properties of the rocks induced by the very beginning of the reaction (e.g. volume change, small grain size nucleation products) can lead to brittle instabilities. As we assume that the rheological behavior of the crust is controlled by a competition between reaction rate and strain rate, experiments involving deformation of granulites while undergoing eclogitization are required. Preliminary results performed on Griggs-type apparatus, which constitutes the best tool for that, will also be presented.