Geophysical Research Abstracts
Vol. 17, EGU2015-4175, 2015
EGU General Assembly 2015

Hydration through Melt-Rock Interaction triggers Local Partial Melting in the Lower Crust: Example from Fiordland, New Zealand

Catherine Stuart, Sandra Piazolo, and Nathan Daczko

ARC Centre of Excellence for Core to Crust Fluid Systems (CCFS) and GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, Australia (cait.stuart@mq.edu.au)

Local partial melting that is discontinuous within and between rock units is commonly observed in lower crustal rocks. Such local variations in melt production are difficult to reconcile with temperature or pressure variation, while at the same time within one specific rock unit compositional changes are not expected.
Here we investigate in detail a low-strain exposure of the lower crust, the Pembroke Granulite, exposed in Pembroke Valley, northern Fiordland, which exhibits patchy but slightly foliation dependent distribution of melt production sites. Detailed field mapping and chemical analyses show that exposed melt-producing and melt-devoid gneisses have gradational boundaries rather than sharp, igneous contacts. They are further indistinguishable in terms of bulk rock chemistry. Gradational boundaries are characterised by the progressive replacement of pyroxene by symplectitic textures of amphibole and quartz. The origin of these microstructures is attributed to a melt-rock reaction occurring as a consequence of diffuse melt flow throughout the bulk of the Pembroke Granulite. As such, diffuse melt-rock interaction results in local hydration of an otherwise largely anhydrous rock, governing later incipient partial melting.
P-T pseudosections indicate that the melt-rock reaction producing a locally hydrated gneiss occurred at conditions of $\sim$700 °C and 13-14 kbar. As aqueous fluids are unstable at these PT conditions, our observations suggest that these changes are evidence for a discrete episode of diffuse porous melt flow in the Pembroke Granulite. Focussed at a scale of tens of metres rather than throughout the complex, melt flow was reactive and pervasive, transforming pods of gabbroic gneiss to hydrated assemblages that subsequently partially melted. This model implies a metasomatic origin to observed variation in melt production in the study area, previously interpreted as a result of compositional differences due to igneous differentiation.