Partial melting in the lower oceanic crust as result of deep hydrothermal activity

Koepke, Juergen[1] Nicolas, Adolphe[2]
[1]Institut fuer Mineralogie, Leibniz Universitaet Hannover, Callinstr. 3, 30167 Hannover, Germany [2]Geosciences Montpellier, CNRS, Universite Montpellier 2, CC60, 34095 Montpellier cedex 05, France

We studied more than 100 oceanic gabbros from the recent oceanic crust and from ophiolites (e.g., East Pacific Rise, Mid-Atlantic Ridge, Southwest Indian Ridge, Oman ophiolite) by scanning electron microscopy and found in 90% of the samples microstructures suggesting that hydrous partial melting reactions proceeded. The characteristic paragenesis consists of orthopyroxene and pargasite rimming olivine and clinopyroxene primocrysts in intimate contact with neoblastic plagioclase strongly enriched in anorthite. The composition of the new An-rich plagioclase is strongly impoverished in incompatible trace element excluding a model that these An-rich zones were precipitated by late, hydrous evolved melts. This is in agreement with recent water-saturated melting experiments on a variety of natural gabbros between 900 and 1000°C. In some cases it is evidenced that the water-rich fluids are seawater-derived, thus suggesting a model that some kind of hydrothermal activity/circulation operates.

At fast-spreading ridges the propagation of water-rich fluids triggering partial melting effects proceeds via microcracks, generated in hot, ductile, just frozen gabbros. These are initiated by the contraction of orientated plagioclase due to the high anisotropy of thermal contraction in plagioclase.

At slow-spreading ridges the situation is quite different. Here, the observed microtextures in the natural gabbros imply the propagation of water-rich fluids on grain boundaries in a ductile regime causing hydrous partial melting. Thus, this type of hydrothermal activity proceeds within the deep oceanic crust at very high temperatures (900° - 1000°C) without a crack system, a prerequisite in current models for enabling hydrothermal circulation. Here, the interplay between magmatic and a-magmatic phases in combination with tectonic forces opens pathways for water propagation into the deep crust which can be liberated causing partial melting of the adcumulate on grain boundaries producing SiO_2-rich melts.

→

Abs. No. **537**
Meeting: **DMG 2008**
submitted by: **Koepke, Juergen**
email: **koepke@mineralogie.uni-hannover.de**
date: **0000-00-00**
Req. presentation: **Poster**
Req. session: **S06**