V43G-2956: A Crystallization-Temperature Profile Through Paleo-Oceanic Crust (Wadi Gideah Transect, Oman Ophiolite): Application of the REE-in-Plagioclase-Clinopyroxene Partitioning Thermometer

Thursday, 14 December 2017
13:40 - 18:00
 New Orleans Ernest N. Morial Convention Center - Poster Hall D-F

The accretion mechanisms forming oceanic crust at fast spreading ridges are still under controversial discussion. Thermal, petrological, and geochemical observations predict different end-member models, i.e., the gabbro glacier and the sheeted sill model. They all bear implications for heat transport, temperature distribution, mode of crystallization and hydrothermal heat removal over crustal depth. In a typical MOR setting, temperature is the key factor driving partitioning of incompatible elements during crystallization.

LA-ICP-MS data for co-genetic plagioclase and clinopyroxene in gabbros along a transect through the plutonic section of paleo-oceanic crust (Wadi Gideah Transect, Oman ophiolite) reveal that REE partitioning coefficients are relatively constant in the layered gabbro section but increase for the overlying foliated gabbros, with an enhanced offset towards HREEs. Along with a systematic enrichment of REE's with crustal height, these trends are consistent with a system dominated by in-situ crystallization for the lower gabbros and a change in crystallization mode for the upper gabbros.

Sun and Liang (2017) used experimental REE partitioning data for calibrating a new REE-in-plagioclase-clinopyroxene thermometer that we used here for establishing the first crystallization-temperature depth profile through oceanic crust that facilitates a direct comparison with thermal models of crustal accretion. Our results indicate crystallization temperatures of about 1220±8°C for the layered gabbros and lower temperatures of 1175±8°C for the foliated gabbros and a thermal minimum above the layered-to-foliated gabbro transition. Our findings are consistent with a hybrid accretion model for the oceanic crust. The thermal minimum is assumed to represent a zone where the descending crystal mushes originating from the axial melt lens meet with mushes that have crystallized in situ. These results can be used to verify and test thermal models (e.g., Maclennan et al., 2004, Theissen-Krah et al., 2016) and their predictions for heat flow and temperature distribution in the crust.

Maclennan, J., Hulme, T., & Singh, S. C. (2004), G3, 5(2). / Sun, C., & Liang, Y., (2017), CMP, 172(4). / Theissen-Krah, S., Rüpke, L. H., & Hasenclever, J. (2016), GRL, 43(3).

Plain Language Summary

Authors

Samuel Mueller *
University of Kiel

Joerg Hasenclever
University of Hamburg

Dieter Garbe-Schönberg

University of Kiel

Juergen Koepke

Leibniz University of Hannover

Kaj Hoernle

*GEOMAR Helmholtz Centre for Ocean
Research Kiel*

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