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CRUSTAL WEHRLITES OF THE OMAN OPHIOLITE: AN EXPERIMENTAL STUDY

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In order to evaluate the genesis of the Oman crustal wehrlites, we combined experimental work with investigations on natural rocks. Discordant wehrlite bodies ranging in size from decameters to hundreds of meters intruded into the layered gabbro series at different crustal levels are found in the Wadi Haymiliyah of the Oman ophiolite (Halyn block). Common feature of all wehrlite bodies is the dominance of olivine and clinopyroxene with high Mg# (MgO/(MgO+FeO)*100, molar) varying between 85 and 95. SIMS analyses of clinopyroxenes from different wehrlite bodies reveal REE and trace element patterns suggesting that the clinopyroxenes were crystallized from tholeiitic, MORB-type melts which were highly depleted in incompatible trace elements. Some wehrlites from the upper section bear mm-sized poikilitic pargasite as magmatic phase, implying that the associated melts showed a high water activity, at least in a late stage.

To constrain the physical conditions of wehrlitic magmas within the lower oceanic crust we put on experimental studies under controlled fO_2 and aH_2O at pressure of 200 MPa. Especially, we want to clarify whether the crustal wehrlites from the Oman ophiolite are derived from wet primitive tholeiitic magmas, as suggested by a model of Feig et al. (2006). Starting material are mixtures of natural olivines and clinopyroxene separated from wehrlites from the lower Wadi Haymiliyah section, and a synthesized

glass representing the "lost" equilibrium melt. Experiments were performed in AuPd capsules (pre-saturated with iron) at temperatures between 1020 and 1160˚C with fO_2 varying between QFM and QFM+2 (QFM=quartz fayalite magnetite buffer). Experiments at nominal dry conditions above 1140˚C (fO_2: $\sim$ QFM) reveal the stability of plagioclase (newly formed crystals), while the doped clinopyroxene became unstable (decomposition by reaction with the melt).

Thus, we were not able to reproduce the characteristic wehrlite paragenesis (olivine plus clinopyroxene without plagioclase) under dry conditions, implying that wehrlitic crystal mushes can not be generated in dry, primitive tholeiitic systems at crustal pressure by simple accumulation of fractionating crystals. At 1060˚C (fO_2: $\sim$ QFM+2) the stability of clinopyroxene and olivine without plagioclase in “wet” conditions ($\sim$6wt% H_2O) were proofed. A potential fractionation of such an assemblage would lead to the formation of cumulate wehrlites.

Our experiments show that the “wehrlite paragenesis” olivine-clinopyroxene without plagioclase is only possible in wet MORB-type magmas.

References:

Feig S.T., Koepke J. and Snow, J., (2006), *Contrib. Mineral. Petrol.* **152**. 611-638.