



## **The gabbro-eclogite transformation as a function of $fO_2$ : constraints on the gabbro-eclogite transition in the Bärenfen metagabbros (Koralpe, Eastern Alps, Austria)**

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The aim of this study is to provide petrological and experimental constraints on the gabbro-eclogite transition from the locality Bärenfen in the Koralpe (Styria, Austria). Miller & Thöni (1995) obtained Permian ages for the magmatic protoliths and an Eo-Alpine age for the eclogite-facies metamorphic overprint. Textural and petrographic investigations showed that the primary magmatic assemblage plagioclase ( $An_{60-76}$ ) + clinopyroxene<sub>1</sub> + orthopyroxene ( $X_{Mg} = 71-76$ ) reacts in microdomains to form spinel, clinopyroxene<sub>2</sub>, garnet, kyanite, hornblende and corundum. Fluid influx lead to the progression of reactions involving plagioclase such as  $An = Gr + Ky + Qtz$  and  $An + H_2O = Zo + Ky + Qtz$ , which lead to the formation of Ca-rich garnets ( $X_{Ca} = 53-91$ ) as well as zoisite and kyanite. Reactions along the plagioclase/orthopyroxene interface such as  $An + En/Fs = Di/Hed + Ky$  lead to the formation of clinopyroxene<sub>2</sub> and kyanite. Within this domain, Mg-rich garnet ( $X_{Mg} = 33-35$ ) forms via the model reaction  $An + En/Fs = Py/Alm + Di/Hed + Qtz$ . Model reactions involving the An-component lead to an increase in the Ab-component in the remaining plagioclase, which eventually breaks down via the reaction  $Ab = Jd + Qtz$ . Thermobarometry of fully equilibrated metagabbros yields  $P - T$  conditions of 670 – 700°C and 1.7 – 2.1 GPa for the Eo-Alpine eclogite-facies overprint.

The experimental investigations were aimed at reconstructing the observed mineral assemblages not only as a function of  $P$  and  $T$  but also as a function of  $fO_2$  using

drilled cores of fine-grained gabbros from the Odenwald as well as grainy mixtures of plagioclase and orthopyroxene from the Bären locality. In all experiments  $H_2O$  was present and thus we conducted buffered (NNO, HM) as well as unbuffered experiments with regard to  $fO_2$ . Experimental conditions in the piston-cylinder were  $700^\circ C$  and 2 GPa. Buffered (HM, NNO) and unbuffered experiments with  $a(H_2O)=1$  resulted in the mineral assemblage omphacite/jadeite + zoisite + paragonite  $\pm$  garnet  $\pm$  hornblende. In the HM experiments, garnet as well as hornblende are absent, but garnet + hornblende occur in the NNO experiments, which represent  $fO_2$  conditions much closer to the natural observations. The lack of kyanite and the occurrence of paragonite is consistent with the investigations of Tropper & Manning (2004) under these conditions. Therefore, lack of paragonite in the natural samples is most likely due to a suppression of  $a(H_2O)$  (e.g. brines) during eclogite-facies metamorphism.

Miller, C. & Thöni, M. 1995 Origin of eclogites from the Austroalpine Ötztal basement (Tyrol, Austria): geochemistry and Sm-Nd vs. Rb-Sr isotope systematics. *Chemical Geology* 122, 199-225.

Tropper, P. & Manning, C.E. 2004 Paragonite stability at  $700^\circ C$  in the presence of  $H_2O$ -NaCl brines. *Contributions to Mineralogy and Petrology* 147, 740-749.