

Al-B substitution in the system albite ($\text{NaAlSi}_3\text{O}_8$) – reedmergnerite (NaBSi_3O_8) at high pressures

J. Stefanski, B. Wunder, and M. Gottschalk
Germany (karef@zedat.fu-berlin.de)

The rare mineral reedmergnerite (reed), NaBSi_3O_8 , is found in nature in evaporitic sediments and in highly evolved Na-rich pegmatites. It is structurally analogue to low albite, $\text{NaAlSi}_3\text{O}_8$, with boron strongly ordered into the tetrahedral site T_{1o} [1]. Reedmergnerite exceeds the P-stability of the Al-counterpart on average by a factor of about two and shows subsolidus breakdown to coesite plus B-nepheline at about 3.5 GPa [2]. At wet and dry conditions reedmergnerite melts incongruently to SiO_2 + fluid/melt at about 300 to 400 °C lower temperatures than albite, which melts congruently in both cases. Low-reedmergnerite has been synthesized hydrothermally between 0.01 and 0.2 GPa up to temperatures of 500 °C. It transforms to the disordered high-form between 500 and 550 °C at 0.1 GPa [1]. Experimental constraints on B-Al solid solution between albite and reedmergnerite come so far only from the study by [3], performing synthesis experiments at 0.1 GPa, 500 °C. At fluid-saturated conditions and starting with glasses of intermediate (ab50reed50) composition, they observed two coexisting feldspars with reed-component of 10 and 97. However, the indicated miscibility gap between reedmergnerite and albite seems to be ambiguous, because the compositions of produced feldspars were strongly heterogenous, suggesting that equilibrium Al-B exchange was not reached.

In the following we present results from high-P experiments on the Al-B exchange between reedmergnerite and albite. As starting materials we used two glasses with reed (R100) and with intermediate (R50) compositions. Piston-cylinder experiments were performed at 1-3 GPa, 750°C, 15-28 days run duration using the dry glasses. Hydrothermal experiments at 0.2 GPa, 450°C, 28 days were performed at wet conditions by adding 10 wt.% of H_3BO_3 to the glasses. XRD by using the Rietveld method indicate that in all experiments with R100 reedmergnerite and with R50 (Al,B)-bearing feldspar formed as main phase beside SiO_2 and at 3.0 GPa jadeite from R100. SEM investigations indicate that we had glass in each of our experiments and that the formed feldspars were too small for EMP analyses. Therefore, compositions were determined from the cell-volumes, assuming a linear V-change between the Al- and B-endmember. The order-state was determined from the mean cation-oxygen distances of the four tetrahedral sites. (Al,B)-feldspars from experiments with R50 had the following reed-components and order-state: at 3 GPa, 750°C, reed98, low; at 1.5 GPa, 750°C, reed44, intermediate; at 1.0 GPa, 750°C, reed41, intermediate; at 0.2 GPa, 450°C, reed10, low. Reedmergnerite was of low order-state in all experiments except at 1.0 GPa, 750°C, at which high-reed formed.

Our study give for the first time indications of large, if not complete Al-B solid solution in albitic feldspars and constraints on the order-disorder transition for boron-bearing feldspars at high pressures.

References:

- [1] Fleet, M.E. (1992): *Amer. Mineral.*, **77**, 76-84.
- [2] Schreyer, W. & Werding, G. (1997): *Lithos*, **41**, 251-266.
- [3] Pichavant, M., Schnapper, D., Brown, W.L. (1984): *Bull. Minéral.*, **107**, 529-537.