

## Experimental study on interaction of the H<sub>2</sub>O-NaCl fluid and model peridotite at 6 GPa

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In order to study the effect of NaCl on the Al<sub>2</sub>O<sub>3</sub>, CaO, Na<sub>2</sub>O-rich H<sub>2</sub>O-bearing peridotite transformation at pressures above 3 GPa, we have conducted the experiments on interaction of model peridotite  $For_{57}En_{17}Prp_{14}Di_{12}$  with the H<sub>2</sub>O-NaCl fluid at 6 GPa and 1050-1450°C. Starting materials were mixtures of oxides, Mg(OH)<sub>2</sub> and jadeite (mg): SiO<sub>2</sub> (37.04); Al<sub>2</sub>O<sub>3</sub> (3.66); CaO (3.62); Mg(OH)<sub>2</sub> (48.30); MgO (4.14), NaAlSi<sub>3</sub>O<sub>6</sub> (3.24). NaCl added at 8 wt. %, that corresponds to mole fraction of  $X_{NaCl} = NaCl/(NaCl+H_2O)$  in the fluid 0.05. The present experiments were performed using Pt capsules of 0.02 mm of the wall thickness.

In absence of NaCl in the fluid, the assemblage Fo+Opx+Cpx+Grt was observed in the solidus of the model peridotite, while melting began at about 1200-1300°C. Clinopyroxene shows the increase of jadeite content with increasing temperature. Addition of NaCl reduces melting temperature down to 1050-1100°C. Amount of orthopyroxene and garnet in solidus decreases, the Al content in orthopyroxene decreases, and the jadeite content of clinopyroxene increases in presence of NaCl. These relationships can be described by the following reactions:

(1)  $1/4 Mg-Ts + 7/4 En + 1/2 NaCl + 1/4 H_2O = Fo + 1/2 Jd + 1/2 HCl$ ; (2)  $1/4 Prp + 5/4 En + 1/2 NaCl + 1/4 H_2O = Fo + 1/2 Jd + 1/2 HCl$ ; (3)  $1/4 Grs + 11/4 En + 1/2 NaCl + 1/4 H_2O = Fo + 3/4 Di + 1/2 Jd + 1/2 HCl$ ,

(where Mg-Ts – Mg- Tschermack molecule, MgAl<sub>2</sub>Si<sub>2</sub>O<sub>6</sub> in orthopyroxene, En – enstatite, Fo – forsterite, Prp – pyrope, Grs – grossular, Di – diopside, Jd – jadeite). These reactions show the destabilization of Grt-Opx association in the presence of the H<sub>2</sub>O-NaCl fluid.

Thus, addition NaCl in the H<sub>2</sub>O-peridotite system does not influence on phase assemblages. However, changing of mineral compositions, mostly increase of the jadeite content in clinopyroxene, results in the decrease of melting temperature. Present experiments further support our conclusion [1] that the effect of interaction of alkali chlorides with silicates in complex peridotite assemblages overpowers the effect of the reduced H<sub>2</sub>O activity in the brine fluid [2].

[1] Safonov & Butvina (2013) Doklady, in print. [2] Chu *et al.* (2011) Contrib **162**, 565-571.

## Pyroxene megacrysts in anorthosites: Revealing continental crust-forming processes at Moho depths

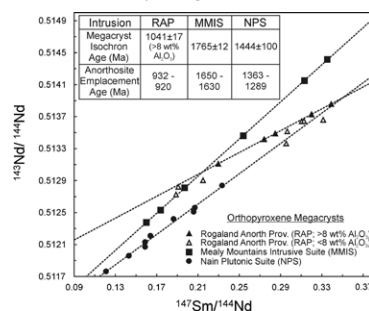
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The mismatch between bulk, intermediate compositions (SiO<sub>2</sub> > 60 %) of the continental crust and predicted basaltic compositions (SiO<sub>2</sub> < 50 %) of mantle-derived melts in crust-forming environments poses a major problem in models of crustal evolution and requires that a mafic component be physically separated from felsic end-members. Although information from the Moho, where some of these poorly understood crustal differentiation processes are thought to occur, is rare, giant (up to 1 m in length), high-pressure (30-40 km) pyroxene megacrysts and comagmatic Proterozoic anorthosite massifs provide insight into crust-mantle differentiation processes at these depths. Using Nd and Pb isotopes, we provide direct evidence for megacryst crystallization in isotopically homogenous magmas that ponded at the Moho (Figure 1). These megacrysts are 110-130 m.y. older than the comagmatic anorthosites that host them, indicating that the magmatic system is long-lived. In combination with EC-AFC modeling, these data also indicate that Proterozoic anorthosites are derived from melting of the depleted mantle at long-lived Andean-type margins. This evidence for ultramafic cumulate formation illustrates that fractionation of ponded magmas at the Moho is a significant mechanism in crustal differentiation and that the loss of these dense phases to the deeper mantle may represent an important component of crustal recycling.



**Figure 1:** Isochronous high-pressure megacrysts in three Proterozoic anorthosite massifs from Canada and Norway.