



## **Phase relations in the silicate-carbonate-chloride systems at HP-HT conditions: implication for the role of chlorides in mantle.**

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Evidence for activity of alkalic chloride-carbonate liquids at depths about of 120-150 km includes (1) high chlorine content in potassic silicate, carbonate-silicate and carbonate melt inclusions in diamonds (Navon et al., 1988; Schrauder, Navon, 1994; Bulanova et al., 1998); (2) individual chloride-carbonate liquid inclusions in diamonds (Izraeli et al., 2001, 2004; Klein-BenDavid et al., 2004); (3) chlorine-rich kimberlites of the Udachnaya kimberlite pipe, Yakutia (Kamenetsky et al., 2004); (4) abundant Cl-bearing phases, forming during metasomatic alteration of eclogite xenoliths (e.g. Misra et al., 2004). Natural data indicate that carbonate-silicate melts show a wide immiscibility with chloride-carbonate liquids at upper mantle conditions. In order to model the interaction of mantle rocks with K-rich chloride and chloride-carbonate liquids, we have experimentally studied phase relations in the systems diopside-KCl (+/- Na<sub>2</sub>CO<sub>3</sub>, CaCO<sub>3</sub>), jadeite (+/-diopside)-KCl, pyrope(+/-grossular)-KCl and enstatite-KCl at 4 and 5 GPa.

Melting temperatures of Ca-Mg silicates (diopside, enstatite) decrease insignificantly with addition of the chloride. For example, we did not observed melting of a silicate in the diopside-KCl mixtures up to temperatures about 1800<sup>o</sup>C. In addition, no interaction is observed between diopside and KCl melt in temperature interval between melting point of KCl and beginning of silicate melting.

However, KCl melt actively interacts with jadeite and jadeite-bearing clinopyroxenes. As a result of intensive K-Na exchange with the chloride liquid, K-Si-Al-rich chlorine-bearing silicate melt is formed at temperatures below 1300<sup>o</sup>C. At 4 GPa, assemblage

clinopyroxene+sanidine coexisting with potassic SiO<sub>2</sub>-rich silicate melt appears at the apparent solidus of the join jadeite-diopside-KCl. Thus, the experiments demonstrate a contrast processes of chloride liquid interaction with peridotitic and eclogitic assemblages.

In all above systems, chloride liquid shows a wide immiscibility gap with silicate melt. A strong influence of chlorides on liquid immiscibility in complex carbonate-chloride-silicate melts is experimentally proved as well. No liquid immiscibility is identified at 4 and 5 GPa both in the carbonate-silicate system CaMgSi<sub>2</sub>O<sub>6</sub>-CaCO<sub>3</sub>-Na<sub>2</sub>CO<sub>3</sub> and chloride-carbonate system CaCO<sub>3</sub>-Na<sub>2</sub>CO<sub>3</sub>-KCl. Nevertheless, the immiscibility appears both with addition of KCl in the carbonate-silicate melts and with addition of silicate in the chloride-carbonate melts. As a result of immiscibility, alkali-rich carbonate-silicate melts are formed in equilibrium with carbonate-chloride liquid.

A model for formation and evolution of potassium-rich liquids in the mantle is suggested on the basis of the present experiments. This model considers potassic silicate and carbonate-silicate melts as products of interaction of mantle rocks with chloride-carbonate deep-seated liquids.

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