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Experimental study distribution of trace elements between clinopyroxene, garnet and silicate melts

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Distribution of 25 trace elements between Cpx, Grt, and silicate melts experimentally studied. There were wide variations (from $n10^{-3}$ to 10 and over) in the partition coefficients rare elements between Cpx, Grt, silicate melts – D Cpx, Grt / m. Elements, preferably distributed in the Grt–Cpx restite (HREE, Y, V with DGrt, Cpx/m> 1) are compatible. The behavior of LILE, HFSE elements - Li, Be, Ba, Th, Ti, Zn, U, Nb, Ta, Pb, Hf, LREE is similar to the behavior of incompatible elements, it is preferable to be distributed in the melt, DGrt, Cpx / m <1. All rare e elements mostly concentrated in the alkaline silicate melt, D Cpx / m of these elements <1.

Key words: experiment, high pressures, rare elements, garnet, clinopyroxene, melt

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Partial melting of eclogite were studied at T = 1400ºC, P = 4 GPa at "dry" condition and with alcalic-carbonaceous fluid. At partial melting “dry” eclogite with clinopyroxene Cpx and garnet Grt coexist melts of andesite-dacite composition. At melting of eclogite with alcalic-carbonaceous fluid Cpx coexist with fluid-bearing alkaline silicate melt. To elucidate the behavior of trace elements during metasomatism and melting of eclogites experimentally studied distribution of 25 trace elements between Cpx, Grt, and acidy and alcaline silicate melt.

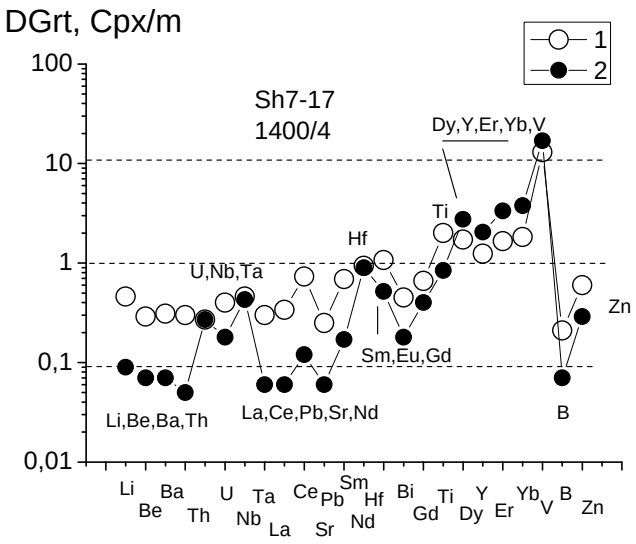

Fig. 1. Partition coefficients rare elements between Cpx, Grt, and andesite-dacite silicate melts. 1 – D Cpx/m, 2 – D Grt/m. T = 1400ºC, P = 4 GPa

Experiments were carried out in the IEM RAS on the "anvil with hole" in Au and Fe-bearing platinum capsules using a quenching technique. The temperature is measured by a Pt30Rh/Pt6/Rh thermocouple. At high temperature, pressure is calibrated using a curve of balance quartz–coesite.

Uncertainties are ± 10ºC for temperature and ± 0.1 GPa for pressure measurements. Duration of experiments were from 6 to 18 hours. Products of experiments were studied by PC-controlled scanning electron microscope Tescan VEGA TS 5130MM with detector of secondary and backscattered electron on the YAG-crystals and energy dispersive X-ray microanalyzer with semi-conductor Si(Li) detector INCA Energy 350.

There were wide variations in the partition coefficients rare elements between Cpx, Grt, silicate melts m D Cpx, Grt / m from n10^{-3} to 10 and over (fig. 1).

By analogy with the peridotite system elements, preferably distributed in the Grt–Cpx restite (HREE, Y, V with partial coefficient DGrt, Cpx/m> 1) are compatible. The behavior of LILE, HFSE elements – Li, Be, Ba, Th, Ti, Zn, U, Nb, Ta, Pb, Hf, LREE is similar to the behavior of incompatible elements, it is preferable to be distributed in the melt, DGrt, Cpx / m <1 .For the association of Grt-Cpx incompatible elements are preferably distributed in the Cpx, compatible – HREE, Y, V – in Grt (fig. 2).

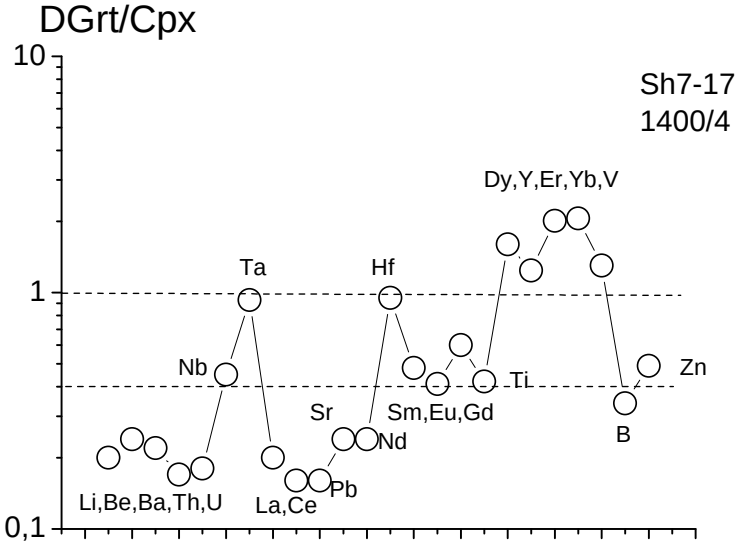

Fig. 2. Partition coefficients rare elements between Grt and Cpx, in equlibrium wth andesite-dacite silicate melts. T = 1400ºC, P = 4 GPa

In case of partial melting of eclogite from the alkaline aqueous fluid with alkaline carbonate melt m coexisting Cpx.. With the exception of V, elements of LILE, HFSE, REE, siderophyle mostly concentrated in the silicate melt, D Cpx / m of these elements <1 (fig. 3).

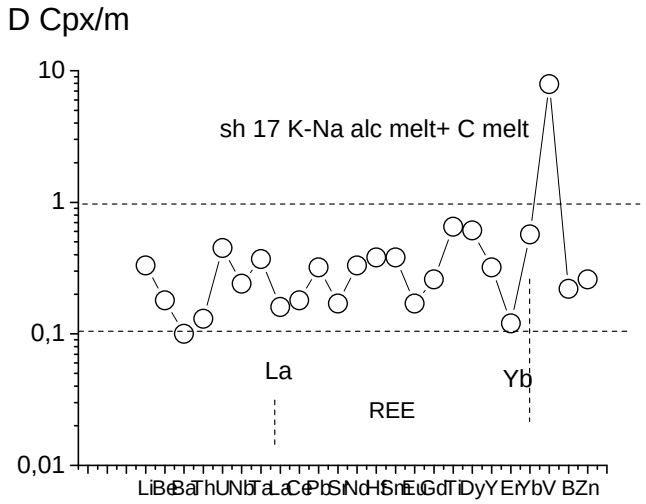

Fig. 3. Partition coefficients rare elements between Cpx and alkaline melt

Wide variations in D Cpx, Grt / m rare elements indicates a significant fractionation of trace elements during partial melting of eclogite at “dry” conditions. These results show, that alkaline melts are efficient concentrator of trace elements and can play important role in enrichment of mantle at mantle metasomatose.

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