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Experimental study melting of garnet-bearing carbonatite

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Melting of garnet-bearing carbonatite studied at T=950–1450ºC, P=3.8–4.0 Gpa. Temperature "dry" liquidus is ~ 1270ºC, "dry" solidus is ~ 1150ºC. It have the full miscibility between silicate and carbonate melts. In experiments with H_2O+CO_2 fluid at T=1450ºC, P=4 GPa stratification of carbonatite melt on highly and low-carbonate-silicate liquids with graphite allocation was observed. At melting UHPC with H_2O+CO_2 fluid T liquidus goes down to T ~ 1250ºC, T solidus - up to ~ 950ºC. In subliqudus areas with carbonatite melt zonality garnet co-exists

Key word: carbonatite, experiment, melting, high pressure, melt, phase composition

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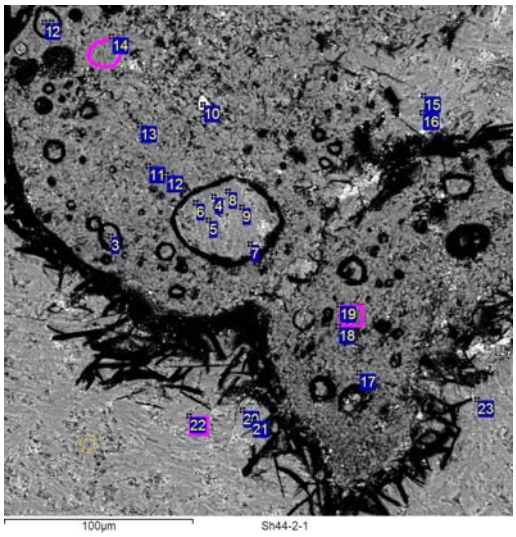
Introduction. In connection with the problem of the genesis of carbonatites at T-P of upper mantle (950–1450 ° C, 3.8–4.0 GPa) studied the melting of garnet-bearing ultra-high pressure carbonatite UHPC Tromsø area, Norway in "dry" conditions and with $H_2O + CO_2$ fluid.

Experimental method. 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.

Results. Temperature T "dry" liquidus UHPC ~ 1270 ºC. It is established full miscibility between silicate and carbonate melts. At quenching carbonatite melt the mix of microlites of variable composition, from the carbonate-silicate to silicate-carbonate is formed.

In the range of T 1250–1200ºC with carbonatite melt garnet Grt co-exists. This garnet differing from initial garnet UHPC by absence of zonality, higher content of CaO, TiO_2, lower Al_2O_3, FeO.



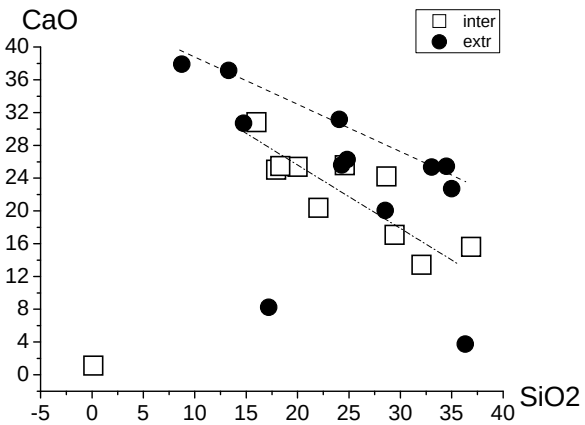


Fig. 1. Stratification carbonatite melt on highly and low- carbonate-silicate liquids with graphite allocation: microphoto an composition of the quenching carbonatite melt sample. 1450ºC, 4 GPa

Temperature "dry" solidus is ~1150ºC. In the range T from 1150 to 950ºC near soliduse and subsolidus associations are presented calcite Cc, garnet Grt, clinopyroxene Cpx, flogopite Flog and accessory minerals – apatite Apt, ilmenite Ilm, rutile Rt.

In experiments with H_2O+CO_2 fluid temperature liquidus goes down to 1250ºC. At T=1450ºC, P=4 GPa stratification carbonatite melt on highly and low-carbonate-silicate liquids with graphite allocation was observed (fig. 1).

In range T=1250–1150ºC with carbonatite melt the zonality garnet co-exists. Its reactionary border in comparison with its central part is enriched in FeO, MgO, MnO and depleted in. CaO, TiO_2, SrO (fig. 2).

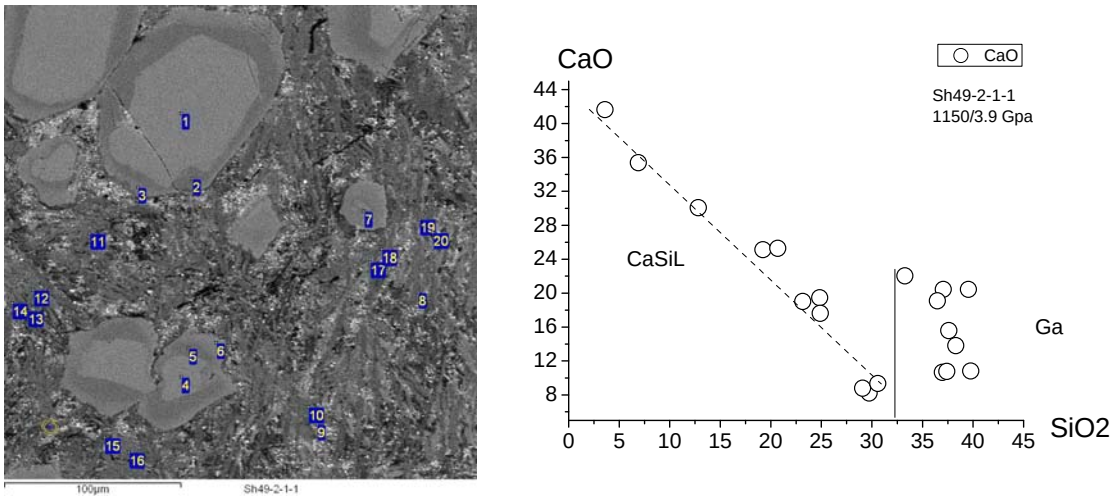


Fig. 2. Microphoto and composition of the quenching sample with zonality garnet. T 1150ºC, P=4 GPa

Zonality of garnet testifies to interaction of carbonatite melt with garnet at which the reactionary garnet is enriched in CaO, TiO_2, SrO.

At melting of UHPC with H_2O+CO_2 a fluid temperature solidus goes down to T ~ 950ºC. At T=950ºC, P=3.8 GPa carbonatite melt co-exists with Cc, Flog, Grt, Cpx, Apt. At increase T up to 1050ºC the portion of carbonatite melt increases, disappears Cpx, on liqudus present Cc, zonality Grt, Flog,

Results of experiments testify to formation characteristic for UHPC associations a carbonate-zonality garnet in the range of T =1150-1250ºC.

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