Vestnik Otdelenia nauk o Zemle RAN, VOL. 4, NZ9001, doi:10.2205/2012NZ_ASEMPG, 2012

# Phase relationship and geochemistry of garnet-bearing carbonatites of Trosø area, Norway

N. S. Gorbachev[1], E. Ravna[2], A. N. Nekrasov[1]., K. Kullerud[2]
[1]Institute of experimental mineralogy RAS, Chernogolovka
[2]University Tromsø, Norway

gor@iem.ac.ru

The phase composition and geochemistry of garnet-containing carbonatites UHPC Tromsø area studied. The matrix of UHPC calcite-dolomite composition contains inclusions of garnet, and accessory minerals - apatite, sphene, ilmenite, rutile. There are three generation of garnet: Grt1, depleted in REE (<2.10$^{-2}$ wt.%); Grt2-3, anomalously enriched (up to 4-8 wt.%) in LREE. Carbonate C and silicate Si fractions of UHPC differ on concentration of trace elements. Anomalous REE distribution in UHPC indicates a lack of equilibrium between Grt and carbonatite melt.

*Key words: carbonatite, high pressures, phase composition, geochemistry, experiment*

**Citation**: Gorbachev, N. S., E. Ravna , A. N. Nekrasov., K. Kullerud (2012), Phase relationship and geochemistry of garnet-bearing carbonatites of Trosø area, Norway, *Vestn. Otd. nauk Zemle, 4*, NZ9001, doi:10.2205/2012NZ_ASEMPG

In connection with the problem of the existence of carbonate magmas in the upper mantle studied the phase relations and geochemistry of garnet-bearing ultra-high pressure carbonatites (UHPC) Tromsø area, Norway. The matrix of UHPC is represented by carbonate C calcite-dolomite composition with inclusions of garnet Grt and accessory minerals - apatite, sphene, ilmenite, rutile. The samples were studied by microprobe, trace elements were determined by ICP MS.

On structure and composition it is allocated three generation of Grt: early, Grt1, of pyr15-gros25-alm60 composition, depleted in REE (<2.10$^{-2}$ wt.%); reacting Grt2-3 of pyr5-gros65-alm30 composition, anomalously enriched (up to 4-8 wt.%) in LREE .

The abundances of trace elements in the UHPC, its carbonate C and silicate Si fraction were examination. Compared to silicate, carbonate fraction is enriched in Ba, Rb, Nb, Sr, P, Zr, depleted in Hf, Ti, Th, Ta (fig. 1).

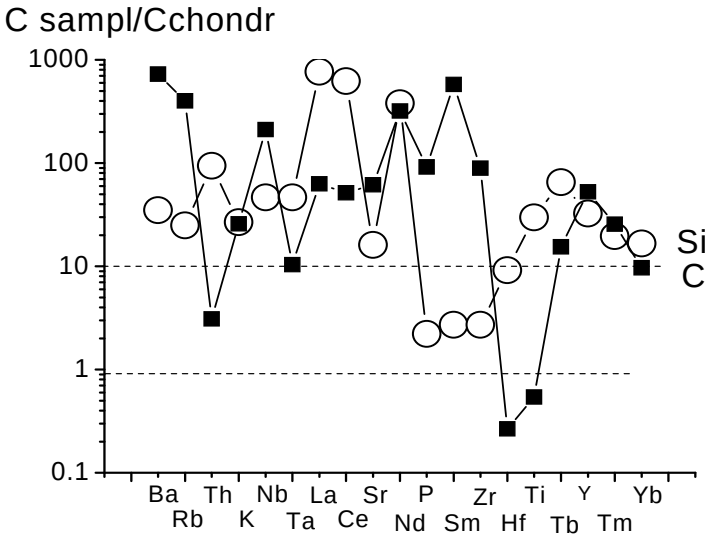


**Fig. 1.** Normalize for chondrite concentration of trace elements in carbonate C and silicate Si fractions of UHPC

Carbonate and silicate fraction of UHPC differ in REE concentrations and the character of its dependence from atomic number N REE. Silicate fraction enriched in REE, the dependence of the normalized for chondrite REE concentrations $C_N$ from N REE has negative slope with slight Eu minimum. In the carbonate fraction to the dependence of $C_N$-N REE has an extreme character with maximum at Gd-Tb. The largest differences are observed in the distribution of LREE. In the silicate fraction $C_N$ REE reduced from 500 at La to 50 for Sm, in carbonate fraction $C_N$ REE rise from 30 to 45 at La to Sm. Starting from Gd to Lu REE behavior is similar in silicate fraction $C_N$ REE reduced to 8, and in carbonate C fraction up to 5 (fig. 2).

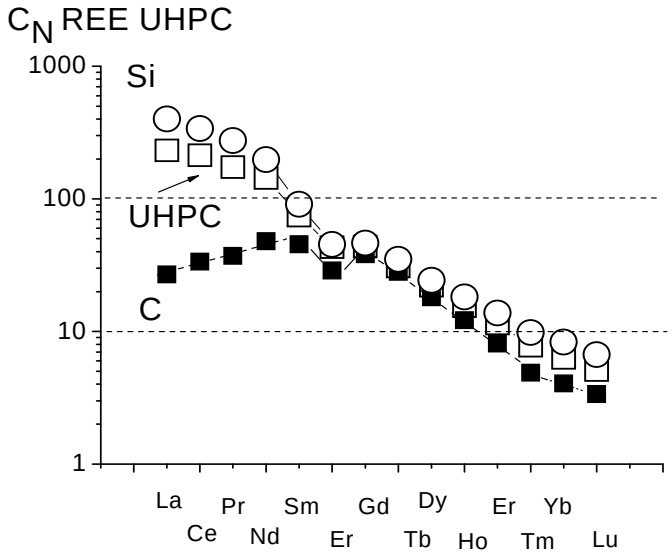


**Fig. 2.** Normalize for chondrite concentration of REE in UHPC, its carbonate C and silicate Si fractions

Since the silicate fraction to UHPC dominates Grt, then we can assume that D REE - partition coefficients between silicate and carbonate fraction to characterize the partition coefficients REE between Grt and carbonatite melt C. However, D REE Si/C~D REE Grt/C in the UHPC differ from the experimental D Grt/C. In UHPC dependence of D REE Si/C is an extreme character, decreasing from 18 to 1.2 for La to Gd-Tb, and then increasing to 2 at Tm-Lu. According to our experimental data, the dependence of D REE Grt / C is positive, increasing from 0.07 at La to 10 at Lu (fig. 3).

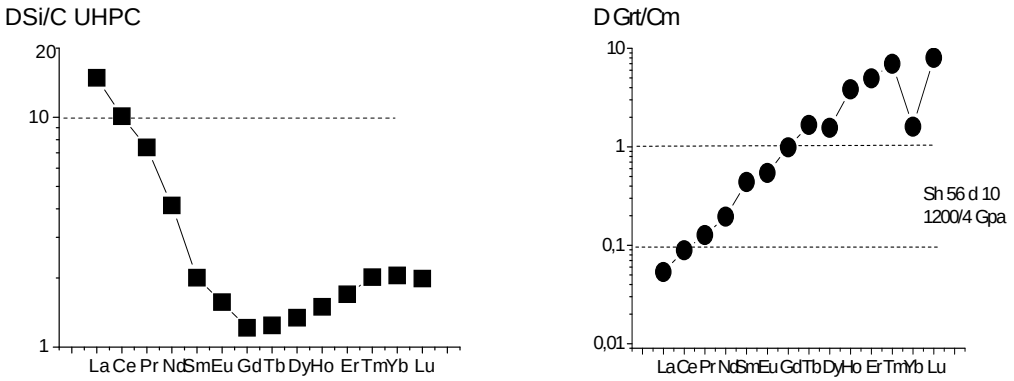


**Fig. 3.** Partition coefficients REE between silicate and carbonate fraction of UHPC (D REE Si/C) and partition coefficients REE between Grt and carbonatite melt (D REE Grt/Cm) (for our experimental datas)

Anomalous REE distribution in UHPC indicates a lack of equilibrium between Grt and carbonatite melt at formation of carbonatite melt at melting of upper mantle.

*Supported by grant RFBR 09-05-0113-a, 12-05-00777-a.*