Peculiarities of trace element geochemistry of the Gaussberg leucitites (West Antarctica)

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Crystal fractionation is one of the major processes affecting the composition of magmas. Investigations in lamproitic magmatism are important for understanding the geochemically anomalous reservoirs in mantle. Gaussberg leucitites are the rocks with unusual petrologic composition (K_2O>Al_2O_3; high SiO_2 content at given MgO) implying non-uniform melting source [1, 2]. Mineral assemblage is 60% Lct, 30% Ol, 10% Cpx. Trace element patterns of Gaussberg quenched glass samples have extreme enriched character. Maxima on Ba, La, Pb and Zr-Hf maxima are typical features of continental lithosphere [1].

In this study we report the Gaussberg mineral collection [3]. Two types of Cpx phenocrysts were detected in Gaussberg: (1) high TiO_2, low Al_2O_3 group and (2) low TiO_2, high Al_2O_3 group. Detailed electron probe microanalysis (ISTerre Université J. Fourier-CNRS, Grenoble, France) revealed the inverted zone character of Cpx grains – the core is enriched in FeO and depleted in Al_2O_3 while the rim is enriched in Al_2O_3 and depleted in FeO. Obviously Cpx imprinted the mix of two different melts. These melts can indicate the two stages of crystallization in Gaussberg magmatic system.

Leucite is the most abundant phenocryst in Gaussberg lavas. Leucite fractionation is restricted in near surface magma chambers. Gauss leucites are enriched in Na_2O (0,1-0,28 wt%) and depleted in K_2O (20,7-20,2 wt%) and FeO (0,7-1,2 wt%) compared to the leucites from another lamproite provinces.

Gaussberg olivine is high magnesium (up to Fo_{93}). Coefficients of olivine/liquid distribution were calculated based on new high precision data on minor elements (Li, Al, Ca, Cu, Zn, Si, Sc, Ti, V, Cr, Mn, Co, Ni, Ga, Ge, Sr, Y, Zr, Mo, Ce, Nd, Gd, Dy, Er, Yb) in olivine and corresponding quenched glasses (GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany). Determined coefficients $K_D^{Ol/Liq}$ are the larger for Ni (73) > Co (5) > Mn (1,2) > Zn (0,8) > Li (0,5) > Cu (0,02) and other non compatible lithophile elements. Gaussberg olivine has high Ni/Co ratios (20-40) implying the melting under the thickened lithosphere [4]. These results make a contribution to lamproite's database expanding the data for weakly studied (due to their rarity) leucitite rocks.

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