TREND OF SiO_2 IN GARNETS FROM KIMBERLITE PIPES.

G.D. Feoktistov and B.M. Vladimirov.

Institute of Earth's Crust, 664033 – Irkutsk, USSR.

Chemical compositions of garnets from the Yakutian kimberlite province (Siberian plataform) whose paragenetic associations have been previously described by N.V. Sobolev (1), were studied statistically. To this aim 122 chemical analyses of garnets from kimberlite concentrates, eclogite xenoliths, grospydites and disthen eclogites, from diamondiferous eclogites, from inclusions in diamonds, intergrowths with diamonds and associated with diamonds from Sobolev's work (1), were selected.

Regular surface trend of SiO_2 of second order in garnets in MgO-Al_2O_3 and Cr_2O_3-CaO coordinates is established. Garnets enriched in Al_2O_3 and MgO contain abundant SiO_2 in respect to total amount of RO and R_2O_3. MgO and CaO, Al_2O_3 and Cr_2O_3 pairs of oxides display the strongest negative correlations. SiO_2 have strong correlations: positive with MgO and negative with CaO. Moreover, SiO_2 shows a significant positive correlation with Al_2O_3, whereas its correlation with Cr_2O_3 is negative, below the level of significance of correlation coefficient. The above correlations influence variation trend of SiO_2 content: in garnets it generally increases with increasing of MgO (less for Al_2O_3) and with decreasing of CaO (less for Cr_2O_3).

A stable increased admixture of Na_2O (0,1–0,22%) compared to garnets from eclogites of metamorphic complexes (0,001–0,05% of Na_2O) is established in garnets from diamondiferous eclogites (2). High contents of Na_2O admixture are also observed in garnets enclosed in diamond (1).

Increased admixture of Na_2O in garnets testifies (1) their belonging to high-pressure diamond-pyrope facies, with isomorphous replacement $CaAl \rightleftarrows NaSi$ taking place in such garnets. Possibility of this isomorphism is proved by experimental crystalization of garnet of $Na_2CaSi_5O_{12}$ composition at pressure up to 18 GPa (3). When synthesizing garnet phase at high pressure (10–20 GPa). A.E.Ringwood and A. Major (4) demonstrated the possibility of crystallization of pyroxene solid solution with garnet in which an excess of silica due to the entrance into the garnet composition of the minal $Mg_3(MgSi)Si_3O_{12}$ appears, i.e. during isomorphous replacement $MgSi \rightleftarrows AlAl$.

We found that variation trend of SiO_2 content in garnet evidences increase of SiO_2 content in garnet groups whose paragenesis obviously corresponds to diamond-pyrope facies (pyropes from intergrowths with diamonds of the Mir pipe and magnesian garnets included in diamond) and also in garnet groups extracted from rocks and possibly belonging ato diamond-pyrope facies (garnets associated with diamonds, garnets of diamondiferous eclogites and chrome-pyropes poor in Ca, from kimberlite concentrate).

The presented data suggest that abundant silica content in garnet composition may indicate their formation under pressure corresponding to conditions of diamond-pyrope depth facies. Its appearance is possibly conditioned by the entrance into the garnet composition either of the minal $Na_2CaSi_5O_{12}$ with simultaneous increase ($>0,1\%$) of Na_2O content, or of the minal $Mg_3(MgSi)Si_3O_{12}$ with small admixture of Na_2O in garnets.

REFERENCES:

1. Sobolev, N.V. Deep-seated inclusions in kimberlites and the problem of the composition of the upper mantle. – Novosibirsk, Nauka, 1964, 264 p.
2. Sobolev, N.V., Lavrent'ev Yu. – Contrib. Miner. Petrol., 1971, vol. 37, p. 7-12.
3. Ringwood A.E., Major A. – Earth and Planet. Sci. Lett., 1971, vol. 12, nº. 4.
4. Ringwood A.E., Major A. In: Petrology of the upper mantle. – M.: Mir, 1968, p. 203-273.