COMPOSITION OF GARNETS WITH DIAMOND INCLUSIONS FROM KRASNOPRESNENSKAYA KIMBERLITE PIPE, YAKUTIA

Barashkov[1] Yu.P. and Zudin[2] N.G.

1. Yakut Institute of Geosciences, Siberian Branch, Russian Academy of Sciences, 39 Lenin pr., Yakutsk, 677891 Russia
2. Diamonds of Russia-Sakha Company, Mirny, 678170 Russia

Syngeneity suggests that the simultaneously crystallizing minerals have equal chances to form inclusions in each other. In this respect, diamond inclusions in other kimberlite minerals and mantle xenoliths present interest. Garnets containing diamond inclusions were first discovered in the XXIII Party Congress kimberlite pipe (Malo-Botuobinsk field, Yakitia) and studied in detail by N.V.Sobolev with co-authors (1986). They found that the garnets belonged to ultrabasic (3 samples) and eclogitic (3 samples) parageneses.

The authors studied garnets with diamond inclusions from the Krasnopresnenskaya pipe (Alakit field). The garnets studied are rounded-oval in shape, violet-red in color and fractured. Along fractures, a secondary material of brown color is found. Upon removal of diamond inclusions, moulds of detailed diamond face topography can be seen in the garnets. They correspond in composition (Table 1) to the harzburgite-dunite paragenesis type on the well-known CaO-Cr_2O_3 diagram (Sobolev, 1974). The garnets studied belong to knorringhite-pyropes and are poorer in Fe and higher in Cr compared to similar garnets from the XXIII Party Congress pipe. Interestingly, they are characterized by higher Cr_2O_3 and lower Al_2O_3 concentrations relative to garnet inclusions in diamonds from the Krasnopresnenskaya pipe (see Table 1). Moreover, two garnet inclusions in a diamond of combination shape are poorest in Cr and richest in Ca, plotting in the field of lherzolite paragenesis type on the CaO-Cr_2O_3 diagram. Also, the two garnet inclusions show maximum Al_2O_3 and FeO concentrations among all garnet inclusions of ultrabasic diamond paragenesis studied from the Krasnopresnenskaya pipe.

The authors also studied the composition of the secondary fracture-filling material in the garnets. It is made up of a fine mixture of different minerals. Scanning in K_α - radiation has revealed a symmetrical-zoned distribution of individual elements. Si is predominantly concentrated in the middle part of a veinlet. Maximum Cr and Al contents are recorded on both sides of Si. Maximum K concentrations are restricted to both exocontacts of a veinlet. Microprobe analyses have diagnosed the presence of chrome-spinellid, serpentine and phlogopite (Table 2). The chrome-spinellid analysis probably includes adjacent phases due to a smaller zise of grains relative to the probe diameter. Quantitatively, the chrome-spinellid is predominating, with serpentine and phlogopite accounting in nearly equal amounts for about 20 per cent of the veinlet area.

The veinlet-filling secondary material of the studied garnets differs in composition from kelyphitic rims of the garnets with diamond inclusions from the XXIII Party Congress pipe. Kelyphitic rims in the latter are dominated by chlorite, whereas serpentine, calcite and chrome-spinellid occur in quite subordinate amounts.

Thus, garnets with diamond inclusions from the Krasnopresnenskaya pipe refer to the harzburgite-dunite paragenesis. Compositional characteristics of these pyropes evidence that garnets with diamond inclusions have a specific composition in each particular pipe.

Table 1

Compositions of garnets with diamond inclusions and garnet inclusions in diamonds, Krasnopresnenskaya pipe

Components	Garnets with diamond inclusions			Garnet inclusions in diamonds		
	1	2	3	4	5a	5b
SiO_2	40.8	41.1	41.2	41.9	42.0	42.2
TiO_2	0.03	0.02	0.01	0.07	0.05	0.03
Al_2O_3	15.5	16.2	14.9	18.2	19.8	19.7
Cr_2O_3	11.8	10.8	12.0	8.16	6.65	6.71
FeO*	6.79	6.41	6.54	6.44	7.66	7.59
MnO	0.40	0.40	0.42	0.32	0.41	0.36
MgO	21.5	22.5	20.4	24.3	20.3	20.6
CaO	3.34	2.10	4.35	1.82	5.56	5.48
Na_2O	0.03	0.05	0.02	0.02	0.03	0.04
Total	100.19	99.58	99.84	101.23	102.46	102.71
Si	5.946	5.970	6.066	5.924	5.930	5.936
Ti	0.003	0.002	0.002	0.007	0.003	0.004
Al	2.659	2.761	2.569	3.026	3.291	3.270
Cr	1.355	1.239	1.390	0.911	0.742	0.746
Fe^{3+}	0.008	0.015	0.035	0.073	0.005	0.011
Fe^{2+}	0.819	0.763	0.766	0.689	0.896	0.881
Mn	0.049	0.049	0.052	0.038	0.049	0.043
Mg	4.674	4.875	4.449	5.118	4.272	4.323
Ca	0.521	0.327	0.682	0.277	0.842	0.825
Na	0.008	0.014	0.001	0.004	0.009	0.012
Total	16.042	16.015	16.012	16.067	16.039	16.051
f	15.7	14.3	15.5	12.4	18.1	17.6

Notes:

* Total Fe as FeO.

4 Inclusion from intermediate zone of colorless rhombododecahedral diamond.

5a and 5 b Inclusions in a colorless diamond of combination shape.

Table 2

Chemical composition of secondary material filling veinlets in garnets

Mineral	SiO_2	TiO_2	Al_2O	Cr_2O_3	FeO*	MgO	CaO	K_2O	Total
Serpentine	38.7	0.21	1.88	0.43	3.68	40.5	0.11	-	85.51
Phlogopite	36.4	0.15	12.0	4.55	5.62	22.4	3.50	6.29	90.91
Cr-spinellid	6.94	0.11	25.7	33.2	13.5	20.9	0.19	0.16	100.70

Notes: * Total Fe as FeO.

Serpentine and Cr-spinellid from Sample 2, phlogopite from Sample 1.

Sobolev, N.V. 1974. The Deep Seated Inclusions in Kimberlites and the Problem of the Upper Mantle Compositon. Nauka Publishers, Siberian Branch, Novosibirsk, 264 p. (in Russian).

Sobolev, N.V., Kharkiv, A.D., Vishnevsky, A.A., Zakharova, V.R., Matsyuk, S.S., and Tkach, V.N. 1986. Mineral. Journ., V. 8, No. 2, 23-31 (in Russian).