THE PECULIARITIES OF THE MINERAL COMPOSITION OF THE DIAMOND BEARING ECLOGITES FROM THE UDACHNAJA KIMBERLITE PIPE.

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The complex study of the mineralogical composition of the diamond bearing eclogites, 67 xenoliths from the Udachnaja kimberlite pipe, including 15 nodules of orange garnets, is carried out by the method of optical and scanning electron microscopy, coloured cathodoluminescence (CL), electron-probe analysis, optical spectroscopy and colorymetry. All the samples of the investigated eclogites have the traces of cataclasis and recurrent metasomatic influence of fluids, causing the intensive replacement of garnet by hydrogarnet and by complicated mineral association (diopside - amphibole - green spinel) and decomposition of clinopyroxene and plagioklase, considerably calcium pyroxene and serpentine.

The diamond crystals in the studied collection of eclogites are of octahedral shape with the microrelief of dissolving and, very seldom, with poorly developed edges of rhombododecahedron. The diamond crystals of the cubic habitus are discovered in one of the studied samples.The sizes of crystals vary from 20μ to 6 mm and, in this case, several diamond crystal of different sizes are discovered in numerous xenoliths. About 30 diamond crystals on the surface of eclogites are studied by the method of coloured cathodoluminescence on the basis of optical microscopy.Most of them have the blue colour of the cathodoluminescence (with high concentration of nitrogen, type I), with the exception of several samples, where together with the crystals of blue CL-colour, the ones of clearly marked yellow colour (type IIa and type IIb) are discovered. The discoveries like these one may have proved the different genetic nature of the diamond crystal in one xenolith.

The rock forming garnet and clinopyroxene are the "conservatives"of the diamond crystals included into them and they provide the conservation of even small crystals of diamond (size of several microns) when they are brought up to the surface of the kimberlite magma.

In the optical absorption spectra of the garnets, the observed lines of absorption are facilitated by the chromophormic centres Fe^{3+}, Fe^{2+}, and Cr^{3+} and are also connected with the availability of complicated chromophormic centres $Fe^{3+}+Ti^{4+}$ as was discovered by the method of optical spectroscopy and colorimetry. Their correlation and concentration facilitate the different shades of colour of garnets from the investigated eclogites,from dark yellow-orange to light yellow-orange. On the modified diagram of colour in the colorimetric coordinates p_e and λ_k, the points of colour of the investigated garnets are in the field of the diamond bearing magnesian-ferrous, disthene and corundum eclogites.

In all the investigated samples, garnet refers to pyrope-almandine-grossular row with wide range of pyrope (29.3-75.5 mol.%), almandine (13.3-46.4 mol.%) and grossular (0.7-52.0 mol.%) minals. The practically full absence of chrome and increased content of titanium (to 0.67 wt.% TiO_2) and sodium (to

0.63 wt.% Na_2O) are characteristic for garnets. With the increase of grossular minal in garnet and decrease of pyrope one, the regular change of colorimetric garnet parameters takes place : the value p_a decreases and dark-yellow-orange colour is changed into light-yellow-orange. According to J.Dawson and W.Stephens (1975) classification all garnets refer to four groups titanium pyrope, calcium pyrope-almandine, titanium and calcium magnesian almandine, pyrope-grossular almandine.

As a result of usage of the data base on garnet from eclogites and the application of discriminant analysis (Garanin et al.,1990), garnets were considered as a mineral from ilmenite-rutile diamond bearing magnesian-ferrous eclogites, bimineral diamond bearing magnesian-ferrous eclogites, aluminous (corundum and disthene) eclogites, magnesian ilmenite-rutile diamond bearing eclogites. The group magnesian-ferrous of eclogites is also marked out where garnets is sharply different from the known ones by the analysis by high contents of iron (to 1.51-1.95 wt.% Fe_2O_3 and 12.16-14.35 wt.% FeO),magnesium (17.4-19.57 wt.% MgO) and low content of calcium(2.47-3.06 wt.% CaO).

Not only the typomorphism of the garnet composition but also that of clinopyroxene is studied. According to the classification of W.Stephens and J.Dawson (1977) the studied clinopyroxenes are referred to diopside, jadeitic diopside and omphacite. The studied pyroxenes are referred to the group of pyroxenites, disthene and corundum diamond bearing eclogites and bimineral diamond bearing eclogites by using the data base on clinopyroxene from eclogites and their chemico-genetical classification and methods of discriminant analysis(Garanin et al., 1990). All of them refer to isomorphic row diopside-jadeite-ferrosilite (+clinoenstatite). In this case diopside and jadeite minals constitute together more than 80 mol.% . The ratio Ca/(Ca+Mg) constitute 41-56. The evaluation of crystallization temperatures of eclogites is carried out for all the samples, in which clinopyroxene is analysed.

The variation of temperatures,using the geothermometer of Ellis-Green (1979),are about 1024-1137°C under the pressure of 40 kbar. The composition of the accessory minerals in all the varieties of eclogites was also studied : corundum (sapphire), disthene, ilmenite, rutile, sulfide pyrrhotine- pentlandite-chalcopyrite(+jerphisherite) association. The wide spreading of ilmenite-rutile intergrowthes in magnesian eclogites should be noted.

Two main evolution trends have been established for eclogites: magnesian - magnesian-calcium and magnesian - magnesian-ferrous. They are clearly shown in the regular change of compositions and different schemes of isomorphic replacement in garnets: $Mg \leftrightarrow Ca$ and $Mg \leftrightarrow Fe^{2+}$.

The differences in the composition of garnets and pyroxenes - inclusions in diamond, on the one hand, and rock forming garnets and pyroxenes of eclogites, containing diamond, on the other hand, were established. The new criteria for the searching of the kimberlite rocks on the basis of the typomorphism of the rock forming garnets and pyroxenes from the diamond bearing eclogites are offered and different genetic models of the diamond bearing eclogites and their role in the general evolution of the both mantle and crustal rocks are discussed.

References :

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