MORPHOLOGY AND GROWTH HISTORY OF DIAMONDS IN ARKHANGELSK KIMBERLITE PIPES

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The peculiarities of diamond crystal morphology from the five kimberlite pipes of Arkhangelsky kimberlite province were investigated by optic and microprobe analyses methods. It was distinguished the main crystalomorphological types of a diamond: round rhombododecahedron crystals, plain-curve transitional forms (O-D), cubic and the octahedron habit crystals. Round rhombododecahedron crystals dominate. Their surfaces are laminar, fluted and overstepping. Some dodecahedra are distorted. Cubic and transmission polyhedra have rough surfaces with tetragonal etch pits on the faces (100) and knobby surfaces {110} The octahedron diamond crystals, as a rule, have sharp edges and smooth faces. Secondary forms are bad developed and, as usual, we can see only two or three faces. The main of them are [110], [111], [001], [211]. Some octahedra are distorted, with combination of faces (110) and (100) All diamond crystals from Arkhangelsk kimberlite pipes have a specific features on their surfaces: inversive triangular pits on the (111) faces, knobby, mosaic-blocked and concentric-hatching relief on the (110) surfaces.

The long and difficult kimberlite magma evolution accompanied by modification of P-T and redox conditions was traced on the diamond crystal morphology. It was established, that the qualitative and the quantitative distribution of different diamond crystales are specified to each kimberlite field and pipe The quantitative one of rombododecahedra, tetragecsahedra and cubic diamond crystals with the sculptures formed during the solution (pits, hills, channels and caveats of etching, strikes of plastic deformation) increases in poor pipes (pipe An-734 from Kepinskoye kimberlite field, for example).

The physical-chemical, thermodynamic and kinetic conditions of kimberlite crystallization change with the depth. It was studied the diamonds from the Pioneerskaya kimberlite pipe. At the upper horizons of this pipe were established usual diamond crystals: round rhombododecahedral (>2mm), octahedral and combinative O-D forms (0,5-1mm), which are typical for all kimberlites [Orlov, 1984]. At the depth unusual diamond microcrystals (<0,1mm) were found: hollow box skeletal round octahedr irregular and incompletely filled by thin diamond plates, growing at the angle to the surface; tabular and crosslooked fragments of zone-sector crystals and the smooth licked grain in plating cover

Such types of crystals are similar to diamonds from metamorphic rocks [Posukhova, Nadezdina, 1990] and therefore we propose the similarity between conditions of their genesis.

The crystallomorphology analyses and the experimental data show, that the boxy crystals are characterized by the fibrous mechanism of growth, which takes place at the non-equilibrium conditions when temperature decreased [Sunagava, 1986]. The result of such deviation from equilibrium may be spherical isometric forms of diamonds. Skeletal growth of crystals are due to fast deposition of carbon, sharp increasing of saturation degree and high content of impurities. The impurities increase the speed of growth and make the diamond crystals defective. They acquires sector and zone-sector structure. Fast saturation (cooling) of mineral solution is the cause of forming a great number of nucleus, that explains a very small size of diamond crystals and a wide spreading of twins.

The occurrence in Arkhangelsk kimberlite province pipes two kinds of diamonds: usual octahedron and rhombododecahedron, which grow by tangle (faced) mechanism, and box-skeletal zone-sector diamonds, which grow by normal (fibrous) mechanism, means the complicate geological and geochemical conditions during the kimberlite forming. We suggest, that the diamond crystals from Arkhangelsk kimberlite pipes had a long and difficult history and distinguished four studies of their growth and postcrystallization changing. The first study is the growth of the first large diamond crystal generation at the stable conditions in the mantle. The second study is the solution of that diamond crystals during the kimberlite lifting. The third study is the spontaneous crystallization of the second little diamond crystal generation at the metastable conditions in the intermediate hearth and the last study is the occurrence of the both types of the crystals at the metastable conditions in the earth s crust.

The changing of P-T conditions during the diamond growth end postcrystalline dissolution of diamond crystals may have as a result the differences in diamond contents of kimberlite pipes and it must be take into account during prospecting and explorative works.

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