REASONS OF VARIATIONS OF INDIVIDUAL DIAMOND CRYSTALS AND PETROGENETIC BLOKING OF ROCKS IN UDACHNAYA PIPE

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INTRODACTION. Sistematic study of kimberlite breccias of the pipe has shown that structural features, i.e. the degree of kimberlite magma saturation in xenogenic material of enclosing carbonate and deep rocks and the presence of different-sized local inhomogeneities in the composition o f the kimberlite cement (of autoliths) are a reliable classification criterion for all studied horizon in the vertical section of the pipe. Comparison investigation of the material composition and diamond tenor autoliths, it matrix and massive kimberlite breccias was allowed to establish generally regularity of distribution the individual diamond crystals and heavy minerals. The aim of this article is to constrain the condition of diamond kimberlite rocks origin, based on the petrografic, mineralogical date.

Petrography The Udachnaya pipe bifurcates into two independent bodies: Udachnaya-West and Udachnaya-east at the 220-250m. depth. In the western body there are kimberlite breccias of two structural varieties. which account for about 75 percent of its aria. The central and western parts of date body are filled with massive kimberlite breccia of brownish-grey color. It is charakterized by large amounts of fine disintegration products of xenoliths metamorphic rocks and phlogopite-magnetite composition of the groundmass and elliptical jointing. The elliptical masses not differ in structural-textural characteristics from the enclosing rock,vary from 5-7sm. to 15sm. size and are oval in shape. They can be easily separated from the groundmass and easily split exhibit concentric joining peripheral zones being more brittle and central zones of fine -porphyritic texture more dense. They are likely to be the" prototypes" of the autoliths seen at the surface. In the upper horizons. massive kimberlite breccia has a non uniform structure characterized by the presence of different-sized, rounded, fine-grained or aphyric autoliths with relatively gradual contacts. In Udachnaya-West pipe, most persistent with depth is a greenish-grey kimberlite breccia with a high concentration of xenoliths of sedimentary rocks and autolithic kimberlite-cement. The microautolithic structure of the cementing kimberlite is due to uneven distribution of the later carbonate to form rounded autoliths of phlogopite-magnetite (initial) carbonate composition and a carbonate-phlogopite groundmass with relics of an ore mineral (carbonatized areas). At contacts between the autolithic green-grey kimberlite breccia and the massive brownish-grey one, there are hybrid rocks of intermediate composition and averaged diamond grade, which is indicative of their mixing during emplacement. Thus the western body of the. Udachnaya pipe is filled with breccias of two structural types which undergo compositional changes both at contacts with the enclosing rocks and at contacts with each other. A variety of structural-textural characteristics can be traced in a wide endocontact zone between these two types of kimberlite breccias and a large reef of carbonate rocks that extends as a thick strip in submeridional direction.

Compared to Udachnaya-West, kimberlite breccias of the Udachnaya-East pipe contain lesser amounts of sedimentary xenoliths but higher amounts unaltered deep rock fragments. This type of breccias is characterized by high concentrations of unaltered olivine and large picroilmenite grains. In the central part of this pipe, there is a large reef of marmorized dolomites. Hybrid rocks of predominantly carbonate composition (with skarn association of minerals) that developed in its endocontact zone have adversely influenced the quality and grade of diamonds in the pipe.

Diamondiferous. Kimberlite rocks of the recognized structural varieties clearly differ in diamond grade and quality and, hence, concentrations and compositions of heavy-fraction minerals. Diamond grade is approximately equal in the Udachnaya-West and Udachnaya-East pipes but diamond quality is higher in the Udachnaya-West body. The quality of diamonds was assessed on the basis of five main features: size, shape and distortion, face surface, defects (inclusion, and cracks), and color. The size group used were -4+2 and -2+1. The proportion of crystals of the two sizes in the total amount of diamond crystals in a sample was determined. The shape and the degree of distortion were assessed for whole crystals, broken no more then by 1/3. The quantity of whole crystals, maccles intergrowths and their fragments, and the degree of distortion were taken into account. By color, diamonds were classified into colorless: yellow, brown, grey, and dark grey.

In the Udachnaya-West pipe, there more crystals of larger size classes, with a larger fraction of whole crystals among them, and , as a rule, of higher average weight. The degree of preservation is higher for diamonds from massive kimberlite breccia and aphyric autoliths. Diamonds from these rocks are also characterized by high average Weight of a single crystals. In the Udachnaya-East pipe, the diamond content is higher. with predominance of smaller stones and higher average weight of larger crystals. For example, the content of -1+0,5 and -0,5+0,2 classes is four times higher compared to the western body. The content of larger intergrowths maccles (of -4+2 and -2+1 sizes) is 2,5 times higher and that of pseudorhombododecahedra and dodecahedroids 3 times higher. Also combination crystals are found which are missing in the western body. Colorless and yellow large crystals are more characteristic of kimberlite from the Udachnaya-West pipe, whereas rocks of the Udachnaya-East pipe are characterized by grey large stones, with colorless and yellow shades being more typical of smaller stones.

Highly diamondiferous dark grey, porphyritic and fine-porphyritic autoliths contain 60 to 70 per cent of whole crystals, where as medium- and low-diamondiferous varieties up to 30 per cent. Among diamonds from autoliths, rhombododecahedra are prevailing, but vary much in content. In a large aphyric autolith, rhombododecahedra account for 70 per cent. octahedra for 20 per cent, intermediate shapes for 10 per cent. In highly diamondiferous porphyritic autoliths, intermediate shapes account for maximum 30 per cent, whereas rhombododecahedra for 15 per cent only. In diamondiferous autoliths of another type, rhombododecahedra account for 60 per cent, octahedra are missing and intermediate shapes account for 15 per cent. Crystals of intermediate type are absent in aphyric autoliths from both the western and eastern bodies.

Mineralogy. Heavy fractions also show clear distinctions. In the Udachnaya -West pipe massive kimberlite breccias have minimum garnet contents, with low-Cr, high-Fe varieties accounting for 75 per cent. Here, greenish-grey kimberlite breccia contain 2-3 times higher garnets. They are more variable in composition, with low-Cr varieties accounting for 40 per cent. There are also high-Cr, low-Ca garnet, as well as Cr-Ca varieties. The Udachnaya-East pipe is characterized by a quite different spectrum of garnet and ilmenite varieties.

Table 1

Content heavy- fraction minerals in Kimberlite breccia Udachnaya pipe

Petrografical varieties of kimberlite breccias	Mass probe kg	Magne-tite	Ilmenite	Garnet kg/t/	Olivine	Chrome spinelides
Udachnaya-East						
Maximum diamondiferous						
Autoliths dark-grey porphyritic, olivine unaltered	837	0.32	1.93	0.12	4.40	0.008
Highly diamondirerous						
Enclosing them breccia	1435	0.33	1.3	0.11	3.4	0.009
Massive Kimberlite breccia, olivine unaltered	1900	0.48	1.72	0.12	5.7	0.001
Same rock, more xenoliths.	1900	0.54	2.48	0.20	5,00	0.004
Autoliths dark-grey porphyrlc Olivine serpentinized.	694	0.04	1.40	0.12	0.17	0.010
Mediun diamondiferous						
Massive breccia. Endocontact	870	0.03	2.61	0.24	0.54	0.07
Autoliths porphyritic grey color with carbnate mineral	136	0.47	2.30	0.18	0.25	0.03
Low-diamindiferous						
Autoliths large porphyritic	156	0.49	1.70	0.25	0.06	0.001
Oligophyric autoliths	600	0.30	1.06	0.09	0.01	0.010
Aphyric autoliths	160	0.06	1.2	0.12	0.04	0.004
Udachnaya-West						
Maximum diamindiferous						
Autoliths dark-grey porphyric	690	0.12	0.61	0.17	0.013	0.001
Autolliths dark-grey small porphyritic	220	0.20	0.14	0.04		0.012
Massive kimberlite breccia	4164	0.53	0.58	0.33	0.01	0.008
Autolithic kimberlite breccia	4075	0.03	0.35	0.18	0.03	0.0004
Autoliths dark-green	939	0.03	0.16	0.10	-	0.002
Peridotite serpentinized	22	43,65	9.81	2.85	0.04	-
Autoliths aphyric grey color	340	1.30	0.43	-	-	0.003

To conclude, the distribution patterns observed in the pipes for diamonds and minerals with definite individual characteristics and compositions could have resulted from non-uniform melting of an unitally heterogeneous upper mantle substrate. Different diamond grades of autoliths and their analogues (rocs found in blocks whithin the pipes) are due to the formation of low-diamondiferous varieties from a liquid portion of the kimberlite melt and medium and highly diamondiferous varieties from a solid-liquid portion containig high concentrations of relics of mantle material.