

Ancient Platforms' Diamond Typomorphism (on the example of Siberian Platform)

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Modern methods of diamond exploration make it possible to receive large volume of information about conditions of their formation, subsequent existence and alteration (that is, concerning the data about typomorphic features), which is very important during forecasting, prospecting and assessment of deposits. From a considerable spectrum of these features the most informative and relatively easy for diagnosis are: morphology, photoluminescence, distribution of optically active nitrogen and hydrogen centres, electronic paramagnetic resonance, isotopic composition of carbon, X-ray-luminescence features, mineralogy and chemical composition of solid inclusions in diamonds. Mineralogical classification of Orlov, Y.L. is made use of therewith, according to which 11 genetic varieties of diamonds are earmarked: 1st variety - colourless and to variable degrees smoky-brown diamonds (due to plastic deformation) subdividing in its turn into six groups (octahedrons, rhombododecahedrons, transitive shapes of row octahedron-rhombododecahedron, pseudo-hemimorphic crystals, cuboids and shapeless fragments without indications of crystallographic faceting); 2nd - crystals of cubic and tetrahedral habit uniformly coloured in yellow and yellowish-orange colours; 3rd - crystals of cubic habit of gray colour; 4th - diamonds with colourless core and coloured in yellow, greenish-yellow and gray colours by coating ("coated diamonds") in the shape of octahedrons, combinational polyhedrons (octahedron+rhombododecahedron+cube), seldom cubes; 5th - dark, overfilled with inclusions of graphite in the external zone diamonds of octahedron-rhombododecahedron row, mainly octahedroids; 6th - polycrystalline splices of "ballas" type being spherocrystals with radial-radiant texture and fibrous structure with typical polyhedrons ("fivelings") usually on the surface of dodecahedral crystals; 7th - deformed in a complicated way twins and splices of dodecahedral close by their specific features to the 5th variety, with solid inclusions of eclogite association; 8th - polycrystalline aggregates, usually consisting of small individuals of octahedral and transitive between them habit; 9th - fine-grained bort; 10th - carbonado of Brazil;

11th - polycrystals of diamond with mixture of hexagonal modification of carbon (lonsdaleite) of impact genesis being absent in kimberlites.

The degree of investigation of diamonds by ancient platforms is different and is stipulated by opportunity to receive a required collection for research. That is why the most completely investigated are the crystals of Siberian and to a smaller degree - East-European platforms, as far as other diamondiferous provinces of the World are concerned - there was fragmentary investigation.

Available data base on diamonds from 147 kimberlite bodies, as well as placers and occurrences of placer diamondiferous property of modern (179 sites) and more ancient (95 sites) ages became the basis for investigation of typomorphism of Siberian Platform's diamonds. On the whole the results of own mineralogical investigations of more than 60 000 crystals from different in age secondary collectors and more than 30 000 diamonds from kimberlite bodies, with application of similar data by other authors, have been used. Investigation results of typomorphic features of diamonds allowed to reveal that the formation of all diamondiferous sedimentations of the province took place on account of erosion of four types of primary sources: 1 - the type of rich kimberlite bodies of phanerozoic age, which are characterized by sharp prevalence of diamonds of the 1st variety, represented by laminar crystals of octahedron, rhombododecahedron and transitive between them habit forming continuous row, as well as by availability of diamonds with coating 4, gray cubes 2, polycrystalline aggregates 8-9 and uniformly coloured in yellow colour cuboids of the 2nd variety with low content of typical rounded diamonds; 2 - type of kimberlite bodies with low diamondiferousness with prevalence of dodecahedroids with shagreen and stripes of plastic deformation of "vein type", typical rounded diamonds of "Ural" type and availability of colourless cuboids of the 1st variety; 3 - unidentified type of primary source the diamonds of which are developed in placers mainly in North-East of Siberian Platform, where their primary sources have not been discovered so far, and which are represented by graphitized rhombododecahedrons of the 5th variety, as well as by complicated twins, splices and dodecahedroids of the 7th variety and uniformly coloured cuboids of the 2nd variety forming the association of "Ebelyakh" ("nizhnelensky" = lower Lena) type; 4 - the type of explosive circular structures of "impact" genesis, the diamonds of which are composed by polycrystals of "carbonado" type with the mixture of hexagonal modification of carbon - lonsdaleite ("yakutit").

The received in the performed investigations data allowed to divide Siberian diamondiferous province into four subprovinces: Central-Siberian (central part of the platform), Lena-Anabar (north-east of the platform), Tunguskaya (south-west of the platform) and Aldan (south-east of the platform). The first one is characterized by sharp prevalence of diamonds of the 1st type primary source, by occurrence of high-diamondiferous middle-Paleozoic kimberlite magmatism and different in age placers of industrial significance. The properties of diamonds from kimberlite bodies and conjugated with them placers are sufficiently close here. That is why typomorphism of diamonds within perspective regions and sites of this subprovince is one of the main criteria for performing works on prospecting of feeding them kimberlite bodies among which there is the highest probability to discover high-diamondiferous targets, in comparison with other regions of Siberian province. Different correlation of octahedral and rhombododecahedral habit crystals at low content (not more than 10%) of rounded diamonds of "Ural" type and cuboids in association with "ballas" is usually the typomorphic feature of diamonds of such perspective territories therewith. Besides, the absence of diamonds of undiscovered genesis of the 3rd type primary source, which

prevail in placers of north-east of Siberian province, is typical for the discussed subprovince.

In Lena-Anabar subprovince there is also sharp prevalence, but of crystals from the 3rd type primary source of undiscovered genesis (associations of "Ebelyakh" type) with considerable availability of peculiar diamonds of 2nd, 5th and 7th varieties, typical rounded diamonds of "Ural" type in all age and genetic types of sediments, as well as appearance in a number of regions (Anabar, Sredne- and Nizhnelensky regions) of the subprovince of "carbonado" type polycrystals with the mixture of the 11th variety lonsdaleite of impact type primary source. The increased mechanical wear of the 2nd, 5th and 7th variety diamonds and the presence within such large territory of the same varieties approximately in equal correlation is common at that. There also is marked low content of crystals from kimberlite type primary sources in placers (about 10-15%), that is, disparity of typomorphic features of diamonds in them and known here kimberlite bodies. At the same time the detailed investigation of diamond morphology from upper Paleozoic sediments of Kyutyungdinsky graben region (north-east of Lena-Anabar subprovince) allowed to reveal the area (40 x 85 km) where the crystals of the 1st type primary source of kimberlite genesis prevail and about 10% of typical rounded diamonds of the 2nd type are present, at complete absence of crystals of the 3rd type primary source typical for the placers of the subprovince under discussion. The above mentioned, as well as the existence of dependence between morphology of crystals and their content in primary sources allow to forecast in this region availability of rich middle Paleozoic kimberlite bodies with peculiar diamond typomorphism.

Tunguskaya subprovince is noted for prevalence of typical rounded diamonds of "Ural" type at noticeable presence (about 5%) of polycrystalline formations of "ballas" type variety 6, and the content of crystals of octahedral and transitive to rhombododecahedral habit reaches 30%. Most of investigated diamonds have high degree of transparency and coloured crystals constitute about 1/3 of total quantity. Large content (about 50%) of diamonds with candy sculpture at considerable presence (about 20%) of crystals with caverns, thin and rough corrosion and pigmentation spots (green and brown) is also their typical feature. These all things serve as indirect indication of multiplicity of diamond primary sources of this subprovince with their prevalence of Precambrian age of the platform and its folding frame. The data of complex research of diamond typomorphism from upper Paleozoic and modern sediments of Baykit anteklize (west of Tunguskaya province) allowed to reveal prevalence of individuals from kimberlite source of the 1st type represented (more than 50%) by crystals of octahedral and transitive to rhombododecahedral habit, with the presence of rhombododecahedrons with splintering hatching, dodecahedroids of "Ural" type and peculiar uniformly coloured octahedroids of the 2nd variety. Diamonds of this anteklize, by the complex of typomorphic indications and spectrum of crystals of individual morphogenetic groups, do not have analogues among known kimberlite bodies and placers of Siberian province, that allows to forecast their own diamondiferous primary sources of middle Paleozoic age.

In Aldan subprovince there are known individual finds of crystals represented by typically rounded diamonds close by their typomorphic features to those from

Precambrian terrigenous formations of the platform and its folding frame, primary sources of which have not been identified so far.

Analysis of typomorphic features of diamonds in other platforms of the World has shown that kimberlite bodies: a) with increased diamondiferousness are also characterized by sharp prevalence of the 1st variety crystals of octahedral and transitive from it to rhombododecahedral habit (for example, industrially valuable kimberlite bodies of subprovinces: Kaapvaal' in South Africa, Slave in Canada, North-Chinese, et al.); b) with decreased diamondiferousness are also emphasized by prevalence of dodecahedral shapes of diamonds (subprovinces: Guinea-Liberian in Western Africa, Baltic in Arkhangel'sk area of Russia, et al.). However, so far there have not been discovered kimberlites analogous to the ones in Congo (Mbuzhi Maiya kimberlite field), with prevalence of cubes, diamonds with coloured coating and diamond bort. Still unsolved there remains the problem of primary diamond sources from Precambrian terrigenous formations of platforms (Brazilian, East-European, et. al.) and their folding frame, which are characterized by typical rounded crystals of "Ural" type that practically are absent in known kimberlite bodies.