An algorithm of kimberlite diamondiferousness estimations.

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Unique method of interpretation of diamondiferous kimberlite's petrochemistry based on hypothesis suggested by occurrence of relationship between diamond content and composition of kimberlite matrix has been taken into consideration. Kimberlite constitution is represented by a set of «populations» - discrete groups differ from each other by Ti content. Seven «populations» have been distinguished within kimberlites of main diamond deposits of Yakutia [Vasilenko,Kuznetsova,1986;Vasilenko,1995]. Distribution of diamondiferousness between «populations» turned out to be uneven. Clusters of diamond contents values concentrate around the A-min, A-med, A-max levels. Mean productivity of these levels for each «population» growth opposite to average TiO_2 content (table 1).

Table 1. Values of diamond content (in arbitrary units) vs TiO_2 (wt. %) content in «populations» [Vasilenko, 1995].

Population	n	Diamond content	TiO2 content
1	21	A-min 9.96	0.38
	32	A-med 42.46	0.37
	4	A-max 116.78	0.36
2	146	A-min 2.81	0.84
	46	A-med 14.05	0.79
	6	A-max 48.75	0.59
3+4	86	A-min 1.40	1.26
	126	A-med 10.37	1.32
	9	A-max 33.81	1.10
5	120	A-min 0.40	1.79
	167	A-med 10.93	1.69
	6	A-max 11.30	1.84
6	17	A-min 0.09	2.39
	40	A-med 5.06	2.40
	5	A-max 21.92	2.37

Taking into account above data, it seems to be possible to establish an algorithm of separation of kimberlite between «populations» using composition of kimberlite matrix. By this way, productive and non- productive kimberlites prove to be separated on the stage of probing and recomendations on exploring and exploitation of kimberlite pipes are likely to be made at the initial steps of diatremes investigation.

E.g., Botuobinskaya pipe situated in Central Yakutia has been studyed. 300 Xray - fluorescence bulk-rock analyses of kimberlites have been used.

With the aim of formalization of separation procedure for Botuobinskaya pipe kimberlites, linear discrimination of database including analyses from all main Yakutian diamond occurrences has been made [Anderson et al, 1972; Lederman, Lloid, 1984]. Taking into account previous experience of Yakutian kimberlites investigation [Vasilenko, Kuznetsova, 1986; Vasilenko, 1995;

Vasilenko et al, 1995], Botuobinskaya has been supposed to be composed of 1st, 2nd, and 3rd «populations» of kimberlite, so discrimination of high-titaniferous varieties hasn't been developed.

Only variables elevated common percentage of correct estimations more than on 0.5% has been counted. As a result, three linear discrimination functions have been observed. There are:

$\varphi_1 = 7.8376\, x_1 + 15.6997\, x_2 + 2.5912\, x_3 + 1.1152\, x_4 + 0.9243\, x_5 + 0.4558\, x_6 - 17.9574;$

$\varphi_2 = 13.0167\, x_1 + 19.3539\, x_2 + 3.4202\, x_3 - 0.7719\, x_4 + 1.3224\, x_5 + 0.3935\, x_6 - 24.1953;$

$\varphi_3 = 25.0374\, x_1 + 10.0653\, x_2 + 2.2609\, x_3 - 0.7260\, x_4 + 1.3974\, x_5 + 0.4106\, x_6 - 24.9053$

where x_1-x_6 mean contents of TiO_2, P_2O_5, Al_2O_3, Na_2O, Fe_2O_3sum, SiO_2, accordingly.

To classify any new sample in terms of 1st, 2nd, and 3rd population, it is necessary to substitute variables x_1-x_6 by oxides contents of investigated sample and function with highest value will define a «population» number. As a whole, ratio of correct classifications is statistically significant (table 2).

Table 2. Features of discrimination quality for initial massif of main diamond deposits of Yakutia.

Population #	Correct classifications, %	φ_1	φ_2	φ_3
1	74.6%	303	99	4
2	77.5%	49	342	50
3	91.6%	33	49	897
Total	84.4%	385	490	951

Results of separation of Botuobinskaya pipe kimberlites show, that among them prevails second «population», that is confirmed by exploitation drilling data. It means that method has been taken into consideration proves to be useful for diamond deposits exploration.

References:

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