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FRACTIONAL STRUCTURE AND MINERALOGICAL FEATURES OF PSEPHYTIC DEPOSITS – POTENTIAL RESERVOIRS OF DIAMOND IN THE NORTH-WESTERN PART OF THE UKRAINIAN SHIELD. Part 3. PIVDENNO-ZAKHIDNA (OVRUTSKA) AND MIZHRICHYNSKA AREAS*

Geologists of the Zhytomyrska Geological Exploration Expedition distinguished the Pivdenno-Zakhidna area in the south-western part of the Ovrutska structure for the search for diamond bearing deposits. The reason for this was the presence of different-age rudaceous rocks – conglomerates, gritstones and coarse-grained sandstones of the Verkhniozbrankivska member of Paleoproterozoic age and Quaternary pebble-sand deposits that overlap the Precambrian rocks everywhere in the region.

In the interfluve of Uzh–Zherev, geologists have identified the Mizhrichynska area for the discovery of Cenozoic diamond placers. The reason for this was the discovery of diamonds and their paragenetic satellites in the rudaceous sediments of the fluvial and floodplain facies from the paleovalley of the river Uzh during previous geological surveys at a scale of 1:50,000.

Detailed lithologic-mineralogical studies of terrigenous rocks have been made on the material of ordinary, large-volume and small-volume samples from the wells and dug holes. It is determined that the distribution of heavy fractions in sediments and clastogene minerals in them depends on the deposits fractional structure, their facies membership and development area. Paragenetic and gravitational diamond satellites (pyrope, chrome-spihellids, picroilmenite, staurolite, etc.), found in the sediments of both facies, according to their typomorphic features do not correspond to the association of the diamond-bearing facies. In addition, their low content, small size (except staurolite), surface features and the degree of roundness show their long stay far from the original source and possible proceeds from older intermediate collectors. Consequently, their search value is low.

Key words: diamond, typomorphism of minerals, paragenetic and gravitational minerals-satellites, placer, terrigenous rocks, north-western part of the Ukrainian shield.

Pivdenno-Zakhidna area is located in the south-western part of the Ovrutska structure. Execution of search work on the detection of diamond-bearing placers was due to the presence of different age rudaceous rocks within it: conglomerates, gritstones and coarse-grained sand-

* This article completes the cycle of three articles (see [4, 5]).

stones of Verkhniozbrankivska member ($PR_1^2zb_2$), which individual researchers compare with coarse-grained sediments of the Bilokorovytska structure, and Quaternary pebble-sand deposits, which everywhere overlap the Precambrian rocks of the explored area.

In the central part of the area, on the outskirts of the Cherepynky-village, the geologists of the Zhytomyrska Geological Exploration Expedition (GEE) by the group of wells No. 1419 uncovered and sampled the thickness of the Zbrankivska suite, including the conglomerates and gritstones of the Verkhniozbrankivska member. In addition, they were uncovered by dug hole No. 128 (large-volume sample 128/1). In the western part of the search area, on the outskirts of Velyka Khaicha-village, the dug holes No. 129 (sample 129) and 134 (sample 134/1), which uncovered Quaternary sandy deposits with a content of 20–25 % of pebble material, have been excavated. Even more west (the village of Malyi Kobylyn), the dug hole No. 135 has been traversed in the Quaternary deposits, in which pebble-sand rocks were uncovered. Two large-volume samples were sampled from them: in the range of 2.9–5.5 m – boulder-pebble deposits (sample 135/1), 5.5–6.5 m – medium grained sand with an admixture of gravel material (sample 135/2).

Features of the structure and composition of rudaceous sediments. The composition and structure of the *Zbrankivska suite* conglomerates were well studied during the earlier research performed by the geologists of the Zhytomyrska GEE (Suprunenko et al., 1978; Bukovich et al., 1982; Vysotskii et al., 1982); and high content of gold was found in them in some places. However, these deposits were not tested on diamonds and their paragenetic or gravitational minerals-satellites.

In the section of group of wells No. 1419, conglomerates have been discovered at the depth of 31.5–56.7 m. Their thickness here varies from 17.1 to 21.3 m. Externally there are brown, dark brown, brownish-red rocks with small-, medium- and large-size pebbles, massive, intensely ferruginizated, sometimes fractured. Rudaceous material (from 5–10 to 40–55 % of the rocks volume) is distributed extremely unevenly. In its composition, the poorly rounded fragments of ferruginizated quartz-porphyries prevail, and there are fewer pebbles of jasper, quartzite-like sandstones and quartz in the size from 1.5 to 5.0 cm or more. The degree of roundness is poor and middle. Cementing mass of the rock is of basal type, is presented by fine- to thin-grained intensely ferruginizated material, which contains fine-scaly mica mineral and finely-aleurite-sized grains of quartz and feldspar. Throughout the interval, secondary processes are intensively developed in conglomerates – hematitization, epidotization, silicification (nests of irregular shape) and streaks of jasper of chocolate colour. The rocks are poorly phosphatizated. Phosphate substance is represented here, in addition to apatite, by amorphous variety of calcium phosphate – collophane (n = 1.621), which is contained in the cementing mass in the form of thin particles and porcelain grains-fragments of fine-sand size and light gray and brownish-cream colour.

Above the section, in the range of 16.7–27.6 m, there are gritstones, often passing into coarse sandstones or small-pebble conglomerates. The content of gravel and pebble in them is variable – from 5–10 to 40 % of the rock volume, its distribution is chaotic. The size of gravel grains is 2.5–5.0 mm, pebbles – 30–35 mm. The pebble roundness degree is low, and gravel is better rounded. The composition of coarse-grained material and the type of rock cement is the same as in the conglomerates described above.

Consequently, the polylithoidal composition of the rudaceous deposits of the Verkhniozbrankivska member and the poor roundness of the pebble material indicate that the source of both coarse-grained and cementing material was mainly local rocks – quartz-porphyries, jas-

pers and fine-grained sandstones of the Nyzhniozbrankivska member. Only well-rounded pebbles and gravel of quartz and quartzite-like sandstones could have been brought from more distant sources or redeposited from older terrigenous rocks.

Quaternary loose rudaceous deposits of the Pivdenno-Zakhidna area are mainly sands. According to the materials of the dug holes field description, the sands contain different amounts of rudaceous material: from 10–15 to 20–25 % and at the top of the section – even 45–50 %. According to granulometric studies performed by the geologists of the Rivnenska GEE, there are medium-fine-grained sands with a different content of gravel and pebble (Table 1), represented mainly by debris of dark brown flints, pinkish-gray quartzite-like sandstones of the Tovkachivska suite and quartz pebbles.

Table 1

Granulometric composition of loose rudaceous rocks of the Pivdenno-Zakhidna area (according to the large-volume sampling), %

Number of the sample	Depth of sampling, m	Deposits	Size classes, mm				
			> 8	8–1	1.0–0.5	0.5–0.2	< 0.2
135/1	2.95–5.50	Boulder-pebble	1.68	8.62	8.82	51.47	29.41
135/2	5.50–6.50	Sand	–	8.82	6.87	47.06	37.25
129	1.50–2.50		9.00	11.62	3.50	50.00	25.88
134/1	2.80–3.80		1.69	8.08	4.62	48.46	37.15

Material and granulometric composition of heavy fraction in the size of 0.2–1.0 mm of *rudaceous deposits of Verkhniozbrankivska member* has been studied on materials of small-volume sampling in the group of wells No. 1419.

It turned out that the content of heavy fraction in the rocks is low and ranges from 10.8 to 34.4 g/t. Moreover, in conglomerates, it is only 11 g/t, and in the gritstones located above it is three times larger. According to the materials of the large-volume sampling, the content of heavy fraction in weathered gritstones is 504 g/t. Heavy fractions are mostly medium-fine-grained (in conglomerates they are finer).

The set of terrigenous minerals in the studied heavy fractions is very poor: iron hydroxides and fragments of a highly ferruginizated rock containing well-cut crystals of ilmenite and its almost leucoxenized grains. It should be noted that we unfortunately studied these fractions after the samples were remelted, so the following list of terrigenous minerals in them is clearly incomplete. We discovered fine, well-rounded, dominated ilmenite grains, as well as garnet, staurolite, tourmaline, titanite, zircon. The content of these minerals in conglomerates does not exceed 1 g/t, and in gritstones leycoxene also is detected in the amount of 1.6 g/t. In addition, they are characterized by pyroxene (4.8 g/t) in the form of oxygonal (crushed) grains, which almost entirely form a heavy fraction of 0.5–1.0 mm and a 25 % fraction with a density up to 3.60 g/cm^3 and 0.2–0.5 mm in size. The same grains of pyroxene, often in growths with amphibole, have been found in a heavy fraction of phyllite-like shales that occur below (sample 1419/3), and sandstones that occur above (sample 1419/1). Pyroxene is a diopside of herbal-green colour. It is noteworthy that among such grains there are single transparent individuals of the prismatic form and the emerald green colour, which have a high refractive index (n_g = = 1,706), characteristic for the chrome-diopside. According to the large-volume sampling, the content of pyroxene in the heavy fraction of weathered gritstones is only 2 g/t. Consequently, in the composition of the gritstones' rudaceous material, there is a small amount of gravel and

pebbles of diopside-containing rock, which are distributed over the section extremely unevenly.

The heavy fraction of gritstones (large-volume sample 128/1, which even before our study also was remelted) contains quite a lot of terrigenous ilmenite (248 g/t) and garnet (63), less staurolite (16) and leucoxene (about 9 g/t). Ilmenite, garnet and leucoxene are concentrated mainly in the fraction of 0.2–0.5 mm, staurolite – in the fraction of 0.5–1.0 mm.

We studied the composition and fractional structure of heavy fractions of *loose rudaceous deposits* on the material of large-volume sampling. In order to detect large grains of paragenetic and gravitational satellites of diamond, we also studied a gravel heavy fraction that has been earlier extracted during the preliminary analysis at the Rivnenska GEE processing plant. According to this analysis, this fraction is 0.01–0.03 % of the material of classes –4+2 and –2+1 mm. The studied fractions contain, mainly, well-rounded, often shiny grains and oölites of iron hydroxides, unrounded cemented aggregates of pyrite, and less – differently rounded fragments of fine- and medium-grained basic rocks, often with ilmenite. In the mass of this material, there are differently rounded grains of garnet, ilmenite, staurolite. Ilmenite is represented by single grains of the tabular form with smoothed edges, garnet – by unrounded oxygonal and poorly rounded grains, there are also completely unrounded fragments of inequigranular garnet rock. Among all the minerals, the most rounded is staurolite, especially in the size of 1–2 mm.

The content of heavy fraction in the size of 0.2–1.0 mm varies considerably and is 0.8–1.0 kg/t in the rocks of the search area western edge (sample 135), 0.5 (sample 129) and 2.0 kg/t (sample 134/1). The fractions are mostly medium-grained, since the class –1.0 +0.5 mm is only 0.1–0.2 % of the entire fraction mass.

In fractions of 0.5–1.0 mm, the sum of the most stable terrigenous minerals varies from sample to sample (from 30 to 80 %), which indicates uneven content of large grains of these minerals in the studied deposits. In fractions of 0.2–0.5 mm, this amount in all samples exceeds 70 %, that is, they contain the most stable terrigenous minerals, primarily ilmenite and leucoxene, then staurolite and tourmaline, garnet, topaz, zircon, rutile, kyanite. The degree of these minerals roundness is different. Garnet grains are rounded the worst of all, especially the size of 0.5–1.0 mm, they are represented by oxygonal fragments of the irregular shape, and occasionally by isometric poorly rounded crystals. Ilmenite is rounded a little more, but among the mass of ilmenite grains there are both completely unrounded grains and well rounded, especially in the class of –1.0+0.5 mm. The grains of the rest of the minerals are well rounded (especially staurolite, tourmaline and topaz). Thus, among the studied terrigenous minerals, four groups of minerals that have undergone a different route of transportation to the place of deposition (and well rounded, apparently, repeatedly redeposited) can be distinguished by the size and degree of roundness: (1) garnet; (2) ilmenite; (3) staurolite, tourmaline, topaz; (4) zircon, rutile, kyanite.

The research carried out made it possible to draw the following **conclusions**. The heavy fraction of different age rudaceous deposits of the Pivdenno-Zakhidna area is very different both in content in general and in the content of stable terrigenous minerals. Although these fractions are predominantly medium-fine-grained, in their composition, large (2–4 mm) grains of one of the most characteristic gravitational satellites of diamond – staurolite were discovered for the first time in the Ovrutsko-Bilokorovytskyi region. Nevertheless, their insignificant content and a significant degree of roundness show a long way of their transportation to the studied deposits, and, possibly, repeated redeposition from the older rudaceous rocks, which, thus, significantly reduces the search value of staurolite in this case.

Typomorphic features of paragenetic diamond satellites. In studied rudaceous deposits of the Pivdenno-Zakhidna area, among the paragenetic diamond satellites, only pyrope and picroilmenite were detected in very small quantities, and they were found only in the large-volume samples (in small-volume samples of the group of wells No. 1419, they were not discovered at all).

In total 104 grains of **pyrope** have been found, in particular, 74 grains* – in weathered gritstones of the Zbrankivska suite, 28 – in sands, and two grains – in boulder-pebble deposits. The grains are small (0.25–0.50 mm) and have pink colour (88 grains), red (13) and purple (3). The refractive index of pink and red grains is 1.747–1.751, and all three purple grains have a different index: 1.747; 1.751; 1.767. The shape of the grains is irregular, sometimes round or slightly elongated, their surface is smooth, barely matte. Small grains are poorly rounded and the degree of conservation is poor. Drop-like sculpture of chemical origin is noticeable on the surface of individual grains.

The small size and character of the surface of the studied pyrope grains indicate their long stay away from the indigenous source, and low content in the investigated deposits – about their possible delivery from older intermediate collectors. Therefore, in this case the search value of pyrope is low.

We studied 148 grains of **ilmenite** by the method of thermoelectric power: four grains of 1–2 mm in size – from conglomerates, 34 – from weathered gritstones, 110 – from loose deposits, exposed by dug holes No. 134 and 135. Among them, 38 grains have positive value of thermoelectric power, and only two grains have the values characteristic of the picroilmenite – 123 and 156 mV/°C, the rest – within the values typical for ilmenite from basic rocks. The grains have a black colour and a strong metallic lustre, unrounded, sharp-edged, with a pitted surface. It is clear that in this case they do not have a search value.

Mizhrichynska area. The geologists of the Zhytomyrska GEE organized a search work on the discovery of the Cenozoic diamond placers (Uzh–Zherev interfluve) after having found (Kotvitsky et al., 1977) 49 grains of diamond (0.05–0.75 mm) and its paragenetic satellites – pyrope, chrome-spinellids, picroilmenite and baddeleyite in coarse-grained Middle Quaternary sediments that fill the Uzh paleovalley. Deposits are represented by the formations of fluvial and floodplain facies. For the channel facies, the predominance of coarse-grained alluvial sands with different gravel and pebble content is characteristic, and the deposits of floodplain facies are more fine-grained.

Deposits have been discovered by wells on five search profiles that were laid across the paleovalley strike (profile I – near the south side of the paleovalley, II, V – in the western part, and IV – in the eastern), and 12 small-volume samples were sampled. The sample consisted of lithologically homogeneous core material of individual wells. In the case that there were layers of small thickness and of inequigranular deposits, a material of different granulometric composition was united in the sample.

Peculiarities of the structure and composition of heterofacies deposits. Granulometric analysis of samples was carried out at the obage fabric of Rivnenska GEE. Its results showed this. The deposits of the *fluvial facies* from different parts of the search area differ significantly in the content of the class –1.0+0.5 mm, less – by the contents of the class –0.2 mm, while the content of pebble (+8 mm), gravel (–8+1 mm) and medium-grained sand (–0.5 +0.2 mm) components are practically the same. It turned out that the deposits on the profiles I,

*In the calculation of 20 litres of rock – nine grains.

II and IV are large-medium-grained sands with a content of pebbles and gravel 11–12 %, and in profile III – medium-grained sands containing up to 15 % gravel and pebbles and more than 20 % – aleuropelitic material. As for the deposits of *floodplain facies*, there is no pebble in them, and the content of the remaining granulometric fractions is substantially variable. Deposits of the western part of the paleovalley are coarse-grained sands, and eastern ones are more fine-grained.

Near the well No. 1510 in which diamonds were discovered early (Kotvitsky et al., 1977), four dug holes (130–133) opened sandy deposits: at the top of the section, these are medium-grained sands with admixture of gravel, and in the lower part – more coarse-grained sands.

According to the study of the material of the size 8–13 and 4–8 mm (Table 2), the fragments of flints and silicified rocks, sandstones and altered granitoids (fragments of quartz-feldspar composition) play a significant role in the composition of the pebble material. Pebbles of quartzites and gravel grains of quartz are less (in some samples of floodplain facies they dominate). From the Table 2 follows also that the distribution of rudaceous material in the studied sediments is extremely uneven in size and composition. The degree of roundness is low, indicating a small distance from the primary source. Only the high degree of roundness of quartzite fragments and quartz grains means that they have undergone long transportation and redeposition from older deposits.

We studied the ***composition and fractional structure of the heavy fraction*** of the potentially productive deposits on the material of small- and large-volume sampling. Sampling involved the separation of a heavy fraction of the class –0.5+0.2 mm and separately – an electromagnetic fraction of the class –1.0+0.5 mm. In addition, from six small-volume samples, heavy fractions of –0.2 mm, as well as of gravel size, gave been sampled to discovery large grains of gravitational and paragenetic satellites of diamond.

According to the small-volume sampling, the content of heavy fraction in the size from 0.06 to 4 mm in gravel-pebble deposits of the fluvial facies is significantly variable: from 208 g/t in the eastern part of the paleovalley to 2,230 g/t in the western. In the sandy sediments of the floodplain facies, the picture is similar – 293 and 1,409 g/t, respectively, and the content of heavy fraction in the size of 0.2–1.0 mm in them is less variable – from 144 to 516 g/t, and only in sediments discovered by the group of wells No. 1498, it reaches 3,098 g/t. Consequently, the higher content of the heavy fraction is characteristic of the rudaceous sediments of the fluvial facies, and lower – for sandy deposits of floodplain facies, discovered, moreover, in the western part of the search area (profile II), or near the southern side of the paleovalley (profile I).

According to the large-volume sampling, the content of heavy fraction in the size of 0.2–1.0 mm in sandy rocks, discovered by dug holes No. 130–133, ranges from 444–490 g/t in the upper part of the section to 738 and 804 g/t – at the bottom.

According to granulometry, heavy fractions are medium-grained with content up to 1–2 % of fine gravel grains and up to 10 % of fine-grained sand and coarse-aleurite grains. Exception is made only of rudaceous alluvial deposits (sample No. 1507), in which the heavy fraction contains 25.4 % of gravel material and 20 % of coarse-grained sand.

The heavy fraction of the class –4+2 mm is composed primarily of iron hydroxides and septarian nodules of fine-grained pyrite (sample No. 1507) or earthy marcasite (sample No. 1527), which often cement clastogene sand material with the formation of peculiar microbreccias. Occasionally there are well-rounded grains of diopside-containing rock and sharp-grained fragments of sillimanite-garnet rock, as well as single gravel grains of staurolite, il-

menite and garnet. In the class –2+1 mm, in addition to these minerals and rocks, rare rounded grains of leucoxene, tourmaline, topaz, and wollastonite were found.

Table 2

Composition of detrital material of heterofacies rudaceous deposits of the Mizhrichynska area (according to the materials of small-volume sampling), %

Composition of fragments	Deposits of fluvial facies					
	Sample No. 1501		Sample No. 1494		Sample No. 1527	
	+8 mm	–8+4 mm	+8 mm	–8+4 mm	+8 mm	–8+4 mm
Flints	56.5	5.4	51.6	25.7	6.9	4.8
Sandstones, quartzites	10.9	17.6	14.5	12.2	51.9	51.5
Altered granitoids	12.1	39.2	14.4	31.2	24.9	15.6
Quartz	4.1	13.7	4.2	15.9	1.5	2.3
Dark-coloured rocks	1.7	2.0	–	–	–	–
Silicified and metasomatically altered rocks	13.7	21.0	14.8	13.1	14.5	25.3
Uncertain debris	–	–	–	0.7	–	–
Scale (contamination)	0.1	1.1	0.5	1.2	0.3	0.5

Composition of fragments	Deposits of fluvial facies		Deposits of floodplain facies			
	Sample No. 1532/2		Sample No. 1510		Sample No. 1532/1	
	+8 mm	–8+4 mm	+8 mm	–8+4 mm	+8 mm	–8+4 mm
Flints	35.3	32.2	–	2.6	42.4	19.2
Sandstones, quartzites	–	9.0	75.8	23.6	7.6	11.1
Altered granitoids	28.8	35.0	–	–	19.3	36.0
Quartz	–	8.2	24.2	73.8	5.0	12.8
Dark-coloured rocks	–	–	–	–	6.5	–
Silicified and metasomatically altered rocks	27.7	11.0	–	–	16.9	9.9
Uncertain debris	8.2	4.6	–	–	–	1.6
Scale (contamination)	–	–	–	–	2.3	9.4

Usually, ilmenite predominates in these fractions; less is a densely pink, sometimes reddish-pink garnet and two varieties of staurolite – dark brown and yellowish-brown (most rounded of these three minerals). There are some poorly rounded crystals of garnet in the form of pentagon-trioctahedrons, as well as its sharp-angle intensively cracked grains. In the class –1.0+0.5 mm, there are all these minerals, however, quite stable clastogene minerals dominate – ilmenite, garnet, staurolite, leucoxene and tourmaline. In the class –0.5+0.2 mm and less,

zircon and topaz are added to these minerals, in separate samples – rutile, kyanite, sillimanite, andalusite, wollastonite.

In general, the highest content of gravitational satellites of diamond – staurolite and garnet – is defined in pebble-gravel deposits of the fluvial facies and in the sandy deposits of floodplain facies. The highest content of such minerals, as ilmenite, leucoxene, topaz zircon, kyanite and wollastonite, we found in the sediments of the floodplain facies discovered on the southern slope of the paleovalley by the group of wells 1498.

The sum of stable clastogene minerals Σ_{SM} in heavy fractions of studied deposits is from 55 to 92 % of the mass of each dimensional class. In the rudaceous deposits of the fluvial facies, the value of Σ_{SM} increases somewhat from larger classes to smaller ones; in some samples of floodplain facies sands this increase is quite significant. The same is the situation with sandy deposits, opened by dug holes 130–133, both in the lower and upper parts of the section.

Using the methods of mathematical statistics and factor analysis, we studied the dependence of the content of heavy fractions, individual clastogene minerals and pyrite on the facies features of rudaceous deposits. For $r_{0.05} = 0.63$ ($n = 12$), significant positive correlation bonds were found for such pairs of minerals as staurolite-I–tourmaline ($r = 0.98$), garnet–topaz (0.88), garnet–staurolite-II (0.71), and weak – for a pair of kyanite–rutile (0.64). According to the distribution of features in the fields of F1–F3-factors, two mineral associations have been identified: staurolite-I–tourmaline and staurolite-II–topaz–kyanite–rutile. Other minerals are distributed separately: garnet and zircon – in different places in the field of F1 positive values, ilmenite – in the field of F2 negative values, and pyrite – in the field of its positive values. The analysis of the distribution of observations in the fields of F1–F3-factors has shown that all three factors affect the distribution of the contents of the studied variables. But F1 has a greater influence on the distribution of the content of heavy minerals in the floodplain facies deposits, discovered by groups of wells closer to the northern board of the paleovalley, and F2 and F3 – on their distribution in the sediments of the fluvial facies, discovered at the edge of the southern side of the paleovalley. Consequently, as in other investigated areas [3–5], the distribution of heavy fractions and their clastogene minerals depends on the fractional structure of the studied deposits, their facies membership and developmental area.

Typomorphic features of minerals – paragenetic satellites of diamond. According to the materials of the foreground studies of the deposits described (Kotvitsky et al., 1977), in their heavy fraction, up to 248 grains of pyrope (calculated on 20 litres of rock) in the size from 5 to 0.2 mm, as well as picroilmenite and chromopicotite were detected.

Investigation of the **pyrope** of the Mizhrichynska area, performed by U. Fenoshyna, showed that up to 90 % of the identified grains have a size of 0.25–0.50 mm and a pink and red colour; their refractive index is 1.744–1.751. Purple varieties have a value of 1.742–1.751 and 1.753–1.762, single grains – 1.767, orange varieties – 1.755–1.763.

About 10 pyrope grains in the size > 0.5 mm were found only in the deposits of the fluvial facies, discovered by wells on the western and eastern flanks of the area, and the same – in the sand sediments, exposed by dug holes near the well No. 1510. As for the deposits of floodplain facies, they do not have large grains; moreover, in general, they have fewer pyropes. Pink grains predominate, very few violet ones. The grains have irregular, slightly elongated, rarely – round shape, they are poorly rounded, angular-rounded, subrounded. Their surface is smooth, polished or matte. Sculptural pattern of chemical (imbricate, hackly) and mechanical (separate potholes) origin is revealed. Some grains are cracked, contain the inclusions of a table-like ilmenite, as well as needle and worm-like minerals. In general, we can conclude that

the studied pyropes on the way from the source to the site of accumulation have undergone long-term mechanical influence.

The results of partial X-ray spectral analysis of nine large and intensely coloured pyrope grains are shown in the Table 3. It turned out that two grains belong to the association of lherzolite paragenesis.

Table 3

The results of partial X-ray spectral analysis of pyrope

Number of the grain	Colour	*n*	Content, mass. %		
			CaO	FeO	Cr_2O_3
130/1-10	Red-orange	1.737	4.21	8.91	1.65
130/1-11			4.98	9.00	2.11
131/1-1	Violet	1.754–1.757	5.54	6.83	3.29
131/1-2	Orange	1.754–1.767	4.80	8.45	1.73
131/1-3	Red		4.56	13.13	0.21
131/1-13	Orange-red	1.754–1.769	4.90	8.40	2.66
131/1-14			4.49	9.14	1.74
156/2	Violet	1.754–1.767	5.33	6.97	2.38
156/2a	Red-violet		4.83	8.14	2.87

N o t e. Analyses have been performed at the Institute of Geology of Yakut branch of the Siberian branch of the Russian Academy of Sciences.

Chrome-spinellids in investigated deposits are distributed locally. Their weight content in heterofacies rocks is given in Table 4 (in the remaining analyzed samples they are either not detected, or there are their single grains).

Chrome-spinellids are small (0.2–0.5 mm); only single grains have a size of 0.5–1.0 mm. The grains are well rounded, black (in transparent fragments they are translucent in brown colour), their shape is round, irregular-rounded, oval, slightly flattened. The surface is smooth, shiny, and sometimes finely rough, often with potholes and pits of mechanical origin.

Table 4

Content of chrome-spinellids in the deposits of the Mizhrichynska area
(according to the data of small- and large-volume sampling)

Number of the sample	Deposits	Sampling interval, m	Content of chrome-spinellids, g/t
1527	Gravel-pebble	6.0–17.0	4.17
1532/1	Fine-middle-grained sand	2.0–8.0	2.02*
1533	Coarse-grained sandy	11.0–16.0	0.77
130/1	Middle-grained sand	3.0–3.7	4.34
130/2	Sand with flints	3.0–6.7	0.80
131/1	Fine-middle-grained sand	2.9–5.3	1.00
133/1	Sand with flints	5.3–5.9	2.59

*Including 0.4 % of the content of electromagnetic fraction in the size of 0.5–1.0 mm.

Partial X-ray spectral analysis of four grains showed that three of them correspond to pleonaste – spinel of composition $(Mg,Fe)Al_2O_4$: Al_2O_3 – 48.22–55.14; Cr_2O_3 – 0.24–1.32; TiO_2 – 0.28–0.74 mass %, and one grain – to picotite – chrome-spinel of composition $(Mg,Fe)(Al,Fe,Cr)_2O_4$: Al_2O_3 – 44.26; Cr_2O_3 – 18.18; TiO_2 – 0.04 mass %. Especially it concerns grains for which no analogues were found among described in the literature chrome-

spinels from various genetic types of ultrabasites and ultrabasic nodules in alkaline basaltoids. Instead, they are quite common (83 grains from 414 analyzed) in the deposits of the Bilokorovytska structure (Suprunenko et al., 1984). This is the chrome-picotite with Al_2O_3 content in the range of 34–53 % and Cr_2O_3 – 10–30 %.

By the method of thermoelectric power, we investigated 542 grains of **ilmenite**, of which 24 were from sandy sediments of floodplain facies, the rest – from sandy deposits discovered by dug holes No. 130 and 131. It turned out that only 14 grains have positive values of thermoelectric power, characteristic of ilmenite of non-diamond-bearing kimberlites (100–200 mV/°C), the rest of the grains according to this parameter (200–400 mV/°C) correspond to the ilmenite of the basic rocks.

Consequently, the performed researches showed that the paragenetic satellites of diamonds found in heterofacies deposits of the Mizhrichynska area, according to their typomorphic features, do not correspond to the association of diamond-bearing facies. In addition, low content of large grains of these minerals, as well as a significant degree of their roundness, prevents these minerals (especially pyrope) from being used for search purposes even as gravitational satellites of diamond.

General conclusions. The main results obtained in the course of research on the study of the material composition and the lithologic-facies features of the potentially productive deposits of the Ovrutsko-Bilokorovytskyi region (Bilokorovytska, Prypiatska, Usivska, Pivdenno-Zakhidna and Mizhrichynska areas) [3–5] are as follows.

New data on composition and lithologic-facies features of deposits, composition and fractional structure of their heavy fraction, on the presence and character of the distribution of stable clastogene minerals in them, including paragenetic diamond satellites, have been obtained. It is revealed that terrigenous minerals within the limits of each search area can be grouped into several associations, which are compared with the heavy concentrate-mineralogical type of associations, allocated by V. Afanasiev [1], to characterize unpromising search conditions. According to their typomorphic features, paragenetic satellites of diamond – chromium pyrope, chrome-spinellid and picroilmenite, belong to the association of non-diamond-bearing facies. Separate grains of chrome-spinellids and ilmenite with "picroilmenite" values of thermoelectric power are comparable with similar minerals from the basic and ultrabasic rocks of the Bilokorovytska structure framing (they were opened by wells during verification of magnetic anomalies).

The hypothesis about the alluvial-proluvial genesis of the Bilokorovytska suite conglomerates is proved, which testifies to their hopelessness in the discovery of metamorphosed placer of diamonds [2, 3]. It has been proved that the same unpromising on the discovery of diamonds are conglomerates and overlapping deposits of the Pivdenno-Zakhidna area, although large grains (2–4 mm) of gravitational satellite of diamond – staurolite – were found in them. A similar situation was observed for the studied deposits of the Mizhrichynska area, although certain lithologic-mineralogical features of heterofacies deposits (the content of heavy fractions, the presence of large grains of staurolite, etc.), determined within it, have a search value. It is shown on the insignificant actual material that in the studied heterofacies rudaceous deposits of the Prypiatska area, there are no signs of alkaline-ultrabasic magmatism, nor the accumulation of diamonds in the placer state. The material that has been collected during the verification of magnetic anomalies in the Usivska area proved to be the most representative for the discovery of indigenous diamond sources and diamond placers. However, the results of

scrupulous research did not succeed – we did not found any signs of alkaline-ultrabasic magmatism and diamond placers in the studied deposits.

Consequently, performed detailed lithologic-mineralogical studies confirmed the conclusion obtained during the geological prospecting works on the hopelessness of the studied areas to discover placers of diamond and its indigenous sources.

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ФРАКЦІЙНА СТРУКТУРА І МІНЕРАЛОГІЧНІ ОСОБЛИВОСТІ ГРУБОУЛАМКОВИХ ВІДКЛАДІВ – МОЖЛИВИХ КОЛЕКТОРІВ АЛМАЗУ В ПІВНІЧНО-ЗАХІДНІЙ ЧАСТИНІ УКРАЇНСЬКОГО ЩИТА. Ч. 3. ПІВДЕННО-ЗАХІДНА (ОВРУЦЬКА) ТА МІЖРІЧИНСЬКА ДІЛЯНКИ

Геологи Житомирської ГРЕ виокремили Південно-Західну ділянку в південно-західній частині Овруцької структури для розшуків алмазоносних розсипів. Підставою для цього стала наявність тут різновікових грубоуламкових порід – конгломератів, гравелітів і гравелітистих пісковиків верхньозбраньківської підсвіти палеопротерозою та четвертинних гальково-піщаних відкладів, які повсюдно перекривають докембрійські породи.

Досліджено звичайні та великооб'ємні проби, відібрані в численних свердловинах і шурфах. Виконаний літолого-мінералогічний аналіз грубоуламкових відкладів засвідчив, що вихід їхніх важких фракцій та вміст у них стійких теригенних мінералів дуже різний. Серед парагенетичних і гравітаційних супутників алмазу в них виявлено піроп, ставроліт і поодинокі зерна пікроільменіту. Зерна ставроліту порівняно великі (2–4 мм), проте їх небагато, і вони добре обкатані, що свідчить про тривалий шлях їхнього перенесення в досліджувані відклади, а, можливо, і неодноразове перевідкладення з давніших грубоуламкових порід. Дрібний розмір і характер поверхні вивчених зерен піропу свідчать про їхнє тривале перебування далеко від корінного джерела, а низький вміст у досліджених відкладах – про можливе надходження з давніших проміжних колекторів. Отже, розшукове значення зазначених мінералів-супутників низьке.

У межиріччі Ужу й Жерева геологи Житомирської ГРЕ виокремили Міжрічинську ділянку для виявлення алмазних розсипищ кайнозойського віку. Підставою для цього стали важливі знахідки мінералів під час виконання в середині 1970-х років робіт зі складання геологічної карти північної частини Коростенського плутону (масштаб 1:50 000): у грубозернистих середньочетвертинних відкладах, які виповнюють палеодолину р. Уж, тоді відшукали 49 зерен алмазу розміром 0,05–0,75 мм та його парагенетичні супутники – піроп, хромшпінелід, пікроільменіт, баделеїт.

Досліджувані відклади розкрито свердловинами по п'яти розшукових профілях, які закладено навхрест простягання палеодолини р. Уж. З них відібрано 12 дрібнооб'ємних проб. Відклади представлені утвореннями двох фацій – руслової (крупнозернисті алювіальні піски з різним умістом гравійно-галькового матеріалу) та заплавної (більш дрібнозернисті). Крім того, чотирма шурфами розкрито піщані відклади (середньозернисті піски з домішкою гравію у верхах розрізу і більш грубозернисті піски – у низах); з них відбирали великооб'ємні проби.

Визначено, що розподіл важкої фракції у досліджуваних відкладах і наявних у ній кластогенних мінералів залежить від фракційної структури порід, їхньої фаціальної належності та площі розвитку. Виявлені в різнофаціальних відкладах Міжрічинської ділянки парагенетичні супутники алмазу (піроп, хромшпінеліди, ільменіт) за своїми типоморфними особливостями не відповідають асоціації алмазоносної фації. До того ж, низький вміст ве-

ликих зерен цих мінералів, як і значний ступінь їхнього обкатування, не дають змоги використовувати ці мінерали з розшуковою метою навіть як гравітаційні супутники алмазу.

Виконані детальні літолого-мінералогічні дослідження підтвердили отриманий під час геолого-розшукових робіт висновок про безперспективність усіх вивчених ділянок на виявлення в них розсипищ алмазу та його корінних джерел.

Ключові слова: алмаз, типоморфізм мінералів, парагенетичні та гравітаційні мінерали-супутники, розсипище, теригенні породи, північно-західна частина Українського щита.