# MINERALOGICAL REPRESENTAION OF KIMBERLITE PIPES OF ZIMNEBEREZHNY AREA IN COVERING MIDDLE PALEOZOIC, QUATERNARY GLACIAL DEPOSITS AND RECENT ALLUVIUM

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Zimneberezhny diamondiderous area located at the north of East-European platform, where the two large regional structures the Baltic shield and Russian plate were combined. in the Late Devonian the area was subjected to Early Hercynian tectono-magmatic activization accompanied by alkalic-ultramafic magmatism.

Diamondiferous kimberlite pipes of the area were buried under Paleozoic terrigenous-carbonate and Quaternary glacial deposits. The basement of the Paleozoic sequence comprises Carboniferous motley colored and red bed sand and sandstone of 50-80 m thickness. There are the two members within the sand and sandstone. The lower comprises continental coarse grained sandstone, siltstone with gritstone partings (alluvial, lacustrine facies). The upper – sands, aleurosandstones of marine shallow water (basin facies). During Middle Carboniferous Central Zimneberezhny area was a part of a single sedimentation basin filled with deposits of different origin as a result of alternated sedimentation and denudation epochs (Figure 1).

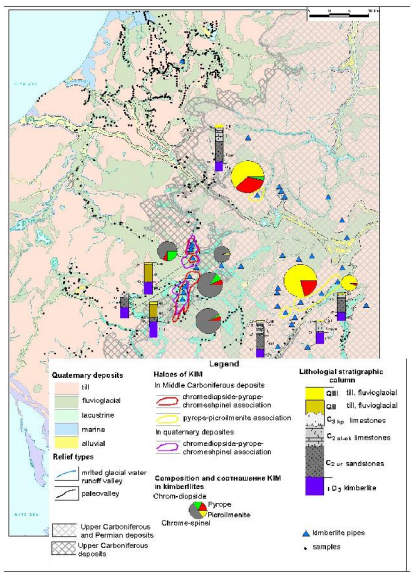


**Figure 1**. Dispertion haloes of kimberlite indicator minerals in covering feposites

Quaternary deposits are poligenous complex of glacial, fluvioglacial and interglacial lacustrine and marine strata. They are areal, subflat-lying cover overlaping Vendian and Early Paleozoic sediments.

Not unidirectional movements of glaciers resulted in total areal contamination of deposits by indicator minerals of alkalic-ultramafic (and kimberlite) magmatism (olivine, chrome spinelides, chrome-diopside, pyrope, picroilmenite and magnesian ilmenite). Typomorphic features of indicator minerals of kimberlite (usually named as diamond indicator minerals, DIM) allow with certainty to diagnose them in covering deposits and localize potential diamondiferous areas. Exploration targets of Zimnebereszny kimberlite-bearing area have some specific features: low contents of indicator minerals in kimberlites, primarily in crater facial deposits; high thickness of Paleozoic and Quaternary cover deposits (20 to 180 meters); the presence of poligenic deposits from differ age glaciers supplied from distal feeder sources and impoverished kimberlite material; poor dynamic activity of recent water flows. All these factors restrict formation of DIM contrast dispersion haloes.

Diamandiferous pipes of Zimneberezhny area contain two mantle DIM associations: Cr-diopside-pyrope-Cr-spinel and pyrope-picroilmenite (Figure. 2)

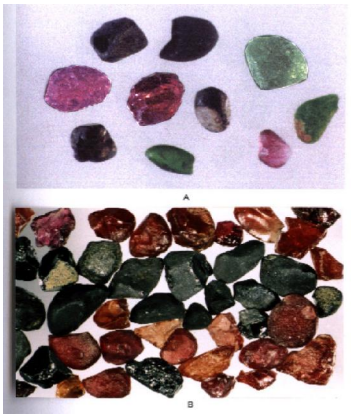

**Figure 2.** Association of DIM: Pyrope-Cr-diopside-Cr-spinel (a); Pyrope-picro-ilmenite (b)

*Cr-spinelides* comprise predominantly combination and myrioedric crystals with high Mg content (8-14

mas.%), low Ti (up to 4 mas.%) and wide isomorphism in a $Cr^{3+}$ – $Al^{3+}$ row (Sablukov et all, 2000). *Pyropes* in association with Cr-spinelide comprise violet and lilac fritten rounded-oval grains and their clasts. Pyropes of ultramafic lherzolite paragenesis are dominated, pyropes of diamond association is no more 1-3%. Pyropes in association with picroilmenite characterized by elevated titan content (up to 6 mas.%) and widespread occurrence of orange-red grains. *Chrome-diopside* in association with Cr-spinelides characterized by elevated chrome (up to 2,4 mas.%) and reduced iron (up to 1,7 mas.%) contents and resulting bright emerald-green color. *Picroilmenite* consist of minute ovalized grains with cavernous pitted surfaces consist of kimberlite cement and nodules from of deep inclusions with MgO 12-17,5 mas.% and $Cr_2O_3$ 1-5,5 mas.%. Mantle minerals characterized by magma-togene and hydrothermal corrosion-related surface type.

Typomorphic properties of DIMs (morphology and chemical composition) are unlike those of other alkaline-ultramafic magmatites. This method is based on the results of research in morphology, features of microsurface and chemical composition of DIM grains from kimberlite pipes and covering deposits of various genetic types. The research used a scanning electron microscopy (SEM) and X-ray microspectral analyzer (Afanasyev, 2008). These allow apply a mineralogical method for 1) identification of pyrope, chrome-spinelides, picroilmenite and chrome-diopside of kimberlite origin; 2) establishing of DIM patterns in kimberlite burying deposits and delineation of mineralogic dispersion haloes of proximal transportation) and localization of potentially diamandiferous areas; 3) assessment of potentially diamond content of forecastting pipes.

DIM dispersion haloes of proximal transportation are characterized by polymineral composition and contrast distribution of DIM quantities. DIM grains are characterized by a broad granulometric spectrum and minor mechanical wear, surfaces with hydrothermal corrosion-related or hypergene dissolution. DIM grains with the above features are traced in a cross-section over kimberlite pipes in carboniferous deposits (for up to 10 m) and glacial deposits (up to 50 m) (Figure 3).

Within Zimneberezhny area, various types of relations between covering deposits and kimberlite pipes were defined. These relations determine the efficiency of using of the mineralogical method for diamond deposit prospecting. Some kimberlite pipes are overlain by Carbonoferous (terrigenous and carbonate, or terrigenous only) and glacial Quaternary deposits, others – by glacial Quaternary deposits only. When there are carbonate rocks in covering deposits, DIM cannot penetrate into Quaternary strata and recent alluvium. The mineralogical prospecting method for Zimneberezhny area is most effective when Carboniferous terrigenous deposits are as thick as 10 m, glacial Quaternary deposits – up to 50 m thick (Golubev et all, 1998).

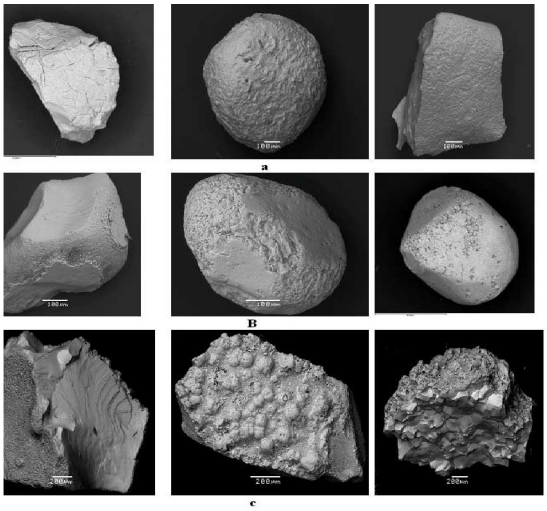

**Figure 3.** Microsurfaces of proximal transportation DIM: pyrope (a); Cr-spi-nelide (b); picroilmenite (c)

In this case, DIM haloes of proximal transport are traced throughout their strata and displayed in composition of recent alluvium (Scherbakova, 2005).

The mineralogical method for diamond deposit prospecting within areas covered by thick, particularly glacial deposits, differing in age and facial composition can be effective when specific prospecting are considered.

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