The characteristics of the plume magmatic activity in middle part The Russian platform (Ust diamondiferous district)

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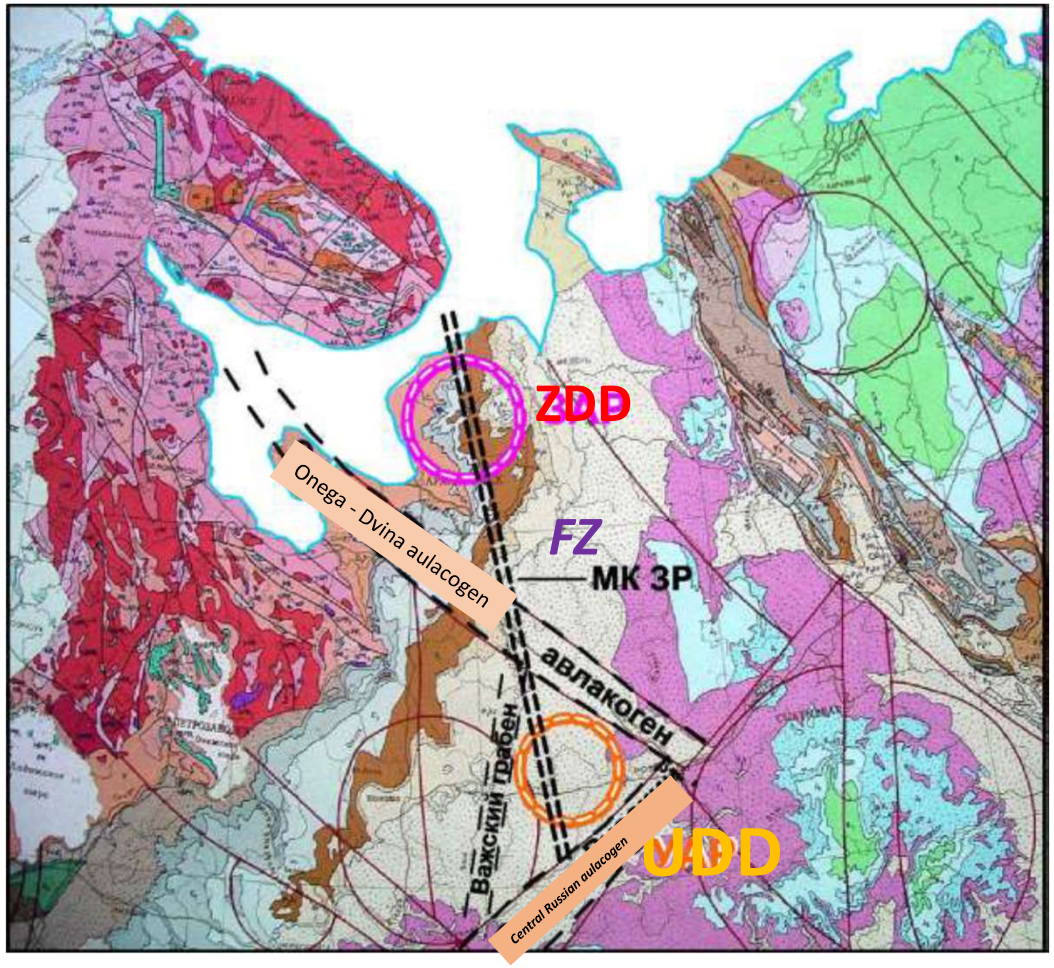
Predictive and prospecting research is the example of «inverse geological task» according to preliminary spatial localization of specific region of a plume activity, prediction and estimation of ore potential of one region in a middle part of the Russian platform. The Ustyansky potential region is characterized by coinciding of all the advantageous regional and local searching suppositions in space (morphostructural, tectonic, geologic-stratigpaphical, geophysical, morphometrical, mineralogical) and search features. It can be caused by implementing of mantle diapir (plume) and can be accompanied by diamong-bearing kimberlitemagmatism. Heavy diamond concentrate contents (most of all of pirop (1206 grains), not so manyof pycroilmenite, chromespinelide, olivine, chromedyopside) in alluvion of the region is 3-5 times higher than in the ZimnyBereg diamond-bearing region. Furthermore, contents of pirop of diamond paragenesis of the G10 group is about 10%. In stream sediment samples of minimum amounts, taken from alluvial and quaternary deposits, nine diamond crystals had been founded. Six of them (octahedrons and dodecahedrons with sizes up to 3,8 mm and weight up to 52 mg) had been founded in «Severnoe» kimberlite potential field. According to a complex of morphological and physical features all diamonds of the Ustyansky region occupy a completely outlier position and have almost no analogues among the diamonds of large known deposits and mineral occurrences of Arkhangelsk, Finland, Urals and Timan, This might indicate to crystals flowing from a new, still unknown native source (or sources) of kimberlite. This new native source of kimberlite may be heightened diamond potential and may contain high-quality and big-size diamonds. Detection of this new native source will be a final confirmation of predictable selection of the Ustyansky region as a region of a plume activity. Features of possible similarity of the Arkhangelsk diamond-bearing province to the Yakutsk diamondbearing province in relation to patterns of kimberlite position and morphological features of diamond crystals, confirm great prospects of diamond-bearance of central regions of the European part of Russia at all, and particularly of the Ustyansky region with «Severnoye» kimberlite potential field.

General position of the Ustyansk diamond-bearing area in structures North of the Russian platform.

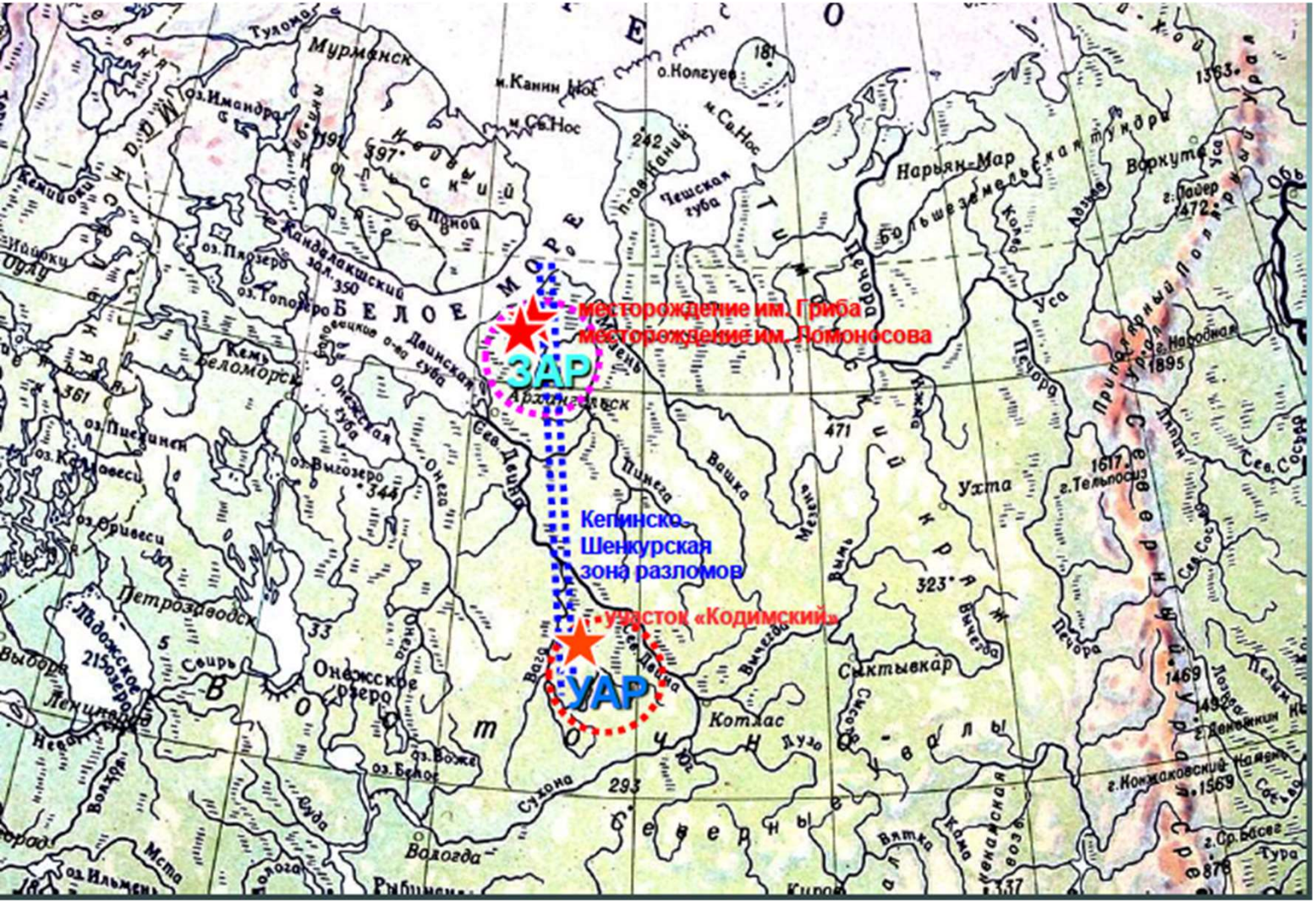


The letters on the diagram indicate:
ZDD – Zimneberezhny diamondiferous district
Ustie diamondiferous district;

FZ– Zone of deep faults.

- Large and unique jewelry diamonds, mined for only 1.5 years
- Fancy colored jewelry diamondsthe field. Lomonosov deposit

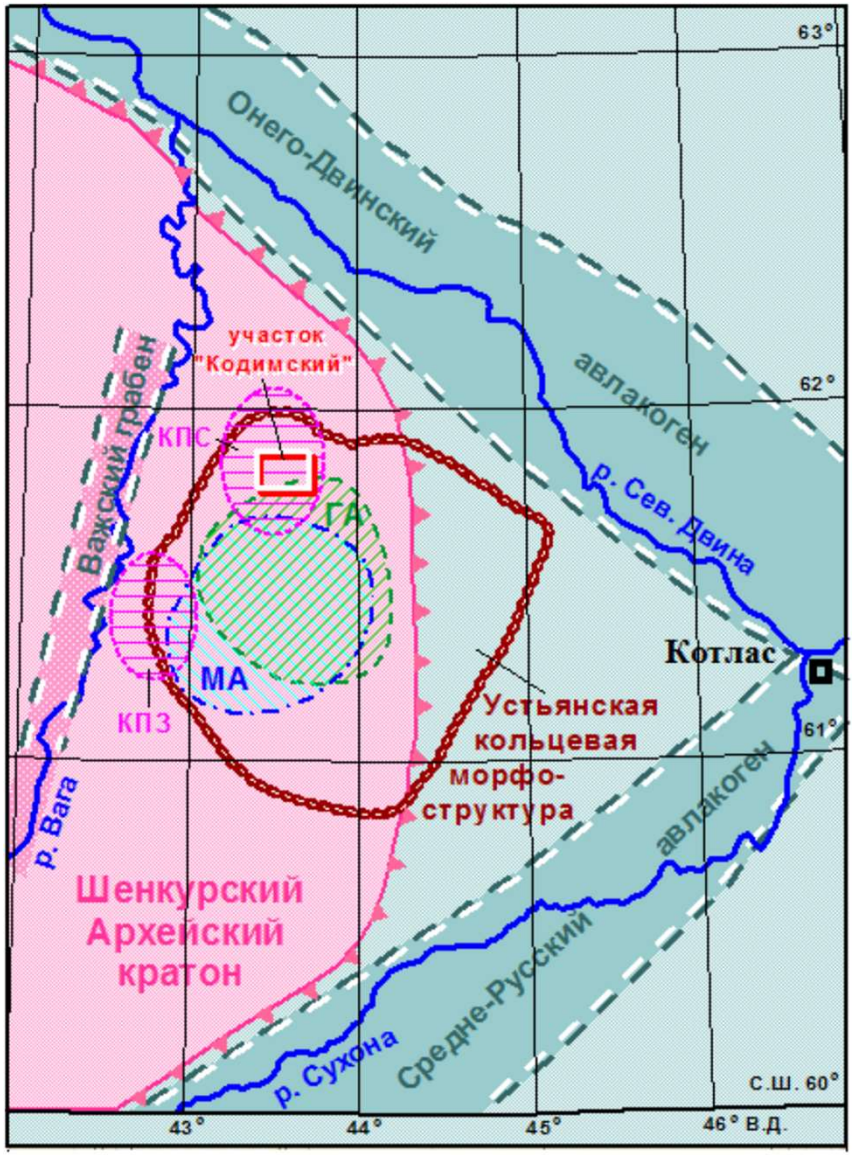
"Kodimsky" (DIAMOND USTYANSKY DISTRICT, ARKHANGELSK region)



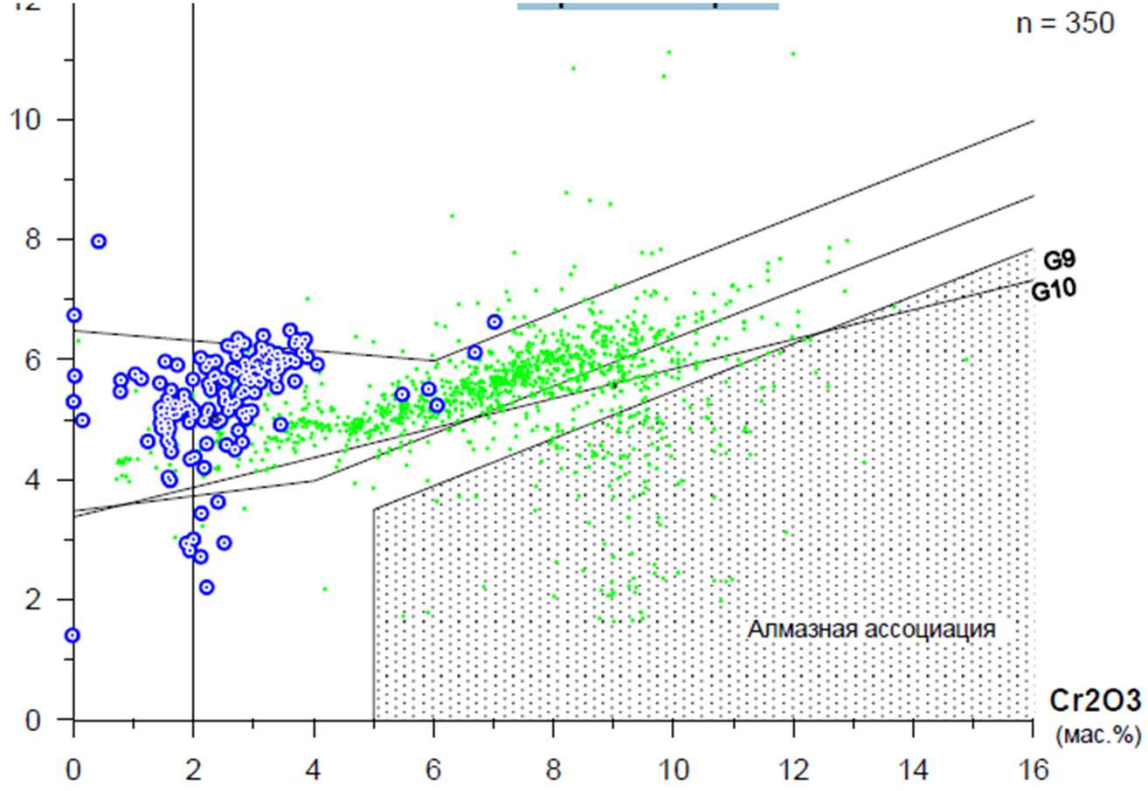
Kodimsky Square

inside the Ustyansk diamond-bearing district (UAR)

This is almost a complete analog of the Lomonosov and Grib diamond deposits in
the Zimneberezhny industrial and diamond-bearing district (ZAR),
It is confined to the same zone of deep ore-controlling faults,but closer to the center of the platform, which increases the potential of its diamond content



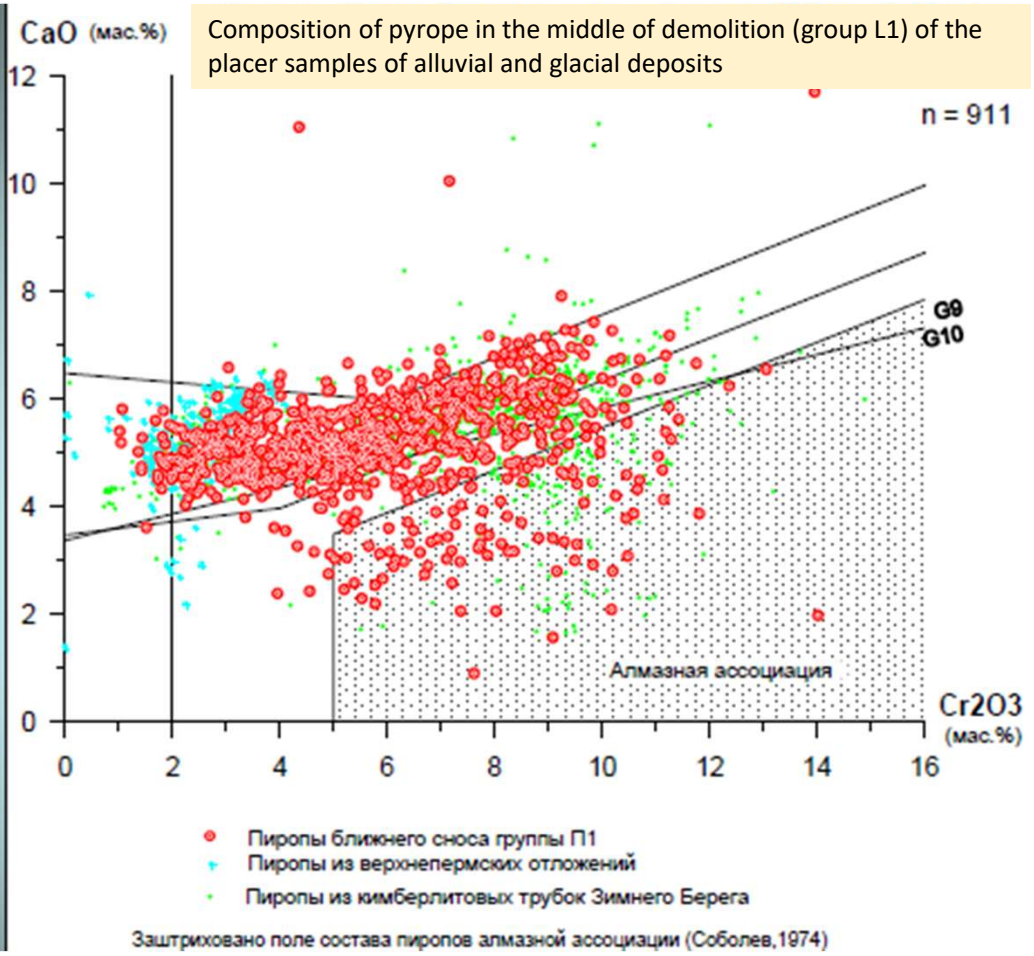
Ust diamondiferous districtThe combination of all favorable search conditions in space (morphostructural, tectonic, geological - stratigraphic, geophysical, mineralogical) may be mofmed due to the intrusion of the mantle diapir and may be accompanied by kimberlite, including diamond-bearing kimberlite magmatism within the Western and North-Western parts of the Ustyansk morphostructureIt is located within the Shenkursky Archean craton with a shallow depth of the crystal basementand the MOHO surface.
It is located within the positive Ustyansk ring morphostructure, regional positive magnetic (MA) and gravitational (GA) anomalies; in the zone of influence of two avlacogens: Onego-Dvinskyand Central Russian; in the area of neotectonic uplifts ("Ustyansk plateau") with a block structure of the territory, on the continuation of the Kepino-Shenkurskaya zone of deep mantle faults



- Composition of pyrope from Nizhneustinskiy Suite of the Upper Permian
- Archangelsck

Judging by the set and composition of KIMs (low-chromium and low-titanium pyrope+ + chromspinelide), kimberlites of late Permian age of the "Western" field may be similar in composition to the group 2 ilmenite kimberlites of South Africa and some kimberlite rocks of the Winter Coast alumina series (Zolotitsky, Verkhotinsky Bush),however, they are unlikely to be of industrial significance, and therefore of search interest

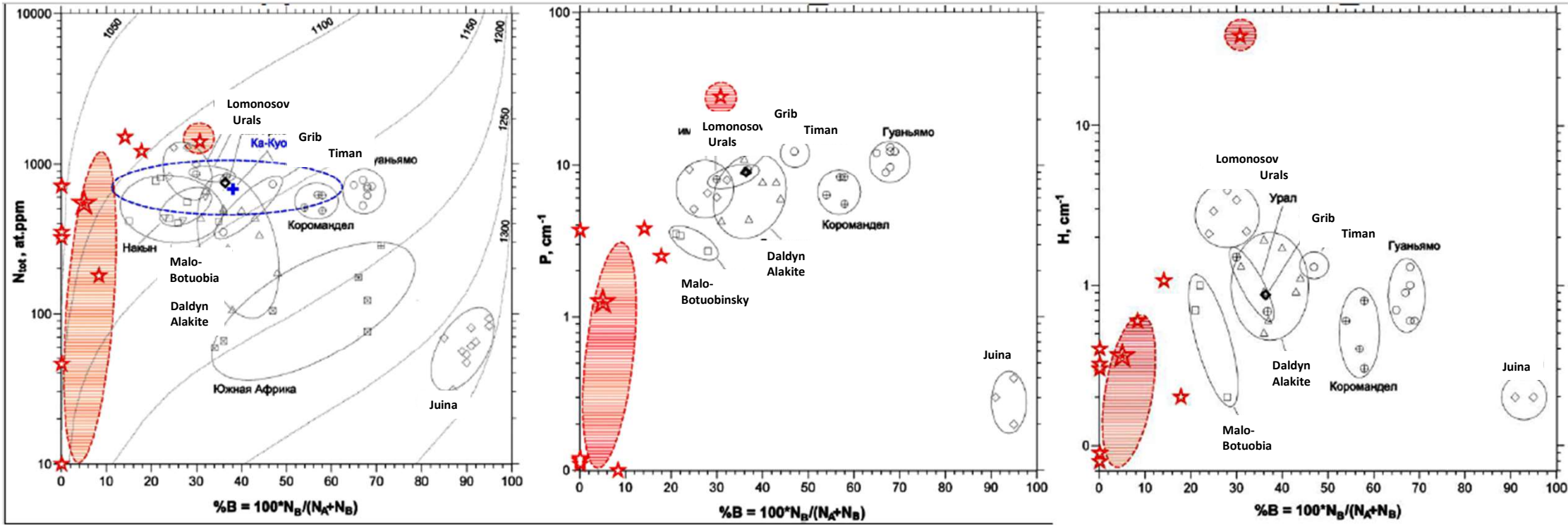
Judging by the set and composition of KIM minerals(high-chromium pyrope, orange Titanic pyrope, high-chromium picroilmenite), kimberlites of Mesozoic age of the Severnoye field may be similar in composition to ilmenite kimberlites of group 1 of South Africa and kimberlitesiron-titanium series of the Zimy Bereg (Winter Bank) (Grib pipe), as well as kimberlites of Yakutia (first of all-the Mir pipe). High-diamond gradeComposition of pyrope in the middle of demolition (group L1) of the placersamples of alluvial and glacial deposits kimberlites may be present in the Severnoye field



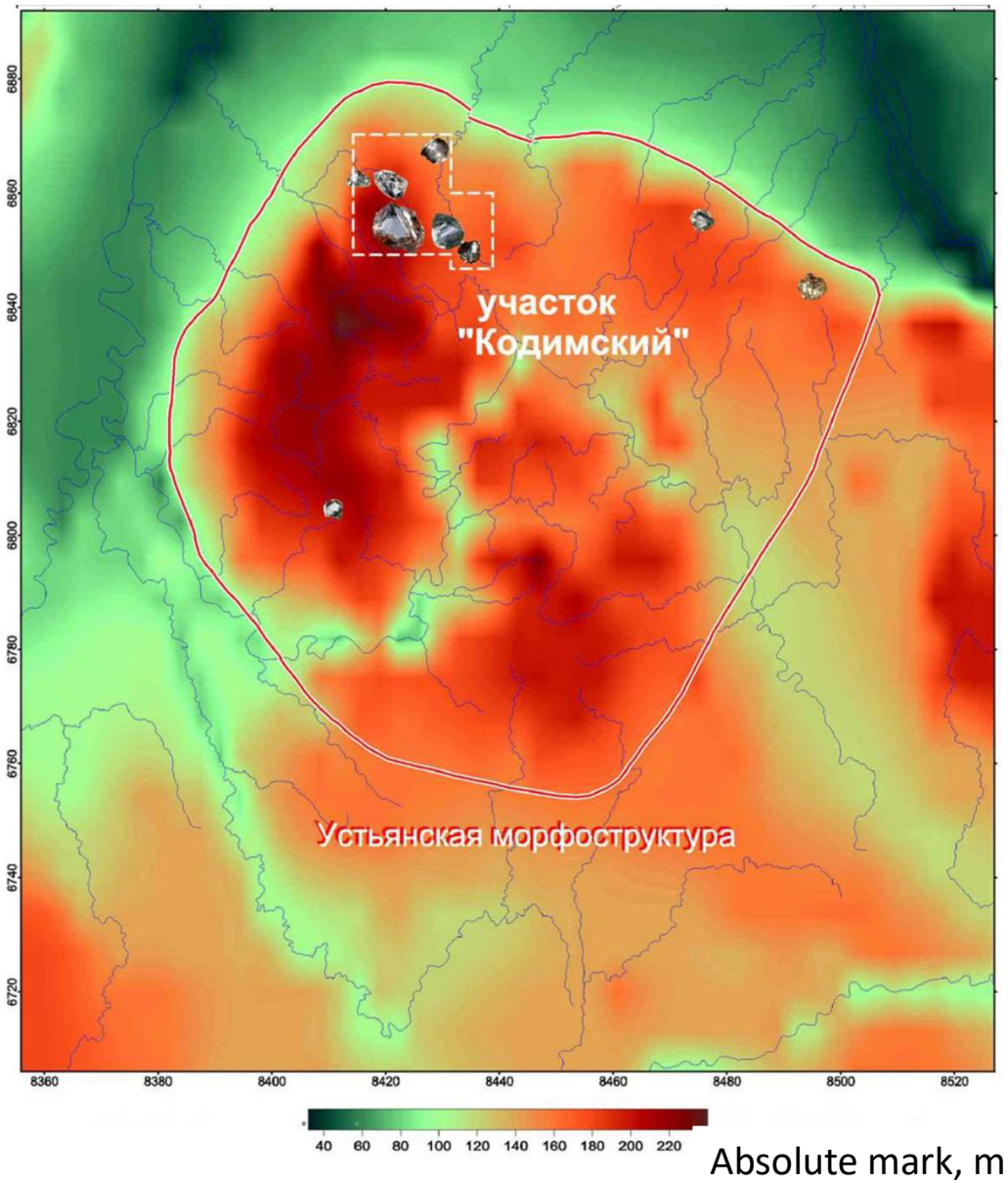
Composition of pyrope in the middle of demolition (group L1) of the placer samples of alluvial and glacial deposits

DIAMONDS of USTYANSKY DISTRICT

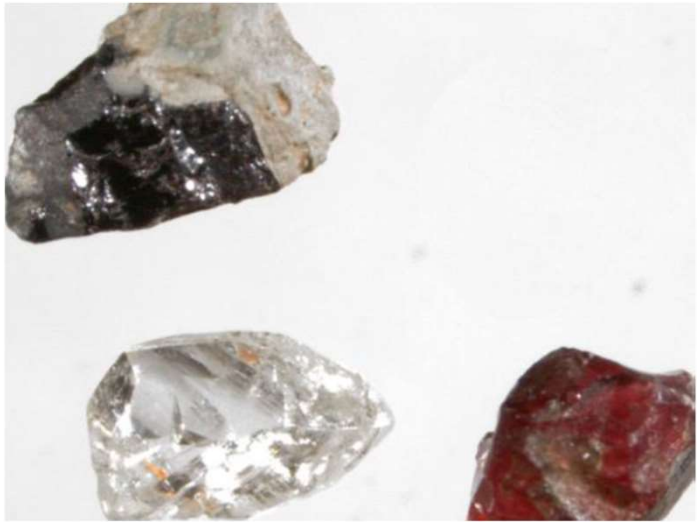
No one other region of East European craton Russia (including the areas of the Ural, Timan, Arkhangelsk and Finland diamond deposits) have such finds of so large dimonds in alluvial deposits. Such large diamond crystals are found in industrial diamond-bearing regions of Yakutia!((Daldyn-Alakit, Malo-Botuobin, Sredne-Markhin Anabar).



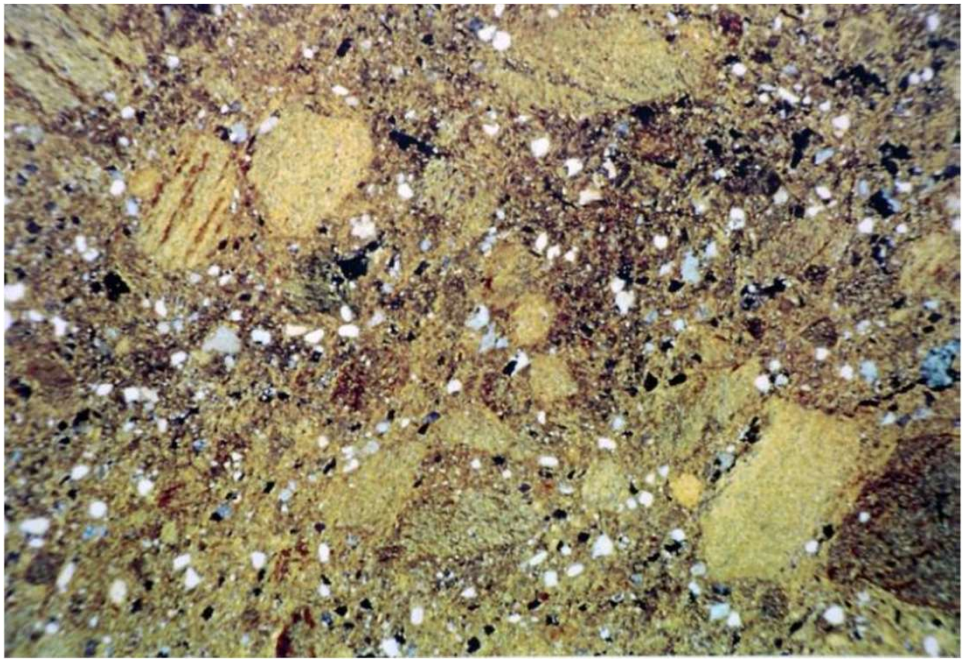
The range of morphological characters and correlation of the main structural impurities of nitrogen, hydrogen and platelets studied diamonds. Diamond from Ustyansky district is a entirely separate group and practically have no analogues among known diamond deposits of Arkhangelsk, the Urals and Timan, but most resemble the diamonds, the Malo-Botuobinsky district of Yakutia (Tr.World). This may indicate the arrival of the studied crystals from a new one, but not yeta well-known kimberlite root source. This potential new a native kimberlite source may have an increased diamond content, high quality and large size of diamonds.



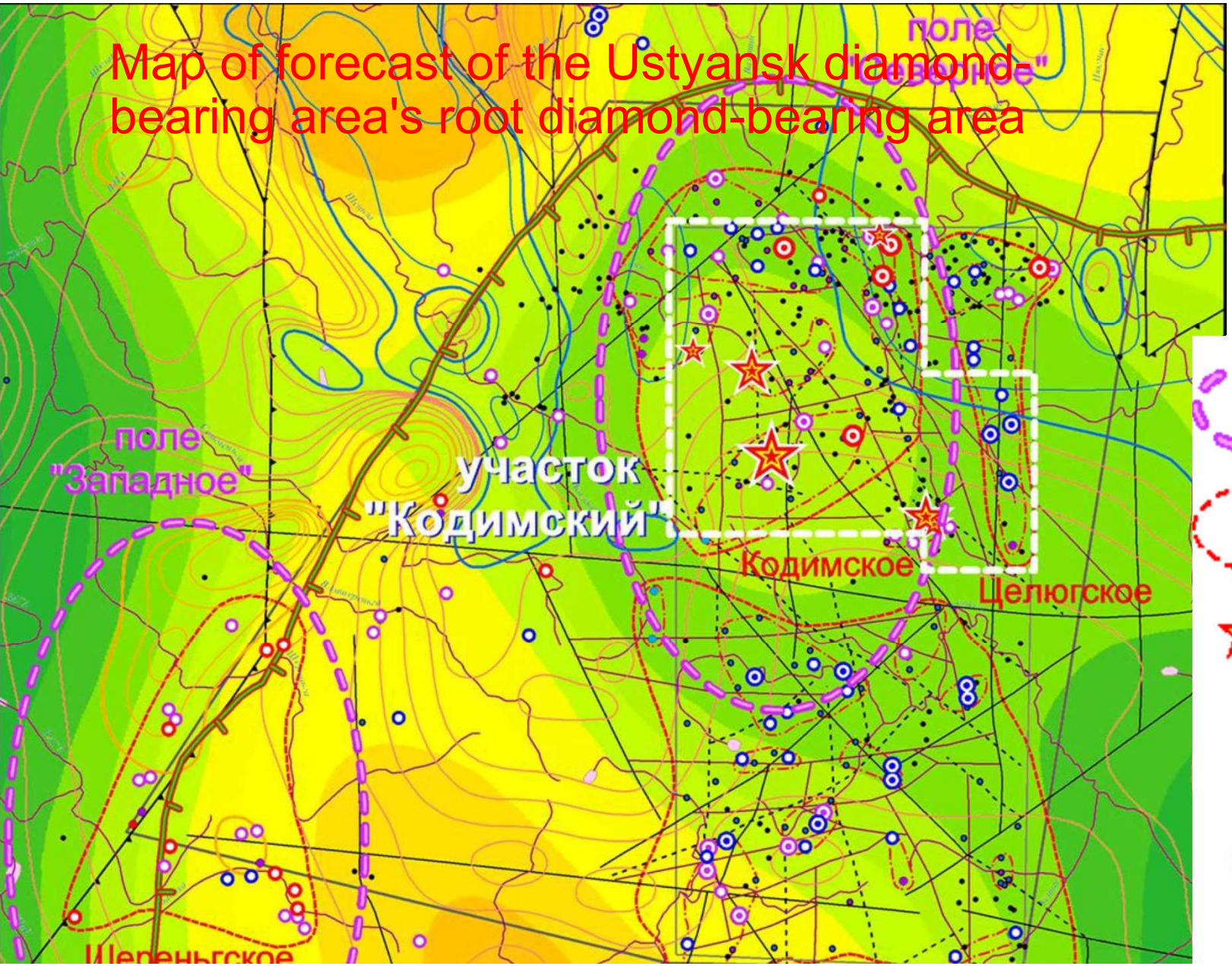
The location of the finds diamond. Most of the diamonds(6 of the 9 crystals, including 3 of the largest, including 2 octahedra) were found in alluvial deposits in the North-West of the Ustyansky district, within the area"Kodimsky".At the same time, 5 diamond crystals were found in the form of a single chain of the North - Western strike on an area of less than 100 km2 . These are extremely rare phenomena in the glacial region:- repeatability of finds and- reproducibility of results



Concentrate of sample K-27 (40 l), size class -2+1 mm:
Mineral Association: Diamond + pyrope ++ picroilmenite with a modified rock face



Dike (vein) of heterogeneous breccia of problematic origin, containing 520 ppm Cr !!! This high chromium content is typical only for ultrabasic rocks,including-for kimberlites

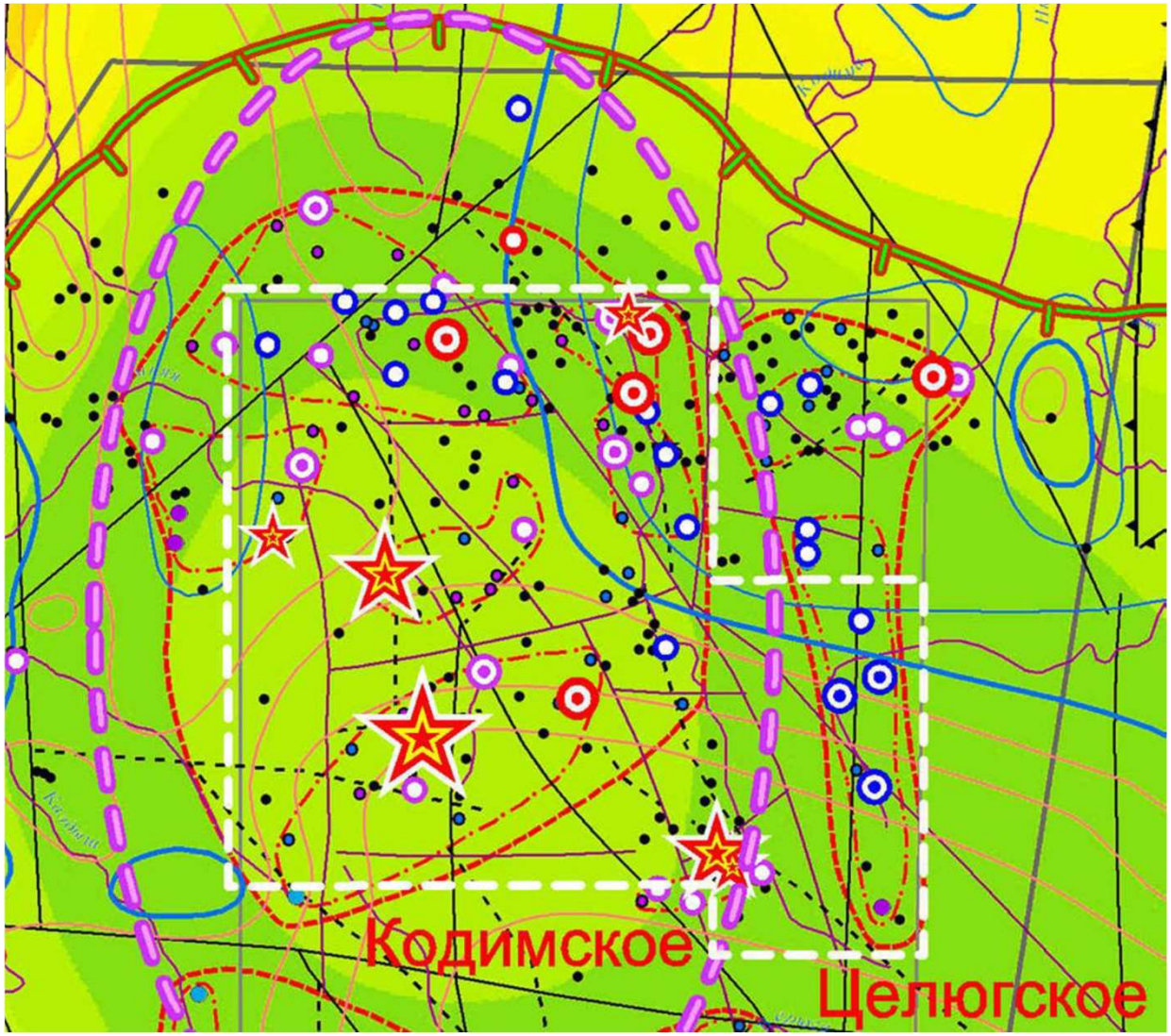


Diamonds
PS-1

PS-2 prospective anomalies

breccia vein
520g / t Cr

Anomalies Background - gravitational field
Isolines-magnetic field
Predicted kimberlite



Map of the forecast of root diamond

"Kodimsky" Square

CONCLUSIONS

The conducted forecast and search operations are an example"solutions to the inverse geological problem" by preliminary spatial localization of a specific area of plume activity, forecasting and evaluating the prospects of ore-bearing capacity of one of these deep-seated magmatism, its sources and plume area in the middle of the Russian platform. Ustyansky perspective district is characterized by a combination ofspace of all favorable regional and local search engine sprerequisites (morphostructural, tectonic, geological-stratigraphic, geophysical, morphometric, mineralogical) and search signs, which may be due to the implementation o fmantle diapir and may be accompanied by diamond-bearing kimberlite magmatism. The content of KIM minerals of diamond in the middle of demolition pyrope (1206 grains), less picroilmenite, chrome spinel, olivine,diopside in alluvium area is 3-5 times higher than in diamond district Winter Coast, while the share of pyropes of diamond paragenesis group G10- about 10%. 9 crystals were found in alluvial and Quaternary depositsdiamond, of which 6 crystals (large octahedrons and dodecahedroids in size up to 3.8 mm and weighing up to 52 mg) were found in the forecast kimberlite field "Northern".According to the complex of morphological features and physical properties allthe diamonds of the Ustyansky district occupy a completely separate positionand have virtually no analogues among the known diamonds deposits and ccurrences in Arkhangelsk, Finland, the Urals, and Timan. It can indicate the arrival of the studied crystals from the new, not yet known kimberlite root source (or sources). This is a potential new kimberlite source may have high diamond content, high quality and size of diamonds. Finding this new root source will be the end confirmation of the forecast allocation of Ustyansky district as a district of plume activity. There are signs of similarity with the Arkhangelsk diamond-bearing province and with the Yakut diamond-bearing province. In Central regions of European Russia as a Ustyanska promising area with the forecast field "North“is most promising. . At the same time, the likely overlap of diamond-bearing pipesterrigenous crater deposits and thick glacial precipitation makes it very difficult to detect physical traces of the presence of kimberlites in modern surface deposits available for study and testing

The estimated resources of P3 diamonds are 50 million carat. The estimated resources of placer diamonds of the P2 category are 1.7 million carats(The assessment was made by LLC Arkhangelsk Diamonds»