KSE | Kyiv School of Economics

DEPOSITS OF CRITICAL RAW MATERIALS FOR EXPLORATION AND EXTRACTION

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Balka Shyroka Gold ore block.

Mineral: Gold ore.

Type and period of subsoil use:
20-years licenses for exploration, pilot development and production.

Plot area: 206.6 ha.

Location: Nikopol district of Dnipropetrovsk region, 2 km east of Tavriya village and 18 km north of Nikopol city. The nearest aspahlroad Nikopol-Chkalove-Nikolaevka (T 0432) passes at a distance of 1 km west of the prospective area.

Reserves and Resources:		
	Reserves	Resources (P1 + P2), tons
Gold with a minimum industrial content in the blocks 3.9 g/t	-	27.6 (12.5 + 15.1)

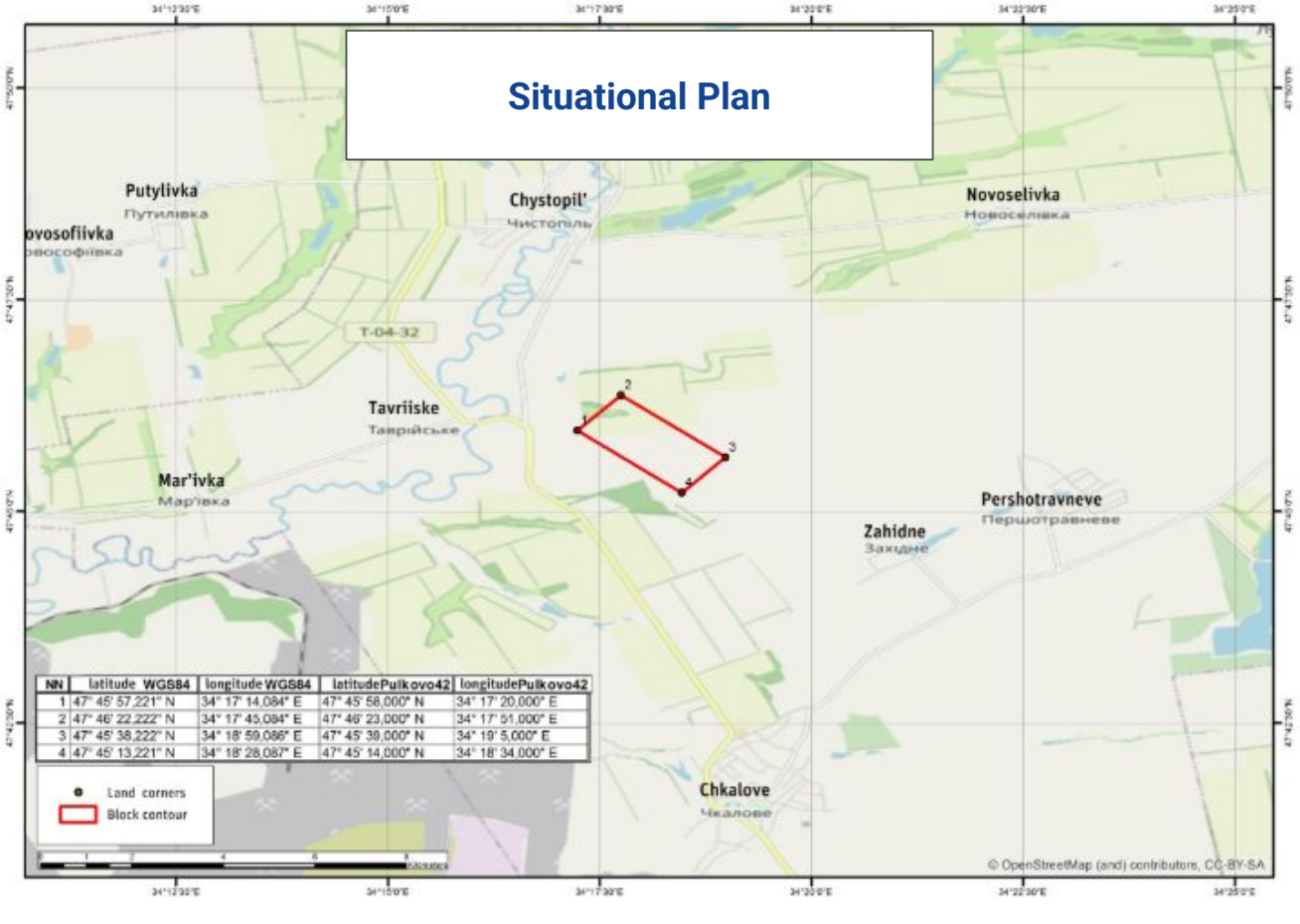
The average content:
The weighted average content of gold in blocks is 7.1 g/t.

Source: Ukrainian Geological Survey

GOLD.
BALKA SHYROKA GOLD ORE BLOCK

Overview map

Situational Plan



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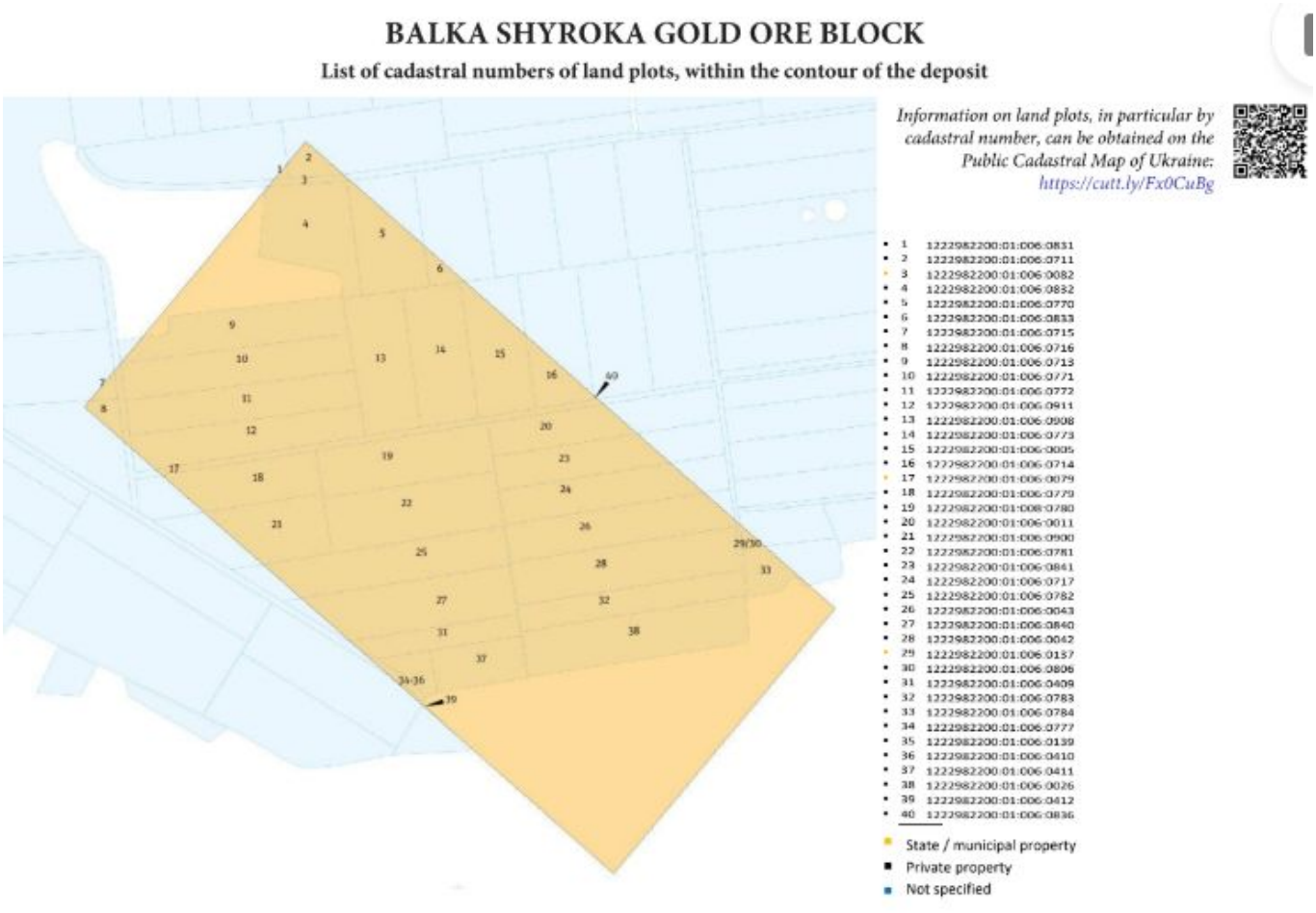
2	47° 46' 22,222" N	34° 17' 45,084" E	47° 46' 23,000" N	34° 17' 51,000" E
3	47° 45' 38,222" N	34° 18' 59,086" E	47° 45' 39,000" N	34° 19' 5,000" E
4	47° 45' 13,221" N	34° 18' 28,087" E	47° 45' 14,000" N	34° 18' 34,000" E

Source: Ukrainian Geological Survey



Geological information

Geological summary. According to the mineral associations within Banka Shyroka prospective area, five mineral types of ores are distinguished: gold-quartz, gold-sulfide-quartz, gold-pyrite, gold-quartz-pyrite-arsenopyrite, gold-silver-polymetallic. Gold-quartz
type of ore is characterized by free gold and sulfide content that is not exceeding 5%. Within the prospective area 76% of ores belong to this type. The content of gold in ores of this type varies from 0.5-6.9 g / t to 1023 g / t, silver - from 0.5 to 19 g / t. Gold-sulfide-quartz type is characterized by a sulfide content of 5-25% and the presence of both free and bound gold. This type of ore includes about 19% of ores of the prospective area. The gold content in gold-sulphide-quartz ores is 0.5–32 g/t, silver - 0.5–13 g/t. 2.5% of the ore of the prospective area belongs to the gold-pyrite type. The content of sulfides in this type of ore is more than 25%. Native gold is quite common in the form of impregnation in pyrite and very rarely in quartz. Gold-quartz-pyrite-arsenopyrite type is uncommon and most often it is combined with gold-sulfide-quartz and gold-silver-polymetallic types of ores. The gold content of this mineral type of ore is insignificant amount. Amount of gold-silver-polymetallic type of ore is 2.5%. The content of sulfides in ores of this type ranges from 8-10% to 50-60%. The main mineral-concentrator of silver is freibergite. This type is a complex ore that

Source: Ukrainian Geological Survey

consists of gold (up to 20 g/t), silver (up to 434 g / t), lead (up to 5%), zinc (up to 1%), copper (up to 0.1%) and cadmium (up to 300 g/t). Hydrogeological conditions of the prospective area are favorable. The most water-enriched horizon associated with the upper fractured part of crystalline rocks and gravelly residuum. The maximum water inflow when drilling a mine shaft in the most fractured interval of crystalline rocks is 17 m3/h. The projected inflow of water into the underground mine during mining will be 366.6 m3 / h. Mining and geological conditions of the prospective area determine the underground method of ore mining.

Available geological information

Available geological information. The prospective area was found in 1989 during prospection within the Chortomlyk greenstone structure. In 1990–1991, greenfield exploration was performed. In 1992–2000, mining and exploration was conducted, which was not completed due to lack of funding. A total of 285 inclined appraisal and exploration wells with a total volume of 92480 m were drilled. The most explored part of the prospective area is the south-western one where the network of wells has been brought to 50x50 m and the mine shaft of industrial cross-section has been passed to a depth of 168.4 m. Currently, the mine shaft is in a state of wet preservation.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Kvitkivska block with Kvitka gold ores prospective field (East & Central ore occurrences).

Mineral: Gold ore.

Type and period of subsoil use:
20-years licenses for exploration, pilot development and production.

Plot area: 670.73 ha.

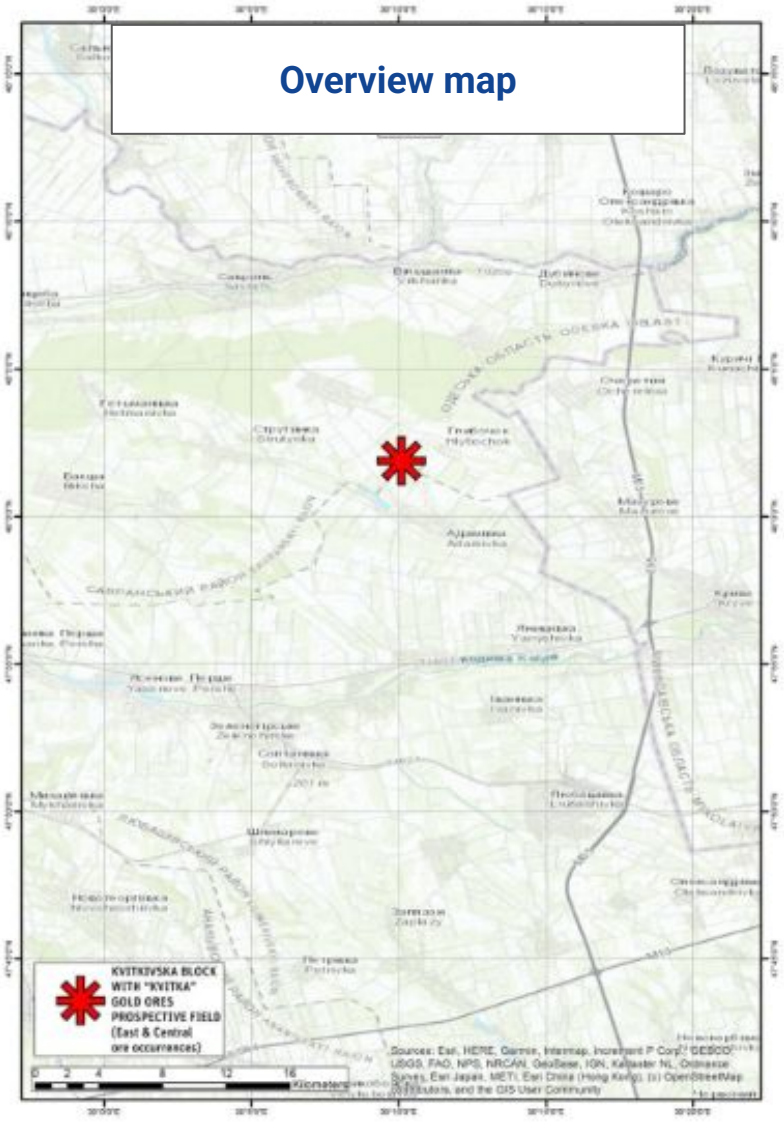
Location: Podilskyi district of Odesa region, between the villages of Krychunove, Polyanetske and Hlybochok. A hard-surface road passes through the northern part of the block. The distance from the block to the Kyiv - Odessa (M 05) highway is 15 km. Located approximately 20 km northwest of the site, Zavallivsky Graphite Plant has access tracks from the Khashchuvate station of the Odesa Railway.

Reserves and Resources:		
	Reserves	Resources (P2), kg
The quantity of gold contingent resources of category P2	-	40,992

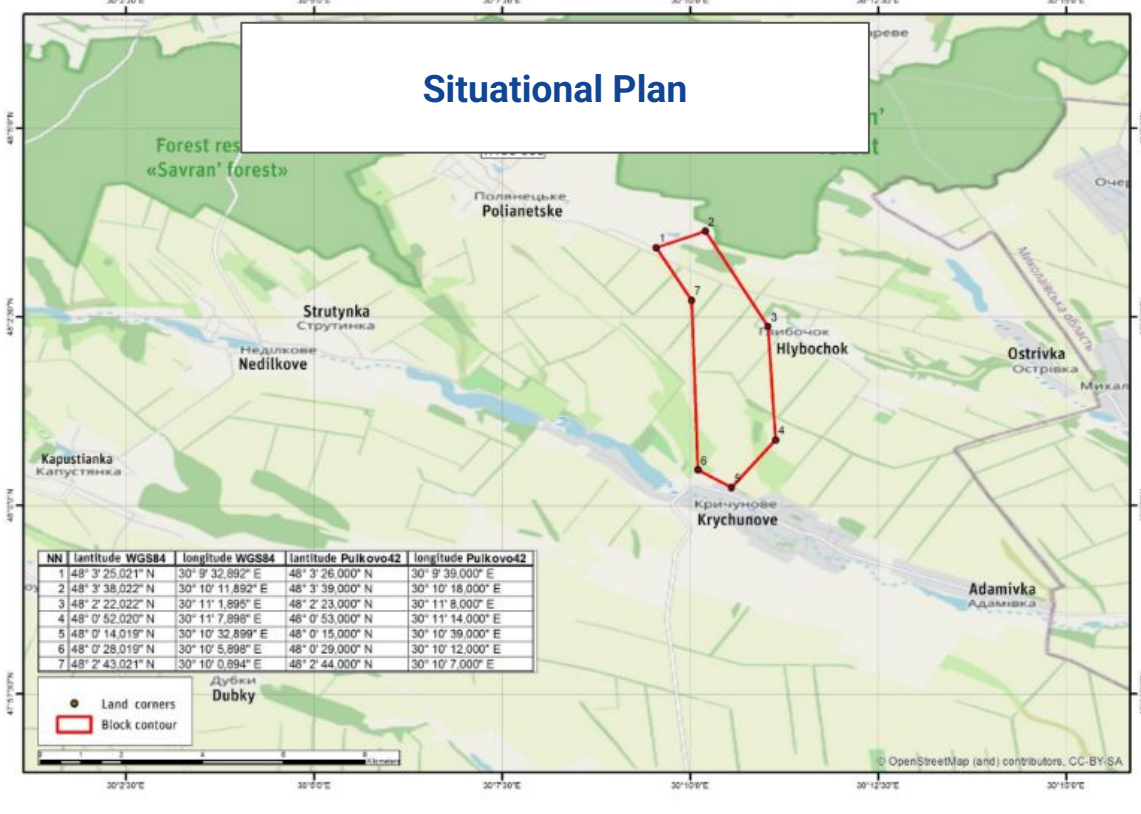
Considering approximate spatial location within the Savranske ore field, the Kvitkivska block with Kvitka gold ores prospective field and Mayska gold ore block can be considered as a single investment project.

Source: Ukrainian Geological Survey

Overview map



Situational Plan



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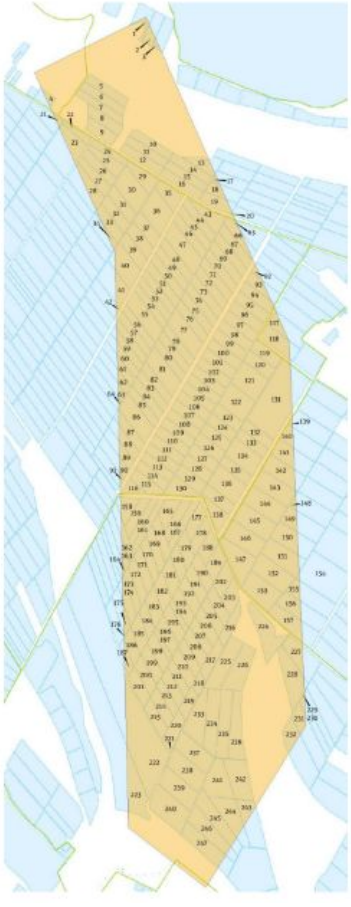
1	48° 3' 25,021" N	30° 9' 32,892" E	48° 3' 26,000" N	30° 9' 39,000" E
2	48° 3' 38,022" N	30° 10' 11,892" E	48° 3' 39,000" N	30° 10' 18,000" E
3	48° 2' 22,022" N	30° 11' 1,895" E	48° 2' 23,000" N	30° 11' 8,000" E
4	48° 0' 52,020" N	30° 11' 7,898" E	48° 0' 53,000" N	30° 11' 14,000" E
5	48° 0' 14,019" N	30° 10' 32,899" E	48° 0' 15,000" N	30° 10' 39,000" E
6	48° 0' 28,019" N	30° 10' 5,898" E	48° 0' 29,000" N	30° 10' 12,000" E
7	48° 2' 43,021" N	30° 10' 0,894" E	48° 2' 44,000" N	30° 10' 7,000" E

Source: Ukrainian Geological Survey

List of cadastral numbers of land plots, within the contour of the deposit



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State / municipal property
Private property
Not specified

Information on land plots, in particular by cadastral number, can be obtained on the Public Cadastral Map of Ukraine: https://cutt.ly/Fx0CuBg

Geological information

Geological summary. Within the block, a mineralized zone has been identified and traced for approximately 6 km in the submeridional direction. The Central ore-bearing zone tends to the submeridional Central fault and is traced from north to south for more than 5 km. It includes two ore-bearing zones, namely Central and Eastern ones. The zone thickness is 300-500 m, decreasing to 75-100 m in the north. The zone dip is eastern at angles of 65-85°. It is represented by a layering of biotite and amphibole-biotite gneisses, largely migmatized ones to migmatites, with low-power bodies of leucocratic and pegmatoid granites and bodies of biotite-quartz-oligoclase metasomatites with a thickness of 2-6 m. The eastern ore-bearing zone tends to the submeridional Eastern fault and is traced from north to south for more than 5 km. The zone thickness is 450-500 m, decreasing to 100-150 m in the north. The zone dip is eastern at angles of 60 - 85 °. It is represented by a layering of largely migmatized gneisses of amphibole-biotite, biotite, amphibolites, biotite migmatites with low-power (up to 3-5 m) layers of leucocratic and pegmatoid granites and bodies of biotite-quartz metasomat oligoclasts with a thickness of 1 to 30 m. Gold ore formation is localized mainly in the bodies of biotite-quartz-oligoclase (quartz-oligoclase-biotite, quartz-biotite-oligoclase) of metasomatites and places of manifestation of brittle

Source: Ukrainian Geological Survey

deformations in them. Biotite-quartz-oligoclase metasomatites are formed by amphibole-containing species of rocks (gneisses and crystalline schist) in the process of siliceous-alkaline metasomatosis during amphibole substitution by biotite and intensive quartzite formation in the central areas of quartz veins, in which 5-3 to 10-12%). The gold content in ore-bearing formations varies from the first g/t to 14.7 g/t. Ore formation belongs to the gold-quartz ubogosulfide type. Sulfides are presented by pyrite, pyrrhotite, chalcopyrite, pentlandite, marcasite and sphalerite. Pyrrhotite is a typical mineral of ore-bearing zones.

Its amount varies from 0.9% to 55% in relation to the total content of ore minerals. There are two pyrrhotite modifications - hexagonal and monoclinic. There are several ore mineral associations, formation of which took place by successive replacement of minerals of earlier associations with later ones. From the earliest to the latest ones the following mineral associations are established: spinel-magnetite, ilmenite-hexapyrotin, chalcopyrite-I-pyrite-I, pyrite-II-chalcopyrite-II-clinopyrrhotite, marcasite-pyrite-III with hematite. A characteristic feature of ore mineralization is sphalerite constant presence, the amount of which varies from 0.9% to 30%, and the presence of ganite, its content is up to 5%. Molybdenite is found in essentially quartz areas of metasomatites, its content in some cases reaches up to 30% of ore minerals. Native gold, silver, bismuth and tellurides are associated with pyrite-II-chalcopyrite-II-clinopyrrhotite paragenesis. Native gold (up to 0.5 mm grain size) is most often observed in areas of quartzation with high sulfide content, where it develops through cracks in the quartz in association with pyrrhotite, pyrite, chalcopyrite. Gold is represented by large pieces (more than 0.05 mm) - 31% and small ones (0.05 mm - 0.01mm) - about 69% fractions. According to the result comparison of amalgamation and assay analysis, free gold in the technological sample is more than 90%. Mining and geological conditions of the site determine the underground method of ore mining. According to previous hydrogeological studies, the flow rates of wells in the aquifer of the fractured zone of crystalline rocks vary from 0.005 to 0.54 l / s, specific flow rates - from 0.0001 to 0.2 l/s. The average values of water conductivity coefficients are 6.52 m2/day at an average specific flow rate of 0.0501 l/s.

Available geological information

Kvitka gold ores prospective field was discovered during gold prospection in the Savranske block from 1991 to 1998. During 1997-2005, greenfield exploration was performed within the Kvitkivska block determination of gold contingent resources of category P2. 25 inclined exploration and evaluation wells were drilled with a total volume of 8,859 m and 234 m. Geological-industrial type - "hydrothermal-metasomatic deposits in Proterozoic granite-gneiss complexes".

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Mayska perspective area of gold ore.

Mineral: Gold ore.

Type and period of subsoil use: 20-years licenses for exploration, pilot development and production.

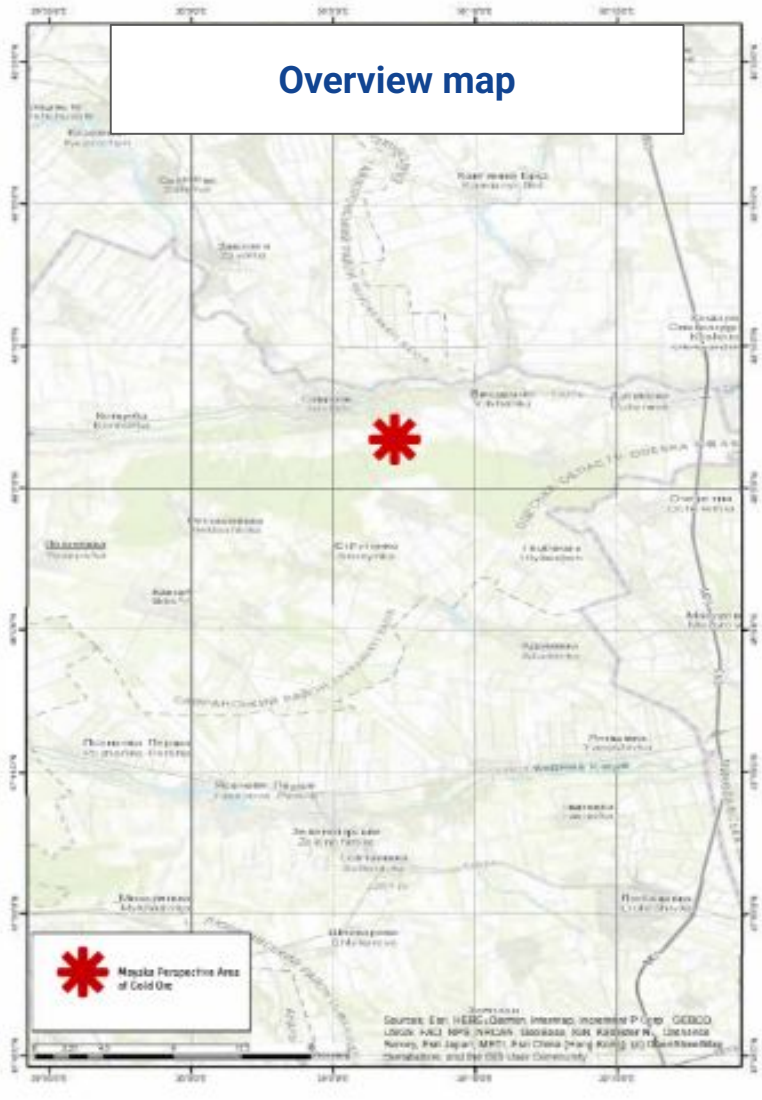
Plot area: 253.05 ha.

Location: Podilsk District of Odesa Region, on the South-Eastern outskirts of Savran Village. The major highway of the area is Kyiv-Odesa (M05) located 15 km East of Savran. Zavallivskyi Graphite Plant, located 14 km North-West from the site, has access to railway tracks from the Khashchuvate station of Odesa Railway. An asphalt road approaches the Northern part of the site directly.

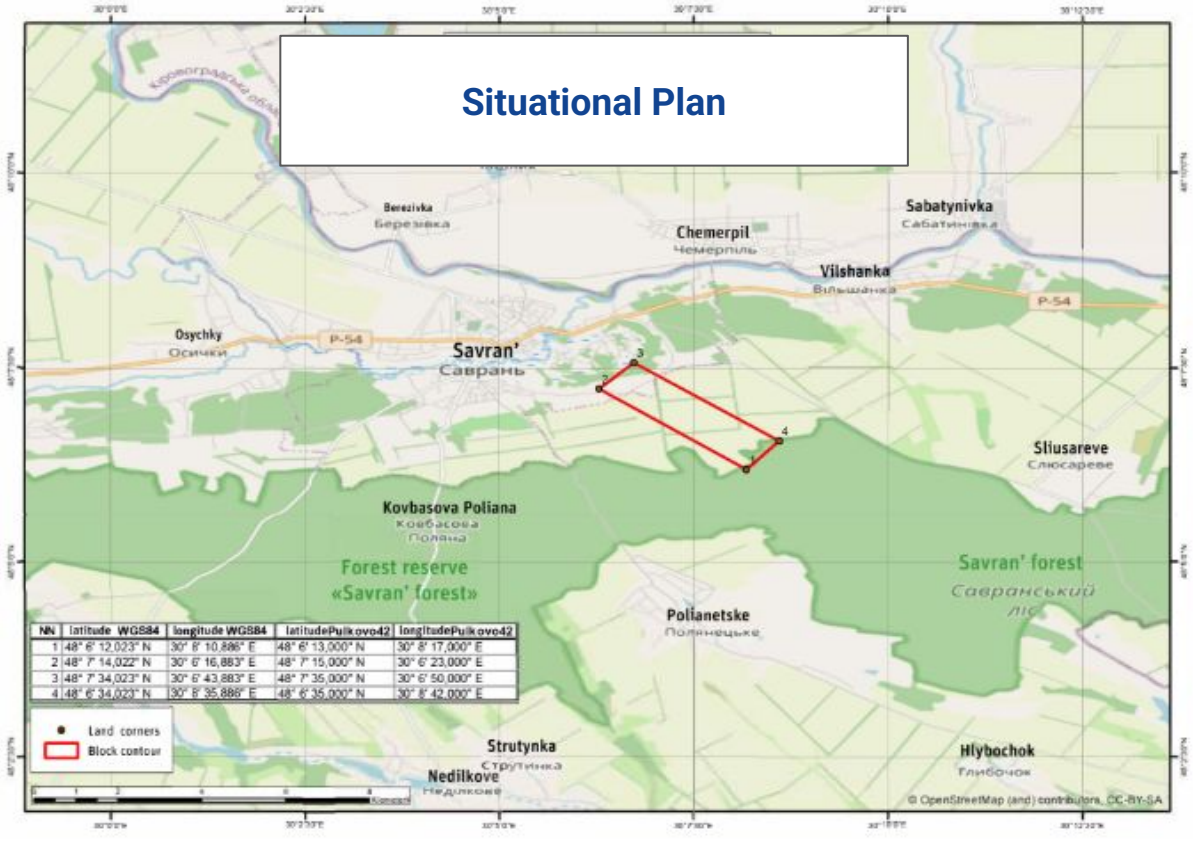
Reserves and Resources:		
	Reserves	Resources (P1 + P2), tons
Promising gold resources of the perspective area		40.7 (21.9 + 18.8)
The weighted average gold content in sections is 3.4 g/t (Minutes of the Meeting of Scientific Council on Forecasting of the Ukrainian State Geological Survey #31 dated 12.12.2001). Given the close geographical proximity between Maiska prospective area of gold ore and Kvitka prospective area of gold ore which are located within the common Savran ore field, these prospective areas can be considered as a single investment project.		

Source: Ukrainian Geological Survey

Overview map



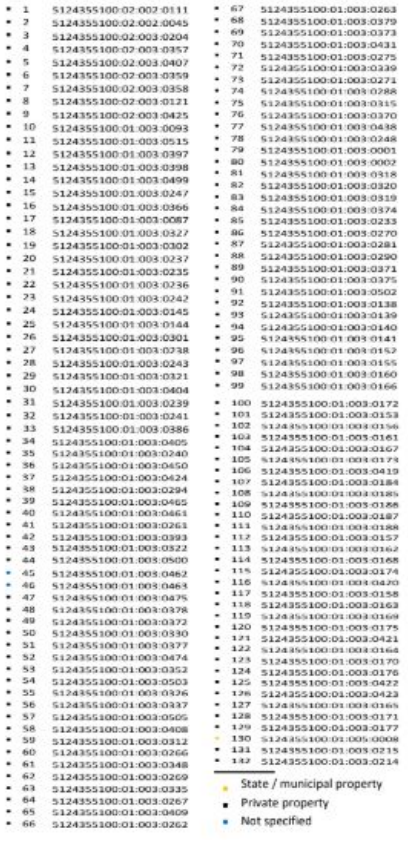
Situational Plan



NN	latitude WGS84	longitude WGS84	latitudePulkovo42	longitudePulkovo42
1	48° 6' 12,023" N	30° 6' 10,886" E	48° 6' 13,000" N	30° 8' 17,000" E
2	48° 7' 14,022" N	30° 6' 16,883" E	48° 7' 15,000" N	30° 6' 23,000" E
3	48° 7' 34,023" N	30° 6' 43,883" E	48° 7' 35,000" N	30° 6' 50,000" E
4	48° 6' 34,023" N	30° 8' 35,886" E	48° 6' 35,000" N	30° 8' 42,000" E

Source: Ukrainian Geological Survey

List of cadastral numbers of land plots, within the contour of the deposit



Information on land plots, in particular by cadastral number, can be obtained on the Public Cadastral Map of Ukraine: https://cutt.ly/Fx0CuBg

Geological information

Geological summary. Two major mineralized (ore) zones identified within the perspective area – Northern zone and Southern zone, which are embedded with the displacing stratum stretch, have North-Western aligning (290°-300°) and subvertical decline. Gold ore formation is confined to metasomatites of biotite-quartz-oligoclase (quartz-biotite-oligoclase, biotite-oligoclase-quartz) compound, which were formed mainly by rocks of the main compound (amphibolites and pyroxene-cummingtonite). Ore formations of the prospective area have indistinct textural and structural characteristics and inhomogeneous mineral composition. The ores of the perspective area belong to the gold-quartz bare-sulfide type. Ore mineralization is represented by oxide, sulfide and precious metal mineralizations. Oxide mineralization is the first stage of ore mineral formation and is represented by magnetite, chromium magnetite, ilmenite, scheelite, rutile, anatase (mineral association of chromium spinelid-chromagnetite-magnetite-ilmenite). Sulfide mineralization is directly related to gold mineralization and is represented by pyrrhotite, pyrite (of three generations), pentlandite, marcasite, chalcopyrite (of two generations), sphalerite, galena, as well as arsenopyrite, loellingite, cobaltite. Precious metal mineralization is separated into two

Source: Ukrainian Geological Survey

branches. The first branch is the actual golden branch, characterized by the predominance of high-fineness native gold and gold tellurides with a subordinate amount of bismuth and native bismuth tellurides. The second branch differs by the development of bismuth-silver-telluride mineralization with the major compound of native bismuth with the subordinate compound of native silver, electrum, hessite and galena. The size of gold grain is 0.001 - 2.0 mm, sometimes visible gold reaches 4 mm.

The content of large gold (> 0.07 mm) is 50 - 60%, small (0.07-0.001 mm) - about 30%, fine - 10-20%. The morphology of gold grains is diverse: lumpy, lamellar, dendritic, streaked, hooked, film, xenomorphic, dusty formations. Native gold fineness is high - 983-992. The gold content in the samples taken from the core wells, ranges from the initial g/t content to 1570 g/t. The gold-silver ratio for areas with industrial parameters averages at 7:1. Mining and geological conditions of the prospective area determine the underground method of ore mining. The conducted hydrogeological works revealed that the main water inflow into the excavation site will occur during the development of the 10 m horizon and will constitute 162.8 m3/h. The prospective area is classified as simple in terms of drainage of the minefield category. No special drainage measures will be required. Drainage can be carried out by means of internal mine outflow. Groundwaters of the prospective area, which are going to be drained during mining operations, have salinity of 0.5-0.7 g/l with hardness of up to 4.2 mg-eq/l. Groundwaters can be discharged into the Southern Bug through the settling tanks for the deposition of mechanical suspensions as well as partially used for technical water supply of the mine complex.

Available geological information

The site was discovered in 1991 during predicting geological works on uranium of Sinitsivska grounds. In 1991-1993 greenfield exploration was performed within the prospective area. In 1994-2000 excavation-drilling exploration was performed but was not completed due to lack of funding. A total of 177 inclined assessment wells and exploration wells of total capacity of 64 510 m; and 40 hydrogeological wells with a total capacity of 7 726 m were drilled within the prospective area. The North-Western part of the prospective area contains a 204 m deep mine shaft of industrial cross section. At the moment the shaft has a wet conservation status. In metallogenic terms the prospective area is confined to the Savran ore field and is its major gold ore object.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Burtynske Deposit, Horodnyavska Area

Mineral resource:
Graphite. Underground technical waters

Type and term of subsoil use:
20-years licenses for exploration

Location: Shepetivskyi district, Khmelnytskyi region, south of the village of Zamorochenya, 1.0 km northeast of the outskirts of the village of Horodnyavka. The nearest railway station is located 0.7 km southeast of the Horodnyavka site

Land plot area: 105 hectares

Reserves and Resources (January 2020):

	Reserves (B+C1)	Resources (C2)	Resources (off-balance)
Graphite Ore	113.4 Mt	16.6 Mt	9.4 Mt
Graphite	6.6 Mt	0.9 Mt	0.3 Mt
Technical water	1,800 m3/day		

The average content of graphite carbon:

graphite ore 6.0 - 7.0%

graphite concentrate 89.5 - 90.5%

Source: Ukrainian Geological Survey

Geological information

The Horodnyavska Area represents the northwestern part of the Burtynske graphite deposit, extending from southeast to northwest over a distance of up to 1.8 km, with a width ranging from 0.3 to 1.3 km. The ore body is associated with the northeastern limb of the large Shepetivka anticline within the Volyn Block of the Ukrainian Crystalline Shield. The primary graphite-bearing rocks are graphite-biotite gneisses and migmatites of the Vasylivska suite of the Teterevska series. The ore body is 400–450 m wide at the flanks and 500–450 m in the central part of the site. Its dip is to the northeast, ranging from 45° to 75°. Non-ore zones constitute about 12% of the ore body volume. The deposit has been explored to a depth of 226 m from the surface.

The mineral composition of the rocks and ores includes feldspar, quartz, graphite, biotite, sericite, kaolinite, nontronite, montmorillonite, chlorite, hydromicas, iron hydroxides, and accessory minerals such as sulfides, apatite, garnet, ilmenite, zircon, and monazite. Graphite in the ores occurs as fine disseminations, forming scaly aggregates and thin layers along the gneissic banding. In gneisses, graphite is generally evenly distributed but occasionally forms enriched layers and nests. Harmful impurities in the graphite are absent or within acceptable limits. The graphite content in all natural types of graphite ore varies from 4.4% to 11.9%.

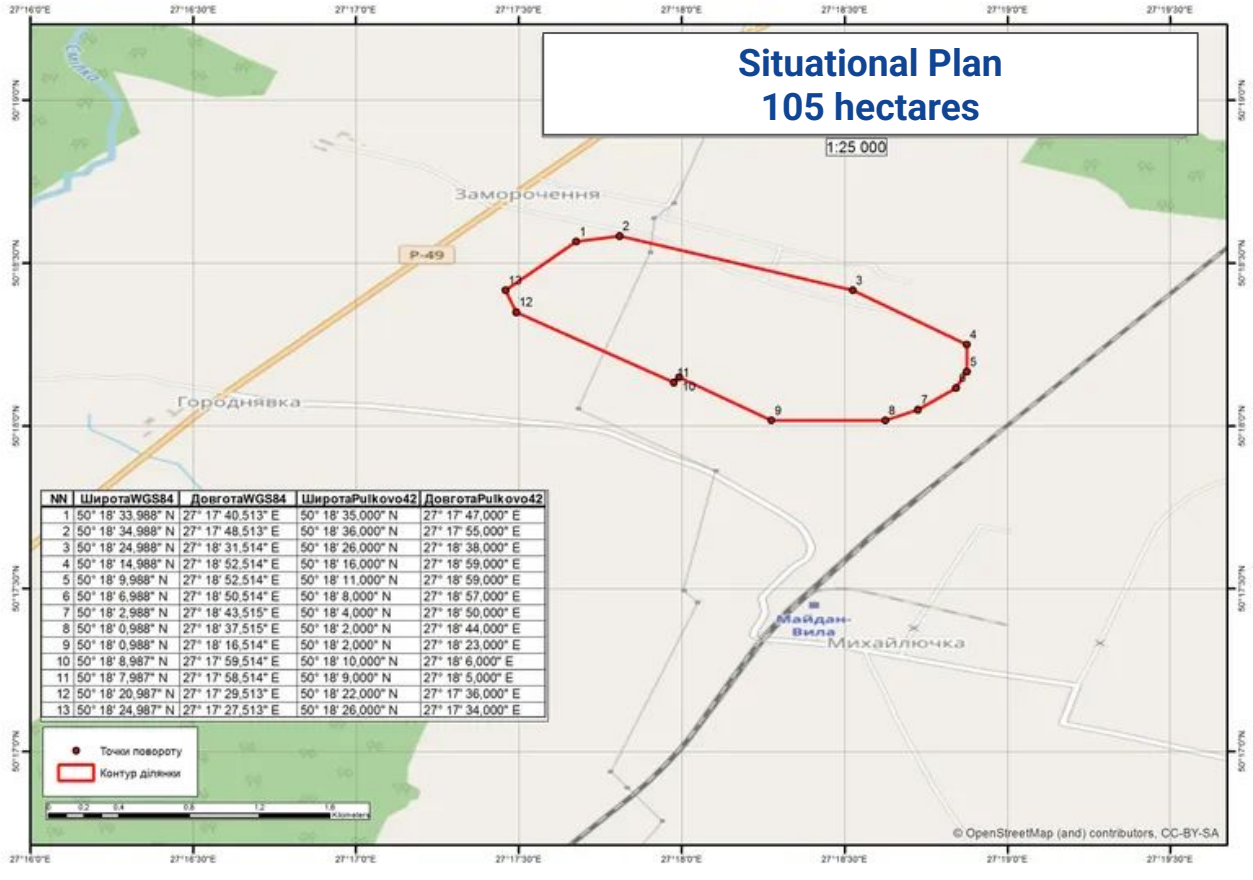
The hydrogeological and mining-geological conditions of the deposit are favorable for open-pit mining operations.

Available geological information

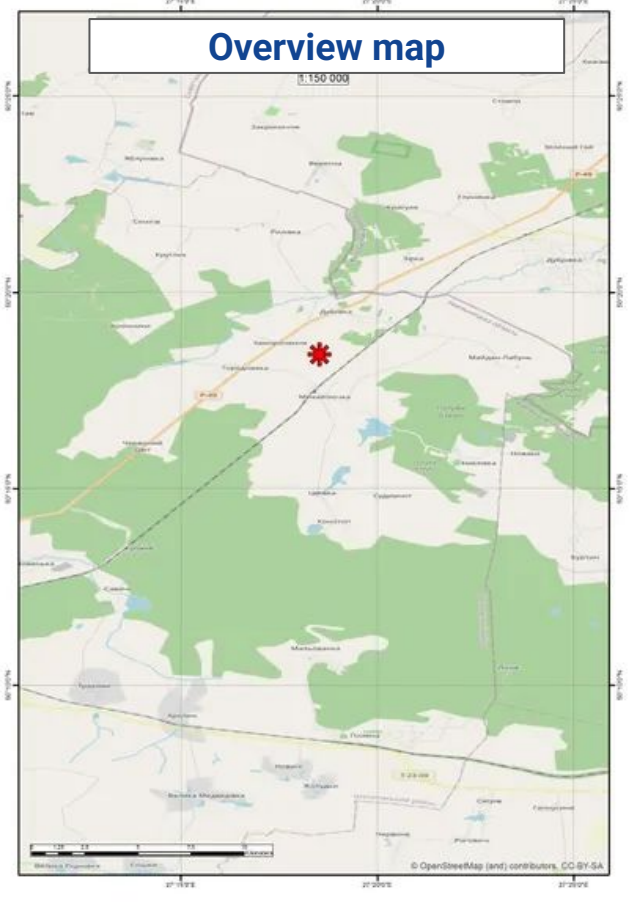
Laboratory and semi-industrial tests of graphite ore samples demonstrated the feasibility of obtaining dense, semi-fluffy, and fluffy ore concentrates with yields of 6.0%, 6.0%, and 7.0%, respectively. The resulting concentrates contained graphite carbon with mass fractions of 89.5%, 89.1%, and 90.5%, and recoveries of 89.5%, 89.1%, and 91.7%, respectively. The obtained concentrate meets the requirements of the physical and chemical specifications of crucible graphite, elemental graphite, and foundry graphite.

Source: Ukrainian Geological Survey

GRAPHITE. BURTYNSKE DEPOSIT, HORODNYAVSKA AREA



NN	ШиротаWGS84	ДовготаWGS84	ШиротаPulkovo42	ДовготаPulkovo42
1	50° 18' 33,988" N	27° 17' 40,513" E	50° 18' 35,000" N	27° 17' 47,000" E
2	50° 18' 34,988" N	27° 17' 48,513" E	50° 18' 36,000" N	27° 17' 55,000" E
3	50° 18' 24,988" N	27° 18' 31,514" E	50° 18' 26,000" N	27° 18' 38,000" E
4	50° 18' 14,988" N	27° 18' 52,514" E	50° 18' 16,000" N	27° 18' 59,000" E
5	50° 18' 9,988" N	27° 18' 52,514" E	50° 18' 11,000" N	27° 18' 59,000" E
6	50° 18' 6,988" N	27° 18' 50,514" E	50° 18' 8,000" N	27° 18' 57,000" E
7	50° 18' 2,988" N	27° 18' 43,515" E	50° 18' 4,000" N	27° 18' 50,000" E
8	50° 18' 0,988" N	27° 18' 37,515" E	50° 18' 2,000" N	27° 18' 44,000" E
9	50° 18' 0,988" N	27° 18' 16,514" E	50° 18' 2,000" N	27° 18' 23,000" E
10	50° 18' 8,987" N	27° 17' 59,514" E	50° 18' 10,000" N	27° 18' 6,000" E
11	50° 18' 7,987" N	27° 17' 58,514" E	50° 18' 9,000" N	27° 18' 5,000" E
12	50° 18' 20,987" N	27° 17' 29,513" E	50° 18' 22,000" N	27° 17' 36,000" E
13	50° 18' 24,987" N	27° 17' 27,513" E	50° 18' 26,000" N	27° 17' 34,000" E



Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION

Burtynske Deposit, Maydanska Area

Mineral resource:
Graphite

Type and term of subsoil use:
20-years licenses for exploration, pilot development and production.

Location: Shepetivka District of Khmelnytskyi Region, on the outskirts of the village of Burtyn, 20 km northeast of the town of Shepetivka.

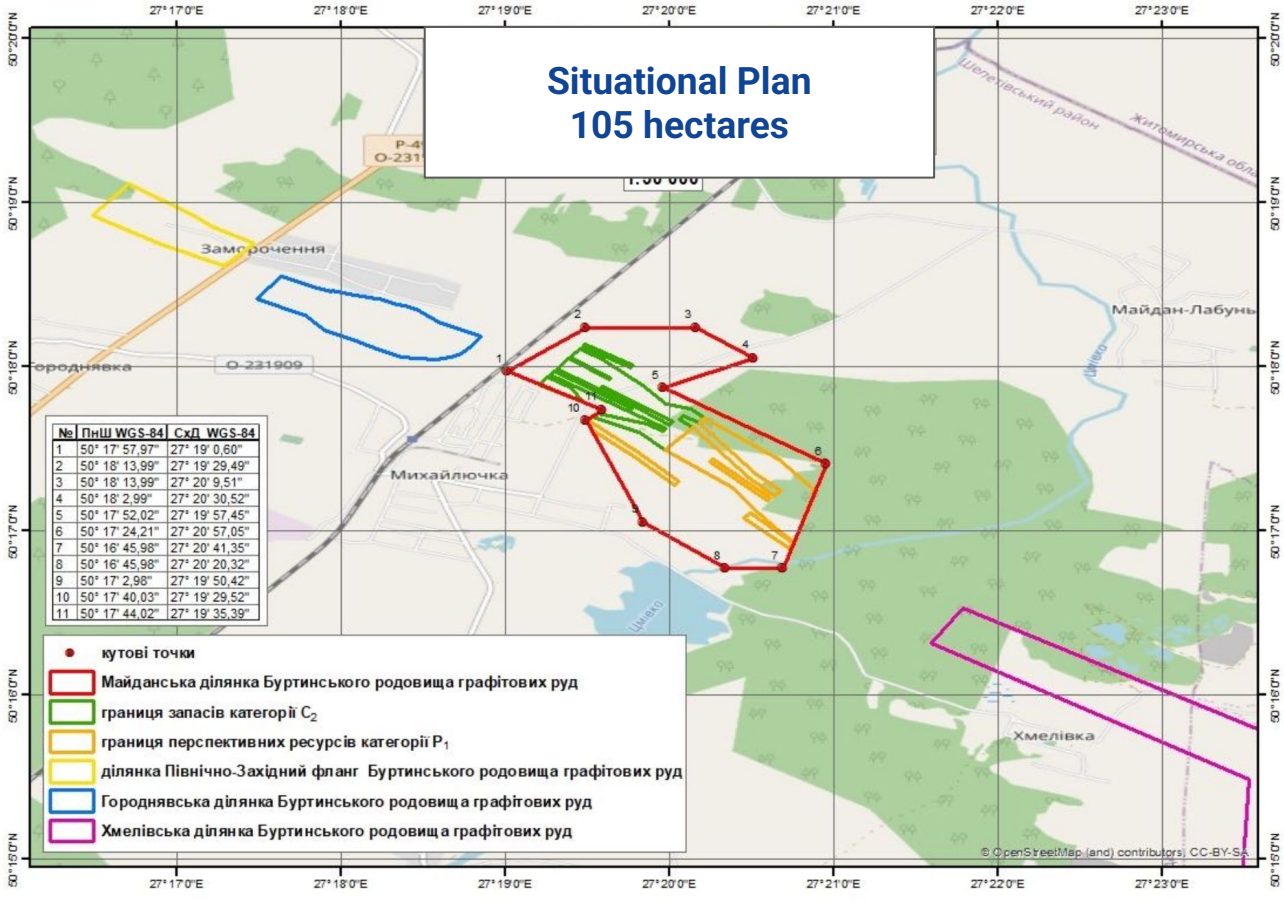
Land plot area: 310.4 hectares.

Reserves and Resources (January 2024):		
	Reserves (A+B+C1)	Resources (C2+P1)
Graphite ores	-	**65.8** (25.5+40.3) Mt
Graphite	-	**3.0** (1.4+1.6) Mt

Average content:

Graphite 5.12 - 5.96%

Source: Ukrainian Geological Survey



№	ПнШ WGS-84	СхД WGS-84
1	50° 17' 57,97"	27° 19' 0,60"
2	50° 18' 13,99"	27° 19' 29,49"
3	50° 18' 13,99"	27° 20' 9,51"
4	50° 18' 2,99"	27° 20' 30,52"
5	50° 17' 52,02"	27° 19' 57,45"
6	50° 17' 24,21"	27° 20' 57,05"
7	50° 16' 45,98"	27° 20' 41,35"
8	50° 16' 45,98"	27° 20' 20,32"
9	50° 17' 2,98"	27° 19' 50,42"
10	50° 17' 40,03"	27° 19' 29,52"
11	50° 17' 44,02"	27° 19' 35,39"

Geological information

The Maydanska area of the Burtynske graphite ore deposit is located in the northern wing of the Burtynske anticline, in the southwestern part of the Volyn Block of the Ukrainian Shield.

The geological structure of the deposit clearly distinguishes two levels:

- The lower level, represented by lower Proterozoic deeply metamorphosed rocks of the Teteriv series and magmatic formations of the Zhytomyr complex;
- The upper level, composed of horizontally lying Cenozoic deposits.

The ore-bearing nature of the deposit is represented by layers of gneisses and migmatites of graphite-biotite composition. The productive layer is consistent, with a length of 2,500 meters and a thickness of up to 750 meters.

Three ore bodies have been distinguished, with thicknesses ranging from 45 meters to 55 meters of loose and semi-loose ores, which have a lamellar shape but are branched. These ore bodies have been delineated based on analytical data and outlined with a boundary carbon content of 2%. The ore bodies are located compactly, with the distance between them ranging from 40 to 200 meters.

Source: Ukrainian Geological Survey

The ore bodies vary in terms of geological exploration: for ore bodies 1 and 3 in the western part of the area, reserves are estimated according to category C2, and for ore body 2, prospective resources are classified in category P1.

Within the Maydanska area, three natural types of ores are distinguished: loose, semi-loose, and dense. The useful mineralization is found only in the loose and semi-loose graphite ores. The loose graphite ores are represented by the weathering crust of graphite-containing rocks, which is widely spread within the area and consists of rocks from the complete and partial kaolinization zone. The thickness of loose ores ranges from 5 meters to 32.5 meters, with an average of 17.3 meters. A significant increase in thickness is observed in the form of elongated lenses and strips in the middle part of the useful thickness of the area. The average graphite content is 5.12%. The bottom of the loose graphite ores lies between elevations of 194.2 m and 219.3 m.

Semi-loose graphite ores consist of more disturbed weathered rocks with a high degree of fissuring, lying in the zone of disintegration and weathering. Like the loose ores, the semi-loose ores have continuous distribution. The thickness of the semi-loose graphite ores varies from the first meters to 26.6 meters, with an average value of 13.3 meters. The average graphite content is 5.96%. The bottom of these ores lies between elevations of 170.9 m and 195.3 m.

Fissured rocks from the disintegration zone and partial kaolinization gradually transition into dense rocks. Dense ores are represented by graphite-biotite gneisses and migmatites, which also have high fissuring. To the northeast and southwest, the ore body is bounded by a package of barren gneisses, lying as elongated bodies in a north-western direction, with a steep dip (50-80°), composed of biotite gneisses, primarily located on the hanging and footwall sides of the ore body, acting as host rocks. Biotite gneisses are gray, dark gray, fine-grained rocks with a banded texture.

Directly over the loose ores lie the loose overburden rocks, which consist of sandy-clayey deposits of Neogene age and are covered by lacustrine-glacial sands, silts, and loams of Quaternary age. The average thickness of the sandy-clayey deposits is 16.2 meters. The average thickness of the sands, loams, and silts is 2 meters. The soil-vegetation layer is sandy, weakly humus-rich, and thin (0.15-0.4 meters).

According to the mineralogical studies, the average mineral composition of the loose ores is as follows (%): kaolinite – 50-70; hydromica – 10; chlorite up to 10; biotite chloritized up to 10; quartz – 15-25; graphite – 2-12; limonite often present, with pyrite and other minerals. The average density of loose ores with natural moisture is 2.11 g/cm^3.

The mineral composition and physical-mechanical properties of the semi-loose ores depend on the degree of weathering and the conditions of rock formation (tectonic disturbances). The average mineral composition of semi-loose graphite ores is as follows (%): kaolinite, nontronite, montmorillonite – 8-30; chlorite up to 12; hydromica

Source: Ukrainian Geological Survey

up to 10; biotite, sericite up to 10; feldspar – 8-30; quartz – 20-35; graphite – 2-12; sulfides up to 2. The average density of semi-loose ores with natural moisture is 2.27 g/cm³.

Dense ores are represented by graphite-biotite gneisses and migmatites, which also have high fissuring. The mineral composition of these ores is (%): feldspar – 30-50; quartz – 20-35; biotite, sericite – 10-17; sulfides up to 3; apatite, ilmenite, zircon, sphene up to 1. The average density of dense ores with natural moisture is 2.58 g/cm³.

According to the data provided, all three types of graphite rocks have stable graphite content: loose rocks – 2-12%, average 6.2%; semi-loose – 2-15%, average 6%; dense – 2-14%, average 6%.

In terms of geological complexity, the Maydanska area of the Burtynske graphite ore deposit is classified as Group II (complex geological structure).

Available geological information

Graphite-bearing rocks were first discovered in 1953 near the village of Burtyn in the Shepetivka district during electrical prospecting works. In the following years, graphite-bearing rocks were studied during geological surveys at a scale of 1:200,000 and deep geological mapping at the same scale. Between 1981 and 1984, during general graphite prospecting in the northwestern part of the Ukrainian Shield (Kozlov G.G., 1984), the Burtynske graphite deposit was identified, with its predicted resources in categories P2 and P3 estimated at 423 million tons, with an average graphite content of 5.9%. It was proven that the occurrence represents a graphite-bearing ore field and is the most promising in the northwestern part of the Ukrainian Shield.

In 1988, prospecting and evaluation work was conducted within the Burtynske graphite-bearing field, resulting in the estimation of reserves (resources) in categories C2+P1 amounting to 350.4 million tons of graphite ore with an average graphite content of 6.37%. This was based on four promising areas: Horodnyavska, Maydanska, Khmelivska, and Lisova. The report and evaluation results were accepted by the protocol of the Research and Technology Council of the Zhytomyr Geological and Prospecting Expedition (Protocol No. 678, 01.12.1988).

In 2004, exploration of the Horodnyavska area was conducted for its geological-economic assessment, with reserves being estimated in categories B, C1, and C2. A preliminary evaluation of the Northwest, Maydanska, Khmelivska, and Lisova areas was also performed, resulting in total reserves (resources) of C2+P1

Source: Ukrainian Geological Survey

category ores amounting to 395 million tons, with an average graphite carbon content of 5.14%.

In 2019, the Pravyberizhna Geological Expedition of the Ukrainian Geological Company, under the technical task of TEK INVEST LLC, conducted a preliminary geological-economic evaluation of the Maydanska area of the Burtynske deposit. As a result, graphite ore reserves were approved (Protocol of the State Commission of Ukraine for Mineral Resources No. 4964, 14.11.2019).

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Petrivske Deposit, Vlasivska Area

Mineral: Graphite.

Type and period of subsoil use: geological study, including pilot-industrial development, followed by extraction (industrial development of the deposit), 20 years.

Location: Oleksandria district of Kirovohrad region, at a distance of 2.5-3.0 km from the southwestern outskirts of the town of Petrove, at a distance of 4.3 km to the railway track.

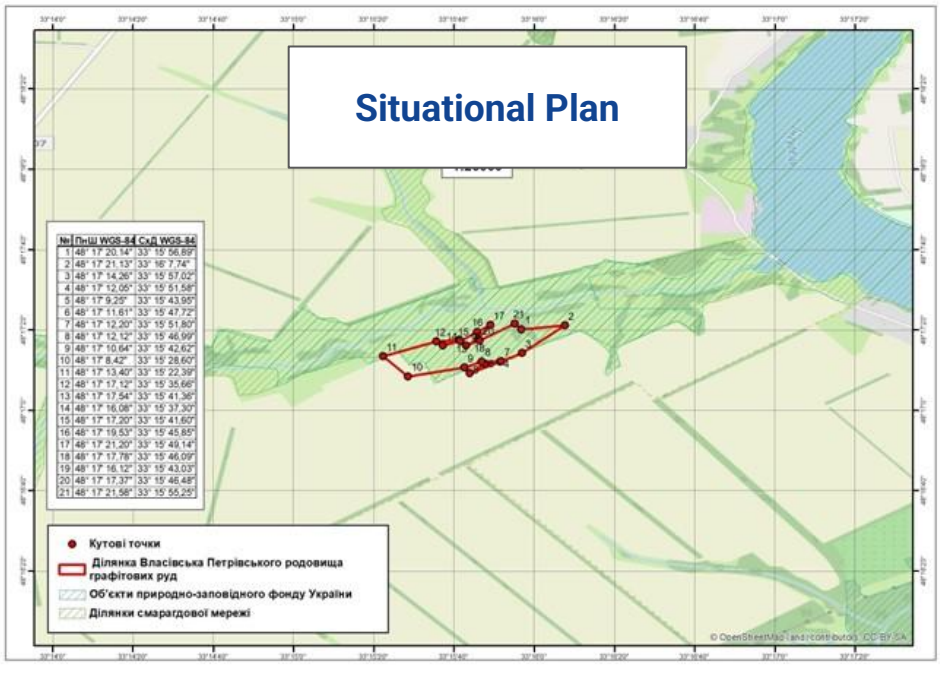
Plot area: 16.6 ha.

Reserves and Resources (March 1958), Kt:		
	Reserves (A+B+C1), Kt	Resources (C2), Kt
Graphite ore	7,165.0	1,696.0
Graphite	515.0	115.0

The average content of graphite carbon:

graphite ore 5.1 - 8.9%

graphite concentrate 84.9%



Source: Ukrainian Geological Survey

Geological information

Geological summary. Structurally, the Petrivske deposit is located in the central part of the Ukrainian Shield, within the Western Ingulets shear zone (Ingulets regional fault (normal fault type)), within the Petrivske dome-shaped structure. The geological structure of the deposit area includes metamorphic, ultrametamorphic, and magmatic rocks of the Archean and Proterozoic, which are overlain by a cover of Cenozoic deposits.

In terms of geological structure, the deposit is composed of crystalline rocks (quartzites, gneisses, and graphite crystalline schists) of the Rodionov formation of the Ingulets-Ingulo series from the Proterozoic era. A weathering crust is developed extensively over the crystalline rocks. The Petrivske deposit is situated on the southern wing of the Petrivske symmetrical fold, with dip angles of the wings ranging from 30 to 60 degrees. The geological structure of the deposit is complicated by tectonic disturbances, including displacements and faulting. Due to the displacements in the central part of the deposit, the width of the graphite schist seam at the surface increases. In terms of morphological type, the graphite ore deposits in the area of the deposit are classified as tabular. The graphite-bearing deposit in the area has a northeastward strike direction, with a length of 1.2-1.5 km and a width of 200-250 m. It is associated with the contact of crystalline rocks of the Rodionov formation of the Ingulets-Ingulo series of the Proterozoic, which are intersected by granite veins of the Ingulets complex. The graphite-hosting rocks in the Vlasivska area are represented by biotite graphite-bearing gneisses and schists with graphite content ranging from 5-13%. The graphite is fine-grained. The weathering crust to a depth of 20-40 m from the surface consists of loose kaolinitic-graphitic rocks. To the west, the graphite schists are in contact with gray biotite granites, and to the east, they are bordered by biotite graphite-bearing gneisses, which gradually transition into biotite non-graphite gneisses. The graphite-bearing rocks are elongated in a northeastward strike direction, with a general dip to the southeast at an angle of 20-500. The graphite ores of the Vlasivska area are classified into three main types based on their mineralogical, petrographic, and lithological composition:

1. Kaolinitized graphite schists, referred to as 'synka' due to their bluish hue, consist of kaolinite, quartz, and graphite flakes. This ore type is widely distributed throughout the deposit, with thicknesses of 170-200 m in the western part and 110-150 m in the eastern part, with an average graphite content of 7.56%. Lenses of the most enriched graphite ores, with large graphite flakes (known as "fish"), are associated with this type, having a thickness of 10-15 cm and a length of 2-3 m, with graphite content ranging from 25-60%.

2. Dense graphite-bearing schists, graphitized, finely layered, fine-grained, with an average graphite content of 8.94%.

Source: Ukrainian Geological Survey

3. Biotite graphite-bearing gneisses, weathered, kaolinitized, occasionally iron-rich, with a graphite content of 5.13%.

All types of graphite ores contain fine- and very fine-grained graphite, with the enriched 'synka' (fine-flaked ore) constituting a small portion of the total graphite deposits. Based on the degree of crystallization, the graphite ores of the deposit are divided into two groups: fine-flaked and very fine-flaked ores. Hidden crystalline or amorphous varieties of graphite are absent in the deposit. The overburden is represented by the soil-vegetation layer and Quaternary-age loams, with thickness ranging from 0.2 to 4 meters in the eastern part and up to 20 meters in the western part. The underlying rocks are crystalline limestones and quartzites. The technological properties of the ores were studied in 1939-1941, and it was determined that only the first type ('sinyka') could be enriched. A concentrate with an ash content of 6.5% was obtained, with a carbon recovery of 84.85%.

Later, in 1955-1956, based on laboratory technological tests, it was established that flotation could be used to enrich all ore types, and a ore concentrate was obtained with an ash content ranging from 7.61% to 12.25%, which met the requirements for elemental graphite. The hydrogeological conditions at the deposit are simple. The main source of water influx into the deposit is water from fractured crystalline rocks and the aquifer system of sedimentary deposits. During the open-pit mining of the deposit, the quarry will be replenished with water from two aquifers and atmospheric precipitation. The majority of the explored graphite-bearing rocks are located above the bottom of the Vlasivska gully, so drainage from the quarry is possible through the gully, provided the quarry is developed to the horizon with an absolute elevation of +165 m. The possible water inflow will be 2.3 m³/hour. The southeastern flank of the Petrivske deposit is prospective for the discovery of new graphite ore deposits.

Available geological information

The Petrovskoye deposit consists of two areas, Vlasivska and Bilyi Horby, which are separated by the Vlasivska gully. Graphite was first discovered in the Vlasivska gully in 1872, where the extraction of graphite from the richest ores continued intermittently until 1939, after which the mine was closed. Geological surveys of the area were conducted at various times, including 1:200,000 scale geological mapping (sheet M-36-XXXIV) (Svyitalskyi N.I., Polovinkina Y.I., Semenenko N.P., Hladkikh V.N., et al.). Geological exploration work was carried out in the Vlasivska area in 1927-1928 (Karpov N.P.), in 1935-1937 (Semenenko N.P.), in 1937

Source: Ukrainian Geological Survey

(Oreshkin I.I.), in 1939-1941 (Agapkin N.G.), and in 1948-1949 search and exploration works (Zhukov S.I.). Based on the results of previous geological exploration work, a recalculation of the graphite ore reserves in the Vlasivska area of the Petrivske deposit was conducted in 1953-1954 (Birchenko M.V.), and the reserves were approved by a decision of the State Commission on Reserves (protocol No. 8844 dated 25.03.1954) under category C1, totaling 4,682 thousand tons with an average graphite content of 9.8%.
Between 1955 and 1958, a more detailed exploration of the Vlasivska area of the Petrivske deposit was carried out (Pyechenina T.I.), and the graphite ore reserves in the Vlasivska area were approved by a decision of the State Commission on Reserves of the USSR (protocol No. 2156 dated 15.03.1958) under categories A, B, C1, and C2. The average graphite content is 6.8%. Subsequently, graphite-bearing rocks were studied during geological surveys at a scale of 1:50,000 (Etinhof I.M., Fedyushin S.V., 1961-1971), and at a scale of 1:200,000 (Sumtsova T.N., 1976-1978), as well as through deep geological mapping of sheets M-36-139-A, B (Zakharyov V.V., 1976-1979), graphite exploration within the Western Ingulets fault zone (Zinchevska L.N., 1979-1981), and geological reassessment of areas at a scale of 1:200,000 of sheets M-36-XXXIV, L-36-IV (Zakharyov V.V., Martyniuk A.V., 1991-1998).The work carried out enabled a reevaluation of the prospects of the Balakhivska-Varvarivska ore zone, considered the most graphite-bearing province of the Ukrainian Shield, within which the Petrivske deposit is located.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Bohoslovskyi and Voyevodivskyi Occurrences of graphite ores.

Mineral: Graphite.

Type and period of subsoil use: geological study, including pilot-industrial development, followed by extraction (industrial development of the deposit), 20 years.

Location: Pervomaisk District, Mykolaiv Region, located 4 km from the Bandurka railway station.

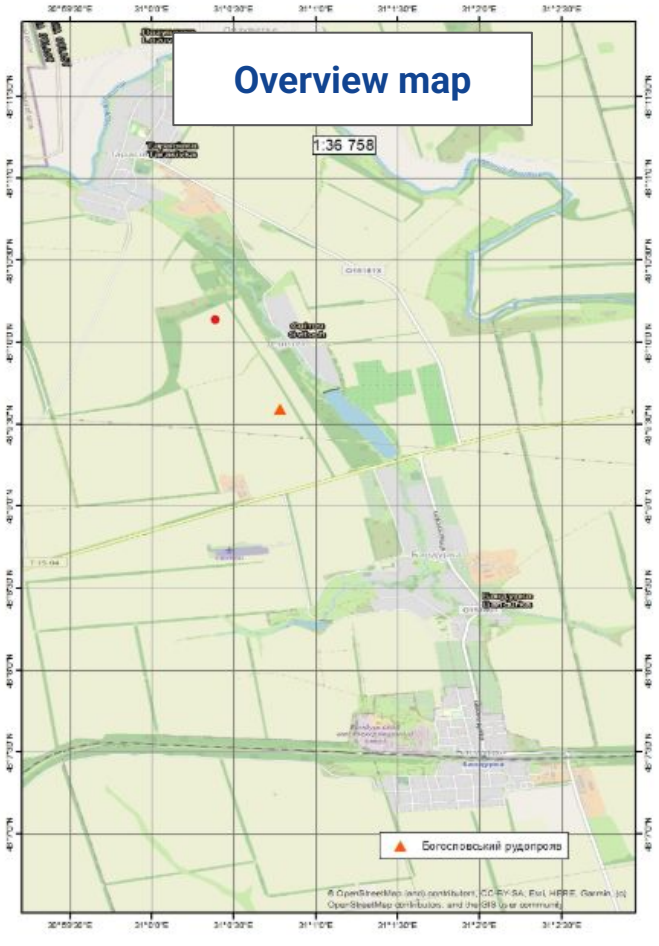
Plot area: 2,040 ha.

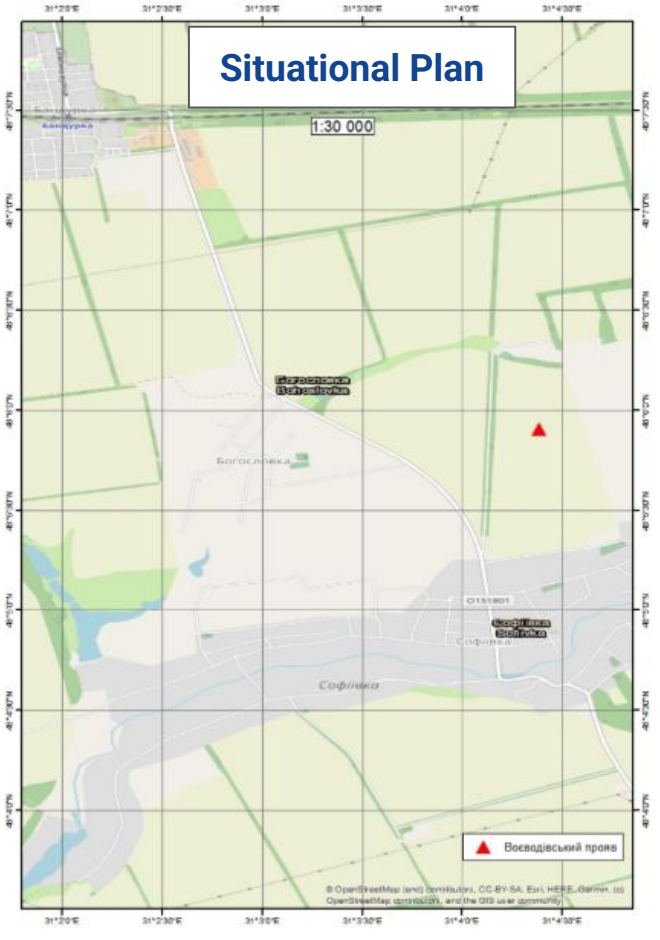
Reserves and Resources, thousand tons:		
	Reserves	Resources (P2 & P3),
Bohoslovskyi occurrence:	-	
❑ Graphite ore	-	9,639 (3,951 + 5,688)
❑ Graphite	-	280 (127 + 153)
Voyevodivskyi occurrence	-	
❑ Graphite ore	-	4,798 (3,869 + 929)
❑ Graphite	-	209 (186 + 23)

The average content of graphite carbon:

graphite ore 2.05 - 10.05%

Source: Ukrainian Geological Survey





Geological information

Geological summary. The Bohoslovskyi occurrence is located strike andentral protrusion of the Ukrainian Shield, the Kirovohrad block, and the Bratsk syncline. It is controlled by the Mykolaiv deep fault with a northwest strike and is associated with the roskhakhivska suite of the Ingulo-Inhulets gneiss series, consisting of graphite gneiss formations. Within the occurrence, three exploration and mapping drill profiles (17s, 16s, and 15s) have been drilled. Profile 16s (exploration wells 42, 43, 44, 47, 48, 46, 45, 247, 248, 249, 59, 60) revealed three ore bodies of graphite ores with carbon content ranging from 2.05% to 8.29%. Ore body No. 4, revealed by wells 42 and 47, consists of two types of ores – loose and dense. Loose ores are graphite-kaolinite weathering crusts of graphite-biotite gneisses, with a true thickness of 17.65 m and a carbon content of 3.26%. Dense ores are represented by weakly disturbed graphite-biotite gneisses, with a thickness of 13.32 m and a carbon content of 2.05%. Ore body No. 5, revealed by well 44, is located 45 meters east of ore body No. 4. It consists of two types of ores with similar composition, with a thickness of 2.5 m and a carbon content of 3.43%. Ore body No. 6, revealed by well 248, has a thickness of 1.26 m and a carbon content of 8.29%.

Source: Ukrainian Geological Survey

In this profile, the ore bodies are represented by stratiform deposits, which are interbedded with the gneisses of the roskhakhivska suite. The strike is northwest, ranging from 3100 to 3200, with an eastern dip and a dip angle of 68-720. The host rocks are biotite-granate gneisses, biotite-cordierite gneisses, and graphite-granate-cordierite gneisses. Profile 17s is located to the north of the Bohoslovskyi occurrence, 1.1 km from profile 16s. Seven exploration and mapping drill holes (239, 83, 80, 61, 78, 79, 62) and three exploration drill holes (153, 154, 155) have been drilled. The wells are located within a zone of increased conductivity, where three graphite-bearing ore bodies have been identified, which are associated with zones of tectonic disturbances with a northwest strike. Ore body No. 1 (well 80) is represented by two types: loose ores – these are hydrosilicate-kaolinite-graphite weathering crusts of graphite-biotite gneisses, with a thickness of 1.87 m and a carbon content of 6.67%; dense ores, intersected by well 155, are represented by garnet-graphite-biotite gneisses, with a thickness of 1.76 m and a carbon content of 3.65%.

Ore body No. 2 (well 155), within the interval of 48-75 m, consists of two types of ores. Dense ores are graphite-garnet-biotite gneisses, while loose ores are their weathering crust. The true thickness of the ore body with a commercial carbon content of 4.08% graphite is 1.5 m. Ore body No. 3 is intersected by well 153 in the interval of 30-88 m and consists of loose ores – weathering crusts of garnet-graphite-biotite gneisses. The true thickness of the graphite-bearing rocks is about 8 m, and the thickness of the ore body is 2.94 m with an average carbon content of 2.32% graphite. The three ore bodies in profile 17s lie concordantly with the surrounding rocks of the roskhakhivska gneiss suite. The strike is northwest at 3200, with an eastern dip angle of 76-800. In this profile, graphite-bearing gneisses and their weathering crusts are intersected by wells 78, 79, and 62. However, due to their small thickness and low graphite content, they are not considered prospective. To the south, the Bohoslovskyi occurrence is traced with the help of exploration and mapping drill holes 251, 252, 253, 51, 50, 49, 52, 240, 53, located in profile 15s. Two ore bodies, No. 6 and No. 7, have been identified. Ore body No. 6 is traced from profile 16s and intersected by well 253. The ores consist of weathering crusts (graphite-kaolinite) developed on graphite-cordierite-biotite gneisses. The total thickness of the graphite-bearing rocks is more than 15 m, with a graphite content of 2.09%. Ore body No. 7 is intersected by well 49 and is associated with dense ores, represented by graphite-bearing calcareous rocks and graphite-granate-cordierite-biotite gneisses, with a total thickness of about 30 m. However, the thickness of the ores that meet the commercial grade requirements is 2.22 m with a graphite content of 3.31%.In addition to these wells, rocks with graphite mineralization within profile 15 have been intersected by the following wells: 251 (graphite content – 0.1%); well No. 252 (0.1-1.92%); No. 51 (0.54-2.56%); No. 52 (0.68-2.95%); No. 240 (0.16-0.47%); No. 53 (0.1-4.5%).The ore-bearing rocks are

Source: Ukrainian Geological Survey

represented by gneisses: biotitic, garnet-biotitic, garnet-cordierite-biotitic, and garnet-hypersthene-biotitic of the roskhakhivska suite. The strike of the host rocks and ore bodies is 300-3,100, with an eastward dip angle of 700. The seven ore bodies of the Bohoslovskyi manifestation are located within the western wing of the Bohoslovskyi syncline, which is bounded to the west and east by deep-seated faults with a north-westward strike. To the east, the syncline borders an anticlinal dome-like uplift composed of shadowy hypersthene-granite gneisses of the First of May type, while to the west, it is bordered by the large Sofiivskyi massif of porphyroblastic migmatites. The Bohoslovskyi syncline is closed to the south of profile 15s.

The Voievodivske occurrence is located within the Central Outcrop of the Ukrainian Shield, Kirovohrad block, and the Bratsk synclinorium. It is controlled by the Mykolaiv deep fault with a northwest-southeast strike and belongs to the κoschakhivska suite of the Ingulo-Inhulets gneiss series, specifically the formation of graphite gneisses. To determine the thickness of the graphitization zone, electrical exploration profiles 6s-13s were conducted. To the south of borehole 2,622, along profiles 9s, 8s, and 7s, which were drilled along the strike of the structure, no zones of increased conductivity or VP anomalies were identified. Profile 13s. In the zone of tectonic contact between porphyroblastic migmatites and gneisses of the Roschakhivska suite, a zone of increased polarization, PC 5-16 (up to 4.5%) is noted. Boreholes drilled here (218, 219, 30, 158, 159) revealed about ten graphite-bearing rock layers, including intensely mylonitized biotite-graphite gneisses, garnet-graphite-biotite gneisses, hypersthene-graphite-biotite crystalline schists, and weathered mylonitized graphitic pyroxenites. Ore body No. 8 (borehole 158) is represented by mylonitized, chloritized, weathered graphite-bearing pyroxenites in the interval of 58-70.5 m. The actual thickness of the body is 7.22 m, with a carbon content of 2.64%. The ore body is located between garnet-pyroxene-biotite and pyroxene-biotite gneisses.

The strike is northwest at 3,300, and the dip is to the east at an angle of 650. The graphite content in the rocks ranges from 0.33% to 4.05%, with uneven distribution and no industrial concentrations. To the east of profile 13s, between PC 33-38, a distinct anomaly of increased VP values is observed, reaching up to 6%. Boreholes 28, 151, 152, and 63 revealed a thickness of calcareous rocks greater than 60 m among the gneisses of the roschakhivska suite, within which two layers of intensely weathered graphite-bearing pyroxenites are present. Ore body No. 9 (with a thickness of 1.02 m and carbon content of 6.1%) is represented by a graphite-kaolinite weathering crust of graphite-garnet-biotite gneisses, according to data from borehole 385. Ore body No. 10 (borehole 152) is represented by a layered deposit (thickness 6.2 m, graphite content 5.59%), consisting of nontronite-hydro-chlorite-graphite weathering crust. At a depth of 165.7 m, the ore body is intersected by borehole 151, with a graphite content of 2.98%. Ore body No. 11 (borehole 151) is exposed in the interval of 179.3-183.3 m.

Source: Ukrainian Geological Survey

The thickness is 2.96 m, with a graphite content of 3.06%. The ores are composed of graphite-pyroxene calcareous rocks, slightly fractured and intensely chloritized. Ore body No. 12 (borehole 151, interval 105.2-111.0 m; actual thickness 2.73 m, graphite content 2.43%) consists of loose rocks of hydro-mica-kaolinite-graphite composition. Ore body No. 13 consists of two types of ores: loose ores with a thickness of 2.62 m and a graphite content of 2.32%, composed of graphite-kaolinite; and dense ores, represented by intensely mylonitized chlorite-graphite-carbonate rocks (thickness of the body 2.68 m, graphite content 2.6%). Thus, the zone of increased conductivity (VP) within PC 33-38 is explained by the presence of five graphite ore layers, as well as the increase in the thickness of the weathering crust within the anomaly. The strike of the rocks is northwest at approximately 3,200, with an eastward dip angle of 700. The host rocks are calcareous and cordierite-biotite gneisses of the roschakhivska suite. Profile 12s. The exploration and mapping boreholes 38, 75, 76, 12, 77, and 58 revealed thin layers of graphite-bearing rocks in the epicenters of VP anomalies. These layers consist of graphite-biotite gneisses, graphite-cordierite-biotite gneisses, and garnet-graphite-biotite gneisses. The graphite content ranges from 0.16% to 3.48%, but due to the small thickness of the graphite-bearing rocks, the ore layers do not have practical significance. Borehole profile 10A is located in the area of borehole 2622. Exploration and mapping boreholes (7, 6, 4, 2, 3) and prospecting boreholes (156, 157) were drilled. In the zone of tectonic contact (Mykolaiv deep fault) between the porphyroblastic migmatites of the Kirovohrad type (Sofiivskyi massif) and the gneisses of the roschakhivska suite, a layer of graphite-bearing rocks is located, consisting of biotite-graphite gneisses, biotite-garnet-cordierite-graphite gneisses, and biotite-cordierite-graphite gneisses. Among these rocks, two ore bodies (Nos. 14 and 15) have been identified. Ore body No. 14 is revealed by boreholes 472 (35), 3, 3bis, 156 and consists of two types of ores. The dense ores are garnet-biotite-cordierite-graphite gneisses, with a thickness of 5.76 m and a graphite content of 4.32%. These ores are intensely fractured and mylonitized. The loose ores are represented by a kaolinite-graphite weathering crust of garnet-biotite-cordierite-graphite gneisses. The thickness of the ore body is 13.19 m, with an average graphite content of 3.8%. Ore body No. 15 is revealed by boreholes 6 and 156, and consists of two types of ores. The dense ores are biotite-graphite gneisses, which are cataclasized, fractured, with an actual thickness of 4.25 m and a graphite content of 10.5%. The loose ores of this body are represented by a kaolinite-graphite-carbonate weathering crust of intensely mylonitized graphite-biotite gneisses, with a thickness of 2.74 m and a graphite content of 9.54%. Both ore bodies (14 and 15) have a similar occurrence to the host rocks, with a northwest strike of 3200, and an eastward dip angle of 650.

Source: Ukrainian Geological Survey

Available geological information

The graphite occurrences in the Middle-Pobuzhskyi region have been known for many years. The Zavallivske graphite deposit was discovered in 1921 and has been explored multiple times. Graphite exploration in the Sofiivska prospecting area (within which the Bohoslovskyi and Voievodivskyi occurrences were found) began in 1923. In the following years, a number of graphite occurrences and mineralization points were identified within the Pobuzhskyi graphite-bearing district during geological mapping and prospecting activities. All discovered graphite occurrences are predominantly associated with graphite varieties of gneisses from the roschakhivska and kamianokostovatskaya suites. The Voievodivske occurrence was discovered in 1964 during a geological survey at a scale of 1:50,000, which revealed a calcite-graphite rock layer between cataclasized garnet-biotite gneisses in the interval of 41.8-50.2 m. The Voievodivske occurrence was studied during general graphite exploration in the southern part of the Middle-Pobuzhskyi region. The occurrence is located in the southeastern part of the Sofiivska area. In 1965-1967, graphite-bearing rocks were identified in three boreholes within the Sofiivska area. In 1982-1983, 26 profiles were conducted using the induced polarization (IP) method, mostly concentrated in the area of the Bohoslovskyi and Voievodivskyi occurrences. Alongside the IP work, exploratory and mapping drilling was carried out. The Bohoslovskyi occurrence, located in the northwestern part of the Sofiivska area, was discovered in 1970 during a geological survey at a scale of 1:50,000 by H.A. Shvarts while drilling borehole 7066. It was studied during general graphite exploration in the southern part of the Middle Pobuzhsky region (Barda V.I., 1987). According to IP data, a zone of increased polarization was identified within the Bohoslovskyi occurrence. The polarization of the rocks in the anomalous zones ranges from 3 to 8%, and the apparent (apparent) resistivity is reduced. The horizontal extent of the anomaly based on IP is between 200 and 500 meters.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY:

Kodatskyi occurrence of graphite ores.

Mineral: Graphite.

Type and period of subsoil use:
geological study, including pilot-industrial development, followed by extraction (industrial development of the deposit), 20 years.

Location: Oleksandria district of Kirovohrad region, 8 km west of the town of Petrove, 25 km southeast of the Kutsivka railway station.

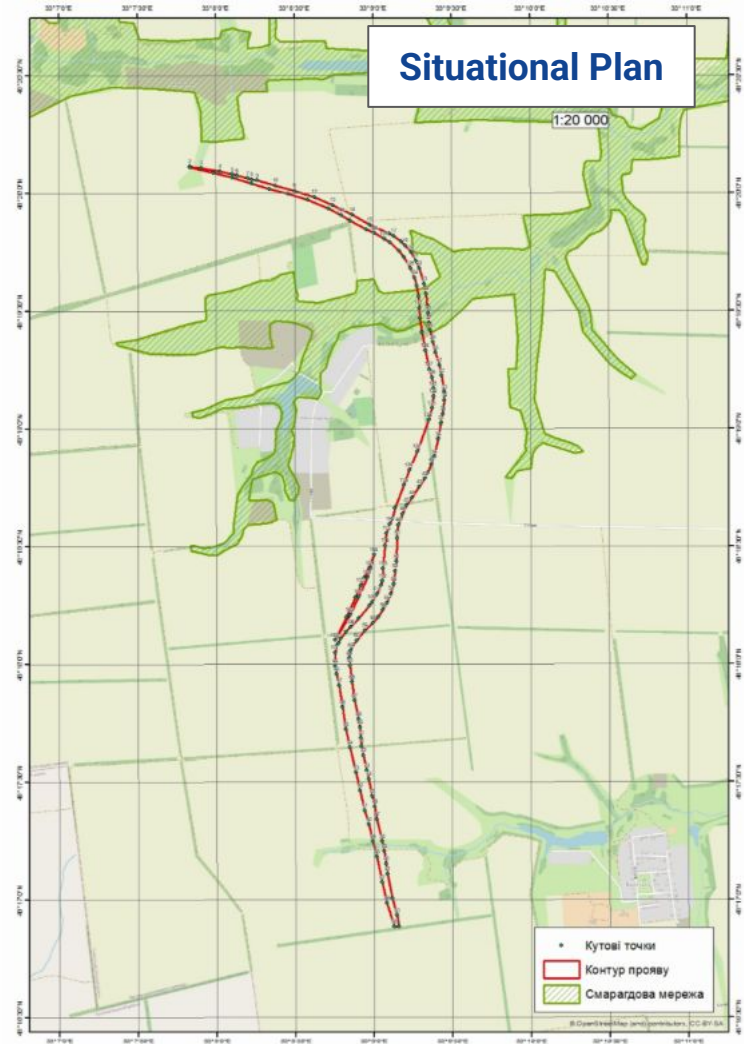
Plot area: 56.97 ha.

Reserves and Resources:		
	Reserves	Resources (P1), million tons
Graphite ores at the occurrence to a depth of 250m	-	280.5

The average content of graphite carbon:

graphite ore 4.17%

Source: Ukrainian Geological Survey



Geological information

Geological summary. The Kodatskyi ore occurrence is located within the Ukrainian Shield in the Kirovohrad Graphite-bearing District. The area has a complex tectonic structure. It represents a miogeosynclinal trough with an external (Inhulian) and an internal (Rodionivska) geosynclinal zones, separated by an anticlinorium (Dolynsko-Bokiviansky uplift), and is part of the Eastern Ukrainian geosyncline. The region's structure is fold-block in nature. The main structural elements are considered to be rigid Archean consolidated blocks of granitoids and graben-like Lower Proterozoic interblock synclines, bounded by faults of various systems, with the largest being the Western Inhulian and Spasivskyi faults. The Kodatskiy graphite deposit is associated with the western wing of the Western Inhulian graben-syncline and is localized in sedimentary-metamorphic formations of the middle substage of the Rodionivska suite of the Inhulo-Inhulian series, which rest upon granites and migmatites of the Kirovohrad-Zhytomyr complex and are overlain by loose sediments of the sedimentary cover. The crystalline rocks of the Lower Proterozoic in the section are represented, from bottom to top, by:Granites and migmatites of the Kirovohrad-Zhytomyr complex, greyish-pink and pink, fine- and medium-grained, with biotite and, locally, hornblende, containing frequent veins

Source: Ukrainian Geological Survey

of aplite-pegmatite granites; Light grey, greenish-grey, medium-grained, massive calcareous rocks consisting of calcite, dolomite, diopside, quartz, microcline, with minor amounts of phlogopite, tourmaline, monazite, with thickness ranging from 0 m in the south to 22 m in the central part; Amphibole-biotite gneisses, grey and dark grey, fine-grained, granitized, with gneissic texture, thickness variable, ranging from 0 to 33 m;The productive graphite-bearing layer, represented by dark grey, medium-grained, granitized graphite-biotite gneisses, with gneissic texture, which rest on amphibole-biotite gneisses and, where these are pinched out, directly on calcareous rocks.

The graphite is medium-flaky, filling intergranular spaces, with carbon content of the graphite ranging from 0.56% to 12.69%, averaging 4.17% across the ore body, increasing from the southern flank to the northern one. The thickness of the layer is variable both along strike and dip, ranging from 25 m to 90 m.
The maximum thickness is observed in the central part of the manifestation. Within the productive layer, barren or low-grade intercalations of graphite-biotite gneisses and aplite-pegmatite granites are noted. There are also light-grey, fine-grained, heavily quartzized pyroxene gneisses, with interlayers of biotite and graphite-biotite gneisses. The contact is gradual. The weathering crust of the crystalline rocks, the thickness of which depends on the composition of the parent rocks, ranges from 28 to 54 m. The most intense weathering has affected the graphite-bearing rocks, particularly the gneisses. Loose rocks of the sedimentary cover are represented by horizontally bedded Neogene clays and sands, as well as Quaternary loams. Sands, in the form of small, low-thickness lenses, are mainly distributed in the southern part of the deposit. The clays are greyish-green, weakly plastic, and have a relatively uniform distribution. Quaternary deposits, including pale and brown loams, are widespread throughout the site area. The total thickness of loose rocks ranges from 0 m (in the ravines) to 50 m, with an average thickness of 28 m. Tectonically, the area of the deposit is stable, and no dislocations have been identified during detailed exploration. The shape of the ore body is tabular, extending 6680 m in length, with an average horizontal thickness of 51.2 m, dipping steeply to the east at 320–500.
Mineralization of the ore manifestation, morphological features of the ore bodies, patterns of their distribution, and quality characteristics:
Graphite at the Kodatskyi ore occurrence forms several types of graphite ore:
Rare accumulations of graphite flakes of various sizes, in the form of clusters and nests about 1 cm in size. Coarse-flaky graphite is gathered into separate clusters, while fine-flaky graphite forms small nests of irregular shapes. Ores of this type are found in gneisses, calcareous rocks, quartzites, and vein formations of pegmatites and quartz;
Solid accumulations of graphite flakes of various sizes in the form of lenses, nests, thin layers, and veins of different shapes and sizes, predominantly associated with the

Source: Ukrainian Geological Survey

contacts between gneisses and igneous rocks, as well as with zones of vein formations of pegmatites and quartz. These occurrences are also found within gneissic rocks that are uniformly saturated with graphite;
Dense, uniform saturation of gneisses with individual graphite flakes; Dense, uniform saturation of rocks with bush-like accumulations of graphite and nests. This type of ore is characteristic of graphite gneisses and constitutes the main graphite ore.
The source of carbon for the formation of graphite was primarily sedimentary carbon, which is part of the carbonaceous and bituminous substances that deposited simultaneously with clayey and bituminous materials. The metamorphic transformation of the sediments and sublimation of the carbonaceous and bituminous substances occurred under the influence of the intrusion of grey Inhulian granites. Based on the size and types of relationships between graphite flakes and other minerals, two varieties of ores are distinguished: Genetically associated with gneisses, where graphite flakes, ranging from 0.1 to 0.6 mm, are closely intergrown with biotite, mostly localized within its cleavage planes; Associated with coarse-flaky fibrolites (sillimanite) - mica schists, where graphite mainly forms independent, lens-shaped aggregates 0.7-2.6 mm long and 0.2-0.4 mm wide. Partially (5%-7% of the volume), graphite is intergrown with fibrolite as small (up to 0.1 mm) isometric flakes. The relationships with micas – biotite and muscovite – are similar to those in gneisses, although here, the graphite forms larger flakes (up to 1.2-1.4 mm).

In carbonate rocks and quartzites, graphite, in amounts ranging from 1.5 to 3.5 volumetric percent, is observed in contact with graphite-bearing shales and gneisses. Often, when calcareous rocks and quartzites occur within the productive layer of gneisses and shales as separate layers, ranging in thickness from a few centimeters to 2-5 meters, they are enriched with graphite and themselves constitute varieties of graphite ores. During weathering, graphite-bearing rocks undergo varying degrees of kaolinization and mainly consist of quartz, kaolin, hydromicas, and nearly completely exposed graphite. The ore minerals and impurities characteristic of graphite ores include syngenetic pyrite, pyrrhotite, and (occasionally) chalcopyrite. Pyrite is most commonly found, forming small lenses, nests, or streaks within the cleavage planes or in close association with dark-colored minerals such as biotite, pyroxene, and amphibole. Mineralogical studies of graphite ore prototypes have shown that the graphite content in them varies (in weight percent) within the range of 1.7-15.3, biotite 12.3-36, pyrite 0.7-11.2, pyrrhotite 0.3-1.4, and chalcopyrite - present as isolated grains. Other minerals, including rutile, sphene, zircon, monazite, magnetite, and ilmenite, are present from isolated grains up to 0.8%.Determining the forms of carbon inclusion across all deposits revealed that 93%-97% of the total carbon content is attributed to graphite carbon, which enhances the quality of graphite ores. Among the graphite ores, there are barren conformable bodies of granites, quartzitic sandstones, amphibole-biotite gneisses, and carbonate rocks with graphite carbon content of less

Source: Ukrainian Geological Survey

than 2%, with thicknesses ranging from 1 to 17 meters. Barren layers with a thickness of up to 3 meters were included in the calculation of reserves up to the boundaries of the ore bodies, while those exceeding this thickness were excluded. This method is commonly used for most exploited deposits of a similar type (such as the Zavalivske deposit), which are worked by open-pit mining with a bench height not exceeding 5 meters. The thickness of the ore bodies, based on the bench carbon content of graphite at 2%, within the studied manifestation ranges from 18.0 m to 138.0 m. The average graphite carbon content within them ranges from 3.0% to 9.51%, reaching up to 22.40% in the most enriched areas based on specific samples. The ash content of graphite ores in samples ranges from 78.7% to 99.7% and is inversely proportional to the carbon content. The sulfur content varies from 0.04% to 2.86%, carbon dioxide content from 0% to 13.13%, and total iron content from 1.23% to 8.18%. Moisture content ranges from 0.1% to 2.3%, reaching its highest values in weathered ores or weathered disrupted rocks. Test pumping was performed using the bailer method on a single borehole. According to the results of the test pumping, the well yield was 0.9 m^3/hour.

Available geological information

Until 1917, the Zelenivske graphite deposit was known and developed by the private entrepreneur Kryshen. In 1925, graphite was discovered on the right slope of the Vodiana ravine. Between 1925 and 1926, this deposit was developed, and in 1928, local residents found graphite on both slopes of the Babenkova ravine. From 1928 to 1932, exploration was conducted at the Babenkivske and Vodianivske deposits by the exploration party of 'Ukrgeoltrest.' Industrial ore areas were established at both deposits, and reserves were calculated. The reserve calculations for the graphite ores at the Petrivske deposit were carried out in 1953 (by M.B. Byrchenko) and in 1957 (by T.I. Pechenina). From 1961 to 1965, during geological mapping at a scale of 1:50,000 (by M.M. Etynhof), the Balakhivske and Varvarivske graphite manifestations were discovered. The possibility of enriching graphite ores by flotation was established, and recommendations were made for further studies of the graphite-bearing rocks.

In 1976-1979, during deep geological mapping of the eastern halves of the M-36-139-A and B sheets (by V.V. Zakharov and K.F. Ryzdvyansky), the Kodatskyi complex manifestation of graphite, molybdenum, and rare earth elements was discovered.In 1979-1981, general graphite prospecting work was carried out in the Western Inhulian fault zone, where the above-mentioned manifestations were found. This work was conducted in the Balakhivska, Kodatska, Varvarivska, and Petrivska

Source: Ukrainian Geological Survey

areas. The first three areas were recommended for further detailed exploration. From 1980 to 1983, deep geological mapping of the M-36-127-A and B sheets (by A.S. Kyselov) was completed in the work area, which confirmed the continuation of the Kodatske graphite manifestation to the northwest and its connection with the Bodyanske manifestation. During 1982-1985, detailed graphite prospecting was carried out by the Kryvyi Rih Geological Exploration Expedition of the NGO 'Pivdenukrgeologia' within the Western Inhulian fault zone. As a result, an evaluation of graphite ores was conducted, and reserves were calculated for the Balakhivske deposit, while forecasted resources were estimated for the Varvarivske and Kodatskiy ore manifestations.

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR MINING:

Lypovenkivske Deposit of Polymetallic Ores

Mineral resource: Ores of nickel, cobalt, chromium

Type and term of subsoil use: mining, 20 years.

Location: Holovanivskyi district of Kirovohrad region, near the western outskirts of Lipovenke village.

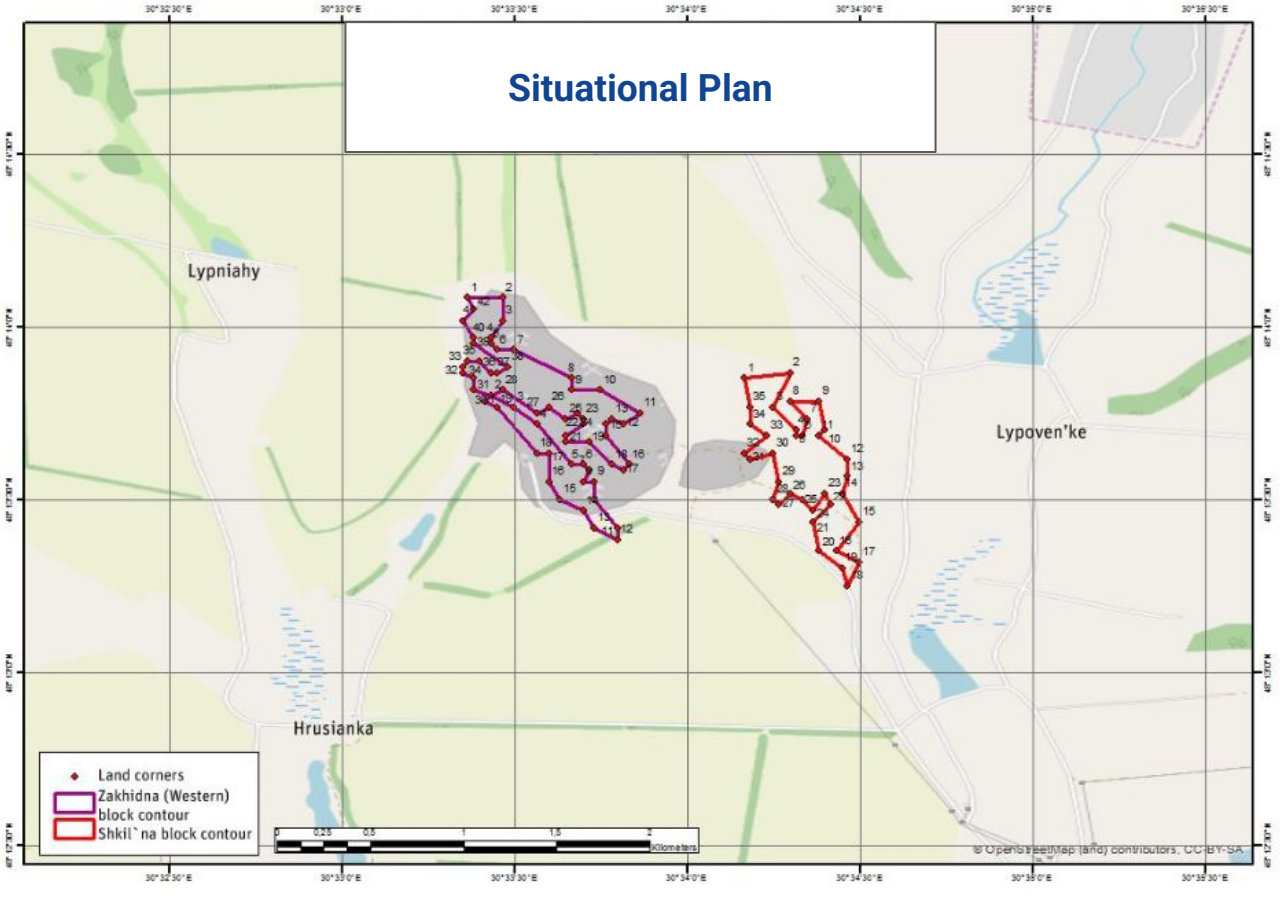
Land plot area: 42.3 hectares.

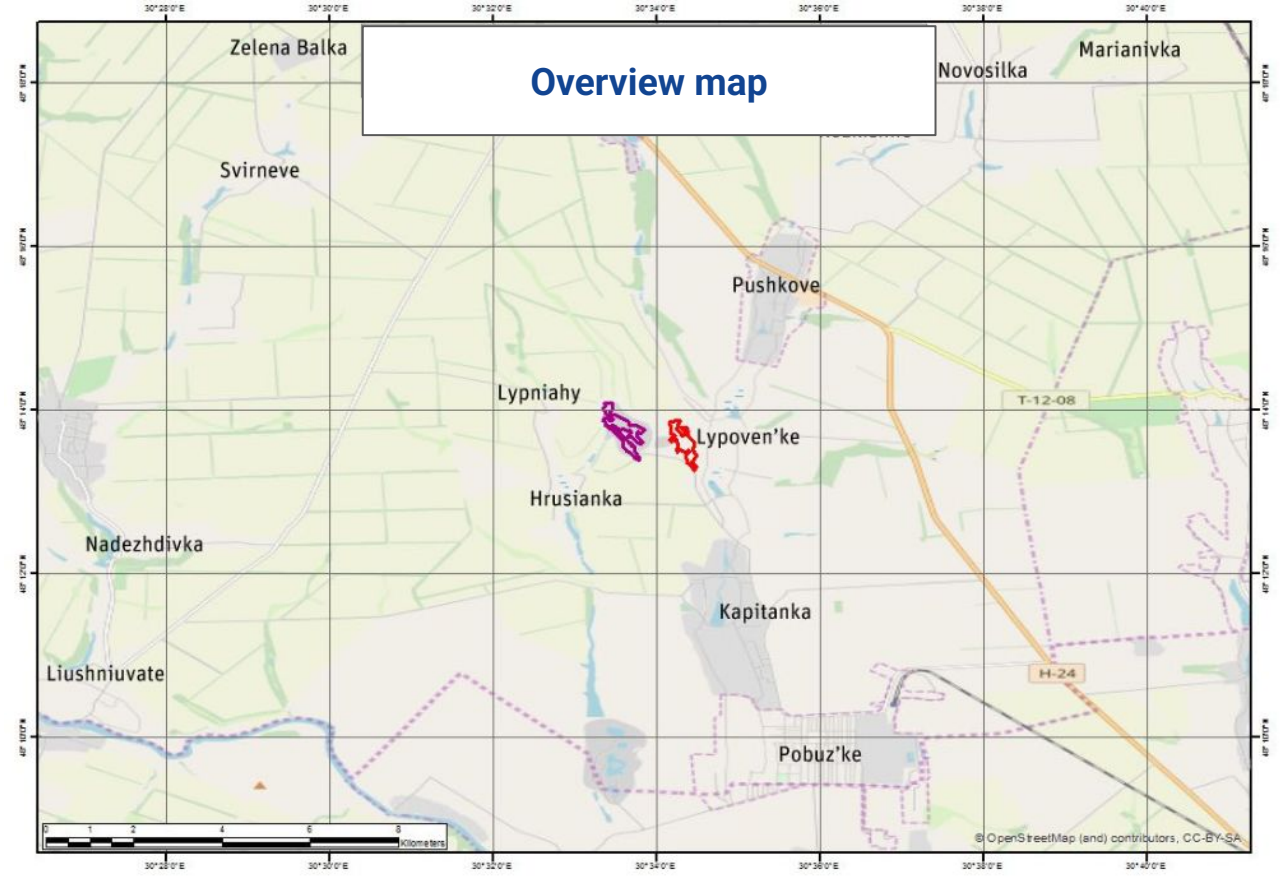
Reserves and Resources:		
	Reserves (A+B+C1)	Resources (C2+P1)
Nickel	Limited access	Limited access
Cobalt	Limited access	Limited access

Average content:

Nickel 0.86-1.09%
Cobalt 0.044-0.064%

Source: Ukrainian Geological Survey





Source: Ukrainian Geological Survey

Geological information

The field is represented by two blocks - Zakhidna (Western) and Shkil`na. The Zakhidna block is located 600 m west of Lipovenke village. Shkilna is on the right side of Mokra Derenyukha river. It is located within the southerwestern slopes of the central part in Ukrainian crystalline massif. The chromite ores of the Lypovenke field on the block are to the west of the village where the blocks of amphibolites and biotite gneisses merge together. In the Zakhidna block of chromite ores, they are represented by three deposits of massive (dense) and densely impregnated ores. Deposits have a lenticular shape. Chromite ores of Shkilna block are represented by a number of small lenticular deposits. Thickness of orebodies of polymetallic ores is up to 15 m and length is 60m –80 m. Ores are massive, dense and sparsely interspersed. Contacts are often clear, sharp, straight or tortuous, contact changes are not observed. Massive (dense) ores with an average chromium oxide content of 36.1–43% do not require enrichment. Dense ores with an average content of useful components from 22.7% to 31.1% need enrichment.

Available geological information

Exploration showed that the best indicators can be obtained by gravity. Thus, from the source ore with a content of chromium oxide 36.5% (dense ores) and 23.6% (interspersed) when grinding up to 0.16 mm, concentrates with an oxide content of 465% and 42%, respectively were obtained, the extraction is 83.9% and 73, 8%. Large portion of chromium ores is associated with residuum of ultrabasic rocks and contains nickel and cobalt in industrial concentrations. The development of cobalt + nickel ores is provided in the way of surface mining. This method will allow together with cobalt + nickel ores to extract a significant part of chromite ores which are represented by a loose variety.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Zalisi-Shmenky Area

Mineral resource: Copper Ores

Type and term of subsoil use:
Geological exploration, including pilot-industrial development, followed by extraction (commercial development of the deposit), 20 years.

Location: The western outskirts of the urban-type settlement Ratne, Kovel District, Volyn Oblast.

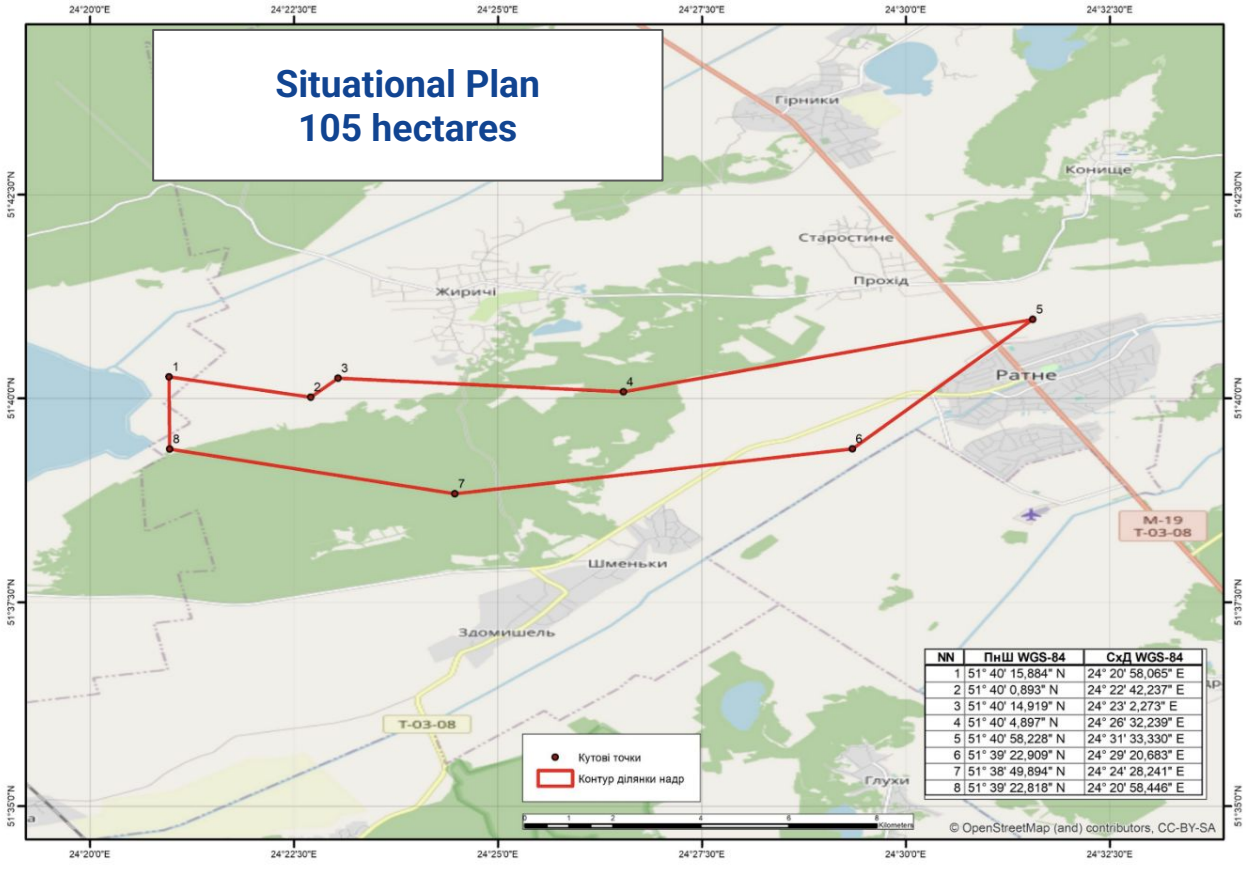
Land plot area: 2 265.9 Ha

Reserves and Resources (November 2016), Kt:		
	Reserves (A+B+C1)	Resources (P2)
Prospective resources		160,0

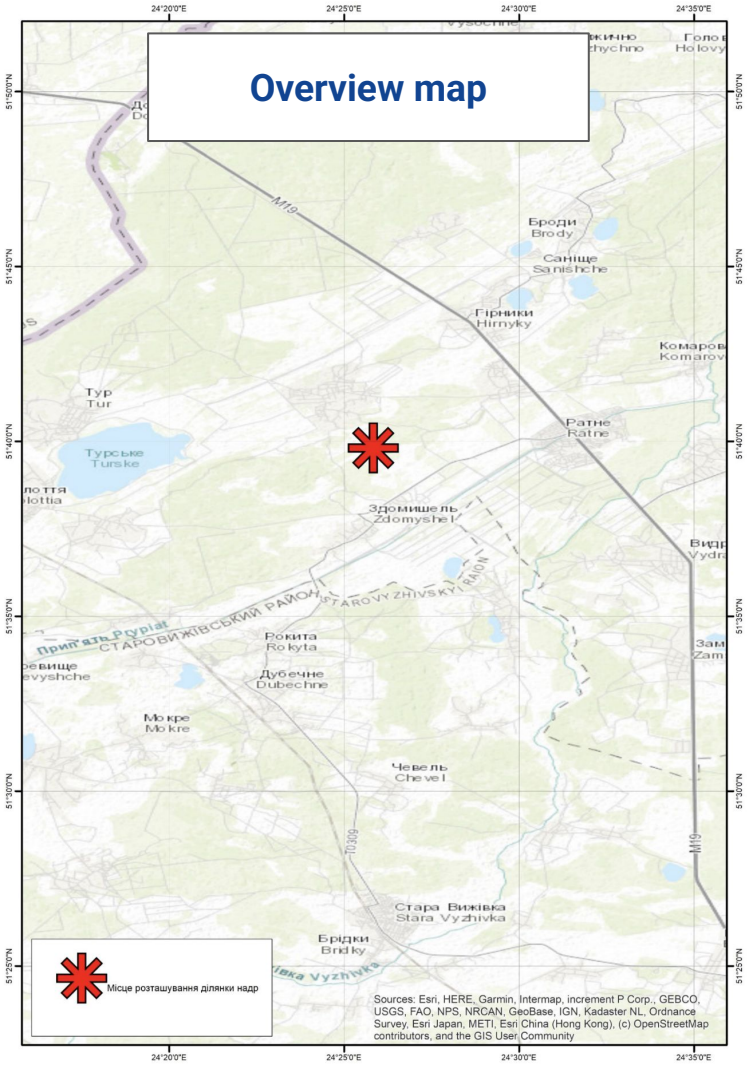
Available geological information

The copper-bearing potential of volcanites was first identified during the study of core samples from well 17-A during a comprehensive geological and hydrogeological survey at a scale of 1:200,000 conducted in 1961–1963. It was later repeatedly confirmed in other wells during various specialized copper exploration works.

Source: Ukrainian Geological Survey



NN	ПнШ WGS-84	СхД WGS-84
1	51° 40' 15,884" N	24° 20' 58,065" E
2	51° 40' 0,893" N	24° 22' 42,237" E
3	51° 40' 14,919" N	24° 23' 2,273" E
4	51° 40' 4,897" N	24° 26' 32,239" E
5	51° 40' 58,228" N	24° 31' 33,330" E
6	51° 39' 22,909" N	24° 29' 20,683" E
7	51° 38' 49,894" N	24° 24' 28,241" E
8	51° 39' 22,818" N	24° 20' 58,446" E



Source: Ukrainian Geological Survey

Geological information

The area adjoins the Zhyrychi ore occurrence from the south, which has been adopted as the reference object. The copper-bearing nature of the volcanics within the ore-bearing field is characteristic of all stratigraphic units of the Upper Horbashivka section of the Volyn series volcanics, each of which displays specific distinctive features of mineralization.

Horizon 1A is associated with the Zabolottya Suite. The upper level (1A2) is characterized by native copper mineralization, while the mineralization of level 1A1 is defined by sulfide copper, almost exclusively in the form of chalcosite. The mineralization of Horizon 1A exhibits variability in its quality indicators, with significant fluctuations in the depth to mineralized intervals (230–730 m).

Horizon 2A. The mineralization is predominantly represented by disseminated morphotypes, with occasional veinlet formations and short inclusions of native copper. Chalcosite is observed sporadically as thin films on fracture planes in association with copper. The latter often associates with magnetite, goethite, and occasionally pyrite and native iron. Copper mineralization is observed in both reddish-brown and green tuffs, with the latter and transitional brownish-green varieties of polymictic tuffs being the most productive. The average copper content ranges from 0.23% to 0.765% (up to 1.33%). Depending on the level of erosion and vertical displacements along faults, the depths of ore-hosting intervals in Horizon 2A range from 220 to 575 m.

Horizon 2B. Native copper is virtually the only copper-bearing mineral in Horizon 2B, as chalcosite is extremely rare and found in amygdaloidal basalts, not associated with native copper. In copper-hosting intervals, magnetite, hematite, and goethite are constant companions of native copper, with pyrite occasionally identified in polished sections. In some cases, native copper directly contacts magnetite without signs of corrosive interaction. The maximum copper content in individual samples reaches 1.66%, with an average of 0.657%. The depths of ore-bearing intervals are 230–620 m.

Horizon 2C is insufficiently studied. The average copper content is at the level of 0.02–0.024%.

Source: Ukrainian Geological Survey

Horizon 3A. Copper content is ≥ 0.1%. Mineralized intervals are almost always found in the first (lowermost) flow of the Luchychi basalts, often also present in the second, with exceptions of mineralization recorded in one section in the first and third flows. Copper mineralization is represented by both native copper and chalcosite, with higher copper content in intervals where mineralization is due to chalcosite compared to those characterized by native copper concentrations.

Maximum identified copper contents in Horizon 3A were 1.06% over 1.1 m (interval 468.8–469.9 m) and 0.47% over 2.1 m (interval 461.2–463.3 m). Chalcosite here is presented as dispersed inclusions among rock-forming minerals, sometimes forming solid fine-grained masses, and is also present in fracture zones of basalts in association with calcite. Occasionally, chalcosite and native copper occur together in combination with magnetite. No consistent ore bodies have been identified within this horizon yet. Increased ore potential is observed in the central and western parts of the occurrence. Mineralized intervals in this area are found at depths of 260–480 m from the surface.

Horizon 3B. Copper content occasionally exceeds 0.1%, with a maximum of 0.62% over 0.2 m. Copper mineralization is found in the most complete sections of the horizon from levels 3B1 to 3B5, but copper content above 0.1% is detected only in the lowermost basalt flow. This horizon is characterized by the occurrence of sulfide copper minerals, primarily chalcosite, alongside native copper. Chalcosite, confirmed by visual identification and polished section studies, is present together with native copper in certain borehole sections. Additionally, chalcopyrite is observed at various levels of the Yakushivka layers: Horizon 3B5, Horizon 3B1, and Horizon 3B4. However, most copper content values above 0.1% belong to intervals with native copper. In some of these, the average copper content over thickness corresponds to values characteristic of ore bodies.

The most intense mineralization trends towards the central and southwestern parts of the area of Yakushivka layers, but delineating such mineralized zones into more or less continuous specific ore bodies is currently impossible at the achieved stage of studying the copper-bearing potential of the Zalisy-Shmenky ore occurrence.

The depth to the most productive mineralized intervals in this horizon, compared to the previous one, is significantly smaller, ranging from 210 to 365 m.
An analysis of the factual data on the Zalisy-Shmenky ore field confirms a high degree of similarity in its geological structure, geologic-structural position, and ore-bearing parameters with those established at the Zhyrychi ore occurrence.

Source: Ukrainian Geological Survey

STATE GEOLOGICAL SERVICE OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Zheleznyaky iron ore prospective area with Zheleznyaky promising accumulation of polymetallic ore formation

Mineral resource: Ores of copper, nickel, cobalt, related components - platinum, palladium.

Location: Zhytomyr district, Zhytomyr region.

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production.

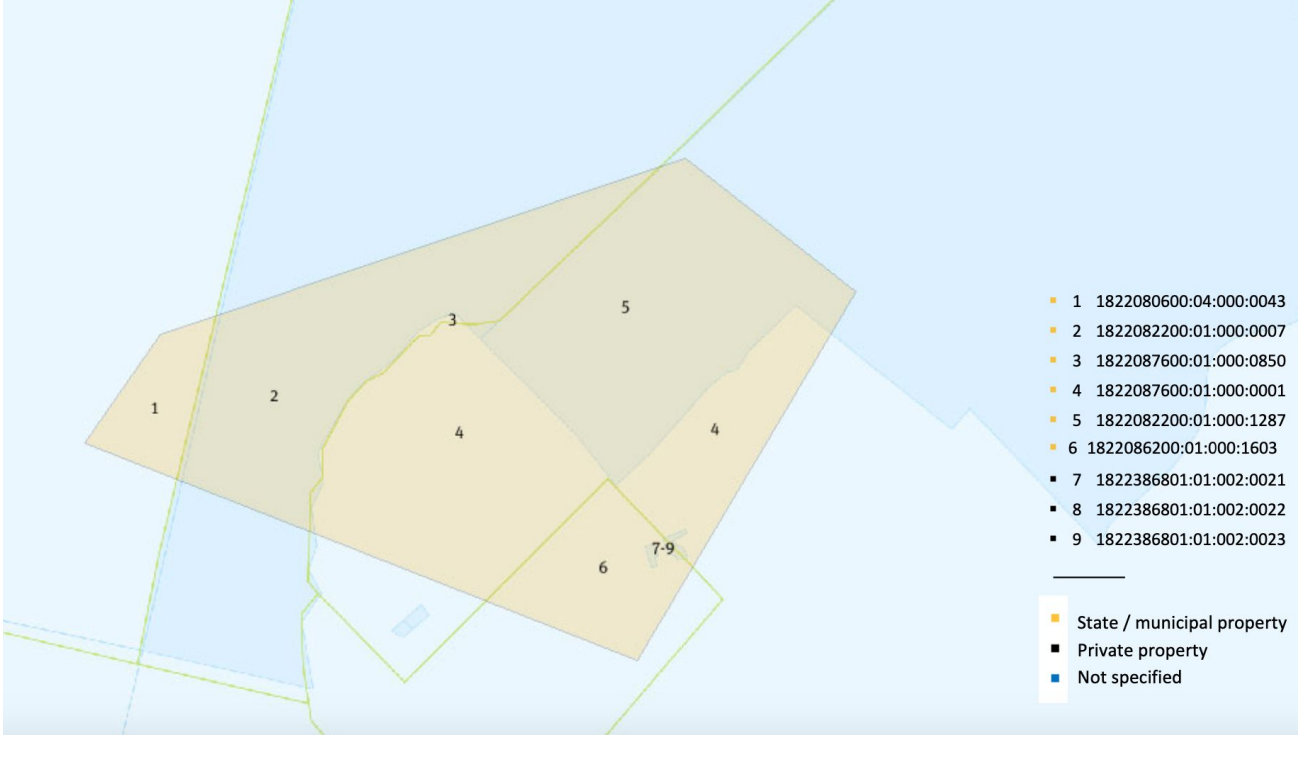
Land plot area: 290 ha.

Calculated forecast resources of metals with an average density of ultrabasites 3.05 t/м3 and reliability factor 0.5 by category P3, Kt		
Iron ore promising accumulation consists, Kt	Reserves (A+B+C1)	Resources (P3)
nickel		150.9
copper		14.4
cobalt	-	3.0
platinum and palladium resources		Limited access

Average content:
Nickel 0.66%
Copper 0.063%
Cobalt 0.013%

Source: Ukrainian Geological Survey

1	50°09'20"	28°21'58"
2	50°09'41"	28°23'36"
3	50°09'25"	28°24'08"
4	50°08'41"	28°23'27"
5	50°09'07"	28°21'44"



Source: Ukrainian Geological Survey

Geological information

Geological summary. This massif belongs to the chamber-differentiated type and is composed of Bukynskyi complex rocks. Within the Iron ore promising accumulation according to the test data, there are two ore intervals with a thickness of 3.5 and 2.0 m. The weighted average content of nickel is 0.66% of a total thickness of 5.5 m, copper - 0.063% and cobalt - 0.013%. The thickness of orebody is 5.0 m that is usually the average for deposits of this genetic type. The content of related components is actual (Pt 0.31 g/t and Pd 0.83 g/t) that is typical for ordinary sulfide copper-nickel ores. Predicted geological_industrial type of deposit - sulfide-copper-nickel. In terms of formation, the rocks compared with the intrusions of the nickel-bearing peridotite-pyroxenite-gabronorite formation. The iron ore massif has an irregular oval shape slightly elongated in the north-eastern direction. Its size is 1.0x1.8 km and in section it is an asymmetric funnel-shaped body with relatively sloping (45-50°) north-eastern and eastern contacts, which are immersed in intrusion and western, falling in the north-western direction towards the Bukynsky massif. Contacts of rocks of the massif with the accommodating migmatites of the Kirovograd-Zhytomyr complex are clear and intrusive. The array is composed of basic and ultrabasic rocks of the Bukin complex, clearly differentiated and stratified. The geological structure of the massif consists of peridotites, pyroxenites and gabbronorites.

Available geological information

Iron ore massif was found in the south-eastern exocontact zone of the Bukynskyi pluton as a result of deep geological mapping at a scale of 1:50000 in the period of 1985–1990. Within the iron ore massif copper-nickel promising accumulation was revealed that was explored by a single well #66. Ore formation is associated with olivine-containing pyroxenites (lercolites) developed in the northeastern part of the massif.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR EXPLORATION AND EXTRACTION:

Dobra block of lithium ores.

Mineral resource:
Lithium ores; accompanying minerals – tantalum ores, niobium ores, beryllium ores, rubidium ores, tin ores, cesium ores.

Location: Novoukrainskyi district of Kirovograd region.

Type and term of subsoil use:
Exploration and extraction, 50 years.

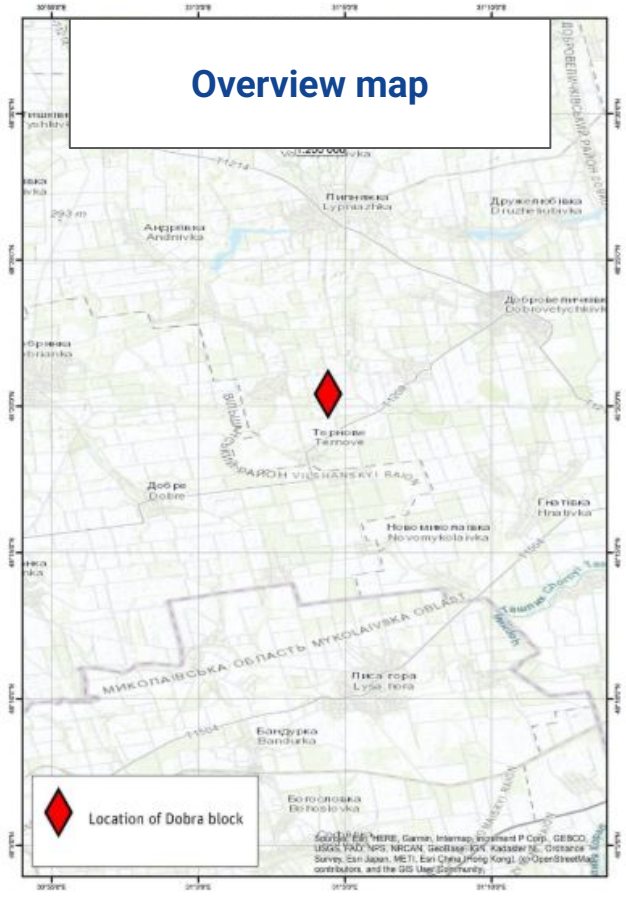
Land plot area: 1,707 ha

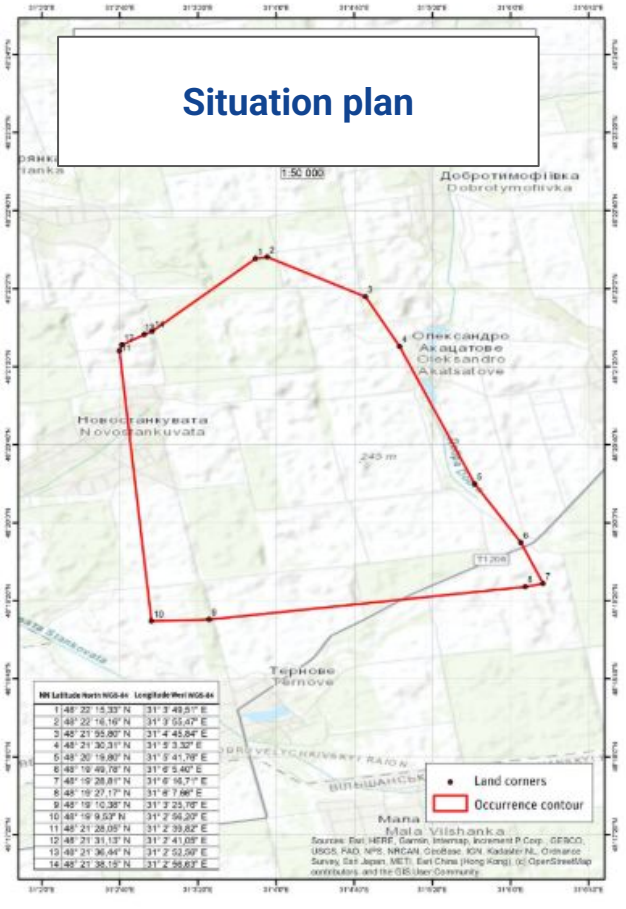
Reserves and Resources (2018), Kt:		
	Reserves (A+B+C1), Kt	Resources (P1 + P2), Kt
Lithium ores	-	1,288.7 (1,218.1 + 70.6)

Average content

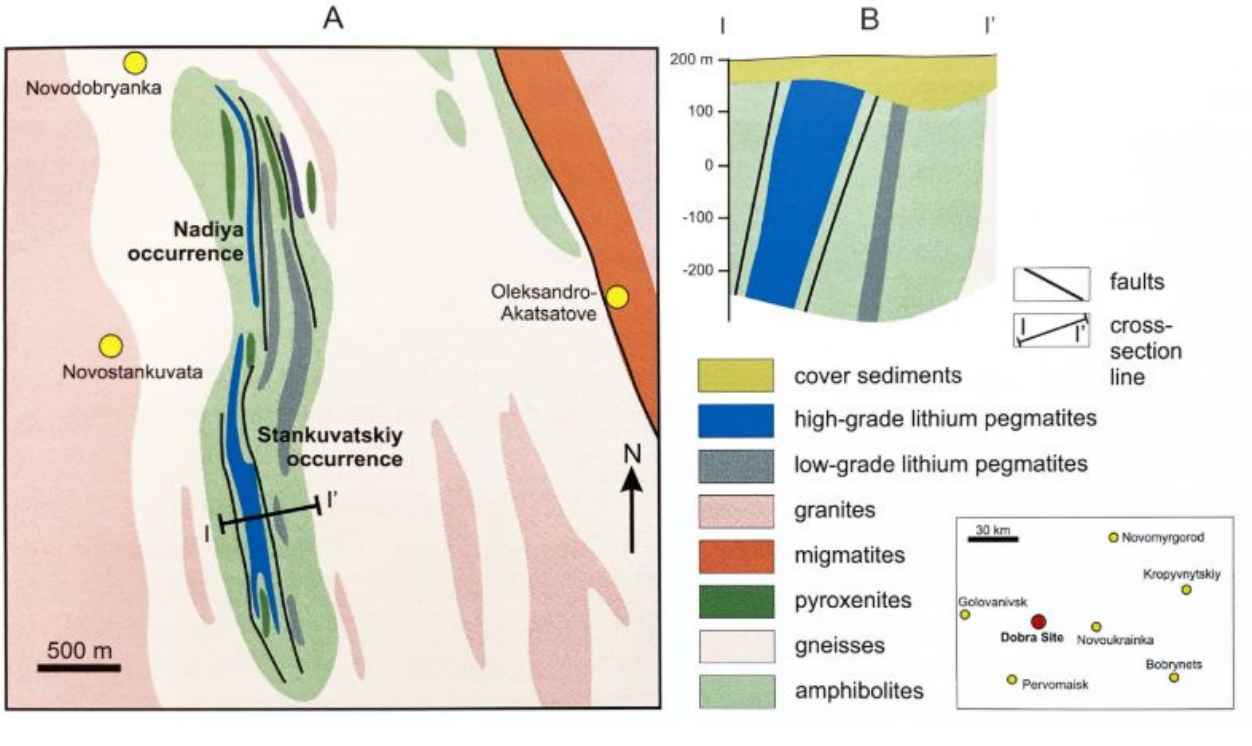
Li2O 1.37 - 1.43%

Source: Ukrainian Geological Survey





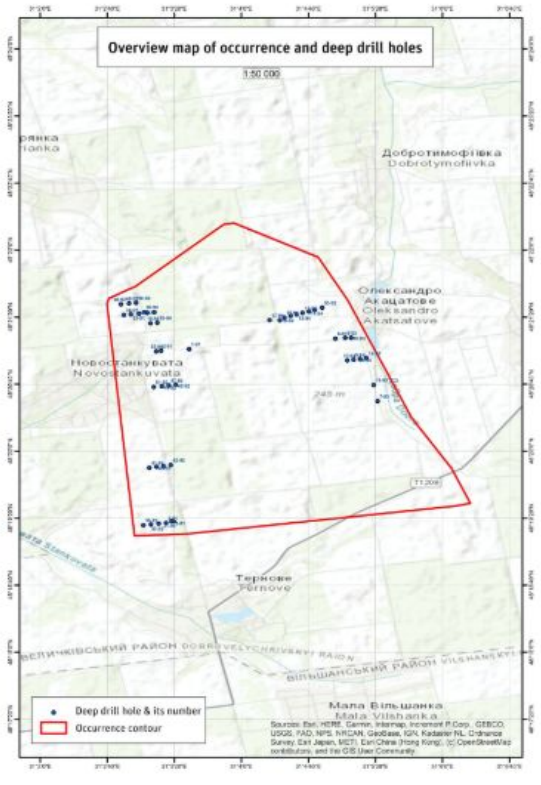
Geological map



Geological map (A) and cross-section (B) of the Dobra Site

Source: Ukrainian Geological Survey

Drill holes location



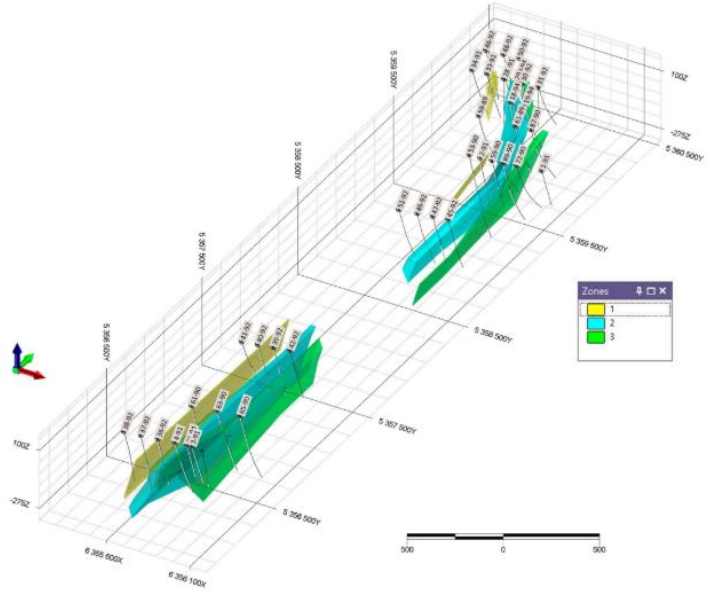
No.	Hole ID	Latitude North WGS-84	Longitude North WGS-84
1	53-90	48° 20' 59,5"	31° 3' 9,2"
2	1-91	48° 21' 0,8"	31° 3' 28,9"
3	2-91	48° 20' 59,8"	31° 3' 12,1"
4	3-91	48° 19' 18,0"	31° 3' 19,7"
5	4-91	48° 19' 17,1"	31° 3' 15,2"
6	32-91	48° 21' 22,1"	31° 2' 59,0"
7	33-91	48° 21' 21,6"	31° 2' 54,0"
8	34-91	48° 21' 21,2"	31° 2' 50,0"
9	36-92	48° 19' 16,7"	31° 3' 10,7"
10	37-92	48° 19' 16,2"	31° 3' 6,1"
11	38-92	48° 19' 15,7"	31° 3' 1,6"
12	39-92	48° 19' 51,0"	31° 3' 13,5"
13	40-92	48° 19' 50,5"	31° 3' 9,4"
14	41-92	48° 19' 50,0"	31° 3' 5,1"
15	42-92	48° 19' 51,6"	31° 3' 17,9"
16	43-92	48° 21' 22,4"	31° 3' 3,9"
17	44-92	48° 21' 22,8"	31° 3' 8,2"
18	45-92	48° 20' 39,6"	31° 3' 20,8"
19	46-92	48° 21' 27,6"	31° 2' 48,2"
20	47-92	48° 20' 39,2"	31° 3' 16,7"
21	48-92	48° 21' 28,1"	31° 2' 53,0"
22	49-92	48° 20' 38,8"	31° 3' 12,6"
23	50-92	48° 21' 28,5"	31° 2' 57,2"
24	51-92	48° 20' 38,2"	31° 3' 7,7"
25	52-92	48° 21' 24,3"	31° 4' 43,8"
26	53-92	48° 21' 25,6"	31° 4' 48,3"
27	7-93	48° 20' 29,8"	31° 5' 21,4"
28	8-93	48° 21' 7,2"	31° 4' 56,2"
29	9-93	48° 21' 7,6"	31° 5' 2,0"
30	10-93	48° 21' 7,6"	31° 5' 5,5"
31	11-93	48° 20' 39,4"	31° 5' 19,1"
32	12-93	48° 20' 55,6"	31° 5' 14,6"
33	8-94	48° 20' 55,0"	31° 5' 10,8"
34	9-94	48° 20' 54,5"	31° 5' 7,0"
35	10-94	48° 20' 54,0"	31° 5' 3,2"
36	11-94	48° 21' 23,3"	31° 4' 40,4"
37	12-94	48° 21' 22,4"	31° 4' 36,6"
38	13-94	48° 21' 21,5"	31° 4' 33,0"
39	14-94	48° 21' 20,6"	31° 4' 29,4"
40	15-94	48° 21' 19,7"	31° 4' 25,7"
41	16-94	48° 21' 18,0"	31° 4' 23,0"
42	17-94	48° 21' 18,1"	31° 4' 16,8"
43	18-94	48° 21' 16,3"	31° 3' 5,8"
44	19-94	48° 21' 16,6"	31° 3' 9,9"
45	20-94	48° 21' 22,9"	31° 3' 2,0"
46	21-94	48° 19' 18,1"	31° 3' 18,4"

Grade of mineral commodities in the ore

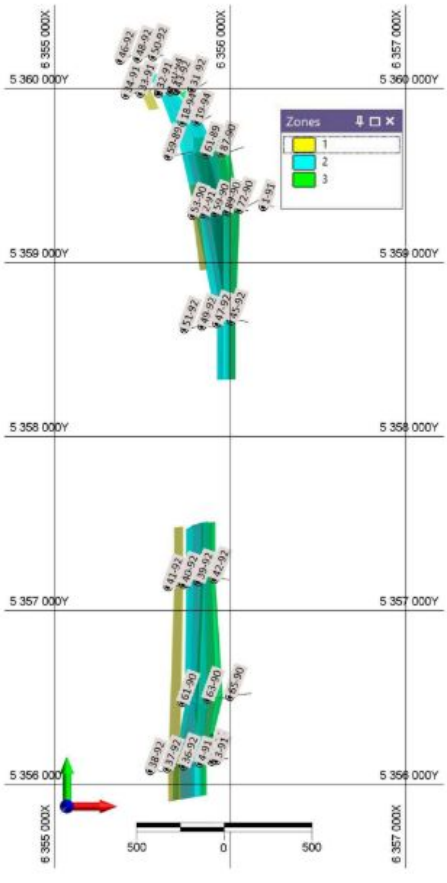
No.	Drill hole No.	Grade								
		% Li_2O	% Ta_2O_5	% WO_3	% Rb_2O	% Nb_2O_5	% Cs_2O	% BeO	% SnO_2	g/t Au
1	53-90	1,0799	0,0122		0,8800	0,0148	0,0178	0,0124		
2	2-91	1,0932	0,0146		0,1500	0,0087	0,0034	0,0092	0,0040	
3	3-91		0,0110	0,1260						
4	4-91	1,1000	0,1090	0,1260	0,0895	0,0096	0,0038	0,0156	0,0053	
5	32-91	0,9747	0,0127		0,1453	0,0120	0,0172	0,0214	0,0014	1
6	33-91	1,6956	0,0146		0,0325	0,0143	0,0152	0,0112		
7	34-91		0,0113							1
8	36-92	1,3400	0,0101		0,0784	0,0080	0,0032	0,0116	0,0031	
9	37-92	1,5900	0,0041	0,1260	0,0868	0,0059	0,0059	0,0061	0,0215	
10	39-92	1,5146	0,0171	0,1260	0,0921	0,0034	0,0185	0,0138	0,0022	
11	40-92	1,2565	0,0159		0,1058	0,0050	0,0027	0,0129	0,0038	
12	41-92	1,1700	0,0046		0,1010	0,0090	0,0104	0,0116	0,0025	
13	43-92	1,2033	0,0106		0,0868	0,0126	0,0053	0,0133	0,0093	
14	44-92	1,4605			0,1335	0,0096	0,0045	0,0156	0,0054	
15	45-92		0,0128							
16	47-92	1,4869			0,1080	0,0054		0,0121		
17	48-92		0,0124							
18	50-92		0,0212							
19	8-93			0,1260						
20	12-93									2
21	10-94			0,3150						
22	14-94			0,2020						
23	18-94	1,4713	0,0117		0,0887	0,0099	0,0060	0,0229	0,0081	
24	19-94	1,6671			0,1206	0,0071	0,0056	0,0343	0,0086	
25	20-94		0,0104							
26	21-94		0,0085	0,1260						

Source: Ukrainian Geological Survey

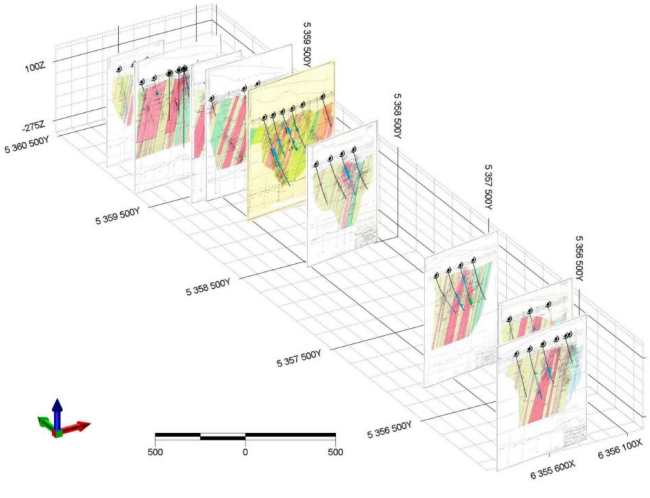
3D models of the mineralization zones



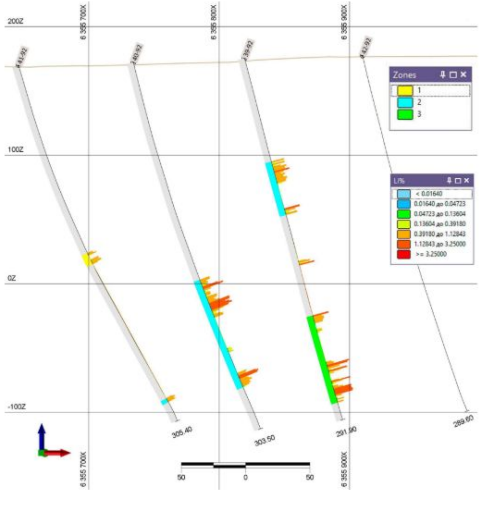
Models of the mineralization zones



3D geological cross-sections



18+60 geological cross-section, sampling data



Source: Ukrainian Geological Survey

Geological information

Geotectonically the object is located in the western part of the Kirovohrad mega block of the Ukrainian Shield within the Bratskyi composite syncline of the Early Proterozoic Era. The prospective field is confined to the Mykhailivka tectonic-metasomatic zone, which is a component of the Zvenigorod-Hannivka fault zone and borders the western part of the Lipnyazkyi granite dome. The Dobra block is located within the Stankuvatsky ore field of the Central Ukrainian (Shpolyansko-Tashlytsky) rare metal district. Pegmatites, which make up the productive ore zones of both prospective fields, belong to the sodium-lithium type. The metallogenic treбnd of Stankuvatsky and Nadiya prospective areas is determined by lithium, tantalum, gold, and tungsten. Often ore mineralization of different elements is spatially combined, therefore the discovered prospective object is complex. The Stankuvatsky prospective field combines the whole range of basic elements inherent in the Mykhailivska zone - lithium, tantalum, gold and tungsten. The spatial combination of lithium and tantalum ore formation is peculiar to Nadiya prospective field. The mineral of the block is represented by lithium ores podumen-petalite mineral composition (useful component - lithium). Productive ore zones of Nadiya and Stankuvatske prospective fields are vein zones of sodium-lithium pegmatites deposited in amphibole crystalline shales. The basement rocks are overlain by loose terrigenous deposits of the Meso-Cenozoic platform cover and weathering crust. The Stankuvatsky prospective field is traced for a stretch of 2 km by 6 profiles of deep wells. In its northern part it is studied by a grid of wells with a density of 350-200 x 200-100 m, in the central and southern part - 650-600x260-100 m. The host rocks are represented by amphibolites and gneisses. Lithium ores are represented by rare metal pegmatites with petalite, spodumene, triphylline, less often hillmquistite and amblygonite. Petalite predominates among ore minerals. The average content of lithium oxide in ores is 1.30%. The amount of lithium minerals in ores varies from 1-2% to 85%, on average 30-40%. The following types of ores are distinguished by the predominant lithium mineral: petalite - 32% of the total amount, spodumene - 28%, spodumene-petalite - 17% and petalite-spodumene - 23%. There are no patterns of different types placement. Mixed type prevails. Petalite ores form areas of rocks with a trunk thickness of the first to tens of meters. Lithium is associated with petalite (16-48.6%), spodumene (13.6-76%), and trifillin (3.2-8%). Lithium ores of prospective field are formed by three ore zones. Nadiya prospective field is traced for 2.1 km by 4 profiles of deep wells drilled on a grid of 800-680 x 200-130 m in the north and 370-310 x 250-100 m in the south of the ore occurrence. The productive stratum is 1,600 m in length, horizontal span 340-390 m. Lithium minerals are represented by spodumene, petalite, triphylline, less often by amblygonite and holmquistite.

Source: Ukrainian Geological Survey

Predominant is predominant. The average content of lithium oxide in ores is 1.31%. Container rocks are also represented by amphibolites and gneisses. According to the complexity of the geological structure, the block of lithium ore Dobra is classified as a deposit of complex geological structure (group 2) in accordance with the Classification of reserves and resources of minerals of the State fund of mineral reserves. Mining and geological operating conditions are characterized by a steep fall and depth of ore deposits. Significant thickness of overburden (up to 80 m) determines the choice of underground method of field development.

Available geological information

Stankuvatskyi and Nadiya lithium ore were discovered by #47 expedition of Kirovgeologiya SE in 1989 during exploration at a scale of 1:50 000 for gold and liquid metals. In 1991-2001, during prospecting lithium and gold deposits at a scale of 1:25 000-1: 10 000. In 2017, by the decision of the State Commission on Mineral Reserves of Ukraine (#4142 protocol as of November 1, 2017), the Nadiya and Stankuvatske ore were united into one ore zone - Dobra block. Calculation of lithium ore reserves of the C2 category (class code 122) of the Stankuvatsky ore strike of the Dobra site itself is based on well data - well number (Li2O content): No. 32-91 (0.9747%); 18-94 (1.4713%); 19-94 (1.6671%); 43-92 (1.2033%); 59-89 (1.4317%); 61-89 (Li2O 1.1421%). The calculation of lithium ore resources of categories P1 (class code 333) and P2 (class code 334) of the Dobra site itself is based on well data - well number (Li2O content): 33-91 (1.6956%); 53-90 (1.0799%); 41-92 (1.17%); 37-92 (1.6864%); 2-91 (1.0932%); 59-90 (1.5294%); 39-92 (1.5146%); 36-92 (1.34%).

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION, PILOT DEVELOPMENT AND PRODUCTION:

Verbynske prospective area

Mineral resource: molybdenum ores

Type and term of subsoil use:
20-years licenses for exploration, pilot development and production

Location: Olevsk district, Zhytomyr region, 33 km east of the Olevsk railway station

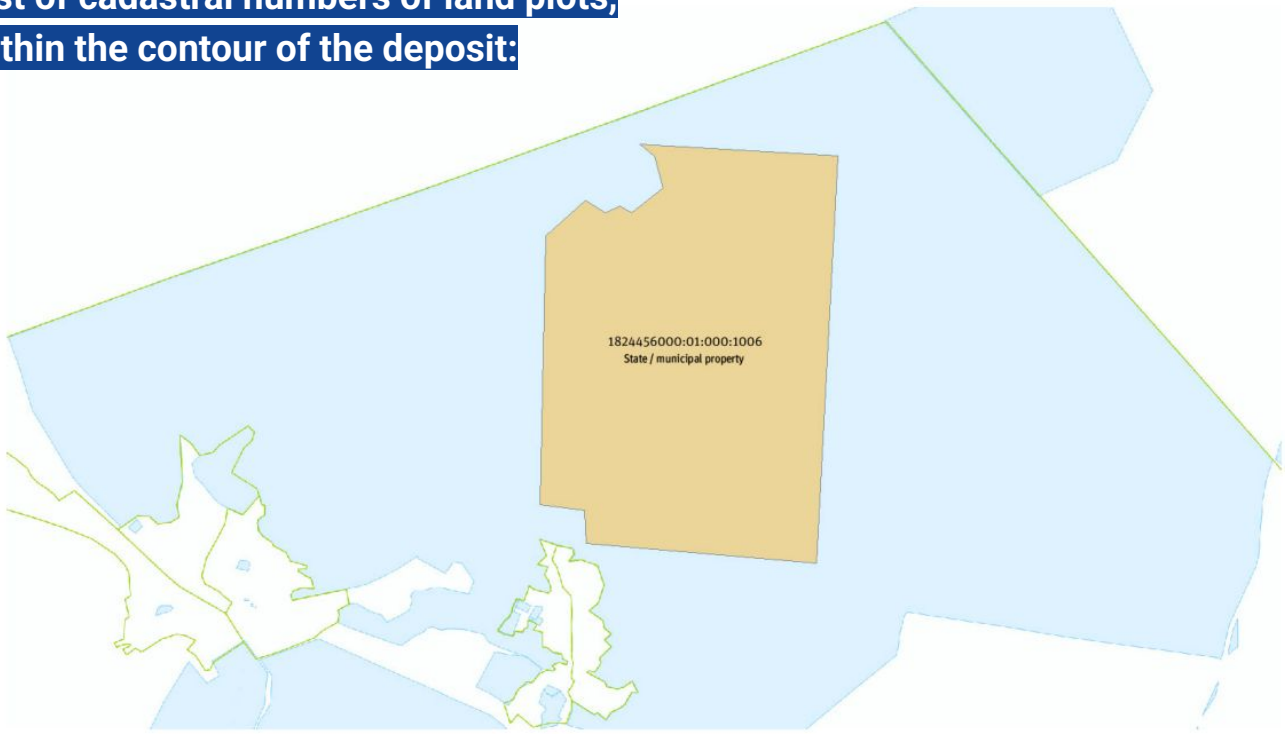
Land plot area: 289.8 hectares.

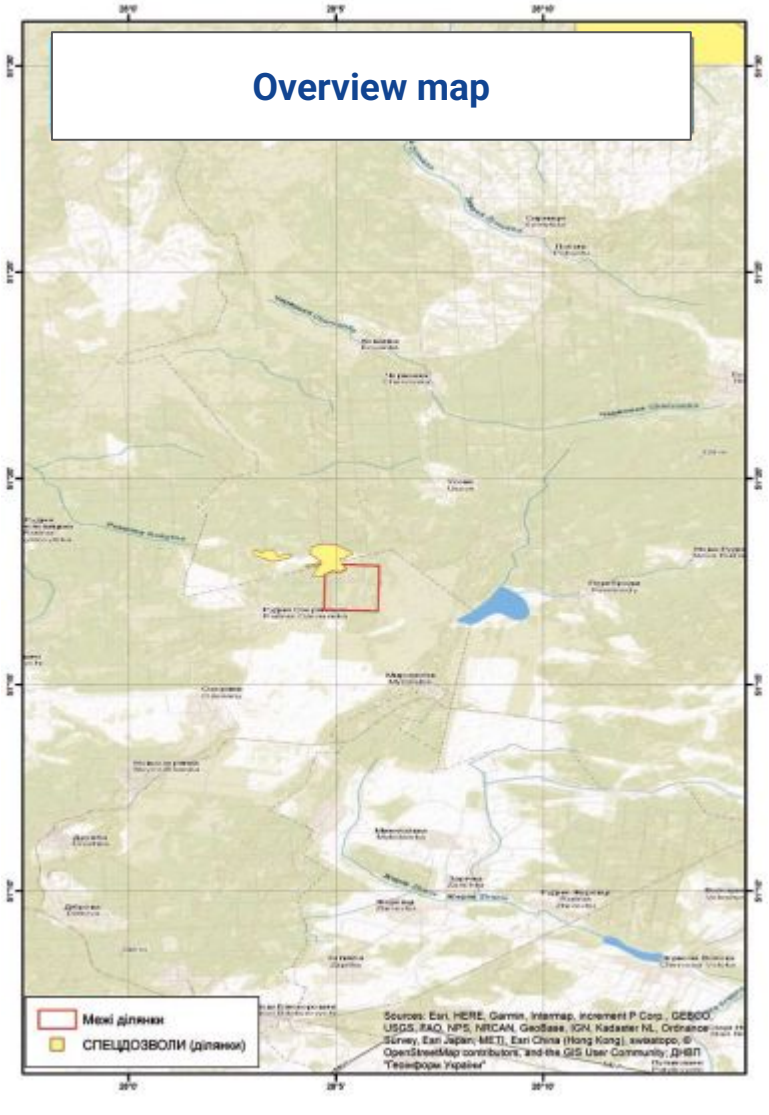
Reserves and Resources (December 2002), Kt:		
	Reserves (A+B+C1), Kt	Resources (C2+P1), Kt
Molybdenum Ore		1,883.1 (1,.792.9+ 90.2)
Molybdenum Metal		8.43 (5.68 + 2.75)

Average content:
Molybdenum 0.3041%

Source: Ukrainian Geological Survey

List of cadastral numbers of land plots, within the contour of the deposit:





Source: Ukrainian Geological Survey

Geological information

The Verbynske ore promising accumulation is a part of the Ustynivskyi contingent ore area. It is located within the North-Western edging of the Korosten pluton, and is confined to the Central Korosten break zone in the eastern endocontact of the Ustynivsky granitoid massif, where it is combined with the western side of Ovruch and the northern closure of Bilokorovytska cavity.

In the Verbynske area, groundwater belongs to the aquifers of the weathering zone and fractures of crystalline rocks of the crystalline basement and loose rocks stacked on top of sand, and at the bottom a flint with a sand filler.

Molybdenum mineralization is associated with a small intrusion of granites of moderate depth, composed of granite porphyries in its apical part and medium-grained weakly porphyritic in the root part.

Available geological information

Distribution area of molybdenum mineralization in the Verbynske area is an area of 1x2 km (2 km2). Its concentration ranges from particles to 5-10%. Molybdenite is the leading ore mineral of ore-bearing granitoids of the Verbynske ore promising accumulation. In addition, a number of related components were identified - bismuth, silver, tin, lead and zinc, copper, fluorite. Within the ore promising accumulation, 7 blocks containing 16 ore bodies have been identified. The thickness of ore bodies is from 0.2 m to 18.6 m, 2.4 m on average. The molybdenum abundance is 0.13–2.0115%, the average is 0.3041%. Ore bodies are mostly steeply dipping. The angle of inclination is from 28° to 75°, the average - 55°. Verbyn ore promising accumulation can be exploited both in open and underground ways. Though positive consequences of development are expected from the underground method of exploitation.

Technical and economic indicators are determined by calculating stocks with a cutoff - 0.005%; 0.01%; 0.015%; 0.02%; 0.03% and 0.04%, with a ore coefficient for the open mining and with an cutoff of 0.04% for underground mining. The shape of ore bodies is mostly simple, plate-like, rarely complex with bulges up to 18.6 m with separate branching. The length of ore bodies downdip is from 40 to 285 m, the average - 160 m.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Sukhokhutirska Area of Talc-Magnesite and Polymetallic Ore

Mineral resource: talc-magnesite, nickel, cobalt ores

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production

Location: Krynychky district, Dnipropetrovsk region, 15 km southwest of the village of Krynychka, on the outskirts of Lozuvatske village

Land plot area: 127.6 hectares.

Reserves and Resources, Kt		
	Reserves (A+B+C1), Kt	Resources (C2+P1), Kt
Talk-magnesite ores		240,427.0
accompanying:		
nickel		72.96
cobalt		4.77
iron		1,420.2

Average content:

Nickel - 0.2 - 2.0%
Cobalt – 0.055%
Iron – 24.3%

Source: Ukrainian Geological Survey

List of cadastral numbers of land plots:

Information on land plots, in particular by cadastral number, can be obtained on the Public Cadastral Map of Ukraine:
https://cutt.ly/Fx0CuBg

- State / municipal property
- Private property
- Not specified

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15. 1222055100:01:002:0260
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37. 1222055100:03:035:0394
38. 1222055100:03:035:0395
39. 1222085500:02:001:0028
40. 1222085500:02:002:0217
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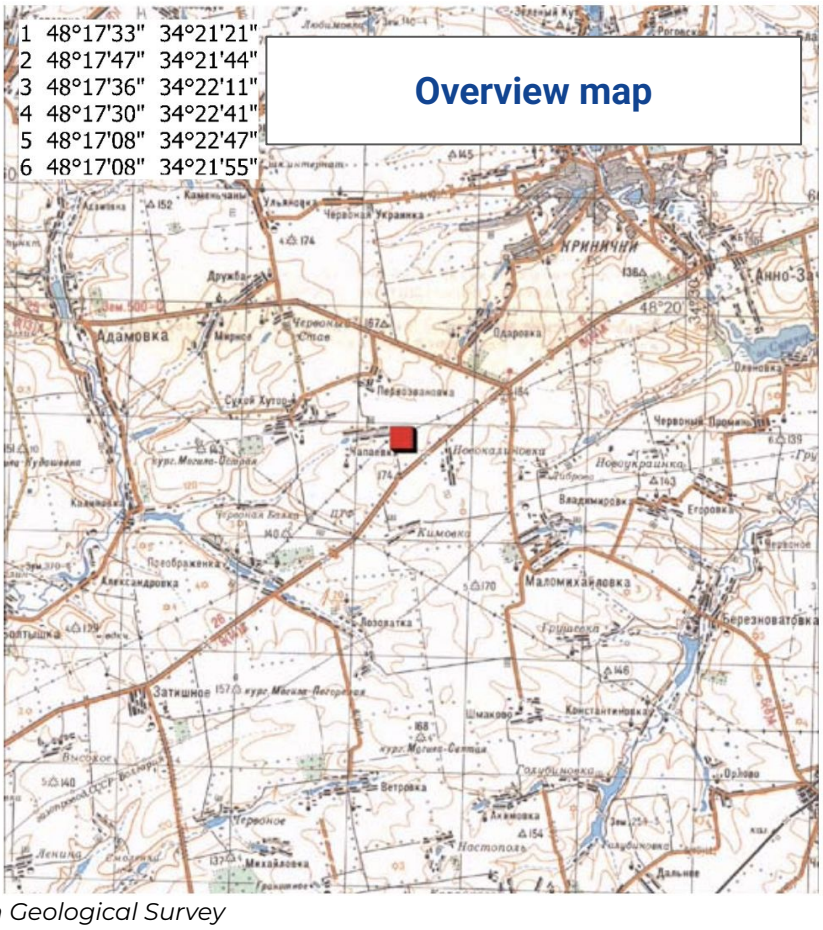
42. 1222055100:03:035:0396
43. 1222085500:02:001:0043
44. 1222055100:01:002:0276
45. 1222055100:01:002:0279

1 48°17'33" 34°21'21"
2 48°17'47" 34°21'44"
3 48°17'36" 34°22'11"
4 48°17'30" 34°22'41"
5 48°17'08" 34°22'47"
6 48°17'08" 34°21'55"

Overview map



Source: Ukrainian Geological Survey

Geological information

In the geological structure of the Sukhokhutirska block lay Archean talc-magnesite ores (minerals) with a thickness of 15.0 to 82.0 m, Mesozoic-Cenozoic weathering crust with an average thickness of 23.9 m and Neogene-Quaternary clay rocks (overburden) with an average capacity of 32.5 m. The weathering crust of serpentinites and talc-magnesite rocks of the block is characterized by the content in the ores of nickel (content from 0.2 to 2.0%), cobalt (average content of 0.055%), iron (average content of 24.3%) and silica.

Available geological information

Field work on Sukhokhutirska area was carried out in the period 2004–2009 by a research group of the Kharkiv Complex Geological Party of “Pivdenukrgeologiya”. Laboratory researches were carried out by ME "Pivdenukrgeologiya", laboratory technological researches were carried out by the Ukrainian Institute of Refractories, radiological assessment of raw materials was performed by Kharkiv SES. The chemical composition of the ores of the Sukhokhutirska area is almost indistinguishable from the ores of the Pravdyn field. According to the results of laboratory studies, the content of MgO in the talc-magnesite ores of the site is 37.59%, SiO2 - 30.34% (MgO / SiO2 - 1.26), CaO and Al2O3 - less than 2.0%, which meets the industry quality requirements for refractory raw materials. Laboratory and technological studies have established the suitability of talc-magnesite ores after pre-firing at a temperature of 1580°C and with an impurity of 30%, periclase as a raw material for the forsterite refractories brand F1 manufacturing. According to the value of the total specific activity of natural radionuclides, talc-magnesite ores belong to the first class (14.7 Bq/kg). The average thickness of talc-magnesite ores (discovered by wells) is 42.6 m. The depth of the mineral varies from 42.0 m to 89.5 m, the average - 60.4 m. The average thickness of overburden is 56.4 m, including 23.9 m of weathering crust. The volume weight of the ore is 2.8 g / m3.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL STUDY, INCLUDING EXPLORATION AND PRODUCTION LICENSE OF SUBSOIL DEPOSITS:

Yuriivska block of gold ore

Mineral resource: gold ore.

Type and term of subsoil use:
20-years licenses for exploration, pilot development and production.

Location: Kropyvnytskyi district of Kirovohrad region, the southern outskirts of Zelene village.

Land plot area: 163.6 ha.

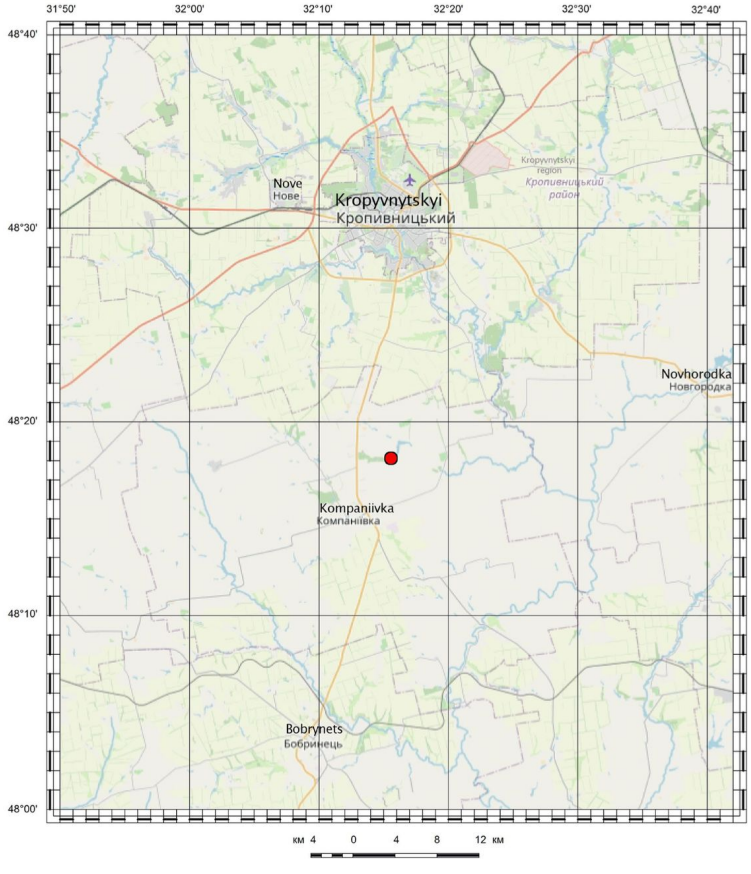
Contingent gold resources of the block are estimated as: category, tons		
	Reserves (A+B+C1)	Resources (P1+P2)
gold		12.3 (1.7+10.6)

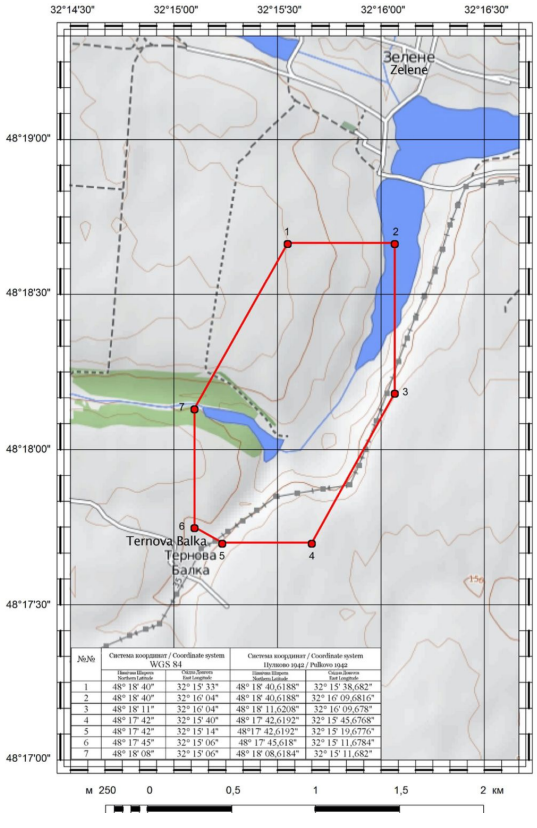
Average gold content:

The weighted average gold content in sections is 9,2 g/t

Source: Ukrainian Geological Survey

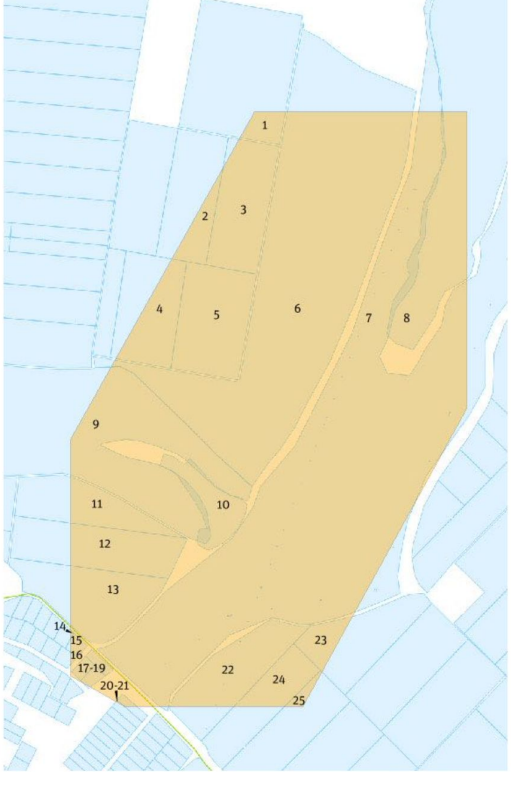
Overview map





№№	Система координат / Coordinate system WGS 84		Система координат / Coordinate system Пулково 1942 / Pulkovo 1942	
	Північна широта Northern Latitude	Східна довгота East Longitude	Північна широта Northern Latitude	Східна довгота East Longitude
1	48° 18' 40"	32° 15' 33"	48° 18' 40,6188"	32° 15' 38,682"
2	48° 18' 40"	32° 16' 04"	48° 18' 40,6188"	32° 16' 09,6816"
3	48° 18' 11"	32° 16' 04"	48° 18' 11,6208"	32° 16' 09,678"
4	48° 17' 42"	32° 15' 40"	48° 17' 42,6192"	32° 15' 45,6768"
5	48° 17' 42"	32° 15' 14"	48°1 7' 42,6192"	32° 15' 19,6776"
6	48° 17' 45"	32° 15' 06"	48° 17' 45,618"	32° 15' 11,6784"
7	48° 18' 08"	32° 15' 06"	48° 18' 08,6184"	32° 15' 11,682"

List of cadastral numbers of land plots



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- 11 3522883000:02:000:1583
- 12 3522883000:02:000:0582
- 13 3522883000:02:000:0581
- 14 3522883000:53:000:0061
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- 16 3522883000:53:000:0003
- 17 3522883000:53:000:0063
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- 23 3522883000:02:000:0424
- 24 3522883000:02:000:2427
- 25 3522883000:02:000:0428

State / municipal property
Private property
Not specified

Source: Ukrainian Geological Survey

Geological information

Geological summary.

Structurally and tectonically, the block is located within the Kompaniivka branch of the Kirovohrad fault, in a rather narrow strip of gneiss stratum of the north-eastern extension with a drop to the south-east at angles of 60-80°, which is located between the Kirovohrad granite massif in the northwest and Sasivsky in the southeast. Within the block, 21 ore (mineralized) zones are distinguished by a complex of geological and geochemical features, which are characterized by gold content of more than 0.1 g/t and are sufficiently sustained for stretching and falling. Gold ore formation is confined to quartzed gneisses, as well as quartz feldspar and quartz veins, and often tends to contact pegmatoid bodies. The number of sulfides in mineralized intervals reaches 5 - 7%. Structural and lithological control of gold ore formation lays in a clear spatial confinement of ore zones and bodies to zones of tectonic development and hydrothermal-metasomatic changes of potassium-silicon composition (K-feldsparization, quartzification) with increased sulfide mineralization. Satellite elements of gold mineralization are arsenic, bismuth, silver, copper, zinc. Mineral indicators of gold ore formation are, first of all, sphalerite, chalcocite, less often arsenopyrite and galena. The source of the initial accumulation of gold was apparently graphite-containing gneisses and in later stages of gold ore formation was a geochemical barrier to gold-containing fluids. Gold content in the ores is uneven - from deciles to 77.1 g t, and in some samples - up to 153.8 g/t. Ores of the block are aluminosilicate, non-oxidized and belong to the gold-quartz low-sulfide type. They are characterized by finely interspersed texture, which sometimes turns into spotted. The interspersed texture is characterized by uneven distribution of small ore aggregates (individual grains or their growths). The size of mineral aggregates of spotted textures does not exceed 1 cm. More seldom in the ores of the block there is a veined texture identified characterized by the development of ore veins, sometimes compatible with vein minerals in cracks that cross the rock. Ore association is represented by native gold, pyrrhotite, chalcopyrite, pyrite, arsenopyrite, lollingite, sphalerite, galena, marcasite, native bismuth, bismuth, faded ores (tenanthite, tetrahedrite), bornite, chalco. Native gold is characterized by a very uneven distribution. It is noted in the contact part of metasomatically changed gneisses and quartz veins, less often - directly in quartz veins. Mainly (more than 90%) is associated with quartz and only a small part (less than 10%) - with sulfides. It is represented by grains of irregular, hooked, isometric and teardrop shape. Forms small clusters, fine interspersed, tracks of 3 - 5 small gold pieces, separated from each other. Characteristic rare growths with sulfides (pyrrhotite, chalcopyrite, pyrite). It is noted that small golds are located near the nests of finely interspersed sulfides, while larger golds are associated with large nests and streaks of sulfides. Directly in quartz veins gold is noted in a free kind (more than 90%) and in splices with sulfides. According to the grain size, gold is

Source: Ukrainian Geological Survey

Geological information

divided into three classes: up to 0.005 mm (predominant), 0.005 - 0.01 mm and 0.01 - 0.05 mm. Larger gold grains (up to 0.7 - 1.5 mm) are found in isolated cases. Finenessof native gold is high - 930 - 990. Pyrrhotite is widely developed and is the most common sulfide mineral in ore zones, its content is up to 3 - 5%. Chalcopyrite is also found everywhere, but in small quantities - up to 0.5% (5 - 15% of all ore minerals). Pyrite is a fairly common mineral in ore zones, its content is 3 - 10% of the amount of ore minerals. Arsenopyrite is observed almost everywhere, but in small quantities (up to 0.5%), mainly in single grains. Lolingitis is closely related to arsenopyrite. Sphalerite is almost always present in ore zones, where it accounts for from rare grains to 0.5 - 1%. Marcasite is relatively rare, accounting for less than 0.5% of all ore minerals. Galena is extremely rare, accounting for less than 0.2 - 0.5% of all ore minerals. Other ore minerals are extremely rare and isolated. Graphite is also observed in up to 2% in ores. Mining and geological conditions of the block determine the underground method of ore mining and are generally favorable. Hydrogeological conditions of the block are simple and are characterized by low water content of loose sand deposits and medium ore-bearing fractured aquifer. In terms of technology, ore of the block is rated as high-tech and easy to enrich. Ore processing is expected to be carried out according to the gravity-flotation technological scheme, which allows to extract 86.8% of gold in the concentrate: The arsenic content in the ore does not exceed 0.021%, which is not a harmful impurity in terms of technological properties. According to complexity of the geological structure, the Yuriivska block of gold ore corresponds to the 3rd group.

Available geological information

The block was discovered and searched as a result of audits and exploration for uranium and gold, performed by the exploration expedition #37 of the Kirov Industrial Geological Association in 1988-1993. In 1993-1994, greenfield exploration was performed within the block. In 1994-2000, drilling was conducted, which was not completed due to lack of funding. During the entire period of the exploration of Yuriivska block, a total of 71,841.5 m of inclined deep wells and 17 000 m of vertical exploration and mapping wells were drilled. The exploration network of deep wells is 100-200 x 200-200 m with thickening in some places up to 50-100 x 100-100 m. Gold ore formation has been studied to the mark of -450 m (600 m from the daytime surface). This block covers a gold ore object, which in the geological literature is called as St. George's gold deposit.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Selyshchanska Area of Titanium Ores

Mineral resource:
Titanium ores

Type and term of subsoil use:
Geological study, including experimental and industrial development of mineral deposits of national importance, 5 years

Location: 6.5 km northeast of the village of Irshansk, Korosten district, Zhytomyr region. The nearest villages of Shershni, Sychivka, Zabrane are connected to each other and the regional center by improved and asphalted roads

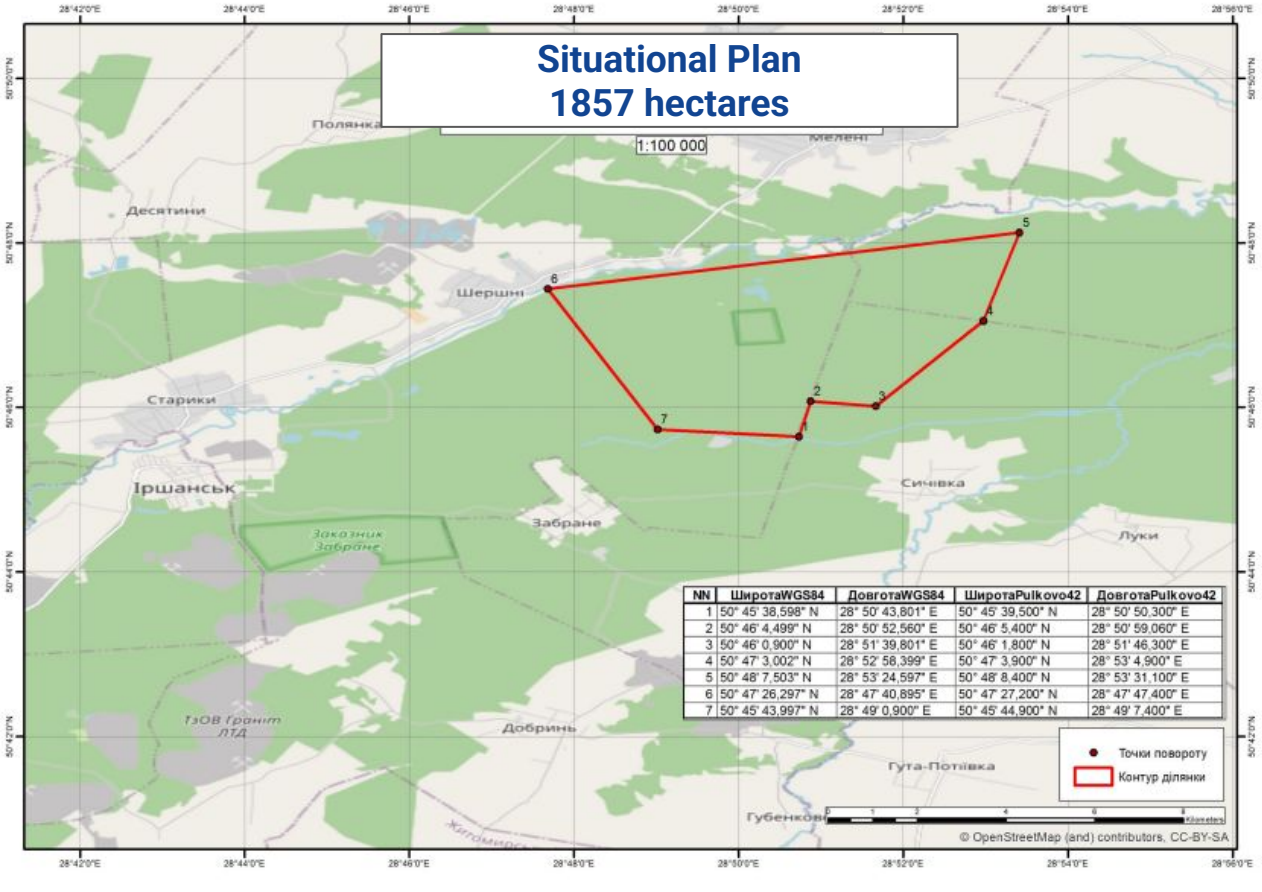
Land plot area: 1,857 hectares

Reserves and Resources

No resources or reserves have been officially evaluated to date

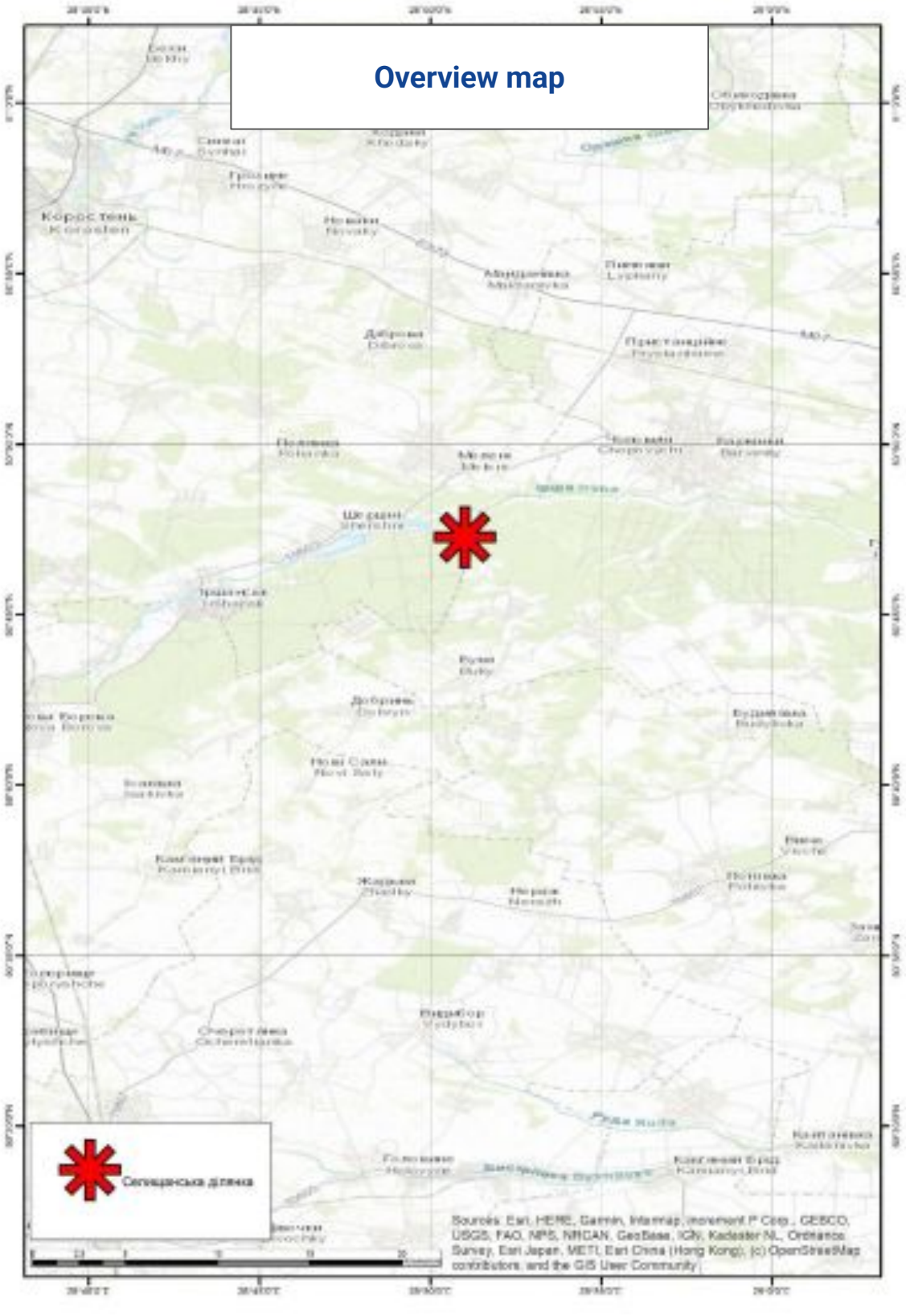
The average content::

ilmenite content 50 - 70 kg/m3



NN	ШиротаWGS84	ДовготаWGS84	ШиротаPulkovo42	ДовготаPulkovo42
1	50° 45' 38,598" N	28° 50' 43,801" E	50° 45' 39,500" N	28° 50' 50,300" E
2	50° 46' 4,499" N	28° 50' 52,560" E	50° 46' 5,400" N	28° 50' 59,060" E
3	50° 46' 0,900" N	28° 51' 39,801" E	50° 46' 1,800" N	28° 51' 46,300" E
4	50° 47' 3,002" N	28° 52' 58,399" E	50° 47' 3,900" N	28° 53' 4,900" E
5	50° 48' 7,503" N	28° 53' 24,597" E	50° 48' 8,400" N	28° 53' 31,100" E
6	50° 47' 26,297" N	28° 47' 40,895" E	50° 47' 27,200" N	28° 47' 47,400" E
7	50° 45' 43,997" N	28° 49' 0,900" E	50° 45' 44,900" N	28° 49' 7,400" E

Source: Ukrainian Geological Survey



Source: Ukrainian Geological Survey

Geological information

The Selyshchanska Area is located within the Volyn Titanium-Bearing Province, near the northeastern contact of the Volodarsk-Volynsky gabbro-anorthosite massif with the granites of the Korosten Complex. The geological structure of the area comprises crystalline basement rocks, kaolin weathering crusts, and Meso-Cenozoic sedimentary deposits.

Within this area, ilmenite-bearing deposits are spatially confined to two local depressions in a paleovalley and form two separate elongated ore bodies oriented in a northeast direction.

- Northern Ore Body: This body is significant in size, with a width varying between 400 to 1,400 meters in cross-section and a strike length reaching up to 7,000 meters, covering a total area of approximately 10 km².
- Southern Ore Body: Parallel to the northern body and separated from it by a local uplift 500–700 meters wide, the southern body is smaller, with a total area of about 6 km².

The productive horizon consists of:

- 55% Lower-Middle Quaternary deposits,
- 33% undifferentiated Middle Jurassic and Upper Cretaceous formations,
- 12% primary kaolin formations.

Due to the varying ages of deposits, the presence of local uplifts and depressions in the valley-like systems, and the uneven distribution of the ore mineral (ilmenite), the parameters of the ore bodies are highly inconsistent.

The cumulative thickness of the productive rocks ranges from 1.0 to 18.5 meters, with an average of 10.0 meters (5.5 meters in alluvial deposits and 4.5 meters in the weathering crust). The ilmenite content averages 50–70 kg/m³. The productive horizons are buried under different depths of overburden:

- In the northern part and on the flanks of the deposit, they are covered by an 8–12 meter thick layer of barren rocks.
- In the southern and central parts, the barren layer reaches 20–25 meters, averaging 13 meters across the deposit.

No technological studies have been conducted within the Selyshchanska Area.

Source: Ukrainian Geological Survey

Available geological information

Available geological information. Between 1955 and 1959, the Western Ukrainian Expedition and Zhytomyr Party of UkrGeolUpravlinnia discovered and explored several large placer and residual ilmenite deposits within the Volyn region. These deposits were collectively named the Irshansk Group of Deposits.

The Selyshchanska area (placer) was identified during prospecting operations conducted between 1972 and 1975. Geological exploration work aimed at evaluating placer ilmenite ore reserves and calculating resources in categories B + C1 was carried out by the State Enterprise "Ukrainian Geological Company" during 2007–2011. These efforts were funded by the state budget.

However, due to a lack of financing, the work was not completed. Despite this, the Selishchanska area has been recognized as promising for further geological study.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Nosachivske Deposit

Mineral resource: Main minerals: titanium ores, apatite; associated minerals: pegmatite (feldspar), vanadium ores.

Type and term of subsoil use: Geological exploration, including pilot-industrial development of mineral deposits with subsequent extraction, for a period of up to 50 years.

Location: Cherkasy district of Cherkasy region, in the southwestern part of the village of Nosachiv. The Odesa railway and the Cherkasy-Uman highway pass directly through the area.

Land plot area: 179.11 hectares.

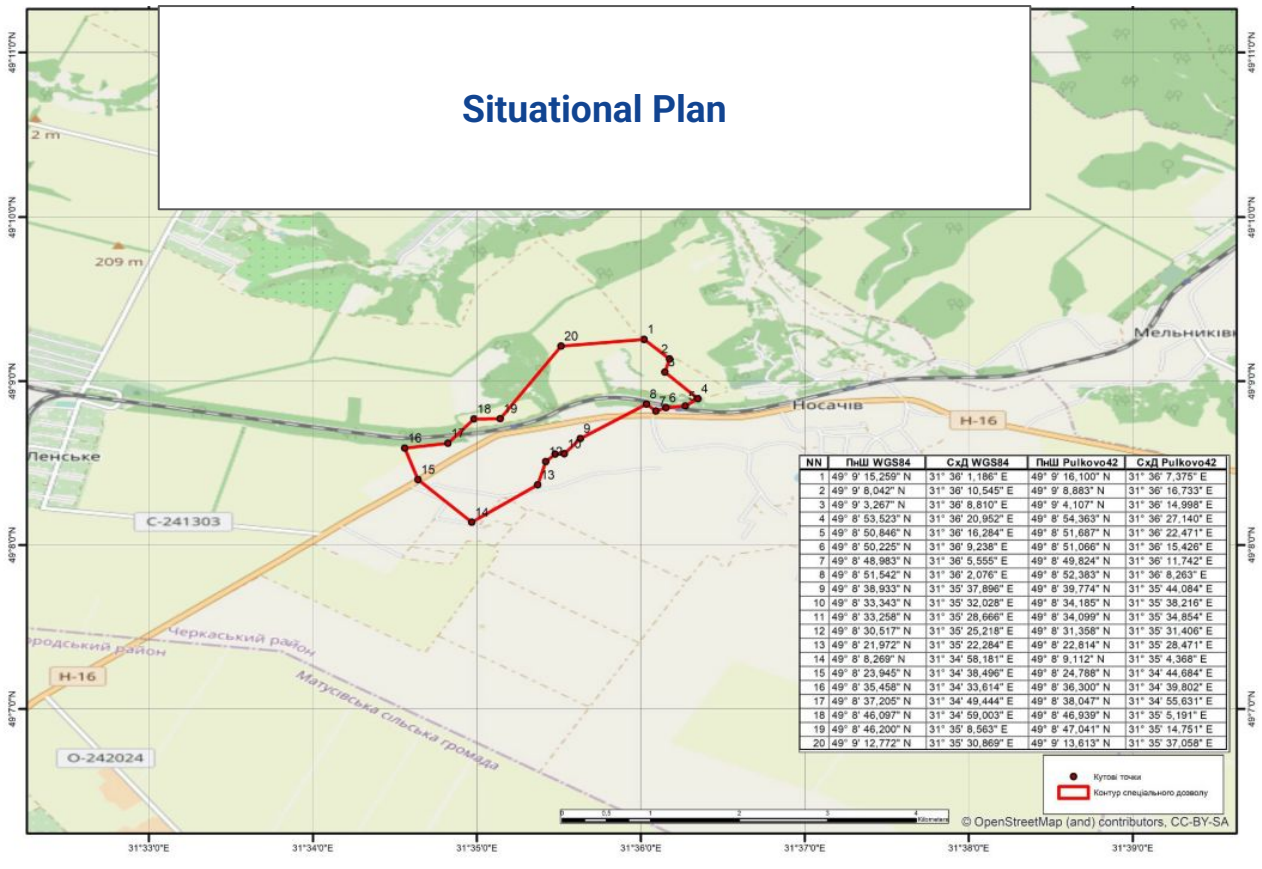
Reserves and Resources (April 2006), Kt:		
	Reserves (A+B+C1), Kt	Resources (C2+P1), Kt
TiO_2	limited access	limited access
P_2O_5 (class 121)	584.4	
P_2O_5 (class 122)		3,812.2
Plagio-raw material	192,703.0	
P_2O_5 (class 333)		4,396.0
V_2O_5 (class 333)		86.6

Average content:

TiO_2 - 4.75% P_2O_5 – 1.26% V_2O_5 – 0.22%

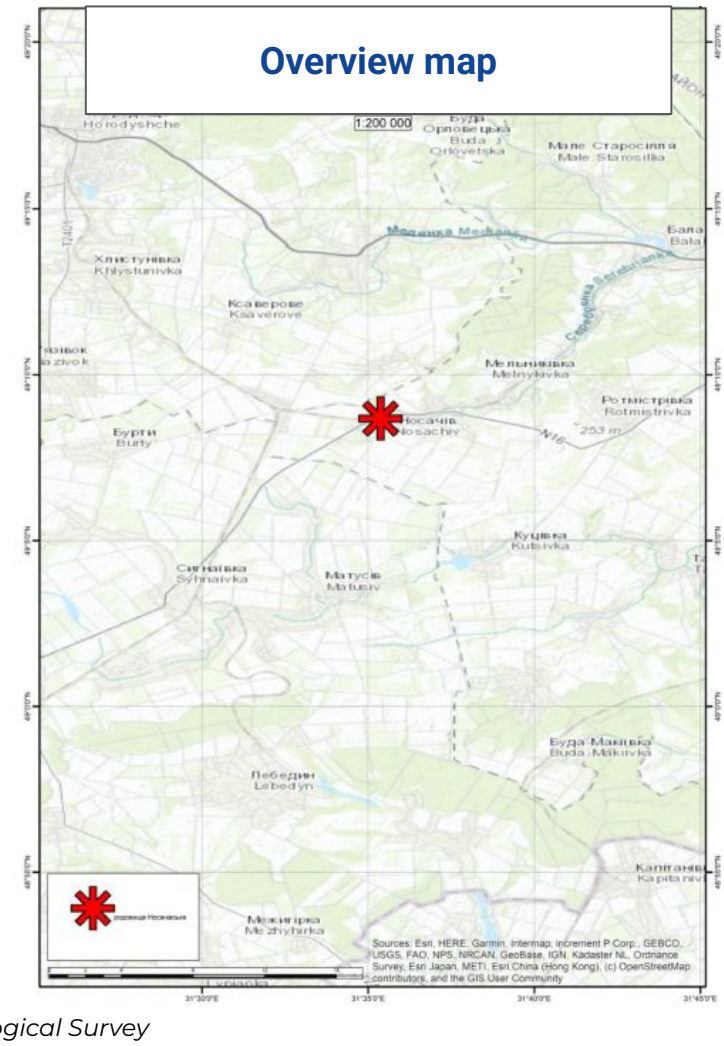
Source: Ukrainian Geological Survey

Situational Plan



NN	ПнШ WGS84	СхД WGS84	ПнШ Pulkovo42	СхД Pulkovo42
1	49° 9' 15,259" N	31° 36' 1,186" E	49° 9' 16,100" N	31° 36' 7,375" E
2	49° 9' 8,042" N	31° 36' 10,545" E	49° 9' 8,883" N	31° 36' 16,733" E
3	49° 9' 3,267" N	31° 36' 8,810" E	49° 9' 4,107" N	31° 36' 14,998" E
4	49° 8' 53,523" N	31° 36' 20,952" E	49° 8' 54,363" N	31° 36' 27,140" E
5	49° 8' 50,846" N	31° 36' 16,284" E	49° 8' 51,687" N	31° 36' 22,471" E
6	49° 8' 50,225" N	31° 36' 9,238" E	49° 8' 51,066" N	31° 36' 15,426" E
7	49° 8' 48,983" N	31° 36' 5,555" E	49° 8' 49,824" N	31° 36' 11,742" E
8	49° 8' 51,542" N	31° 36' 2,076" E	49° 8' 52,383" N	31° 36' 8,263" E
9	49° 8' 38,933" N	31° 35' 37,896" E	49° 8' 39,774" N	31° 35' 44,084" E
10	49° 8' 33,343" N	31° 35' 32,028" E	49° 8' 34,185" N	31° 35' 38,216" E
11	49° 8' 33,258" N	31° 35' 28,666" E	49° 8' 34,099" N	31° 35' 34,854" E
12	49° 8' 30,517" N	31° 35' 25,218" E	49° 8' 31,358" N	31° 35' 31,406" E
13	49° 8' 21,972" N	31° 35' 22,284" E	49° 8' 22,814" N	31° 35' 28,471" E
14	49° 8' 8,269" N	31° 34' 58,181" E	49° 8' 9,112" N	31° 35' 4,368" E
15	49° 8' 23,945" N	31° 34' 38,496" E	49° 8' 24,788" N	31° 34' 44,684" E
16	49° 8' 35,458" N	31° 34' 33,614" E	49° 8' 36,300" N	31° 34' 39,802" E
17	49° 8' 37,205" N	31° 34' 49,444" E	49° 8' 38,047" N	31° 34' 55,631" E
18	49° 8' 46,097" N	31° 34' 59,003" E	49° 8' 46,939" N	31° 35' 5,191" E
19	49° 8' 46,200" N	31° 35' 8,563" E	49° 8' 47,041" N	31° 35' 14,751" E
20	49° 9' 12,772" N	31° 35' 30,869" E	49° 9' 13,613" N	31° 35' 37,058" E

Overview map



Source: Ukrainian Geological Survey

Geological information

The deposit is genetically and spatially associated with the eponymous massif of ore-bearing norites of the Nosachivsk-Volkovsk ore field, which is part of the Korsun-Novomyrhorod pluton - a complex magmatogenic structure from the proto-platform stage of the geological development of the Ukrainian Shield. Structurally, it is located at the intersection of the sublatitudinal deep Tarasivska fault zone and the submeridional Kaniv-Novomyrhorod fault zone. The formation of the Nosachivsk intrusion took place during the final stage of tectonomagmatic activation, with a two-phase intrusion of norites. In terms of structural-morphological features and chemical composition, the Nosachivske deposit is represented by a linear stockwork consisting of two closely spaced, layer-like deposits of variable thickness, which occasionally merge. The stockwork of ore-bearing norites stretches in a northeast direction, with a length of 2,250 meters and a width ranging from 200 meters on the southwestern flank to 780 meters on the northeastern side of the deposit. The ore deposits include bodies of relatively simple layered form, complicated by minor short apophyses and lens-shaped inclusions of xenoliths of barren rocks. Ore body No. I is a steeply dipping, simple layered form, while ore body No. II is in the form of a G-shaped anticline structure of poor apatite-ilmenite ores.

According to geological-geophysical modeling, based on structural-textural features and chemical composition, the ores are divided into two phases of intrusion. Ore body No. I consists of ilmenite norites from the second phase and apatite-ilmenite olivine-bearing norites from the first phase. Ore body No. II is entirely composed of apatite-ilmenite olivine-bearing norites from the first phase. The ores from the first phase are fine- to medium-grained, predominantly olivine and olivine-bearing apatite-ilmenite norites with a massive texture. The main part of these ores is concentrated in the northeastern part of the deposit. The ores from the second phase, distributed across the central and southwestern parts of the deposit, are characterized by the almost complete absence of olivine and apatite, with a coarse - to medium-grained texture, trachytoid, and elements of taxitic texture.

Regarding the distribution of valuable components, there is an increased concentration of P_2O_5 in the apatite-ilmenite gabbroids of the first phase of intrusion, with a negligible amount in the ilmenite norites of the second phase.
On the other hand, TiO_2 shows the opposite trend, with its highest concentrations found in ilmenite norites and significantly lower concentrations in the apatite-ilmenite gabbroids of the first phase.

Source: Ukrainian Geological Survey

The Nosachiv deposit is represented by ore bodies of complex geological structure with inconsistent parameters of ore bodies, uneven distribution of mineralization, and, according to the Classification of Reserves and Resources of Mineral Resources of the State Fund of Subsoil, belongs to the second complexity group.

Available geological information

The study of the deposit began during general exploration for primary titanium ores starting in 1985. Within the Mezhiritsky, Smilyansky, and Horodyshchensky massifs of the gabbro-anorthosite formation in the field of the Nosachivska magnetic anomaly, rich ilmenite ores were discovered. Between 1990 and 1996, exploratory and evaluation work was carried out at the deposit, but only partially (60% of the planned work). The obtained data confirmed the presence of ores that hold industrial interest, allowing for the calculation of reserves in category C2 and the evaluation of forecast resources in category P1. The high quality and favorable technological indicators of ore enrichment led to the recommendation for further study and industrial development of the Nosachivsk deposit. The first review of the materials from the exploratory and evaluation work conducted at the Nosachiv deposit was carried out by the State Commission on Mineral Reserves (DKZ Ukraine) in 2004 (protocol No. 815 dated January 29, 2004). In 2005, upon the request of LLC "Tio Fab, LTD," the institute "Krivbassproekt" developed provisional conditions for calculating the reserves of the Nosachiv deposit, which were approved by the protocol of DKZ Ukraine dated February 23, 2006, No. 1078.The main useful components of the Nosachiv deposit's complex apatite-ilmenite ores are titanium dioxide (TiO_2) and phosphorus pentoxide (P_2O_5). The accompanying components include feldspar, which after enrichment and cleaning meets the requirements of GOST 13451-77 and TU V 14.5-05468498–005–2004 and is suitable for use in ceramic and glass production.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Stremyhorodske Deposit of Titanium Ores

Mineral resource: Titanium ore - the main, apatite, accompanying are scandium ores, vanadium ores, fluorine, primary kaolin, shale, weathered gabbro, gabbro-anorthosite.

Type and term of subsoil use: Geological exploration, including pilot production and production license, 50 years.

Location: Korosten district of Zhytomyr region, 20 km southeast of Korosten. T he nearest railway station – Stremyhorod, connected to the Korosten railway node, located 4 km north of the deposit.

Land plot area: 424 hectares.

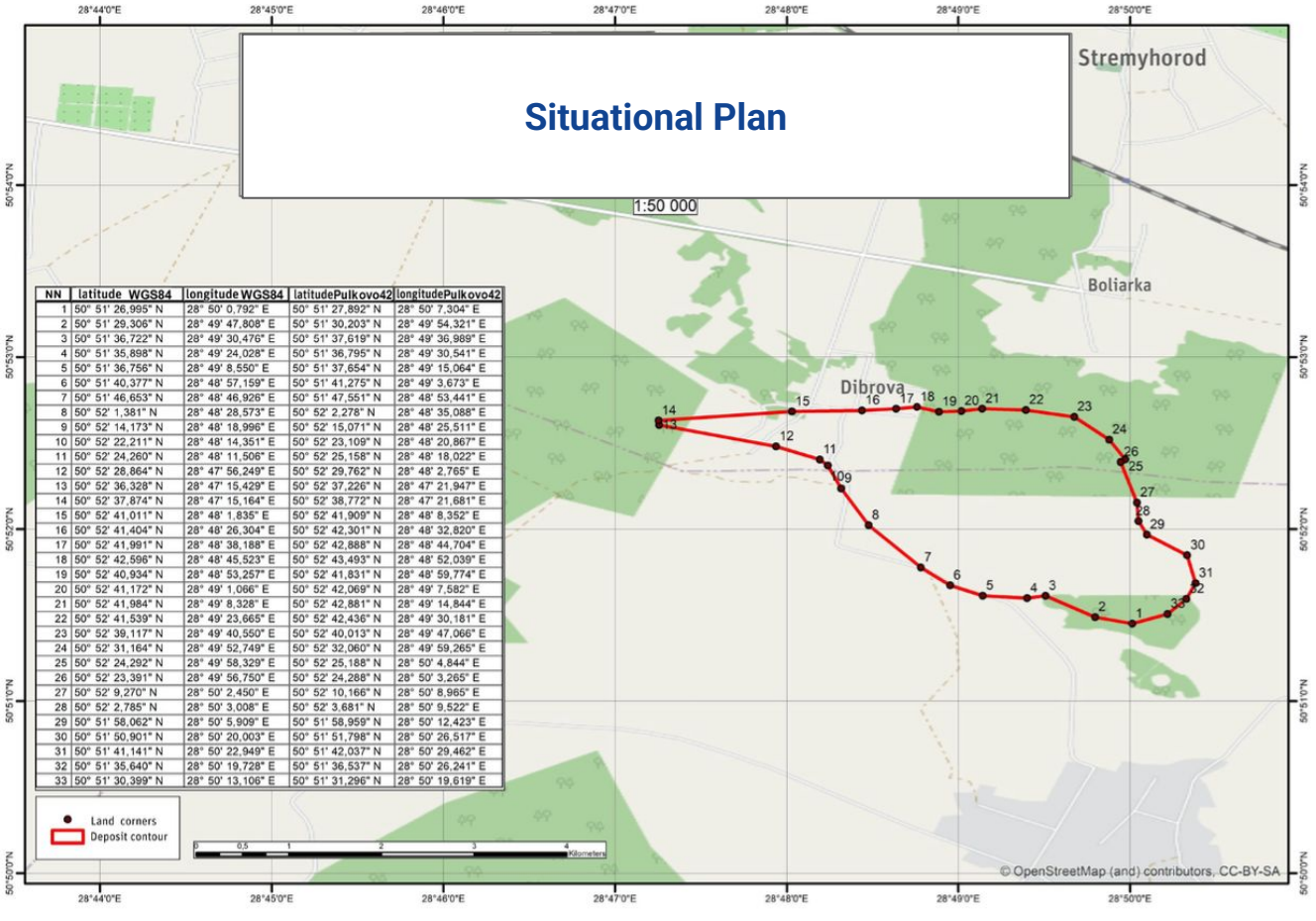
Reserves and Resources (November 2016), Mt:		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium Ore	Limited access	Limited access
Scandium Ore	Limited access	Limited access
Apatite	31.8 Mt	
Vanadium ores	0.22 Mt	-
Fluorine in apatite	1.36 Mt	
Primary kaolin + cherts + weathered gabbro	32.35 Mt	-
Gabbro-anorthosite	197.7 M m3	-

Average content:

TiO2 - 6.91%
P2O5 – 2.42%
Vanadium – 0.2%
Fluorine in apatite is 2.22%
Scandium 80 g/t

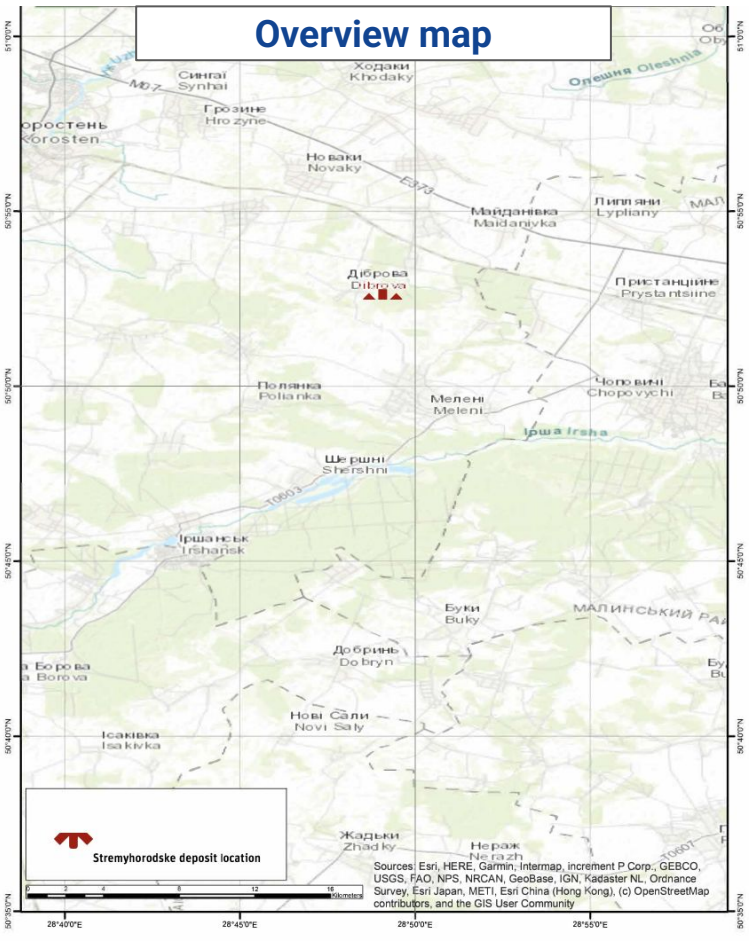
Source: Ukrainian Geological Survey

Situational Plan



NN	latitude WGS84	longitude WGS84	latitudePulkovo42	longitudePulkovo42
1	50° 51' 26,995" N	28° 50' 0,792" E	50° 51' 27,892" N	28° 50' 7,304" E
2	50° 51' 29,306" N	28° 49' 47,808" E	50° 51' 30,203" N	28° 49' 54,321" E
3	50° 51' 36,722" N	28° 49' 30,476" E	50° 51' 37,619" N	28° 49' 36,989" E
4	50° 51' 35,898" N	28° 49' 24,028" E	50° 51' 36,795" N	28° 49' 30,541" E
5	50° 51' 36,756" N	28° 49' 8,550" E	50° 51' 37,654" N	28° 49' 15,064" E
6	50° 51' 40,377" N	28° 48' 57,159" E	50° 51' 41,275" N	28° 49' 3,673" E
7	50° 51' 46,653" N	28° 48' 46,926" E	50° 51' 47,551" N	28° 48' 53,441" E
8	50° 52' 1,381" N	28° 48' 28,573" E	50° 52' 2,278" N	28° 48' 35,088" E
9	50° 52' 14,173" N	28° 48' 18,996" E	50° 52' 15,071" N	28° 48' 25,511" E
10	50° 52' 22,211" N	28° 48' 14,351" E	50° 52' 23,109" N	28° 48' 20,867" E
11	50° 52' 24,260" N	28° 48' 11,506" E	50° 52' 25,158" N	28° 48' 18,022" E
12	50° 52' 28,864" N	28° 47' 56,249" E	50° 52' 29,762" N	28° 48' 2,765" E
13	50° 52' 36,328" N	28° 47' 15,429" E	50° 52' 37,226" N	28° 47' 21,947" E
14	50° 52' 37,874" N	28° 47' 15,164" E	50° 52' 38,772" N	28° 47' 21,681" E
15	50° 52' 41,011" N	28° 48' 1,835" E	50° 52' 41,909" N	28° 48' 8,352" E
16	50° 52' 41,404" N	28° 48' 26,304" E	50° 52' 42,301" N	28° 48' 32,820" E
17	50° 52' 41,991" N	28° 48' 38,188" E	50° 52' 42,888" N	28° 48' 44,704" E
18	50° 52' 42,596" N	28° 48' 45,523" E	50° 52' 43,493" N	28° 48' 52,039" E
19	50° 52' 40,934" N	28° 48' 53,257" E	50° 52' 41,831" N	28° 48' 59,774" E
20	50° 52' 41,172" N	28° 49' 1,066" E	50° 52' 42,069" N	28° 49' 7,582" E
21	50° 52' 41,984" N	28° 49' 8,328" E	50° 52' 42,881" N	28° 49' 14,844" E
22	50° 52' 41,539" N	28° 49' 23,665" E	50° 52' 42,436" N	28° 49' 30,181" E
23	50° 52' 39,117" N	28° 49' 40,550" E	50° 52' 40,013" N	28° 49' 47,066" E
24	50° 52' 31,164" N	28° 49' 52,749" E	50° 52' 32,060" N	28° 49' 59,265" E
25	50° 52' 24,292" N	28° 49' 58,329" E	50° 52' 25,188" N	28° 50' 4,844" E
26	50° 52' 23,391" N	28° 49' 56,750" E	50° 52' 24,288" N	28° 50' 3,265" E
27	50° 52' 9,270" N	28° 50' 2,450" E	50° 52' 10,166" N	28° 50' 8,965" E
28	50° 52' 2,785" N	28° 50' 3,008" E	50° 52' 3,681" N	28° 50' 9,522" E
29	50° 51' 58,062" N	28° 50' 5,909" E	50° 51' 58,959" N	28° 50' 12,423" E
30	50° 51' 50,901" N	28° 50' 20,003" E	50° 51' 51,798" N	28° 50' 26,517" E
31	50° 51' 41,141" N	28° 50' 22,949" E	50° 51' 42,037" N	28° 50' 29,462" E
32	50° 51' 35,640" N	28° 50' 19,728" E	50° 51' 36,537" N	28° 50' 26,241" E
33	50° 51' 30,399" N	28° 50' 13,106" E	50° 51' 31,296" N	28° 50' 19,619" E

Overview map



Source: Ukrainian Geological Survey

Geological information

Stremyrhorodske deposit is represented by an intrusive body of ore-bearing gabroids confined to the intersection zone of the deep Korosten fault north-west trending with a belt-shaped fault in the north-east direction. Two intrusive phases are distinguished among the main rocks of the Korosten pluton: early (anorthosite) and later (gabbro, gabbro-norite). The geological structure of the deposit includes ore crystalline rocks (gabroids), their weathered formations (weathered gabbro, cherts and primary kaolin), as well as mineral-free sand-clay deposits of the Cenozoic age. Ore crystalline rocks are a rod-like body of gabroids, which lies in the middle ore-free anorthosite. Rocks of the gabbro-anorthosite complex of Stremyrhorod deposit are represented by a close layering of anorthosite, gabbro, gabbro-anorthosite, gabbro-peridotites, peridotites and pyroxenites, which are connected by gradual transitions. Ores are represented by three genetic types, which are located one below the other, from top to bottom: the zone of complete weathering of ores is represented by kaolins and cherts with an average bed thickness of 12.4 m; the zone of partial weathering - weathered gabbro by thickness 14.1 m; crystalline gabbro (reserves confirmed to a depth of 500 m, traced to a depth of 1378 m). The mineral is overlain by loose ore-free sand-clay deposits of an average thickness of 32.2 m. According to the geological structure of the territory, three aquifers are distinguished: an aquifer in Quaternary deposits; aquiferous horizon confined to sandy soils of Paleogene-Neogene sediments; aquifer of the zone of weathering and cracking of crystalline rocks.

Quarry protection measures from surface (flood and rain) water during the development of the deposit consists in the correct choice of the capacity of the quarry drainage and the construction of an effective system restrictive mountain ditches. The depth of the quarry and the period of its development determines the feasibility of using a step drainage scheme.

Available geological information

The deposit was discovered in 1954 in the course of magnetometric works carried out by the Ukrainian Geological Administration with the aim of identifying sulphide-nickel mineralization. In 1955–1956, a detailed exploration of the weathering crust, reserves of ilmenite and accompanying apatite was carried out, which were approved by the USSR State Committee on Mineral Resources (April 13, 1957 No. 1734). In 1973–1974, three prospecting wells for titanium with a depth of 420–520 m were drilled at the deposit, they established the presence of titanium-bearing (ilmenite) mineralization to a depth of more than 500 m. In 1976–1981, state geological enterprise "Pivnichukrgeologia" carried out exploration of the Stremyhorod

Source: Ukrainian Geological Survey

deposit of apatite-ilmenite ores. Reserves of the Stremyhorod deposit were evaluated in accordance with the conditions approved by the State Committee on Mineral Resources of the USSR (November 19, 1980 No. 1525 K).

The next geological and economic reassessment of apatite-ilmenite ore reserves was carried out in 2016. The purpose of this work is to determine the effectiveness of working out apatite-ilmenite ores reserves in modern economic conditions. The assessment of reserves was carried out according to the approved version of the conditions - USSR State Committee on Mineral Resources (October 23, 1981 No. 8856).

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR MINING:

Tarasivske Deposit

Mineral resource: Titanium ores, Zirconium ores, Kyanite (distene) + sillimanite, Staurolite, Associated minerals - Vanadium ores, Scandium ores

Type and term of subsoil use: mining, 20 years

Land plot area: 1 019 hectares.

Location: Bila Tserkva district of Kyiv region near the southern outskirts of the village of Fastivka and the southwestern outskirts of the village of Hayok, 25 km southwest of the town of Bila Tserkva, where the railway station is located. The nearest settlements are also the villages of Shcherbaki, Tarasivka, Mykhailivka.

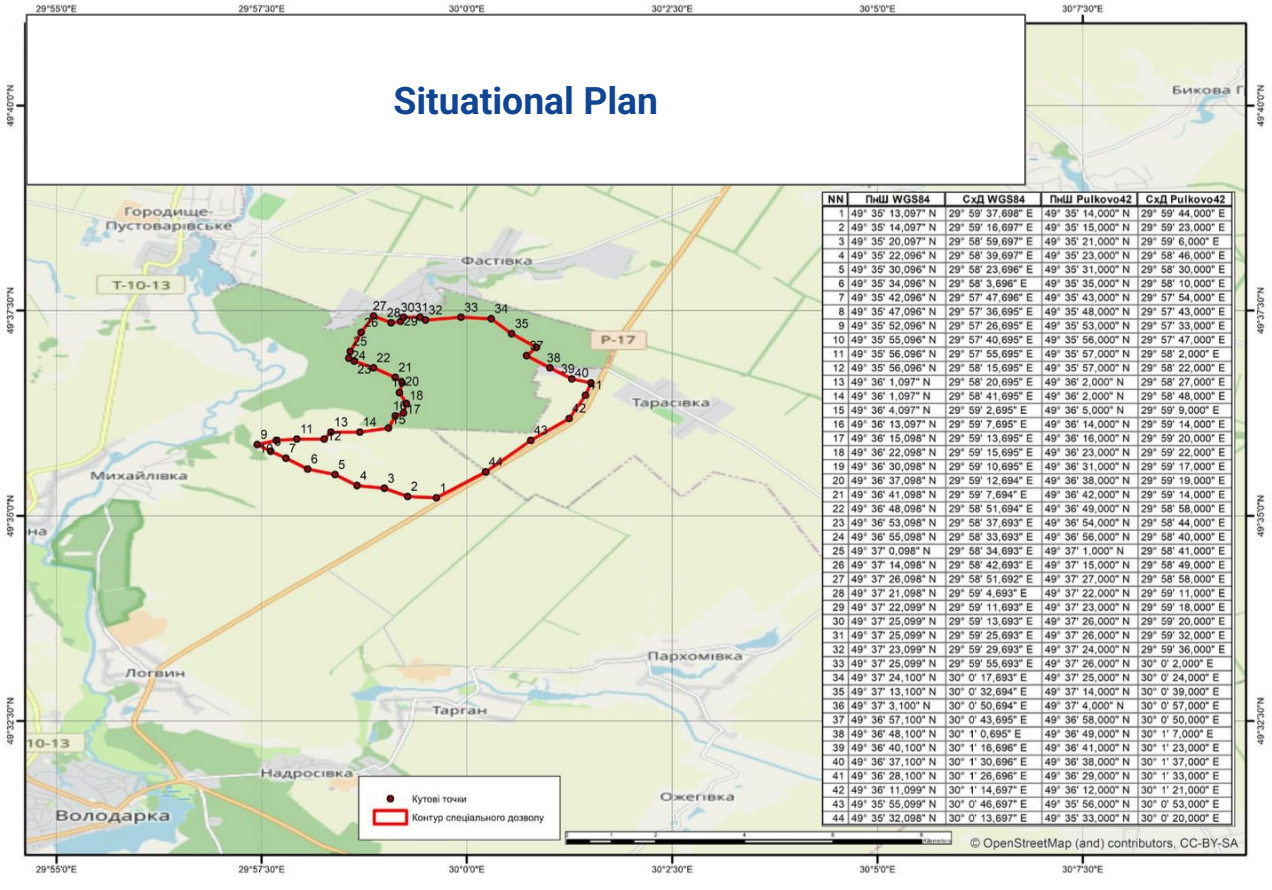
Reserves and Resources (February 2020), Kt:		
	Reserves (B+C1), Kt	Resources (C2+P1), Kt
Titanium ores	Limited access	Limited access
Zirconium ores	Limited access	Limited access
Kyanite (distene) + sillimanite	369.1 (74.9+294.2)	
Staurolite	55 (14.7+40.3)	
Associated minerals		
Vanadium ores	5.4	

Average content:

Ilmenite is 17.53 kg/m3
Leucoxene – 0.97 kg/m3
Rutile – 6.39 kg/m3
Zircon – 7.24 kg/m3
Kyanite (disthene)+sillimanite – 3.43 kg/m3
Staurolite – 0.51 kg/m3

Source: Ukrainian Geological Survey

Situational Plan



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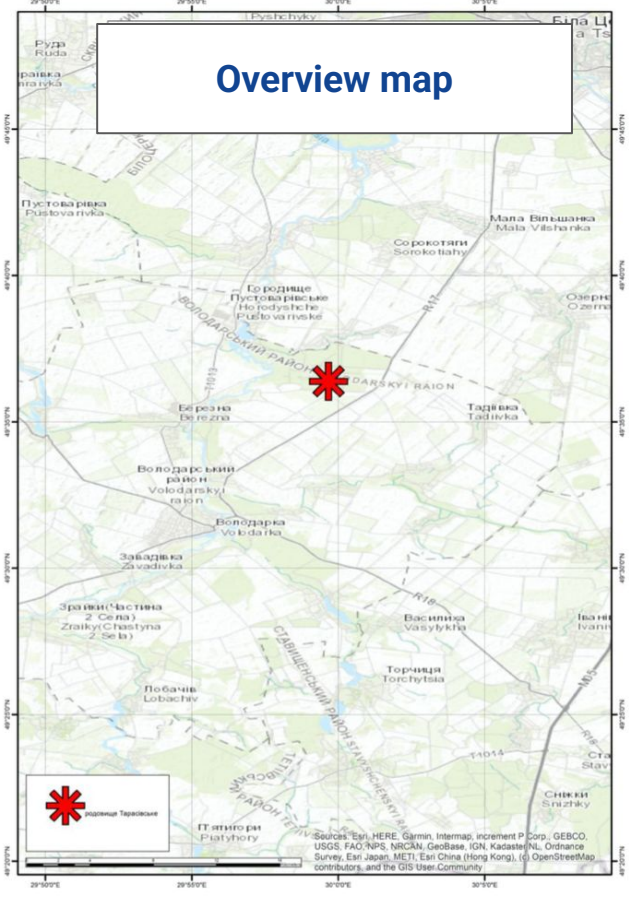
4	49° 35' 22,096" N	29° 58' 39,697" E	49° 35' 23,000" N	29° 58' 46,000" E
5	49° 35' 30,096" N	29° 58' 23,696" E	49° 35' 31,000" N	29° 58' 30,000" E
6	49° 35' 34,096" N	29° 58' 3,696" E	49° 35' 35,000" N	29° 58' 10,000" E
7	49° 35' 42,096" N	29° 57' 47,696" E	49° 35' 43,000" N	29° 57' 54,000" E
8	49° 35' 47,096" N	29° 57' 36,695" E	49° 35' 48,000" N	29° 57' 43,000" E
9	49° 35' 52,096" N	29° 57' 26,695" E	49° 35' 53,000" N	29° 57' 33,000" E
10	49° 35' 55,096" N	29° 57' 40,695" E	49° 35' 56,000" N	29° 57' 47,000" E
11	49° 35' 56,096" N	29° 57' 55,695" E	49° 35' 57,000" N	29° 58' 2,000" E
12	49° 35' 56,096" N	29° 58' 15,695" E	49° 35' 57,000" N	29° 58' 22,000" E
13	49° 36' 1,097" N	29° 58' 20,695" E	49° 36' 2,000" N	29° 58' 27,000" E
14	49° 36' 1,097" N	29° 58' 41,695" E	49° 36' 2,000" N	29° 58' 48,000" E
15	49° 36' 4,097" N	29° 59' 2,695" E	49° 36' 5,000" N	29° 59' 9,000" E
16	49° 36' 13,097" N	29° 59' 7,695" E	49° 36' 14,000" N	29° 59' 14,000" E
17	49° 36' 15,098" N	29° 59' 13,695" E	49° 36' 16,000" N	29° 59' 20,000" E
18	49° 36' 22,098" N	29° 59' 15,695" E	49° 36' 23,000" N	29° 59' 22,000" E
19	49° 36' 30,098" N	29° 59' 10,695" E	49° 36' 31,000" N	29° 59' 17,000" E
20	49° 36' 37,098" N	29° 59' 12,694" E	49° 36' 38,000" N	29° 59' 19,000" E
21	49° 36' 41,098" N	29° 59' 7,694" E	49° 36' 42,000" N	29° 59' 14,000" E
22	49° 36' 48,098" N	29° 58' 51,694" E	49° 36' 49,000" N	29° 58' 58,000" E
23	49° 36' 53,098" N	29° 58' 37,693" E	49° 36' 54,000" N	29° 58' 44,000" E
24	49° 36' 55,098" N	29° 58' 33,693" E	49° 36' 56,000" N	29° 58' 40,000" E
25	49° 37' 0,098" N	29° 58' 34,693" E	49° 37' 1,000" N	29° 58' 41,000" E
26	49° 37' 14,098" N	29° 58' 42,693" E	49° 37' 15,000" N	29° 58' 49,000" E
27	49° 37' 26,098" N	29° 58' 51,692" E	49° 37' 27,000" N	29° 58' 58,000" E
28	49° 37' 21,098" N	29° 59' 4,693" E	49° 37' 22,000" N	29° 59' 11,000" E
29	49° 37' 22,099" N	29° 59' 11,693" E	49° 37' 23,000" N	29° 59' 18,000" E
30	49° 37' 25,099" N	29° 59' 13,693" E	49° 37' 26,000" N	29° 59' 20,000" E
31	49° 37' 25,099" N	29° 59' 25,693" E	49° 37' 26,000" N	29° 59' 32,000" E
32	49° 37' 23,099" N	29° 59' 29,693" E	49° 37' 24,000" N	29° 59' 36,000" E
33	49° 37' 25,099" N	29° 59' 55,693" E	49° 37' 26,000" N	30° 0' 2,000" E
34	49° 37' 24,100" N	30° 0' 17,693" E	49° 37' 25,000" N	30° 0' 24,000" E
35	49° 37' 13,100" N	30° 0' 32,694" E	49° 37' 14,000" N	30° 0' 39,000" E
36	49° 37' 3,100" N	30° 0' 50,694" E	49° 37' 4,000" N	30° 0' 57,000" E
37	49° 36' 57,100" N	30° 0' 43,695" E	49° 36' 58,000" N	30° 0' 50,000" E
38	49° 36' 48,100" N	30° 1' 0,695" E	49° 36' 49,000" N	30° 1' 7,000" E
39	49° 36' 40,100" N	30° 1' 16,696" E	49° 36' 41,000" N	30° 1' 23,000" E
40	49° 36' 37,100" N	30° 1' 30,696" E	49° 36' 38,000" N	30° 1' 37,000" E
41	49° 36' 28,100" N	30° 1' 26,696" E	49° 36' 29,000" N	30° 1' 33,000" E
42	49° 36' 11,099" N	30° 1' 14,697" E	49° 36' 12,000" N	30° 1' 21,000" E
43	49° 35' 55,099" N	30° 0' 46,697" E	49° 35' 56,000" N	30° 0' 53,000" E
44	49° 35' 32,098" N	30° 0' 13,697" E	49° 35' 33,000" N	30° 0' 20,000" E

Overview map



Source: Ukrainian Geological Survey

Geological information

Geological characteristics: The Tarasivske deposit is located within the Rosynsko-Tykytcya megablock of the Ukrainian Shield. The region is characterized by a three-layered structure. The crystalline basement consists of metamorphic, ultrametamorphic, and magmatic structurally-compositional complexes of Archean and Proterozoic age. In the paleodynes, sedimentary rocks of the Cretaceous system are localized. The upper layer is composed of Cenozoic deposits, which cover the older formations throughout the region, forming a cap up to 40-55 meters thick.

On crystalline rocks, a weathering crust is developed almost everywhere, mainly of a kaolinitic composition and predominantly of the planar type. A characteristic feature of the area is the lowering of the crystalline basement's hypsometric level in the northeastern direction, toward the Dnieper-Donets basin.

The ore-bearing deposits of the deposit are represented by placer ores, which are associated with the rocks of the sedimentary cap. Its sequence from bottom to top includes Paleogene deposits (Buchach, Kyiv, Obukhiv horizons), Neogene (Novopetrivsk suite, layer of variegated clays, layer of red-brown clays), and Quaternary deposits.

The Novopetrivsk suite is widespread and is the main productive layer of the Tarasivske deposit. Within the deposits, three horizons are distinguished, differing in lithological, granulometric, and structural-textural features, and they are well-mapped based on core samples: lower, middle, and upper. The main carrier of industrial concentrations of titanium-zirconium and other heavy minerals is the middle horizon, which is widespread throughout the deposit and absent only in areas of erosion (Quaternary period).

The main industrial minerals of the placer are altered ilmenite, rutile, and zircon. They account for about 70% of the heavy fraction. Other minerals identified include kyanite (distene), sillimanite, staurolite, tourmaline, andalusite, anatase, brookite, corundum, spinel, chromespinels, baddeleite, topaz, dumortierite, monazite, xenotime, cassiterite, and other minerals.

Source: Ukrainian Geological Survey

STATE GEOLOGICAL SERVICE OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Malyshevska area, Pivnichno-Zahidna Field of Titanium and Zirconium Ores

Mineral resource:
Titanium ore and zirconium ores – the main; accompanying minerals are kyanite, sillimanite, and staurolite

Location: Oleksandrivsky District of Kirovohrad Region and Pyatihatsky District of Dnipropetrovsk Region, 20.1 km north of Pyatihatky

Type and term of subsoil use:
20-years licenses for exploration and production

Land plot area:
3 309.8 hectares

Reserves and Resources (November 2016), Mt:		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium Ore	Limited access	Limited access
Zircon	Limited access	Limited access
Disten + sillimanite	-	1.4 Mt
Staurolite	-	0.57 Mt

The average content of TiO_2:

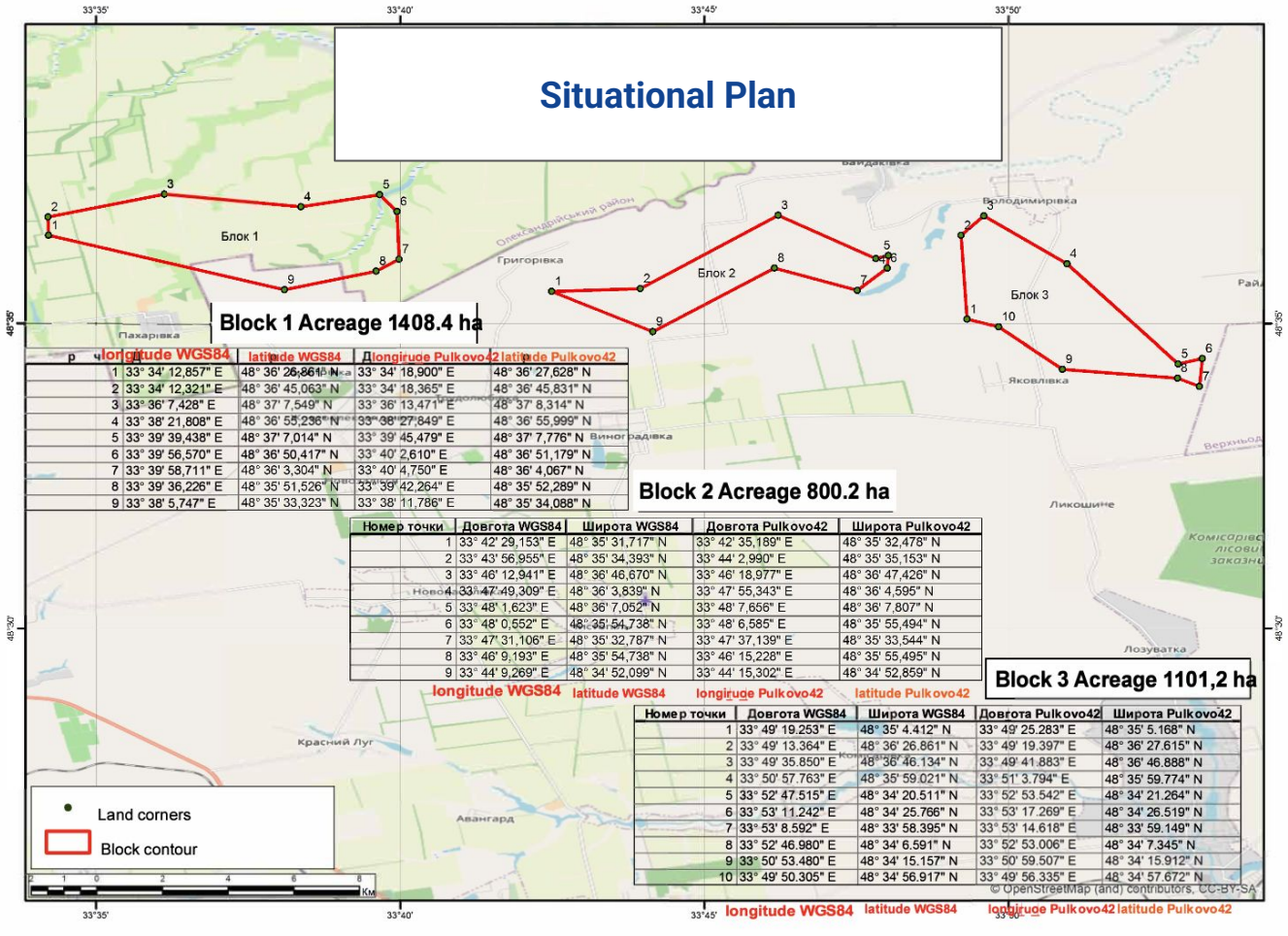
in ilmenite – 62.23%,
in leucoxene – 83.26%,
in rutile – 90-98%

The average content of ZrO_2:

from 63.1 to 63.9%.

Source: Ukrainian Geological Survey

Situational Plan



Block 1 Acreage 1408.4 ha

	longitude WGS84	latitude WGS84	longitude Pulkovo42	latitude Pulkovo42
1	33° 34' 12,857" E	48° 36' 26,861" N	33° 34' 18,900" E	48° 36' 27,628" N
2	33° 34' 12,321" E	48° 36' 45,063" N	33° 34' 18,365" E	48° 36' 45,831" N
3	33° 36' 7,428" E	48° 37' 7,549" N	33° 36' 13,471" E	48° 37' 8,314" N
4	33° 38' 21,808" E	48° 36' 55,236" N	33° 38' 27,849" E	48° 36' 55,999" N
5	33° 39' 39,438" E	48° 37' 7,014" N	33° 39' 45,479" E	48° 37' 7,776" N
6	33° 39' 56,570" E	48° 36' 50,417" N	33° 40' 2,610" E	48° 36' 51,179" N
7	33° 39' 58,711" E	48° 36' 3,304" N	33° 40' 4,750" E	48° 36' 4,067" N
8	33° 39' 36,226" E	48° 35' 51,526" N	33° 39' 42,264" E	48° 35' 52,289" N
9	33° 38' 5,747" E	48° 35' 33,323" N	33° 38' 11,786" E	48° 35' 34,088" N

Block 2 Acreage 800.2 ha

Номер точки	Довгота WGS84	Широта WGS84	Довгота Pulkovo42	Широта Pulkovo42
1	33° 42' 29,153" E	48° 35' 31,717" N	33° 42' 35,189" E	48° 35' 32,478" N
2	33° 43' 56,955" E	48° 35' 34,393" N	33° 44' 2,990" E	48° 35' 35,153" N
3	33° 46' 12,941" E	48° 36' 46,670" N	33° 46' 18,977" E	48° 36' 47,426" N
4	33° 47' 49,309" E	48° 36' 3,839" N	33° 47' 55,343" E	48° 36' 4,595" N
5	33° 48' 1,623" E	48° 36' 7,052" N	33° 48' 7,656" E	48° 36' 7,807" N
6	33° 48' 0,552" E	48° 35' 54,738" N	33° 48' 6,585" E	48° 35' 55,494" N
7	33° 47' 31,106" E	48° 35' 32,787" N	33° 47' 37,139" E	48° 35' 33,544" N
8	33° 46' 9,193" E	48° 35' 54,738" N	33° 46' 15,226" E	48° 35' 55,495" N
9	33° 44' 9,269" E	48° 34' 52,099" N	33° 44' 15,302" E	48° 34' 52,859" N

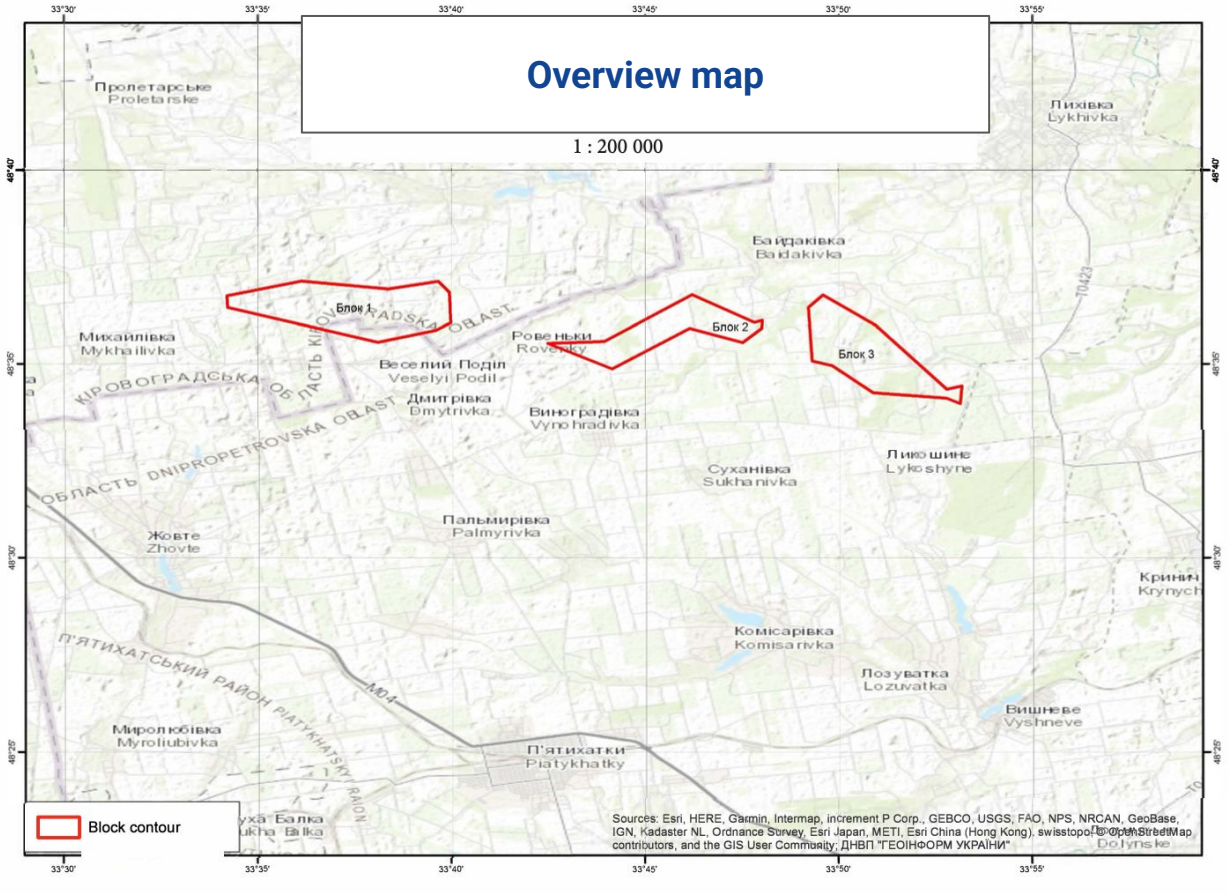
longitude WGS84 latitude WGS84 longitude Pulkovo42 latitude Pulkovo42

Block 3 Acreage 1101,2 ha

Номер точки	Довгота WGS84	Широта WGS84	Довгота Pulkovo42	Широта Pulkovo42
1	33° 49' 19.253" E	48° 35' 4.412" N	33° 49' 25.283" E	48° 35' 5.168" N
2	33° 49' 13.364" E	48° 36' 26.861" N	33° 49' 19.397" E	48° 36' 27.615" N
3	33° 49' 35.850" E	48° 36' 46.134" N	33° 49' 41.883" E	48° 36' 46.888" N
4	33° 50' 57.763" E	48° 35' 59.021" N	33° 51' 3.794" E	48° 35' 59.774" N
5	33° 52' 47.515" E	48° 34' 20.511" N	33° 52' 53.542" E	48° 34' 21.264" N
6	33° 53' 11.242" E	48° 34' 25.766" N	33° 53' 17.269" E	48° 34' 26.519" N
7	33° 53' 8.592" E	48° 33' 58.395" N	33° 53' 14.618" E	48° 33' 59.149" N
8	33° 52' 46.980" E	48° 34' 6.591" N	33° 52' 53.006" E	48° 34' 7.345" N
9	33° 50' 53.480" E	48° 34' 15.157" N	33° 50' 59.507" E	48° 34' 15.912" N
10	33° 49' 50.305" E	48° 34' 56.917" N	33° 49' 56.335" E	48° 34' 57.672" N

longitude WGS84 latitude WGS84 longitude Pulkovo42 latitude Pulkovo42

Overview map



Source: Ukrainian Geological Survey

Geological information

The exploitation region is located in the northern depression of the central part of the Ukrainian crystalline shield. The North-Western prospective area (residual reserves) is located in the north-western part of the Malyshevska field and is a placer associated with coastal and marine sediments of quartz fine-grained sands of the Poltava series of veins and partially quartz fine-grained sands of the Sarmatian tier of the Miocene. The meaningful mineral comprises of the layer of industrial ore sands of the Poltava series of veins, which is attached to the upper part of the Poltava horizon and to the lower part of the sands of the Sarmatian tier in some places, at a cap of up to 5 m. The horizon of ores is represented by gray, yellow-gray, occasionally dark gray fine-grained quartz sands with high content of heavy minerals. In the sands of the Poltava series of veins there are 3 horizons with different degrees of mineralization. The upper horizon is enriched by minerals of heavy fraction. Ore sands consist of quartz, clay minerals and heavy minerals: zircon, rutile, ilmenite, leucoxene, kyanite, sillimanite, staurolite, tourmaline, spinel, chromite, monazite.

The main bulk of quartz grains belongs to the class -0.28 + 0.1 mm (89.84%). The most common titanium mineral is ilmenite with grains of high leucoxene content. The average content of TiO2 in ilmenite is 62.23%, TiO2 in leucoxene - 83.26%, TiO2 in rutile - 90-98%. The main mineral containing zirconium is zircon. The ZrO2 content varies from 63.1 to 63.9%.

Technological properties studies of ore sands of the Poltava series of veins were conducted at the Motronnivsko-Annivska prospective area of the Malyshevska field. As a result the following concentrates were obtained: ilmenite - 62.23% TiO2; rutile - 94.05% TiO2; zirconium - 64.57% TiO2; kyanite-sillimanite - 62.28% Al2O3; staurolite - 50.9% Al2O3.

Hydrogeological conditions of the Malyshevska field are characterized by the presence of an aquifer complex in the Miocene sediments. Miocene aquifer complex is associated with fine-grained sands of the Sarmatian tier and fine-grained sands of the Poltava series of veins and is the only aquifer horizon that will affect the flooding of the quarry. According to the complexity of the geological structure of the North-Western prospective area (residual reserves) is classified as the one with a complex geological structure (Group 2).

Source: Ukrainian Geological Survey

Available geological information

Site exploration was carried out in 1955-1958 by the Ukrainian Geological Survey. For the first time the residual reserves of the North-West prospective area were approved by the protocol of the State Committee of the USSR from 20.01.1959 No 2553. In 2019, a detailed geological and economic assessment of reserves of zircon-rutile-ilmenite sands of Motronovsko-Annivska and North-Western prospective areas of the Malyshevska field was concluded (protocol of the State Committee of Ukraine dated 20.12.2019 No 5000-DSK).

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION AND MINIG:

Yuriivsko-Koziivskyi Deposit

Mineral resource: Titanium ores, zirconium ores

Type and term of subsoil use: Geological exploration, including pilot industrial development of minerals, follow

Location: Zhytomyr district, 6.3 km northeast of the city of Korostyshiv, between the villages of Tesnivka, Nova Yurivka, Koziivka, Gorodske, on the watershed of the Teteriv, Myka and Svinoluzhka rivers.
Land plot area: 23.5 km2

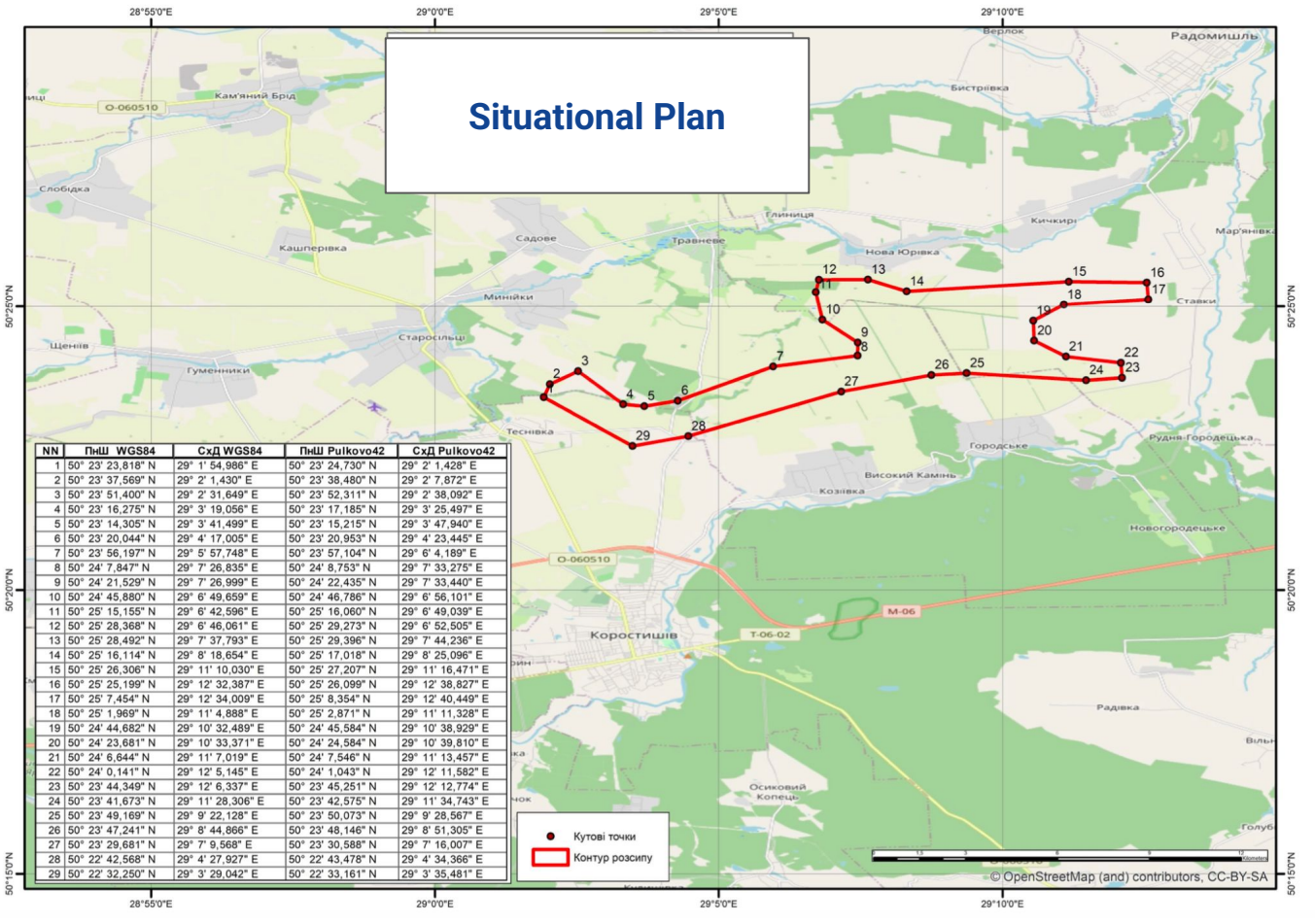
Reserves and Resources, Mt:		
	Reserves (A+B+C1), Mt	Resources (P1 + P3), Mt
Conditional ilmenite	-	5.5 (2.7 + 2.8)

Average content:

Conditional ilmenite (P1) 163.02 kg/m3
Conditional ilmenite (P3) 65.53 kg/m3

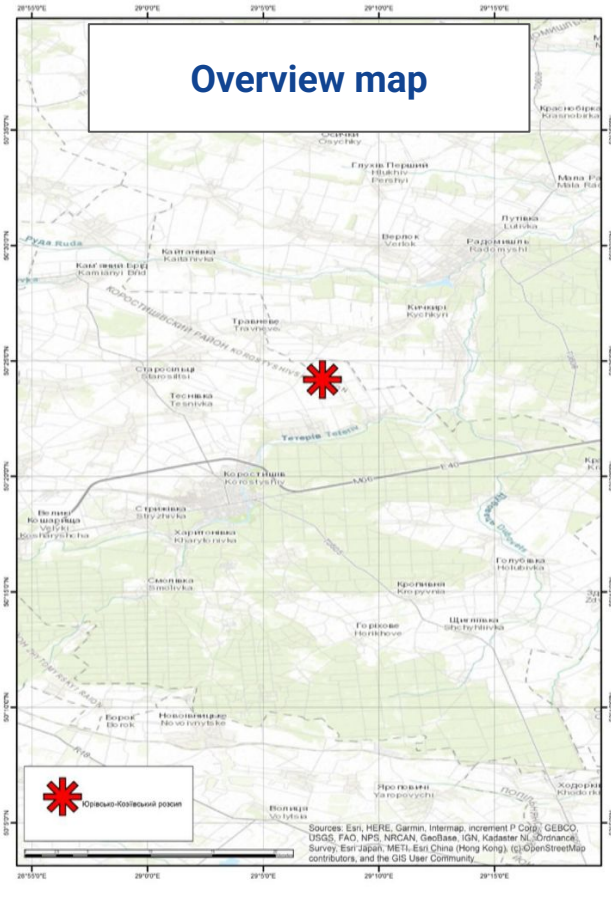
Source: Ukrainian Geological Survey

Situational Plan



NN	ПнШ WGS84	СхД WGS84	ПнШ Pulkovo42	СхД Pulkovo42
1	50° 23' 23,818" N	29° 1' 54,986" E	50° 23' 24,730" N	29° 2' 1,428" E
2	50° 23' 37,569" N	29° 2' 1,430" E	50° 23' 38,480" N	29° 2' 7,872" E
3	50° 23' 51,400" N	29° 2' 31,649" E	50° 23' 52,311" N	29° 2' 38,092" E
4	50° 23' 16,275" N	29° 3' 19,056" E	50° 23' 17,185" N	29° 3' 25,497" E
5	50° 23' 14,305" N	29° 3' 41,499" E	50° 23' 15,215" N	29° 3' 47,940" E
6	50° 23' 20,044" N	29° 4' 17,005" E	50° 23' 20,953" N	29° 4' 23,445" E
7	50° 23' 56,197" N	29° 5' 57,748" E	50° 23' 57,104" N	29° 6' 4,189" E
8	50° 24' 7,847" N	29° 7' 26,835" E	50° 24' 8,753" N	29° 7' 33,275" E
9	50° 24' 21,529" N	29° 7' 26,999" E	50° 24' 22,435" N	29° 7' 33,440" E
10	50° 24' 45,880" N	29° 6' 49,659" E	50° 24' 46,786" N	29° 6' 56,101" E
11	50° 25' 15,155" N	29° 6' 42,596" E	50° 25' 16,060" N	29° 6' 49,039" E
12	50° 25' 28,368" N	29° 6' 46,061" E	50° 25' 29,273" N	29° 6' 52,505" E
13	50° 25' 28,492" N	29° 7' 37,793" E	50° 25' 29,396" N	29° 7' 44,236" E
14	50° 25' 16,114" N	29° 8' 18,654" E	50° 25' 17,018" N	29° 8' 25,096" E
15	50° 25' 26,306" N	29° 11' 10,030" E	50° 25' 27,207" N	29° 11' 16,471" E
16	50° 25' 25,199" N	29° 12' 32,387" E	50° 25' 26,099" N	29° 12' 38,827" E
17	50° 25' 7,454" N	29° 12' 34,009" E	50° 25' 8,354" N	29° 12' 40,449" E
18	50° 25' 1,969" N	29° 11' 4,888" E	50° 25' 2,871" N	29° 11' 11,328" E
19	50° 24' 44,682" N	29° 10' 32,489" E	50° 24' 45,584" N	29° 10' 38,929" E
20	50° 24' 23,681" N	29° 10' 33,371" E	50° 24' 24,584" N	29° 10' 39,810" E
21	50° 24' 6,644" N	29° 11' 7,019" E	50° 24' 7,546" N	29° 11' 13,457" E
22	50° 24' 0,141" N	29° 12' 5,145" E	50° 24' 1,043" N	29° 12' 11,582" E
23	50° 23' 44,349" N	29° 12' 6,337" E	50° 23' 45,251" N	29° 12' 12,774" E
24	50° 23' 41,673" N	29° 11' 28,306" E	50° 23' 42,575" N	29° 11' 34,743" E
25	50° 23' 49,169" N	29° 9' 22,128" E	50° 23' 50,073" N	29° 9' 28,567" E
26	50° 23' 47,241" N	29° 8' 44,866" E	50° 23' 48,146" N	29° 8' 51,305" E
27	50° 23' 29,681" N	29° 7' 9,568" E	50° 23' 30,588" N	29° 7' 16,007" E
28	50° 22' 42,568" N	29° 4' 27,927" E	50° 22' 43,478" N	29° 4' 34,366" E
29	50° 22' 32,250" N	29° 3' 29,042" E	50° 22' 33,161" N	29° 3' 35,481" E

Overview map



Source: Ukrainian Geological Survey

Geological information

Structurally, the Yuriivsko-Koziivskyi placer lies within the Volyn Block. Mesozoic-Cenozoic formations are represented by deposits of the Buchach series (Middle Jurassic), Kyiv and Obukhiv suites (Paleogene), the Novopetrivske suite, and the variegated clay layer of the Neogene, as well as the Quaternary system. The Novopetrivske suite deposits form the main productive and promising layer for identifying industrial concentrations of titanium and zircon. The thickness of the sand layer varies from 0.5 m (well 1298) to 16.5 m (well 1312). The absolute elevations of the roof range from 189.1 m (well 1294) in the south to 153.4 m (well 1298) in the northeast.

Lithologically, the Novopetrivske suite deposits consist of quartz sands that are light gray, fine to very fine-grained, occasionally with coarse-grained layers, and predominantly horizontally stratified. The average sand thickness is about 6.5 m. In the upper part of the section, lenses of gray and variegated fine-grained sandstones on kaolinitic cement (wells 5326, 5327) are present. Occasionally, interlayers of cross-bedded sands, secondary kaolin lenses, and gray plastic clays with thicknesses of 0.5–5.4 m occur. The sand in the upper section is medium to fine-grained, transitioning predominantly to fine-grained below.

The sands of the Novopetrivske suite are characterized by an elevated content of heavy minerals, especially titanium and zircon, which in some areas form placers. The mineral composition includes quartz (86–100%) and feldspar in the light fraction, while the heavy fraction contains zircon, rutile, garnet, ilmenite, leucoxene, sphene, sillimanite, kyanite, staurolite, tourmaline, and hydrogoethite. The combined content of titanium and zirconium minerals (bulk concentrate) ranges from fractions of a kilogram to 108 kg/m³ (well 1270), with isolated cases exceeding 200 kg/m³ (well 9783).

The variegated clay layer, sometimes with interbeds of differently grained sands, is found in isolated areas on the watersheds and ranges in thickness from 0.4 to 27.0 m. Sands in the lower part of the layer transition gradually to clays through highly sandy clays and clayey sands. These sands are light gray, ochre-yellow, and variously grained, with a thickness of 0.6 to 6.9 m. The heavy fraction of sandy clays contains ilmenite up to 22.32 kg/t, leucoxene up to 5.88 kg/t, zircon up to 1.34 kg/t, and rutile up to 0.67 kg/t. The bulk concentrate content in the sands ranges from 0.54 to 20.84 kg/m³.

The Quaternary system deposits, ranging from 1.5 to 30.0 m thick, cover the entire working area. They consist of loams, sands, clays, and soils. In the alluvial sands of the Quaternary system, the bulk concentrate content ranges from 1.08 to 48.2 kg/m³.

Source: Ukrainian Geological Survey

STATE GEOLOGICAL SERVICE OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Bilovodske Prospective Area With Titanium – Zirconium Ores Promising Accumulation

Mineral resource: Titanium ore and zirconium ores.

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production.

Location: Sumy region, 1 km south of Yablunivka village, 4 km north of Khrapivshchyna and Korchakivskyi promising accumulation. The H-07 highway passes through the prospective area.

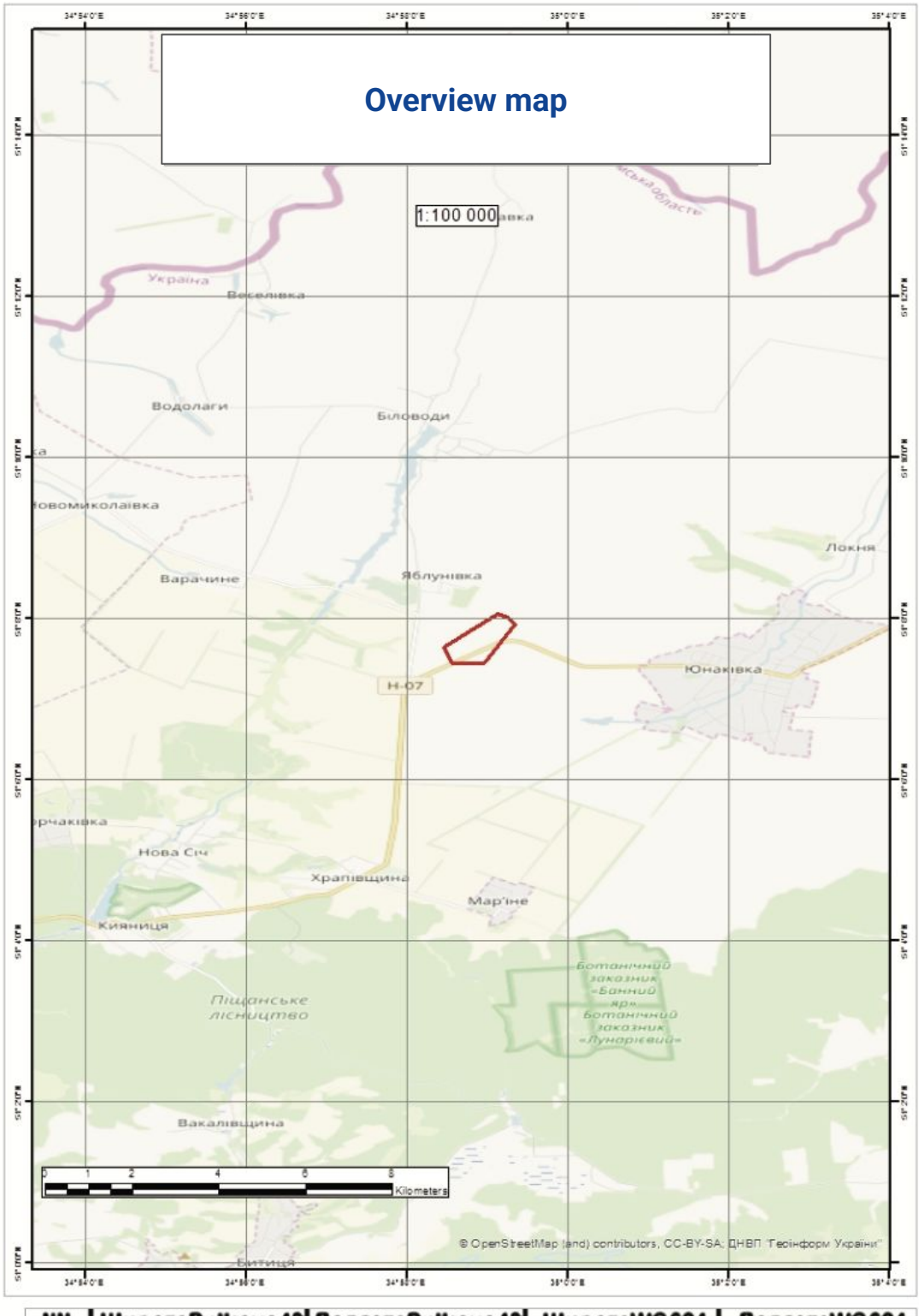
Land plot area: 62 hectares

Reserves and Resources (November 2016):		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium Ore	-	Limited access
Zircon	-	Limited access

The average content of TiO2:

Zircon – 6 kg/m3 Rutile – 8.4 kg/m3

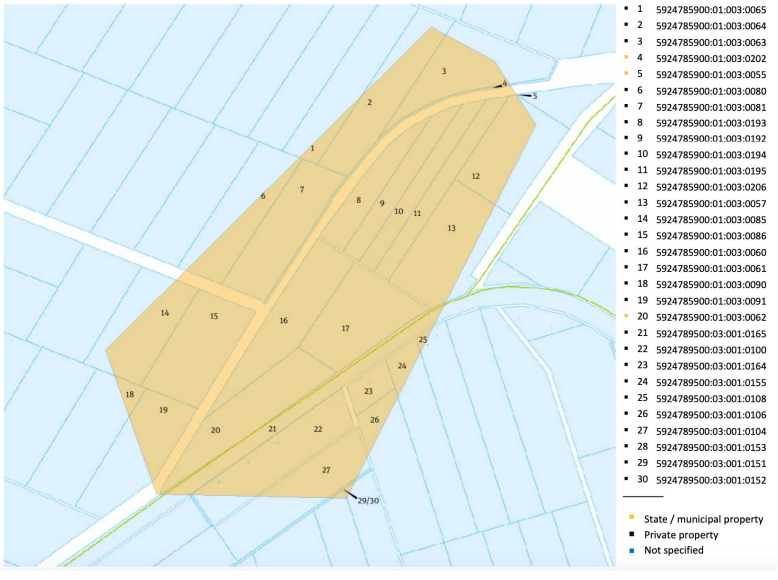
Source: Ukrainian Geological Survey



NN	ШиротаPulkovo42	ДовготаPulkovo42	ШиротаWGS84	ДовготаWGS84
1	51° 7' 38,458" N	34° 58' 33,855" E	51° 7' 37,914" N	34° 58' 27,551" E
2	51° 8' 3,633" N	34° 59' 14,230" E	51° 8' 3,090" N	34° 59' 7,927" E
3	51° 8' 0,943" N	34° 59' 22,109" E	51° 8' 0,400" N	34° 59' 15,806" E
4	51° 7' 56,022" N	34° 59' 27,226" E	51° 7' 55,479" N	34° 59' 20,923" E
5	51° 7' 26,899" N	34° 59' 3,694" E	51° 7' 26,355" N	34° 58' 57,392" E
6	51° 7' 27,219" N	34° 58' 40,146" E	51° 7' 26,675" N	34° 58' 33,843" E

Source: Ukrainian Geological Survey

List of cadastral numbers of land plots, within the contour of the deposit:



Geological information

The geological structure of this area involves deposits from the upper cretaceous (maastricht tier), which are represented by writing chalk, to the quaternary. The top of the upper cretaceous lies at depths of 55–56 m (abs. +168 m); above is a layer of glauconite-quartz sand of Buchach, Kyiv and Mezhyhirya assises with a total thickness of up to 30–32 m. Beretskaya assise lies on the Mezhyhirska one. It includes lower (Zmiyiv) subsuite - sands with glauconite, green leaf clays at the bottom, thickness 7–8 m, absolute marks of the sole +196, +201 m and upper (Syvash) subsuite with mineralization. The Verkhneberetsk deposit consists of light quartz fine-grained sand with thickness from 5.4 to 6.8 m, on average 6.1 m, the bottom mss is from +206 to +208 m. The section is completed by Neogene mottled clays and Quaternary loams with layers of sand with a total thickness of 8–11 m.

Three wells (NoNo 29, 226, 227) were drilled on the prospective area during geological extraction at a scale of 1:50000, the distance between them is from 320 to 600 m. The average thickness of mineralized sands is 3.7 m, the overburden is 9.6 m, the weighted average content of zircon 6 kg/m3, rutile 8.4 kg/m3, conditional ilmenite - 50 kg/m3, opening ratio - 2.6.

Resources/reserves assessment. Pre-calculated forecast resources of titanium-zirconium ores by category P2. Resource information has limited access.

Available geological information

The promising accumulation was discovered during a photogeologic survey at a scale of 1:50,000 of the Sumy city district (letters M-36-34-B, G and M-36-46-A, B) by Kharkiv geological exploration expedition in 1969–1972. In 1992, the promising accumulation was further examined and identified as one of the most perspective. Bilovodske promising accumulation is a part of the Korchakiv ore field.
The prospective area is recommended for greenfield exploration.

Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Korchakivskyi Prospective Area of Titanium-Zirconium Ore

Mineral resource: Ttitanium ores, zirconium ores.

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production.

Location: Sumy district, Sumy region, on the northern outskirts of the villages of Mala Korchakivka, Korchakivka and Nova Sich.

Land plot area: 750 hectares.

Reserves and Resources (November 2016):		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium-Zirconium Ore	Limited access	Limited access

Average content:

Conditional ilmenite 51.4 kg/m3
Zircon 6.5 kg/m3
Rutile 7/6 kg/m3

Source: Ukrainian Geological Survey

Geological information

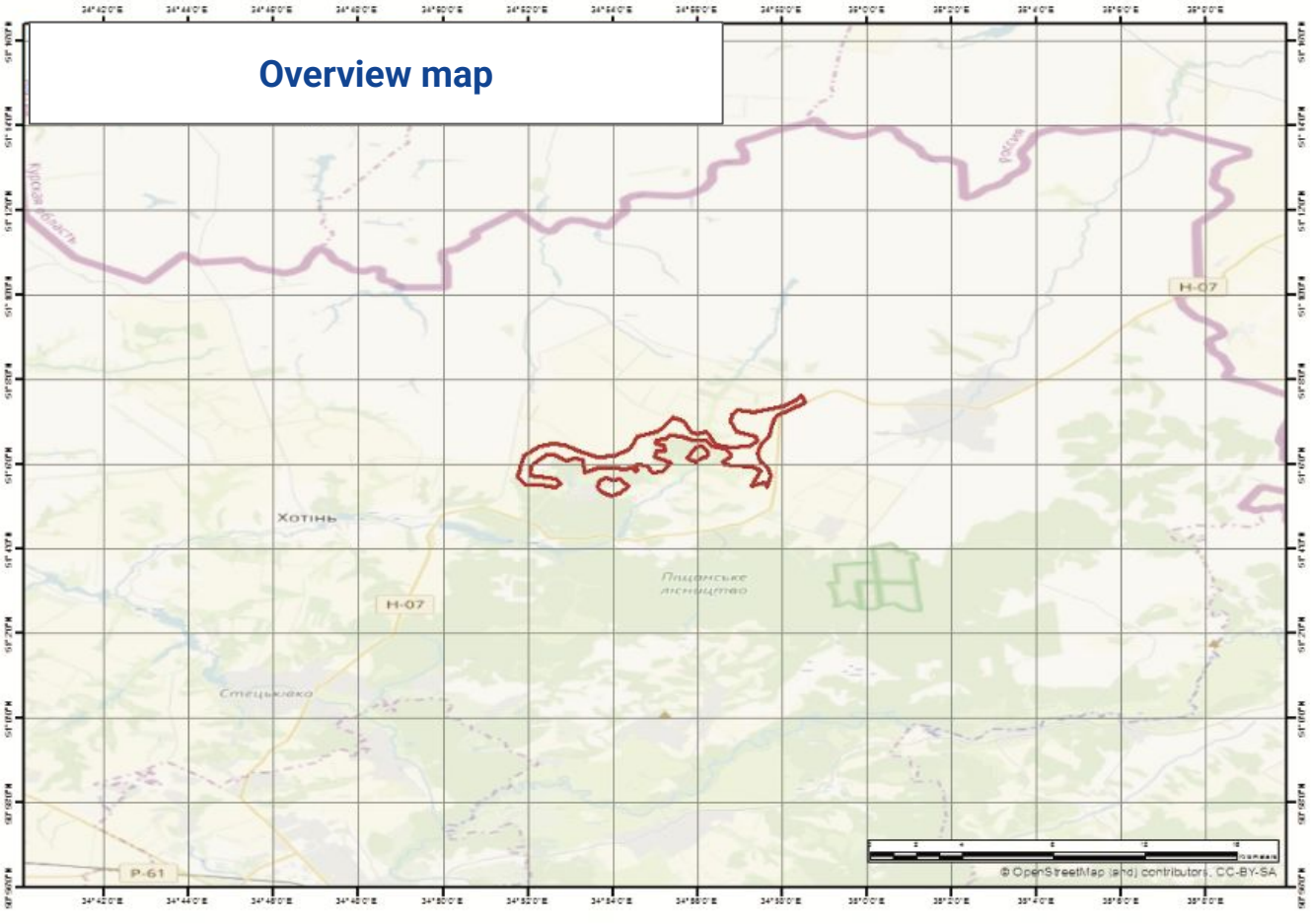
The length of the prospective area is about 10 km, the width is on average 700–800 m, it is elongated in the north-eastern direction. Absolute marks (mss) of the earth's surface from +208, +210 m in the southwest up to +225 m in the northeast. In the geological structure of the area take part Upper Cretaceous, Paleogene, Neogene and Quaternary deposits. The writing chalk of the Maastricht tier lies at depths of 57–68 m. The upper layer of glauconite-quartz sands, which includes the Kaniv, Kyiv Eocenes and Mezhygirska deposit of the Lower Oligocene, has thickness of 34–37 m. The composition and structure of the Berets deposit are similar to those of Belovodskyi and Khrapivshchyna. The thickness of the Nyzhnyoberets subdeposit is 6.7–10.6 m, the absolute marks of its bottom range from +185 m to 198 m. The upper (Syvash) subdeposit of the Berets deposit is characterized by absolute marks of the bottom from 196 m to 208 m, on the right bank of the Oleshnya river they range from +196 m to +200 m. The thickness of the subdeposit is from 3 to 18 m, on average about 9 m, the thickness of the overlying Neogene mottled and red-brown clays and Quaternary sediments is from 3.6 to 16 m. During the geological survey at a scale of 1:50,000 at the site of the Korchakivskyi promising area, mapping and separate exploration wells were drilled, and several outcrops were described. Zircon-bearing sands (with zircon content> 4 kg/ m3) of Verkhnyoberetsky deposit were discovered and tested in all 6 wells (No 7, 8, 24, 47, 33, 320) and two outcrops (No 1, 5), distance between exploration points researches from 500 m to 2.2 km. The ore mining is confined to the upper part of the Verkhnyoberetsky deposit. The average thickness of the ore deposit is 4 m, the opening is 10.8 m, the opening coefficient is 2.7. The weighted average content of zircon is 6.5 kg / m3, rutile is 7.6 kg / m3, conditional ilmenite is 51.4 kg / m3.

Available geological information

The promising area was discovered during a geological survey at a scale of 1:50000 in the Sumy city district (letters M-36-34-B, G and M-36-46-A, B) in 1969-1972 by Kharkiv GEE. Later, in 1992, the promising area was further studied and identified as one of the most promising. The Korchakivskyi promising area is a part of the Korchakivskyi ore field. The site is recommended for greenfield exploration.

Source: Ukrainian Geological Survey

Overview map



THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Khrapivshchyna Prospective Area of Titanium-Zirconium Ore

Mineral resource: titanium ores, zirconium ores.

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production.

Location: Sumy district in Sumy region, on the north-northeastern outskirts of Khrapivschyna village.

Land plot area: 170 hectares.

Reserves and Resources (November 2016):		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium-Zirconium Ore	Limited access	Limited access

Average content:

Zircon - 7.8 kg/m3
Rutile - 9.9 kg/m3
Conditional ilmenite - 63 kg/m3

Source: Ukrainian Geological Survey

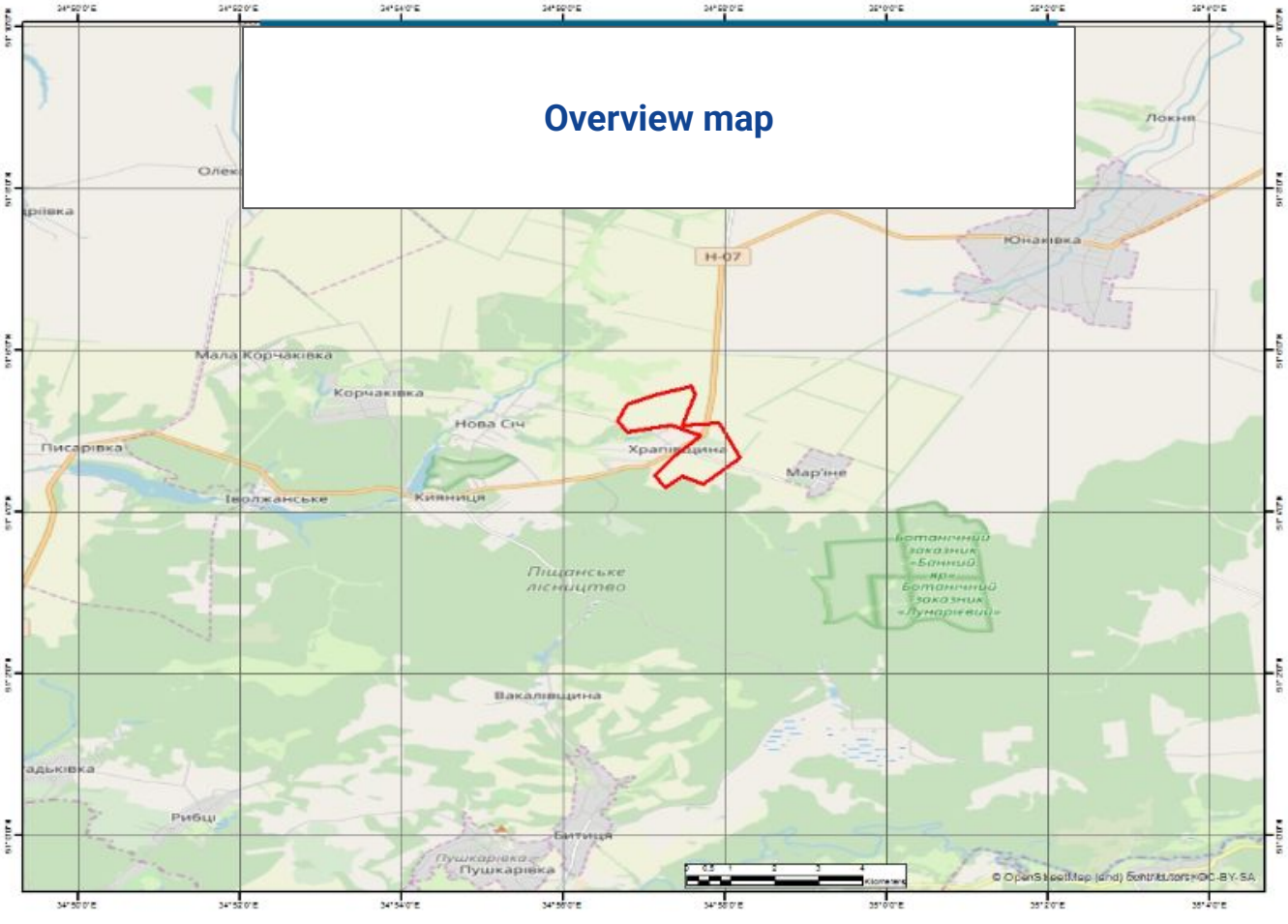
Geological information

Upper cretaceous lies at a depth of 58–66 m within the prospective area. It is covered by glauconite-quartz sands of the Eocene and similar sands of the Mezhigorsk assise of the Lower Oligocene with a total thickness of 31–37 m. on which the Berets assise of the Upper Oligocene. It is overlain by the motley clays of the Neogene or directly by the Quaternary loams. Beretskaya assise consists of lower and upper subsuites. The lower (snake) subsuite is represented by quartz sands, usually with significant impurities of glauconite and layers of green leafy clays. Absolute marks of the sole of the subsuite range from +189 to 195 m, its thickness is 6.5m-13.6m, on average - 9.8 m. The upper subsuite, to which the ore-bearing stratum is confined, is composed of light gray and white sands, often in the upper contact and in layers throughout the stratum of brick-red, orange, and yellow colors. Sand by the granulometric composition is very fine-grained to siltstones, sometimes containing low- thickness layers of larger sand. There are very thin dark layers, which are enriched with ore minerals. During geological survey at a scale of 1: 50000 14 wells were drilled, 10 out of them (##34, 187, 188, 222, 325, 327, 328, 334, 336, 338) opened the ore sands of Upper Oberec subsuites and rest of wells of the Verkhnoberetsky deposits were completely or mostly blurred. The distance between the wells is from 350m to 800m. The ore-bearing horizon is confined to the upper part of the Siva subsuite and is not flooded. The zircon content in 9 wells is more than 4 kg/ m3 (from 4.01 to 15 kg/m3) and only in 1 - #328 is reduced to 2.67 kg/m3. The average thickness of the mineral is 5.6 m, the opening - 13.0 m, the weighted average zircon content for the whole prospective area - 7.8 kg/m3, rutile 9.9 kg/m3, conditional ilmenite 63 kg/m3, opening coefficient 2.3 . With a thickness of 4.3 m the content of zircon increases to 8.6 kg/m3, rutile - to 10.7 kg/m3. Light gray and white varieties of sand meet the requirements for marshal of the 2nd grade.

Available geological information

The promising accumulation was found during a geological survey at a scale of 1:50,000 in Sumy (letters M-36-34-B, G and M-36-46-A, B) by the Kharkiv geological exploration expedition in 1969–1972. In 1992, the promising accumulation was further examined and identified as one of the most perspective. Khrapivshchyna promising accumulation is part of the Korchakiv ore field. The prospective area is recommended for greenfield exploration.

Source: Ukrainian Geological Survey



Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR GEOLOGICAL EXPLORATION:

Haydarivsky Prospective Area of Ilmenite-Zirconium Ore

Mineral resource: Titanium ores, zirconium ores.

Type and term of subsoil use: 20-years licenses for exploration, pilot development and production.

Location: Zmiiv district, Kharkiv region, on the southwestern outskirts of the village of Gaidary

Land plot area: 971.4 hectares.

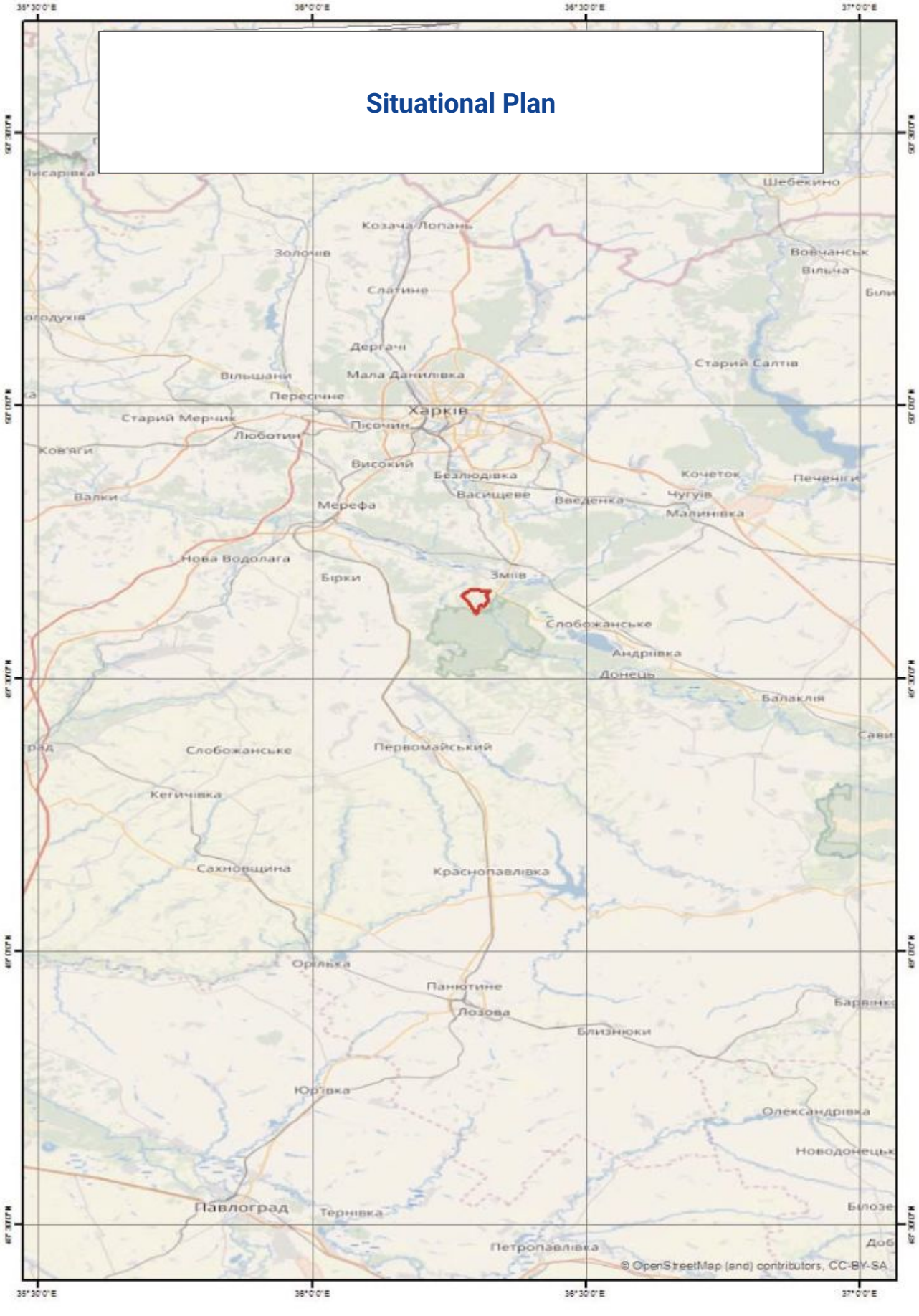
Reserves and Resources (November 2016):		
	Reserves (A+B+C1)	Resources (C2+P1)
Titanium-Zirconium Ore	Limited access	Limited access

Average content:

Zircon - 8.3 kg/m3
Rutile - 6.8 kg/m3
Conditional ilmenite - 42.4 kg/m3

Source: Ukrainian Geological Survey

Situational Plan



Source: Ukrainian Geological Survey

THE UKRAINIAN GEOLOGICAL SURVEY OFFERS A LICENSE FOR MINING:

Kropyvnyanske Deposit of Titanomagnetite-Ilmenite Ores with Apatite

Mineral resource:
Titanium Ores, Apatite.

Type and term of subsoil use:
mining, 20 years.

Location: Khoroshiv District, Zhytomyr Region, 0.3 km west of the deposit lies the village of Kropyvenka

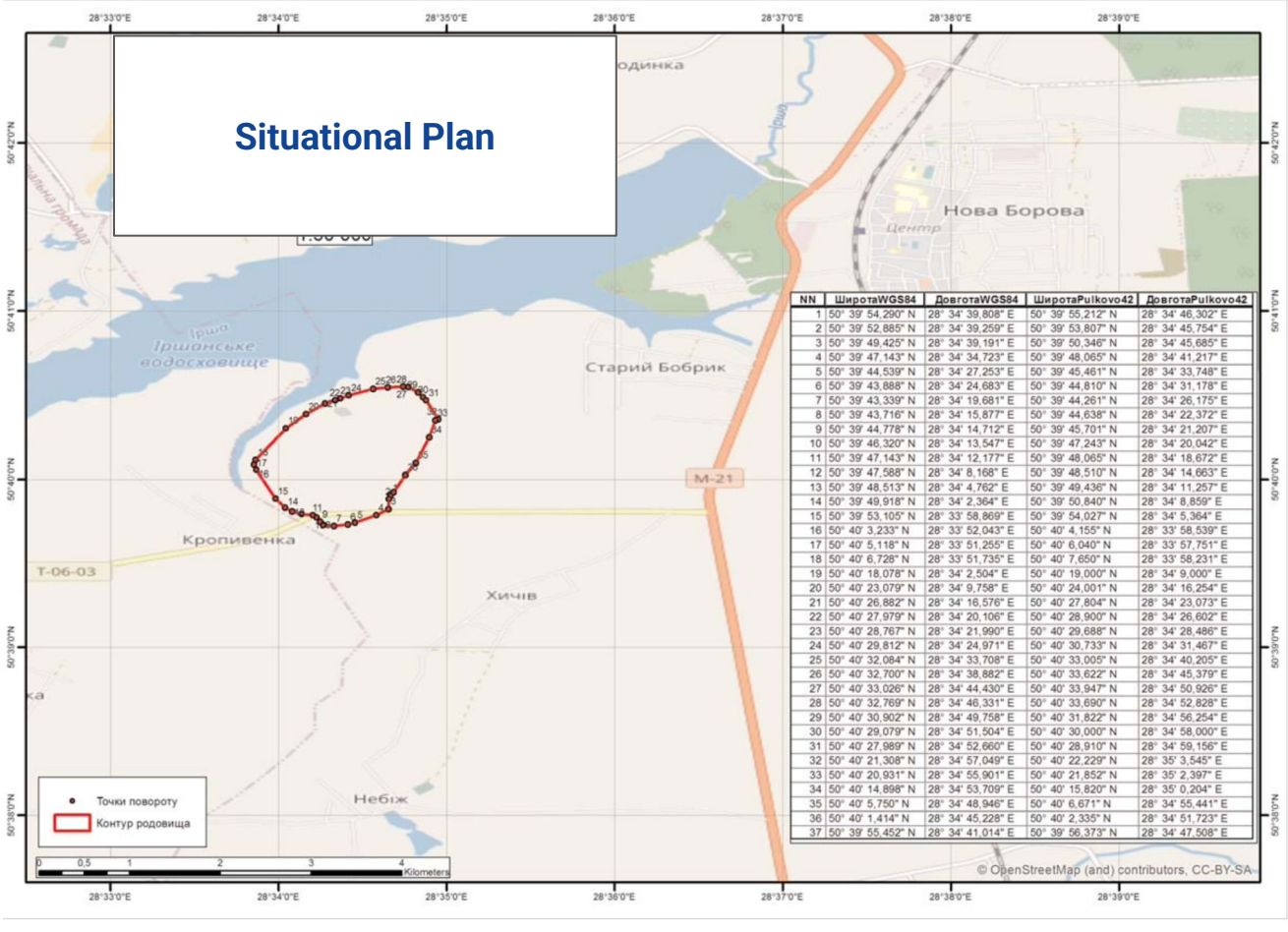
Land plot area: 128.1 hectares.

Reserves and Resources, Kt:		
	Reserves (A+B+C1), Kt	Resources (C2+P1), Kt
Titanium ores	Limited access	Limited access
Apatite ores	4,941.0	446,021.0
P_2O_5	81.0	10,219.0

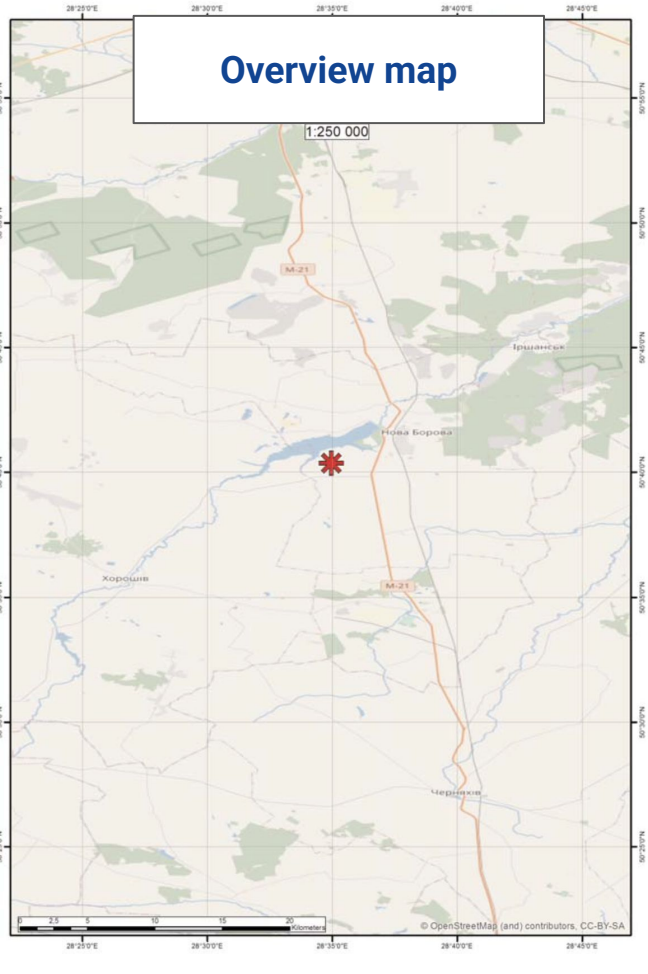
Average content:

TiO_2 6.2 - 6.47%
P_2O_5 1.65 - 2.29%

Source: Ukrainian Geological Survey



NN	ШиротаWGS84	ДовготаWGS84	ШиротаPulkovo42	ДовготаPulkovo42
1	50° 39' 54,290" N	28° 34' 39,808" E	50° 39' 55,212" N	28° 34' 46,302" E
2	50° 39' 52,885" N	28° 34' 39,259" E	50° 39' 53,807" N	28° 34' 45,754" E
3	50° 39' 49,425" N	28° 34' 39,191" E	50° 39' 50,346" N	28° 34' 45,685" E
4	50° 39' 47,143" N	28° 34' 34,723" E	50° 39' 48,065" N	28° 34' 41,217" E
5	50° 39' 44,539" N	28° 34' 27,253" E	50° 39' 45,461" N	28° 34' 33,748" E
6	50° 39' 43,888" N	28° 34' 24,683" E	50° 39' 44,810" N	28° 34' 31,178" E
7	50° 39' 43,339" N	28° 34' 19,681" E	50° 39' 44,261" N	28° 34' 26,175" E
8	50° 39' 43,716" N	28° 34' 15,877" E	50° 39' 44,638" N	28° 34' 22,372" E
9	50° 39' 44,778" N	28° 34' 14,712" E	50° 39' 45,701" N	28° 34' 21,207" E
10	50° 39' 46,320" N	28° 34' 13,547" E	50° 39' 47,243" N	28° 34' 20,042" E
11	50° 39' 47,143" N	28° 34' 12,177" E	50° 39' 48,065" N	28° 34' 18,672" E
12	50° 39' 47,588" N	28° 34' 8,168" E	50° 39' 48,510" N	28° 34' 14,663" E
13	50° 39' 48,513" N	28° 34' 4,762" E	50° 39' 49,436" N	28° 34' 11,257" E
14	50° 39' 49,918" N	28° 34' 2,364" E	50° 39' 50,840" N	28° 34' 8,859" E
15	50° 39' 53,105" N	28° 33' 58,869" E	50° 39' 54,027" N	28° 34' 5,364" E
16	50° 40' 3,233" N	28° 33' 52,043" E	50° 40' 4,155" N	28° 33' 58,539" E
17	50° 40' 5,118" N	28° 33' 51,255" E	50° 40' 6,040" N	28° 33' 57,751" E
18	50° 40' 6,728" N	28° 33' 51,735" E	50° 40' 7,650" N	28° 33' 58,231" E
19	50° 40' 18,078" N	28° 34' 2,504" E	50° 40' 19,000" N	28° 34' 9,000" E
20	50° 40' 23,079" N	28° 34' 9,758" E	50° 40' 24,001" N	28° 34' 16,254" E
21	50° 40' 26,882" N	28° 34' 16,576" E	50° 40' 27,804" N	28° 34' 23,073" E
22	50° 40' 27,979" N	28° 34' 20,106" E	50° 40' 28,900" N	28° 34' 26,602" E
23	50° 40' 28,767" N	28° 34' 21,990" E	50° 40' 29,688" N	28° 34' 28,486" E
24	50° 40' 29,812" N	28° 34' 24,971" E	50° 40' 30,733" N	28° 34' 31,467" E
25	50° 40' 32,084" N	28° 34' 33,708" E	50° 40' 33,005" N	28° 34' 40,205" E
26	50° 40' 32,700" N	28° 34' 38,882" E	50° 40' 33,622" N	28° 34' 45,379" E
27	50° 40' 33,026" N	28° 34' 44,430" E	50° 40' 33,947" N	28° 34' 50,926" E
28	50° 40' 32,769" N	28° 34' 46,331" E	50° 40' 33,690" N	28° 34' 52,828" E
29	50° 40' 30,902" N	28° 34' 49,758" E	50° 40' 31,822" N	28° 34' 56,254" E
30	50° 40' 29,079" N	28° 34' 51,504" E	50° 40' 30,000" N	28° 34' 58,000" E
31	50° 40' 27,989" N	28° 34' 52,660" E	50° 40' 28,910" N	28° 34' 59,156" E
32	50° 40' 21,308" N	28° 34' 57,049" E	50° 40' 22,229" N	28° 35' 3,545" E
33	50° 40' 20,931" N	28° 34' 55,901" E	50° 40' 21,852" N	28° 35' 2,397" E
34	50° 40' 14,898" N	28° 34' 53,709" E	50° 40' 15,820" N	28° 35' 0,204" E
35	50° 40' 5,750" N	28° 34' 48,946" E	50° 40' 6,671" N	28° 34' 55,441" E
36	50° 40' 1,414" N	28° 34' 45,228" E	50° 40' 2,335" N	28° 34' 51,723" E
37	50° 39' 55,452" N	28° 34' 41,014" E	50° 39' 56,373" N	28° 34' 47,508" E



Source: Ukrainian Geological Survey

Geological information

The Kropyvnyanske deposit features two natural ore types: primary (bedrock) and weathering crust ores. The primary ore body is associated with basic and ultrabasic rocks forming a bowl-shaped mass. Its central part consists of densely impregnated gabbronorites, melano-, meso-, and leucogabbros, with a gradual decrease in valuable components towards background levels.

The TiO_2 content ranges from 0.74% to 11.91%, averaging 6.50%, while P_2O_5 varies from 0.01% to 7.37%, with an average of 2.50%. The main ore mineral in primary ores is titanomagnetite, ranging from 6.7% to 27.53%, with an average of 18.24%. Apatite content reaches 6–8%, ilmenite up to 4%, and sulfides (pentlandite, pyrrhotite, chalcopyrite) collectively do not exceed 12–2%.

Among the rock-forming minerals, pyroxene predominates, ranging from 18.7% to 57.1% and averaging 45.46%. Olivine is present in amounts of 15–35%, while plagioclase varies from 5% to 20%.

The ore-bearing weathering crust lies almost horizontally with some discontinuities ("windows"). The ore body associated with this crust averages 3.4 m in thickness. TiO_2 content in the crust ranges from 0.29% to 16.12%, averaging 5.55%, and 6.18% in the ore body.

Key minerals in the weathering zone include iron hydroxides, nontronite, montmorillonite, kaolinite, titanomagnetite, ilmenite, and apatite, with their composition depending on parent rock and weathering degree. Secondary minerals include relicts of pyroxene and plagioclase.

The titanomagnetite-ilmenite-apatite ores of the Kropyvnyanske deposit belong to two technological types: primary ores, which predominate, and residual ores from the weathering crust, accounting for only 1.2% of total reserves.

A technological scheme is recommended for the beneficiation of residual ores, involving:

- Two stages of disintegration and screening at 3 mm;
- Grinding ore to 50% -0.074 mm;
- Two-step desliming;
- Gravity concentration of deslimed ore, producing gravity tails for apatite flotation;
- Wet magnetic separation of the gravity concentrate to obtain titanomagnetite concentrate;
- Regrinding gravity middlings and directing them to apatite flotation;

Source: Ukrainian Geological Survey

- Drying the non-magnetic fraction from high-gradient magnetic separation to produce ilmenite concentrate via magnetic-electrostatic separation.

Hydrogeological conditions at the Kropyvnyanske deposit are complex. During initial development, with the quarry reaching the kaolin roof in the weathering crust ore body, groundwater inflow is expected at 4,474 m³/day. Inflow from atmospheric precipitation is estimated at 974 m³/day, with peak inflow during heavy rains reaching up to 131,000 m³/day.

Mining and geological conditions support open-pit development, facilitated by the bowl-shaped ore body, minimal overburden thickness, absence of barren interlayers, and uniform strength of ore and host rocks. Open-pit mining ensures high recovery of valuable minerals from the deposit.

Available geological information

The Kropyvnyanske deposit of titanomagnetite-ilmenite ores with apatite was discovered as a prospective ore-bearing site in 1980 through exploratory drilling conducted by the Zhytomyr Geological Exploration Expedition.

Source: Ukrainian Geological Survey