

## KROPYVENKA FIELD OF TITANOMAGNETITE-ILMENITE ORES WITH APATITE

**Mineral:** titanium ores, apatite.

**Type and period of subsoil use:** mining, 20 years.

**Location:** Kropyvenka village is located in Khoroshiv district of Zhytomyr region, 0.3 km west of the field, Irshansk reservoir is 140 m to the west, T-06-03 highway passes through the northern edge of the field.

**Plot area:** 128.1 ha.

**Geological summary.** There are two natural types of ores - indigenous rocks and residuum. The ore deposits of root ores are associated with base-ultrabasites, which form a cup-shaped body. The central part of the ore deposit consists of densely interspersed gabbro-peridotite melano, meso, and leuko-gabbro with a gradual decrease in the content of useful components. The  $TiO_2$  content varies from 0.74% to 11.91% and on average is 6.50%. The content of  $P_2O_5$  varies from 0.01% to 7.37% and on average is 2.50%.

The main ore mineral of root ores is titanomagnetite, its content ranges from 6.7% to 27.53%, on average - 18.24%. The content of apatite is 6%-8%, ilmenite - up to 4%, sulfides (pentlandite, pyroite, chalcopyrite) in total do not exceed 12%-2%. Among the rock-forming minerals of root ores, pyroxene is the main one - its content varies from 18.7% to 57.1% and on average is 45.46%. Olivine is presented in the amount of 15%-35%, plagioclase - 5%-20%. Ore-bearing residuum lies almost horizontally, has several gaps (windows). Accordingly, there is an ore deposit that is associated with residuum. Its average thickness is 3.4 m. The  $TiO_2$  content varies from 0.29% to 16.12% and on average is 5.55%, and in the ore deposit - 6.18%. The main minerals in the weathering zone are iron hydroxides, nontronite, montmorillonite, kaolinite, titanomagnetite, ilmenite, apatite, the content of which varies depending on the composition of parent rocks and the degree of weathering. Accessory minerals are presented by pyroxene and plagioclase. Titanium-magnetite-ilmenite ores with apatite from the Kropyvenka field belong to two technological types - ores in root rocks, which significantly dominate and ores in residuum, their share being only 1.2% of the total reserves of the field. For enrichment of residual ores, the basic technological scheme is recommended. There are foreseen two stages of disintegration, screening by class 3 mm; grinding of ore to a size of 50% of the class - 0.074 mm; desliming in two stages; gravitational enrichment of slurry ore with the allocation of gravity tails for apatite flotation; wet magnetic separation of the heavy fraction of gravity enrichment with the release of titanomagnetite concentrate; grinding of industrial products of gravity and their direction on apatite flotation; drying of non-magnetic fraction of high-gradient magnetic separation in order to obtain ilmenite concentrate by magnetic electrostatic enrichment. Hydrogeological conditions of the Kropyvenka field are characterized as complex. At the first stage of field development, when deepening the quarry to the roof of residuum kaolin (ore body of residual ores), water inflow to the quarry due to groundwater is projected and equal to 4,474  $m^3/day$ . Water inflow due to precipitation is 974  $m^3/day$ . The expected maximum of water inflow due to heavy rains is 131 thousand  $m^3/day$ . Mining-technical and mining-geological features of the Kropyvenka field allow to conduct development in an open way and are caused by a cup-shaped form of ore deposit, insignificant capacity of overburden, complete absence of empty layers and equal durability of ore and containing rocks. The way of surface mining should provide a high extraction of minerals from the subsoil.

**Available geological information.** The Kropyvenka field of titanomagnetite-ilmenite ores with apatite was found as contingent resources in 1980 by drilling of exploratory wells by the Zhytomyr Geological Exploration Expedition.

**Resources/reserves assessment.** DKZ of Ukraine by protocol dated April 3, 2014 No. 3153-DSK (addendum to protocol No. 2661-DSK dated 07.3.2012) tested pre-estimated total reserves state significance of complex titanomagnetite- of ilmenite ores with apatite by classes and categories: ilmenite-apatite ores code of classes 121+122 (categories geological study  $C_1+C_2$ ); balance reserves of  $P_2O_5$  - 121+122 (categories of geological study  $C_1+C_2$ ) - 5429 thousand tons. Further increase of ore reserves and of useful components is possible outside the site priority development at its geological post-study According to the Organization's Framework Classification of the United Nations (UNSC-2009) reserves of titanomagnetite-ilmenite ores with apatite are included according to possible commercial stocks, feasibility the development of which requires further evaluation (class code 121+122).

Information on the amount of  $TiO_2$  reserves is limited.

[http://geoinf.kiev.ua/wp/geologichni%zviti.php?rep=fnd\\_shifr.rdf&schifr=63522](http://geoinf.kiev.ua/wp/geologichni%zviti.php?rep=fnd_shifr.rdf&schifr=63522) [http://geoinf.kiev.ua/wp/geologichni%zviti.php?rep=fnd\\_shifr.rdf&schifr=64187](http://geoinf.kiev.ua/wp/geologichni%zviti.php?rep=fnd_shifr.rdf&schifr=64187)

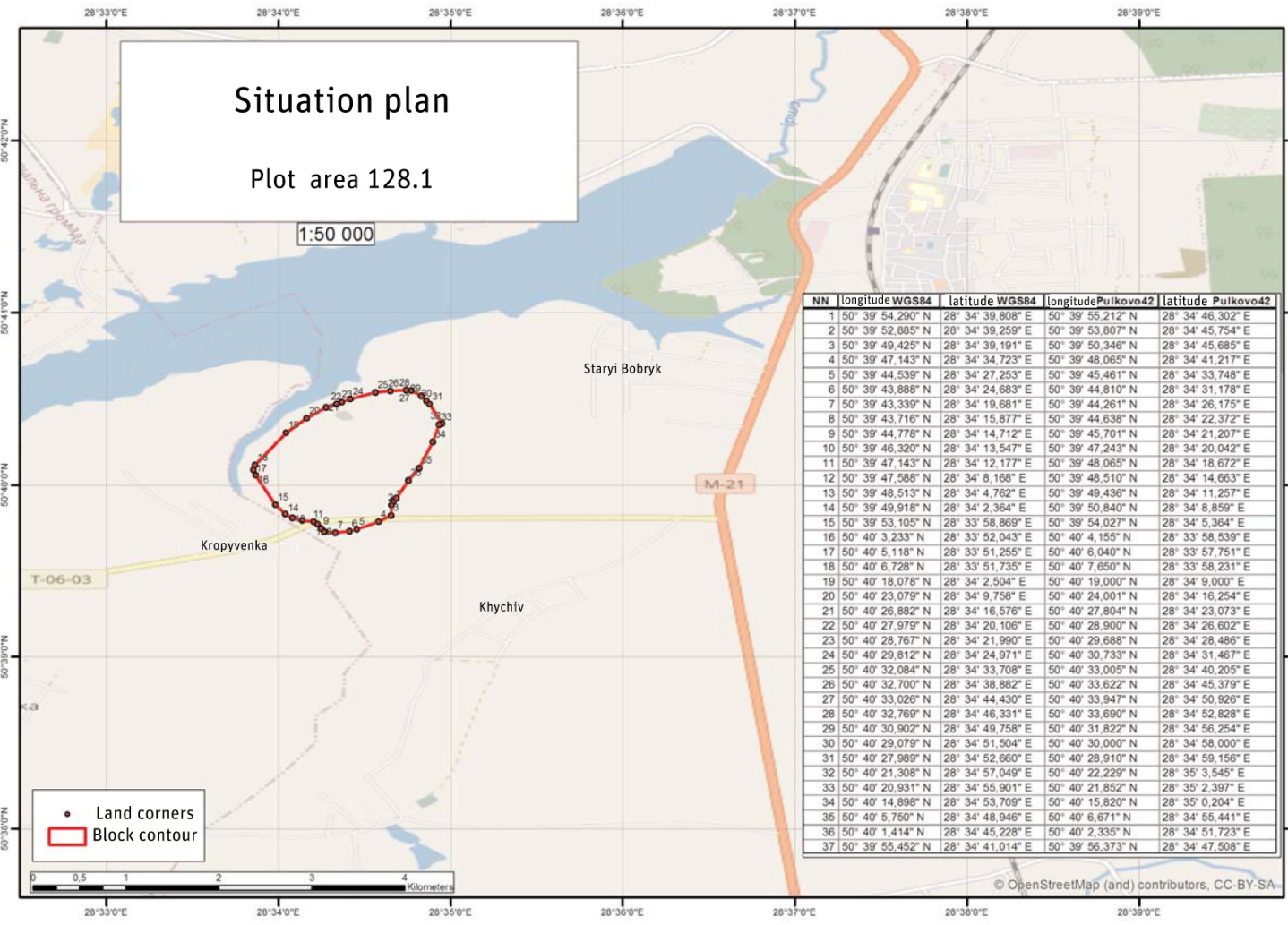
**Minimum work program.** Provided by Mining terms Model agreements and defined in "Work Program" annex.

Model agreements are listed at the link: <https://www.geo.gov.ua/prirnri-ugodi-pro-umovi-koristuvannya-nadrami/>

# Situation plan

Plot area 128.1

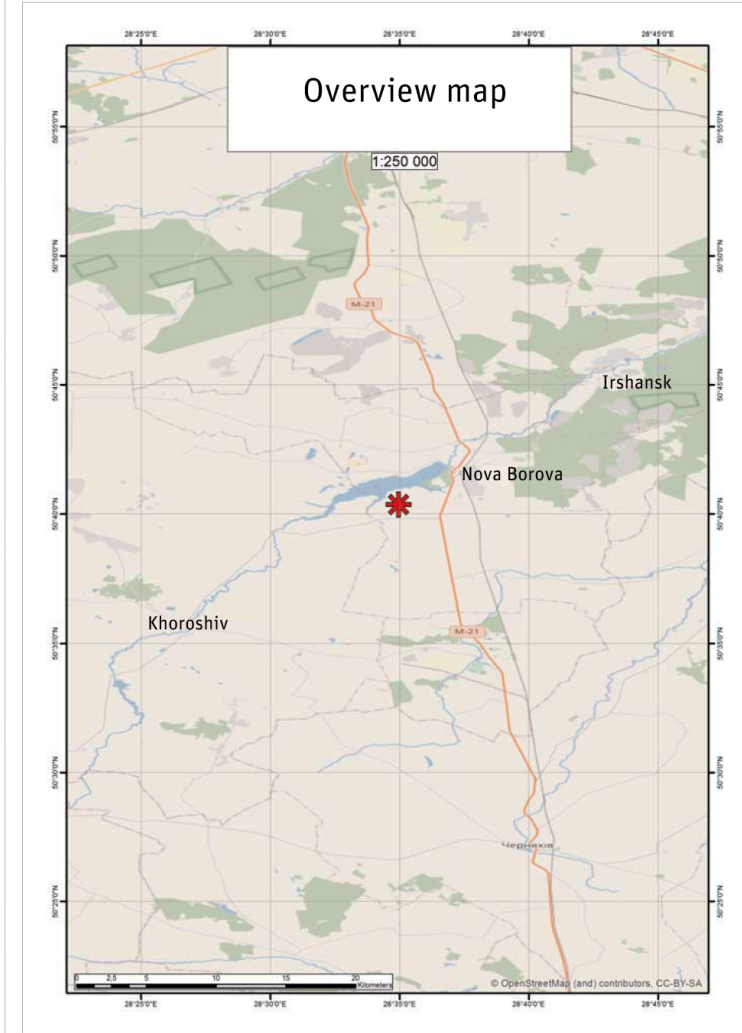
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NN	longitude WGS84	latitude WGS84	longitude Pulkovo42	latitude Pulkovo42
1	50° 39' 54,290" N	28° 34' 39,808" E	50° 39' 55,212" N	28° 34' 46,302" E
2	50° 39' 52,885" N	28° 34' 39,259" E	50° 39' 53,807" N	28° 34' 45,754" E
3	50° 39' 49,425" N	28° 34' 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

# Overview map

1:250 000



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