



CRM of Ukraine Database Supplements

Mineral target:	Tarnavatske deposit
Commodity:	Nickel and cobalt ores

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Location: Mykolaiv Region, Pervomayskiy District, Kryvozerska Territorial Community, west outskirts of Ternuvate village, 15 km from Pobuzskiy Ferronickel Plant LLC.

Research: In 1950 a complex geological survey on a scale of 1:200 was carried out on the territory of the deposit 000 and 1:50 000 for setting up prospecting works for silicate nickel ores. The Tarnavatske deposit was discovered and explored in 1953-1958, when the Pobuzka Expedition of the "Kyivgeologiya" Trust carried out prospecting and exploration work for silicate nickel. According to the results of the work, the reserves of cobalt-nickel-silicate ores were approved by the decision of the State Committee of the USSR (protocol dated February 14, 1959 #2594). In 1996 preliminary exploration of the first body of the Tarnavatske deposit, which is part of the hypergenic nickel deposits of the Middle Pobuzhzhia, was carried out (protocol of the Ministry of Industry and Trade of Ukraine, 1995). According to the results of the work, the composition of the ore was studied, the morphology of the ore body was clarified, and the increase in reserves was obtained.

Geological characteristics: the deposit is located on the southwestern slope of the Ukrainian Shield. A composite complex of metamorphic and igneous rocks of the Archaean age, an ancient weathered crust of the Meso-Cenozoic age, and a layer of the Tertiary and Quaternary sediments take part in the geological structure of the Tarnavatske deposit.

Precambrian rocks include: amphibole-plagioclase, pyroxene-plagioclase, sillimanite, biotite, graphite and other gneisses, quartzites, crystalline carbonate rocks, serpentinites, pyroxenites, gray Kirovogradski, pink and pink-gray, porphyry Umanski granites.

Silicate nickel ores, as in the entire Pobuzhzhia area, are confined to the weathering crust of serpentinites, as well as amphibolites near their contact with serpentinites.

Silicate nickel ores of the deposit are petrographically represented by nontronites, ironized nontronites, nontronite-chlorite rocks, less often ochres, brown ironstones, and nontronitized serpentinites. In this regard, the productive and host rocks, represented by the weathering crust, do not differ externally, the boundary between them is drawn on the basis of the nickel content.

Neogene sediments are represented by various-grained sands and gray carbonate clays of the Baltska Suite.

The layer of Quaternary sediments is represented by loess and brown loams and red-brown clays, the thickness of which varies from 4.5 to 23.0 m.

The ore body forms three horizontal or gently inclined, according to the ancient topography, lenticular layers, elongated in accordance with the general extension of the rocks in the north-west direction. The layers are numbered from north to south.

The largest layer is the first, located in the northern part of the deposit in the weathering crust of the northern largest serpentinite body, up to 2100 m long, the width of the deposit in the northern part reaches 800 m, in the southern part 300 m. The thickness of nickel ores within this layer varies from 1 m to 19 m, on average - 4.5 m. The depth of nickel ores varies from 20 m to 46 m. The content of nickel in the ores is not constant and varies from 0.5% to 1.43%, on average 0.81%.

The second layer of industrial nickel ores is located 650 m to the south of the first and is also associated with the weathering crust of the central serpentinite body. Its length is 540 m and width do not exceed 120 m. The thickness of industrial ores of this deposit is also variable and varies from 1.0 to 8.6 m, on average - 2.90 m. The depth of ores varies from 17.0 m to 40.0 m. The average nickel content is 0.91%, varying from 0.58% to 1.27%.

The third layer of the simplest configuration is located 260 m south of the second, 300 m long, 40 to 120 m wide. The average thickness of the industrial ores of the layer is 3.19 m, varying from 2.9 m to 13-15 m. The depth of the layer varies from 4.3 to 18.0 m. The average nickel content of the layer is 0.94%, varies from 0.5% to 1.49%.

According to the conditions of occurrence of ore layers, they belong to sheet-like bodies.

Industrial ores in the deposit are confined mainly to the central parts of the serpentinite massif, with the exception of some areas of the deposit, where the upper part of the weathering crust of crystalline rocks was destroyed by erosion processes even before the accumulation of Cenozoic sediments.

In the roof of industrial ores, there are ore-free rocks of the weathering crust, off-balance ores, less often sand-clay rocks of the Cenozoic (Tertiary). In the bottom there are nontronitized serpentinites, off-balance ores, less often dense serpentinites. More often, industrial nickel ores are located in the central part of bodies.

On the periphery of industrial nickel ores, there are off-balance nickel ores, in addition, the latter usually constitute transitions between industrial nickel ores and ore-free areas of the weathering crust.

Off-balance nickel ores, in addition to containing industrial ores in the three described deposits, form three independent layers associated with the weathering crust of the central serpentinite body and the southern serpentinite body. They occur in the form of horizontally or obliquely falling layers, as well as in the form of lenses that are quickly wedged out. Barren rocks are often observed among off-balance ores, which split the layer into 2-3 layers.

The average thickness of off-balance nickel ores of the first layer is 5.0 m, second – 5.18 m, third – 3.45 m, fourth – 4.98 m, fifth – 9.96 m, and sixth – 6.17 m.

The average thickness of the off-balance nickel ores in the deposit is 5.52 m. The average nickel content is 0.53%.

Chemical composition of nickel ores of the Tarnavatske deposit:

Components	Ni	Co	Fe	SiO ₂	Cr ₂ O ₃	Al ₂ O ₃	CaO	MgO	CuO	P ₂ O ₅
min. content, %	0.5	0.011	9.0	15.6	0.14	0.37	0.9	1.04	0.0001	0.09
max. content, %	1.43	0.140	32.5	68.2	4.06	10.5	25.6	29.8	0.0375	0.18
avg. content, %	0.81	0.044	20.6	42.86	1,177	2.84	5.56	7.84	0.0053	0.025

Hydrogeological conditions are simple. Four aquifers have been identified at the deposit: Quaternary sediments, Baltski sediments, weathered crust, and the fractured zone of crystalline rocks. The inflow of water into the future pit will be no more than 40-50 m³/h and will not significantly affect the development of the mineral.

The relatively shallow occurrence of the ore body, uncomplicated mining and technical conditions, and mainly the area-like weathering crust type of serpentinites determines the economic feasibility of developing the deposit by the open-cast method.

Assessment of resources/reserves: as of 01.01.2023, reserves of cobalt-nickel-silicate ores amount to categories B+C1 – 3,185.0 thousand tons, including nickel - 21.1 thousand tons; cobalt – 1,083.0 t; off-balance reserves – 7,720.0 thousand tons, including nickel - 30.6 thousand tons; cobalt - 1,851.0 tons.