



CRM of Ukraine Database Supplements

Mineral target:	Chervoniy Yar deposit
Commodity:	Nickel and cobalt ores

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Location: Dnipropetrovsk Region, Kryvorizka District, Devladiv Territorial Community, southwestern outskirts of the Krasnyy Yar village, at a distance of 7 km to the south-west of the deposit is the Devladove railway station.

Exploration: the deposit was discovered and explored by the South Ukrainian Expedition of the Ukrainian Geological Administration in 1956-1958. Exploration was conducted on a 100x50m grid, the central part on a 100x25m grid. The deposit contains 3 layered bodies of silicate-nickel ores, 400 to 900 m long and 75-200 m wide. Conditioned nickel ores are confined to the upper part of the nontronites. The average thickness of ores of the deposit is 6.47-9.54 m. The depth of occurrence of conditioned ores varies between 25-52 m and reaches 91-123 m.

In 1981-1983, prospecting work was carried out with the aim of identifying nontronite clays as raw materials for flocculation of iron ore concentrates in the area of the Chervoniy Yar deposit of silicate nickel ores.

Geological characteristics: the deposit is located in the southeastern part of the Ukrainian Shield, within the Middle-Dniprean megablock, confined to the western part of the Krasnoyarskiy massif of ultrabasites.

Proterozoic crystalline rocks and sediments of the Tertiary and Quaternary systems take part in the geological structure of the deposit area.

Crystalline rocks are represented by diabases, peridotites and gabbro-peridotites, most of them serpentinized, polymigmatites, aplite-pegmatoid plagiogranites, amphibolites. The youngest rocks of the dyke complex are diabases and peridotites. Nickel mineralization in the deposit is associated with the weathering crust of serpentinized peridotites, which form a dike among Precambrian crystalline rocks. Peridotites and gabbro-peridotites form a sublatitude dyke-like body. The length of the dyke is up to 10 km, the width varies from 25-50 m, most of it is 100-150 m. The dipping is steep (75-80°). In the western part, where there are deposits of silicate-nickel ores, the dyke is mainly composed of peridotites. In the eastern direction, the amount of plagioclase in the rocks increases and they turn into gabbro-peridotite.

The weathering crust is represented by zones (from bottom to top): serpentinized peridotites, with a thickness of 5- 10 m, nontronites – with a thickness of 8-15 m, sometimes up to 30 m and more, which contain nickel mineralization, ochre, with an average thickness of 15-20 m, and halluasite-beidellite rocks with a thickness of 1-2 m, which lie in the upper part of the zone of ochre.

Nontronite is a loose argillaceous rock of mainly green color, to varying degrees of blackening, enriched with scales of chlorite and jefferysite. The breeds differ in high moisture content - up to 32%. The composition of nontronite is dominated by montmorillonite (nontronite) - 10-60% and chlorite - 10-20%, quartz - 6%, iron hydroxides - 6-40%, hydromica (jefferysite) - 1.5%. Amphibole – 8%, ore – 1% of bedrock minerals.

Sediments of the Tertiary and Quaternary systems are represented by sandy-clay rocks, 30-60 m thick.

The Sarmatian layer of the lower Neogene is represented by fine- and multi-grained sands with layers of yellowish-gray clays, the thickness reaches 20 m, on average 6.5 m.

The Pontic layer of the Upper Neogene is represented by greenish-gray lumpy clays, among which there are brown-red and ochre spots. Towards the bottom, the clays are replaced by light gray sands. The average thickness of Pontic sediments is about 4 m, with a maximum of 13.7 m and a minimum of 0.5 m.

Sediments of the Quaternary system (undivided Upper Pliocene - Lower Quaternary sediments) are represented by red-brown and brown clays, as well as pale and light brown loams. The total thickness of Quaternary sediments is up to 30 m.

Within the deposit, depending on the nickel content, the following are distinguished: conditioned ores with an average nickel content of 1.1-1.2% with a cutoff 0.7%; off-balance ores: a) with a nickel content of 0.7-1.0%; b) with a nickel content of 0.3-0.7%.

Each type of ore is confined to a clearly defined weathering profile. At the base of the section, in the lower part of the nontronite zone, off-balance ores containing 0.3-0.7% nickel are distinguished. Conditioned ores are confined to the upper part of the nontronite zone. In the lower part of the ochre, weakly mineralized rocks with a nickel content of 0.3-0.7% are distinguished. The latter on part of the area are covered directly by nickel ores, and in other cases are separated from them by layers of low grade ores, the thickness of which does not exceed 3-5 m. The iron content in ochres varies between 25-40% (30% on average).

The Chervoniy Yar deposit consists of three separate bodies of silicate-nickel ores: "Western", "Central" and "Eastern". The ores occur almost horizontally, it is rare to observe an inclined occurrence with an inclination angle of 10-15°. 4 ore beds are established within the deposit. Conditional nickel ores are confined to the second (main) layer, located in the upper part of the nontronite zone, and the fourth layer. The ores of other layers are classified as off-balance according to their metal content.

The "western" body (conditional ores) occupies the western part of the peridotite massif, 730 m long, and the width varies from 75 to 125 m (on average 100 m). The thickness of ores varies from 1 m to 18 m (6.47 m on average). The depth of ore occurrence varies between 25 and 52 m. One ore layer (the second) is distinguished in the contour of the deposit. It forms a continuous plate-like body. The average nickel content of the deposit is 1.18%, and the average cobalt content of the deposit is 0.05%.

The "central" body (conditional ores) has a length of 970 m, the width varies from 75 to 175 m. There are two layers within the deposit: the second (main) and the fourth. The second (main) ore layer is located in the upper part of the nontronite zone, quite clearly repeats the configuration of the peridotite massif, and forms a slightly inclined body. More than half of the deposit's reserves are located in the "Central" body. The depth of the ores varies from 41 to 91 m. The thickness of the ores varies from 2 m to 25 m (an average of 9.54 m). The average nickel content of the deposit is 1.16%. The fourth layer forms two separate blocks connected with the lower part of the nontronite horizon. The average thickness of ore in blocks is 6.73 m. The average content of nickel is 1.18%, cobalt is 0.04%. The ores lie at a considerable depth from 92 m to 123 m.

In the "Eastern" body (off-balance ores with a nickel content of 0.7-1.0%) , the length of the body is 410 m, the width is 75-175 m. Two layers are established within the deposit: the second and fourth. The depth of the ores of the second layer is 40-53 m, the thickness of the ores varies from 1 m to 25 m (6.36 m on average). The average metal content of the deposit is 0.93%. The second layer does not create a continuous body, it has an ore-free area. Ores of the fourth layer lie at a considerable depth - more than 100 m and are not of great importance.

Off-balance ores with a nickel content of 0.3-0.7% are associated with two horizons of the weathering crust: the first layer is located at the base of the ochre section, and the third layer is located in the lower part of the nontronite zone. The average nickel content in the first and third layers within the deposit is approximately the same 0.43-0.44%, outside the deposit there is a deterioration in quality - 0.39%. In the area of conditioned ore deposits, the first layer forms four separate blocks, further to the east it is traced as a continuous layer. The third layer within the deposit repeats the shape of the peridotite dyke. The depth of the first layer does not exceed 50 m, the third layer reaches 80-120 m.

Ni	Co	Fe ₂ O ₃	Cr ₂ O ₃	SiO ₂	Al ₂ O ₃	TiO ₂	CaO	CuO	MgO	P ₂ O ₅	SO ₃	LOI
1.47	0.054	27.60	0.91	44.64	7.66	0.59	1.69	0.003	7.93	0.044	0.075	8.93

The hydrogeological conditions of the deposit are simple. Four aquifers were identified: soil; aquifer of Sarmatian sediments; aquifer of the ochre zone; aquifer of weathered crust and fractured crystalline rocks.

The mining and technical conditions for the development of the deposit are favorable. It is advisable to develop the field by an open cast method.

Assessment of resources/reserves: as of January 1, 2023, reserves of cobalt-nickel-silicate ores amount to category C1 – 2,894.0 thousand tons, incl. nickel - 22.7 thousand tons; cobalt – 970.0 t; off-balance - 23,281.0 thousand tons, incl. nickel - 66.1 thousand tons; cobalt – 4,704.0 tons.