



CRM of Ukraine Database Supplements

Mineral target:	Kyz-Aulske deposit
Commodity:	Phosphate rock

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Location: the Kyz-Aulske deposit is located in 27 km from the Kamysh-Burunskiy iron ore plant, which is located directly on the Kamysh-Burunske deposit in the Arshintseve village of Autonomous Republic of Crimea, it is connected to the railway and has a sea port for shipping agglomerate, receiving fuel and other cargoes. Inhabited locations: Arshyntseve, Priozerne, Cheliadynove, Zavetne villages.

Research: Geological prospecting studies of the Kerch iron ore basin were carried out in the first half of the 20th century (1926-51). Detailed geological prospecting of the deposits of the Southern Group was carried out in 1952-1953, the iron-ore reserves of the Kyz-Aulske deposit were approved by the DKZ of the USSR in 1953-1954 (protocol No. 8509 dated 31.10.1953). In 1973-78, with the aim of determining the raw material base of the Kamysh-Burunskiy iron ore plant, the "Ukrchormetgeology" enterprise carried out geological exploration of the Southern group of deposits of the Kerch iron ore basin, the results of which were approved by the decision of the State Committee of the USSR (protocol No. 8175 of November 22, 1978) .

Geological characteristics: the Kyz-Aulske deposit belongs to the Southern group of deposits of the Kerch iron ore basin, located in the southeastern part of the Kerch Peninsula. In the regional structural plan, the Kerch Peninsula is located in the junction zone of three large geostructural elements: the Crimean and Caucasian megaanticlinories and the Indo-Kubanska marginal depression. The southern group of deposits is confined to the brachysynclinal folds of the southeastern and northeastern blocks of the Kerch Peninsula (synclinal zones). Ores are deposited in the form of layers in shallow dimples. In the cross-section, the Kyz-Aulska dimple is trough-shaped, elongated in the northeast direction.

Tertiary and Quaternary sediments take part in the geological structure of the work area. Blue-gray Pontic clays with an average thickness of 2.7 m lie at the bottom of the ore layer. The deposits of the Kimmerian layer, to which the ore layer is confined, are represented by three horizons: Lower Kimmerian - bluish and dark gray clays with oolites of brown ironstones and layers of earthy vivianite with an average thickness of 5.2 m; middle Kimmerian - oolitic iron ores with layers of clays and glauconite-chlorite rocks with an average thickness of 9.8 m; Upper Kimmerian – plastic blue-gray siltstones and siltstone clays with vivianite inclusions with a thickness of several meters to 47 m (average 9.2 m).

The main natural types of ores of the deposit are non-oxidized (tobacco) and oxidized (brown and caviar). Tobacco ores lie in the central, deeper part of the mine, where the ore layer is made. On the dimple limbs they lie together with brown and caviar in the lower part of the ore horizon. Brown ores are distributed in the marginal part of the dimple and make up the ore layer, spawning - in the southwestern part and lie among brown or above tobacco ores, stretching in a narrow strip from the southwest to the northeast. Layers of clays in the ore horizon with a thickness of 0.2 to 3 m are most widespread in the central part of the dimple, facially replacing oolitic ores. Glauconite-chlorite layers (thickness 0.2-1m) are found among ore deposits. Layers of dimple rocks make up 7.6% of the total ore mass.

The absolute mark of the top of the ore layer ranges from 7.78 m to 98.39 m; absolute mark of the bottom - from 2.88 m to 96.99 m; the depth of the ore layer is 0-80 m, the average thickness of the ore layer of brown ores is 7.99 m, the average thickness of the ore layer of tobacco ores is 4.57 m, the total thickness is 6.95 m, in the contour of the pit - 7, 95 m. The ore layer comes to the surface in the north-western limb of the dimple and sinks to 50-80 m in the axial part. The thickness of the ore layer of 10-20 m is observed in the northwestern limb of the southwestern part of the deposit, in the area where spawning ores are distributed. Smaller capacities are in the peripheral and central part, where the ore layer is wedged out. In the other part of the deposit, thicknesses of 4-6 m prevail. The average thickness of overburden rocks in the deposit is 30.4 m, in the outline of the project pit - 23.7 m.

The ores have an oolitic or pisolito-oolitic texture. The ratio of oolites and cement in ores varies within fairly wide limits. Ore components are oolites and pseudo-oolites of hydrogethite composition,

less often hydrogethite-chlorite and chlorite. In addition, the ores contain minerals of the group of manganese oxides and hydroxides - psilomelan, pyrolusite, phosphates - vivianite, kerchenites and others.

Technological grades of ores of the Kyz-Aulske deposit are outlined by blocks.

Chemical composition of technological grades of ores (%):

Unoxidized ores (tobacco): Fe (total) – 36.22-38.44; Fe⁺ – 2.31-3.80; FeO – 2.97-4.93; Fe₂O₃ – 46.28-51.66; MnO – 0.66-1.27; SiO₂ – 20.61-22.76; CaO – 1.25-1.28; MgO – 0.81-0.84; Al₂O₃ – 3.61-6.25; TiO₂ – 0.27-0.272; V₂O₅ – 0.08-0.108; SO₃ – 0.314-0.35; P₂O₅ – 2.36-2.372; K₂O – 0.392-0.55; N₂O – 0.200-0.30; As – 0.125-0.162; LOI – 12.97-13.99; Co – 0.016; NiO₂ – 0.014-0.02; Σ – 100.01.

Oxidized tobacco ores (brown, caviar): Fe (total) – 35.7-37.06; Fe⁺ – 0.09; FeO – 0.12; Fe₂O₃ – 50.92-52.86; MnO – 2.40-6.72; SiO₂ – 19.25-23.25; CaO – 1.54-1.59; MgO – 0.01-0.88; Al₂O₃ – 4.77-4.81; TiO₂ – 0.242-0.260; V₂O₅ – 0.100-0.118; SO₃ – 0.144-0.167; P₂O₅ – 2.02-2.191; K₂O – 0.440-0.468; N₂O – 0.288-0.300; LOI – 11.53-12.44; Co – 0.022-0.032; NiO₂ – 0.023-0.025; Σ – 100.01.

Iron, phosphorus, copper and, to a lesser extent, vanadium are mainly concentrated in oolites, and alumina, silica, calcium oxide and magnesium oxide - in the cement of ores. Manganese is concentrated both in large nodules and oolites and in cement. The composition of iron in oolites of tobacco ores ranges from 40.67-51.41%, in brown - 36.84-52.55%. The distribution of iron in ores is uniform (coefficient of variation <20). The average iron content in the ore layer of the Kyz-Aulske deposit is 36.77%.

Among iron-related elements, manganese and phosphorus are the most important. The manganese content in the ores of the Kyz-Aulske deposit ranges from 0.25 to 7.52% (in brown ores) and from 0.25 to 2.64% (in tobacco ores).

Phosphorus in Kerch ores is contained in nodules, its content in the ore ranges from 0.63 to 1.39% (in brown ores) and from 0.72 to 1.23% (in tobacco ores).

The technological study of ores was carried out by the Institutes of Mekhanobr, Mekhanobrchormet, Dnipropetrovsk Mining Institute, Kryvyj Rig Mining Institute, and Ukrchormetrudy enterprises. According to the conclusions of Mekhanobrchormet, the best technical and economic indicators are the washing-gravity method of beneficiation, which was used at the Kamysh-Burunskiy iron ore plant. The output of the concentrate according to this scheme can be increased by 8-10% due to grinding in the class of 1-0 mm (instead of 3-0) and precipitation. It is recommended to continue the work on the development of a more effective scheme for the enrichment of iron ores of the deposit. According to the data of the Azovstal plant, the removal of phosphorus in slags, which are used as a fertilizer, will amount to 35%.

The stripping rocks are represented by sediments of the Kuyalnytskiy layer (thin-layered sandy clays with interlayers and lenses of sand) and Quaternary sediments (loess-like loams, pebbles and deluvial sands). The thickness of overburden increases from the periphery to the center of the dimple.

The hydrogeological conditions of the Kyz-Aulske field are characterized by the presence of two aquifers, which are confined to the syncline zone. The horizons are divided into supra-ore and ore horizons. Supra-ore includes waters of Quaternary (Kuyalnytski) sediments, the horizon is widespread, water-bearing rocks are quartz sands. The water enrichment of the horizon is low, the filtration coefficients vary from 0.0 to 0.3 m/day. The ore horizon includes the waters of the Pontic and Meotic sediments. Water-bearing rocks are brown, caviar and tobacco cracked ores. The water enrichment of the horizon is low, the filtration coefficients range from 0.0 to 0.7 m/day.

The Kyz-Aulske deposit belongs to the poorly watered field. Water inflow into the quarry to the overburden ledges will be 121.5 m³/day, to the ore ledges – 1500 m³/day.

The Kyz-Aulske deposit belongs to the I group. The calculation of ore reserves of the deposit is based on the conditions approved by the DKZ of the USSR on October 12, 1977. (protocol No. 1167-k). The calculation of reserves and the assessment of quality were carried out separately for brown and tobacco ores with an on-board iron content of 30 and 34%, respectively, the thickness of ore bodies and

the maximum thickness of substandard and empty rocks for brown ores – 1 m, for tobacco – 2 m. Iron ore reserves of two types with an iron content higher than cutoff, located in the pit contour and in protection pillars, are included in the balance. Off-balance reserves include brown and tobacco ore reserves with a content above the cutoff, but located along the contour of the pit and not subject to development due to low technical and economic indicators, as well as reserves of tobacco ores with an iron content below the cutoff.

Mineral reserves.

The deposit is located on the territory annexed by Russia, the Crimea, and as of January 1, 2014, reserves at the deposit were compiled by category, thousand tons:

Iron ores:

- brown ironstones, brown: A+C1 – 104152.0;
- brown iron, tobacco: A+C1 – 43924.0, off-balance – 9351.0;
- in protection pillars (on the contour of the quarry) brown iron, brown, tobacco: A+C1 – 32882.0;

off-balance - 37975.0.

Phosphorite:

- ore: A+C1 – 109280.0; including P₂O₅ – 2370.0;
- in protection pillars (along the quarry contour): ore A+C1 – 24267.0; including P₂O₅ - 527.0.

Degree of development: not being developed.