

CRM of Ukraine Database Supplements

Mineral target:	Azovske deposit
Commodity:	Rare earth

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Minerals: rare earths, zirconium, accompanying: feldspar raw materials, construction sand.

Location: located in the Nikolskiy district of the Donetsk region, 1.0 km west of the Nikolske village and 25 km west of the Mariupol railway station.

Degree of study: in 2007, prospecting and evaluation works were performed, as a result of which the area of localization of mineralization was identified and outlined within the boundaries of the Azovska structure - the Azovskiy ore occurrence.

Geological characteristics: the Azovske ore deposit belongs to the Azovske ore field of the same name - a component of the East-Azov metallogenic zone. Confined to the northwestern part of the endocontact zone of the large syenite (Volodarskiy) massif of Early Proterozoic age. The rocks of the massif are represented by intrusive phases: gabbro-syenite, syenite, granite-granosyenite and vein; all of them are quite clearly localized. The weathering crust is developed everywhere, represented by three zones of clayey and intermediate products of weathering and disintegration. Its thickness varies from 9.0 to 47.0 m, the average is 29.0 m. Quaternary deposits are spread over the entire area of works, represented by loams and clays with a thickness from 0.8 to 31.5 m, on average - 21.0 m.

Eleven conditioned ore bodies were found within the ore deposit, which are characterized by uniformity of material composition, ore load, geophysical and geochemical characteristics.

The first ore body is the Main one, it differs from the others in terms of maximum capacity, length, area of development, reserves of ore and useful components ($\Sigma\text{TR}_2\text{O}_3$ and ZrO_2). All other bodies are apophyses of the Main ore body, less often they are separated from it. In plan, it has an arcuate, sickle-shaped shape with a general dip towards the center of the Azovska structure. The dip angles of the body vary from 75 to 10°, generally repeating the elements of the lying contact of the body of quartz biotite syenites. Total dipping of the body ~50°.

The internal structure of the bodies is homogeneous: they all contain two natural types of rocks: olivine-pyroxene-amphibole and amphibole syenites. At the same time, ore bodies are characterized by a complex and irregular distribution of ore types both vertically and laterally. Of ore minerals, britholite, zircon, orthite and pseudomorphoses of britholite are of practical importance. In the useful layer, areas of poor (too poor) ($\Sigma\text{TR}_2\text{O}_3 - 0.40\text{--}1.0\%$), poor ($\Sigma\text{TR}_2\text{O}_3 - 1.0\text{--}1.5\%$), ordinary ($\Sigma\text{TR}_2\text{O}_3 - 1.5\text{--}2.0\%$), rich ($\Sigma\text{TR}_2\text{O}_3 - 2.0\text{--}3.0\%$) and very rich ores ($\Sigma\text{TR}_2\text{O}_3 - 3.0\text{--}10.0\%$, rarely more).

The content of the main ore components varies widely. The content of the sum of trioxides of rare earths ranges from 0.01 to 20.1%. The composition of the ores is dominated by light lanthanides: the ratio of the cerium group to the yttrium group is characterized as 3:1.

The content of zirconium dioxide in the samples ranges from 0.01 to 34.24%. In most intersections, the content of zirconium dioxide is higher than the amount of rare earths (70% of the total amount), on average by 1.58 times along the ore strike.

The results of the radiation-hygienic assessment proved that the ores of the Azovske ore deposit have increased natural radioactivity. The effective specific activity in them ranges from 578 to 9095 Bq/kg. The host rocks (supra-ore, sub-ore layers and intra-ore layers) have values of effective specific activity from 142 to 467 Bq/kg and according to the radiation factor belong to the 1st class of building materials.

Two technological schemes of ore beneficiation (flotation and settling) have been developed, which include four blocks: a cycle of preliminary beneficiation, where building sand is allocated; rare earth, zircon and feldspar cycles combined in the main ore beneficiation workshop, which allows to obtain as a commercial product a rare earth concentrate (industrial product) with the content of the sum of trioxides of rare earth elements (hereafter REE) up to 10.3%, zircon concentrate with the content of zirconium dioxide 63.5%, feldspar concentrate, which meets the requirements of DGST, and construction sand.

During technological studies of schemes for metallurgical processing of raw rare earth concentrates in laboratory conditions and experimental and industrial studies of optimal technologies, various methods of REE discovery were studied: alkaline, sulfuric and nitric acid.

It has been established that the most complete extraction of REE is carried out by acid methods (95-98%). Options for cleaning leaching solutions from impurities of iron and thorium, uranium and sum of elements - iron, uranium, calcium, fluorine, aluminum - have been tested in laboratory conditions. The maximum achieved content of REE trioxides in intermediate rough concentrates is 46.9%. During precipitation of REE from re-extracts in the form of ammonia hydroxide, it is possible to obtain the final REE product with a $\Sigma \text{TR}_2\text{O}_3$ content of about 65%. With oxalate precipitation, the product contains 89.4% $\Sigma \text{TR}_2\text{O}_3$. The iron content is at the level of 0.5%.

Information about REE mineral resources and reserves is confidential.

Reserves of associated useful components, which are obtained during the technological processing of the main raw materials of complex zirconium-rare earth ores of the Azovske ore deposit, amounted (thousand tons):

1. feldspar raw materials: by categories C 1 + C 2 – 6684.99;
2. construction sand: by categories C 1 + C 2 – 12859.26.