



CRM of Ukraine Database Supplements

Mineral target:	Yastrubetske deposit
Commodity:	Rare Earth Elements, fluorite

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Location: located 1.5 km northeast of the Perga village of Olevskiy District, Zhytomyr Region.

Research: Geological and economic assessment of minerals in the South-Western part of the Yastrubetske deposit was carried out based on the materials of geological exploration carried out by the Zhytomyrska GRE PDRPGP "Pivnichgeologiya" in 1986-1986. The work was carried out by the production cooperative "Geolog", as a result of which reserves of complex zirconium ores and associated useful components, suitable for the production of commercial concentrates, were approved by the decision of the DKZ of Ukraine (protocol dated 04/09/2015 No. 3348-dsk).

Geological characteristics. The Yastrubetskiy massif of crystalline rocks is located in the central part of the Sushchano-Perzhanska zone among the granitoids of the Perzhanskiy complex. The geological-structural position of the massif is controlled by the junction node of the system of converging multi-oriented faults of the northern, northwestern and northeastern trend. The massif is a weakly eroded rod-like intrusive body, having an isometric shape in plan, slightly elongated in the northwest direction. The area of the ore-bearing zone was approximately 2.1 km². The south-west and east contacts dip to the north-east at angles of 46-71°.

The Yastrubetskiy massif is characterized by a complex, zonal structure, which is explained by the active interaction of the syenite intrusion with the younger host rocks. The exocontact part of the massif is composed of granosyenites (quartzized syenites), among which granitized (k-feldspatized) diorites are developed to varying extents in the form of individual elongated, arcuate or lenticular bodies. Silicified syenites, which alternate with granitized diorites in the form of a horseshoe-shaped band with a width of 50 to 300 m, can be traced along the western, northwestern, northern, northeastern, and eastern contacts of the Yastrubetskiy massif. The largest fields of granosyenites and diorites are developed in the northern and northeastern endocontacts, where they are traced to a depth of up to 350 m.

In the southwestern and southern peripheral parts of the massif of alkaline rocks, granosyenites and granitized diorites are represented by low-power elongated bodies. Towards the center of the massif, the quartzized syenites break up into a series of converging or separate bodies of a lenticular, elongated shape.

The southeastern part of the Yastrubetskiy massif is composed of melanocratic biotite-amphibole syenites.

The 11 ore bodies were discovered in the south-western part of the Yastrubetskiy massif during prospecting and exploration and evaluation works. The selection of ore bodies was carried out according to analytical data. On the periphery, the body is outlined by low-grade ores.

In most cases, the composition of ore bodies does not differ from the composition of the host rocks. The difference between the ore body and the host rocks consists only in the concentration of zircon mineralization; there are no clear boundaries between them.

Mineralization is mainly associated with biotite, less with biotite-amphibole meso- and melanocratic syenites and granosyenites. Areas of leucocratic syenites and small bodies of diorite are sometimes noted.

Ore formation is accompanied by a wide development of superimposed mineralization, represented by complex and simple veins filled with biotite, quartz, amphibole, aegirine, microcline, fluorite, calcite, pyrite, molybdenite, magnetite, arsenopyrite and other minerals. Ore bodies of zirconium deposits have vein-like lenticular shape with interruptions, apophyses and pinching out along the dip of the body and along strike. In cross-section these are with even, sometimes wavy hanging and footwall sides. Pinch out of the bodies is simple, in places it is intricate.

Mineralization of the Yastrubetskiy massif is represented by complex fluorite-rare-earth-zirconium ores. Ore-bearing (zirconium-bearing) rocks are biotite-amphibole and amphibole-biotite K-feldspar metasomatites, up to biotite, syenites with a massive, sometimes banded texture. The structure is medium-grained, coarse-grained to pegmatoid with nest-like and lenticular formations of dark-colored

minerals in the feldspar mass. In cataclased syenites and zircon-K-feldspar metasomatites, the breccia structure is similar; biotite forms veins or spreads along cracks in microcline-perthite.

The main useful minerals are zircon, rare earth elements (parisite), fluorite and feldspars.

According to the chemical composition, the mass fraction of silica in syenites varies from 59.0% to 63.0%, alumina from 17.03 to 17.24%; the alkali ratio changes slightly and is generally close to 1. The share of zirconium dioxide ranges from 0.55% to 0.95%; the share of liquid earth ranges from 0.1% to 0.2%, fluorine from 0.42% to 0.89%.

The mineral bearing zirconium in ores is zircon, represented by two generations. By chemical analysis, 65.0-65.5% of zirconium dioxide was found in zircons from technological samples.

The main fluorine-containing mineral of complex ores is fluorite. Its average content is 1.5%. It forms grains up to 2 mm, preferably up to 0.5 mm in size. The fluorine content in fluorite is 45-46%.

The admixture of rare earths is 2.1-2.3%, on average 2.2%.

The main minerals-concentrates of rare earths (including yttrium) in ores are fluorite, zircon and parisite (fluorcarbonate of calcium and rare earths). At the same time, the main one is fluorite, in which 15-35% of the amount of rare earth is concentrated; in zircon - 5-9%. The rest of the rare earths are contained in rare earth carbonates and other minerals (brytholite, monazite, xenotime, etc.).

Chemical analysis of the main rare-earth minerals-concentrates found that about 50% of the total yttrium content is concentrated in fluorite.

In addition to zircon and fluorite, one of the main concentrates of rare earths in ores is rare earth carbonates of the parisite type. Monazite, xenotime, britholite, thorite and others were found among minerals containing rare earth.

The recommended technological scheme of ore enrichment includes the following processing cycles:

1. Pre-enrichment of ore in heavy suspensions at an actual density of 2.65-2.58 g/cm³ with obtaining from a light fraction:

- a) high-grade feldspar concentrate for the ceramic industry, brand PSM-02-2 (K₂O/Na₂O ratio), ore yield – 3%;

- b) feldspar product of PSM-20-03 grade (K₂O/Na₂O ≈ 1 ratio), ore yield – 8%;

- c) building sand, yield from ore – 25.8%.

2. Gravitational-magnetic beneficiation of the heavy fraction and ore class - 0.2 mm, which make up - 48.4-51.35% of the original ore, with the production of zircon-rare-earth-fluorite concentrate and tailings.

3. Electroseparation (sludge) separation of zircon-fluorite-rare-earth concentrate with separation of conditioned fluorite concentrates and separation of sulfides, respectively, concentrate I - fluorite content is more than 88% when extracted - 57.7%; brand of concentrate FG-85 GOST 7618-83 (sulfur content - 0.1%; phosphorus - 0.3%); concentrate II - fluorite content 90%, brand FG-90 (sulfur content - 0.1%, phosphorus - 0.32%, silicon dioxide - 3%, calcium carbonate - 1.0%).

4. Separation in a high-intensity magnetic field of zirconium-rare earth concentrate (class -0.2+0.05 mm) to obtain conditioned zirconium and rare earth concentrates:

- d) the yield of zirconium concentrate is 0.88% from the ore, the mass fraction of zirconium dioxide is more than 62% when 73.95% is extracted, the grade of KCPT OST 48-82-81;

- e) the yield of rare earth concentrate is 0.14%, the mass fraction of rare earths is 42.1% with the extraction of 29.52%.

When applying the specified technological scheme of enrichment, the following commercial products can be obtained: zirconium concentrate; rare earth concentrate; fluorite concentrate; feldspar concentrate PSM 02-2 and PSM 20-03.

The mining and geological conditions for the development of the deposit are determined by the engineering and geological features of the mineral and the hydrogeological conditions of the development.

The following aquifers are distinguished within the Yastrubetsky deposit of zirconium ores:

- aquifer of Quaternary sediments;
- aquifer of the fractured zone of crystalline rocks and their weathering products.

Aquifers confined to sedimentary formations, with the exception of Quaternary sediments, have a local distribution. The most widespread are the waters of fractured crystalline rocks of the Precambrian period. The aquifer of the fractured zone of crystalline rocks and their weathering products is widely distributed within the deposit. The total water inflow to the project pit for the final term of its development will be 278 m³/day.

The south-western section of the Yastrubetske deposit is classified as a group of deposits with a complex geological structure (group 2) in accordance with the Classification of Mineral Reserves and Resources of the State Mineral Resources Fund.

Information about mineral resources and reserves is confidential.