CONDITION AND PROSPECTS OF THE INGICHKE DEPOSIT (REPUBLIC OF UZBEKISTAN)

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The Ingichke skarn-scheelite deposit is administratively located in the Samarkand region of the Republic of Uzbekistan. The relief of the area of the deposit is relatively poorly dissected, the absolute elevation marks mainly range from 700 to 850 meters. The highest points of the area of the district are the elevations of 1018 m and 1054 m. The main water arteries within the described area are Karnabsay, Sypkisay and Temsay and a number of smaller valleys, which are flooded only in early spring, and closer to the beginning of summer they all dry up. The climate of the region is sharply continental with cold winters and hot dry summers.

The Ingichke skarn-scheelite deposit is located in the southeastern part of the Zirabulak Mountains and is related to the eastern contact of the Zirabulak intrusion with the terrigenous-carbonate formations of the Pyazynska suite.

The cross-section of the Ludlovskyi section of the Silurian S_2ld (Pyazynska suite) is represented by dolomites, dolomitic limestones with interlayers and lenses of limestones. Thickness is 650-700 m. The carbonate rocks of this suite are transformed into medium-, large- to giant-grained marbles (the so-called calcite rocks).

Cretaceous deposits are represented by the Sukaitinska, Karnapska and Tymska suites. Previously, in a series of studies, the authors considered specific features of geochemistry and distribution of elements in different types of caustobiolites, in coal [1-28] and oil [29-33].

The Sukaitinska suite (K_2cm-K_2t) is divided into three subsuites. The lower one is green-gray sandstones with interlayers of clays, siltstones, gravelstones and conglomerates, thickness is 10-30 m. It belongs to the Middle-Upper Cenomanian. Medium - gray, green-gray clays with thin interlayers of siltstones and sandstones, thickness 10-90 m. Refers to the lower and middle Turonian. Upper - gray, red sandstones, shell rocks, clays, siltstones, thickness - 10-100 m. Refers to the middle Turonian. From above, it transgressively overlies the Paleozoic, overlaps with erosion by the Karnapska suite.

The Karnapska suite (K_2t-K_2st) is divided into three subsuites. Lower - green-gray, red sandstones, gravelstones, clays, siltstones, thickness - 50-70 m. Conditionally refers to the upper Turonian. Medium - green-gray clays, siltstones, sandstones, thickness - 30-90 m. Belongs to the Coniacian stage. Upper - red, gray, pink sandstones, siltstones, clays, shell rocks, thickness - 26-40 m. Refers to the Santonian. It overlies with erosion on the Sukaitinska suite, overlaps with the erosion by the Tymska Formation.

Tymska suite (K_2cp-K_2m) is represented by gray, green-gray sandstones, sands with interlayers of clays and limestones, thickness - 10-245 m. It overlies with erosion on the Karnapska suite and is overlain by Quaternary formations.

Intrusive rocks are represented by late Carboniferous biotite and leucocratic granites. Biotite granites are a product of the main phase of the Zirabulak intrusion. Leucocratic granites form stocks, dikes, sheet-like deposits among biotite granites and enclosing carbonate-terrigenous rocks. The deposit area is 1 km^2, along the vertical dikes are traced 300-500 m, stocks up to 150 m. Pre-granitoid dikes of lamprophyres and post-granitoid dikes of leucogranites are widely developed. The former form a thick fan-shaped belt of dikes with northeastern meridional strike, emphasizing the projection of a deep basement fault. Leucogranite dykes form a field of sublatitudinal northwest direction, separate dikes of northeast direction are noted. On the whole, this belt marks the deep root system, and local concentrations of dikes also mark the boundaries of large swell-like uplifts of the intrusive roof.

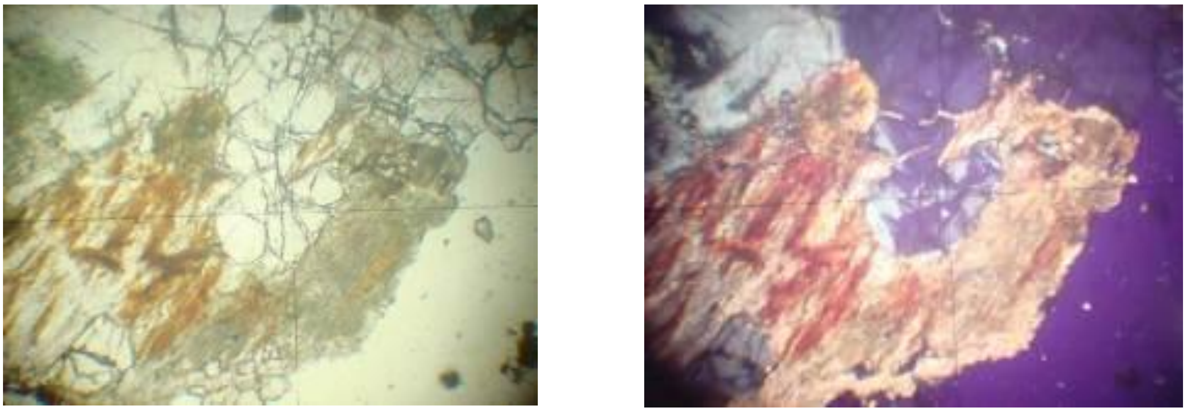
Structurally, the ore field is shaped like a horst bounded by a polygonal system of large faults with amplitudes of vertical displacement up to 1-2 km, and horizontal displacement up to 5 km. From the southeast and southwest, these are the Dzhinskyi and Altyaulskyi strike-slip faults, from the north - the Shauvazskyi fault, from the west, conditionally the Kattasayskyi fault-slip.

In general, the system of these faults, taking into account the Alpine activation, forms a ring structure, which in general follows the contour of the intrusive surface. The morphology of the latter within the ore field is determined by the steep northern and eastern walls, which are directly connected with the root system and serve as the main ore supply channels, and the southern contact gently dipping under the intrusion, forming the laccolithic component of the massif. Directly inside the ore field, the roof of the intrusion is gently sloping, characterized by a system of ridges and ore-distributing troughs.

Skarn-ore bodies are related directly to the contact of the granitoid massif and, partially, to small bodies of alaskites with marbles. The geochemical specialization of skarns is characterized by elevated concentrations of tin, bismuth, niobium, germanium, copper, and molybdenum. Valuable components for complex extraction can serve rare earths and molybdenum in scheelite, bismuth in native form and in sulfides. Associated products can be gold, copper, bismuth, germanium, tin. From non-metallic minerals - garnets, as abrasive, collection and jewelry raw materials.

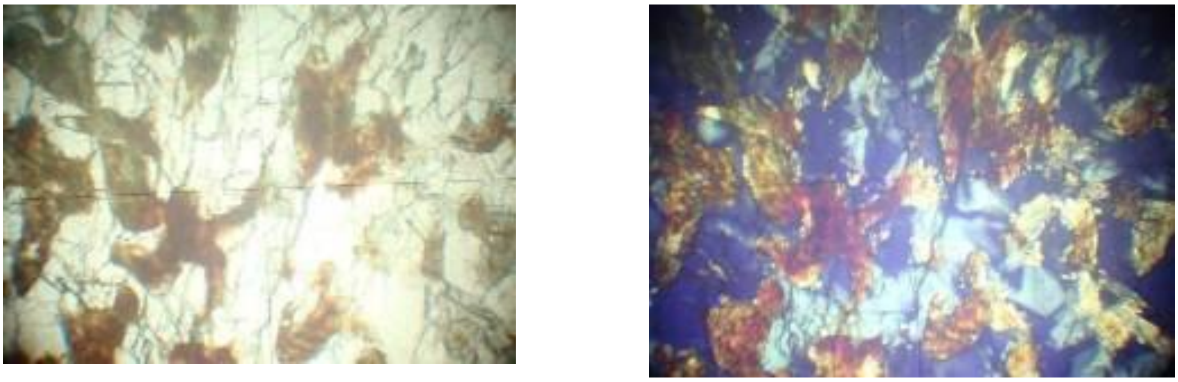
The skarn deposits of the Ingichke deposit are composed of pyroxene-garnet, pyroxene-hornblende, garnet, hornblende, vesuvian-garnet, pyroxene-wollastonite varieties of skarns. The most common skarn mineral is pyroxene (hedenbergite), less common are garnet and amphiboles (hornblende, actinolite, tremolite). Garnet is represented by andradite difference. Other minerals are less common (epidote, chlorite, sphene). Ore minerals are represented by pyrrhotite, pyrite, chalcopyrite, marcasite, less often arsenopyrite, native gold, molybdenite, sphalerite, galena, bismuthine. Secondary changes are represented by chloritization and ferruginization. The main ore mineralization is scheelite mineralization.

When viewing transparent thin sections, the authors identified the main paragenetic mineral associations shown in the figures (Fig. 1-3).



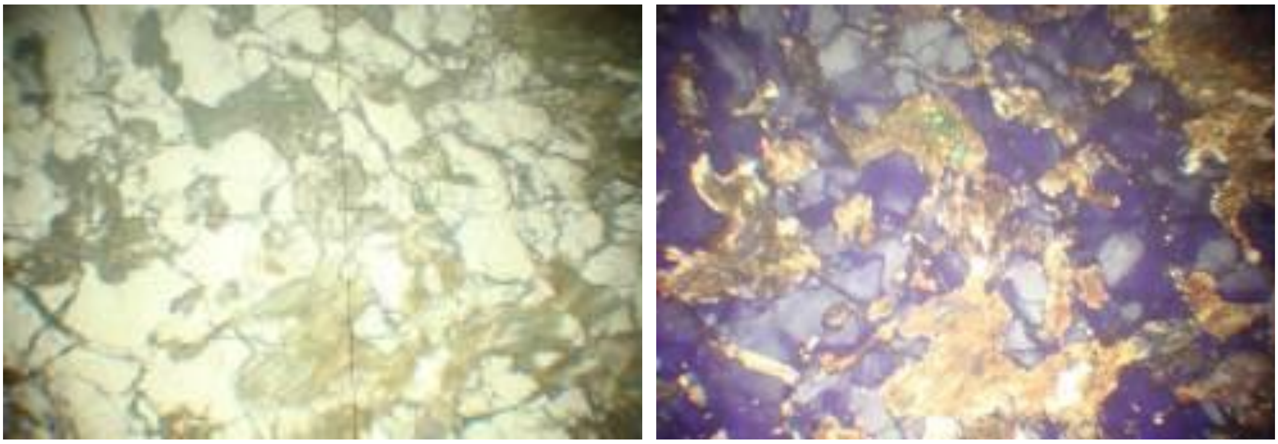
a b

Fig. 1. Garnet (andradite) intergrown with pyroxene (hedenbergite). In garnet grains, internal reflections associated with the deformation of the crystal lattice are observed. Legend: a - simple transmitted light, b - polarized transmitted light. Zoom 50^x.



a b

Fig. 2. Association of monoclinic pyroxene (hedenbergite) with chlorite. Legend: a - simple transmitted light, b - polarized transmitted light. Zoom 50^x.



a b

Fig. 3. Garnet-pyroxene association in skarns.
Legend: a - simple transmitted light, b - polarized transmitted light. Zoom 50ˣ.

For prospects assessment of the complex processing of technogenic deposits of ore-dressing at the Ingichke deposit, X-ray phase analysis of three samples was performed. X-ray phase analysis was carried out on a DRON-2 X-ray diffractometer in monochromatized Co-Ka radiation (l=1.7902A). Compounds (phases) were identified by comparing the interplanar distances (d, A) and relative intensities (I otn-I/I0) of the experimental curve with the data of the PCPDFWIN electronic filing cabinet.

The results of X-ray phase analysis are shown in Figs. 4 - 6.

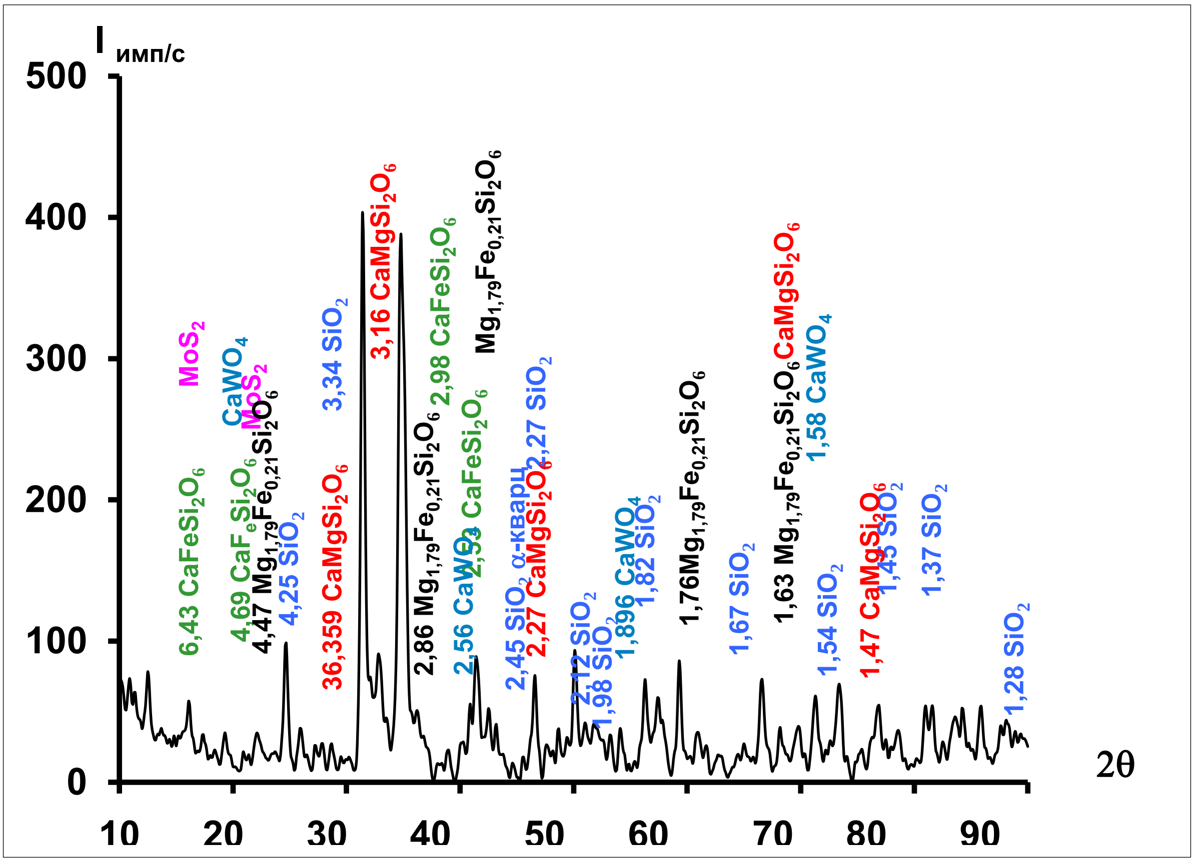


Fig. 4. Results of X-ray phase analysis of sample No. 1.

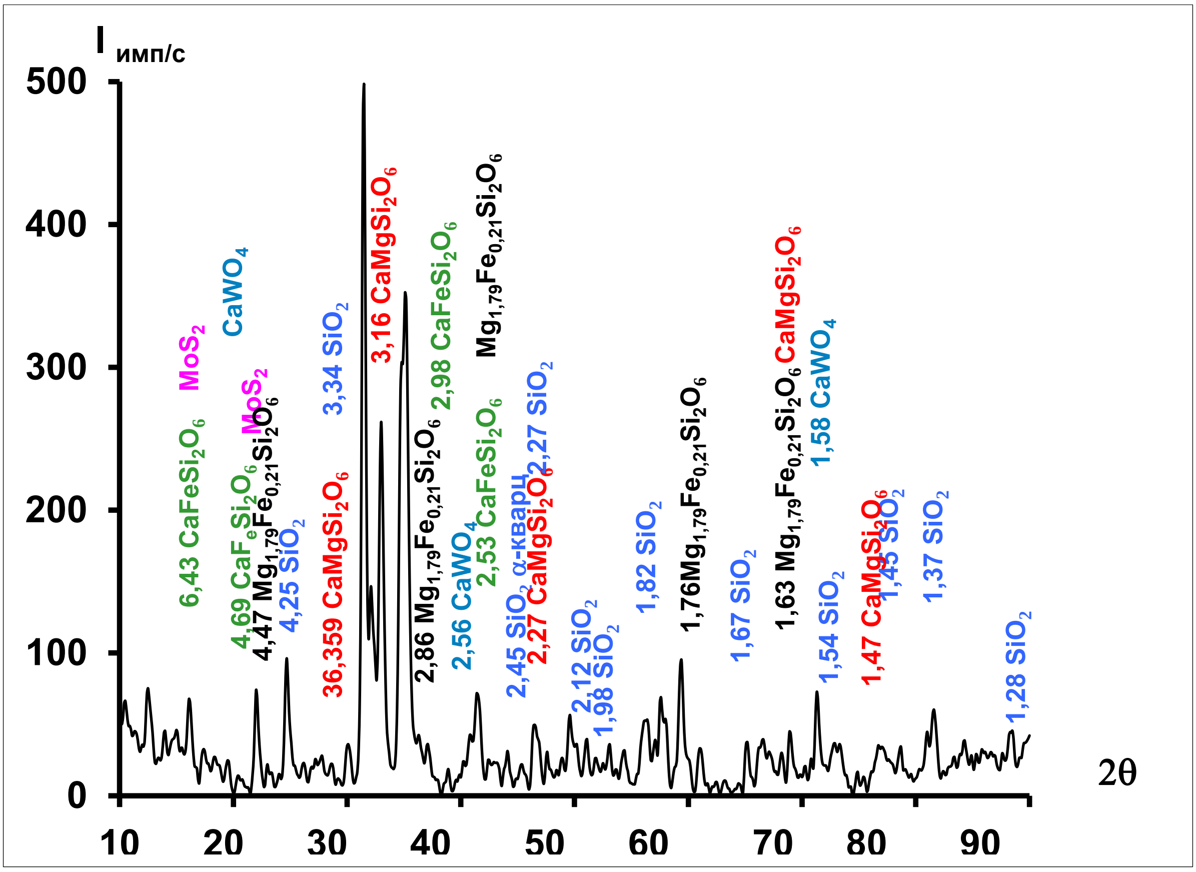


Fig. 5. Results of X-ray phase analysis of sample No. 2.

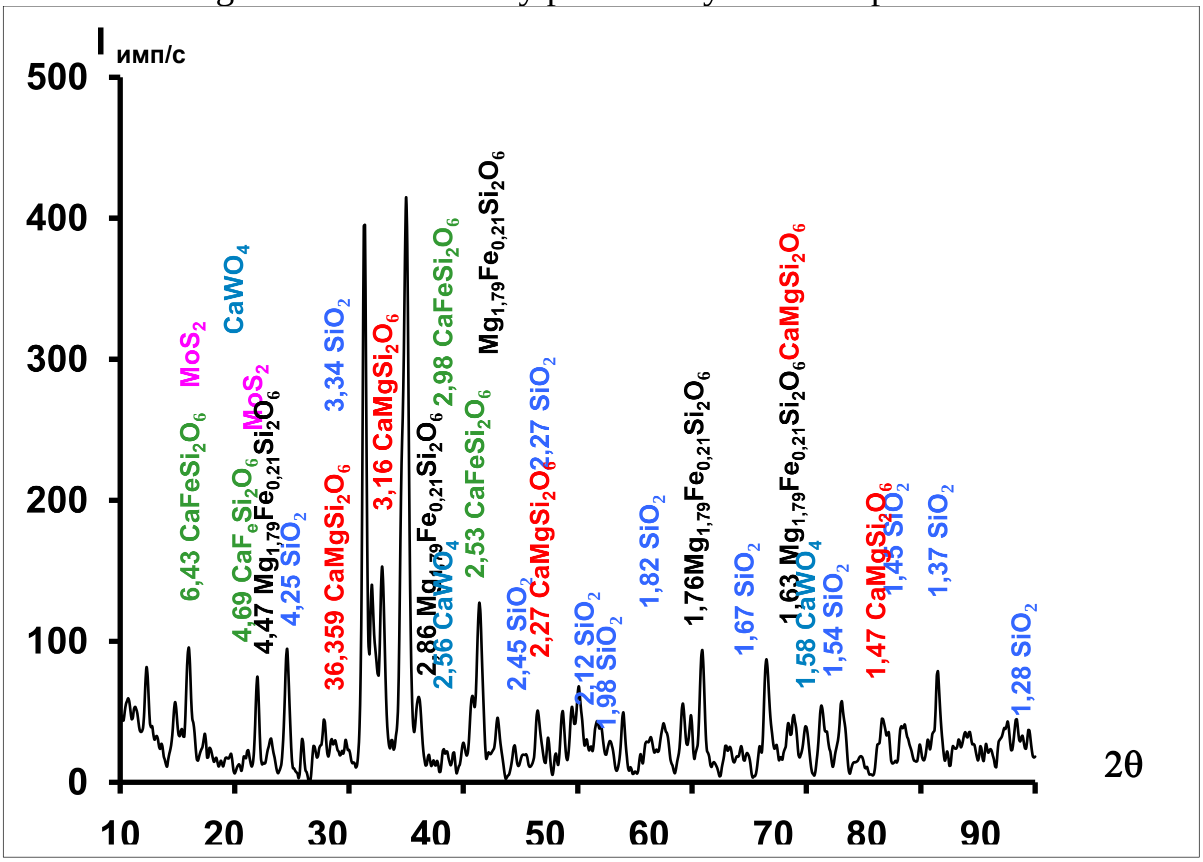


Fig. 6. Results of X-ray phase analysis of sample No. 3.

The performed studies will allow us to formulate the following main conclusions:

1. The results of the analysis of the geological features and rocks composition, in relation to the concept of metasomatic zoning by D.N. Korzhinskyi, allow us to attribute the studied mineral associations of the Ingichke deposit to the garnet-pyroxene association of endoskarns with epidote and plagioclase relics.

2. Based on the results of mineralogical and petrographic studies, typomorphic features of the main paragenetic mineral associations of the deposit were established.

3. The main geological and industrial prospects for the use and processing of ores from the Ingichke deposit and waste from their enrichment are associated with an integrated approach to the extraction of both metallic and non-metallic useful components.

4. The main geological and economic interest at present are ore minerals of wolfram, molybdenum, bismuth, gold, rare earths, germanium, copper and tin. Of non-metallic minerals, garnet and quartz are of particular interest, primarily as a mineral base for obtaining high-quality abrasive raw materials.

Thus, our research convincingly show that all the prospects of this deposit are related to the issues of a comprehensive assessment and development of integrated processing technologies for both the remaining ore bodies and technogenic formations formed by enrichment waste.

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