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Mineral and Geochemical Features of the Zengibobo-Sheikhjelinskaya Ore Bodies of the Dzhelinsky Area of the Sultanuizdag Ridge

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ABSTRACT

The mineralized zones of the Zengibobo-Sheikhjelinskaya area are timed to narrow violations of the tectonic zones of the north-eastern and north-western direction. The main form of gold-containing mineralization are small sharp-falling veins and lenses of quartz containing interspersed pyrite, arsenopyrite, chalcopyrite and pyrrotin, which are represented by gold-quartz, gold-arsenopyrite-pyrite natural type of ores.

KEYWORDS: Sultan-Uvays range, metavulcates, gold, pyrite, gold-containing mineralization, mineral composition, mineralization, silver, sulfide-gold mineralization, arsenopyrite, copper, nickel, cobalt.

INTRODUCTION

The Sultan-Uvays Ridge, located in the extreme southwestern part of the Kyzyl-Kum, is administratively part of the Karakalpak Autonomous Republic. It is characterized by an exceptionally wide occurrence of deeply metamorphosed Phanerozoic rocks (Fig-1).

The study of the geological structure of the ridge began with the work of Barbot de Marny (1874) and then continued by A.E.Voznesensky, K.A.Popov, I.A.Preobrazhensky (1912), A.I.Churakov, A.V.Pek (1936) and Ya.S.Visnevsky (1940). In these works, titanomagnetite ores associated with basic rocks were noted. Subsequent studies on searches, geological surveys were carried out by G.Yu. Naferov, A.A. Kulesh, R.I. Burtman and et al., (1953-1956), A.P.Agafonov (1955-1956), A.A.Kulesh and others (1966-1967), D.T.Boyonov, Sh.T.Toshpulatov (2011-2020) and many others.

Thematic research work was carried out by V.D. Tsoi and et al., (2011) V.V. Baranov, K.M. Kromskoy, A.F. Sviridenko and others (1963-1972), A. A. Kustarnikova (1971), O. I. Kim (1971), S. S. Schultz (ml), 1972), V.V. Baranov and others (1982), K.A. Keshishyan (1983), A.K. Bukharin et al., (1990), (T.K. Artikov et al., 2003). G.R. Yusupov (2012), O.N. Nikitina and V.K. Panasyuchenko (2007), D.T. Boyenov (2009), R.I. Koneev et al., 2010 and many others.

The gold deposits of the Sultan-Uvays Mountains in the territory of the republic are extremely western objects.

Despite the rather detailed study of most aspects of the geological structure and ore content of the Sultan-Uvays Mountains, to date, the problems of identifying patterns of localization and development of gold ore mineralization in known and new deposits and areas are topical and need to be solved.

The main purpose of our research was to study mineral-geochemical features of gold-ore manifestations of the Zengibobo-Sheikhjelinskaya area of the Sultan-Uvays Mountains.

The study of the material composition of ore bodies is carried out on the basis of the principles set out in the methodical manuals.

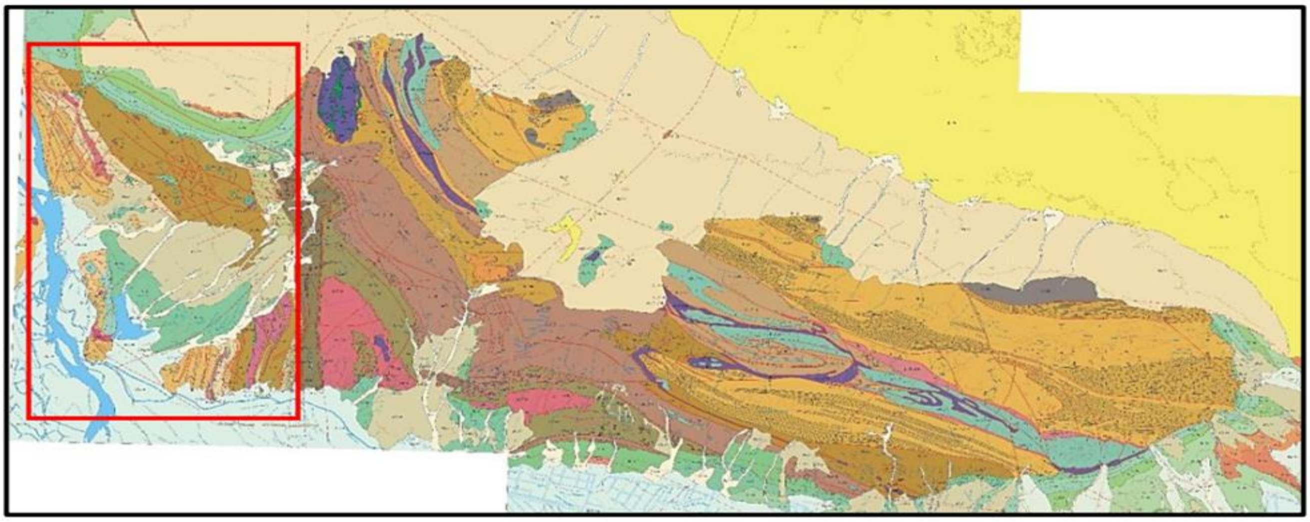


Fig.1. Geological map of the Sultan-Uvays Mountains scale 1:50000. Nikitina O.N., 2007 (dedicated site-location of Zengibobo-Sheikhjelinskaya Square.

To this end, all available information on the geological structure, mineralogy and geochemical features of the Zengibobo-Sheikhjelinskaya gold mining sites, performed by previous researchers, was collected (G.R. Yusupov, O.N. Nikitina, V.K. Panasyuchenko, T.K. Artikov, D.T. Boyonovay. R.I. Koneyev et al., V.D. Tsoi et al.), which were generalized and analyzed, also conducted their own analytical studies. The main results of which are described in this article.

Zengibobo-Sheikhjelinskaya Square (fig-2) is composed of meta-effusive and tuffogenic rocks of Sheikhjelinskaya retinue derivatives of dioritoid and basalt magma, penetrated daicoobrate and sillopoid bodies of diabasins, gabbrodiabasins, andesite porphyrites, diorites, quartz diorites and granodiorites (Zengebobo-Sheikhjeelinsky) gabbrodiorite-plagiogenite complex.

The affiliation of most of the rocks of the Sheikhjeelin entourage and of the co-magnetic intrusive formations to the products of differentiation of the Basalt and Dioritoid magma is confirmed by their mineral composition, structural-textural features and types of transformations.

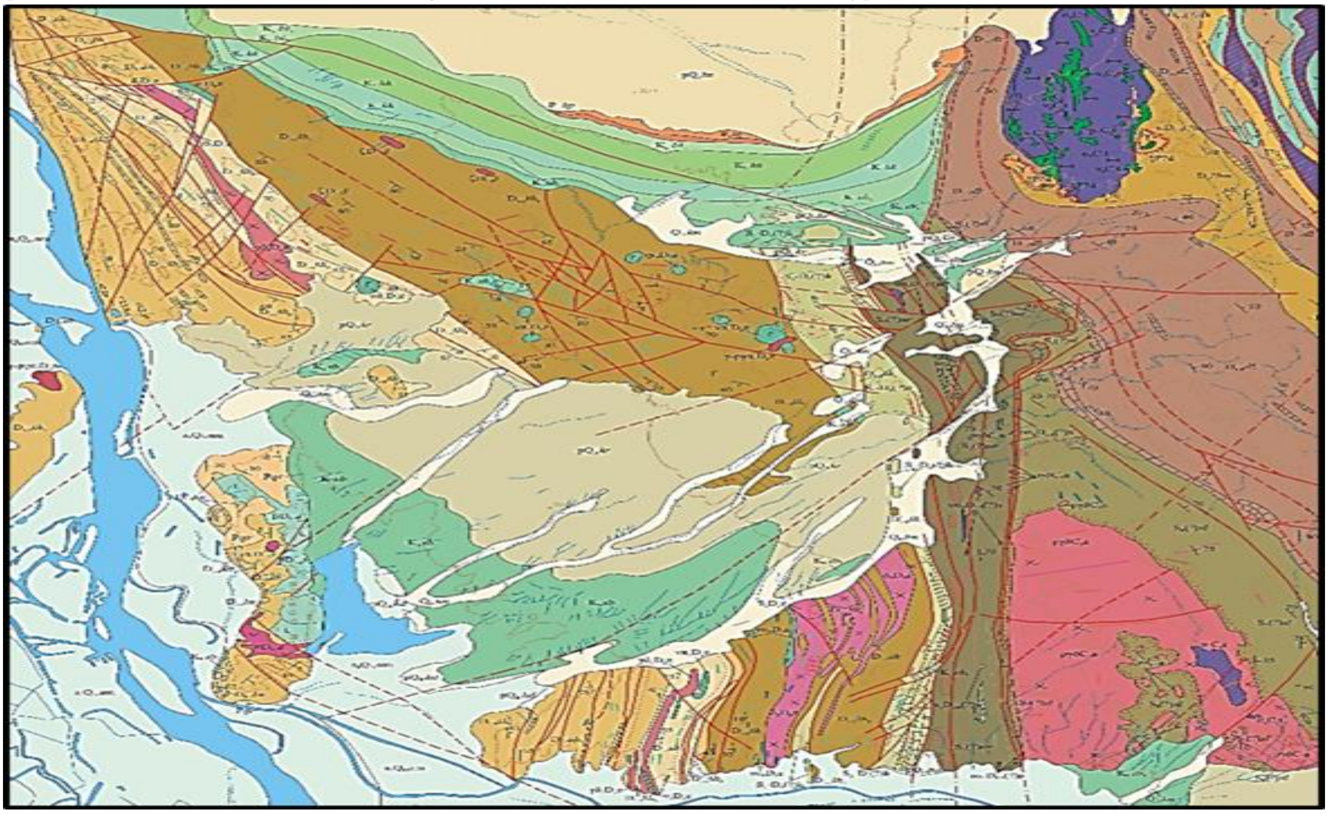


Fig. 2. Schematic geological map of Zengibobo-Sheikhjelinskaya Square.

The main minerals of metatuffs, metaeffusives and most shales are sodium-calcium field spars, chlorites, sericite, hydromicides, carbonates, magnetite, quartz, actinolite, tremolite, epidot. Emphasize the primacy of magnetite in intrusive, effusive and tugenous rocks. Minor quantities include pyrite, chalcopyrite, iron hydroxide, apatite, rutile, leukoxen. Porphyry secretion relics are often observed in metaeffusions, fragmentary preserves typical of diorites and diorite (andesite) porphyrites of the underlying microstructure. With characteristic for metamorphized sedimentary rocks structural-textured features “accessory” minerals are distributed in them - rutile, leukoxen, and magnetite. In matatufs, they are most often present in the form of small lensoid or jet thicknesses of improper grains (leukoxen) or crystals (magnetite, pyrite), textually subordinated slate layering.

In the areas of increased deployment, there are secant and congruent cores and veins of quartz, carbonate, pyrite. In the rocks of the near-surface zone, there are frequent net-thin-veined neoplasms of goethite, hydrogoitis, and more loose clusters of orange-blue limonite.

The contents of the main rock-forming chemical components in the rocks of the Sheikhjeelin retinue also indicate their belonging to the magma derivatives of the basic composition. The sharp quantitative predominance of sodium oxide over potassium oxide is clearly manifested by the “through” natra specialization of the original magma in the homodrome sequence of outbreaks and introductions. This is particularly pronounced in the composition of the acidic members of the homogenic series of intrusive formations. There is no doubt about the influence on this geochemical feature of the processes of diagenesis and early propylation, which lead (with the participation of seawater sodium in them) to intensive albitization.

The extension of packs of volcanogenic sediments and their splitting intrusive bodies on the Zengibobo-Sheikhjelinskaya area sub-meridional (fig-2). The fall of the strata varies from east to west in accordance with the folded deformations of the same stretch. As a result of folding in the thickness of rocks of different competence on many contacts there was a slide with the formation of breccias and milonites.

Among the manifestations of intrusive magmatism on the area, the dike-like bodies of diabasis, gabbro-diabasics, diorites and quartz diorites received the most magnificent vitrification.

Four gold-ore mineralized zones have been identified on Zengibobo-Sheikhjelinskaya area, which are located in fractures of 500-1200 m in power from 10 to 50 m, located between the outlets of the diabase, gabbrodiabasis.

The mineralized zones and deposits are oriented in accordance with the extent of the rocks of the Sheikhjeelin column.

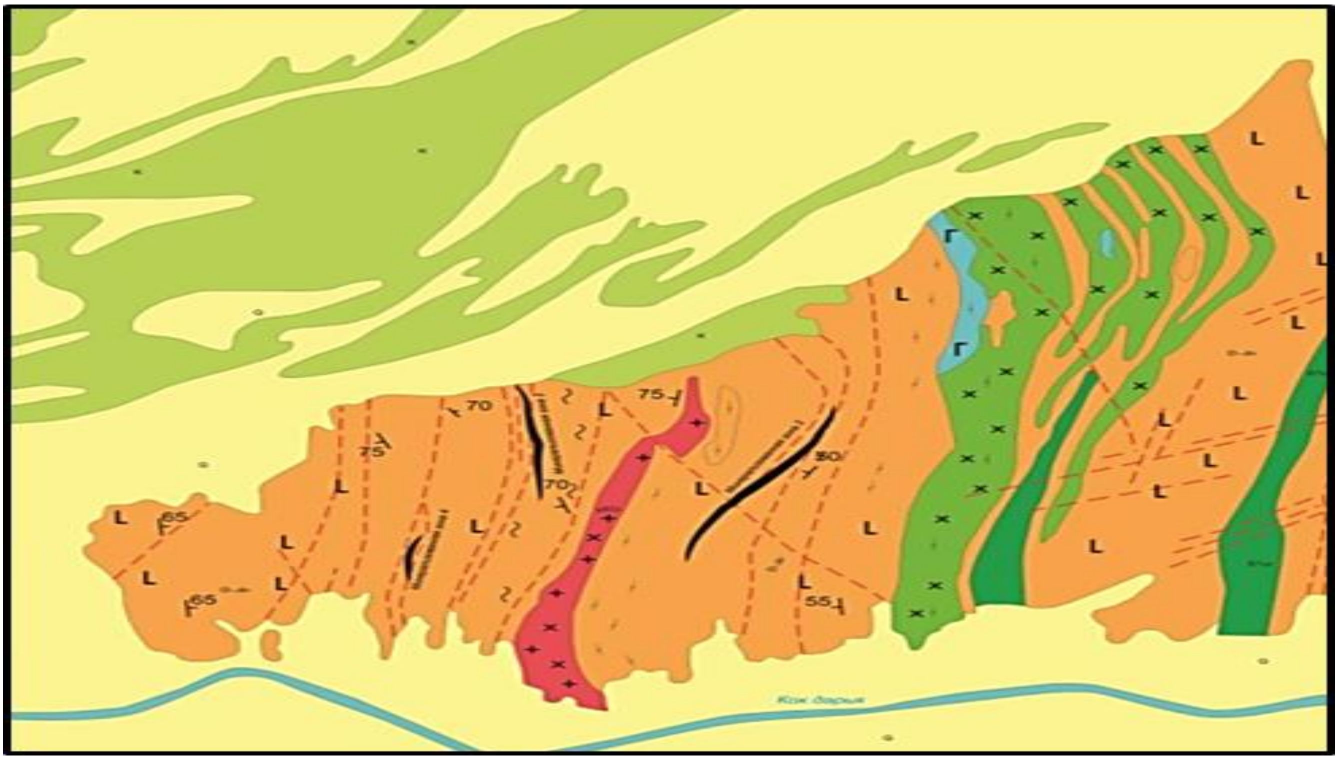
They are arranged intensively arranged, milonized and propylated rocks with wide development of epidot, chlorite, albita. The highest concentrations (up to 2.7 g/t per 1 m) are associated with intensive occultation plots, quartz sulphide veins and striations up to 0.3 m (Figure 3). The length of individual zones reaches 200-300 m. Gold is accompanied by elevated concentrations of silver (up to 13.7 g/t), copper (up to 0.2%), molybdenum (up to 0.01%), tungsten (up to 0.005%), and arsenic (up to 0.01%). Only copper greens and iron hydroxide are installed from ore.

The main form of gold-bearing mineralization is the culinary systems of small conformal and secant cores, lenses and quartz veins in meta-volcanogenic rocks with poor pyrite inclination.

Very unevenly distributed are small sulfide lenses, thin veins and nests consisting of pyrite with insignificant amounts of arsenopyrite, chalcopyrite, pyrrotin, pale ore, micro-secretions of native gold, telluride and selenides.

The main positions of localization of productive mineral changes in rocks are sinmetamorphic folding and disjunctive dislocations. (Fig-3). This is indicated by the subordination of the productive mineralization to the breccia zones and the intensive crushing of the layers and packs of tuftogen rocks along the contacts with the bodies of basalts, andezalts, diorites and diorite porphyrites.

Both north-western and north-eastern zones have a rather large number of quartz, quartz-microclinic, quartz-sulfide veins (Fig-4-5). The most interesting are the quartz sulfide cores. They are usually associated with northeastern violations, have a power of up to 10 cm, a length of 2-3 to 10-15 m and are fragmentary traced to the first hundred meters.



. **Fig-3.** Schematic geological map Zengibobo area with mineralized zones.

The gold content in these veins reaches 7.3-16.0 g/t, whereas the mineralized zones are usually characterized by concentrations of one-tenth of a gram, and only in some cases are values of 1-2.3 g/t at 11.5 m. Gold is accompanied by silver (from traces up to 12 g/t), arsenic (up to 0.02-0.08%), molybdenum (up to 0.02-0.04%), cobalt. The copper content ranges from 0.0n% to 0.1-0.2%.

The main ore mineral is pyrite, magnetite is widely distributed. Chalcopyrite, molybdenite, Bornite, Marcasite, Arsenopyrite, etc. In the anschliffs, native gold has been identified. It occurs in quartz, pyrite, and iron hydroxide.

In the studied anschlifes selected from mineralized zone 2, it is possible to observe a significant contamination of the rocks with gold, copper, molybdenum, arsenic. The gold content of almost all samples exceeds 0.01 g/t and most of them are accompanied by copper concentrations of the order of 0.01-0.03%.

Fig. 4-5. Gold-ore cores on mineralized zone 2 (Zenhybridobo)

In certain mineralized zones, the gold content rises to 0.5-0.8 g/t, copper to 0.1 g/t. Mineralogical studies established the presence of the following ore minerals: pyrite, magnetite, chalcopyrite, barite, pale ore, galena, pyrrotin, gold. Gold is very fine (2x10 μm), excreted by contact of pyrite and quartz (Fig-6-7).

The Zengebobo section has a weathering and oxidation zone up to a depth of 20-50 m. Clay minerals, iron hydroxide, manganese, copper, jarosite, natroiraosite, malachite, co-wellin, azurite, cerussite, anlesite, atacamite are common. "Primary" sulfides (pirit, chalcopyrite, arsenopyrite, galenite, sphalerite, faded ores) in the area of gipergenesis occur throughout the area, but only in the form of microrelicts in the most dense and least weathered mineralization differences

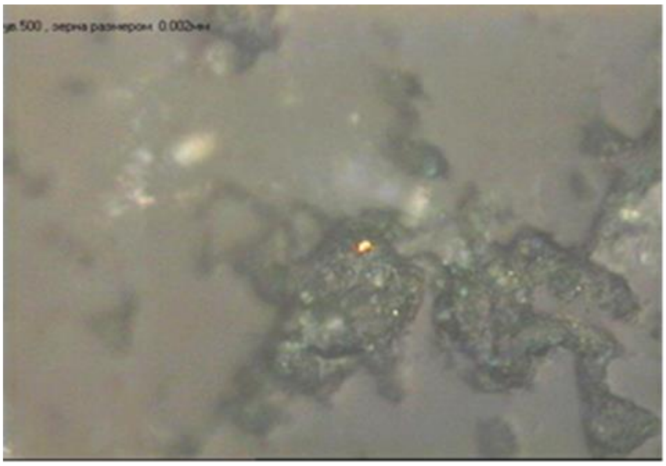


Fig. 6-7. Anschliff 3A- 15, Zengibobo. Increase 500x and 2500h. In the recesses of the fracture zones of quartz, the wrong gold grain size is 0.002mm. The presence of rare gold grains of 0.002mm in indentations of quartz grains has been detected. The quartz aggregates of the granule structure, the quartz grain are subparallel to the dispersion of the containing rocks, bearing signs of fragile deformation.

The revealed minerals in the composition of the metamorphized rocks and ores of the mineralized zones of the Zengibobo-Sheikhjelinskaya area previously amounted to more than 70 minerals (Baranov et al., 1987.), the last years were completed with mineralogical studies carried out by R.I.Konev, R.A.Halmatov dr. (2010).

Pyrite in mineralized rocks clearly predominates over all other moors of sulphides. In ore-substituting rocks (outside the productive areas of the ungraded zones), pyrite is distributed by an uneven inclination of micro- (framboids, globules, lumpy clusters of the same with sizes from micron fractions to 0.1-0.25 mm) and macro concreations (thin nodule layers and lenses, disc-shaped and less regular fine-grained clusters with a cancerous curl) predominantly in tugenous gender differences.

The content of pyrite in the productively mineralized rocks of Zengebobo ranges from the hundredths to 3-5%; in nests and rare sulfide veins up to 30-85%. Uneven inclination, Nesting and chained clusters of crystals and alloriomorphic grains are distributed in bands along the shale; they are particularly intensively developed in quartz-sericite metasomatites. Cubic crystals predominate in the blended type of miner of the animalization, and combinations of the Cube nation with the Pentagon-Decahedron are less common. Pentagon decahedra, octahedra and trapezohedra are rare. In shale rocks, the cubic pyrite crystals are flattened and elongated along the shale of the rocks containing the ingress of fromboidal pyrite.

Impurities in analyzed monosamples of "total" pyrite are (D.T.Bayonov, 2009): silver (sporadically 0.03-0.07%), copper (fairly constant 0.01-0.48%), arsenic (almost stable 0.06-5.01%) cobalt (stable 0.01-0.27%), and nickel (0.48%) (fairly stable 0.03-0.30%). Lead and zinc (50-3000 g/t) are constantly detected by spectral analysis. Gold is present sporadically in concentrations of 50 to 300 g/t.

Arsenopyrite in only a few samples accounts for up to 3% of the heavy fraction of the gold-bearing protolexes. It is represented by small (up to 0.2mm) prismatic (up to needle) and dipyramidal crystals, rounded grains in addition to pyrite. The microprobe in arsenopyrite showed elevated concentrations of Ag, C, Sb, Co, Ni. The Se content reaches 1%, and Te - 0.3%). These deposits are found above in the pyrites of other gold deposits.

Chalcopyrite is usually associated with polysulfide veins. Their composition includes galenite and sphalerite in the silicification sites and pyrrotin in the chlorinated porphyrytes. In modified porphyrytes, chalcopyrite is often present in cloud clusters of incorrect micrograins in pseudomorphoses of chlorite by dark-colored minerals of porphyry secretions. It is replaced by iron hydroxide, malachite and atacamite on the surface, and by chalcozine+bornite+covellin in the transition zone.

Galenite is regularly found in the form of extensions and micronutrients in pyrite. Grain size up to - 0.2 mm. It has an increased silver content and especially Se (up to 3.88% in the selenistic variety).

Sphalerite only in individual samples is up to 5% of the heavy fraction. In the anschlifts, sphalerite discharge is observed in a cracked pyrite. Some sphalerite secretions contain rare chalcopyrite emulsions, and some are replaced by it along the edges and along cracks.

Bleak ore (predominantly tennantite) occurs together with other ore minerals in the form of single grains of 0.002-0.02 mm in the pyrite of the containing rocks.

Pyrite, arsenopyrite, galenite, chalcopyrite, sphalerite, bleached ore I are placed “basis” for inclusion of finely dispersed and pulverized self-native gold.

The composition of native gold is common; its sampling in “primary” ores is about 850%, although occasionally the grain of electrum is found. The sample of hypergenic gold is sometimes close to 1,000%.

CONCLUSION

The collected and analyzed material of previous researchers and the researches conducted by us allows drawing the following conclusions on mineral-geochemical features of gold-bearing mineralized zones of Zengibobo-Sheikhjelinskaya area of Sultan-Uvays range:

I. Timing of mineralization:

- the main localizations of productive mineral changes in rocks are sinmetamorphic folding and disjunctive dislocations.

- the main form of gold-bearing mineralization manifestation are culinary systems of small conformal and secant cores, lenses and veins of quartz in metavolcanogenic rocks with a poor inclination of pyrite.

- andesites, andesito-basaltic porphyries and their tuphypropylated and stratified.

- torching linear bodies of diorites and quartz diorites, dykes of the main composition (diabasis, gabbrodiabasis).

- linear zones of quartz and quartz-microclinic cores (up to 25% of the total area).

II. Mineral type, complex of inclusions (main, secondary):

In the secretions: pyrite, magnetite and quartz (in total-90%). Minor-chalcopyrite, molybdenite, arsenopyrite, marcasite, bornite.

III. Extraction of gold content: Microinclusion in sulfides, quartz veins, in contact with torn granite bodies. The gold content is the hundredth-tenth g/t, rarely the first gram, only 10-16 g/t.

IV. Geological-industrial type (ore formation): Gold-sulfide-quartz.

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