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Research Article

FACTORS CONTROLLING THE LOCALIZATION OF GOLD MINERALIZATION IN THE ZIYOVUDDIN ORE FIELD (WESTERN UZBEKISTAN)

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ABSTRACT
This paper examines the factors influencing the spatial distribution of gold ore deposits in the Ziyovuddin ore field. Regularities in the formation and localization of gold mineralization within the Ziyovuddin ore field have been identified. It is demonstrated that the principal regional controls on gold mineralization within the ore field are structural and lithological factors. The study also indicates that there are favorable geological prerequisites for increasing the resource potential of tin ore deposits in Uzbekistan.

Keywords: *Gold, Deposits, Formations, Fault Structures, Industrial-Geological Type Of Gold, Classification, Distribution Regularities, Mineral Type, Uzbekistan, Southwestern Tien Shan, Ziyovuddin Gold Ore Field*

INTRODUCTION
The Ziyovuddin gold ore field is located in the northeastern part of the Zirabulak–Ziyovuddin Mountains and belongs to the orogenic system of the Southwestern Tien Shan. From a tectonic perspective, this area represents a fragment of the Epipaleozoic Turan Plate, where, as a result of Alpine neotectonic activation, the basement was brought to the surface and is exposed in the form of isolated uplifts (Turyatau, Katarmay, Rabindzhan, and others), collectively known as the Zirabulak–Ziyovuddin Mountains.
The geology and gold-bearing occurrences of the Zirabulak-Ziyovuddin Mountains were studied by H.M. Abdullaev, I.Kh. Khamrabaev, Baimukhamedov, and other researchers. In recent years, significant contributions to the study of the gold mineralization of this region have been made by M.M. Pirnazarov, V.D. Tsoi, Sh.P. Alimov, L.R. Sadykova, O.T. Razikov, and others.
As a result of scientific research and geological exploration aimed at gold prospecting and forecasting, the prospects for the discovery of new gold ore deposits in the Zirabulak–Ziyovuddin Mountains have increased significantly.
A distinctive feature of the Ziyovuddin ore field is its location at the boundary between the Zarafshan–Alay and the Zarafshan–Turkestan mineragenic zones (Razikov, 2020). In the framework of modern geodynamic interpretation, two terranes are distinguished: the Zarafshan and the Kuldzhuk–Chakylkalyan terranes (Fig. 1). The Zarafshan terrane is composed of geological formations belonging to two formations: a carbonate–terrigenous–siliceous formation of D_1–C_1 age, and a metavolcanogenic–carbonate–siliceous formation (with hyperbasites) of Є–D_1 age. These formations correspond to geodynamic regimes of a condensed section in a deep-water trough and the upper layers of oceanic-type crust, respectively. The Kuldzhuk–Chakylkalyan terrane is represented by a terrigenous–carbonate formation of O_2–$C_{2\text{-}3}$ age, formed under continental shelf conditions.
The Ziyovuddin gold ore field belongs to the Zarafshan terrane, which is characterized by a metallogenic specialization in gold (Mirkamalov et al., 2020).

The industrial-geological type of the deposits is gold–sulfide–quartz. Morphologically, the deposits are represented by small veins and mineralized zones of fracture and crushing
To date, 217 gold occurrences of different ranks—including deposits, occurrences, and ore showings have been identified within the Zirabulak–Ziyovuddin Mountains. All reference gold deposits are concentrated within the Ziyovuddin ore field, including the Karakutan, Tillyatag, Kapkakly, Yangi Davon, Tashkan, and other deposits (Pirnazarov et al., 2020).
At the same time, several important issues remain unresolved, including the geodynamic evolution of the region, the precise age dating of the gold-hosting geological formations, the full assessment of the gold potential of the region, and the further development of scientific and methodological approaches to geological exploration that ensure reliable estimation of gold reserves and resources.
To develop criteria for forecasting new gold deposits in the Ziyovuddin ore field, studies were conducted to identify the role of various geological factors in controlling their localization.

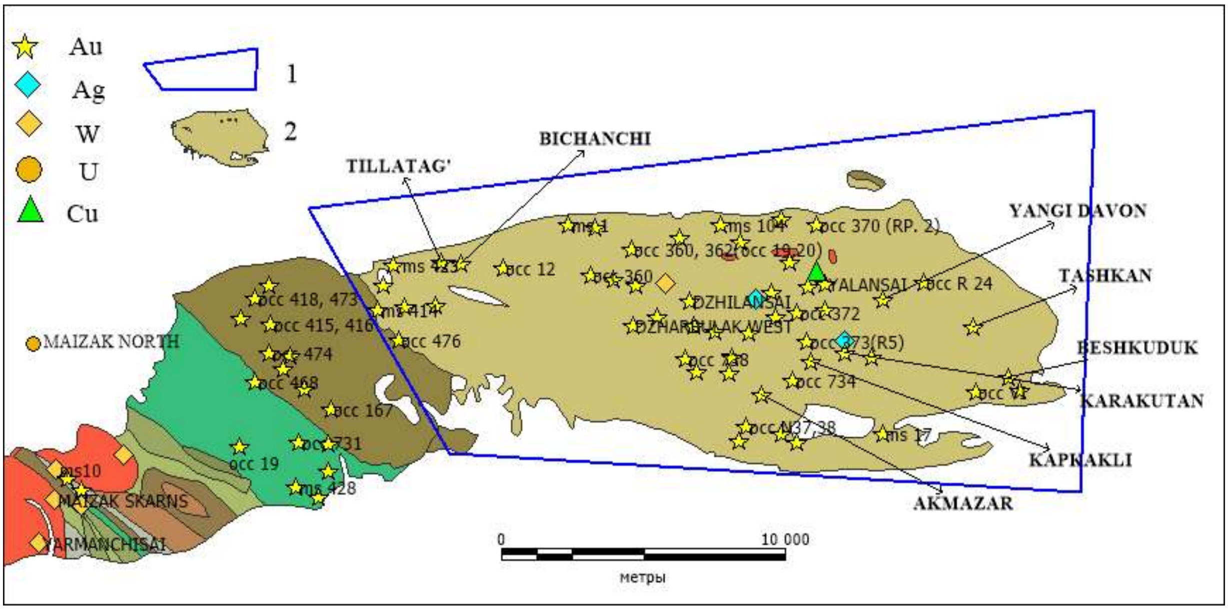

Figure 1: Distribution of gold-bearing objects in the Zirabulak–Ziyovuddin Mountains.
1- Ziyovuddin gold ore field; 2-Outcrops of the heterogeneous basement of the ore field.

MATERIALS AND METHODS

This study is based on published articles, monographs on gold deposits of Uzbekistan, internet resources, and the results of field observations conducted at gold deposits of the Ziyovuddin ore field, including sampling for various analytical investigations.
For computer-based analysis of informative indicators, a database of gold occurrences of the Zirabulak–Ziyovuddin Mountains was used. This database includes 20 parameters: object ID number, object name, coordinates, administrative affiliation, industrial-geological type, average gold grade, mineral type, reserves, resources, and other indicators.
In addition, a digital cartographic database was compiled, reflecting the geology, mineral resources, tectonics, folded and fault structures, metamorphic and metasomatic alterations, as well as other aspects of the geological evolution of the study area.
The methods applied in this study include formation analysis (Dalimov et al., 2010; Pirnazarov, 2017) and statistical metallogenic analysis (Usmanov et al., 2006). The compiled computer database of tin deposits and ore occurrences of Uzbekistan also served as a fundamental basis for the performed analysis.

RESULTS AND DISCUSSION

The statistical metallogenic analysis revealed that approximately 87% of the gold occurrences of the Zirabulak–Ziyovuddin Mountains are concentrated mainly in the northeastern part of the Ziyovuddin

Mountains, within the Ziyovuddin ore field. The conducted metallogenic zoning also substantiates this conclusion.

The Ziyovuddin ore field is composed of metamorphosed effusive–terrigenous deposits of the Lower Devonian, which are dislocated into a large asymmetrical Katarmay anticline. The limbs of this anticline are complicated by higher-order folds and numerous faults of different ages, predominantly of sublatitudinal strike. The anticline has an asymmetric structure, and its limbs are complicated by folds of higher orders as well as by numerous multi-age faults. The northern limb of the Katarmay anticline is best preserved, while the southern limb is truncated by the Navruzalinsky fault and overlain by weakly dislocated Mesozoic and Cenozoic sediments.

The strike of the fold is northwestern (250–290°). The dip of rocks near the hinge zone ranges from 10–15°, increasing to 40–50° and more on the limbs. The northern limb is complicated by high-order folding, in some cases overturned toward the core.

Against the background of the general northern monoclinal bedding of the rocks, folded dislocations are widely developed and are represented by near-fault flexure-like bends and shear folds. In the vast majority of cases, the near-fault folding is expressed by corrugation zones of the enclosing schists, the intensity of which sharply decreases at a distance of 5–10 m from the fault.

The folded structures were formed during the Hercynian stage of tectogenesis (Mikhailov, 2000). The spatial distribution of the folded structures is shown on the tectonic scheme of the Zirabulak–Ziyovuddin Mountains (Fig. 2).

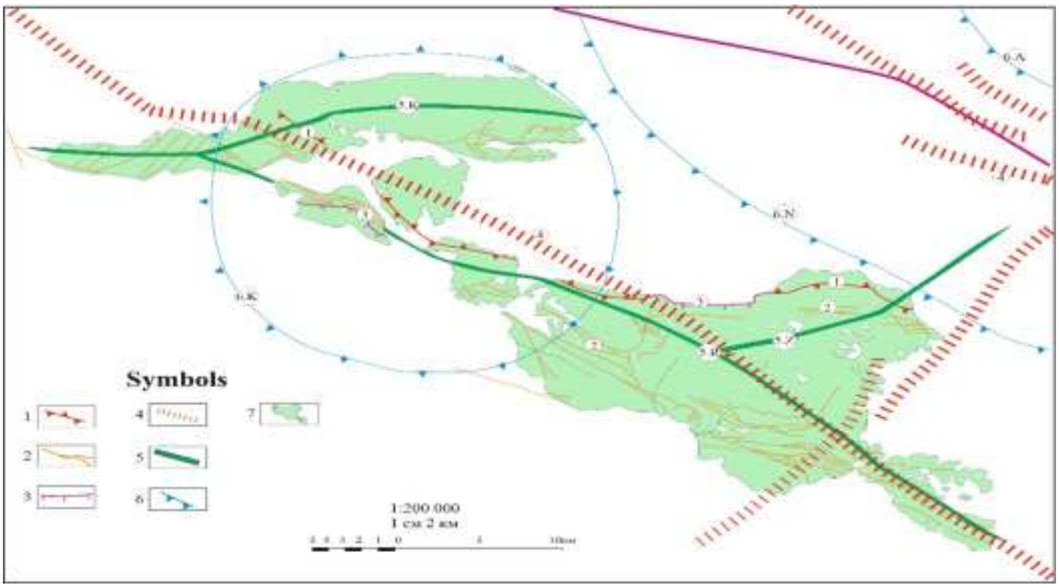

Figure 2: Tectonic scheme of the Zirabulak–Ziyovuddin Mountains. (compiled using materials by A.K. Glukh and A.K. Bukharin, among others). Legend: 1 – faults forming the boundaries of mineragenic (geodynamic) zones; 2 – secondary intrablock faults (reliable); 3 – reliable thrust faults (hachures indicate the direction of the displacement plane); 4 – tectonic lineaments; 5 – anticlinal folds: 5K – Katarmay anticline, 5Z – Zirabulak anticline, 5R – Rabindzhan anticline; 6 – dome-type circular structures: 6K – Katarmay, 6N – Nurata, 6A – Aktau; 7 – basement outcrops.

Fault structures, i.e., fractures, are widely developed within the ore field and, like the folded structures, were formed during the Hercynian stage of tectogenesis. In order of decreasing abundance, the following fault orientations are distinguished: sublatitudinal faults with northeast and southeast strikes (75–105°), dipping predominantly to the north at angles of 60–90°, and less commonly to the south at angles of 40–90°; northeast-striking faults (30–60°), dipping both to the northwest (60–90°) and to the southeast (50–80°); northwest-striking faults (300–340°) with steep dips of 70–90°; submeridional faults (0–20°) dipping eastward at angles of 40–90°.

The most widespread are the sublatitudinal faults, which are also the most extensive. Major fault structures are represented by zones of several closely spaced fractures arranged in en echelon patterns.

The width of such zones varies from 50 to 150 m. Despite their total length of several kilometers, individual component faults are traced for no more than 1.0 km. One of the characteristic morphological features of these faults is their wavy geometry, both in plan view and in cross section.

All fault structures belong to three age groups: pre–Late Carboniferous, pre-Permian, and Permian.

Deep-seated faults of pre–Late Carboniferous age are grouped within the Karakutan deep fault zone, which extends for more than 30 km and has a width of 2–3 km. Within this zone, three branches are distinguished—the Karakutan, Kizbibi, and Northern branches—which play a leading role in controlling the distribution of gold mineralization. These branches represent weakened zones of fracturing and alteration, composed of smaller parallel and intersecting faults with numerous feathering fractures of northeast and northwest strike (Fig. 3).

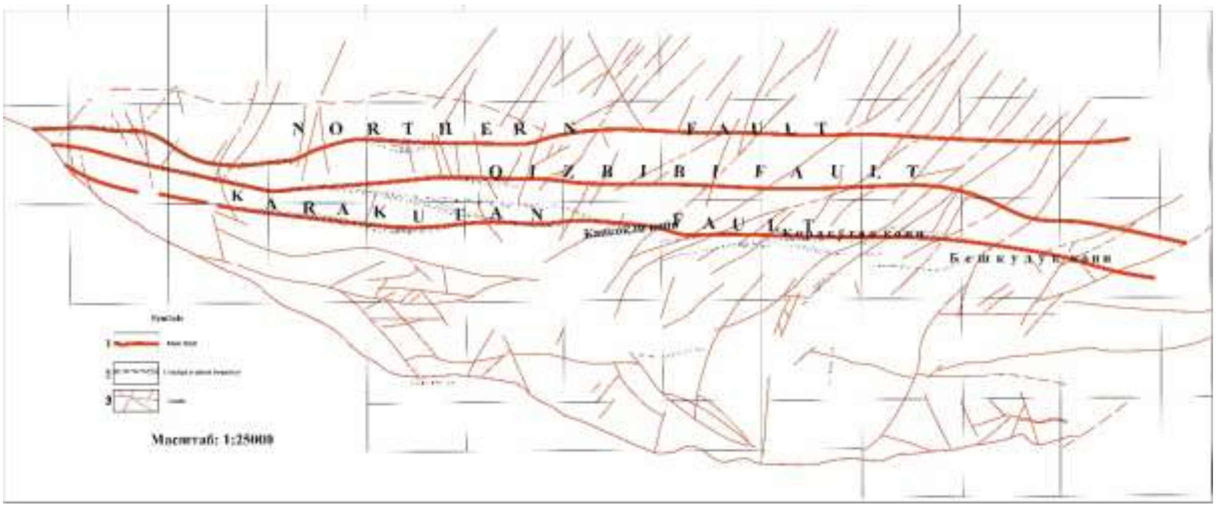

Figure 3: Map of fault structures of the Ziyovuddin ore field (Zh. Rakhmatullaev, 2025).

One of the branches of the Karakutan fault zone—the Karakutan branch—extends in a latitudinal direction across the entire ore field and controls large concentrations of economically significant gold. The visible width of the fault zone ranges from 100 to 1000 m, with a general northward dip at angles of 45–75°. It is characterized by intense crushing, limonitization, sulfidization, sericitization, bleaching, and is accompanied by pervasive silicification both within the rock matrix and through the development of quartz veinlets and veins. Within the crushing zones, quartz, quartz–schist breccias, quartz–carbonate rocks, and listvenitized volcanics are widely developed. In most cases, these formations serve as the principal carriers of gold mineralization, composing the main volume of ore bodies.

Another branch of the Karakutan deep fault zone the Kizbibi branch is located approximately 1.0-1.5 km north of the Karakutan branch and extends along the ridge of the same name both to the south and north across the entire ore field. The visible width of this fault zone is 100–1000 m, with a steep northward dip. It is also characterized by crushing, limonitization, sulfidization, sericitization, bleaching, and silicification within both the host rocks and quartz vein systems. Prospecting and evaluation works have revealed its high productivity, exceeding that of the Karakutan branch.

The third branch of the Karakutan deep fault zone the Northern branch is located 0.75–1.0 km north of the Kizbibi branch and extends across the entire ore field in a latitudinal direction. Its visible width is 100–750 m, with a steep northward dip (60–80°). This branch remains insufficiently studied; however, economically significant gold concentrations are also recorded within its limits. It is characterized by the same products of hydrothermal metamorphism as the other branches of the Karakutan fault zone.

Small stocks and dikes of intermediate and acidic magmatic rocks are intruded into the deep fault zone (Divaev et al., 2022; Ishbaev et al., 2020).

More than 90% of the gold deposits and occurrences known within the Ziyovuddin ore field are confined to the northern limb of the Katarmay anticline, within the sublatitudinal steeply dipping Karakutan deep fault zone. The largest industrial gold accumulations are concentrated within the Kizbibi branch, while smaller ones occur within the Karakutan and Northern branches.

Pre-Permian fault structures are controlled by dikes and are developed mainly in the northern part of the ore field, within the fourth subformation of the Katarmay Formation.

Late Hercynian faults of Permian age form a network of northwest- and northeast-trending structures, creating a block structure of the ore field. These faults are characterized by strike-slip and reverse strike-slip displacement. Displacements of dikes, volcanic rock sequences, and ore bodies are recorded along these faults.

Among the structural controls, sublatitudinal, northeast-, and northwest-trending faults played the primary role in the localization of gold mineralization. The sublatitudinal faults are associated with the formation of dikes and ore zones. Left-lateral displacement occurred along the northwest-trending faults, whereas right-lateral displacement was observed along the northeast-trending faults. Changes in the deformation regime caused diagonal fault systems (northwest and northeast) to remain long-lived and to change the sense of displacement under different tectonic stress regimes. These diagonal structures were permeable to dikes and hydrothermal ore-bearing fluids, although to a lesser degree.

Among the magmatic factors, dike formations of Late Carboniferous–Early Permian (C_3–P_1) age are distinguished, including: 1) biotite–hornblende granodiorite porphyries; 2) quartz diorite porphyrites; 3) kersantite–spessartite lamprophyres.

Studies confirm the similarity of geological settings, ore-localization conditions, and the compositional identity of the Yangi Davon, Tashkan, Tashkan-1, and Kimine deposits, which allows the conclusion that the exploration methodologies and mining conditions of newly discovered deposits may be analogous.

The deposits of the Katarmay Formation serve as the host environment for more than 92% of all endogenous gold occurrences. The age of the Katarmay Formation remains debated and varies in different publications from Cambrian to Devonian age (Likhachev et al., 1961; Korsakov et al., 1971; Yaskovich et al., 1972; Abdullaev et al., 1972; Mirkhodzhaev et al., 1973; Abduazimova et al., 2000; Mirkamalov et al., 2019; Sadykova et al., 2022).

In this paper, the age of the Katarmay Formation is accepted as Devonian (D_1kt). Based on lithological characteristics, the Katarmay Formation is subdivided into four subformations with gradual transitions between them.

First subformation (terrigenous–volcanogenic, D_1kt_1) this subformation is composed of terrigenous–volcanogenic rocks represented by agglomeratic basaltic tuffs with interbeds and lenses of micaceous–feldspathic–quartz schists, marbles, dolomites, limestones, and siliceous rocks. The thickness of the subformation exceeds 600 m. Metabasite layers (14–80 m thick) are usually represented by foliated dark-green banded rocks, clearly exposed in cross sections and traceable along strike for tens to hundreds of meters. Their contacts with schists are gradual and characterized by fine alternation of sedimentary and volcanogenic rocks. The main mass of metabasalts is exposed in the core of the Katarmay anticline as a narrow latitudinal belt.

Second subformation (carbonate–terrigenous, D_1kt_2) this subformation is composed of dark-gray crystalline schists with interbeds of metabasalts, carbonate rocks, and quartzites. The rocks are intensely silicified, as indicated by abundant quartz bands and nests oriented parallel to bedding. Layers of quartzites and carbonate rocks (marbleized dolomites and limestones) range from 0.1 to 20 m in thickness and extend for tens to hundreds of meters. Their distribution is uneven: isolated layers occur in the lower part, while interbedded horizons dominate the central part, and lens-shaped limestone and dolomite bodies occur in the upper part. Compared to the first subformation, the content of metabasalts decreases significantly. The visible thickness exceeds 500 m.

Third subformation (volcanogenic–terrigenous, D_1kt_3) This is the most lithologically diverse subformation and is distinguished by the presence of coarse-clastic and carbonaceous rocks. It occupies the central part of the ore field as a wide belt (up to 3.5 km) extending in a sublatitudinal direction. This subformation is characterized by extensive gold geochemical halos, mainly within the zone of influence of the Karakutan deep fault zone, where most industrial-grade ore bodies are localized. It consists of unevenly alternating metamorphosed mica–feldspar–quartz, mica–quartz–feldspar, feldspar–quartz–mica, siltstone–clayey, and glaucophane schists, as well as phyllites, with subordinate layers and lenses of dolomites, limestones, sandstones, gravelites, and conglomerates. Numerous layers and lenses of tuffs and agglomeratic tuffs of basaltic and olivine–basaltic composition occur, with thicknesses up to 200 m and lengths from several hundred meters to more than 10 km. The visible thickness of this subformation exceeds 2500 m.

Fourth subformation (terrigenous, D_1kt_4) this subformation replaces the volcanogenic–terrigenous rocks of the third subformation. Its boundary follows the last carbonate outcrops of the third subformation and shows both tectonic relationships and gradual transitions along the Kizbibi ridge. It is represented by a massive sequence of dark-gray micaceous–feldspathic–quartz and micaceous–quartz–feldspar schists with interbeds of phyllites, siliceous schists, and, less commonly, gravelites and metabasalts. The thickness of the interbeds reaches 0.5 m, metabasalts up to 20 m. The visible thickness exceeds 2200 m.

All gold-bearing objects of the ore field are confined to the Katarmay Formation; however, the overwhelming majority of gold is concentrated within the third subformation with its terrigenous–carbonate–volcanogenic composition.

Some geologists correlate the Katarmay Formation with the ankaramite–trachybasalt formation (Mikhailov et al., 2007), indicating its affiliation with the olivine–basalt association. The development of this association is typically related to volcanic depressions and rift-like structures. Considering that the volcanic bodies often conformably overlie the host rocks, it is likely that they merge into unified volcanic structures at depth.

Intrusive rocks of the ore field form part of the Katarmay dike belt in the northern Ziyovuddin Mountains. The belt is 5–6 km wide and more than 30 km long, extending in a sublatitudinal direction. According to age, genetic affiliation, and sequence (Yudalevich, 1975), the following intrusive phases are distinguished: biotite granodiorite porphyries; amphibole–biotite porphyritic granodiorite porphyries and quartz diorite porphyrites; amphibole–biotite garnet-bearing diorite porphyrites; and lamprophyres.

Biotite granodiorite porphyries form stock-like bodies of irregular shape with areas up to 0.5 km^2. These rocks are gray to brownish-gray in color, porphyritic in texture, variably altered, with rare schlieren-like fine-grained segregations of mafic minerals.

Amphibole–biotite porphyritic granodiorite porphyries and quartz diorite porphyrites form the thickest (up to 25 m) and most extensive (up to 3 km) dikes, striking sublatitudinally and dipping mainly northward. The rocks are gray, brownish, or greenish-gray, with uneven-grained porphyritic textures.

Amphibole–biotite garnet-bearing diorite porphyrites form thick (up to 10 m) and elongated (up to 1 km) dikes, mostly conformable and sub-conformable, although numerous cross-cutting bodies also occur. These are gray porphyritic rocks, often containing xenoliths of schists and quartz.

Lamprophyres form bodies up to 7 m thick, usually thinner, and extend from tens of meters to more than 1 km. Most lamprophyre dikes occur as conformable, sub-conformable, and cross-cutting bodies. The rocks are brown, dark brown, or greenish-gray, massive, and fine-grained. Compositionally, they correspond to spessartites, vogesite–spessartites, and syenite–diorite porphyrites.

Within the third subformation where the main industrial gold accumulations are concentrated-lamprophyre, diorite porphyrite, and quartz diorite porphyrite dikes are recorded within the ore-localizing structures. These dikes are strongly altered.

Volcanic rocks are widely developed within the first and third subformations of the Katarmay Formation, where they form thick sheets extending in a latitudinal direction for more than 20 km. Among these rocks, metalavas, volcanic metabrecchias, metatuff lavas, and metatuff conglomerates are distinguished. They are generally dense, less commonly porous, often foliated, and dark green to black with a greenish tint. They exhibit a clear olivine–basalt composition and represent typical greenstone rocks subjected to metamorphic alteration. In the central part of the ore field, their primary composition and textures are preserved, whereas in other areas they are transformed into metabasalts. Within crushing zones and ore-localizing structures, listvenite–beresite alterations are developed.

Gold mineralization of the Ziyovuddin Mountains belongs to the gold–sulfide–quartz formation and is classified, based on sulfide content, as low-sulfide (up to 2%) and moderately sulfide (up to 5%). Based on morphology, occurrence conditions, and internal structure of ore bodies, the following types are distinguished: – veins and mineralized zones within effusive–terrigenous rocks; – stockworks within sheets of mafic effusives. In total, 94 ore bodies have been identified within the Ziyovuddin ore field. Of these, two belong to the stockwork type, while the remaining ones are of vein and mineralized zone types. The length of ore bodies ranges from 22 to 1340 m: 80% are up to 200 m long (average 90 m), 14% up to 400 m (average 270 m), and only 6% exceed 1050 m (average 540 m). The morphological complexity of the ore bodies is determined by their wavy geometry along both strike and dip, as well as by highly uneven thickness, where pinch-outs of 0.2 m alternate with swellings up to 25.4 m. The average thickness of 71% of ore bodies is 2.0–3.0 m; 25% are less than 2.0 m thick, and only 4% exceed 3.0 m. The thickness variation ranges from 0.68 to 14.54 m. Most ore bodies strike sublatitudinally (70–125°), while some strike northeast (30–60°) and meridionally (350–10°). The dip is steep, reaching up to 90° in both directions.

Mineralogical and compositional studies of ores from the Ziyovuddin ore field have made it possible to establish the scheme of mineral formation and to identify new mineralogical types of gold mineralization (Tsoi et al.; Turesebekov et al.; Alimov et al.).

Generalization, analysis, and comparison of previous studies with the authors' investigations at the Karakutan, Tillyatag, Yangi Davon, Tashkan, Kimine, and Chambar areas allow the overall material composition of the ore bodies of the Ziyovuddinfield to be characterized. The ore bodies exhibit highly variable material composition and contain the following rock varieties formed as a result of crushing, cataclasis, and hydrothermal metamorphism: – quartz veins and quartz breccias up to 41.1% (average 11.9%); – quartz–schist breccias up to 46.3% (average 13.3%); – brecciated silicified schists up to 54.5% (average 19.1%); – silicified schists of various compositions up to 85.4% (average 42.7%); – silicified altered mafic effusives up to 45.4% (average 6.6%); – silicified diorite porphyrites up to 39.8% (average 4.8%); – silicified granodiorite porphyries up to 17.2% (average 1.6%). Stages of Ore Formation

The pre-ore stage developed in two phases. The initial phase was characterized by displacements and partial opening of deep fault structures, through which hydrothermal fluids penetrated. During the first phase,the host effusive–terrigenous deposits of the Katarmay Formation and dike bodies underwent transformation. In diorite porphyrites and granodiorite porphyries, beresitization occurred (formation of quartz veinlets and sulfide mineralization), whereas mafic effusives underwent listvenitization (development of carbonates and micas). Schists were affected to a lesser degree. Feldspars were replaced by albite, sericite, carbonate, and quartz; biotite by chlorite, epidote, and sagenite; amphiboles, pyroxenes, and olivine by epidote, chlorite, carbonates, sericite, iron hydroxides, and actinolite. Ore minerals of this stage pyrite, pyrrhotite, and arsenopyrite together with quartz formed accumulations along schistosity planes and foliation of effusives, as well as short cross-cutting veinlets.

The ore stage began with the fragmentation of rocks in tectonic zones. In the conditions of cracking, the skeletal growth of pyrite and arsenopyrite inclusions began. The intensification of crushing led to partial cracking of the already formed monolithic arsenopyrite crystals, cracking, and plastic deformation of pyrite. The most favorable environment for the skeletal growth of pyrite was the permeable relics of chloritized rocks, chlorite formations, and to a lesser extent, pre-ore quartz. Further fragmentation leads to the formation of cracks and voids, which are filled with intrarudate fine-grained quartz and ankerite. The deposition of native gold and silver is associated with one generation of intrarode quartz, while magnetite and lead sulfosalts are associated with the other. The influx of intrarode quartz was accompanied by the recrystallization, enlargement, and cataclasis of pyrite grains, their cementation by quartz, which affected arsenopyrite to a lesser extent.

Subsequent crushing affected the intra-ore quartz and, to a lesser extent, pre-ore quartz, arsenopyrite, and pyrite. Newly formed fractures and cavities were first filled by sphalerite, pyrrhotite, and chalcopyrite with covellite, and later by galena, tetrahedrite–tennantite ("fahlore"), and hematite.

The post-ore stage began with the formation of cross-cutting northeast- and northwest-trending faults and fracture zones, along which semi-transparent quartz and carbonate veinlets were deposited. Subsequently, up to the present time, oxidation processes within the supergene zone have transformed sulfide minerals into hydroxides.

CONCLUSIONS

The Ziyovuddin gold-bearing field belongs to the Zarafshan terrane, which is characterized by a metallogenic specialization in gold. Gold mineralization was formed as a result of tectonic, metasomatic, and hydrothermal processes that occurred during the Late Carboniferous–Early Permian period. The genesis of the gold ores is hydrothermal.

The gold-bearing ore bodies are associated with fracture systems and are confined to sublatitudinal fault structures and their intersections with diagonal faults. They are characterized by complex geometry and significant variability both along strike and, especially, down dip. Displacements of ore bodies with considerable amplitudes are frequently observed.

The spatial distribution of gold mineralization within the Zirabulak ore field is closely related to the conditions of formation of the host rocks, their lithological composition, deformation features, and the associated fault structures (extensional, shear, and tensional fracture systems at fault intersections). The primary potentially ore-hosting rocks were affected by tectonic dislocations that served as pathways for hydrothermal ore-bearing solutions predominantly of aluminosilicate composition. Gold deposition within the host rocks was accompanied by metasomatic alteration and dense stockwork quartz veining associated with the penetration of hydrothermal fluids.

In terms of morphology and material composition, the ore bodies consist of a series of closely spaced lenses and mineralized zones composed of intensively brecciated, silicified, and micaceous rocks.

Two main regional factors controlling the localization of gold mineralization in the Ziyovuddin ore field have been established: 1. The presence of the large ore-feeding Karakutan fault zone; 2. The heterogeneous lithological composition of the Katarmay Formation (terrigenous, carbonate, and volcanic rocks), which hosts the gold mineralization.

The Karakutan deep fault zone, represented by three main branches, extends beyond the limits of the ore field into areas covered by younger sedimentary deposits. This provides grounds to assume that new gold deposits may be discovered in similar covered areas.

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