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On the Issue of Studying Some Geological Factors Location Mineralization in Southern Uzbekistan

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Abstract: Evaluation criteria and factors of mineralization placement were used to identify promising areas for gold, copper, lead, zinc and tungsten in Southern Uzbekistan. Geology, tectonics, magmatism, etc. have been studied in detail. features of the structure of Southern Uzbekistan and identified metallic, non-metallic minerals: non-ferrous, noble, rare metal and rare earth elements, as well as nonmetallic raw materials and identified factors of mineralization placement.

Keywords: forecasting methods, geochemical, magmatic factors, criteria, structure, ore deposits, gold ore objects, Southern Uzbekistan.

INTRODUCTION The territory of Southern Uzbekistan in geomorphological terms is flat spaces in the west, mountains and intermountain depressions in the east. The pre-Mesozoic basement of Southern Uzbekistan is represented by various intensively dislocated sedimentary, igneous and metamorphic rocks of Precambrian and Paleozoic ages, which is overlain by sedimentary strata of the Mesozoic and Cenozoic. According to the structure of the stratigraphic section, the area is clearly divided into three districts - Baysun-Kushtangsky, Yuzhnogissarsky and Chakylkalyan-Yuzhnogissarsky [1].

In the Baysun-Kushtangsky district, the section begins with gneisses, crystalline shales, quartzite’s, amphibolite’s and marbles intensively metamorphosed in the amphibolite facies. Volcanogenic sedimentary deposits of Early-Middle Carboniferous age lie directly on them. They are unconformable overlain by a thickness of conglomerates, sandstones, siltstones with lenses of gravesites and limestone’s of Middle-Late Carboniferous age. In the south of the Baysuntau ridge, this stratum is sharply inconsistently overlapped by Early Permian sedimentary and volcanogenic (andesite-basalts) formations. And the Paleozoic section in this area ends with a red-colored molasses of conditionally Permian age. In the Yuzhnogissarsky district, the section begins conditionally with Proterozoic crystal shales, gneisses, quartzite’s, marbles, amphibolite’s. Limestone and dolomites, often marbled, of Early-Late Silurian age and carbonate strata of Early-Middle Devonian age are exposed above. Further, Early-Middle carboniferous volcanogenic (rhyolites, decides, basalts and their tuffs) and sedimentary sandstones, siltstones, silicones, gravesites, conglomerates and limestone’s are deposited with deep erosion. The most representative stratigraphic section is given in the Chakylkalyan-Yuzhnogissar district. Here, siltstones, sandstones, mudstones, conglomerates, rhyolites, decides, andesite’s and their tuffs of the Middle-Upper Ordovician are deposited on the underlying crystalline shales, gneiss-like rocks, marbles, quartzite’s, amphibolite’s of the Cambrian-Ordovician age. Limestone, dolomites, sandstones, gravesites, and flints of the Early Silurian age lie above it. The section is being expanded by limestone’s, dolomites with interlayers of sandstones, of Early-Late Silurian age.

Two types of section are distinguished in the overlying stratigraphic sediments. The first is composed of limestone of Early-Middle Devonian age; the second consists of phthanites, jaspers, flints, detrital limestone of Devonian-Early Carboniferous age.

Above are carbonate deposits of Early-Middle Carboniferous age. In the Upper Moscow-Late Carboniferous, mudstones, siltstones, sandstones, gravesites and conglomerates, blocks and olistolites of limestone's, flints, sandstones and vulcanite's were deposited in this area. And the section ends with Early Permian trachyte's, phonolites, rhyolites and their tuffs with interlayers of conglobreccia's and limestone's. The Mesozoic group of sediments in Southern Uzbekistan is represented by all three systems. Of these, Jurassic and Cretaceous have independent significance [2]. The most significant outcrops of the Jurassic system are located in the southwestern spurs of the Hisser Ridge and on its southern slopes. The Jurassic system is represented by three sections, the sections of which are composed of various sedimentary rocks of continental and marine origin.

On the territory of the southwestern spurs of the Hisser, a gradual change of continental terrigenous sediments with coal beds by marine deposits of terrigenous- carbonate composition is observed from bottom to top. The sediments of the listed Middle and Upper Jurassic sections are represented by marine carbonate, in places containing interlayers of fine-grained terrigenous rocks and gypsum lenses.

Within the southwestern spurs of the Hisser, sediments transitional from the Jurassic to the Cretaceous are distinguished. The most complete section of the Cretaceous system is represented in the southwestern spurs of the Hisser, where it is composed of marine, lagoon and continental factes, the main ones are marine.

Magmatic factor. These include Vakhshibarsiy Civh, Siominsky Cism and Luchobsky Pies subvolcanic and Podgursky subintrusive Pip complexes. The first three complexes belong to the rhyolite, the fourth to the syenite-diorite-gabbroid- granite formation. They are represented by sub volcanic rod-shaped and dike bodies [3]. The first two is usually oval in outline and relatively small in size (0.2-2.0 km), the third form single bodies or extended dyke zones.

The Vakhshibarsi and Siominsky complexes are closely related to ring structures, they are the root parts of widespread formations of the same name. It is possible that a certain part of the Ci sub volcanic formations are actually Permian.

Although the age of the described complexes is older (Ci) than the age of silver-gold mineralization, they significantly influenced the placement of mineralization. By the period of the Permian tectonic-magmatic activation, the marked complexes, as tectonically prepared, served as favorable channels for the penetration of ore-bearing solutions and a favorable environment for ore localization, especially extrusive, near-vent and vent factes of rocks, often geochemically specialized for gold and silver [4, 5].

A significant part of the sub volcanic formations is controlled by caldera-type ring structures, within which these formations, paired with the same ring structures, but on a smaller scale, form volcanic-domed strata.

The formation of sub intrusive formations, which were of great importance for the quartz-arsenic-gold ore formation, is stretched over time (from C_2 to P_2-T). They are located mainly in the Hisser zone and the zone of the South Hisser deep fault. The P_2 dyke complexes have been widely developed. A number of manifestations of quartz-arsenic-gold ore formations are spatially and, apparently, Para genetically related to sub intrusive and dyke complexes. The role of the described complexes was manifested, in our opinion, in two ways: during their formation, under their thermodynamic influence, there was a redistribution and concentration of gold, silver, and other elements from copper-pyrite deposits, volcanogenic formations C_1, in the other - an additional amount of ore matter from other deep sources is allowed. At the same time, the ore substance migrated to the sites of development of favorable positions and during localization used previously created volcano-dome c structures C_1, younger C_3, P intrusive-domed structures, zones of gentle thrusts, nodes of intersection of various violations, etc. Of particular interest are the areas of manifestation (transformation) of multi-age complexes and, accordingly, polygenic multiformational mineralization. Less eroded sub intrusive bodies (the level of volcanogenic strata C_1) are most favorable for mineralization.

The thrust zones are accompanied by volcano-dome structures C_1, intrusive dome structures D, sub volcanic bodies of quartz and rhyolite porphyries C_1, dike complex P-T. The thrusts are intersected by zones of increased permeability of various directions, accompanied by geochemical halos of Au, Ag, As, shlich halos of gold, arsenopyrite, chalcopyrite, scheelite, antimonite, cinnabar, bismuthin, galena, magnetite and barite. A number of manifestations with silver-gold, quartz- arsenic-gold and copper-pyrite mineralization are confined to the hanging side of the thrusts, within the Karatag formation - along with this, a wide range of ore minerals traced along the thrust of the thrusts indicates a large-scale manifestation of the ore process. The formation of the silver-gold ore formation within the zone of the Yuzhnogissar deep fault has a complex multi-stage character.

Structural Factors.

a) Linear type

I. Zones of increased permeability of the sub meridional and northeastern strike.

They belong to the system of arc faults of morph megastructures of the central type of aspinospheric and, possibly, mantle deposition, which, due to the planetary scale of their manifestation, are taken for linear-type structures on separate segments. They are probably aspinospheric or mantle deposits, the modem fragmentation (fragmentation with different displacement amplitudes) of which is due to Alpine tectogenesis.

In relation to hypogenic mineralization, they are considered as ore-bearing and ore-distributing structures, in particular for the silver-gold ore formation. The width of these zones varies 0.5-1.5 km, and the length is hundreds and thousands of kilometers.

They are fixed by geophysical fields, geochemical halos, the location of magmatic rods, dikes, etc.

With a detailed study, it is possible that their isolation during the decoding of satellite images, and the zones of «lineaments» allocated according to the latter are suspiciously straight and unreformed by powerful Alpine processes, if their age is considered Paleozoic.

The described zones were significantly renovated during the period of tectonic- magmatic activation and, as an ore-bearing structure, actively participated in the placement of the silver-gold ore formation. As a result of this activation, regeneration processes occur with leaching, redeposition and localization of ore matter from pyrite-polymetallic and copper-pyrite deposits. There was also a certain introduction of noble-metal elements from other deep sources associated with the basement deep foci of the described zones of increased permeability.

They control Permian volcano-dome structures, dike zones, geochemical halos Au, Ag, Bi, Sb, As.

Starting from the Lower Carboniferous, when the volcanogenic Karatag formation was formed during volcanic activity, interplastic copper-pyrite deposits (chalcopyrite, pyrite, barite) were formed within the underlying terrigenous- carbonate-volcanogenic Obizarang formation in the near-water parts of the anticlines with sub dispersed dispersed gold and possibly silver. There are signs of geochemical specialization of the lower volcanogenic-shale part of the formation, where copper-pyrite deposits for copper and gold are concentrated. The upper carbonate part of the suite served as a screening barrier about m. With the formation of the Tankhazin complex of plagiogranites and C_{1-2} gabbroids, scarn deposits with scheelite, as well as scarnoid horizons with scheelite and sulfides appeared on contact with the Obizarang formation at the sites of interlayer of shales and limestones. Interplastic quartz lenses were formed, the processes of migration of gold from copper-pyrite deposits were carried out.

The processes of the Middle and Upper Paleozoic variation led to the formation of a system of sublatitudinal thrusts with a gentle overhang. According to this system of thrusts, the volcanogenic strata of the Karatag formation were moved to the volcanogenic-shale strata of the Obizarang formation, with interplastic copper-pyrite deposits enclosed in them. With these processes, interplastic quartz lenses are breccated, crushing zones and cleavage cracks are formed. The processes of migration and concentration of gold and silver in the marked deposits continue. The formation of the Shatrut complex of granitoids P**1** is associated with the formation of quartz-arsenic-gold ore formation (Au, Bi, Pb, Zn, Sb) and berezites, especially in thrust positions, at the level of the Obizarang formation (lower Oymanak). Telescoping of different age types of mineralization occurs: copper-pyrite, pyrite- polymetallic with quartz-arsenic-gold ore (Choirly) at the nodes of the intersection of thrust zones with faults of other directions. Source of ore material.

II. Nodes of intersection of zones of increased permeability (ZIP) with other structures (and among themselves).

They belong to the category of ore-neutralizing. The nodes located within and outside the Vakhshibar suite Civh are highlighted. The first ones are the most promising for localization of the silver-gold ore formation, since the marked formation itself is highly informative for this formation due to a number of signs (geochemical specialization, increased fracturing, favorable level of erosion cut). Spatially, they are closely related to other factors and features: volcano-dome structures C_1, P_1, dike zones P_1, P_2-T_1 geochemical halos Au, Ag, Bi, Sb, As ore occurrences.

In predictive constructions, this factor, especially if they are located within the Vakhshivar formation, was given great importance.

The thrust zone of about 30 km can be traced in the zone of the Yuzhnogissar deep fault. The zone is a system of scaly thrusts with a gentle fall (30-60°) on the CB.

According to this system, the bottoms of the deposits of the Karatag formation C_1kg (rhyolites, andesites, basalts, tuffs, jaspers, flints and limestones) are pushed over the rocks of the Obizarang formation O_1-S_1, in another case, the above- mentioned deposits of the Karatag formation (bottoms) from the South are pushed over the tops of the same formation (rhyolites, rhyolite-dacites). In addition to the sublatitudinal thrust zones, there are violations of the NW and SV directions, which are often of a discharge nature and accompanied by powerful zones of epigenetic transformations [7].

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The formation of the Shatura complex of granitoids Pi is associated with the formation of quartz-arsenic-gold ore formation (Au, Bi, Pb, Zn, Cu) and berezites, especially in thrust positions, at the level of the Obizarang formation (lower Oymanak). Telescoping of different age types of mineralization occurs: copper- pyrite, pyrite-polymetallic with quartz-arsenic-gold ore (Choirly) at the nodes of the intersection of thrust zones with faults of other directions. The source of the ore substance, in particular gold and silver, could be deposits of the marked pyrite ores and volcanogenic formations of medium and acid composition containing them.

The silver-gold ore formation, propylites, and berezites are spatially connected with the subvolcanic bodies of rhyolite porphyries P-Ti developed in thrust positions and areas of the placement of copper-pyrite deposits, usually confined to the nodes of the intersection of thrust zones with transform faults of the NE strike, as well as the submeridional. The main silver-gold mineralization is concentrated mainly in the areas of development of copper-pyrite and pyrite-polymetallic ores (Dondokchakan, Choirly). At the same time, accumulations of gold and silver, close to industrial, often do not depend on the intensity of the manifestation of chalcopyrite-bornite ores. Gold-silver mineralization is accompanied by increased contents of Bi, Mo, Nd, Sb. The spatial relationship of the copper-pyrite deposits and the later silver- gold mineralization indicates that a certain part of the gold and silver was borrowed from these deposits, the other part was introduced during the formation of sub volcanic formations of the R-T and localized at the junctions of the transform faults of the SV strike with thrust. Relatively independent silver-gold ore manifestations in connection with the noted subvolcanic bodies R-T and SV transform faults are located below, in the volcanogenic Karatag formation (upper Oymanak).

Elevated gold and silver contents are associated with abnormal contents of Au, Bi, Mo, Hg, Te and are usually associated with streaks of grayish-white and bluish- gray quartz that secrete interplastic quartz lenses. Relatively rich ores are formed by spatial combination of formations of different ages (copper-pyrite-quartz-arsenic- gold-silver-gold). In the samples-protolochki, selected from various parts of copper-pyrite deposits, are everywhere noted in units. signs of gold pieces of 0.1-0.3 mm in size, having horn-shaped, lamellar, dendritic shapes associated with fragments of quartz and calcite.

Relics of caldera-type ring structures. Formed as a result of the Middle and Upper Paleozoic volcanic activity. These are the areas of accumulation of powerful volcanogenic-sedimentary and volcanogenic strata of the Vakhshibar C**1**vh, Siomin C**1**sm, Karatag Cikg, Kayrak R1kg, Luchob R1c formations (the last two formations are largely eroded), resulting in the formation of caldera-type depression formations limited by ring structures. The latter were established during the decoding of satellite

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images and in the process of morphostructural analysis. Having a Pz age, they "shine through" the Mz-Kz case and are installed by the marked methods. On these areas, products of coal and Permian volcanic activity, as well as pyrite-polymetallic and silver-gold mineralization may be placed under the Mz-Kz cover. The level of erosion of these structures is determined by the degree of preservation of sedimentary and cover volcanogenic rocks C**1** and their root parts. In the modern re

In the areas of development of copper-pyrite deposits (Dondonchakan, Vertical, etc.), together with gold, small fragments of cinnabar, fluorite, antimonite are often noted - indirect signs of the presence of a young ore formation with finely dispersed, bound gold of the "Karlin" type. This type of mineralization can be localized in the nodes of the intersection of the thrust zone with the transform faults of the NE strike, in the carbonaceous-clay shales of the Obizarang formation, under the shielding influence of volcanites of the Karatag formation.

b) Central type

Ring structures that limit Alpine megaswaters inheriting fragments of older faults on their individual segments often control the placement of noble-metal formations, a number of mineragenic factors and search signs, especially at the intersection points [9, 10].

The described structures are well deciphered on satellite images and confirmed by morphostructural analysis. The informativeness of this factor increases if it is manifested within the Vakhshivar Civh, Siomin Cism or Karatag Cikg suite.

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Structures laid in the Paleozoic foundation, in the case of their burial, «shine through» through Meso-Cenozoic deposits and are diagnosed by the same signs. They are spatially and often genetically closely related to nodes of intersection of zones of increased permeability, with caldera-type structures, with halos of concentration of volcanogenic formations C_1 and their root facies, geochemical halos Au, Ag, Sb, As, hydrothermally altered rocks, sulfidization sites. The formation of silver-gold mineralization, closely related to the Lower Carboniferous and Permian-Triassic volcanic activity. Thus, regeneration processes played an important role in the formation of the silver-gold ore formation along with the introduction of precious metals from possible deep sources. Ore deposition processes developed most actively near volcano-dome structures (P-T age) tectonically prepared and ore-bearing. Similar structures of Ci age - tectonically prepared, are favorable for the localization of mineralization, in case of manifestation of tectonic-magmatic processes of P-T age in them in the form of dyke complexes. The safety of the silver-gold ore formation depends on the level of the erosion section of the volcano-dome structures. The optimal level of erosion cut for mineralization is the spatial combination of the cut of these structures (P-T age) with the middle and upper stratigraphic levels of the Vakhshibar formation (large-block tuffs of liparite porphyry). The section of these structures (P-T age) below the level of the marked formation is less favorable for the silver-gold formation.

The described structures formed as a result of Lower carboniferous volcanic activity are accompanied by the formation of pyrite-polymetallic and copper-pyrite deposits, and were a favorable prerequisite (structurally prepared environment) for the formation of Upper Paleozoic volcanogenic complexes and silver-gold mineralization within its limits [13].

Caldera-type structures can be considered epicenters (reflections) of magma-ore-bearing foci that gradually arise at a certain depth. Since the silver-gold ore formation is spatially closely related to the upper stratigraphic levels of the Ci volcanogenic-sedimentary formations located within the described structures, the degree of erosion of the noted formations is of great importance for mineralization.

Considering that caldera-type structures control the areas of ore nodes, they occupy one of the leading places in terms of them in formativeness.

Volcano-dome structures (millstone type).

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Volcano-dome structures (vent type). They have a diameter of 0.1-1.0 km and often form isolated dome elevations within caldera-type structures. Their formation is associated with the formation of sub volcanic, sub extrusive formations of Ci or P-T age. When these formations are combined spatially, polygenic volcano-dome structures are formed. The described structures are often controlled by nodes of intersection of zones of increased permeability and are located both within the areas of development of volcanogenic-sedimentary and volcanogenic formations Ci and P-T (vakhshibarskaya, karatagskaya, kairakskaya) and outside them.

The decommissioned structures are sometimes deciphered on satellite images (especially mineralization), but most of them were revealed during morphostructural analysis (decryption of the or hydrographic network).

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The main signs in this case are cases of turbulence of tallwegs of high orders and their tributaries or their oval concentric arrangement. The spatial combination established by morph structural analysis of ring structures with sub volcanic and sub extrusive rods allows them to be classified as volcano-dome structures with the determination of their genetic, morphological and age features.

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The formation of silver-gold mineralization, closely related to the Lower Carboniferous and Permian-Triassic volcanic activity.

Thus, regeneration processes played an important role in the formation of the silver-gold ore formation along with the introduction of precious metals from possible deep sources. The most active processes of ore deposition developed near volcano-dome structures (P-T age) tectonically prepared and ore-bearing. Similar structures of Ci age - tectonically prepared, are favorable for the localization of mineralization, in case of manifestation of tectonic-magmatic processes of P-T age in them in the form of dyke complexes. The safety of the silver-gold ore formation depends on the level of the erosion section of the volcano-dome structures. The optimal level of erosion cut for mineralization is the spatial combination of the cut of these structures (P-T age) with the middle and upper stratigraphic levels of the Vakhshibar formation (large-block tuffs of liparite porphyry). The section of these structures (P-T age) below the level of the marked formation is less favorable for the silver-gold formation.

Volcanic vents and extrusive domes of the Ci and P-T age are located on the development areas of cover volcanogenic deposits of the same age. In contrast to sub volcanic facies, the described formations are characterized by a much smaller erosive section and can be used in the search for hidden mineralization.

Vents and domes of C**1** age were installed in the Khandizinsky, Kuldarinsky, Chakcharsky ore fields, in the north of Baksuntau, in the south of Surkhantau, in the Chopukh-Dondongakan strip. Some of them may be of Permo-Triassic age. The dimensions of the structures range from 0.5-1 km. Their structure involves vent and near-ore facies transformed into whitewashed quartz-sericite rocks on a modern erosive section. The described structures, as a rule, tend to the development areas of the Akhshivar formation Civh. They have been installed and contoured during geological survey and prospecting works, it is possible to identify them during morph structural analysis within the Paleozoic basement. Spatially, they are closely related to other factors and features: caldera structures, areas of volcanogenicsedimentary and volcanogenic formations C**1**, they tend to zones of increased permeability of various directions. In the vertical radial column of the volcano- plutonic complex (intrusive-sub intrusive - sub volcano-sub extrusive-vent), these structures occupy an extremely upper position, where the role of the screening factor is minimal. Therefore, the accumulation of large concentrations of mineralization in connection with these structures is unlikely. These concentrations can be concentrated deeper, where sub volcanic facies of rocks exposed to P-T tectonic- magmatic activation are manifested. The described structures are accompanied by poorly informative halos of Au, Ag, Bi, Sb, As, Pb, Zn, Cu and extensive halos of hydrothermally altered rocks.

Vents and domes of R-T age are relatively less developed and reliably established in the south of Surkhantau. They are also composed of vent and nearvent facies. Sometimes the explosion tubes of P-T age are confined to the marginal parts of the rods of liparite porphyries Ci. Subextruded bodies accompany the vent structures and occupy relatively large areas in the south of Surkhantau. The described structures have been contoured and studied during geological survey and prospecting work. They are closely related to other factors and features: volcano- dome structures Ci, areas of Vakhshivar Ci and Kairak Pi formations, zones of «lineaments» and nodes of their intersection, hydrothermaby altered zones, geochemical halos Au, Ag, As.

The described structures are characterized by the development in the apical parts of pyrophyllite rocks and the like with a specific olive-yellow color. Two of the most famous «pyrophyllite» stocks are located in the northern Baysuntau (rudopr. Aksu) and the Anjur sayas, which are extreme to the east (Voirs- Kuldarinskaya Square). It is noteworthy that both rods are only opened by erosion from under the Mz-Kz cover. According to the Aksu stock of rhyolite porphyries involved in the structure of the western part of the anticline of the same name, the following facies of altered rocks (from the center and periphery) develop in the apical part: sericite (quartz+sericite+pyrite), pyrophyllite (quartz+pyrophyllite+hematite), alunite (quartz+alunite+hemagite), dickite (quartz+dickite+hematite), monoquartz (quartz+hematite). The apparent thickness of pyrophyllite volcanites is 200-250 m.

The central sericite-quartz-pyrite zone associated with breccia lavas of the last pulses of dome formation carries silver-gold mineralization. In addition to pyrite, arsenopyrite is present, less often chalcopyrite. The Apzhursky «pyrophyllite» stock is eroded much weaker and is represented by oreless facies of metasomatites. The «blind» mineralization is apparently located at a depth of 200-250 m.

The information content of the described structures of P-T age is of primary importance, C_1 age is of secondary importance. B. Modeled factors I. Geodynamic Transform faults of the SV strike were established during geodynamic studies and are often accompanied by zones of increased permeability identified by morphostructural analysis. They are of great importance for the young silver- gold ore formation. As ore-distributing and ore-supplying, and at the intersection with other structures - ore-localizing structure. The described faults are spatially closely related to other factors and search signs. In areas of intersection with other structures, volcano-domed, sub intrusive-domed structures of P-T age, known and predicted ore fields with telescoped noble-metal mineralization, are often monitored. The ore- controlling role is especially clearly manifested in the Hisser zone, in the areas of intersection of transform faults with the zones of nadvigo the work-controlling role is particularly clearly manifested in the Hisser zone, in the areas of intersection of transform faults with thrust zones (the Dondonchakan and Biobe bands). In the Baysun zone, this role is less pronounced, and volcanic-tectonic structures (caldera and vent type) are of paramount importance here.

The first stage of the formation of silver-gold mineralization occurred in P_1 time and is associated with ore-bearing structures of the sub meridional direction (zone of increased permeability) and sub volcanic and dike formations of the mentioned age. The noted structures and volcanogenic formations for the localization of mineralization used previously created structures of the volcano-dome and caldera type. Under the influence of Permian volcanic-plutonic formations, the redistribution of noble elements from lower carbon pyrite-polymetallic and copper- pyrite deposits was carried out.

C by the first Pi stage, where the main ore-bearing and ore-distributing role belongs to the zones of increased permeability of the sub meridional strike, industrial concentrations of silver-gold ore formation should be expected only in the areas of development of pyrite-polymetallic and copper-pyrite deposits (potential sources of Au and Ag). The same stage, manifested in all the marked areas, will be represented by small-scale manifestations.

The second stage of the formation of the silver-gold ore formation falls on the P_2-T time and is associated with ore-bearing, ore-distributing transform faults of the SV strike. He was the most powerful and productive. Under the influence of this stage, the further redistribution of Au and Ag from pyrite-polymetallic and copper- pyrite deposits continued and the formation of possibly industrial silver-gold mineralization in other geological and structural positions, outside the areas of development of the mentioned pyrite deposits. Divergent boundaries of the spreading zone.

Manifested in the Hisser zone. The peripheral parts of this zone, where rift-like mineragenic factors and search signs are concentrated, are considered promising, and volcanogenic-terrigenous Vakhshibar Civh, Siomin Cism and Karatag Cikr formations favorable for silver-gold and quartz-arsenic-gold formations are traced along the strike. Well-known ore fields with copper-pyrite, pyrite-polymetallic and noble-metal mineralization are confined to these parts of the zone. The formation and mineralogical features of geological formations located in the spreading zone indicate the active participation of mantle matter along with the crust (Hisser zone). In the neighboring Baisun zone, remote from the spreading zone, there are "echoes" of the mantle impact.

The zones of increased permeability of the northwestern and sub latitudinal strike as ore-bearing and ore-distributing structures, especially at the intersection nodes, control the placement of caldera-type structures, volcanic-dome and sub intrusive-dome structures of C_1, P_{1-2} age and, associated with them, the manifestations of the quartz-maniac-gold ore formation. Ore-bearing solutions circulating through these zones from focal deep foci, in addition to the introduction of ore matter, participated in the redistribution and localization of gold, silver, and other elements from copper-pyrite deposits, creating polygenic telescoped mineralization. Thrust zones. The main part of the manifestations of the quartz-arsenic-gold ore formation and the volcanogenic strata of the Karatag formation C_1 containing them are clearly controlled by the thrust zones.

Structures of the central type are ring structures bounding Alpine megaswaters and their role in the placement of noble metal formations [9]. The relicts of caldera- type ring structures are characterized by a multi-stage character of development and, accordingly, control different-aged volcanic-domed, intrusive-domed structures and multiformational noble-metal mineralization.

Intrusive dome structures have different ages - D, C_{2-3}, C_3, P_2 -T.

Structures of Devonian age were developed in the Baysun zone and, partially, in the zone of the South Hisser deep fault. They are located among Precambrian metamorphic strata and are controlled by ring structures established by morphostructural analysis. Structures of C_{2-3}, C_3 age were developed in the Hisser zone and the zone of the South Hisser deep fault, i.e. in the areas of development of sub-intrusives of similar age. Spatially, they are associated with caldera-type structures, zones of increased permeability of various directions and ring structures.

The often noted close spatial relationship of the above-described structures with the manifestations of the quartz-arsenic-gold ore formation, geochemical and shlich halos of gold, the dike complex of P_1, P_2-T age allows us to consider these structures, if they are renewed by the processes of Permian tectonic-magmatic activation, favorable for the localization of the aforementioned ore formation.

12 12 Structures of P_2-T age were noted in the zone of the South Hisser deep fault and are spatially associated with the same-age sub-intrusives. The accompanying features of these structures - geochemical halos of gold, arsenic, etc., gold dressing halos, hydrothermally altered rocks, etc. - indicate the connection with them of noble metal mineralization, including quartz-arsenic-gold ore. This connection may be paragenetic, in which certain deep sources generated ore matter with its subsequent localization in favorable dome structures.

Mineralogical and geochemical factors. halos Au, Ag, Bi, Sb, As, accompany the silver-gold ore formation. The possible presence of a silver-gold ore formation is indicated by complex halos (in various combinations) of Ag +Sb+As; Au+Ad; Au+Ad+As; Au; Ag; As+Au+Sb; Ag+Au+As; Sb+Ad; As+Ad+Sb; Ag+Au+Sb; Sb+Ag+As+Au; As+Sb+Ag+As+Sb; Sb+Au+Ag; Au+Ag+As+Sb. On mineragenic maps, the counted halos have a single conventional sign. They have a close spatial relationship with the minerogenic factors of the silver-gold ore formation and in combination with the latter can be used as an important search feature, reflecting the material composition of the desired mineralization in the first approximation.

Gold ore halos are widely distributed in known and predicted ore areas. They are used in predicting noble metal formations. They are spatially closely related to mineragenic factors and search signs of the predicted ore formations. Reflecting the material composition of the predicted ores, the described

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halos are used as an important search feature when outlining forecast sites [11, 12].

Visible sulfide mineralization in the form of extended zones and oval sections accompany ore manifestations. By composition - pyrite zones are more common, sometimes with an admixture of arsenopyrite, chalcopyrite, pyrrhotite. Zones or areas with pyrite-polymetallic and copper-pyrite mineralization (galena, sphalerite, pyrite, chalcopyrite, etc.) are of interest. These may be pyrite deposits or zones with scattered sulfide mineralization. Spatially, telescoped noble-metal mineralization can be associated with them.

The graphic materials (map of geochemical halos) depict mainly complex additive halos, where the elements (from left to right) are arranged as their significance (contents) decreases, by which one can judge the degree of erosion. For example, relatively high arsenic contents indicate a relatively weak erosive section of the ore site. the possible presence of the described formation is evidenced by complex halos in various combinations: As+Au; Au+As; As+Au+Ag; Au+As+Ag.

On mineragenic maps, the listed halos have a single conventional sign. They have a close connection with the minerogenic factors of the described formation and, in combination with the latter, can be used as an important search feature, reflecting the material composition of the desired mineralization in the first approximation [13]. Dressing halos of gold as well as silver-gold ore accompany the described formation.

Visible sulfide mineralization. Taking into account the wide development of sulfides in the described formation, the given feature is expediently used in the search and prediction of mineralization. In conclusion, we note that the process of forming the noble-metal formations of the Hissar region had a complex multi-stage character.

The initial stage coincides with the time of formation of the C1 volcanogenic complexes (Vakhshibar, Siominskaya and Karatag formations) and associated pyrite-polymetallic and copper-pyrite deposits with dispersed dispersed gold and silver. With the complex formation of these complexes, favorable structures were laid for the subsequent localization of noble metal mineralization in them. The petrological-geochemical composition of volcanogenic formations predetermined the ore-formation features of hypergenic mineralization.//In the Baysun zone, the formation of the Vakhshivar volcanogenic complex (rhyolite formation) is associated with the formation of pyrite-polymetallic deposits with a telescoped, superimposed silver-gold ore formation, passing from a depth (below the Vakhshivar stratigraphic level) into quartz-gold ore. In the zone

The formation of the Karatag volcanogenic complex (basalt-andesite formation) was accompanied by the formation of mainly copper-pyrite deposits with a telescoped quartz-arsenic-gold ore formation in the South-Gissar deep fault and the Gissar zone.

The next stage coincides with the time of the manifestation of tectonic- magmatic activation in C_3-P_1, P_2-T and the formation of the above-mentioned noble- metal mineralization due to two sources - pyrite deposits with primary dispersed gold and silver, deep ore-magmatogenic foci. The repeated manifestation of the mentioned activation was accompanied by the corresponding migration of noble metal elements from the mentioned deposits and foci. The areas where repeated polygenic mineralization has manifested itself are of the greatest interest.

Conclusion.

Thus, in the territory of Southern Uzbekistan, the following minerals are allocated:

- colored: - copper, lead, zinc, aluminum;
- noble: - gold, silver, platinum group metals;

- rare metals and rare earths - tungsten, tin, molybdenum, cerium, ytterbium, yttrium, tantalum, niobium, lithium, beryllium, caesium, rubidium;
- non-metallic: - barite, celestine, fluorite, native sulfur, rock and potash salts, coal, oil shales, agricultural ores.

The main noble-metal formations have been established: silver-gold ore, with a depth possibly turning into quartz-gold ore, and quartz-arsenic-gold ore. Possible sources of ore matter (gold and silver) include: pyrite-polymetallic and copper-pyrite deposits with scattered silver and gold, C_1 volcanogenic formations with an increased geochemical background of the noted elements, deep pockets of P-T activation. The scale of the predicted mineralization is extremely limited laterally and may increase

The scale of the predicted mineralization is extremely limited laterally and may increase vertically. This feature requires the formulation of detailed in-depth searches in relatively limited areas. The most promising areas with a silver-gold ore formation are concentrated in the contact zones of carbonate horizons with the underlying volcanogenic formations, especially the intersection of these zones with transform faults of the NE or the submeridional strike. The intersections belong to important ore-localizing structures.

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