JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 5, ISSUE 05
MONTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

ENDOGENOUS MINERALIZATION OF THE CENTRAL BUKANTAU AREA (USING THE EXAMPLE OF THE KYZYLKUM REGION)

Kh.Boboyorov
A.Samiev
T.Sakhibov
M.Alimov
National University of Uzbekistan named after
Mirzo Ulugbek Department of
Geology 4-University Str., 100174, Tashkent. Uzbekistan.
https://doi.org/10.5281/zenodo.20325639

Abstract. The article investigates the mineral composition of the oxidized ores developed in the Kaskirtov, Boztov and Zhelsay promising fields in the north-western part of the Central Bukantov, as well as their formation characteristics and productive mineral associations are determined. According to the obtained results, the main ore minerals consist of iron hydroxide (goethite, hydrogethite), jarosite, scorodite, and pure gold, which are located in the limonited parts of shale and metasiltstones, which are the host rocks. It was found that the oxidized ores were formed under the influence of hypergenic solutions and formed mineral associations with gold-jarosite-hydrolyte in the lower part of the oxidation zone, and gold-hydrogoethite-kaolinite in the upper part.

Keywords: Endogenous mineralization, prospective area, Bukantau, deposits, area, host rocks, gold mineralization zone

I. INTRODUCTION

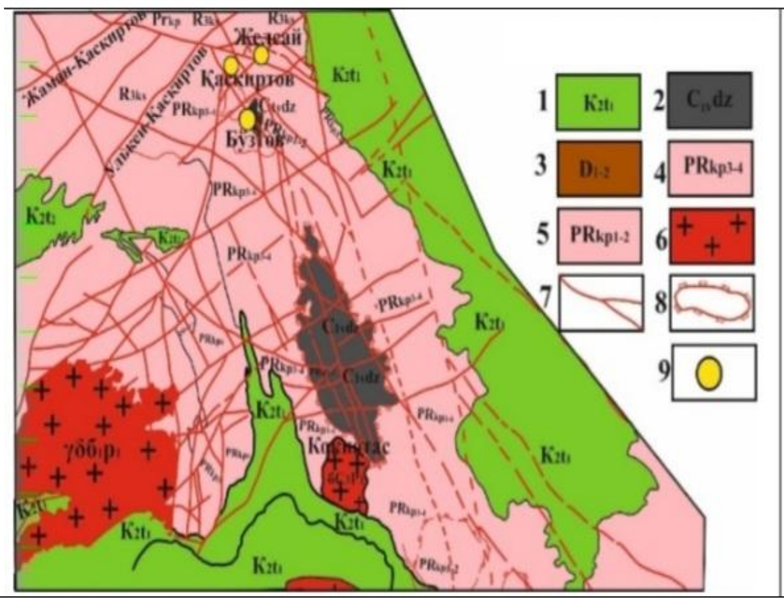
Oxidized ores in gold ore deposits are considered important raw materials for the mining and metallurgical industry, because weathering processes lead to their partial enrichment, an increase in the amount of valuable metals and, most importantly, a change in the form of the main useful components in the ores. Due to the fact that oxidized ores do not require complex technological processes of processing, the cost of extraction of the final product (gold) decreases, so low grades of oxidized ores are also of great practical importance [1-3]. Oxidation zones of gold deposits are of fundamental interest from the point of view of exogenous mineralogy-geochemistry and metallogeny of gold, in addition to their economic importance. Today, there is a lot of information about the migration of gold in the form of various compounds in supergene (hypergene) conditions [3, 4]. Due to the confusion of considerations regarding the distribution of hypergene gold, it is emphasized that it is necessary to consider the mobility of gold in connection with weathering of host rocks and sulphide alteration processes in exogenous conditions. Oxidized ores formed as a result of exogenous processes can be observed in many gold mines and prospective fields in Uzbekistan.

As a result of the comparison of the characteristics of the distribution of the main elements in the primary endogenous mineralization zones and the oxidized ores developing along them, the natural enrichment of ores in exogenous processes was determined, that is, the concentration level of gold in oxidized ores has the highest index compared to other elements, and this is related to its geochemical properties - sulfides decompose in exogenous processes. it was noted that when exchanging places with secondary minerals, the dispersed gold contained in them was separated

JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
VOLUME 5, ISSUE 05
MONTHLY JOURNALS
ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

and collected in a pure state [5-9]. Oxidation zones of gold mines, which have been the object of mining since ancient times, have not lost their importance even now. The reason for this is that in recent years, significant reserves of gold in oxidized ores have been discovered in various foreign countries, as well as in the mining areas of Western Uzbekistan. Among them, Kokpatas, Daugiztov, Amantaitov mines and Kaskirtov, Jelsoy, Buztov prospective fields belong to this type [10].

In the geological structure of the region, the Proterozoic deposits of the bluestone suite are widely distributed, and the lithological composition is divided into four distinct groups. They occupy 60% of the area and are described as Proterozoic Kokpatas suite: I-pachka volcanogenic-terrigenous rocks (*PR kr*1); Class II quartz-chlorite-sericite, quartz-sericite shales (*PR кр2*): Class III carbonate-siliceous shales (*PRkp3*); Unit IV consists of siliceous-terrigenous *(PR kr4) rocks (Fig.1)*



1- Clays, conglomerates;
2-3 - Limestone, dolomites;
4 - Siliceous shales;
5 - Volcanogenic-terrigenous rocks;
6 - Granitoids;
7- Earth cracks;
8 - Transfer;
9 - Research areas.

Fig 1. Geological map of central Bukantov (north-western part).

According to the deposits of the Kokpatas Formation, the rocks of the Kokzoi Formation (R3ks) consisting of siltstone-shales of Lower Riphean-Vendian age are formed in the wings of folded structures. Moreover, deposits of the Juzguduk suite (Civdz), consisting of carbonate rocks of Paleozoic age, limestone, dolomite, and dolomitized limestone, and the Laygak suite (C2g), consisting of Carboniferous siliceous shales and fragmentary rocks of the Upper Carboniferous age, were identified.

Carbonate rocks form openings in the central parts of the Boztov uplift, and in the remaining places they are overlain by Meso-Cenozoic terrigenous formations (Pyatkov et al., 1989). In the southeastern part of the region (Ko'kpatas mining area), intrusive features are widespread, formed during the Hertzian tectonomagmatic cycle and are divided into several groups according to their age [10 -15]:

- a group of intrusions formed before regional metamorphism;
- a group of genetically related granitoid and dyke formations;
- a group of dykes with medium and sub-business composition.

The first group includes intrusive rocks that have undergone regional metamorphism and shale formation together with layers of overlying basic, basic and ultra-sour composition.

The group of genetically related intrusions - granitoids and dykes consists of the blue granitoid massif and its vascular features - adamellite, biotite pegmatoid, granite stocks and dykes

JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 5, ISSUE 05
MONTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

Separation of oxidized ores samples mineral description of products						
Host rocks description	Sample of weight (*grams*)				Mineral Composition	
	Initial amount	Heavy fractions	Light fractions	Decay of the heavy fractions	Heavy fractions	Light fractior
Fertilized, quantized rocks	200	0,4-1,40	136-160	0,1-0,63	on hydroxide (80-95%), pure gold – separate	ost rock flal (75-85%) quartz (5 40%), carbonate

Mineral content of oxidized ores based on electronic microprobe analysis data

№	№ sample	Mineral	Amount of elements, %									
			SiO2	*TiO2*	*V2O5*	*K2O*	*MnO*	*FeO*	*CuO*	*AS2*	*SO3*	1
2	К-55	Гетит	2,30	0,06	0,07		0,24	83,20	0,01	0,38	0,34	86
3	К-62		2,15	0,05	0,06	0,05	0,27	83,62	0,03	0,34	0,39	86,9
4	К-62б		2,45	0,04	0,05		0,26	82,80	0,01	0,36	0,36	86,3
5	К-62	Г идрогетит	3,18	0,06	0,36	0,05	0,01	69,60	0,60	0,60	1,30	75,7
6	К-62г		3,36	0,04	0,54	0,03	0,03	70,04	0,26	0,55	3,50	78,3

According to the data of electronic microprobe analysis and the sizes and composition of pure gold in oxidized ores in the tadz area.

T.p	Sample number	Size (мкм)	Amount of components (%)				
			Au	*Aд*	*Fe*	*Cu*	*1*
1	ПК-3-1	5	92,08	7,46	0,24	0,1	99,88
2	ПК-3-2а	6	86,12	12,4	1,22	0,06	99,80
3	ПК-3-1-в	8	74,42	25,16	0,34	0,02	99,94
4	ПК-3-3	6	74,56	25,05	0,22	0,12	99,95
5	ПК-3-6	5	68,3	31,4	0,12	0,14	99,96
6	ПК-3-2в	6	64,23	35,2	0,38	0,06	99,97

of sour composition (granite-porphyry, aplite). The complex of dykes of medium and subshish composition consists of diorite, diorite-porphyrite, syenite-diorite, quartz diorite-porphyrite, lamprophyre (chersanthite, spessartite) dykes. A number of folded and discontinuous structural elements are distinguished in the tectonic structure of the mining area. The main folded structures are the Kokpatas-Buztov anticline and the Kokpatas Okjetpes graben-syncline. The Kokpatas-Buztov anticline stretches from the north along the north-west direction, its length is 45 km, and the width of its wings reaches 10-15 km. Kokpatas-Okjetpes is a complex structure consisting of a two-way thrust graben-syncline, the flanks of which are composed of ancient deposits. Discontinuous structures are divided into regional earth faults and small-sized fault systems according to the scale of their appearance, and they are developed in a state corresponding to the direction of folded structures. One of the major faults in the region is the blue deep fault, which is embedded in the eastern flank of the fault. This fault formed a large tectonic zone and extended to the western flank of the anticline.

JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
VOLUME 5, ISSUE 05
MONTHLY JOURNALS
ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

II.METHODS AND MATERIALS

Since the minerals in the oxidized gold deposits in the research areas are microminerals according to their morphological form, they were studied using the separation method and microprobe analysis (Superprobe JXA-8800R, Jeol, Japan). Oxidized type ore mineralization developed in the zones of tuffed rocks with iron hydroxides formed at a depth of 10-15 m to 30-40 m in the Kaskirtov and Buztov fields, and up to 30-60 m in the Jhelsay field (Fig. 2-a, b).

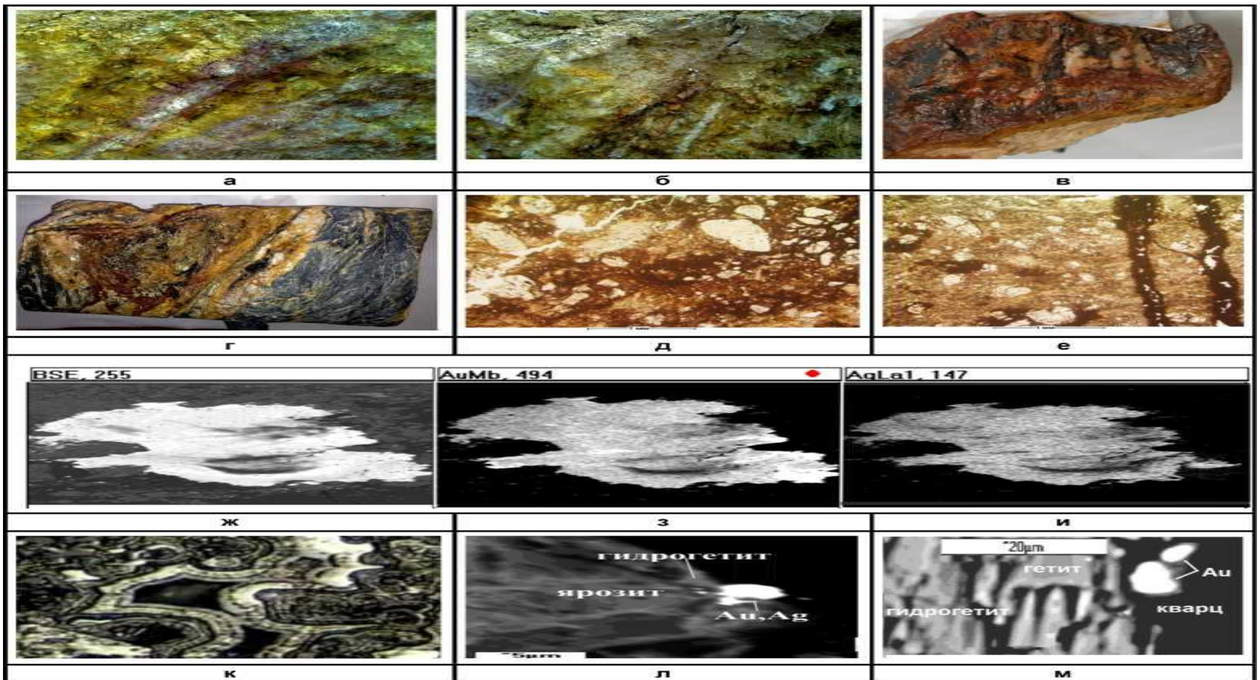
The mineralized zones, which were made by means of mountain loams on the surface of the earth, are mainly composed of brecciated, weathered, limonitized shales and metalaleurolites (Table 1), and formed quartz veins with a thickness of 8-10 cm (Fig. 2 v, g). The main part of the oxidized type ore bodies was formed as a result of alpine tectogenesis, developed in the zones of almost parallel vertical (slightly inclined to the north) and relatively younger undulating earth faults in the sublatitude direction.

In the Zhelsoy and Boztov fields, the convex side of the tectonic waves is directed to the north, and Kaskirtov - to the south, and these structures are of great importance in the location of ore bodies.

When the oxidized ores were crushed using the separation method, the heavy fractions showed distinct signs of iron hydroxide (60-70%) and gold. Individual particles of partially oxidized pyrite can be seen in the samples taken from the lower part of the oxidized zone. Light fractions include host rocks (75-85%), quartz (5-40%), carbonates (0-10%), gypsum (0-1%). The presence of gypsum in the samples is associated with hypergenic processes.

The ore minerals goitite and hydrogyotite are widely distributed in oxidation zones. The primary aggregates of these minerals fill the Porosity of Primary Sulfides. Iron hydroxides have developed in cracks formed in quartz veins, and they have formed intersections up to 1 mm thick, 3-5 mm veins, and vein-like separations. In oxidation zones, the amount of iron hydroxide is 2-8%, in some samples up to 20%.

The amount of these minerals in heavy fractions reaches 70-90%. Sandstone-shale rocks in these zones are composed of limonite and rock-forming minerals preserved from primary formations, which make up 35-40% of the total mass. Limonite is formed from a mixture of iron hydroxide and mainly consists of goitite, hydrogyotite minerals (Fig. 2, g).



hydrogoethite association in oxidized ores (microprobe image - scanning electron

microscopy)

The main ore minerals of oxidized ores consist of iron hydroxide (gyotite, hydrogyotite), jarosite, scorodite and pure gold. They are found in the form of ochres, pseudomorphoses of sulfides, and flow formations accumulated as a result of seepage (Fig. 2, d).

The color is different, especially brownish. Goethite's highest reflective light-gray part is dense, the dark-brown part is dull and usually has a hidden crystal structure. Dull dark-gray hydrogyotite has a fine porous structure. They are earthy, loose, powdery, have developed, variable internal reflexes due to the formation of microcavities as a result of urinary exchange processes: that is, copper-yellow with rusty ocher, brownish-brown in color.

Iron oxides are mainly distributed in chlorite-sericite, shaly rocks, forming fairly flat, small cloud-spotted aggregates. But sometimes psammite grains of clearly cataclased plagioclase accumulate around their visible clusters. Iron oxides sometimes form thin elongated vessels with a thickness of 0.15-0.2 mm.

Oxidized ores consist of gold-jarosite-hydromica (in the lower part of the zone of oxidized minerals) and gold-hydrogoethite-kaolinite associations (in the upper parts of the oxidation zone). The zonal locations of the indicated associations were formed as a result of infiltration of surface waters (hypergenic solutions).

As a result of seepage and dispersion of these solutions, sulfide minerals of primary ores were decomposed and various sulfates (jarosite, scorodite, etc.) were formed. Uta is freed from the composition of fine-dispersed gold sulfides and accumulates in a pure, native form, forming a gold-jarosite-hydromica association.

This association is associated with the formation as a result of the infiltration of surface waters (hypergenic mixtures), which are located on the basis of the zonal cone. Alteration of minerals in sulfide-sulfate-hydroxide and feldspar-hydromica-kaolinite series reflects the characteristics of the evolution of hypergenic mixtures. Most of the amount of pure gold corresponds to oxidized ores, because fine dispersed and microscopic gold sulphides are separated from the composition and form aggregates.

In the Kaskirtov and Boztov fields, their shape is plate-like, unevenly circular, and they contain particles with a size of 5-10 microns. The purity level of gold is 643-921 (table 1), it differs from endogenous gold in the high content of iron (up to 1.22%). In Jelsoy, the pure gold found in goitite and hydrogyotite formed xenomorphic particles with a size of 2-12 μm. The purity of gold is 900: Au~90%, Ag~9%, Fe~0.8%.

In oxidized ores, under the influence of hypergenic conditions that form them, the degree of purity of gold can change sharply in individual particles, and uniform fine grain-like, flake-like gold particles are observed (Fig. 2, j-i). The particle on the right part of the sample consists of very pure gold (purity level 921, PK-3-1), and the gold on the left has a purity level of - 744 (PK-3-1-v). In parts of gold with a low purity level, the amount of iron is higher (0.34%), and copper is lower (0.02%, table 1).

III. RESULTS

Mineral types in the research areas were divided according to the mineral content, location and morphological characteristics of the minerals. These indicators ultimately determine the technology of extracting gold from ores. Oxidized ore types in the upper parts of the indicated areas and primary mineralized zones in the part of the boundary of the oxidation zone allowed to be distinguished.

Oxidized ore mineralization has developed in the limonited and limonitized zones of the rocks at depths of 10-15 m to 30-40 m in the Kaskirtov and Boztov fields, and up to 30-60 m in the Zhelsay field. Their main ore minerals are goethite, hydrogethite, jarosite, scorodite and pure gold.

Most of the amount of pure gold corresponds to oxidized ores, because due to exogenous processes, finely dispersed microscopic gold is separated from the composition of sulphides and combines with each other to form micromineral aggregates. They are developed in the form of plate-like, irregularly circular particles with a size of 5-10 µm.

The greenness level of gold is 643-921, different from endogenous gold, which has a high iron content. Oxidized ores consist of gold-jarosite-hydromica (in the lower part of the zone of oxidized minerals) and gold-hydrogoethite-kaolinite (in the upper part of the oxidation zone) associations. The location of these associations based on the law of zonation is related to the formation of surface waters (hypergenic mixtures) as a result of downward infiltration. Alternating development of sulfide-sulfate-hydroxide and feldspar-hydromica - kaolinite reflects the chemical characteristics of the evolution of hypergenic mixtures.

IV.CONCLUSION

It was found that the mineralization of oxidized type of ore is developed at the depths of 10-15 m to 30-40 m in the Kaskirtov and Boztov fields, and in the Zhelsay field - up to 30-60 m, in the weathered and limonitized zones of the rocks;

Oxidized ores consist of gold-jarosite-hydromica (in the lower part of the zone of oxidized minerals) and gold-hydrogoethite-kaolinite (in the upper part of the oxidation zone) associations. The location of these associations based on the law of zoning is considered to be important because of their formation as a result of downward infiltration of surface waters (hypergenic mixtures).

V.REFERENCES

1. Abduazimova Z.M. Actual directions in the study of the Precambrian of Western Uzbekistan. Principles of developing a stratigraphic scheme. Geology and mineral resources. - 2002. No. 5. S. 3-15.
2. Annenkova T.E., Azhgirey D.G. Mineralogical and geochemical zoning of the Paleozoic ledge of the Auminzatau Mountains // Actual problems of geology and geophysics. - volume 2. - T.: Fan, 2007. -p.3-9.
3. Kalinin A. Yu., Palyanova A. G., Naumov E. A., Kovalev K. R., Pirozhnie F. Hypergenesis of Au remobilization in Au-bearing regolith associated with orogenic deposits: on the example of Kazakhstan // Geol. Geophysics. 2019. C. 358-369.
4. Karabaev M.S. Geochemical features of the gold-rare metal and gold-silver mineralization of Bukantau and Auminzatau, their predictive value. Mountain Bulletin of Uzbekistan. - Navoi, 2017, No. 2. pp. 83-88.
5. Крав Д., Мас Кензие Д., Гриеве П. Supergene gold mobility in orogenic gold deposits, Otago Schist, New Zealand. N. Z. J. Geol. Geophys. 2015, 58, 123-136, doi:10.1080/00288306.2014.997746.
6. Krav D., Kerr G. Geochemistry and mineralogy of contrasting supergene gold alteration zones, southern New Zealand. Appl. Geochem. 2017, 85, 19-34, doi:10.1016/ j. apgeochem. 2017.08,005.
7. Moyliev M.Sh., Karabaev M.S., Tukhtamishov F.G., Sadirov R.M. Geological and structural features of the placement of gold mineralization in the Kaskyrtau area (Bukantau mountains). Bulletin of NUUz. -Tashkent. 2017, No. 3/2. pp. 280-283.

8. Moiliev M.Sh., Karabaev M.S., Ashirov M.B. The importance of accompanying elements in the search for Central Bukantov gold deposits // Geology and mineral resources, 2020, No. 5. pp. 49-53.
9. Moiliev M.Sh., Boboerov KhA "Central Bukantov Mineral Associations Of Gold Mining And Their Composition (On The Example Of Kaskirtov, Boztov, Jelsay Fields)" Awarded For Conference "Pedagogy and modern education: tradition, experience And innovation", 02/05/2021, pp. 94-96 URL: https://doi.org/10.37547/iscrc-intconf02.
10. Radomsky S.M. Oxidized ores of the Pokrovskoye gold deposit (Upper Amur region) // Mining Information and Analytical Bulletin. 2014, No. 1. S. 379-384.
11. Ore deposits of Uzbekistan / Ed. M. Golovanova. - T.: GIDROINGEO, 2001. 661 p.
12. Smirnov S.S. Oxidation zone of sulfide deposits of the Academy of Sciences of the USSR. - Moscow, Russia, 1955.232 p.
13. Sedelnikov L.V., Tusmetov A.A., Zhumaev S.O., Turaev T.N. Prospects for expanding the mineral resource base of oxidized gold-bearing ores in the deposits of the mountains of Central and Southern Bukantau. Mountain Bulletin of Uzbekistan, 2006, No. 1. pp. 3-6.
14. Seltmann, R., Konopelko, D., Biske, G., Divaev, F., Sergeev, S., (2011). Hercynian postcollisional magmatism in the context of Palaeozoic magmatic evolution of the Tien Shan orogenic belt. Journal of Asian Earth Sciences 42, 821–838.
15. Stratigraphic Dictionary of Uzbekistan / Tr. IMR. T.: GIDROINGEO, 2001. S. 255.
16. Silyanov S.A., Sazonov A.M., Zvyagina E.A., Savichev A.A., Lobastov B.M. Gold in the Oxidized Ores of the Olympiada Deposit (Eastern Siberia, Russia)// Minerals 2021,1-21 p. URL: https://doi.org/10.3390/min11020190.
17. Tangirov A.I., Urunov B.N., Isakhodzhaev B.A. Features of the structure and patterns of manifestation of gold mineralization in the Bukantau mountains // Mining Bulletin of Uzbekistan. - Navoi, 2014. No. 1. pp. 53-56.