International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2024 Vol. 14, pp. 1-6/Aleksandr and Alla
Research Article

IMPLICIT ANOMALIES OF THE ALMALYK ORE REGION (EASTERN UZBEKISTAN)

***Aleksandr Panchenko[1] and Alla Kamishova[2]**
[1]National University of Uzbekistan named after Mirzo Ulugbek, Uzbekistan, Tashkent
[2]GA, Regionalgeology, Uzbekistan, Tashkent region, Eshonguzar
**Author for Correspondence*

ABSTRACT
Comprehensive analysis of the actual data obtained in recent years has made it possible to interpret the negative results of poorly studied areas of the ore region in a new way and identify new promising areas for endogenous mineralization that does not manifest itself on the surface.

Keywords: *Gold Mineralization, Implicit Anomalies, Shielding Surface, Aerogammaspectrometry, Near-Ore Metasomatites, Ore Mineralization*

INTRODUCTION
In world practice, due to the reduction of reserves of easily accessible developed deposits of precious metals, forecasting gold mineralization on the flanks of known deposits and promising areas is important. The integration of geochemical, geophysical, mineralogical and petrographic data obtained on the basis of modern high-precision laboratory and analytical studies allows us to establish completely new prerequisites for the identification of new ore occurrences.
Purpose of the work was to conduct research on the study and establishment of additional criteria - signs in rocks of the Middle and Upper Hercynian tiers, by studying implicit anomalies in a well-studied ore region. The conducted research will make it possible to identify new promising ore occurrences in the volume of areas classified as unpromising at the early stages of the study of the territory, due to the underestimation of the conditions for the localization of mineralization that does not come to the surface and the insufficient volume of prospecting in this regard.
As a result of applying the criteria in practice, the reserve of advanced research of the current stage of geological surveys for the future will be increased.

MATERIALS AND METHODS
Field observation methods were used in the research: lithochemical survey at a scale of 1:10000, mineralogical and petrographic sections, measurements of mercury vapor concentration in soil air using the RA-915+ analyzer, examination of detected anomalies, experimental sampling from loose modern sediments; laboratory studies (spectral, goldmetric, assay, ICP-massspectrometric and other types of analyses); desk research: modeling quantitative and qualitative indicators based on the created geological and geochemical database.

RESULTS AND DISCUSSION
The task of identifying new ore objects is extremely important and relevant. This provision is noted in numerous scientific works of local geologists (Pirnazarov, M.K. Turapov, F.K. Divaev, V.F. Skryabin, R.A. Khalmatov, V.D. Tsoi, etc.). Based on the degree of study of the mountainous and elevated part of the territory of the republic, it can be concluded that deposits or entire ore fields that are not exposed on the daytime surface are manifested by implicit geological, geochemical, and geophysical anomalies against the background of scattered mineralization.
In recent years, the promising areas of the main ore regions of the republic, identified by direct search signs, have received a forward-looking assessment. The ways for their further study are outlined. One of the main tasks of the geological industry at the present stage is the allocation of new promising areas based on weakly expressed - indirect signs. in the developed mining areas, the so–called “unclear”, “vague” – additional criteria - signs occupy a primary place.

At the North Kyzata site, located within the well-studied Almalyk ore region (Kauldy ore field), explicit criteria - signs (ancient mine workings, mineral output to the daytime surface, near- or industrial concentrations, etc.) were not manifested for any of the types of endogenous mineralization profiling in the area (gold, polymetallic, copper-porphyric with gold). Single surface mining operations carried out at the site in different years did not reveal quartz veins or hydrosluidic-quartz metasomatites, which indicates the absence of indirect signs of mineralization development. Despite this, drilling has uncovered gold deposits localized at some depth from the daytime surface.

The North Kyzata site is located in a poorly studied part of the Kauldy ore field - the Central tectonic block of the Almalyk ore region, where copper is the main endogenous mineralization in addition to gold and polymetallic (Golovanov, 2001).

From the west, the site borders on the developed Kauldy gold deposit and the Miskon copper ore deposit, and in the south with the Yoshlik-II and Sary-Cheku copper deposits, which elevates the area to the rank of promising, and the economic situation is favorable. The listed objects are localized at three stratigraphic-hypsometric levels, the common feature of which is the shallow occurrence of ore bodies – closed ore systems against the background of widely developed shielding surfaces. Copper objects are manifested in intrusive rocks of a subalkaline profile, lead-zinc mineralization in carbonate deposits, gold ore in volcanogenic ones (Dzhabarov *et al.*, 2007).

Modern loose cover deposits, comprising 60-70% of the site, with a capacity of up to several tens of meters, are widely developed in the area. The site is poorly studied by mining and drilling operations with a drilling density of $n \cdot 10^0$ wells per 1 km^2, in comparison with the Kauldy field, where the drilling density per 1 km^2 is $n \cdot 10^2$ wells.

The pre-Mesozoic complexes are represented by volcanogenic sedimentary formations C_2-$_3$, which have the greatest development, lying with erosion on terrigenous carbonate deposits D_2-C_1, developed at depths of 200-500 m from the surface, broken through by rocks of intrusive complexes (Sedelnikov, 1989).

In the North Kyzata site, gentle structures (10-30°) are developed, similar to the Kauldy deposit, acting as promising for the discovery of gold deposits (Meshchaninov, 1980). Gentle zones have a drop in the eastern points, and the ore deposits of the site do not reach the daytime surface.

The following geological features are noted for the North Kyzata site:

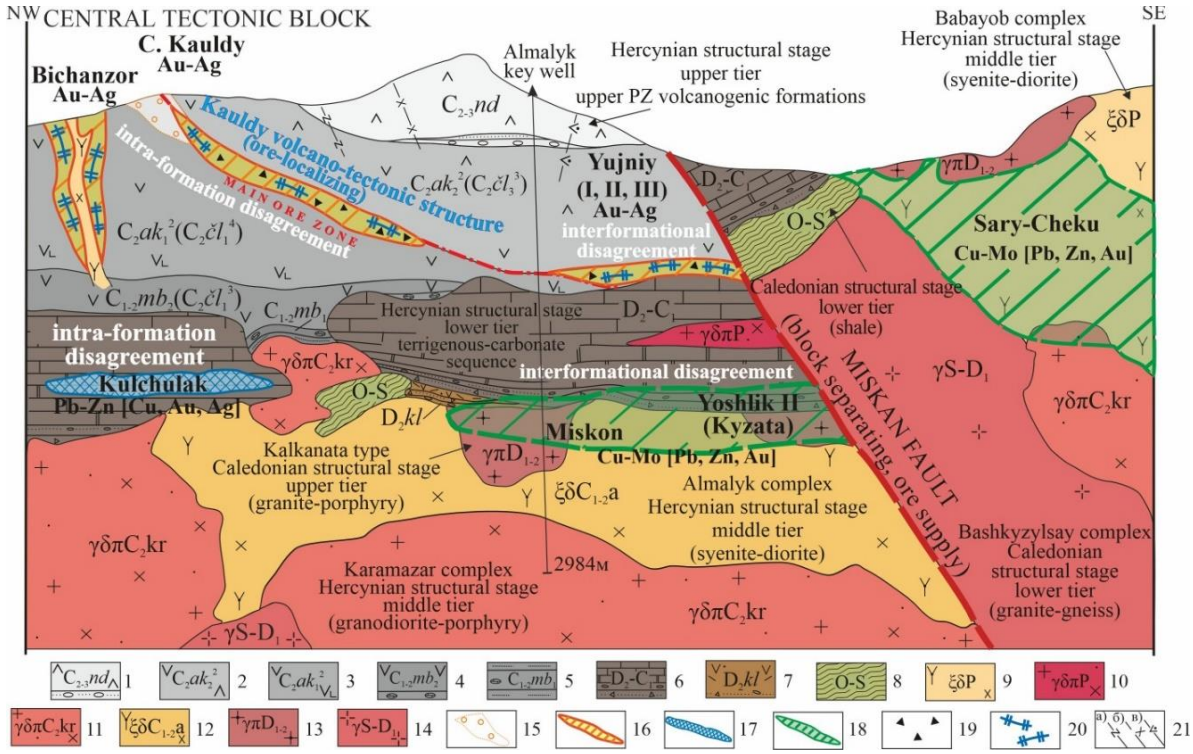
- the site has a multi-tiered section of volcanogenic formations and terrigenous-carbonate deposits of considerable thickness;
- the volcanogenic-hydrothermal class of gold mineralization, hidden and buried under the quaternary cover, prevails;
- the lower sub-formation of the Akcha formation, depending on the geological and structural type, is ore–containing, and the middle one is an ore-containing and supra-ore stratum shielding mineralization;
- there are prerequisites for the identification of stratiform-scarn polymetallic mineralization in connection with the deposits of the dolomites of the Kulata and Karatagata formations (Golovanov, 2001; Titova *et al.*, 1989).
- there are prerequisites for the detection of copper-porphyric mineralization in connection with stocks of syenite-diorites, quartz monzonite-diorites, granodiorite-porphyries (Karimova *et al.*, 2022), breaking through terrigenous carbonate deposits D_2-C_1 at depths over 500 m.

The ore-controlling structures by spatial connection, in the Caledonian and Hercynian structural floors and tiers are:

- for gold mineralization, interformational (contact of the Lower Hercynian and Upper Hercynian structural tiers) and intraformational (contact between the second pack of the lower and middle sub-formations of the Akcha formation) surfaces of discordant rock occurrence;
- polymetallic mineralization is localized near the intraformational disagreement (at the stratigraphic level of the Mirzarabad limestone and Kulata, Karatagata calcareous-dolomite deposits);
- copper-porphyric mineralization tends to interformational disagreement - the overlap of the terrigenous carbonate strata D_2-C_1 on the volcanogenic formations $D_{1\text{-}2}$, broken through by small porphyric Hercynian intrusions.

An integral element in the preliminary prediction of previously unknown ore occurrences and deposits is their three-dimensional representation, which mentally forms the initial model of the object (image)

filled with geological meaning, the development of which is carried out after constant reflection and data analysis, taking into account factual material based on the experience and erudition of the researcher himself.



1–dacites, andesite-dacites, conglomerates; 2–andesite-dacites and their tuffs; 3–andesites, andesite-basalts and their tuffs; 4–andesites, conglomerates; 5–siltstones, sandstones, limestone conglomerates; 6–limestones, dolomites; 7–quartz porphyries, andesitic porphyrites, their tuffs, conglomerates; 8–shales, sandstones; 9–syenite-diorite; 10, 11–granodiorite porphyries; 12–syenite-diorite; 13–granite-porphyries; 14–granites, granite-gneisses; 15–supraore metasomatites; 16–deposits: gold ore; 17–polymetallic; 18–copper; 19–clastolavas of the Kauldy type; 20–veins, veinlets of chalcedonic quartz; 21–dykes: a) diabase, b) dioritic, c) syenite porphyrites

Figure 1: Idealized section the western part of the Almalyk ore region (based on the materials of the Almalyk State Geological Survey)

Considering the fact that gold, polymetallic and copper-porphyric mineralization is controlled by being confined to unified hydrothermal-magmatic systems, the criteria for their detection are presented as follows (Dzhabarov *et al.*, 2007; Golovanov, 2001; Karimova *et al.*, 2022; Sedelnikov, 1989; Titova *et al.*, 1989):

- geochemical anomalies of Au, Hg, Te, Se, As, Fe, etc., in rocks of the Upper Alpine tier, geophysical inhomogeneities (gradient zones), areas of landslide activity, increased thickness of Cretaceous-Paleogene deposits;
- in rocks of the Upper Hercynian structural layer: anomalies of Pb, Zn, Ag, Cu, Mo, Bi, etc., increased capacities of volcanogenic complexes, areas of shallow fracturing, zones of development of pre-ore metasomatites (rarely near-ore), mylonitization, crushing, crumpling, clarification, sericitization, metasomatic calcification with pyrite, magnetite, chalcopyrite, veins quartz, barite, calcite and mixed composition with sulfides, quartz lenses, solid and nested quartz with rare increased gold content, as well as emerald-free quartz veins;

- on the upper horizons of the Upper Hercynian structural layer: dykes of syenite-diorites and granodiorite-porphyries as apophyses of mesabyssal intrusions of the subalkaline series, “Kauldy type” clastolaves;
- local manifestation of substandard copper mineralization;
- surfaces of stratigraphic inconsistencies, interformational and interplastic disturbances, synvolcanic structures;
- on the lower and middle horizons of the Upper Hercynian structural tier: veins and veins of productive chalcedony quartz against the background of quartz-hydrosluidic, quartz-sericite-hydrosluidic carbonate and monoquartz metasomatites with significant gold enrichment;
- at the level of the Middle and Lower Hercynian structural tier: the relationship of small porphyric intrusions with terrigenous-carbonate deposits and the development of skarns, interplastic deposits of quartzites developed by limestones, dolomites, sandstones of Devonian age near their contact with subvolcanic rocks near their contact;
- in rocks of the Upper Caledonian structural layer, areas of fine fracturing in exo-, endocontacts and apical parts of the stocks of sericitized granodiorite porphyries modified to monoquarcites, widespread development of quartz-sericite-biotite-chlorite propylites, as well as zones of converging faults.

The listed criteria are regarded as indicators of non-eroded ore occurrences on three structural floors, on the basis of which an idealized section is drawn up (Figure 1).

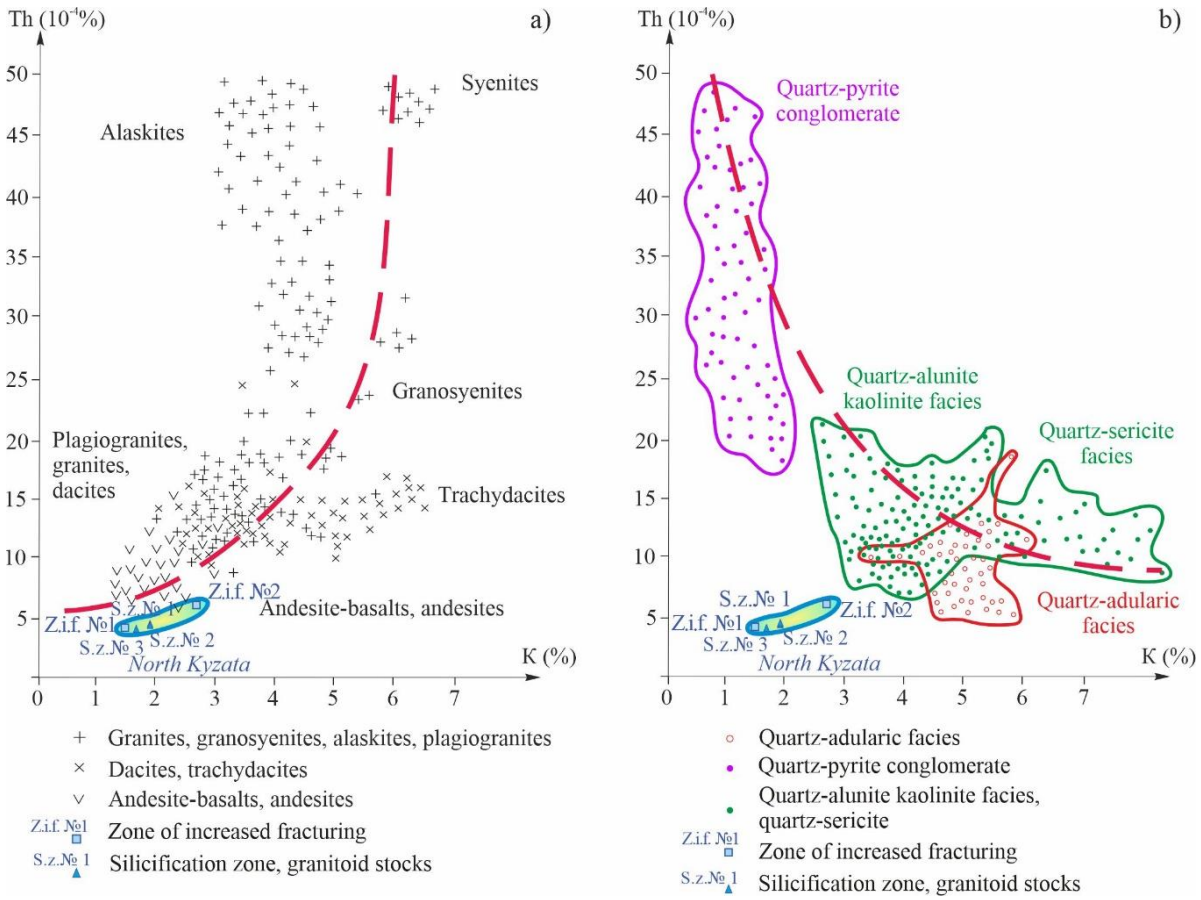


Figure 2: Distribution of potassium and thorium in rocks of the Chatkal-Kurama metallogenic province (I.G. Kremnev, 1982): igneous rocks a); metasomatites b)

In 2020, the State Unitary Enterprise "Regional geology" (D.R. Golovko, S.S. Murashkin, 2020) conducted aerogeophysical studies in the Kurama Mountains on a scale of 1:25000, including aeromagnetic exploration, aeroelectronic exploration by the field formation method and

aerogammaspectrometry. Based on these studies, promising areas have been identified - the North Kyzata section has been marked. As a result, according to the geophysical data on the site, the proposed zones of calcification No. 1, 2, 3 and zones of increased fracturing No. 1, 2 were identified.
A ground survey of the site showed that, according to aerogeophysical data, the zones of calcification No. 1, 2, 3 and increased fracturing No. 1, 2 record poorly manifested ore processes developed by volcanogenic rocks in the form of hydrothermally altered rocks located on the Th/K graph outside the facies region of near-ore metasomatites, in the field of andesite-basalts, andesites (Figure 2).
The host rocks are represented by micro–spotted, limonitized dacite porphyries consisting of quartz, pelitized feldspar, goethite and hydrogetite according to porphyric secretions of dark-colored minerals and their tuffs - “red stone changes" (Figures 3, 4).

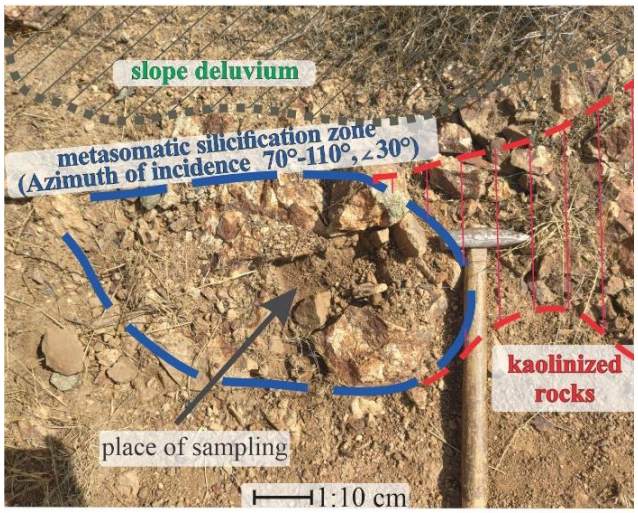


Figure 3: Modified rocks of the North Kyzata site (natural outcrop)

Figure 4: Sample of modified rocks (surface)

The structure is unevenly porphyric, the texture is breccia-like with a cataclysm of detrital quartz grains and plagioclases, which gives the rock a tuff appearance. The described rock differences in the studied ore region, according to many researchers, are not predisposed to the concentration of metals. According to the results of the metallometric survey at the North Kyzata site (Geochemical and Geophysical scientific departments of SUE “Regional geology”, 2021), spectral and goldmetric analysis revealed anomalies: Au, Ag, Cu, Pb, Zn, As, etc.; mercury-measuring and electrical exploration anomalies with increased values of apparent electrical resistance with an intensity of the first hundreds of ohms · m (Rudenko, 2021). When testing primary scattering halos, ICP mass spectrometric analysis established high-clark values of As, Se, Ag.
Prospecting drilling (Almalyk GPE), under a complex, low-contrast geological, geochemical and geophysical anomaly, revealed ore intersections with conditioned gold contents $n \cdot 10^1$ g/t and silver $n \cdot 10^1$ g/t, exposed in volcanic rocks and near contact with terrigenous carbonate deposits D_2-C_1 at depths of 100-300 m from the surface. The basic ore mineralization is represented by a quartz-carbonate aggregate with pyrite, pale ores, chalcopyrite, galena, sphalerite.
It is concluded that the Almalyk ore region is part of the province of completely non-eroded gold mineralization, the area of which extends beyond the area of known deposits. At the North Kyzata site, geological, geochemical and geophysical anomalies are associated with poorly manifested ore processes acting as an indicator of non-surfacing gold mineralization, and similar positions may be widespread in the region.

Conclusion

The analysis of data and the study of the patterns of deposit placement with a three-dimensional mental representation forming the initial model of ore occurrence allowed us to develop additional criteria for its identification.

The conducted survey shows fundamental differences in criteria between the developed and identified deposits, which requires a comprehensive, comprehensive and detailed study of the territories. The criteria should be improved for areas overlain by modern loose sediments. These features can be regarded as indicators of eroded ore occurrences on three structural floors.

ACKNOWLEDGMENT
The authors are grateful for the consultations and the materials provided on the geology, the ore content, the results of laboratory and analytical studies to the employees of the geological enterprises of the industry.

REFERENCES
Dzhabarov RA, Meshchaninov EZ (2007). Prospects and direction of exploration work in the Central block of the Almalyk ore region. *Tr. scientific-practical*. conf. "Modern problems of geology and development of the mineral resource base of the Republic of Uzbekistan, T. GP "IMR", 129-132.
Golovanov IM (2001). Ore deposits of Uzbekistan. T.: *GIDROINGEO*, 354.
Karimova FB, Jumaniyazov DI, Usmanova ShV, Tevelev AV (2022). Mineralogical and geochemical features of the Yoshlik deposit (Almalyk-Angren mining region, Uzbekistan). *Bulletin of Moscow University. Series 4. Geology*, **5** 95-98.
Sedelnikov LV (1989). Conditions of placement and quantitative forecast of latent endogenous mineralization in the Central block of Almalyk: Abstract of the dissertation of the Candidate of Geological Sciences. - Frunze. 23.
Titova AP, Levin YaS and Kheifets DI (1989). Patterns of stratiform lead-zinc mineralization in the Middle Tien Shan. -T. Fan. 194.