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***Research Article***

# GEOPHYSICAL AND COSMOSTRUCTURAL FEATURES OF THE WESTERN PART OF NORTHERN NURATAU

**Ibragimov Rustam Kholikulovich[1] and *Khasanov Nomonjon Rakhmatovich[2]**
*[1]Department of Expertise of Geological Projects of the State Institution "Subsoil Use Center" Tashkent, Uzbekistan*
*[2]Institute of Mineral Resources State Institution, Tashkent, Uzbekistan*
**Author for Correspondence: numon.raxmatovich@mail.ru*

**ABSTRACT**.
The article presents the results of a comprehensive analysis of data from the interpretation of multispectral satellite images and maps of geophysical anomalies in the western part of Northern Nuratau. The geophysical characteristics of the magnetic field of the reference gold ore object were established. As a result of the research, it was possible to identify previously unknown faults in the northeastern direction, which are the main ore-controlling structures of the study area.

***Keywords:*** *Gold Deposits, Cosmostructures, Faults, Shifts, Interpretation, Ore-Controlling Factors, Magnetic Anomaly*

## INTRODUCTION

In recent years, work has been carried out in the Nuratau Mountains to study the ore-bearing capacity of ancient strata, the minerageny of geodynamic complexes, geochemical zoning, etc. Deposits of gold (Charmitan, Guzhumsay, Urtalik, Sarmich, etc.), tungsten (Lyangar, Ingichke, etc.), tungsten (Lyangar, Ingichke, etc.) were discovered here. polymetals (Uchkulach), iron (Chimkurgan) and a large number of ore occurrences, points of mineralization of precious, non-ferrous, rare metals. At the same time, the richest ore resources of this region are far from being exhausted.

The geological interpretation of geophysical materials is a powerful means of studying the structure and material composition of the earth's crust (mainly its upper part), which is reflected in the features of geophysical fields. These features are associated with the physical heterogeneity of the earth's crust. The study of the distribution patterns of the magnetic properties of rocks and their changes during geological processes is one of the main elements of the interpretation of geophysical research materials.

As is known, the physical parameters and material composition of rocks are inadequate to each other. Different types of rock forges can have the same magnetization, and vice versa. In this regard, the results of interpretation of geophysical materials based on magnetic surveys, especially aeromagnetic ones, are not always associated with natural geological structural bodies.

Based on the results of previously completed general searches along the northern slopes of the Northern Nuratau ridge, it was established that the main search criterion is the highly permeable zone of the North Nuratau fault. Based on this, the need to decipher space images to identify ore-controlling cosmostructures is determined.

## MATERIALS AND METHODS

When studying the materials of geophysical work (aeromagnetic survey) on the western territory of Northern Nuratau, special attention was paid to the relationship of geophysical anomalies with magmatic formations.

Igneous formations of acidic composition, represented by granites, are weakly magnetic or practically non-magnetic. Intrusive formations are usually spatially associated with zones of stable magnetic anomalies with magnetic field intensity values of zero or close to zero.

Igneous formations of intermediate composition have increased magnetization. Typically, such rocks are distributed over large areas and are recorded by positive anomalies of magnetic fields.

A higher intensity of magnetization is characteristic of igneous formations represented by diorites and other rocks of high basicity. They are characterized by effective magnetization values in the range from 500 to 600 $10^{-6}$ CGS (centimeter-gram-second).

The relationship between gold ore occurrences and geophysical anomalies is also not clear. Gold deposits in the study area are located in magnetic fields with values of 120-160 nT (nanotesla) (fig.1).

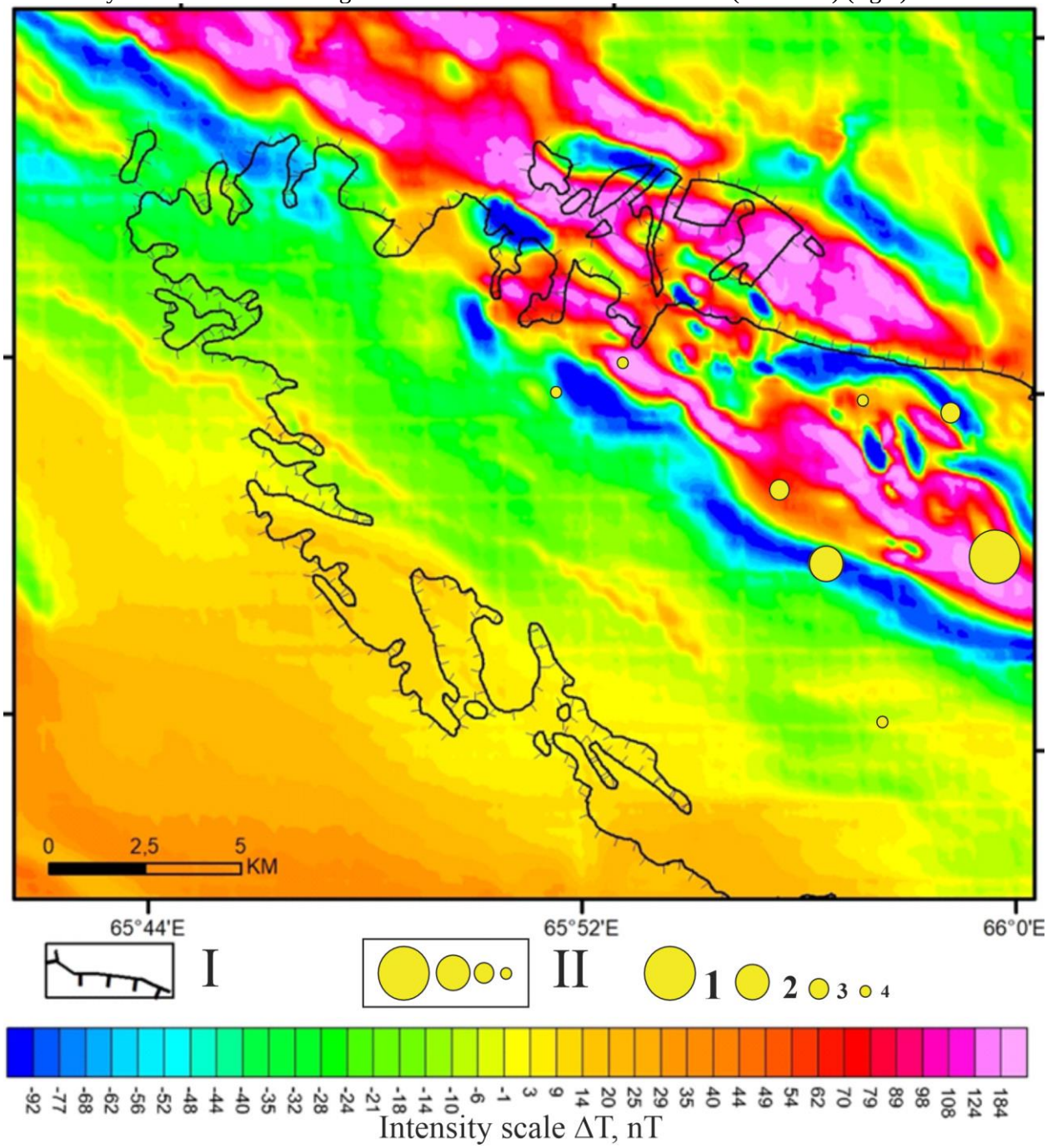


**Figure 1. Map of the anomalous magnetic field of the western part of Northern Nuratau (using materials from I.G. Kremneva, 2003).**
***Legend: I-boundaries of the Paleozoic basement outcropping; II-gold objects on a scale: 1-large deposits; 2-deposits, 3-ore occurrences;4-mineralized points.***

Such a wide variation in the values of magnetic anomalies is apparently associated with the composition of the geological formations hosting gold mineralization.
The analysis showed that the nature of the magnetic field of the territory of the western part of the Northern Nuratau Mountains is differentiated, with many both positive and negative anomalies, predominantly having a northeastern strike and characterized by values from -110 to +200 nT.

Based on the value of effective magnetization, using data on the physical properties of rocks, the material composition of magnetically disturbing objects was determined.
Gradient zones, chains of local geophysical anomalies, changes in strikes and disturbances in the structures of magnetic fields were geophysical signs for identifying zones of tectonic disturbances.
One of the main elements of the magnetic field of the study area is the Kansai positive anomaly, which is linear in nature, extends in a northwest direction for a distance of about 55 km, in the western and central parts the width of the anomaly reaches 8-12 km. To the east, towards the Temirkabuk intrusion, the Kansai anomaly, bounded by faults, descends from the north and south.
The North Nurata magnetic anomaly is spatially confined to the southern flank of the Dzhambulak anticline, composed of the Kansai (Besapan) suite. In some places, the anomaly covers the near-nuclear part of the fold composed of formations of the Suvliksai Formation [Mirkamalov *et al.,* 2014]. The western part of the magnetic anomaly is covered by a cover of Cenozoic sediments. Within the magnetic anomaly is the Kansai mineralized zone with the Kansai gold deposit, a number of ore occurrences and numerous mineralized points. In the northern frame of the anomaly, conformally to its strike, the Madavat (Pistalin) mineralized zone is located [Ishbaev *et al.,* 2021].
The second method of work involves traditional interpretation methods, which include visual interpretation of Landsat-8 space images with the use of geological and geophysical materials for interpretation and clarification of the geological nature of the identified cosmic structures.

## RESULTS AND DISCUSSION

A comprehensive analysis of data from the interpretation of multispectral satellite images of geophysical anomalies in the western territory of Northern Nuratau made it possible to identify new faults and reliable tectonic disturbances, mapped earlier by geological surveys.
This group of faults includes the Kattashchinsky, Ulus and Tashbulak faults. The first two faults were identified by R.R. Usmanov and others in 1982 in the area of the village of Ulus and the Yambash collective farm, which were confirmed as alpine faults by decoding materials from satellite images and the results of geophysical research. These faults cut all the disturbances of the previous stages of deformation and along the fault-shear movements of tectonic blocks are observed. Along the Tashbulak fault, which can be traced along the northern foothills of the Northern Nuratau ridge at the mouth of the Tashbulak region, tectonic blocks composed of rocks from the Tulebay and Ilonchisay formations moved. They are expressed by mylonitization, brecciation, and significant ferruginization. Along the faults, the rocks are sheared parallel to the fault planes, which indicates the intense nature of their tectonic activity.
Researchers who studied geology and tectonics (Gar'kovets V.G. 1969; Sabdyushev Sh.Sh, 1978; Shayakubov T.Sh. *et al.,* 1966; Bukharin A.K. *et al.,* 1989; Burtman V.S, 1974; Akhmedjanov M.A. *et al.,* 1977; Biske Y.S, 1996; and et al). The Nurata region within the North Nurata area is distinguished by age of formation: Hercynian and Caledonian faults.
Hercynian discontinuities. These include the Dzhadyrsky, Kamyshlaksky, Shirgalinsky, Karakuduksky, Kepaksultinsky, Tandyrsky, Tamdynsky tectonic disturbances of the latitudinal, sublatitudinal and northeastern directions. They also include Hercynian capping formed as a result of compression during collision processes in the collision zone of the Kazakhstan and Turkestan microcontinents [Akhmedjanov M.A. *et al.,* 1977; Biske Y.S, 1996.]. Along the filament, if it runs through brittle strata, brecciation and shearing are observed. It is associated with mélange. Limonitization is observed in the area of the covering. A common feature of the capping is their parallel orientation with the layering of the enclosing layers [9]. The most promising from the point of view of ore bearing are: the earlier Caledonian thrust, the mélange zone of the Hercynian main thrust [Mirkamalov *et al.,* 2014].
Zones of tectonic faults observed on the periphery of various folds are characterized by mylonitization, silicification, and, in places, sulfide mineralization (Kamyshlak fault). The Dzhadirsky fault is the largest structure of northwestern strike and extends from Shokhsay in a westerly direction. Sediments of the Kesken, Terrarsay, Dzhadyr and Kansai formations are in contact along the fault. The fault is a fault with the fault dipping at angles of 50-70° to the south. Its zone is represented by fragmented silicified and limonitized rocks. Near the displacement plane there are many small folds of Hercynian age with broken wings and differently oriented. The amplitude of the fault in the west is at least 500-600 m. In the eastern direction, the rupture, branching into a number of components, gradually fades.

The Kamyshlak fault complicates the northern flank of the Shokh-Gum anti-cline. The fault has a northwestern strike, but experiences a latitudinal bend in the middle part and then attenuates in the northwestern direction.
The gap is clearly visible on satellite photographs. Along the zone there are widespread quartz veins, intense limonitization, bleaching, crushing, and mylonitization. The fault zone is characterized by manifestations of gold and sulfide mineralization. The amplitude of the rupture reaches a few hundred meters.
The Dzhadyrsky and Kamyshlak faults are ore-controlling structures and control the placement of the Yaryk, Dzhadyr and other gold occurrences.
Caledonian discontinuities. In the studied territory they are represented by fragments in late superimposed structures. According to the data of Sh.Sh.Sabdyushev and others [Sabdyushev Sh.Sh, 1978.], these disturbances could be renewed by later tectonic disturbances. One of such disturbances is the Uchmola fault. A cutting cleavage is developed parallel to the fault planes in relation to the foliation. The fold-and-thrust complex is intruded by granitoids of the Late Carboniferous-Permian age [Mirkamalov R.Kh, 2008].
The fault is accompanied by numerous small tectonic disturbances. Probably, in the process of renewal, they became control structures for the Kansai, Madavat and Suluk gold zones, characterized by the occurrence of gold, molybdenum, tungsten, vanadium and other minerals.
The largest longitudinal faults are the Ulus and Kattaashchinsky reverse faults, running along the northern foot of the ridge. The Ulus fault was established by CRWM seismic exploration (Correlation Refractive Wave Method) and mapping drilling. Along it, the mountain structure is pushed onto the foothill plain. The amplitude of the Ulus reverse fault is 100-250m and increases in the easterly direction.
Longitudinal faults complicate folded structures, cut overhangs and thrust faults; as a rule, they are reverse faults with a displacement amplitude of hundreds of meters. The fault zones are represented by intensely brecciated, silicified, and ferruginous rocks.
In addition to the above-described systems of faults, the following are observed in the study area: cutting faults (Tandyrsky, etc.) and shifts (Tamdynsky, Kepaksultansky, Karakuduksky, Shirgalinsky), oriented in the northeast direction.
Numerous gold deposits were once discovered on the territory of the Nuratau Mountains. According to R.S. Khan (2006), the Madavat and Kamyshlak gold mining zones are distinguished here.
The Madavat gold ore zone can be traced from the village of Pistali (in the north-west) to the Ustuk intrusion. It is represented by a series of closely spaced subparallel faults, which are noted in the area of Pistali, the Madavat intrusion and the Kamyshlak fault zone. Within the zone, intensively catacaustic, mylonitized, ferruginized, silicified, graphitized, and locally sulfurized shales, siltstones, quartzites, and dolomites of the Suvliksai Formation are developed. The width of the zone is from 0.5 to 1.1 km. In terms of the change in the strike of the zone from the northwestern direction to the sub latitudinal direction, it branches into two zones, where the most promising areas of gold occurrence, Pistali and Ancient, are located. Gold mineralization is closely associated with rod-shaped quartz veins and veinlets.
The Kamyshlak gold ore zone can be traced from the northwestern end of the Northern Nuratau ridge to the Merishkor Upland. Within the zone, rocks of the Zhivachisay, Kaltadavan and Kansai formations are developed. The South Kamyshkan and Mingbulak faults played a major role in the formation of the zone. In zones of faults, intensively catallactic, locally crushed, mylonitized, graphitized, silicified shales, siltstones, sandstones, gravesites, marls are observed, the thickness of which does not exceed 17-25 m. The thickness of the Kamyshkan zone ranges from 0.3 to 1.8 km. Gold is associated with sulfide-rich quartz veins, scorodite. The thickness of the cores is from 0.2 to 6.0 m.
In the zone there are gold ore occurrences Tamdy, Tandyr, Djadir, Yaryk, Akchob, Aktash, Zargar, related to the gold-quartz formation.

## CONCLUSION

Thus, the study of geophysical features, cosmic structure and metallogeny of gold in the western territories of Northern Nuratau allows us to conclude:
- the peculiarity of geophysical anomalies is that the increased magnetic properties of the Kansai zone do not depend on the lithological composition and stratigraphic affiliation, but are determined by the level of superimposed progressive metamorphism and subsequent ore formation processes. The intensity of the

magnetic field is determined by the contents of magnetic monoclinic pyrrhotite, as well as by the depth of the pyrite-pyrrhotite zone at the current level of erosional section;
- by interpreting satellite images, new discontinuities in the longitudinal and transverse directions were identified;
- the placement of gold mineralization is controlled exclusively by discontinuous tectonics, determining their structural positions in zones of large faults.

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