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# Research Geodynamic Situation of the Ore Formation of the Ore Deposits

**Janibekov B.O., Turapov M.K., Akbarov H.A., Tulyaganova N.Sh., Abdullaev A.X.**

***Abstract: The research reveals the goals and tasks of the science of geodynamics. A new technique is being considered aimed at studying the geodynamic situation of ore deposits in ore formation processes. The results of the reconstruction of the geodynamic conditions of the area of the Daugiztau deposit during ore deposition are presented.***

***Keywords : geodynamic, geotectonic, deposit, metallogenic, tectonomagmatic, tectonophysic, region, faults, formations, structural***

## I. INTRODUCTION

In the development of the production forces of any state, the presence of mineral resources in their interiors is of great importance. The search and exploration of mineral raw materials, the expansion of their resources – these are the main tasks of geology. In this regard, geological prospecting and exploration are structure-forming sectors of the country's economy. Their task is to identify, explore and prepare for the industrial development of new mineral deposits.

The era of discovery of deposits near the surface and reaching the surface of the Earth in many states, regions, metallogenic belts is long over. Currently, in geology, special attention is paid to territories where ore-bearing structural floors, horizons, geological formations favorable for mineralization, structures are overlain by younger rock complexes. All this makes exploration and mining operations an increasingly difficult and capital-intensive set of activities. Under such conditions, it is possible to increase the efficiency of expensive geological exploration operations by developing and improving the theoretical and methodological foundations for studying the genesis, patterns of formation and placement conditions of industrial mineralization through the use of innovative technologies.

## II. OBJECTS AND METHODS OF RESEARCH

At the end of the last century, geological science was marked by the emergence of a new direction – geotectonics-geodynamics, which considers the underlying forces and processes that arise as a result of the evolution of the Earth and determine the movement of masses of matter and energy inside it and in external hard plates (Planet Earth, 2008). The basis for the development of the geodynamic methodology has become complex geological, geochemical, geophysical, aerospace, biostratigraphic and other studies of planetary and regional scales, aimed at studying surface and deep geological phenomena and physico-chemical processes that cause tectonomagmatic activation, new formation, metasomatic changes, ore formation accompanied by the migration of chemical elements and their concentration in the earth's crust. As a result of applying these studies in geodynamics, new concepts appeared, such as historical geodynamics, regional and deep geodynamics, geodynamic analysis, geodynamic (structural-material) complexes, geodynamic models, geodynamic maps, geodynamic processes, and others. For each of them, a methodology for conducting geodynamic studies and identified their goals of decoding these concepts, as well as the expected results are established.

Today, for many countries of the world, the main problem of geology is the expansion and strengthening of the mineral resource base. One of the ways to solve this problem is to study and evaluate the flanks and deep horizons of known and developed deposits, where the laws of their formation and mineralization conditions with the identification of the main ore-controlling factors: lithological, structural and igneous are established. As shown by studies of ore deposits of the Central Asian metallogenic belt Kh.M. Abdullaev, A.V. Korolev, P.A. Shekhtman, V.A. Koroleva, H.A. Akbarova, V.P. Fedorchuk, F.I. Wolfson, N.A. Nikiforov, E.M. Nekrasova, N.P. Laverov, V.A. Nevsky, P.V. Pankratyva, VF Chernysheva and others. The main factor in the control of hydrothermal mineralization is structural. In this regard, when studying the flanks and, in particular, the deep horizons of the studied deposits, it became necessary to decipher the kinematics (mechanism of formation and development) of ore-controlling structures.

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* Correspondence Author
**Janibekov Bobir Omonovich,** Assistant professor Department of Geology, mineralogy and petrography, Tashkent state technical university, PhD
University Street 2, Tashkent, Uzbekistan, 100095E-mail: jonibekovbobur@mail.ru,
**Turapov Mirali Kamalovich** State Enterprise "Institute of Mineral Resources" Head of the Tectonophysical Research Methods Sector, Doctor of Geological and Mineralogical Sciences, Professor, Russian Federation Academician of Natural Sciences, T.Shevchenko Street 11a, Tashkent, Uzbekistan,
**Akbarov Khabibulla Asatovich,** Professor of the department of geology, Prospecting and exploration of mineral deposits, Academician of the Academy of Sciences of the Republic of Uzbekistan Tashkent State Technical University, University Street 2, Tashkent, Uzbekistan, 100095,
**Tulyaganova Nargiza Shermatovna,** Head of Department of Geology, mineralogy and petrography, Tashkent state technical university,University Street 2, Tashkent, Uzbekistan, 100095 E-mail: nargiza.tulyaganova@mail.ru
**Abdullaev Abror Khushmurotovich** Senior Lecturer, Department of Urban Roads and Streets, Tashkent Institute of Design, Construction and Maintenance of Automobile Roads A.Temur Street, 20, Tashkent, Uzbekistan, 100060 E-mail: Abror_Abdullaev_87@mail.ru,

Their formation and development takes place against the background of tension and deformation of the earth's crust, which are closely interconnected. The manifestation and combined influence of the internal and external forces of the Earth change the structure, structure and composition of the earth's crust, which is always in motion. These movements affect tectonic tension and deformation, activate previously laid structures and can form new structures, which in the future may become the main cause of the manifestation of various geological phenomena, including ore ones. All these processes in the complex determine the geodynamics, that is, the geodynamic situation of the earth's crust. It should be recalled that the process in the liquid shells of the Earth primarily affects the geodynamics of the earth's crust.

Study by Kh.M. Abdullaev, K.L. Babayev, I.Kh. Khamrabaev, A.V. Korolev, P.A. Shekhtman, V.P. Fedorchuk, H.A. Akbarov, P.V. Pankratiev, V.A. Korolev, Yu. Shikhin and other geological and structural conditions for the placement of endogenous mineralization in various geological and industrial types of gold, silver, lead-zinc deposits. The Central Asian folded belt makes it possible to clearly distinguish ore-controlling structures pledged before ore formation and in ore formation processes. One of the supporting elements of the developed methodology for studying the geodynamics of ore fields and deposits is the data on the geological and structural conditions for the formation and location of mineralization, the interpretation of geodynamics are divided into: the geodynamic situation before ore formation and the geodynamic situation of the ore formation period.

The interpretation of the geodynamic environment of ore formation primarily relies on data on the study of regional geological processes that determined this geodynamics, which make it possible to determine and clarify the direction of regional tectonic forces affecting the study area during ore formation.

The study of the geodynamics of ore fields and deposits consists in determining active structures, the influence of their activity on the stress and strain, on the movement of tectonic blocks and ore-controlling structures, in establishing the relationship of the processes of activity of blocks, fracture structures, tension and deformation with the display of ore mineralization. But the most important thing is that the developed technique allows us to decipher the kinematics of the formation and development of ore-controlling structures, to trace their physical state before the time of ore formation. In addition, it will allow us to establish the reason why this endogenous mineralization is localized in certain local areas (structural positions) of the ore-controlling structures, despite that the structure is many kilometers long.

Thus, the study of the geodynamic situation of ore fields and deposits of the ore formation period will allow: to establish regional causes that determine the activity of structural elements in the stage of ore deposition; to identify the causes (fault activity, structure and composition of the ore-containing medium, tension, deformation, by which ore localization occurred in ore-controlling structural positions, to establish the nature and intensity of tectonic activity of ore-controlling structures; to determine the local compression and extension strain zones with the establishment of the reason for their formation; to analyze the results deciphered geodynamic conditions, with manifestations of ore mineralization that will be the basis for the development of geodinamical criteria for forecasting and searching for new industrial accumulations of ore elements.

A feature of geodynamic research is that it primarily relies on the results of studying the geological and structural conditions for the formation and placement of endogenous mineralization, where the main method is geological and structural formation with special attention removed to the structural elements of the studied area of manifestation of endogenous mineralization. However, this method can record the results of geological processes at certain stages of the development of the object, including the ore stage. This does not allow us to trace the mechanism of formation and development of ore-controlling structures, the formation of favorable structural positions, and stress-strain of the ore object area during the manifestation of mineralization. The solution of these problems of the geodynamics of ore fields and deposits is carried out by the method of physical modeling of tectonophysics, the essence of which is to study the tension and deformation of the model of structures of the ore object by optical modeling.

Thus, the basis of the developed methodology for the geodynamic studies of ore fields and deposits is the data of geological and structural studies of the conditions for the formation and placement of mineralization and the study of their stress-strain state.

## III. RESULTS AND DISCUSSION

A comparative analysis of the results of geodynamic studies with the metallogenic feature of ore objects allows us to determine the dynamics of the formation of favorable positions for mineralization and this will allow us to develop geodynamic criteria for forecasting and searching for new ore deposits on the flanks and deep horizons of known and developed deposits.

The developed methodology for studying the geodynamics of ore fields and deposits was tested on the gold deposits of Chatkalo-Kuraminsky (Guzaksai, Kauldy, Kochbulak, etc.) and the Central Kyzylkum regions (Muruntau, Daugiz, Amantaytau, etc.).

Geodynamic situation of the Daugiztau ore field during ore formation. As is known, the geological and structural position of the Daugiztau ore field determines its confined site at the intersection of the Daugiztau dislocation zone with the Beltau-Daugiztau fold-fracture structure (Ore deposits of Uzbekistan 2006). One of its main objects, the Daugiztau gold mine, is confined from a structural position due to the intersection of the Daugiztau and Asaukak faults. In the geological structure, two structural floors are distinguished: the Lower-Paleozoic structural floor composed of metaterrigenous formations of the Besapan Formation, and the upper Mesozoic-Cenozoic structural floor. Ore-bearing are formations of the lower structural stage. The spatial distribution of ribbon-like and lenticular orebodies is controlled by the northwestern and northeastern, submeridional faults. Before proceeding with the reconstruction of the geodynamics of ore formation in the Daugiztau ore field, it is necessary to determine the geodynamic position of the Beltau Upland, in the central part of which there is an ore field, in the geodynamics of the Central Kyzylkum Khertsinsky metallogenic epoch of development.

The Central Kyzylkum are characterized by the complexity of the geological structure, the diversity of the display of folded-fault faults and the block structure. A study of the geodynamics of the region (Fig. 1) of the Hercynian stage of its development made it possible to establish that under the influence of regional tectonic efforts of the northeastern direction, primarily North-Eastern, submeridional faults, which are the boundary elements of large tectonic blocks, were activated. The activity of the faults caused the movement of the blocks, which was reflected in the internal structure and stress-strain state of each block.

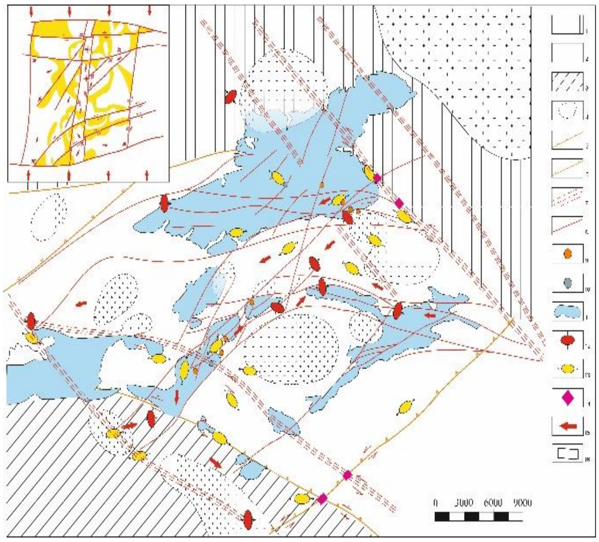

**Fig. 1. Map of geodynamics and ore-controlling structures of the Tamdytau-Beltau, Amantaytau-Beltau, Auminzatau, Beltau-Sangruntau regions.**

**Table 1.Tectonic deformation plan.**

| # | Legend |
|---|---|
| 1 | South Bukantau Turkestan-Alai PPS |
| 2 | Zerafshan-Turkestan PPS |
| 3 | Zerafshano-Alai SFZ |
| 4 | acid and basic intrusions |
| 5 | longitudinal faults restricting the PPS |
| 6 | transverse faults |
| 7 | through ore-controlling fault |
| 8 | ore-controlling faults |
| 9 | boundary of the volcanic structure |
| 10 | gold ore objects |
| 11 | silver objects |
| 12 | outputs of the Paleozoic |
| 13 | zone of local compression |
| 14 | zone of local tension |
| 15 | slightly open fault sections |
| 16 | direction of combination of blocks |

The Beltau Mountains is one of such elongated blocks, where the western and eastern borders are the anti-tianshan transverse deep faults, which also came into motion when the region was affected by regional tectonic compression forces (impact of microplate by L.P. Zonanshaynu, T.N. Dalimova, Yu.S. Savchuk, R.Kh. Mirkamalov and others) the movement along the boundary faults occurred counterclockwise, and therefore, the Eastern part of Beltau is relatively shifted to the Northeast, and the Western to the Southwest. The influence of multidirectional forces on the Beltau Square led to the formation of ore-controlling Northeastern fault systems, in addition, the tension decreases to a minimum with the weakening of the overall Beltau deformation. Under the influence of regional geodynamics, the activity was manifested, in addition to boundary transverse faults, by the Northeastern and Northwestern fracture systems. Activity in the form of a fault-shift with a small amplitude. In such a geodynamic situation, caused by the influence of regional tectonic efforts, as well as magmatic processes, the formation of gold ore objects took place, including the gold deposit Daugiztau, Asaukak, Amantaytau and numerous ore occurrences.

A study of the geodynamics of the Daugiztau ore field during the period of gold mineralization (Fig. 2) based on geological, structural and tectonophysical data shows that by the stage of ore formation, faults of Northeastern and latitudinal systems, transverse anti-tianshan deep faults existed.

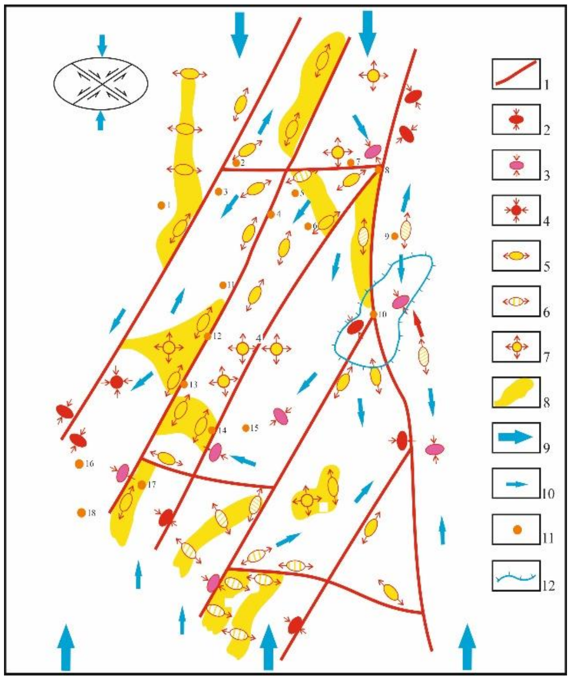

**Fig. 2. Scheme of the geodynamic situation of the ore formation period of the Daugiztau ore field. Option 3. (The basis is in m-be 1: 50,000).**

**Table 2.Tectonic deformation plan.**

| # | Legend |
|---|---|
| 1 | faults |
| 2 | zone of local compression |
| 3 | estimated compression zone |
| 4 | zone of comprehensive stretching |
| 5 | zone of local tension |
| 6 | proposed stretch zone |
| 7 | zone of comprehensive stretching |
| 8 | stretching area |
| 9 | direction of regional compression force |
| 10 | direction of displacement of local sections |
| 11 | ore display |
| 12 | border of the Paleozoic basement |

The staged formation of these fault systems divided the area of the ore field into a series of small tectonic blocks. Thus, the block structure and the system of discontinuous structures determines the structural framework of the ore field.

According to structural positions, morphological features of mineralization, their association with discontinuous structures and other geological data, the activity of northeastern transverse deep, latitudinal structures has been established. Their activity caused the displacement of tectonic blocks, which served as the main reason for the tectonic activity of intra-block structures, changes in the tension and deformation of the block. These changes are especially clearly observed along ore-controlling structures, as well as in the zones of their conjugation and intersections. The dominance of horizontal tectonic forces in the geodynamics of ore formation led to increased activity of the northeastern structures along the horizontal plane in the form of a shift. Fault movement caused the displacement of tectonic blocks. The blocks along which the Dargyztau, Asaukak, and Vysokovoltnoye deposits are confined experienced a displacement in the southwest direction. Despite the slight displacement of the blocks, it was reflected in their stress-strain state. The joint manifestation of the activity of the boundary structures of tectonic blocks, the displacement of the blocks themselves and their stress - strain determined the internal geodynamics of the blocks, where there is an update of intra-block structures and new structure formation. In addition, these processes contributed to the formation of opening cavities along ore-controlling structures, in the interface zones and them with the Daugiztau deep fault, creating structural positions favorable for the placement of endogenous gold mineralization. It was in these structural positions that the formation of the Daugiztau and Asaukak deposits took place. Their structural position is confined to a block with a wedge-shaped form formed due to the conjugation of the northeastern faults with the Daugiztau depths of the faults. The geodynamic situation of the areas of these deposits is due to the horizontal displacement of tectonic blocks. The displacement of blocks, the wedge-shaped morphology of their northern sections under the influence of regional tectonic compression forces contributed to the formation of opening cavities. And simultaneously with these processes, new separation structures were formed, complicating the internal structure of the ore-controlling structures and their fracture space, which led to the decompression of the host medium, which was one of the reasons for the arrival of ore-bearing solutions from the depths of the Earth and, subsequently, the formation of gold deposits.

## IV. CONCLUSION

The geodynamic situation of the Daugiztau ore field with gold mineralization, manifested in the Hercynian metallogenic era, is due to the regional tectonic regime, where horizontal movements dominate. Horizontal forces caused the activity (shift) of Northeastern, latitudinal ore-controlling faults, and they -tectonic blocks. These tectonic phenomena were reflected in the tension of the formation, there was a redistribution of tectonic stresses both on faults and inside tectonic blocks. Zones of local deformation of compression and tension were formed. The latter, characterized by a drop in tectonic tension, a weakening effect of tectonic, which was a favorable environment for the manifestation of gold mineralization. The geodynamic processes observed in the ore-controlling fault, tectonic blocks, contributed to the formation of cavities ajar, new structure formation, which also was a favorable environment for the formation of gold ore objects.

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## AUTHORS PROFILE

**Janibekov Bobir Omonovich**, Assistant professor Department of Geology, mineralogy and petrography, Tashkent state technical university, PhD
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: jonibekovbobur@mail.ru
Phone number: 99899813-01-30

**Turapov Mirali Kamalovich** State Enterprise "Institute of Mineral Resources" Head of the Tectonophysical Research Methods Sector, Doctor of Geological and Mineralogical Sciences, Professor, Russian Federation Academician of Natural Sciences, T.Shevchenko Street 11a, Tashkent, Uzbekistan,
E-mail: No
Phone number: +998983036075

**Akbarov Khabibulla Asatovich** Professor of the department of geology, Prospecting and exploration of mineral deposits, Academician of the Academy of Sciences of the Republic of Uzbekistan
Tashkent State Technical University, University Street 2, Tashkent, Uzbekistan, 100095
E-mail: No
Phone number: +998712469951

**Tulyaganova Nargiza Shermatovna**, Head of Department of Geology, mineralogy and petrography, Tashkent state technical university,
University Street 2, Tashkent, Uzbekistan, 100095
E-mail: nargiza.tulyaganova@mail.ru
Phone number: 99893 575-77-38

**Abdullaev Abror Khushmurotovich** Senior Lecturer, Department of Urban Roads and Streets, Tashkent Institute of Design, Construction and Maintenance of Automobile Roads
A.Temur Street, 20, Tashkent, Uzbekistan, 100060
E-mail: Abror_Abdullaev_87@mail.ru
Phone number: +998972604151