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***Research Article***

# PRECIOUS METALS FIELDS OF BUKANTAU MOUNTAINS CENTRAL PART AND CRITERIA OF THEIR VALUATION (GEOLOGICAL ASPECTS AND ORE CONTENT)

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**ABSTRACT**
The main prognostic searching criteria of blind gold ore body in the area is stratigraphic, structural and lithological. They are the most favorable for the ore localization position of the mutual combination of all factors. Local positions of the ore bodies are mainly predetermined by structural factors.

***Keywords:*** *Gold Mineralization, Metallogenic Outlook Volume of Deposits, Structure of Mountain Bukantau, Gold Deposits, Boztau-Kokpatas-Okzhetpes Trend*

## INTRODUCTION

These days around the world extensive research and development work is being carried out on mineral deposits to develop and improve methods for improving the quality of geological data, ensuring the reliability of sampling, and assessing reserves of deposits. In particular, using the example of gold deposits at the stages of prospecting and evaluating deposits, ensuring the reliability of sampling and processing samples and the quality of primary geological documentation, the use of modern geographic information systems (GIS technologies) help to improve these methodological approaches.

## MATERIALS AND METHODS

When performing dissertation research to assess the quality and reliability of exploration in the field, a set of field observations (geological routes, lithological, mineralogical and structural sections) was applied. Special attention was paid to the method of documentation of mine workings and cores of boreholes, sampling of mine workings and boreholes, preparation of samples for laboratory research. The capabilities of the mining and geological information system (GGIS) in the processes have been tested. Also used are geological and structural methods, modern high-precision analytical instruments (ICP MS, Jeol, DRON-3 mass spectrometer), methods of scientific synthesis of materials obtained under laboratory conditions, comparative analysis of research results, creation of an electronic database and 3D models developed in modern software product Micromine.

## RESULTS AND DISCUSION

Bukantau ore mining region is of the second important regions after Tamditau in Central Kyzyl-Kum concerning availability of payable ore bodies, first of all related to precious metals.
Metallogenic outlook of Kyzyl-Kum province is determined by development and frequent spatial combining along with gold ore, uran and precious metals mineralization.
Gold mineralisation of the Kyzyl-Kum aurigerous province is associated with middle depth polygenous fields of gold-quartz (Muruntau, Myutenbai, Sarmich, etc.), gold-sulfide (Кокpatas, Daugiztau, Amantaitau, Biran, etc) and gold-silver (Kosmanachi, Okzhetpas, Visokovltnoye) types.

There is also a common thing in the positions of objects in the composite stratigraphic sections of the regions expressed in the diversity of the components of lithological complexes, the presence of stratigraphic disagreements often expressed tectonically, the presence of carbonate strata at the top of the

column. All of them are characterized by the presence of a complex of rare-metal related elements (Fig. 1).

A distinctive feature of the province is its distinctive geological position - its intermediate position between two rigid arrays, heterogeneity of the upper crust where multi-cover structures are developed, the structural appearance of which is largely predetermined by the processes of crowding, as well as the duration and multiplicity of geodynamic and related processes including ore formation (Composite authors 2011).

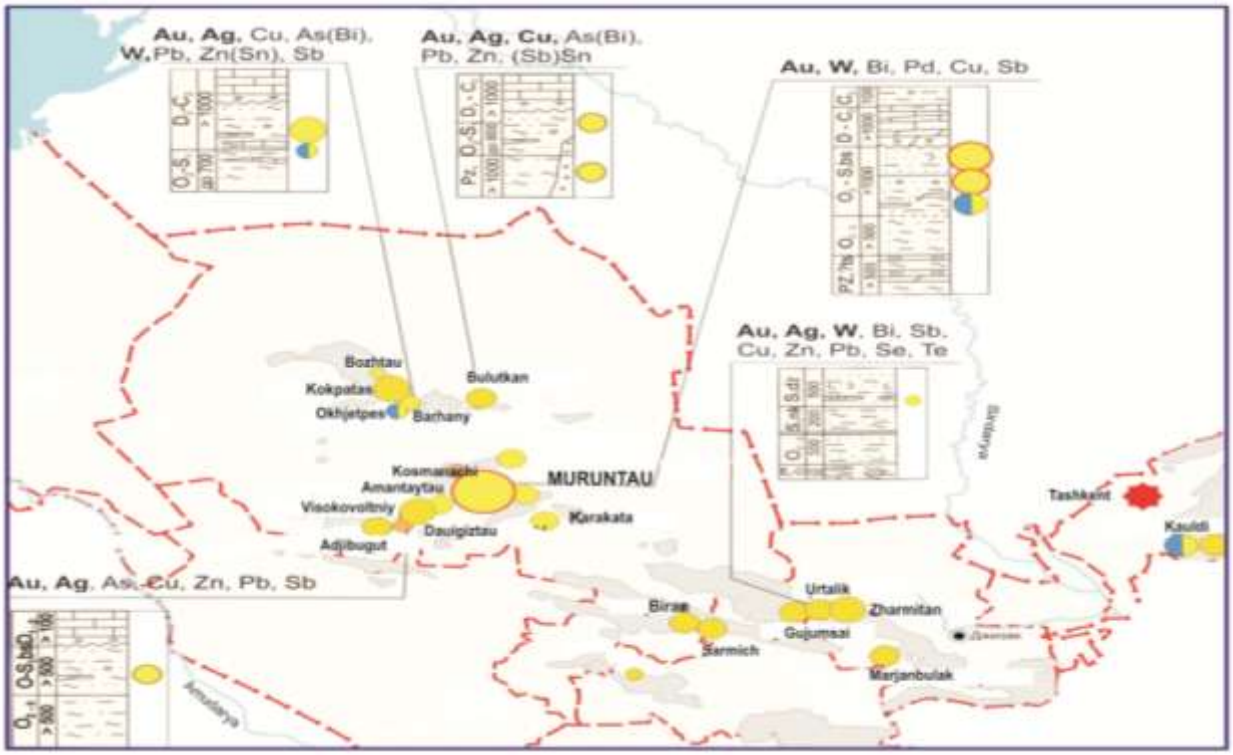



**Fig. 1. Precious metals mineralization and its occurrence in leading gold ore project sites of central Kyzyl-Kum**

structures, dyke formations have intensive development. Described structures are extended in west-north-west direction and trace zone of Kokpatas geosuture development. Separating Boxtau-Kokpatas-Okzhetpes antiform it is necessary to underline that it composes the largest gold and silver deposits of the region. Structural outlook of this diagonal zone and adjacent areas is characterized by its confinedness to zone of large overstep of Kokpatas suite ($O_{1-2}$) sediments on carbonate sediments of Devon and Carbon outstripping in antiform core. In palan it is ribbon of metaterrigenous and cherty intensively broken rocks (Turamuratov and Pirnazarov, 2007). In relation to the composition the strongly ferruginized and silicified differences represented by clay rock, silt rock and sandstone are allocated. Thrust zone complicated by multiple splits, has uneven wavy shape frequently hidden under aggradations and complicated by multitude of faults of longitude and orthographic orientation, where there are enough steep dip angles varying within $50^0$ - $80^0$ are marked.

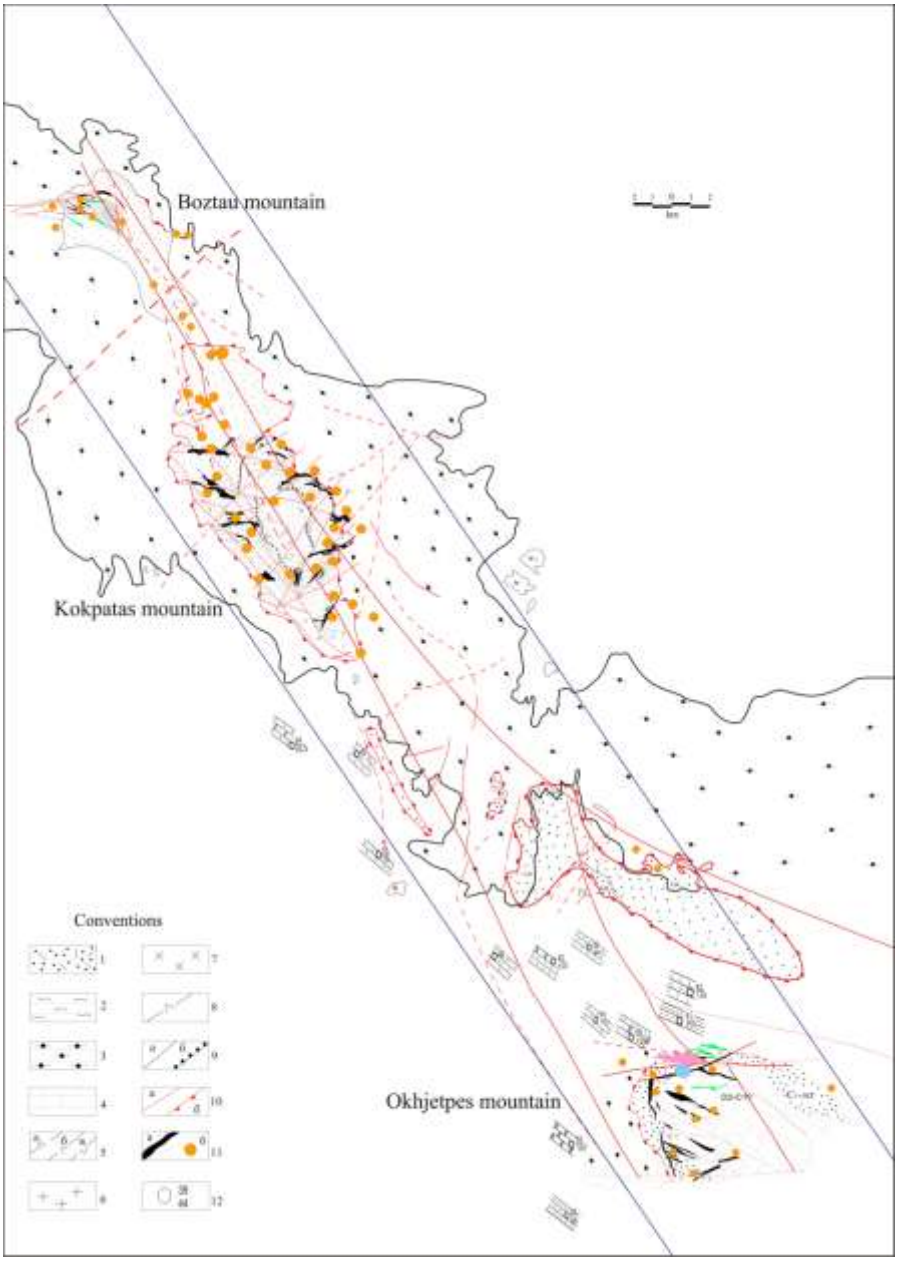



**Figure 2. Layout of structure and ore content of Bukantau mountains central part**

***Explanations to Fig..2.***

*1- Karashoho suite ($C_2$): sandstones, silt stones, sgales, tuff silt stones, tuff breccia; 2- Kokpatas suite ($R_{2-3}$): microquartzites, limestones, dolomites, shales, silt stones, sanstones; 3 - Kokpatas suite ($R_{2-3}$): cherty rocks; 4 – Djuskuduk suite ($C_1$): limestones; 5 – Sautbai gabbro-sienitet-granosienite association ($P_1$): spessartites (а),diorite porphyirites (б), kersantites and vogesites (в). Kokpatas quartz-diorite-granite association ($C_2$): 6 – quartz porphyrites; 7 - granodiorites, adamellites; 8 – Bukantau ultrabasite-gabbro-plagiogranite association ($C_2$): basites, ultrabasites; 9 – borders of stratigraphic divisions: а) conformable, б) discodrant; 10 – splits (а), oversteps (б); 11 – ore bodies (а) and ore sites (б): 12 – wells and their numbers;*

All this can witness about significant unrevealed perspectives of Kyzyl-Kum gold bearing province not only with regard to gold but also a range pf precious metals. Bukantau mountains and its ore fields are not an exclusion.

As a result of geologic exploration works during the second half of last century, significant resource base of oxidized and primary gold-sulfide ores in deposits of Bukantau mountains central part – within Kokpatas ore field serving raw material resources base of MP-3 NMEC is created. Valuation was preformed to the depth of 80-120m on average. Wide-scale geologic exploration works continue within Bozatau and Okzhetpes ore fields and adjacent areas. During recent years exploration works were started at deep horizons (up to 350m).

**Boztau, Kokpatas and Okzhetpes** ore fields represent antiforms traced as a chain in central part of Bukantau mountains. Mentioned structures are similar to each other. Devon-Carbonic formation is outstripping in Orzhetpes structural and compositional complex. Chanks are composed of volcanogenic-terrigenous formation of Karashaho structural and compositional complex. Within the cores of antiform

Main elements of folds and its parameters are determined by elements of rocks attitude, more rarely they are fixed on locality by lock and core parts of structures determined by position of sandstones intensively changed by cleavage, more rarely rocks of quartz-cherty composition. Pivots are deep to NW direction at enough gentle angles $10^0$-$30^0$.

Bukantau gold field's occurrences are related to four rock formations: gold-sulphide vein- disseminated ores, gold-(sulphide)-quartz, gold-silver and gold-skarn. Fields of gold-(sulphide)-qurtz formation can be divided into two sub-formations: low-sulfidation vein-veined zones and ore folds and low-sulfide lodes, linear stockworks and breccia.

All gold fields and occurrences in Bukantau mountains are distributed within extended interblock shear and crush zones, usually sub-conformable with enclosing thicknesses. Thus, these zones play role of ore control structures and can be compared with ore join splits. Besides shear and crush, small subjacent intrusives and dikes of marmorate composition frequently forming vein system and batches, sometimes increased number of quartz lodes and veins is marked.

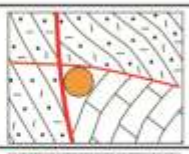
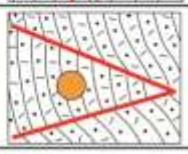
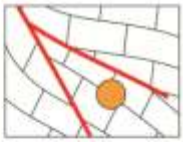
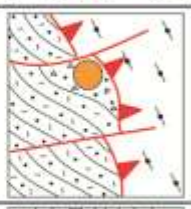
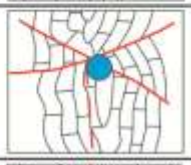
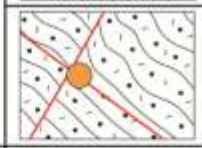
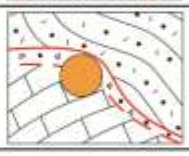
Transversal and diagonal failures and zones of failures of different order play role of ore control structures: from small influencing ore bodies and column-of-ore localization within the fields to regional trans-block ones close and at crossing with longitudinal zones where ore fields are localized (Fig. 2).

Following regularities in gold fields distribution appear:

- Spatial confinedness of the most fields to peripheral parts of carbonate core of Boztau, Kokpatas and Okzhetpes brachy-uplands.
- The tendency of mineralization to the zone of tectonically weakened contact of powerful carbonate strata with the overlapping formations of the ICS Karashakho. This is due, apparently, to the properties of the overlying rocks as a screen.
- A noticeable increase in the shielding role of overlapping terrigenous sediments by the influence of thrust structures. At the same time, in the places of approach of the thrust zone to the interformational contact, the intensity of gold mineralization increases.
- Numerous failures dividing regional structure into series of tectonic blocks different in size and shape. In antiform core and parts close to core small failures are developed characterizing by crush zones, metosomatic and vein-vained silification, dolomitization and sulphidization bearing gold ore mineralization.

Thickness of similar structures varies from 5-10m to 25-30m.

The system of longitudinal with a zone of regional Boztau-Kokpatas-Okzhetpesky direction of faults is most common. The internal constitution of structures is characterized by varying degrees of crushing, schistosity, sometimes accompanied by quartz-lode veinlet.

| Pos. № | Geologic-struktural positions of fields and ore occurrences | | Examples of prospects |
|---|---|---|---|
| I | Zone of splits crossing in main part of anticline |  | Prikontaktny, Yuzhjny, Severnoye I-II, Koskum, Kushban, Severovostochny, Zhuskuduk |
| II | Tan structures |  | Serebryany, Rudnaya zona-8, 12. |
| | |  | Zapadny-1,2, Sulfidny, Boztau-1, 2, Zhulbet, Bozdala, Vodorasdelny, Rudnaya zona-3,5,7, Oreolny-2, 5, |
| III | Underthrust positions complicated by splits |  | Karashoho, daikovy, telketau, Sainyi, Bahtli, Karatag, Vostochny, Kvartzevoye, Teronsai, Tsentralny, Pridorozhny,Bulutkan, Kyzylkashar. |
| IV | Zones of splits junction and crossing among monotonous terrigenous sediments |  | Antimonitovy |
| | |  | Barhany, Rudnaya zona 4, Rudnaya zona 6 |
| V | Zone of splits twisting (bending) |  | Okzhetpes, Djelsai, Djelsai 2, Boztau, Kaskirtau, Kaskirtau-2, Sador, Rudnaya zona 2, 7, 9. |

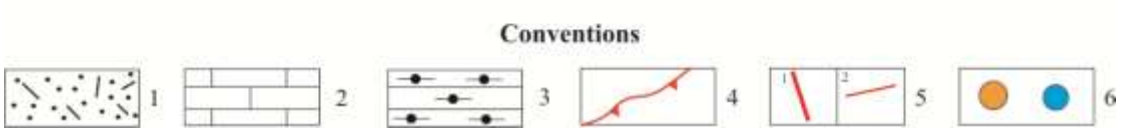



**Figure 3: Geologic-structural positions of fields and ore occurrences in Bukantau mountains central part**

***Explanations to Figure 3***

*1- Karashoho suite ($C_2$): sandstones, silt stones, shales, tuff silt stones, tuff breccia; 2-Djuskuduk suite ($C_1$): limestones; 2-Kokpatas suite ($R_{2-3}$): cherty rocks; 4- thrusts; 5-splits; 6-ore sites.*

Ore mineralization is spatially associated with:
- area main structural element – thrust zone (Boztau, Karashoho, Vostochnoye, Yuzhny, Okzhetpes, etc.);
- structures of general north-west (290-310$^0$) direction, zones of their influence – more than 35% of fields and ore occurrences.
- zones of splits of north-east (70-80$^0$) bearing or chisels, which formed with structures of submeridional or diagonal NW bearing.

Splits of north-west direction are marked fragmentarily, thickness of this zone does not exceed 3-4m. Internal structure is characterized by increased degree of catackase in the form of breccia differences, sometimes up to mylonites, frequently cemented with quartz cement.

**At the same time, the local structural factors of gold mineralization localization are as follows:**

1. Zone of splits crossing in anticline upstructure portion (Fig. 3. Position-I)
2. Tan structures (Fig. 3. Position-II)
3. Underthrust positions complicated by splits (Fig. 3. Position-III)
4. Zones of splits junction and crossing among monotonous terrigenous sediments (Fig. 3. Position-IV)
5. Zone of splits twisting (bending) (Fig. 3. Position-V).

Study of library materials of geological exploration works (deep prospecting, exploration, in-mine exploration, operational exploration) and selective field observations made by authors allow to conclude that concerning undervaluation of deep horizons of some developed fields of the Bukantau mountain's central part where due to different factors valuation and general reserves calculation were performed to depth of 80-120m. In result, data of tens of wells uncovered industrial gold concentration at deeper horizons (200-250 m, sometimes up to 350 m) remained out of view. On the most of these wells depth of ore mineralization was not delimited.

Above mentioned study gives a ground to underline that resource potential of deep horizons and gold fields flanks of Kokpatas ore field and Bukantau mountains central part as a whole are not nearly exhausted and require further investigations.

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