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Research Article

REGIONAL SPECIFIC FEATURES OF BUKANTAU MOUNTAIN STRUCTURE AND PRECIOUS METALS MINERALIZATION DISTRIBUTION

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ABSTRACT
On the basis of a comprehensive analysis and reinterpretation of the available data and our own field observations, the possibility of identifying a large regional structure in the Bukantau Mountains, more diagonal along the strike in relation to the Tien Shan structure, is substantiated. The main features of gold bearing and patterns of its manifestation in the Boztau-Kokpatas-Okzhetpesky trend are identified.

Keywords: *structural of mountain Bukantau, gold deposits, Boztau-Kokpatas-Okzhetpes trend, gold mineralization.*

INTRODUCTION

Currently, worldwide, research has been targeted on the development of criteria for forecasting mineral deposits in hidden areas, based on the study of local conditions and patterns of mineral deposits. Therefore, for the discovery of deposits, applied research to determine the location of mineral, their morphology and studying their geological and structural classification are of particular importance. The solution of these problems makes it possible to ensure the accuracy of forecasting of mineral in closed territories and contributes to the scientific specialization of the geological and structural positions localizing industrially useful minerals and assessing the industrial significance of ore objects.

MATERIALS AND METHODS

In carrying out the thesis work, various modern methods were used including field observations (geological routes, preparation of lithological, mineralogical and structural sections, sampling, geological documentation, etc.), geological and structural, modern analytical devices (ICP MS mass spectrometer, Jeol, DRON-3), methods of scientific synthesis of materials obtained in the laboratory, a comparative analysis of research results. The creation of an electronic database, 3D models developed in the environment TERM Micromine software product.

RESULTS AND DISCUSION

To carry out geological study and localization of endogenous gold mineralization in Bukantau mountains, works of Khamrabayev I.Kh., Rakhmatullayev Kh.R., Shvetsov A.D., Usmanov F.A., Tsoi R.V., Isakhodjayev B.A., Tsoi V.D., Turapov M.K., Pirnazarov M.M., Mirkhodjayev B.I., Yuldashev O.A., Dulabova N.Yu., and many other researchers were studied.

The tasks of further development and strengthening of the mineral resource base of the mining companies operating in the region, necessitate the development and substantiation of other views on ore-controlling structures aimed at identifying new areas promising for the discovery of precious metals, primarily gold.

Structural base of the area under consideration is presented by chain of brachiform carbonaceous constructions of Devon-Carbonic age extended for more than 80 km along geosuture - structural and tectonic fensters among sediments of Proterozoic flushoid formation with controlled gold mineralization in the Bukantau mountains central part (Isakhodjayev and Tangirov and Urunov 2013).

It is known that Central Kyzyl-Kum including Bukantau mountains presents fold system formed in a process of multi-cycle development from Neocryptozoic to Permian (Scherban and Tsoi et al. 1990).

The possibility of the existence of a large regional structure in the Bukantau Mountains, was emphasized earlier. Some authors presented it as a deep fault with brachiform carbonate structures of the Devonian-Carboniferous age stretched along it. Structural-tectonic erosion windows (Boztau-Kokpatas-Okzhetpes) are distributed among the deposits of the Proterozoic siliceous-carbonate rocks, with precious metals mineralization controlled by them (Isakhodjayev et.al.1981).

In Kyzyl-Kum sector of Tien Shan coverage-folded system within Southern-Bukantau structural and formational zone the Boztau-Okzhetpes graben of the Late Ordovician formation confined by the Sautbai and Turtkuduk deep faults at north-north-west 326^0 extension (Fig .1) has been selected **(**Oransky, 1984).

Within its limits, a characteristic set of volcanogenic (Karashakhskaya stratum) is determinate. Carbonate formations of the Middle Devonian and Carboniferous age in the areal occurrence, exposed in the cores of the Boztau, Kokpatas, Southbay, and Okzhetpesky antiforms, are also identified.

The internal structure and morphology of the Boztau-Okzhetpes graben should be considered by morphostructural intervals: 1) overlapped translucent (North Bukantau); 2) thrust (Southern Bukantau, North Tamdytau), 3) decaying, increased permeability zone (Southern Tamdytau, Aristantau).

Graben is a fold-rupture structure clearly delineated by faults with the development of volcanogenic, carbonate and intrusive formations and a wide range of ore mineralization, primarily of precious metals.

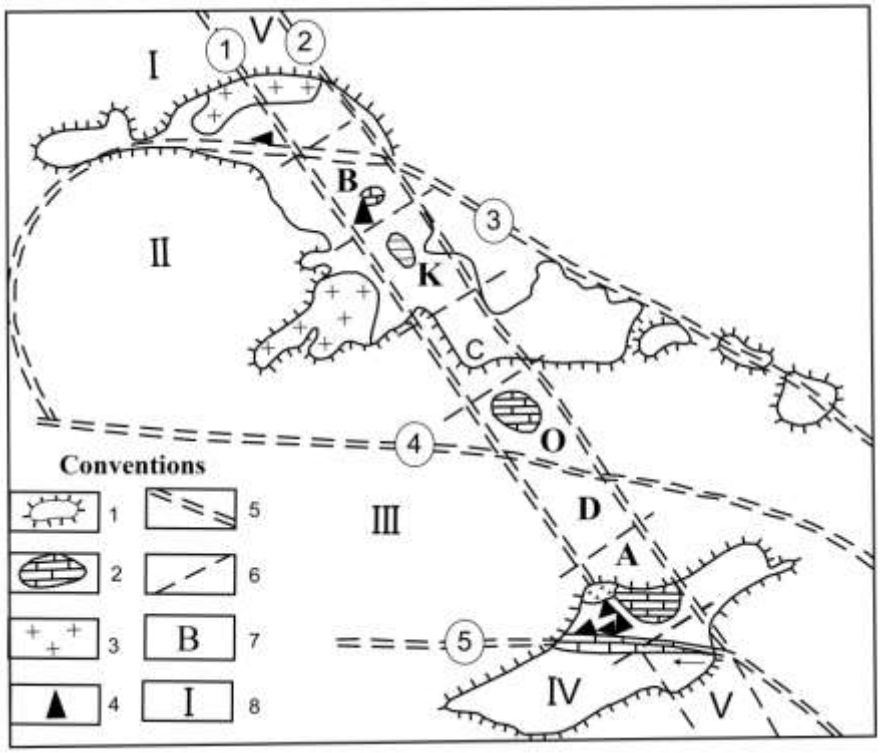

Figure 1. Position of Boztau-Okzhetpes graben in Kyzyl-Kum regional structures (by Oransky N.I., 1984)

Explanations to Fig. 1.

1- Paleozoic basement outcroppings; 2-carbonaceous formations; 3-granitoids; 4- serpentinites; 5-geosutures (figures on picture.): 1-Tutkuduk; 2-Sautbai;3-Bukantau; 4-Altintau-Pistalitau; 5-Besapan. 6-splits transverse to graben, splits of other azimuths not shown: 7-blocks in graben with carbonates antiforms: B-Boztau, K-Kokpatas, O-Okzhetpes, D-Djamankum, A-Aktau: 8- structural and formational zones: I-Northern-Bukantau, II-Southern-Bukantau, III-Tamditau, IV-Auminzatau-Beltau, V-Boztau-Okzhetpes graben.

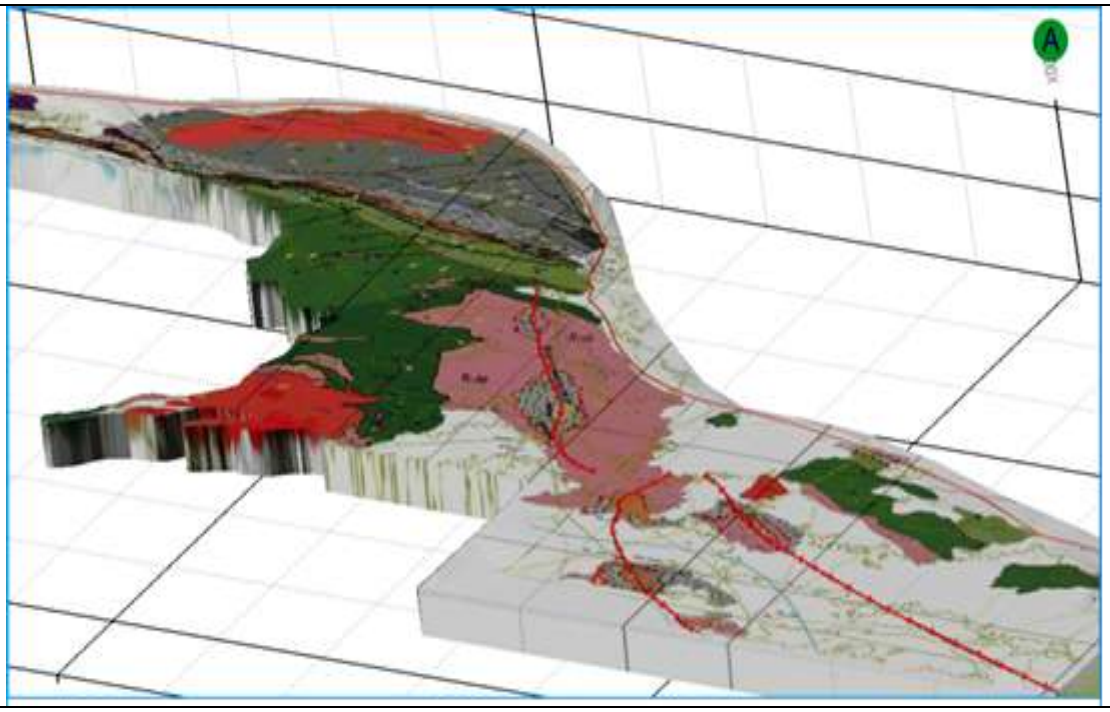

Figure 2a. Boztau-Кокpatas-Окzhetpes trend (BKOT) according to data of geodynamic [A investigations

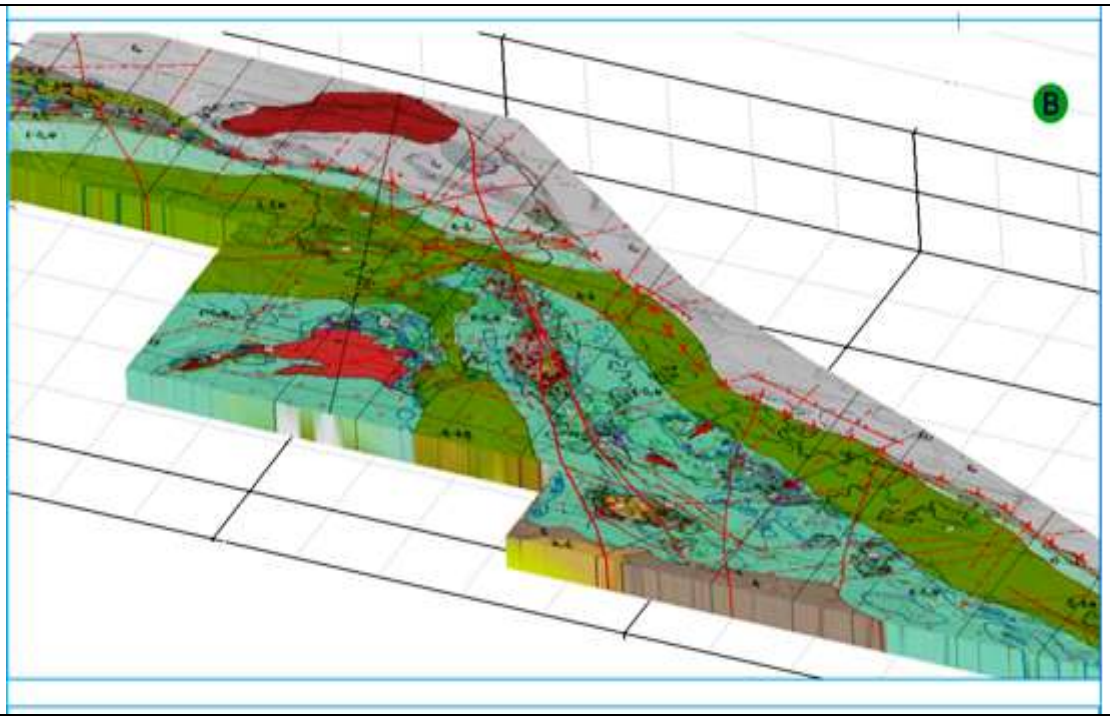

Figure 2b. Boztau-Кокpatas-Окzhetpes trend (BKOT) according to data of geologic-geophysical [B], investigations

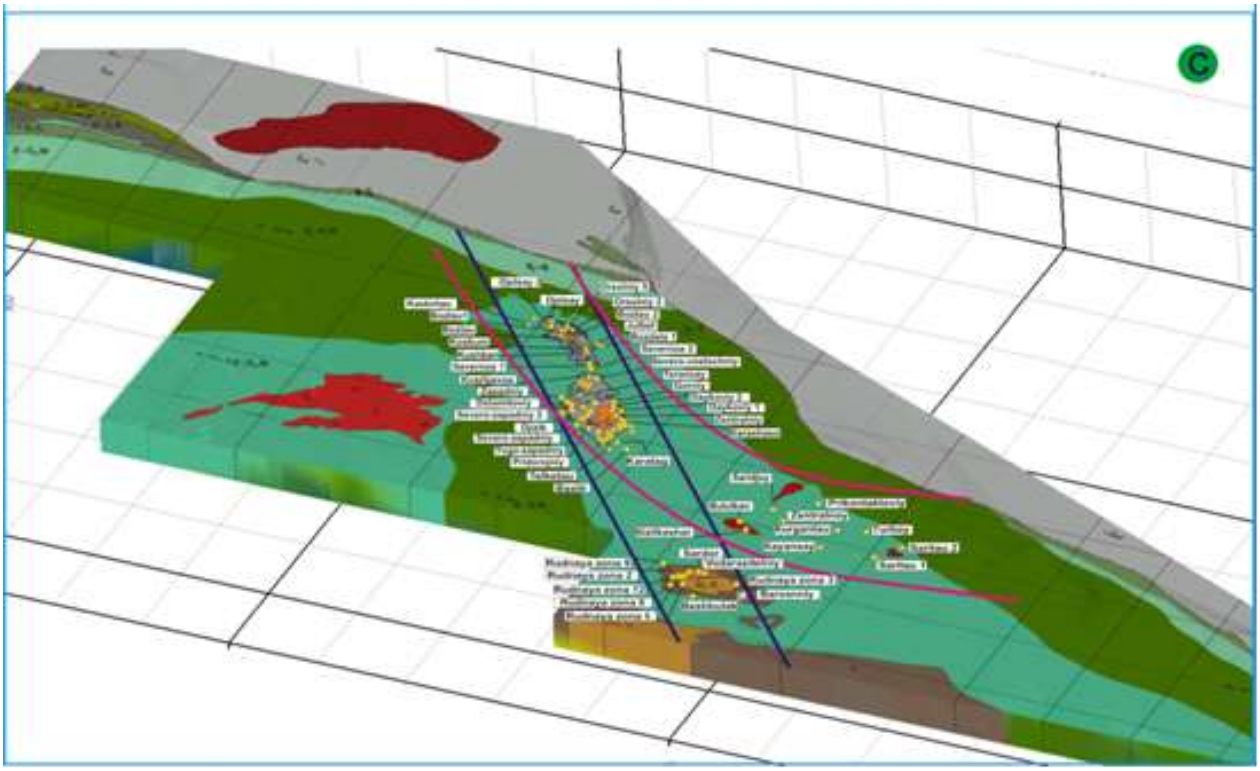

Figure 2c: Boztau-Кокpatas-Окzhetpes trend (BKOT) according to data of metallogenic [C] investigations

When studying the regional regularities of endogenous mineralization distribution of an area the authors of the article used the possibilities of trend analysis, which in geology is used to identify the regional and local components of the studied characteristics. This approach is widely used in world practice. Thus, the large gold deposits of the Karlin group in the state of Nevada (Basin and Hrebtov Province) are confined to a nearly meridional belt at an extension of about 1000 km where gold-arsenide deposits are located in a sub-thrust zone.

Other overseas fields are in similar situations, for example: carbon-bearing and silty-shale rocks of late Proterozoic of Suhoi Log field (Russia) is contorted in anticline fold. Metallizing is confined to cleavage fractures of thick schistose zone (up to 150m), which is formed along over fold apex (Burak *et al.*, 1997). Within this regional schistosity zone, two similar fields and many points of mineralization are located. Vasilkov field (Kazakhstan) is also confined to thick schistose zone of northern-east bearing. It stretches for many tens of kilometers and on its continuation there are a number of significant gold occurrences (Pivenstein *et al.*, 1969).

Kumtor field (Kyrgyzstan) formation is connected with complex and polygenous combinations of sedimentary and volcanogenic-hydrothermal processes in rifting conditions and later at subduction-collision stage economic mineralization is formed. According to Genesis, at one time AD Shcheglov proposed to call this type of deposits as sedimentary-volcanogenic-hydrothermal-metamorphic (Scheglov 1987).

Authors carried out complex investigations and analysis of geological-survey works (Bukharin, *et al.*, 1990) mineral fields location (Mikhailov, 2004), space images identification (Glukh, 2008), geological and geodynamical conversion (Mirkamalov, by works of 2012) and others. This was done for the possibility of large regional structure existence – the trend detected along the Boztau Mountains through

Kokpatas to Okzhetpes uplands by 6-8km wide and in 320^0 extension with carbonaceous rocks outcropping in antiform structures – Boztau, Kokpatas, Sautbai and Okzhetpes. (Fig.2)

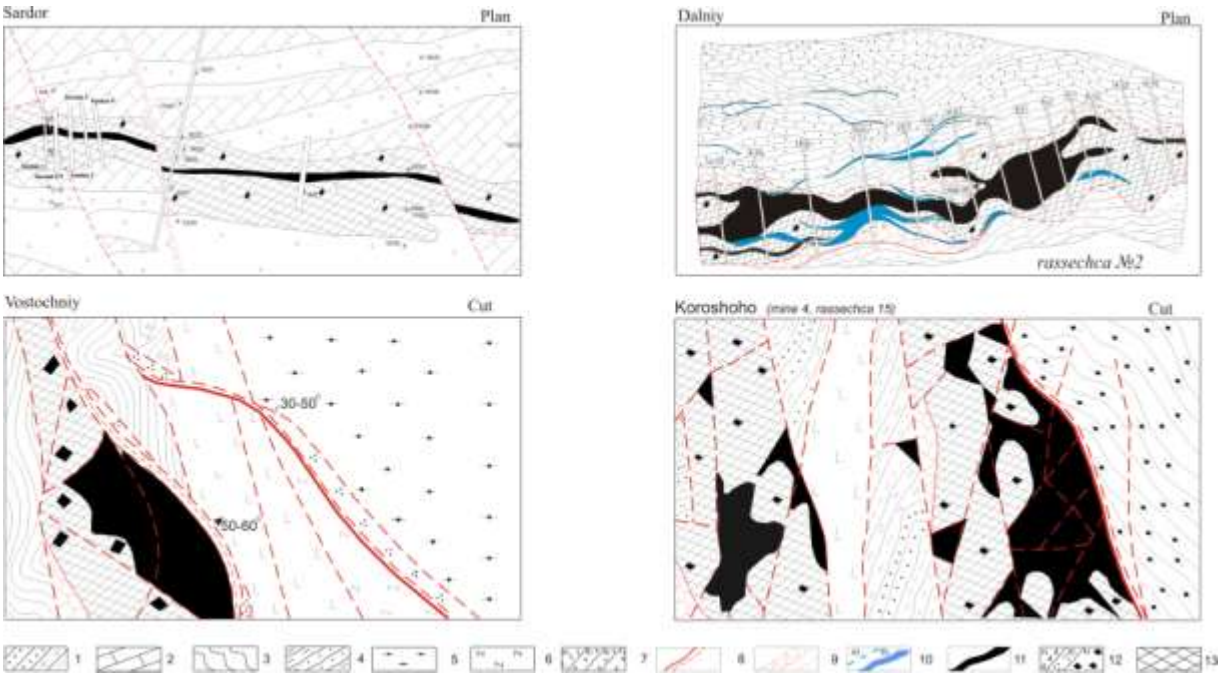

Figure 3: Episodes of mineralized rocks bodies and ore and ore bodies development positions

Explanations to Figure 3.
1 - interdigitation of carbon-bearing-chloritic and carbon-bearing-cherty shale rocks, silty rocks with sandstones and carbon-bearing shale rocks intercalation; 2 - heavy-bedded limestones; 3 - argillaceous slates, silty rocks; 4 - tuffaceous sandstones, сланцы argillaceous, cherty slates, etc.; 5 - silicium, siliceous schists, etc.; 6 – irestones and similar rocks; 7 - minor intrusions:
а) lamprophyres; б) granodiorite-porphyry; в) diorite porphyry; г) syenite-diorite porphyry; 8 - overthrust plane; 9 - tectonic dislocations: zones of crush; 10 - quartzitic formations:
а) veins; б) lodes; 11 – ore body; 12 - а) silicification; б) anthracolithization; в) bunchy sulphide mineralization; 13 – hydrothermal changes: (silicification, carbonatization, incarbonisation) among Karashakh shale rocks.

According to the data of various authors (Abduazimova Z.M., Mirkamalov R.Kh. 2012), the geologic structure of the described area includes terrigenous and siliceous-terrigenous-carbonate formations of the Kokpatas suite, carbonate deposits of the Okzhetses, Boztau and East Sardar formations and volcanic-sedimentary formations constituting the basis of the Middle Paleozoic accretionary complex of island-arc formations of the Karashakh series. Magmatic rocks form Kokpatas monzonite-granodiorite and Saritau trondhjemite-adamelite complexes. According to (Golovko and Divayev, 2007) in the center of Kokpatas uplands there are outcroppings of Lamproite swarm rocks (Isakhodjayev, 1981).

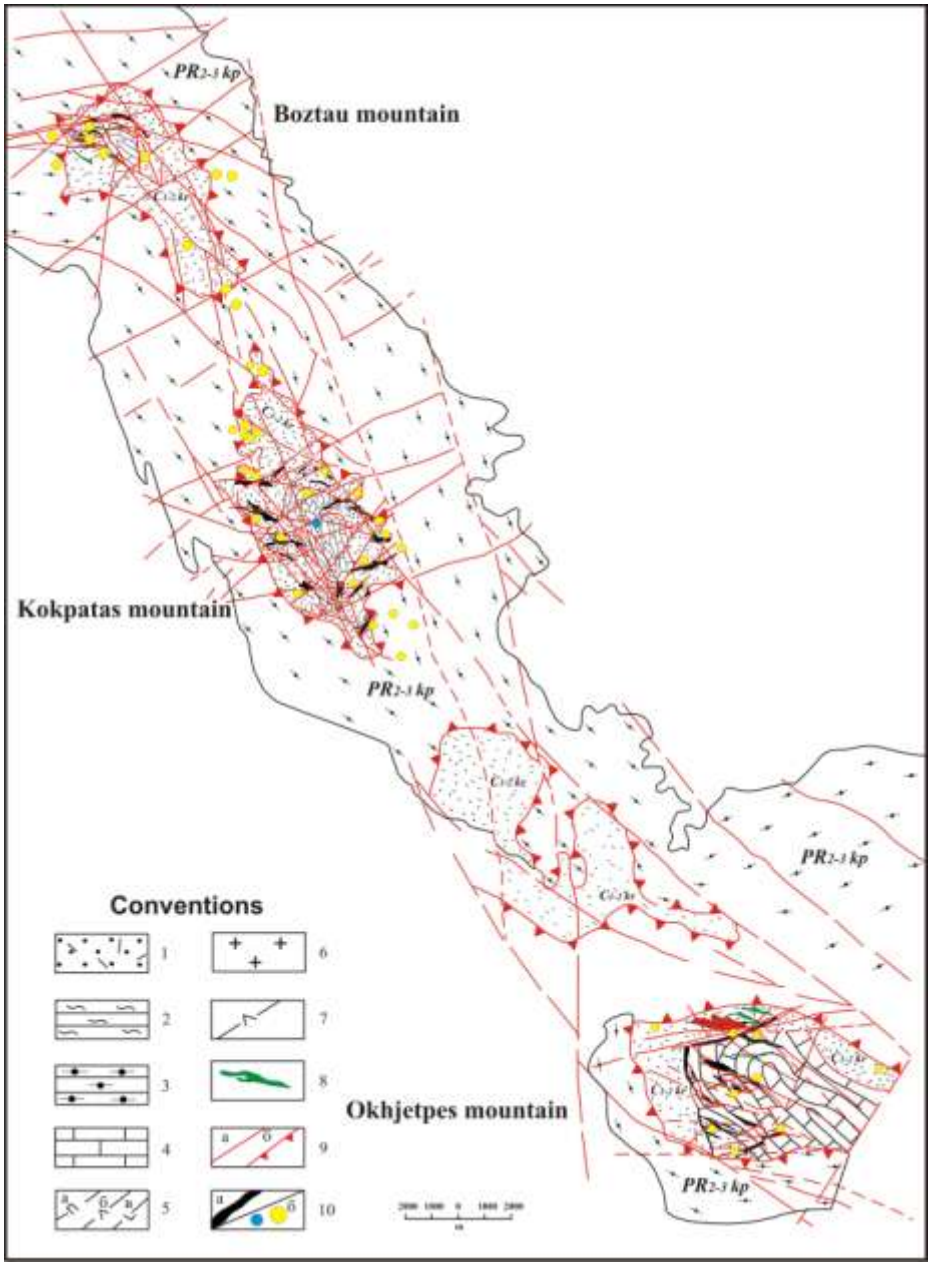

Fig. 4. Layout of Boztau-Kokpatas-Okzhetpes trend zone structure and ore content

Explanations to Fig. 4.

1- Karashakh suite (C2):sandstones, silty rocks, tuff siltstones, tuff breccia; 2- Kokpatas suite (R2-3): micro quartz rocks, limestoines, dolomites, shale rocks, silt rocks, sandstones; 3 - Kokpatas suite (R2-3): cherty grounds; 4 – Djuzkuduk suite (C1): limestones; 5 - Sautbai gabbro-syenit-granosyenit complex (P1): spessartites (а), diorite porphyry (б), kersantites and vogesites (в). Kokpatas quartz-diorite-granite complex (C2): 6 - quartz porphyry; 7 - granodiorites, adamellites; 8 - Bukantau ultrabasit-gabbro-plagiogrenite complex (C2): basic rocks, ultrabasites; 9 - splits (а), overstep (б); 10 – ore bodies (а), ore sites (б).

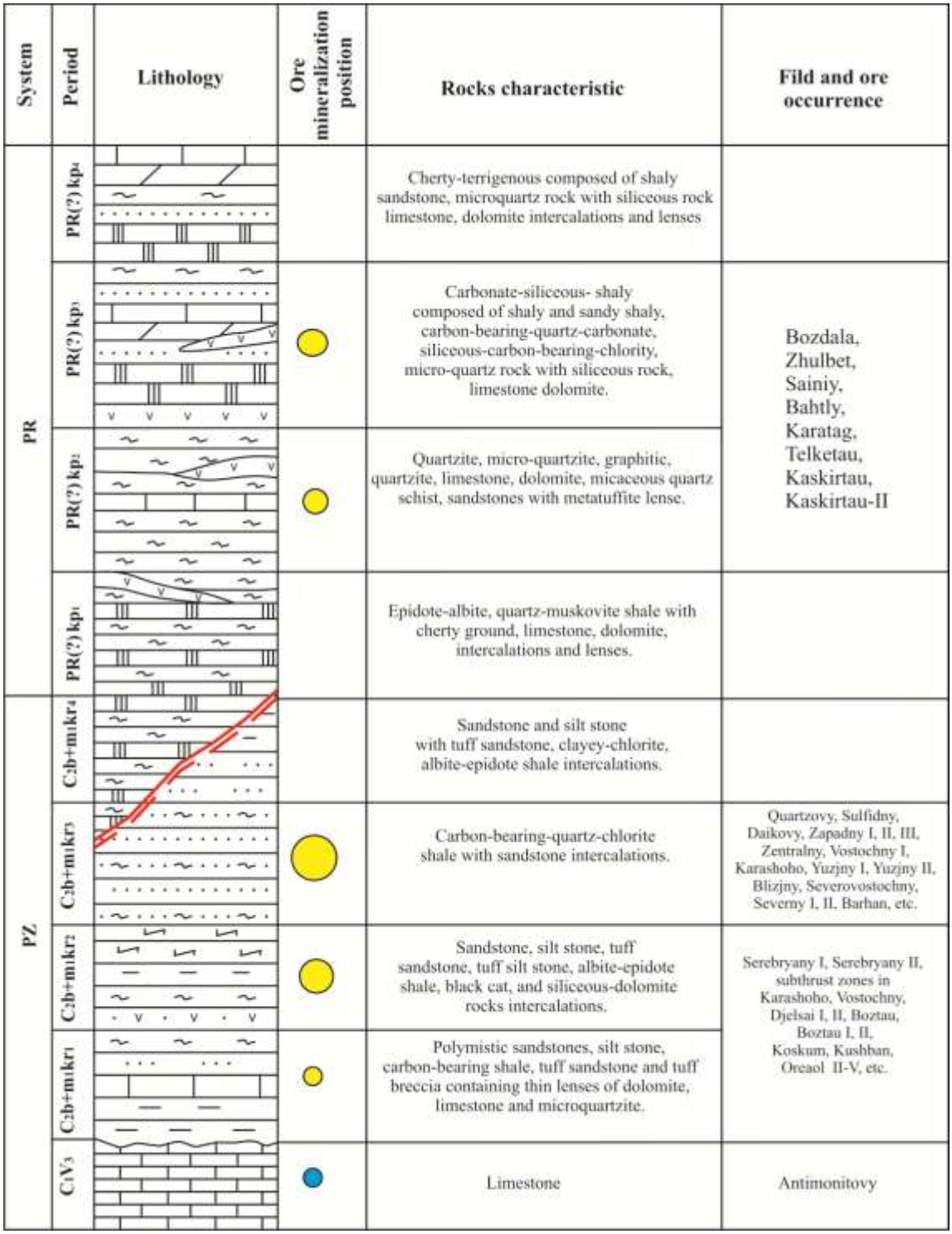

Figure 5: Key positions of gold mineralization in BKOT rock section

In structural geometry each upland has enough complicated aspects. Main orogenesis of NW orientation with main axes of 290^0-300^0 in azimuth is presented by a system of linear strongly compressed folds of carinate shape.

Folds parameters and main elements are determined by rocks occurrence elements, more seldom they are fixed at locality by articulates and nuclear parts of structures determined by position of sandstones with intensive cleavage, more seldom – by quartziferous-cherty composition. Apex downwarping to NW direction under enough gentle angles of 10^0-30^0.

Multiple faults divide BKOT into the series of tectonic blocks different in size and shape. In the cores and near the cores of antiforms small faults are developed characterized by crushed zones, metasomatic and lode-veined silicification, dolomitisation and sulphidization, frequently bearing gold mineralization. Such structural competence is from 5-10 m to 25-30 m. Figure 3 demonstrates episodes of manifestations of marked faults characteristic of the main deposits of the BKOT zone.

System of longitudinal disjunctive dislocation is most abundant. This fact consideration jointly with other also supported opinion about possibility of BKOT existence, which is presented by multitude linearly extended, weakly waved structures of the same direction with main rocks orogenesis and bearing (bearing azimuth 280^0-310^0). Split pitch in SSW direction under angle of 65^0 - 85^0. Zone competence varies from 3.5 m to 7.0 m. Internal structure is characterized by different degree of crushing, schistosity, sometimes is accompanied with quartzitic veined veinlet.

Splits of northern-west direction (bearing azimuth 330^0-350^0) form fragmentarily separate structures and plot on mainly in the eastern part of regional structure. This system splits competence does not exceed 3-4 m. Internal structure is characterized by raised degree of undulose in form of breccia variations, sometimes up to mylonites, frequently cemented with carbonaceous or quartz cement. (Fig. 4)

Separated regional structure is distinctly marked by the following elements:

- Availability of extended faults and tectonic dislocations of various order and appearance but mainly in rocks of Middle Paleozoic accretionary complex;
- Availability along this zone of chains of brachiform carbon-bearing build-up of Devonian-Carbonic period presenting structural-tectonic fensters among sediments of Proterozoic Kokpatas suite and flysch-olystostromic Karashakh thickness;
- Confoundedness to this structure are significant majority of known ore objects. Trend width is conditionally accepted within 6-8 km under total length along the strike more than 70 km and can have extension to southeast. In this trend zone 70 from 86 known in Southern Bukantau fields and ore occurrence of gold, silver and antimony are localized that constitutes more than 80% of known original occurrences [Fig. 2, C]. Karashakh diatreme bearing diamond mineralization is located. Peculiarities of field's spatial distribution in BKOT zone are demonstrated on Fig.5.
- Materials of geologic-geodynamic [Fig. 2, A], geologic-geophysical and geochemical investigations [Fig. 2, B], metallogenic generalizations [Fig. 2, C] are observed.

3D simulation of specific fields in BKOT zone allows express opinions of geologic-methodological nature concerning geologic generalization authenticity enough steadily. But authors think that they are materials for independent papers.

Speaking about possibility of BKOT separation, authors cannot confirm existence of any extended single structural or other control elements. But it is evident that BKOT is a consequence of geodynamic development and response of long lasting deep penetrating processes of accretion complexes during collision and post-collision stages of the Late Paleozoic.

On the basis of above mentioned work the following can be stated:

1. In the Bukantau Mountains, a large regional structure, more diagonal along a relatively common Tien Shan area (BKOT) with a stretch of about 320^0 and a width of 6-8 km, can be assumed. The most precise feature of it is the chain of brachiform uplands of the Devonian-Carboniferous age among the sediments of the more ancient rocks of the Kokpatas suite and the chaotic formations of the Karashakh thickness.

2. In BKOT zone more than 80% of known important fields and ore occurrence of gold, silver, antimony as well as field of diamonds – Karashoho are localized.
3. It is evident that further investigations of the valley region shall be needed in coordination with BKOT zone and work activation concerning perspective of its buried parts.

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