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Research Article

DISTRIBUTION OF ELEMENTS IN ORE AND WALLROCK AREA OF GOLD RARE METAL DEPOSITS AND IT SIGNIFICANCE FOR PREDICTION

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ABSTRACT
Based on the statistical evaluation of analytical data of elements distribution in the wallrock and ores it is identified as geochemical criteria for prospecting gold-rare-metal mineralization and also provided their typification.

Keywords: *Gold-Rare-Metal Ores, Distribution of Elements, Ore, Wallrock, Intensity of Accumulation of Elements, Correlation, Prediction Criteria*

INTRODUCTION
Geochemical studies are one of the efficient methods in the search for mineral deposits, as halos of elements scattering in nature are more large-scale and far exceed the areal limits of ore bodies, with which they are associated (Koneev, 2009). In this paper, based on the statistical evaluation of analytical data it is revealed the most important geochemical criteria for gold-rare-metal mineralization prospecting in area under consideration.

MATERIALS AND METHODS
Methods
The contents of elements were determined using quantitative mass spectrometric analysis by inductively coupled plasma instrument ICP MS 7500 (Agilent Technologies, Japan), in the Central Laboratory of the State Geology Committee of Uzbekistan.
Statistically the following parameters of elements distribution were established: average content of elements and determination of their degree of concentration relatively to abundance ratio of element in the earth's crust; definition of the intensity of the geochemical series of elements accumulation in the ore; identification of the nature of the relationship in the distribution of the main elements; graphical analysis of the elements distribution.
Geological Structure of the Area and Ore Fields
The study area is located within the South Bukantau structural-formational zone of the South Tien Shan orogenic belt, "... formed as a result of the subduction of the oceanic crust of the Turkestan paleoocean under the Kazakhstan-Kyrgyz continent and its subsequent collision with the Karakum- Tarim continent» (Yakubchuk *et al.*, 2005; Goldfarb *et al.*, 2013; Seltmann *et al.*, 2011). In structural terms, it is confined to the nuclear part of Turbay anticline, which is composed by carboniferous volcanogenic-sedimentary strata of Kokpatas Formation (PR_2 kp), which are represented by heavily dislocated folded basement (Karabaev, 1990; Pirnazarov *et al.*, 2012).
To study the nature of the distribution of the most important elements in the near ore space we analyzed data of boreholes material on the flanks of granitoid stocks, in the marginal parts of which were found the most interesting, industrially ore bodies. The results show that the values of the average contents of the elements are changing in the area (Table 1). Approaching to the granitoid the contents of W, Au, Bi, and Te is increasing more intense (correlation coefficient is + 0.4-0.5) than the other elements, which in turn, affects the contrast of their halos. Distribution of copper and zinc are less dependent from the distance of the intrusion contact.
The values of the pair correlation of elements in the near ore space changes in relation to the contact of the intrusive body (Figure 1).

Table 1: Average Content of Elements in the Near Ore Space

Distance from Intrusion Contact	Number of Samples	Average Content of Elements by Interval (g/t)					
		W	Mo	Sn	Cu	Bi	Au
By all interval	273	190	43	23	11	8,4	0,4
up to 300-350 m	56	8	39	24	13	1,0	0,2
up to 200-250 m	91	55	45	25	10	3	0,5
up to 80-100 m (Volcanogenic sedimentary)	96	240	40	54	9	10	1,1
Granodiorite porphyry	30	100	38	10	7	5	0,4

Interrelation of elements at a distance are essentially negative or absent (Au-W-Mo = -0,21-0,35; W-Sn = -0,26; Au-Mo, Au-Sn = -0,15 and -0.31) due to spatial (also temporary) disconnection of various paragenesis of ore minerals at a distance from the intrusion. There are positive correlations of Cu-Zn (+0,63), Au-Cu (+0,34), Au- Zn (+0,28) and Au-Ag-Sb - on the surface.

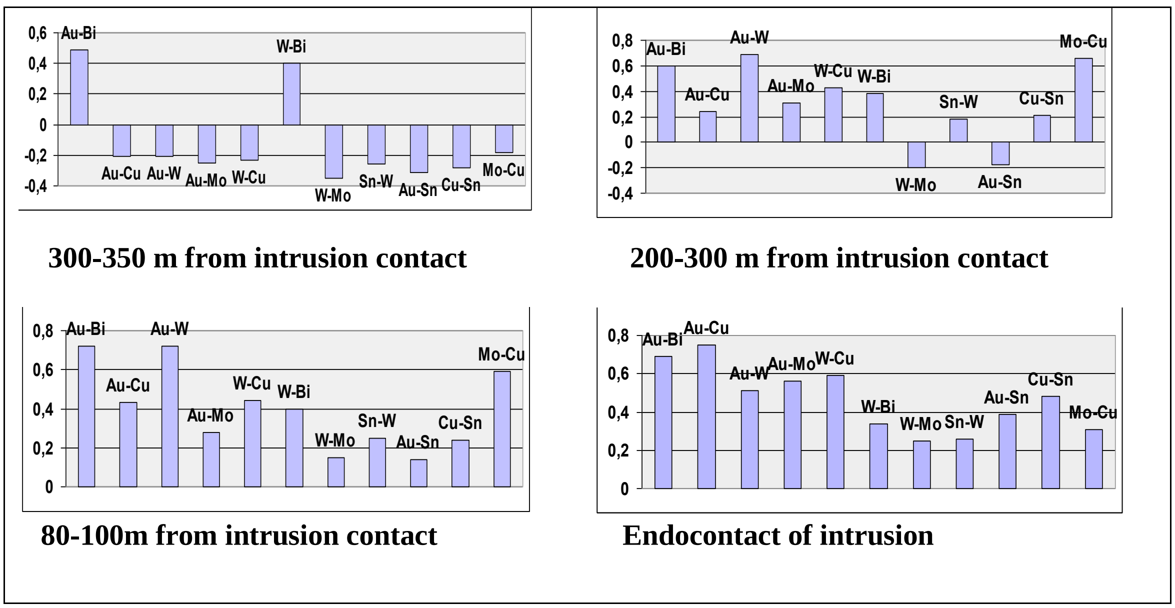

Figure 1: Change of Correlations of Elements at Different Distances from the Contact of the Intrusive Body

As getting close to the exo and endo-contact part of the granitoid rocks, where the ore bodies are located, negative connection of elements are reduced and transformed into positive. Strong positive associations Au are characteristic with W (0,72), Bi (0,71), Te (0,69) Mo (0,57). Most combined form of main elements halos related to the imposition of different mineralization stages (single postmagmatic process) in the space, as a result of ore body formation.

The study of the distribution character of elements in ores identified geochemical range of intensity of elements accumulation (Table 2): Te -Bi -Au -Se -As -Ag -Sb -W- Mo- Sn-Cu-Zn-Pb. The degree of accumulation of Te and Bi are very high - 5461 and 1154, respectively. Correlation links of the main and accompanying elements in ores presented in Figure 2. The elements forming the positive connection with gold by intensity are divided into the following groups: Au-Te-Bi (0,93); Au-As (0,70); Au-Ag-Se-Cu-Zn-Pb (0,4-06); Au-W (0,23); Au-Sb (0,1).

Table 2: Average Content and Degree of Concentration of Main Elements of Gold-Rare-Metal Ores (ISP-Analysis)

46 samples	**Cu**	**Zn**	**As**	**Se**	**Te**	**W**	**Mo**	**Sn**	**Sb**	**Ag**	**Au**	**Bi**
Average by object (A)	244	150	159	9,4	5,5	45	35,8	26	9,1	3,76	0,80	196
Clarke (B)	55	70	2	0,1	0,001	1,5	1,5	2,0	0,2	0,07	0,004	0,17
A/B	4,4	2	89	188	5461	30	24	13	45	54	201	1154

Geochemical Series of Intensity of Elements Accumulation:Te -Bi -Au -Se -As -Ag -Sb -W- Mo- Sn- Cu- Zn- Pb

Correlation Relationship of Elements

	Pb	**Cu**	**Zn**	**As**	**Se**	**Te**	**W**	**Mo**	**Sn**	**Sb**	**Ag**	**Au**	**Bi**
Pb		0,5	0,1	0,6	0,3	0,5	-0,3	-0,2	0,3	-0,3	-0,1	0,6	0,45
Cu	0,5		0,1	0,5	0,7	0,6	-0,1	0,1	0,0	0,1	-0,1	0,6	0,6
Zn	0,1	0,1		0,5	0,1	0,5	-0,1	0,0	0,7	0,2	0,6	0,4	0,5
As	0,6	0,5	0,5		0,6	0,7	-0,1	-0,2	0,5	0,1	0,3	0,7	0,7
Se	0,3	0,7	0,1	0,6		0,7	0,03	0,03	0,3	0,4	0,2	0,5	0,6
Te	0,5	0,6	0,5	0,7	0,6		-0,3	-0,1	0,5	0,3	0,3	0,9	0,99
W	-0,3	0,0	0,1	0,0	0,0	-0,3		0,6	-0,1	0,1	0,0	0,23	-0,3
Mo	-0,2	0,1	0,0	0,1	0,0	-0,2	0,6		-0,1	0,2	0,1	-0,3	-0,2
Sn	0,3	0,0	0,7	0,5	0,3	0,5	-0,1	-0,1		0,1	0,2	0,4	0,5
Sb	-0,4	0,1	0,2	0,1	0,4	0,3	0,0	0,2	0,1		0,7	0,1	0,3
Ag	-0,1	0,1	0,6	0,3	0,2	0,3	0,0	0,1	0,2	0,7		0,2	0,3
Au	0,56	0,6	0,4	0,71	0,5	0,93	0,23	-0,3	0,4	0,1	0,4		0,91
Bi	0,45	0,6	0,5	0,7	0,6	0,99	-0,3	-0,2	0,5	0,3	0,3	0,9	

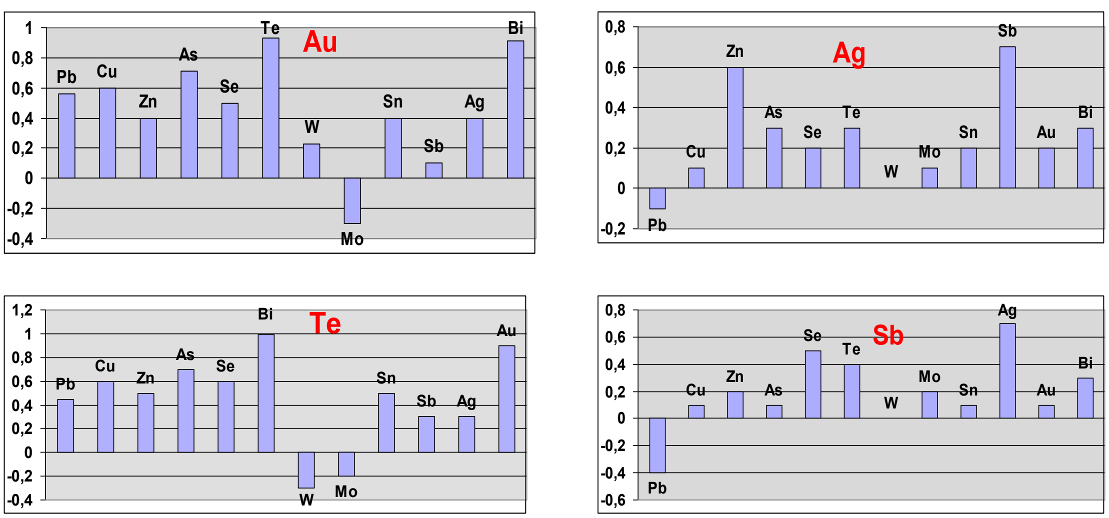

Figure 2: Correlation of Most Important Elements in the Ores of Gold and Rare Metal Deposits

This indicates that gold mineralization in these deposits is connected with manifestation of Au-rare-metal, of Au-Bi- telluride, of Au-pyrite-arsenopyrite, of Au-silver-selenide-polysulfide, of Au-antimony associations that make up the various ratios of gold and gold- rare metal ores of Central Kyzyl Kum (Koneev *et al.*, 2009). This sequence of ore formation is confirmed by mineralogical studies (Karabaev, 2015). The main part in the overall balance of the gold mineralization of the studied deposits comprise Au-Bi-Te and Au-As, endogenous types of gold mineralization. The value of the low-temperature Au-Sb associations in ore bodies in near-contact of the intrusion is negligible.

Ag is forming strong positive link with Zn, Sb (0,6-0,7), which indicates the formation of a silver mineralization in connection with later sulfide - sulphosalt associations of mineralization. Noteworthy link in paired Te-Bi (+ 0,99), which is registered rarely.

Conclusion

In the gold and rare metal deposits of the Eastern Bukantau the intensity of the most important accumulation of ore elements (Au, W, Bi) are directly dependent on the distance from the contact of the intrusion, which indicates a genetic link of mineralization with granitoid magmatism.

In these deposits are manifested Au-rare-metal, Au-Bi- telluride, Au-pyrite-arsenopyrite, Au-silver-selenide-polysulfide, Au-Sb ore types. The overall balance of the gold mineralization of the main part consists of Au-Te and Au-As type.

The revealed features of the distribution of elements suggests that in the search for hidden gold and rare metal mineralization are effective geochemical methods with an emphasis on the distribution of W, Bi, Te, Se, As, Ag, and Sb. With halos complexes of the first associated industrial mineralization.

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