International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2019 Vol. 9 (3) September-December, pp. 90-94/Karabaev et al.
Research Article

GEOCHEMICAL FEATURES OF ORES AND HOST ROCKS OF GOLD ORE OBJECTS OF THE CENTRAL KYZYLKUM

***Mamatkhon Karabaev[1], Elmurod Amirov[1], Alisher Djurabayev[1], Aziz Orolov[1], Janiev Khurshid[2], Rustam Sadirov[1]**
[1]Institute of Geology & Geophysics, Tashkent
[2]Kyzylkum Geology, Uzbekistan
**Author for Correspondence*

ABSTRACT
This paper highlights the possibility of using the data processing results on the distribution pattern of the main ore elements in rocks to identify ore formation conditions and highlight search and evaluation criteria using gold ore objects (gold-rare-metal, gold ore and silver-gold ore) of the Central Kyzylkum, which differ in features of the formation and scale of mineralization. It was established that gold mineralization in Central Kyzylkum connected to the manifestation of post-magmatic processes, regardless of the composition and type of rocks, which should serve as the basis for forecasting researchs.

Keywords: *Central Kyzylkum, Rock Varieties, Ore types, Granitoid Magmatism, Gold Mineralization, Formation Conditions, Distribution of Elements, Endogenous and Exogenous Mineralization, Forecast and Search Criteria*

INTRODUCTION
The using of geochemical data in geological surveys, along with theoretical developments is related to the genetic issues, which allows us to solve the most important problems of prospecting work – the determining of the prospects for mineralization in space, since the features of the concentration of elements, due to the conditions of their formation, carry important information about the nature of the ore-forming system and can be used as search terms (Karabayev, 2004; Koneyev and Halmatov, 2013).

MATERIALS AND METHODS
Methods
To solve the problems, the results of more than 6,200 determinations of the main and related elements were statistically processed using the data of quantitative analysis methods - mass spectrometric (ISP MS 7500 Series), atomic absorption (AAS-3300 Perkin Elmar) in the Central Laboratory and X-ray electron microscope Superprobe JXA-8800R (Jeol, Japan) at the Institute of Geology and Geophysics of the State Committee on Geology and Mineral Resources of the Republic of Uzbekistan.

Geological Structure of the Area and Ore Fields
The Kyzylkum mining region is located in the South Tien Shan orogenetic belt, which is a regional zone of contortion, shale and crushing of the sub-latitudinal north-western strike (Moon, 1996; Goldfarb, Ryan and Gregory, 2013; Groves, Goldfarb and Gebre-Mariam 1998; Yakubchuk, Shatov and Kirwin, 2005). The host rocks at the studied objects are represented by volcanic-sedimentary sequence of the Kokpatassky (Bukantau), Besapan (Auminzatau) and Taushan (Kuldzhuktau) formations - shales, siltstones, sandstones with interlayers of siliceous, carbonate formations metamorphosed into chlorite-sericitic granite-green facies intrusions. Gold mineralization, represented by gold-rare-metal (Muruntau, Sarytau, Sautbay mines), actually gold (Kokpatas, Daugiztau, Taushan) and silver-gold (Vysokovoltnoe, Kosmanachi, Okzhetpes) types that are spatially and genetically associated with intrusive magmatism, S3-P1 in age. The formation of deposits occurred in the period of 310-220 million years, but the period of maximum ore deposition falls on the 280-290 million year interval, i.e. to the C3-P1 border (Seltman et al, 2014), which confirms the conclusions about a certain synchronism of gold mineralization and granitoid magmatism (Goldfarb, Ryan and Gregory, 2013). It has been established that gold

mineralization is superimposed on sedimentary-volcanogenic and igneous rocks of various compositions, from Precambrian to Upper Carboniferous - Lower Permian, and ore formation lasted about 60-70 Ma (Karabayev, 2004; Koneyev, Halmatov and Moon, 2009). The main element of the localization of gold mineralization is steeply dipping faults of sub-latitudinal strike, represented by zones of crushing, crushing and accompanied by the introduction of dikes of various compositions, as well as ore-bearing changes in the birch-leaf-limestone formation (Karabayev, 2004).

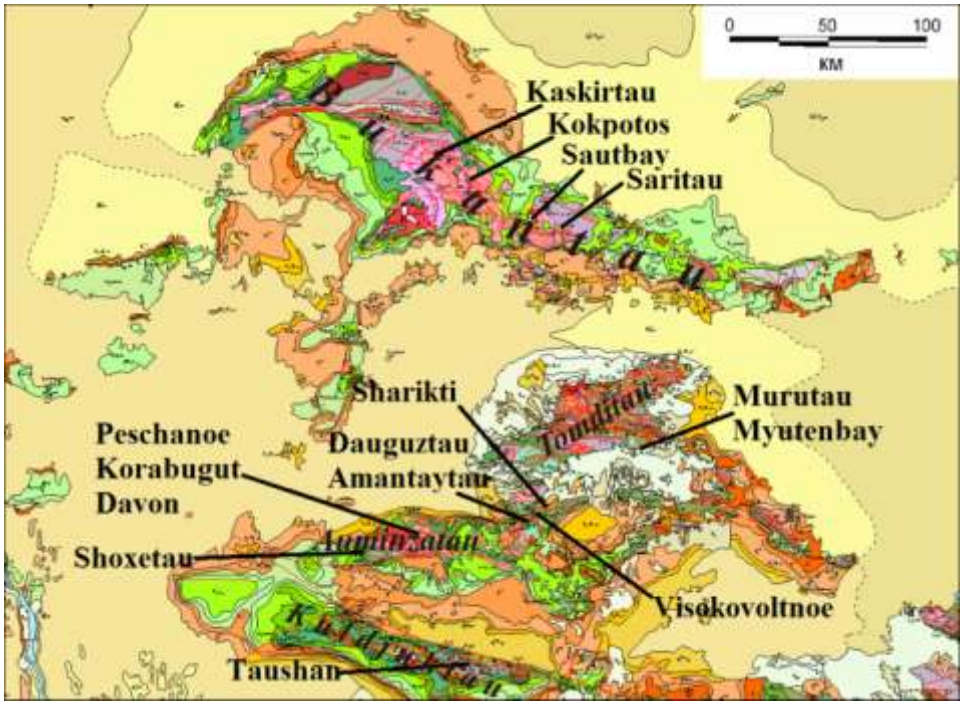

Figure 1: The layout of the studied objects of the Central Kyzylkum

RESULTS AND DISCUSSION

1. *The distribution of elements in various types of rocks containing gold mineralization.* In order to identify the relationship of the element contents with the conditions of rock formation, we performed statistical processing of geochemical data for individual samples, reflecting rocks of various genesis (regionally-metamorphosed, contact-metamorphic and metasomatic) and composition (schists, sandstones, carbonates, granitoids, diorite-porphyrites and lamprophyres) of rare-metal gold, gold ore and silver-gold ore deposits of the Central Kyzylkum, where a wide range of different types of rocks and ores is manifested (Karabayev, 2004; Koneyev and Halmatov, 2013; Koneyev, Halmatov and Moon, 2009). To obtain more reliable results, samples of sedimentary-metamorphic rocks of the Kokpatassky suite were taken from the corresponding differences at a distance from the deposits, as well as the outcrops of intrusive bodies. The most reliable is the determination of the geochemical background and the minimum anomalous content of elements from samples taken from the given difference in rocks beyond the limits of obvious anomalies.

The association of the significant elemental contents to metasomatically altered rocks, the formation of which is associated to post-magmatic hydrothermal solutions, has been established. Theoretically, this means that the gold-rare-metal mineralization of the Central Kyzylkum is genetically related to the processes of formation of granitoid intrusions, and in practical terms, similar ores can be predicted in connection with aureoles of the distribution of igneous rocks in favorable geological and structural positions.

Gold mineralization in Central Kyzylkum is localized in rocks of a wide age range and various composition (Karabayev, 2004; Koneyev, Halmatov and Moon, 2009) and it seems to us that the formation of deposits is most important when there is a process (in this case post-magmatic) that facilitated ore formation, which should serve as the basis for judgments on issues genesis and forecasting of similar deposits.

2. *The study of the nature of the distribution of elements in ores and ore-space of gold ore objects.* Statistical processing of geochemical data was carried out in two samples - in the above-ore and ore-bearing zones of gold ore objects (Shohetau, Karabugut, Peschanoe NW flank in the mountains of Auminzatau and Kaskyrtau).

The geochemical series of the intensity of accumulation of elements of the above-chest zone is as follows: - (Te-Se-Sb-Au-Ag-As) -Mo-Pt-W-Bi-Zn-Cu-Sn-Pb-Ni- Co.

The main part of the elements in this series and the strong positive relationships in the Sb-Cu-Pb-Zn-Ag group indicate an intensive manifestation in the more remote parts of ore formation of the relatively low-temperature silver-gold-antimony (with Se and Te) mineral-geochemical associations.

In probes taken from the inner part of the ore-bearing zones and the immediate lateral space, there is a sharp increase, compared with the above-ore zones, of silver and gold (by 2–3 times), indicating a higher value of the gold – arsenic geochemical association in the inner zones of ore formation. A number of element accumulation intensities in ore zones: - (Te-Se-Au-Sb-As-Ag) -Pt-Bi-Cu-Zn.

Directly in the ore bodies and in the near ore space, gold forms a strong positive relationship in the distribution in two groups: very strong with arsenic (0.91) and less with silver, tellurium, zinc and antimony (0.40- 0.52). This clearly indicates the correlation of gold-arsenopyrite and silver-gold-sulfosol association of ore formation, which indicates the manifestation of meso-epithermal mineral formation and upper ore mineralization levels in the studied objects.

Table 1: Comparison of the degree of element concentrations in endogenous (EN) and exogenous (EX) ores

	Taushan		**Peschanoe**		**Karabugut**		**Kaskyrtau**		Average for all objects	
	Probes quantity									
	56	62	42	51	50	43	39	72	187	228
	The degree of concentration of elements									
	EN	**EX**	**EN**	**EX**	**EN**	**EX**	**EN**	**EX**	**EN**	**EX**
Au	73	142	135	306	42	110	95	344	86	225
Ag	31	25	79	52	47	31	40	23	49	33
As	29	26	85	1.8	52.4	25	55	71	56	31
Se	82	118	267	218	211	77	242	161	201	144
Te	280	240	330	200	310	180	240	201	290	205
Sb	78	48	115	101	77	34	95	599	91	196
Bi	5.6	1.5	6.3	2	5.6	1.5	6.3	1.3	6.2	1.6
Pt	10	12	10	14	8.5	7.2	8	8	9.1	10.3
Cu	1	0.9	2.6	2.4	2	1.1	2.2	1.2	2.0	1.4
Pb	1.1	4.4	1.8	1.6	1.5	1.2	1.7	0.7	1.5	2.0
Zn	1.6	1.6	2.6	5.1	2.3	1.6	2.5	0,7	2.3	2.3
W	5.3	5.5	6	2.6	6.7	1.2	6.1	1	6.0	2.6
Mo	9	6.9	37	16	32	9.7	28	8.4	27	10.3
Sn	1.8	1.1	1.6	1.2	1.8	1.4	1.5	0.8	1.7	1.1
U	21	9	24	12.6	19.6	10	18	13.7	21	11.3

Stable geochemical criteria for predicting gold mineralization in areas with gold ore and gold-silver mineralization are (except gold) arsenic, selenium, antimony, silver and tellurium. Ore zones with industrial potential are characterized by high values of arsenic, which directly correlates with gold.

The nature of the distribution of elements in exogenous ores of gold-sulfide objects, which are formed as a result of hypergenic processes, is studied in separate samples, since they differ in terms of formation, which determine their geochemical features and forms of finding useful components, as well as the technological properties of ores.

Geochemical series of element accumulation intensity in exogenous ores: Au-Te-Sb-Se-Ag-As-Mo-Pt-U-W-Zn-Pb-Bi-Cu-Sn.

A comparison of the distribution pattern of the main elements in the zones of endogenous gold mineralization and exogenous formations developing along them (Table 1) shows the fact that the ores are benefication (on average 3-5 times) in the oxidation zone.

The maximum values of the degree of concentration are characteristic of gold, indicating that gold accumulates in the oxidation zone much more intensively, in comparison with other elements, which is associated with its geochemical features. When sulfides were replaced by secondary minerals, dispersed gold was released from their composition and concentrated in a native form. The strong positive relationship between gold and platinum is interesting, although the content of the latter in ores is not high (average concentration 10), which is associated with the accumulation of platinum together with gold in the oxidation zone.

In oxidized ores, the degree of concentration of arsenic (by 45%), selenium and tellurium (by 30%) is reduced, compared with primary ores, indicating a transfer of part of the content of these elements from the oxidation zone.

CONCLUSION

The indicated research results allow us to draw the following conclusions: -statistical processing and analysis of geochemical information should be based on the genetic basis for the formation of the research object (deposits, rocks, types of ores, etc.), since the genetic characteristics of the object determine the composition, value, nature of spatial distribution and other properties of geochemical features. With this approach to solving the tasks, the obtained results acquire geological meaning and can be used in prospecting and evaluation work.

The confinement of significant contents of useful components to metasomatically altered rocks indicates that the gold mineralization of the Central Kyzyl Kum is genetically related to the formation of granitoid intrusions, and in practical terms, similar ores can be predicted in connection with aureoles of igneous rocks in favorable geological positions.

Stable geochemical criteria for predicting gold mineralization are (except gold) arsenic, selenium, antimony, silver and tellurium. Ore zones with industrial potential are characterized by high values of arsenic, which directly correlates with gold.

REFERENCES

Goldfarb RJ, Ryan D (2013). Gregory S. Phanerozoic continental growth and gold metallogeny of Asia. *Elsevier* 4-55.

Groves DI, Goldfarb RJ, Gebre-Mariam M (1998). Orogenic gold deposits: A proposed classification in the context of their crustal distribution and relationship to other gold deposits type. *Ore Geology Reviews* 13 7-27.

Karabayev MS (2017). Mineralogical and geochemical features of gold and gold-rare-metal mineralization of the mountains Auminzatau and Bukantau and search and evaluation criteria. *D.Sc. Thesis*, Tashkent, IMR, 204 (in Russian).

Koneyev RI, Halmatov RA (2013). Some aspects of mineralogy, geochemistry and genesis of ores of gold deposits of Uzbekistan. Ores and metals. 2 39-51. (in Russian)

Koneyev RI, Halmatov RA, Moon Yu S (2009). Gold ore deposits of Uzbekistan: mineralogical and geochemical style, patterns of distribution and formation. *Geology and mineral resources. Tashkent*, 4 11-24 (in Russian).

Moon Yu S (1996). Paleozoic structure and history of the southern Tien Shan. - S.-Pb.: S. Petersburg University. 192 (in Russian).

Seltmann R, Koneyev RI., Divaev FK, Halmatov RA (2014). New data on the absolute age of magmatism and gold mineralization in Uzbekistan. *Geology and Mineral Resources*. 2 10-15. (in Russian)

Yakubchuk AS, Shatov VV, Kirwin D *et al.* (2005). Gold and Base Metal Metallogeny of the Central Asian Orogenic Supercollage: *Society of Economic Geology, Anniversary Volume*. 1035-1068.