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TRACE ELEMENTS IN SOME MINERALS FROM ALSHAR DEPOSIT

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Abstract: The data from the study of the presence of microelements in the individual minerals (lorandite, realgar, orpiment, stibnite and marcasite) from Alshar deposit carried out by the mass spectrometric method are presented this paper.

Key words: trace elements, Alshar, lorandite, realgar, orpiment, stibnite, marcasite

INTRODUCTION AND GEOLOGICAL FEATURES

The Alshar mining district is located in the Mountain Kožuf in Macedonia. The district has been intensively mined for its antimony, arsenic and thallium resources beginning in about 1860.

The bedrock geology of the district is comprised of two distinctive chronostratigraphic sequences:

1. Mesozoic carbonate and clastic sediments unconformably overlain by,

2. Tertiary tuffaceous sediments and Pliocene felsic tuffs.

The Alshar deposit is of hydrothermal low temperature origin, genetically associated with the Pliocene subvolcanic dacite andesitic intrusive. The age of the volcanic activity is about 7 to 5 million years (Boev, 1988).

Small bodies of intrusive mineralized, porphyrytic subvolcanic rock, intrusive cross both Mesozoic and Tertiary rocks. Several major structural sets (northwest, northeast and northherly dissect and juxtapose the bedrock sequence in a complex contact relationship.

Hydrothermal ore fluids containing large amounts of silica, iron, sulphur, arsenic, antimony, mercury, thallium, barium and gold from silificied replacements, hypogene argillic stratigraphic horizons and disseminated replacements in both Mesozoic and Tertiary rocks are found.

Two main types of mineralization occur:

1. As-Tl-Hg-Sb-SiO_2 associated with argillic clays and

2. SiO_2-Sb-Al-Tl-Hg-Au-Ba replacement silifications.

Type 1 is characterized by orpiment, realgar, lorandite, complex thallium minerals, cinabar, minor silica and stibnite.

Type 2 consists of microcrystalline quartz, stibnite, iron sulphide, falcmanite, fizelite, realgar, cinabar, Tl minerals, baryte.

APPLIED METHODOLOGY

Spark Source Mass Spectrometry was used during the analytical treatment of the separated fractions which determined the presence of the rare elements in the individual types of minerals. The mineral separation and obtaining of pure mineral fractions from the mineral paragenesis in Alshar deposit was carried out by the use of microscope methods - separation under binoculars.

The instrument used was a JMS 012BM 2, JEOL double focusing high resolution mass spectrometer with Mattauch Herzog ion optics in the following recording conditions:

Exposure:		from $1 \cdot 10^{-12}$ to $3 \cdot 10^{-7}$ Coulomb
Voltage:		4 kV
Opening of impulse:		30 μs
Frequency of impulse:		300 Hz
Vacuum:		
	source	$4 \cdot 10^{-6}$ Pa
	analyst	$1.33 \cdot 10^{-6}$ Pa

Table 1

Microelements in the minerals from Alshar deposite [%]

	lorandite	orpiment	realgar	stibnite	marcasite
Be	0.000009	-	-	0.00004	0.0001
B	-	-	-	0.004	0.001
F	-	-	-	0.07	>0.1
Na	0.001	0.004	0.006	0.006	0.01
Mg	-	-	-	>0.1	-
Al	0.002	0.01	0.007	-	-
Si	-	-	-	>0.1	-
P	0.002	0.0004	0.001	0.04	0.003
Cl	0.001	0.003	0.002	0.002	0.003
K	0.001	0.006	0.009	0.1	0.03
Ca	0.01	-	0.07	>0.1	0.04
Sc	-	-	-	-	-
Ti	0.002	-	0.01	0.01	0.006
V	0.00002	-	0.00007	0.001	0.00007
Cr	-	-	-	0.001	0.004
Mn	0.004	0.002	0.009	0.005	0.03
Fe	-	0.08	-	>0.1	>0.1
Co	0.00005	-	0.0001	0.001	0.01
Ni	0.001	-	-	0.02	0.02
Cu	0.001	0.0004	0.0002	0.001	0.0009
Zn	-	-	-	0.003	0.01
Ga	-	-	-	0.0004	-
Ge	-	-	-	-	-
As	>0.1	>0.1	>0.1	>0.1	>0.1
Se	0.0003	0.001	0.002	>0.1	0.00001
Sr	0.0002	-	0.0001	0.0006	0.03
Rb	-	-	-	0.002	0.0009
Y	0.00004	-	-	0.0001	-
Zr	0.00005	0.0001	0.0002	0.0003	-
Nb	-	-	-	0.00005	-
Mo	-	-	-	0.001	0.004
Sn	0.03	-	-	>0.1	-
Cs	0.00003	0.00007	0.0003	-	0.01
Ba	0.009	-	-	-	0.0005
La	0.00004	-	-	-	-
Hg	-	-	-	-	0.01
Tl	>0.1	0.02	0.07	0.01	0.04
Pb	0.0003	0.00008	0.0002	0.001	0.0002

RESULTS AND DISCUSSION

The determination of the presence of microelements in individual mineral fractions from the mineral paragenesis has so far been carried out only for lorandite, realgar, and orpiment by INA method (Pavicevic et al., 1988).

In this paper we give data about the presence of microelements in lorandite, realgar, orpiment, stibnite and marcasite obtained by the use of the mass spectrometer method. The obtained results are shown in Table 1 which gives the basis for the following conclusion:

Lorandite contains individual microelements with several ppm (Be, V, Co, Se, Sr, Y, Zr, Cs, La, Pb) as well as microelements of tenths of ppm (Na, Al, P, Cl, K, Ti, Mn, Ni, Cu, Ba).

The content of the microelements in orpiment ranges from several of ppm (P, Cu, Zr, Cs, Pb) up to tenths of ppm in the elements Na, Cl, K, Mn, Se and up to hundreds of ppm in the point out the presence of thallium in orpiment with 200 ppm.

The content of individual microelements in realgar are as follows: elements such as V, Co, Cu, Sr, Zr, Cs, Pb can be found with several ppm, but Na, Al, P, Cl, K, Mn and Se occur with tenths of ppm, whereas Ca, Ti and Tl have several hundreds of ppm. The Tl content reaches 700 ppm, which, compared to that of orpiment, is much greater.

The content of the microelements in stibnite are as follows: Be, Ga, Sr, Y, Zr, Nb occur in several ppm, whereas elements like B, Na, Cl, V, Cr, Mn, Co, Cu, Zn, Rb, Mo, Pb occur in several hundreds of ppm. Mg, Si, Ca, Fe, As, Se occur in amounts greater than 1000 ppm.

The content of individual microelements in marcasite is also variable, ranging from several ppm (Be, V, Cu, Se, Rb, Ba, Pb), to amounts of tenths ppm (B, P, Cl, Ti, Cr, Mo).

Elements like Na, K, Ca, Mn, Co, Ni, Zn, Sr, Cs, Hg, Tl occur in amounts of several hundreds of ppm, whereas F, Fe, As in amount greater than 1000 ppm.

CONCLUSION

The mass spectrometric examinations carried out in individual mineral fractions from the mineral paragenesis in Alshar deposit lead to the conclusion that:

Lorandite, being a pure mineral, is of interest for accomplishing the project for solar neutrinos.

Orpiment, realgar, stibnite and marcasite contain relatively great amounts of thallium, 100 up to 700 ppm.

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