

**MICROELEMENTS IN SOILS OF GOLD ORE DEPOSIT VYUN (THE REPUBLIC SAKHA-  
(YAKUTIA))**

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Currently, in Russia research aimed at discovering new deposits of strategic minerals, including gold, is highly relevant.

The expansion of the mineral resource base of gold in Russia is carried out by prospecting in areas with significant forecast resources, mainly in the metallogenic provinces of the Siberian and Far Eastern federal districts. The indigenous gold content of these territories is associated with terrigenous complexes, and primarily with the Verkhoyan-Kolyma folded region [1]. At the same time, at least 90 % of the reserves and forecast resources of ore and placer gold throughout the Verkhoyan-Kolyma folded region are concentrated within the Yano-Kolyma gold-bearing belt [5], covering part of the territory of the Magadan Region and the Republic of Sakha (Yakutia).

One of the objects located within the Yano-Kolyma belt on the territory of the Republic of Sakha (Yakutia), in the Elgenzhinsky ore-placer cluster of the Adycha-Taryn gold zone, which is also of interest for assessing gold resources, is the Vyun gold deposit, discovered in 1974.

An assessment of the current ecological and geochemical state of the subarctic territories (which the studied object belongs to) is impossible without studying the ecogeochemical features of the components of the environment.

Of particular importance are the ecogeochemical studies in the pre-operational stage of field development. The given work is devoted to a background ecogeochemical assessment of the territory of the gold ore deposits Vyun (Republic Sakha-(Yakutia)) at preoperational operation stage using soil cover.

The gold ore deposit of Vyun is in the territory of the Republic Sakha (Yakutia), in a southern part of the Verkhoyansk area, in 250 km to the southeast from an administrative center of area of settlement Batagay and in 550 km to the northeast from of Yakutsk.

The area of the deposit is located in subarctic zone with severe, sharp-continental climate, long-term severe winters and moderately warm short summers.

The continuous propagation of perennially cryolithic rocks are 200-350 m thick [7].

According to soil-geographical division, the territory of gold ore deposits Vyun is related to the Verkhoyansk province very cold cryogenic soils of the northern taiga. A soil cover of the deposit is characterized by low natural fertility and is not valuable from the agricultural point of view. The basic value of soils consists in maintenance of normal functioning ground-based ecosystems.

From the geological standpoint, gold ore deposit Vyun are referred to hydrothermal type. The area of a deposit is composed of the terrigenous deposits of the upper Triassic Age (aleurolites and argillites).

The ore-bearing structure of deposit Vyun is presented by quartz vein zone.

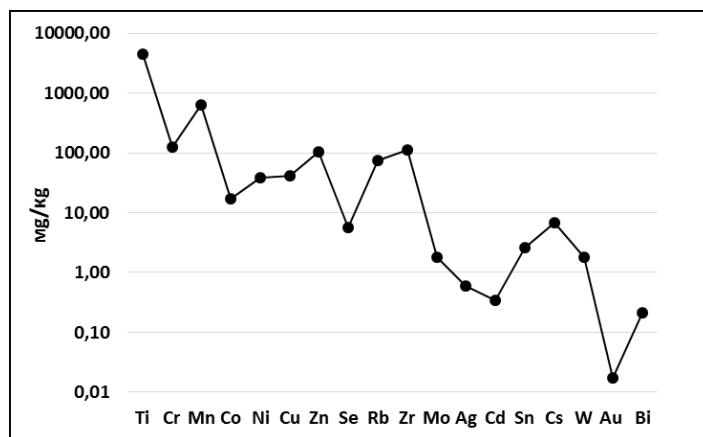
The ores of the deposit belong to low-sulfidation gold-quartz type and are characterized by a rather simple mineral structure. Among ore minerals arsenopyrite prevails, but pyrite and chalkopyrite are less often observed.

In the summer of 2017, soil samples were taken in the territory of the gold ore deposit Vyun. The soil was selected from the top horizon (0-10) cm by the envelope method. In total 19 soil samples have been selected.

The samples were analyzed by the weights-spectrometry method with inductive associated plasma in the accredited laboratory of Tomsk.

In this paper, we discuss the data on the content of microelements in the soils of the Vyun deposit.

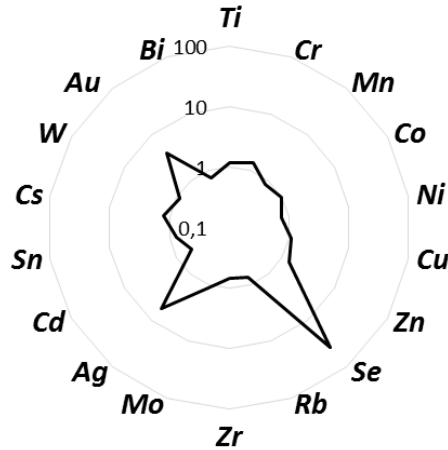
The term «microelements» or «trace elements» has no definite interpretation. Some scientists prefer to call microelements those elements that serve as initiators and activators of biochemical processes, without which regulatory role of enzymes is impossible [6]. At the same time, microelements usually include Ti, Cr, Mn, Co, Ni, Cu, Zn, Se, Rb, Zr, Mo, Ag, Cd, Sn, Cs, W, Au, Bi. The average concentrations of the microelements in the soil cover of the territory of the gold ore deposits Vyun are shown in figure 1.



*Fig. 1 Average concentrations of the microelements in the soil cover of the territory of the gold ore deposits Vyun*

As can be seen from the graph, the highest contents in soil are typical for such microelements as Ti (4493 mg/kg), Mn (643 mg/kg), as well as Zr, Zn and Rb (112, 103 and 74 mg/kg, respectively).

In order to establish the anomalous content of microelements in the soil of the territory of the Vyun gold ore deposit, a geochemical association was identified. The clarks of the microelement concentration were calculated relative to the average composition of the top part of the continental crust according to Grigoriev [2]. The results are shown in figure 2.



**Fig. 2** Clarks of the microelement concentration in the soil cover of the territory of the gold ore deposits Vyun concerning an average structure of the top part of the continental earth's crust according to Grigoriev [2]

It was revealed that the given association is generated by the raised contents of Se, Ag, Au (clarke concentration 4-38) and in less extent Zn, Cr, Cs, Ti, Mo, Cu (clarke concentration 1-2).

Those raised concentrations, Se, Ag, Au and Zn, Cs, Ti, Mo, in the soil cover of gold ore deposits Vyun are typical for the soils of the gold-bearing areas of the northeast Yakutia, i.e. the association of the given chemical elements reflects a natural geochemical area of the considered territory.

High concentration of Au reflects the metallogenic features of the deposit Vyun, which are typical for the streams of the gold ore deposits distribution of East Yakutia [4].

Using the results of the research, the analysis of spatial distribution of the microelement concentrations has been carried out in the soil in the territory of deposit Vyun. It was established that the highest content of the microelements relative to their average values occurs in the raised concentration in the soil of the central territory of the ore-bearing zone of the deposit. In particular, the contents of Au, W, Cs, Co, Cu, Te, Cr, Ag, Se, Zr, Rb, Mn are 1,2–13,8 times higher in these soils.

It has to be noted that the revealed geochemical association of microelements is typical for the structure of soils and the bottom sediments in the zone of hypergenesis in the Verkhneindigirsky gold-bearing area [3].

Studying the received results of the chemical sample analysis of soil cover of the gold ore deposits Vyun it can be assumed that the auras of dispersion of the ore bodies play a leading part in the formation of the geochemistry soil features in the research territory. Thus, having in view of the mineral structure of the deposit ores, one can speak with the certain degree of confidence that the sulphidic minerals (arsopyrite, chalkopyrite, etc.) containing Cu, Se and other specific to the deposits chemical elements in the structure have a crucial influence on the geochemical area of the soil.

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