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METASOMATIC ROCKS OF THE CHAKYLKALYAN MOUNTAINS AND THEIR RELATIONSHIP TO MINERALIZATION

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Abstract

The article is devoted to the metasomatites of the Chakylkalyanmountains and their ore content. The formation of metasomatites includes the following processes: decarbonatization, argillization, silicification, and calcitization. A distinctive element for the region is the formation of hydrothermokarstbreccias on carbonate rocks, containing gold mineralization.

Key words: Chakylkalyanmountains, metasomatites, gold, ore, breccia, carbonate, argillisite, jasperoid, hydrothermal solutions.

МЕТАСОМАТИЧЕСКИЕ ПОРОДЫ ЧАКЫЛКАЛЯНСКИХ ГОР И ВЗАИМООТНОШЕНИЕ ИХ С ОРУДЕНЕНИЕМ

Аннотация

Статья посвящена метасоматитамЧакылкалянских гор и их рудоносности.Формирование метасоматитоввключает следующие процессы: декарбонатизацию, аргиллизацию, окварцевание и кальцитизацию. Отличающимся элементом для региона является формирование по карбонатным породам гидротермокарстовых брекчий, вмещающих золотое оруденение.

Ключевые слова: Чакылкалянские горы,метасоматиты, золота, руда, брекчия, карбонат, аргиллизит, жаспероид, гидротермальные растворы.

ЧАКИЛКАЛЯН ТОҒЛАРИНИНГ МЕТАСОМАТИК ЖИНСЛАРИВА УЛАРНИНГ МАЪДАНЛАШУВ БИЛАН ЎЗАРО МУНОСАБАТЛАРИ

Аннотация

Мақола Чакилкалян тоғларининг метасоматитлари ва уларнинг маъданлийлигигабағишланган. Метасоматитларниҳосил бўлиши қуйидаги жараёнларни ўз ичига олади: декарбонатлашиш, аргиллизитлашиш, кварцлашиш ва кальцитланиш. Минтақа учун фарқ қиладиган элемент карбонат жинслар бўйлаб олтин маъданлашуви жойлашган гидротермокарст брекчияларнинг шаклланганлиги ҳисобланади.

Калит сўзлар: Чакилкалян тоғлари, метасоматитлар, олтин, маъдан, брекчия, карбонат, аргиллизит, жаспероид, гидротермал эритмалар.

Introduction. Unlike other types of rocks (magmatic, metamorphic, sedimentary) due to their formation, metasomatic rocks represent a special type of rocks whose material composition depends on the composition of the silicate and carbonate rocks that are occupied by them, as well as on the composition of the hydrothermal solutions that affect them [1]. Metasomatites are of great practical importance, most ore and non-ferrous minerals are associated with them. In the second half and last decades of the last century, a large amount of real materials on the chemical and mineral composition of various types of metasomatic rocks were collected.

The study of natural objects shows that mineral deposits occur in close spatial association with different types of metasomatic rocks and in different genetic proportions. The study of the relationship between metasomatism and ore accumulation is considered one of the main directions in the theory of metasomatic processes, because interest in metasomatic rocks in general arose due to the presence of non-ferrous and rare metals in them.

Determining direct and indirect criteria of mineralization of metasomatic formations in the course of research allows us to use them in the search and evaluation of polymetallic mineralization within the boundaries of a certain region and in other similar provinces.

Мавзуга оид адабиётларнинг таҳлили (Literature review)

Many researchers are engaged in the study of metasomatic formations, rare metal, gold-rare metal and gold ore deposits of South and West Uzbekistan. Conditions of occurrence of metasomatic derivatives and features and prospects of minerals related to this process I.Kh. Khamrabaev, I.V. Mushkin, T.N. Dalimov, V.M. Breivinsky, A.V. Golovko, V.I. Lebedeva, V.V. Yarmolyuk, D.V. Kovalenko, D.S. Korzhinsky, M.I. Kuzmina, R. Akhundjanov, M.S. Studied by Karabaev et al. At the same time, despite the large amount of work devoted to the study of metasomatic formations and the successes achieved in this direction, many features of the occurrence of these rocks in the Chakilkalyan Mountains have been relatively little researched.

Тадқиқот методологияси (Research Methodology)

In order to study the material composition and genesis of metasomatites, the documentation of outcrops was carried out through field observations, mining and well samples. Theoretical analyzes of mineral paragenesis have been performed. Based on topological analysis of mineral paragenesis and thermodynamic calculations, the physical and chemical conditions of metasomatite formation have been determined.

Таҳлил ва натижалар (Analysis and results)

The Chakilkalyan Mountains are located on the border of the Zarafshan-Olai structural-formation zone of the Southern-Tianshan fold-thrust. It is the extreme southeastern segment of the carbonate shelf zone of the Afghan-Tajik continent. The block is bounded to the east by the Magian orefield, which is the western termination of the Shing-Magian anti-mercury orebody. From the west, it is adjacent to the Karatyubin granitoid intrusion and its satellites surrounded by Paleozoic carbonate terrigenous deposits.

Chakilkalyan mountains are characterized by sections of the Paleozoic, which contain large thickness of carbonate rocks. In most areas, carbonate rocks are considered the leading element of the structure of sections.

The main factor determining the development of gold metasomatites is their location in highly tectonically active zones and a sharp change in the acidic-alkaline regime, which creates conditions for the mobility of elements in the carbonate environment [2, 3].

The following are formed as a result of the process of impact of mineral solutions from mineral to mineral on carbonate rocks: argillites with embryonic jasperoidization in the distant-mineral situation; in the case of minerals - jasperoids with an amorphous form of silica; in the case of ore - jasperoids with crystallized quartz, or hydrothermokarst breccias with kaolinite-hydromica-calcite cement [4].

The limited donor properties of the carbonate environment, as well as the lower Paleozoic volcano-terrigenous deposits below it, make it possible to estimate the juvenile nature of gold in apocarbonate gold mineralization and focus the search for sources of ore-generating fluids in the deep levels of structures [5].

The formation of pre-ore metasomatites of apocarbonate gold mineralization of the Chakilkalyan Mountains includes the same stages as in the Karlin deposits: decarbonation, argillization, quartzization, and calcitization. A distinctive feature of the Chakilkalyan Mountains is the formation of hydrothermokarst breccias, where gold mineralization occurs through carbonate rocks [6].

Decarbonation (dissolution of carbonate rocks prior to ore) has occurred everywhere and is characteristic of all types of apocarbonate gold mineralization. In the process of decarbonation, dissolution and leaching of calcite occur, which leads to the formation of thin porous structures and dissolution cavities. In the outer parts of the metasomatic column, decarbonated limestones and dolomites occur as individual grains and as thin veins filled with newly formed secondary calcite. Compared to the inner part of the mineralized zones, the intensity of vein-cell calcification decreases sharply here, but the obvious recrystallization of limestones is preserved with different colors, due to the lightening of the color in different grain sections and more dissolved sections, which leads to a mottled appearance of the rocks.

Pores and voids formed in the internal parts of the metasomatic column are filled with hydromics, kaolinite and endogenous hematite in addition to calcite. In the more mineralized sections of the zones, the rocks are represented by metasomatic recrystallized carbonate synch (framework) with different sizes of new formations.

Dolomitization is represented by the replacement of small (0.02 mm) sections of irregularly shaped pelitomorphic calcite with micro-grained dolomite, which sometimes clearly fills microcracks and small pores, forming a continuous chain. Sometimes dolomite and calcite grains are mixed, and intergranular calcite space is filled with fine-grained (0.01-0.03 mm) dolomite.

In the formation of metasomatites, dolomite is mainly a secondary mineral formed during the replacement of calcite and consists mainly of micro-grained mass. In this case, in the mass of calcite, it is observed that the edges of the mass of dolomite micro-fine crystals are expanded, in which dolomite erodes and corrodes the calcite. In some places, dolomite is as well crystallized as calcite, but these are mostly microcrystals with a size of 0.01-0.05 mm.

Dolomite metasomatites formed during recrystallization and replacement of limestones form a lenticular body up to 100 m thick and up to 600 m long. The metasomatites are mainly pinkish-gray in color and have a mottled appearance due to the patchy nature of the sections, which are mainly composed of dark gray fine-grained limestones and light-gray fine-grained dolomites with a volume of 75-90%. The pink color of metasomatites is due to the relatively uniform saturation of the rock mass with iron hydroxides (mainly hydrogetite, sometimes jarosite). Zones of dolomite metasomatites do not have clear boundaries, they pass into dissolved, partially recrystallized and dolomitized limestones with a porous and porous texture, microscopically unclear structure.

In the process of hydrothermal dolomitization of limestones to the ore, there is an incomplete compensation of the volume of the exchangeable rocks, which means that its conductivity for the solutions of the next, especially the ore stage, increases sharply.

Calcite metasomatites develop through the dolomites and represent a metasomatically formed rock composed of 85-100% fine- to fine-grained light-gray glassy calcite. During preservation, dolomites became rapidly bleached and saturated with newly formed calcite throughout the pores and mass. Calcite metasomatites are rapidly ironized everywhere, in the mass of iron minerals, there is a large amount of hydrogetite-jarostic aggregates of droplet-collomorph form, filling numerous voids and pores of the rock and surrounding the remnants of dolomites. From the surface, the calcite metasomatites are mostly significantly melted and often have a dry appearance. Calcite metasomatites form lenticular bodies up to 8-12 m thick and up to 150 m long. Limestones in contact with calcitic metasomatites were intensively tectonically reworked and formed a 10-15 m thick vein calcitization zone and lenses of 70-80% newly formed calcite microbreccias.

Hydrothermal mineralization was manifested in the form of a network of calcite veins 10-20 cm thick. In places, calcite bodies of irregular lenticular shape are noted, the length of which is the first tens of meters, and the thickness is the first meters.

Metasomatites with apodolomite calcite are mainly located in linear zones of tectonic contacts of limestones and dolomites, and are characteristic of individual parts of local deposits; in them, dolomite metasomatites and hydrothermokarst breccias are localized in the internal (allochthonous) parts of the superimposed coins and are mainly developed along the pelitomorphic massive limestones.

In addition to the described metasomatites and breccias, linear zones of hydrothermally altered rocks, located mainly at the tectonic contacts of dolomites and limestones, are clearly observed. The contact rocks in these zones are 20-30 m thick vein- and metasomatic calcite in some places, covering both dolomites and limestones in direct contact, saturated with veins of calcite in different directions (up to 50-60% of the rock volume), cherry-brown and brown iron hydroxides ochres and occasional veins and nests of argillites (with hydromica-kaolinite composition) form lenticular bodies.

Hydrothermokarst breccias are mainly developed along pelitomorphic massive limestones and form more isometric and elliptical bodies with ill-defined boundaries. In intensively fractured sections, recrystallization of the limestone into relatively larger coarse-grained aregate and lightening of its color is observed. In the central parts of these bodies, typical breccias are localized, consisting of different, but mostly sharp-edged fragments of different sizes (from a fraction of a cm to tens of cm). Fragments of limestones are practically everywhere intensively metasomatically dolomitized and saturated with veins of calcite.

At the Akata site, the hydrothermokarst breccia zone containing gold mineralization is composed of a clast of highly recrystallized limestone filled with calcite, hydromicas, kaolinite, hematite, and goethite.

Argillites are composed of variable amounts of cryptogranular metasomatic calcite and hypogene clay minerals. According to the data of diffractometric analysis, calcite-hydrolysed belt cavities have the following composition: calcite 44.7%, all clay minerals 43.3%, hematite 8.2%, apatite 3.8%. Clay minerals are kaolinite (30%) and hydromica (70%), with up to 10% layers of montmorillonite, showing a mixed-layer formation consisting of 2M1 muscovite type hydromicas [7].

Quartz metasomatites formed along the carbonate rocks (jasperoids) developed in the Chakilkalyan mountains, are divided into 3 types: siliceous, carbonate-silicon and embryonic.

Silicic jasperoid - in general, the rock is dominated by quartz, intensively chloritized or sericitized feldspars are less important. Microscopic jasperoids are composed of fine-grained quartz aggregates with microgranoblast and spherulite structures, with small ink-like inclusions of iron oxides and hydroxides and occasional clay particles.

Carbonate-silica jasperoid - carbonate material and siliceous material are developed in approximately equal amounts. Carbonates are represented by large amounts of calcite and low levels of dolomite (less than 5%).

Embryonic jasperoid - clay-carbonate pelitomorphic-fine-grained main mass with crypto-grained siliceous (metasomatic chalcedony-like quartz) budding forms.

Geological observations clearly show that limestones with varying degrees of sedimentary clay content served as the primary matrix for the jasperoids.

In addition to the main types of metasomatites before mining, it is necessary to point out the presence of various mineralized tectonic breccias in areas where gold mineralization is spread in carbonate rocks.

Хулосаватаклифлар (Conclusion/Recommendations)

Carbonate rocks are an important physico-chemical, structural and ore-forming factor. The carbonate environment determines a sharp change in the acid-alkaline regime of the ore-bearing aluminosilicate solutions and the chemical elements that form the metasomatites of the ore environment (Si, Ca, Na, K) and are included in the main paragenesis of apocarbonate gold mineralization (Au, As, Ng, Sb, Ag, Pb). creates conditions for the movement of the full line.

The formation of pre-ore metasomatites of apocarbonate gold mineralization of the Chakilkalyan Mountains includes the following stages: decarbonation, argillization, quartzization, and calcitization.

The following were formed as a result of the process of the action of mineral solutions that are acidic to the point of ore on carbonate rocks: argillites with embryonic jasperoidization in the remote-mineral condition; in the case of minerals - jasperoids with an amorphous form of silica; in the case of ore - jasperoids with crystallized quartz, or hydrothermokarst breccias with kaolinite-hydrolysed-calcite cement (with mylonitization and cataclase zones with gold ore bodies).

The argillites in the extended-ore position are characterized by the amount of Au of 0.1-0.5 g/t; jasperoids in surface position - 0.5-2.5 g/t and in ore position - 2.0-4.0 g/t; mylonites along hydrothermokarst breccias – 4.0-5.0 g/t.

The complex specialization of rocks of the alkaline basaltoid-lamprophyre formation of the Chakilkalyan Mountains allows predicting gold and complex gold precious metal mineralization in its territory.

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