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CONNECTION OF PALEOZOIC CARBONATE AND VOLCANOGENIC-SEDIMENTARY DEPOSITS WITH MINERALIZATION AT THE KULCHULAK POLYMETALLIC DEPOSIT

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Abstract
This article examines the sedimentary rocks present in the Kulchulak polymetallic deposit. Carbonate rock outcrops located within the deposit's territory cover an area of approximately 0.5 square kilometers and are exposed in the central and southeastern parts of the deposit as two massifs and separate outcrops. Devonian ore-bearing carbonate formations were formed in arid climates in shallow basins with high water salinity. Based on data obtained from exploration and development work, the article discusses changes in sedimentary rocks during magmatic processes, their relationship to mineralization, patterns of their occurrence, as well as sedimentary formations.

Keywords: Kulchulak deposit, carbonate layer, formation, Almalyk Formation, Kulatin Formation, Kulchulak Formation, dolomite, limestone, Akchin Formation, tectonic block, sandstones.

Introduction

The Kulchulak deposit is located in the southeastern part of the Central Tectonic Block and consists of carbonate and effusive formations of the Middle and Upper Paleozoic, broken silloid bodies of the Hercynian magmatic complex, and dikes of igneous rocks.

The oldest formations are quartz porphyries of the Lower Devonian, covering the carbonate layer, which are deposited in wells at depths of 250-700 m.

Microscopically, these are dense, massive, often fluidal, light gray or pink rocks, which under a microscope have a porphyritic structure, consisting mainly of quartz and feldspar, often fragmented in nature, with the main mass being fine-grained microgranular.

Porphyritic inclusions are represented by irregularly shaped quartz sized 3-8 mm.

Plagioclase has a tabular shape and is replaced by a coarsely scaled aggregate of sericite.

Hornblende is rare and is determined by the relic shape of the grains. Accessory minerals include apatite, zircon, sphene, and magnetite. The thickness of quartz porphyries is about 300 m.

Based on the data obtained as a result of geological exploration, the age of quartz porphyries can be considered Lower Devonian, and their origin - effusive.

On the eroded surface of quartz porphyries, carbonate deposits of upper-lower carbonate lie with an angular unconformity.

It is difficult to determine the age relationships of quartz porphyries with carbonate rocks, since tectonic activity and metamorphic processes are intensively manifested.

In the field, the outcrops of carbonate rocks occupy an area of about 0.5 sq. km and are exposed in the central and southeastern parts of the deposit in the form of two massifs and separate outcrops, and at depth, under effusive formations, they are exposed with all drilled wells.

Employees of the Problem Laboratory of Sedimentary Formations and Sedimentary Minerals of Tashkent State University, based on the complex biorhythm-stratigraphic method of separating sedimentary formations, developed a rhythm-stratigraphic scheme for separating the Middle Paleozoic carbonate formations of the deposit.

According to the conducted research, the carbonate formations are part of the Middle Tien Shan complex and are divided into Late Franco-Famenic and Tourneisian-Middle-Visaisian strata. The Late Franco-Famenic layer consists of the Almalyk, Karatagata, and Kulatin suites, while the Tournai-Middle Visean layer consists of the Kulchulak suite, which is further subdivided into smaller suites and then into rhythmopachs.

The Almalyk Suite (D3fral) corresponds to the sand-carbonate horizon in the scheme of I.B. Fedorova (1964), Kuznetsov J.N. (1973) to the lower part of the Almalyk Suite, and Shamgunov K.J. et al. (1977) to the Takkeli Suite, identified in the section of the Kalkanata Mountains and the Karakiya River. The age is set equal to the French age in terms of location under the Lower Famen deposits, which are characterized by phase. The suite is composed of thin rhythmic relaying of dolomites, argillites, limestones, anhydrites, and rarely stopping siltstones and sandstones. Anhydrites, mainly distributed in the middle and upper parts, play a large role in the structure of the suite. Anhydrites are white, light gray, thin and medium-layered, fine and medium-grained. The thickness of the layers varies from 3-5 cm to 1.0 m, rarely up to 5.0 m. Anhydrites alternate with dolomites in the section of sedimentary formations and usually lie on rhythmopachs. In the fault zone and in contact with igneous rocks, dolomites are crushed into secondary limestones.

The isotopic composition of sulfur in anhydrites is oceanic. Their location in the section, paragenesis, evaporite sediments, and isotopic composition indicate their sedimentary origin.

in thin sections, rock salt is rare. The thickness of the sandstone layers is 0.5 - 5.0 cm.

The upper part of the suite consists mainly of black and dark gray dolomites.

The contact of the suite with quartz porphyries of the Lower Devonian is tectonic, associated with an interformational rupture at the boundary of two different media. In this regard, various horizons (20-20 sections) of the Almalyk Suite come into contact with quartz porphyries.

The thickness of the formation varies from 0 to 112.0 m.

The Karatagata Suite (D3fm1-2kr) lies in the deposits of the Almalyk Suite and is divided into two sub-suites: lower-Karatagata and upper-Karatagata.

The Lower-Karatagata subsuite (D3fr1kr1) is the beginning of a large rhythm in the sedimentation of the territory.

The suite is represented mainly by light gray, greenish-gray sandstones, green, grayish-green, gray argillites, and thin relaying of light gray sandstones (thickness 0.1 - 5 cm, sometimes 5-10 cm) along dolomites. Stratification is rhythmic. Usually, terrigenous or terrigenous-carbonate rocks underlie the rhythms.

Above it lie gray, light gray, greenish-gray, dark gray, rarely black, thin and medium-layered, argillite-layered, and rarely lenticular sandstone dolomites.

The Lower Almalyk Suite is distinguished by a coarser composition, a predominance of sandstone strata, and the absence or presence of single, low-strength anhydrite strata. Capacity up to 60 m.

The boundary between the deposits of the Almalyk Suite and the deposits of the Upper Karagaty Lower Suite is determined conditionally, since their cross-sections are very close to each other. In carrying out the connection between them, special research data were used by the staff of the Laboratory of Sedimentary Formations and Sedimentary Ores of Tashkent State University (I.V. Pleshenko et al.).

The Upper Karatagata Suite (D3fm2kr2) mainly consists of thick-layered black and dark gray bituminous dolomites.

It corresponds to the massive dolomite horizon, identified by Zh.N. Kuznetsov (157) and I.B. Fedorova (1964), and is the defining horizon for the Almalyk ore region. In the Kulchulak section, the main part of the polymetallic mineralization is located in the deposits of the Upper Karagatai Lower Suite.

The lower part consists of dark gray, black, bituminous, thick-layered, spark-induced dolomites, formed in a zone of fine-block stagnation. Dolomites are fine and finely granular. According to carbonate analysis data, dolomite accounts for 96.5 - 98.3%, calcite - 0.7 - 1.2%, insoluble residue - 0.5 - 2.86%.

According to spectral analysis, high concentrations of lead and zinc are present in dolomites, the thickness of which ranges from 44.0 to 81.0 m.

The middle part consists of thin layers of light gray, gray, greenish-gray dolomite with a thickness of 1-10 mm and thin layers of gray, grayish-green, green, micro- and foliate argillites. Stopping of sandstones with a thickness of up to 10 cm at the base and in the middle was noted. The sandstones are medium-grained, the fragments are mainly quartz. The thickness of the layer is from 6.0 to 10 mm.

The upper part of the suite consists of dark gray and black bituminous dolomites. Dolomites are medium- and thick-layered, thin and fine-grained, resembling black dolomites of the lower suite.

According to spectral analysis, dolomites contain high concentrations of lead and zinc. The thickness of the layer is from 9.0 to 20.0 m. The power of the rhythmic subunit is up to 100 m.

The Kulatin Suite (D3fm2kl), like the previous suites, opens with wells at depth. Kuznetsov Zh.N. (1957) and Fedorova I.B. (1964) identified similar deposits in adjacent sections as a belt dolomite horizon. In 1964, they were identified by J.N. Kuznetsov as the Kulatin Suite of the Famen Stage.

The deposits of this suite consist of a uniform layering of dolomites of various colors: dark gray, light gray, gray, and greenish-gray. Usually, pale gray, greenish-gray, gray dolomites, layered pelite, rarely siltstone, and sandstone lie at the base of rhythmopaches. The terrigenous mixture is found in the lower part of the substrate.

Dolomites have a dark gray, black color in the upper part of their rhythms, often bituminous. In the structure of the suite, 8 rhythmopaches are distinguished.

Faciesally, dolomites are formed in the zone of shallow silt and, less often, in the zone of stagnation.

Faciesally, Devonian ore-bearing carbonate formations are formed in arid climatic conditions in a shallow water basin with high water salinity, in the form of isolated or semi-isolated wide lagoons with a shallow facies belt with fragmented silt and stable facies zones in their areas.

The Kulchulak Suite (C_1V_2-3kč) is exposed on the surface of the deposit in the form of separate outcrops, and at depth under the effusives of the Akcha Suite. Contact with the lower Famen deposits is tectonic. The suite consists of re-stratification of limestones, including organogenic, organogenic-fragmented, chemogenic, pelithic limestones, and rare layers of argillites. In them, silicon constrictions, lenses, and silicification are widely manifested.

According to the definition of microfauna by Kuznetsov Zh.N. (1964), these formations belong to the Middle-Upper Vise and are classified as the Kulchuluk Suite.

In the lower part of the suite are located gray, layered dark gray and light gray limestones, thin and fine-grained, medium and rarely thin-layered limestones. They contain layers of dark gray and gray-colored argillites (1-5 mm). At the base, the limestones are clearly quartzified. Package thickness 40.0 m.

Above it lie gray, dark gray, thin and fine-grained, crinoidal, organogenic-fragmented, coarse-dendritic, medium and thick-layered limestones. Crinoids reach a diameter of up to 1 cm, corals, fragments of sea urchins are less common. The parts are quartzified. In the upper part of the rock, up to 12.0 m thick, it consists of solid quartzite, often with silicified crinoids. Fine-spotted pyrite and very rarely galena are found in the silicified areas. Package thickness 30.0 m.

Above them lie piles of gray limestones with layers of light gray and dark gray. Limestones are medium-layered, micro- and fine-grained, in some places recrystallized and quartzified, with layers of completely quartzified limestones consisting of solid quartzites with a thickness from 5.0 to 30.0 m.

Thin layers of green and gray argillites are rarely observed in them. Crinoids and sea urchin detritus are also rare.

Siliceous rocks are represented by a microgranular silicon aggregate in the main mass, with grains of 0.02 - 0.03 mm being rare. Fine-grained and fibrous quartz veins and cavities were noted, the thickness of the bundle ranged from 30.0 to 80.0 m.

The suite consists of a collection of organogenic and organogenic-fragmental limestones, rarely stopping chemogenic limestones.

Limestones are gray and dark gray, thin and fine-grained, medium-layered, with layers of light gray limestone, with siliceous strands, with areas of silicification. Crinoidal and polydecrite limestones. Fragments of sea urchins and algae are found in polydecrite limestones. Package thickness from 20.0 m to 50.0 m. The thickness of the formation is up to 170 m. Polymetallic mineralization has been identified in quartzified limestones and secondary quartzites from the limestones of a number of wells, but no industrially significant ore bodies have been identified. Stratigraphically unconformable carbonate deposits of the Kulchulak Suite are covered by effusive formations of the Akcha Suite.

These deposits are exposed along the Kulchulak, Chilik, Kauldy rivers and their watershed sections, occupying approximately 70% of the deposit area. They mainly consist of andesite porphyries, andesitodacite porphyries, lavobrecci, and tuffs.

The derivatives of the suite are divided into two sub-suites: the Lower Aqcha (S_2ak_1) and Upper Aqcha (S_2ak_2) sub-suites are absent.

At the base of the Lower Akcha Suite, in the northern and northeastern parts of the deposit, there is a sedimentary packet (S_2ak_1), consisting of conglomerates, gravelites, sandstones, and siltstones.

The composition of pebbles mainly consists of limestones, dolomites, andesite porphyrites and their tuffs, less often quartzites. Sedimentary formations of this pachka lie on the eroded surface of carbonate rocks. Their thickness varies from 6.2 to 88.0 m.

In the central part of the Kulchulak deposit, deposits of this aggregate are absent, and in carbonate rocks with tectonic unconformity lies the upper aggregate of the lower Akcha suite (S_2ak_2) - andesite porphyrites. These are green, dark green, and greenish-gray rocks with a massive or fluidal texture, having a fine-grained, fine-porphyry structure. The main mass consists of feldspars, where carbonate, albite, and chlorite are developed. Porphyritic extracts consist of elongated plagioclase (andesine) and amphibole granules arranged parallel to each other, often replaced by carbonate or chlorite. The total thickness of andesite porphyrites, exposed by column boreholes, is 360 m. Their strength increases with the penetration of the brachianticlinal wings to the north and northwest.

The Middle Akcha subsuite is developed on the northeastern and southwestern wings of the deposit area. It consists of andesitodacite porphyries and their tuffs. These are greenish-gray, dark gray, purple, violet, and brown rocks with a massive or fluidal texture, with a large porphyritic texture. They consist of porphyritic, glomeroporphyritic secretions of plagioclase up to 8 mm, hornblende (up to 5 mm), biotite (up to 1 mm), rare water-transparent grains of quartz (up to 4 mm), and a binding mass. Porphyritic inclusions make up 20-40% of the rock volume, while plagioclase always has a sharp advantage over other minerals.

The binding mass consists of microlites of these minerals, calcite, and glass. Dark-colored minerals are partially opacified in green lavas, dark-colored minerals are almost completely opacified in violet and brown lavas, and magnetite and hematite formed during opacification impregnate the binding mass thinly, giving it a violet and brown tint.

The degree of crystallization of green and dark green lava is somewhat higher than that of violet and brown lava. The total thickness of Andezitodacite porphyries has been determined up to 330 m.

In the northeastern part of the area, along the Chiliksay, a tuffaceous-sedimentary pachka with a thickness of about 30 m is revealed under this suite. These deposits have not been identified by wells.

In the northeastern and western wings of the deposit, deposits of the lower nadak suite are revealed in small areas, represented by dacite-containing tuffs, conglomerates, gravelites, and sandstones. These deposits lie on the eroded surface of the Middle Aqcha Lower Suite with stratigraphic unconformity.

Conclusion

At the Kulchulak polymetallic deposit, some areas of Paleozoic rocks are covered with Cretaceous and Paleogene (K2+P1) deposits, which developed on a very limited area and are

preserved from erosion in the high watersheds of the northwestern part of the deposit area. The cross-section of these deposits is mainly studied by wells and is represented from bottom to top: red clays (1-5 m), carbonate-cement sandstones (5-20 m), green striped clays (5-10 m), shell limestones (5-10 m).

The total preserved thickness of these deposits does not exceed 30 m.

Quaternary deposits cover approximately 60% of the deposit area (taken from a 1:2000 scale geological map). They are developed on the slopes of inclined watersheds, valleys and slopes of streams and ravines, and are represented by alluvial and deluvial-proluvial deposits. Their thickness reaches 60 m.

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