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Geology and Mineral Minerals of Paleogene Period Deposits in Pachkamar Area

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ABSTRACT: In this article, the rocks, geology and minerals related to the deposits of the Bukhara suite of the Paleogene period in the Pachkamar area are described. A geological map of the area and laboratory results of some minerals are also available. It is recommended to carry out additional geological research in this area.

KEYWORDS: Minerals, raw material, mineral, geological shear, geological prospecting, geological map, limestone, dolomite, dolomitized limestone, gypsum, quartz sand, rock.

I. INTRODUCTION

In recent years, the demand for industrially important minerals has been increasing. In this place, the role of natural minerals is incomparable. Because the need for natural minerals for the development of production, agriculture and construction industries is increasing year by year.

Today, large-scale scientific research aimed at production is being carried out in countries with developed geology. In our republic, extensive measures aimed at the exploration of nomadic deposits and the expansion of its mineral raw material base are being implemented step by step. In this regard, scientific research aimed at identifying and improving Paleogene-era minerals in the Pachkamar area is of great importance.

II. SIGNIFICANCE OF THE SYSTEM

In this article, the rocks, geology and minerals related to the deposits of the Bukhara suite of the Paleogene period in the Pachkamar area are described. The study of methodology is explained in section III, section IV covers the experimental results of the study, and section V discusses the future study and conclusion.

III. METHODOLOGY

Pachkamar area is administratively located in Guzor district of Kashkadarya region. Their geographical location corresponds to the northern foothills of the southwestern foothills of the Hisar ridge.

The geographical coordinates of the Pachkamar area and the sheet nomenclature are as follows.

Object	Geographic coordinates		Sheet nomenclature
	North latitude	East Longitude	
Pachkamar square	38º33′ − 38º34′	66º21′ − 66º22′	J-42-49 B-v

As a result of the study of the Paleogene deposits in this area, mainly limestone, dolomite and gypsum can provide reserves of industrial scale.

The geological structure of the area includes the formation of deposits of the Meso-Cenozoic: Cretaceous, Paleogene, Neogene and Quaternary periods. (Figure 1)[1].

The oldest deposits in the area are Cretaceous rocks. Upper Cretaceous deposits ***(K_2md-kt; K_2sr-kf)*** occupy a large part of the studied area. It consists of clays, sandstones, limestones and siltstones up to 250 m thick.

Paleogene period *(Ꝑ)*. Bukhara suite *($Ꝑ_1$bh)*. The suite deposits are located unconformably in the Upper Cretaceous deposits and are represented by dolomites, limestones, gypsum and gels up to 150 m thick.

Suzoq and Khanabad suites *($Ꝑ_{1-2}$ sz-hn).* Suzoq suites together are up to 250 m and consist of argillites, siltstones and clays.

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The productive layer of the Bukhara suite, according to previous work, is represented by dolomite and dolomite limestones, which are practically indistinguishable from each other in appearance and represent a light gray, white rock similar to chalk, and lie in parallel layers.

Productive layers in the area can be observed at a distance of up to 12 km with an apparent thickness of 100-250 m. From the morphological point of view, it is expressed that the layer is layered with a dip of 10-20º to the west and south-west. In order to study the productive layer in the area, prospecting work was carried out, geological sections, routes and canvases were studied, and a detailed description of all rock layers was given.

IV. EXPERIMENTAL RESULTS

According to the structural-textural characteristics and color of the rocks, layer thicknesses can be grouped into the following basic units (from top to bottom) [4].

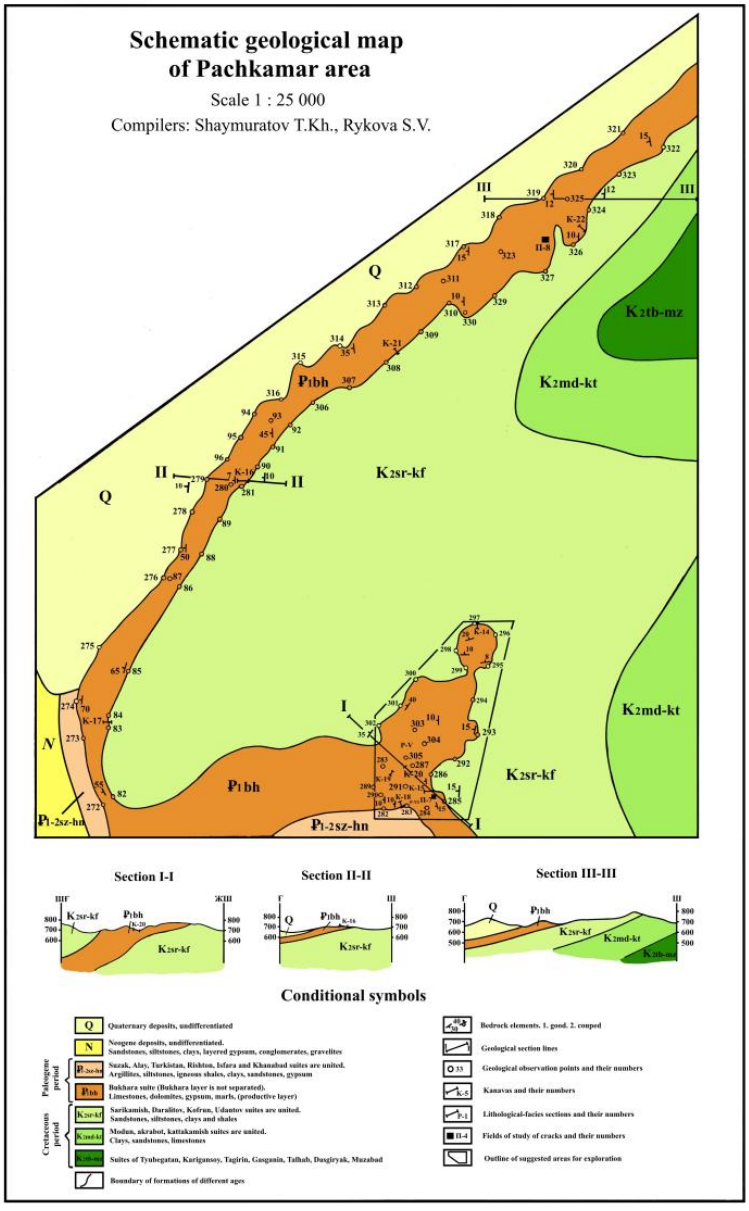

Figure 1. Geological map of Pachkamar area.

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I- dolomitic limestones and dolomites. Dolomite limestones are characterized by the presence of iron hydroxides along the cracks, large and small oolites, light gray and gray-white with a yellowish tint, and unevenness. Under the microscope, the rocks look like pseudo-olitic limestones. Pseudoliths are composed of cryptocrystalline calcite surrounded by a thin shell of complex solid crystalline calcite. The rocks are characterized by the abundance of phoromifera fauna. Dolomites are white, chalky, pelitomorphic, sometimes fine-grained. The rocks of this layer are soft and easy to process. Under the microscope, this rock consists of carbonate, composed of a homogeneous cryptocrystalline mass with grain sizes of 0.001-0.003 mm. Rocks are less porous. The total actual thickness of the layer is 10-20 meters.

II- light gray gypsum with dense hidden crystals. In the cross-section, sometimes separated and productive layers can be observed along the length and is considered a marker horizon. Its thickness is 8-10 meters.

III- chalky, white-gray dolomites, similar to the I-pachka rock, in the lower part of the cross-section, the layered part of dolomites is located between gypsum layers with a thickness of 0.5-3 m. The thickness of the patch is 5-15 meters.

According to the mineralogical and petrographic composition of the rocks, I and III packs are almost the same - it can be seen that they passed between dolomites and dolomitized limestones in different ways (Table 1).

1-Table

Quality indicators of dolomites of the Pachkamar Prospective Area, Pach 1, according to research data.

Qualitative indicator		Edinitsa, izmerenia	Indicators		
			Minimum	Maximum	Average
Amount	CaO	%	29,68	32,69	31,21
	MgO	%	12,39	20,96	18,97
	CO_2	%	20,20	45,97	35,93
Mass volume		g/cm^3	1,63	2,08	1,85
Water absorption		%	3,77	26,64	14,83
Dry strength limit:		kg/cm^2	20	415	27,5
The same - in a state saturated with water		kg/cm^2	7	350	178,5
The same - after freezing		kg/cm^2	9	260	134,5
Softening coefficient			0,62	0,69	0,67
Cold resistance coefficient			0,25	0,55	0,4

The chemical composition of the main components is as follows: CaO - from 29,68 to 32,69%. Average 31,21%; MgO- from 12,39 to 20,96%, average 18.97%; CO_2 - from 20,20 to 45,97%, average – 35,93%. According to the analysis, it is clear from the chemical composition that the rocks belong to dolomites, the Pachkamar field is considered a promising area, and the estimated resources of R1 dolomites are estimated at 7,5-8 million tons.

The deposits of the Paleogene period lie with washed sediments of the deposits of the Neogene period. In its last appearance, it is represented by sandstones, siltstones, clays, conglomerates, gravelites. These deposits can be seen in the form of openings in the southwestern part of the site.

Quaternary deposits occupy a large part of the area. It is represented by boulders, sandy-gravel materials and loess-like soils up to 20 m thick.

Structurally, the Pachkamar area is bounded by the western flank of the Guzor-Lyangar anticlinal structure, whose axis passes eastward from the described area. In the direct field, the western part of the fold dips monoclinally to the west (340-360º) at an angle of 10-40º and is not complicated by any faults. Disjunctive processes were manifested in the formation of several genetically interconnected fault systems in this area.

The following minerals can be found in the Bukhara suite deposits of the Paleogene period in the Pachkamar region. Mainly limestones, dolomites, dolomitized limestones and gypsum rocks. Let's get acquainted with the conditions of formation and chemical composition of these rocks, as well as the fields of use.

Limestones are carbonate sedimentary rocks that are composed of more than 50% calcite or skeletal remains of organisms, sometimes the mineral aragonite (CaSO3). Often, a mixture of authigenic, diagenetic and epigenetic minerals, chalky (terrigenous and carbonate) particles is found in the composition. If limestone contains 4-17% MgO, dolomite limestone; 6 - 21% SiO_2+R_2O, - marly limestone; if quartz, opal and chalcedony are added - it is called sandstone and silicified limestone [2].

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Figure 2. Opening of limestone layers in the Pachkamar section.

Limestone is widely used in industry, agriculture and construction (Figure 2). In ferrous metallurgy, as a substance (flux) added to increase ore melting and form slag; raw materials for lime and cement production; soda, mineral fertilizers, glass, paper production, refining of oil products, etc. used as an additive in processes. Limestone forms an important group of building materials, including facing and decorative stones, stones used in sculpture and architecture, etc. is prepared. The limestone sample taken from the Pachkamar area that we are studying can be used as a mineral, as can be seen from the analysis results Table 2.

Dolomite - $CaMg[CO_3]_2$ - ***Chemical composition.*** CaO 30.4%, MgO 21.7%, SO_2 47.9%. The amount of CaO and MgO varies slightly. Isomorphic compounds: Fe, sometimes Mn (up to several percent), rarely Zn, Ni and So are present. There are also cases where bitumen and other foreign substances are added to dolomite crystals. The main mass of dolomite is associated with carbonate layer sediments of all geologic periods, especially Precambrian and Paleozoic periods. Among such layers, dolomite often forms solid massifs and is layered with limestone, sometimes forming piles, nests, etc., of a more regular shape.

The question of some details of the formation of dolomites has caused a lot of debate. In most cases, they are primary sediments, formed in saline basins, as indicated by their association with gypsum, anhydrides, and salts of more water-soluble alkaline elements. In other cases, it is possible that previously deposited calcium carbonate sediments were dolomitized. Because there are facts of dolomite formation in place of calcareous remains of shells, corals and other organisms (Fig. 3).

Dolomites are widely used for various purposes: 1) as a building material (stone); 2) as products for connecting thermal insulation materials with asbestos and others; 3) as an additive (flux) and refractory product in metallurgy; 4) used in chemistry and many other industries Table 1.

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Figure 3. Paleogene dolomites in Pachkamar section.

Dolomitized limestone is a process of new formation of dolomite in rocks. Calcite in dolomitized limestones is formed by metasomatic replacement of dolomite. As a result, secondary dolomites appear. The effect of dolomite on the porosity of rocks (especially limestone) is a complex process, and its course depends on the shape, size, arrangement and other properties of dolomite particles [2].

GIPS (Greek gypsos - chalk, lime) - natural gypsum - mineral; aqueous calcium sulfate salt $CaSO_4 \cdot 2H_2O$; contains pure CaO (32.56%). It will be SO_3 (46.51%), N_2O (20.93%). It crystallizes in a monoclinic system. Crystals are plate-like, columnar, diamond-like and fibrous. Often, it is found in the form of contiguous granular, fibrous masses, various crystalline groups. Pure gypsum is colorless and transparent; it is gray, yellow, brown and other colored because it contains additives [3].

Gypsum is formed in different ways under natural conditions.

1. It occurs in the form of much larger masses by sinking in salt water lakes and sea basins that have begun to dry up. In this case, gypsum along with NaCl can be separated only in the initial stages of water evaporation when the concentration of other dissolved salts is not yet high. When the concentration of salts, including NaCl and especially $MgCl_2$, reaches a certain level, anhydrite begins to crystallize in place of gypsum, followed by other easily soluble salts. So, gypsum is one of the chemical sediments that appear in these basins much earlier.

2. A large mass of gypsum occurs in sedimentary deposits under the influence of surface waters, under conditions of reduced surface pressure (on average, up to a depth of 100-150 m) as a result of hydration of anhydrite according to the following reaction: $CaSO_4 + 2N_2O = CaSO_4\ 2H_2O$. In this case, the volume of the rock expands significantly (up to 30%), accordingly, in the conditions where the gypsum layers are lying, there are many and complex deformations typical for this place. This is how most of the large gypsum deposits in the world originated.

3. Gypsum is abundantly found in the form of thin veins and nodules (jelvak) in the weathering zone of rocks with a very diverse composition in semi-arid and desert areas. Often, limestone is also formed by the action of sulfate, acid, or dissolved sulfate-rich waters. Finally, it is found in the oxidation zone of sulfide deposits, although not as abundantly as expected. The fact is that, in most cases, sulphide ores contain a certain amount of pyrite and pyrrhotite, and their (especially the first) oxidation significantly increases the amount of sulfuric acid in surface waters. Enrichment of water with sulfuric acid, on the other hand, slightly increases the solubility of gypsum. Therefore, in many deposits, gypsum is a mineral that usually occurs above the primary ore zone and is found in the cracks (cracks) along with other sulfates.

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4. Gypsum, a typical hydrothermal mineral, is rarely found in sulphide deposits formed at low pressure and temperature. In these deposits, it sometimes occurs as large crystals in voids and contains chalcopyrite, pyrite, sphalerite, and other minerals.

Just as there are pseudomorphs of calcite, aragonite, malachite, quartz and other minerals formed in place of gypsum, there are also pseudomorphs of gypsum formed in place of other minerals.

Gypsum sedimentary deposits are associated with deposits of different periods, and gypsum minerals in the Pachkamar area correspond to the second clause of the illuminated sentence (Fig. 4).

Gypsum is very important in construction works.

1. Model or painting plaster (pre-burnt plaster) is used in plastering walls and ceilings for casting, hanging decorations, patterned cornices, surgery, paper industry, production of white thick paper and other purposes. In the gypsum used in construction works, its content should not be less than 85%, and it is used as cement in bricklaying and stonelaying, in the preparation of slabs and bricks for flowered floors, stairs and plinths, and other purposes.

Figure 4. Excavation of clay rocks in Pachkamar section.

2. Raw (natural) gypsum, which is mainly used as an additive to Portland cement in the cement industry, should not contain more than 90% $CaSO_4 \cdot 2H_2O$, as a material for sculpture, in various decoration works (especially Ural selenite), paints, enamels, paints in production, it is used in metallurgical processing of oxidized nickel ores and in other places [5].

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Table 2
Results of ICP-MS analysis of limestone sample from Pachkamar area

The name of the sample	Lab№	Geol №	Elements	Li	Be	B*	Na*	Mg*	Al*	P*	K*	Ca*	Sc	Ti*	V	Cr	Mn	Fe*	Co
Measuring range def. elements				0,05-4000	0,05-4000	0,10-4000	0,004-11%	0,004-11%	0,002-20%		0,008-30%	0,005-28%	0,10-4000	0,0006-9%	0,20-4000	1,0-4000	0,002-10%	0,006-30%	0,10-4000
Limestone	116-1	Sample -2		7,00	<0,088	22,0	541	103263	2349	123	613	234687	0,489	60	20,1	41,4	28	4590	1,27

Table 2 continued

The name of the sample	Lab№	Geol №	Elements	Ni	Cu	Zn	Ga	As	Se	Rb	Sr	Y	Zr*	Nb	Mo	Ag	Cd	In*
Measuring range def. elements				1,0-4000	1,0-4000	1,0-4000	0,10-4000	0,10-4000	0,50-4000	0,10-4000	0,10-4000	0,10-4000		0,005-4000	0,10-4000	0,05-10,0	0,005-4000	
Limestone	116-1	Sample -2		9,64	12	13,1	0,365	10,6	6,32	1,75	168	0,519	2,30	0,188	3,20	0,058	0,139	<0,005

Table 2 continued

The name of the sample	Lab№	Geol №	Elements	Sn	Sb	Te	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho
Measuring range def. elements				0,10-10	0,10-4000	0,30-4000	0,02-4000	0,10-4000	0,50-4000	0,04-4000	0,01-4000	0,01-4000	0,01-4000	0,01-4000	0,01-4000	0,01-4000	0,01-4000	0,01-4000
Limestone	116-1	Sample -2		0,085	0,342	<0,30	0,130	12,1	0,664	1,88	0,143	0,547	0,062	0,046	0,145	0,008	0,091	0,021

Table 2 continued

The name of the sample	Lab№	Geol №	Elements	Er	Tm	Yb	Lu	Hf	Ta	W	Re	Pt*	Au*	Tl	Pb	Bi	Th	U
Measuring range def. elements				0,01-4000	0,01-4000	0,01-4000	0,01-4000	0,05-4000	0,04-4000	0,08-4000	0,01-4000	0,05-4000	0,05-4000	0,01-4000	0,1-4000	0,01-4000	0,01-4000	0,01-4000
Limestone	116-1	Sample -2		0,045	<0,01	0,062	<0,01	0,069	0,030	0,119	0,018	<0,05	<0,05	0,275	1,95	0,078	0,565	3,86

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V. CONCLUSION AND FUTURE WORK

In conclusion, it can be said that based on the results of the geological exploration and scientific research conducted in the Pachkamar area, it can be said that limestone, dolomite and gypsum minerals are of industrial importance and that the reserves are sufficient.

If we take into account the results obtained from limestone, dolomite and gypsum rocks in this area, it is possible to continue geological exploration. Because in the Pachkamar area, there is an opportunity to find mineral reserves from limestone, dolomite and gypsum rocks.

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