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OCCUPATION CONDITIONS AND LITHOLOGICAL AND PETROGRAPHIC CHARACTERISTICS OF THE CAINOSOIAN DEPOSITS OF THE NORTHERN SIDE OF THE FERGANA DEEP.

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ABSTRACT
The stratigraphic confinement of individual layers of the Paleogene-Neogene strata of the Fergana region is in demand due to the need for geological exploration in order to study the conditions for the occurrence of Cenozoic deposits and, as a result, the search for mineral deposits. On the example of the northern side of the Ferghana depression, the results of geological surveys in separate areas and a detailed description of thin sections, selected rock samples are presented. The studies carried out made it possible to reveal the patterns of sedimentation conditions, the stratification of the Kaisozoic strata. It was also established that sedimentation and the formation of individual strata and layers in individual areas were different, which is apparently associated with the depths of the Paleogene Paleosea and hypsometric marks of paleosurfaces.

KEYWORDS: Paleogene, Neogene, Paleozoic, shelf, limestone, dolomite, Geological structure, petrographic characteristics, lithology

INTRODUCTION

Since ancient times, the Ferghana region has attracted special attention of specialists from various sectors of the national economy, including geological exploration enterprises. Various mineral deposits, including hydrocarbon raw materials, ore and non-metallic raw materials, have been identified within the Fergana Depression. The northern side of the Ferghana Depression is characterized by a complex geological and tectonic structure, sediments from Paleozoic to Quaternary age appear on the daytime surface. To date, within this part of the depression, the main mineral deposits are confined to terrigenous-carbonate deposits of Cenozoic age. In this regard, a detailed study of the lithological and petrographic properties of Paleogene-Neogene formations is necessary at the stage of prospecting and exploration for all types of mineral deposits. The sections of the Ferghana region are characterized by a variety of lithological and petrographic composition of Paleogene-Neogene formations and geological development during this period. A detailed study of the history of sedimentation and lithological-petrographic differences of rocks composing the section of the Cenozoic strata contributes to geological exploration for the purpose of prospecting and exploration of mineral deposits.

STUDY AREA

The area of the conducted research is the northern side of the Ferghana intermountain depression, which in turn is a large negative structure located between the mountain ranges of the middle and southern Tian Shan. The mountain frame or zone of the peripheral ridges of the Middle Tien Shan is composed of highly metamorphosed Paleozoic rocks crushed into complex structures broken by numerous faults. Within the mountain frame, the relief is sharply dissected, absolute marks in places reach 5000-7000m above sea level. The object of the study is the outcrops to the daytime surface of ancient rocks of Paleozoic, Paleogene and Neogene ages (Fig. 1.).

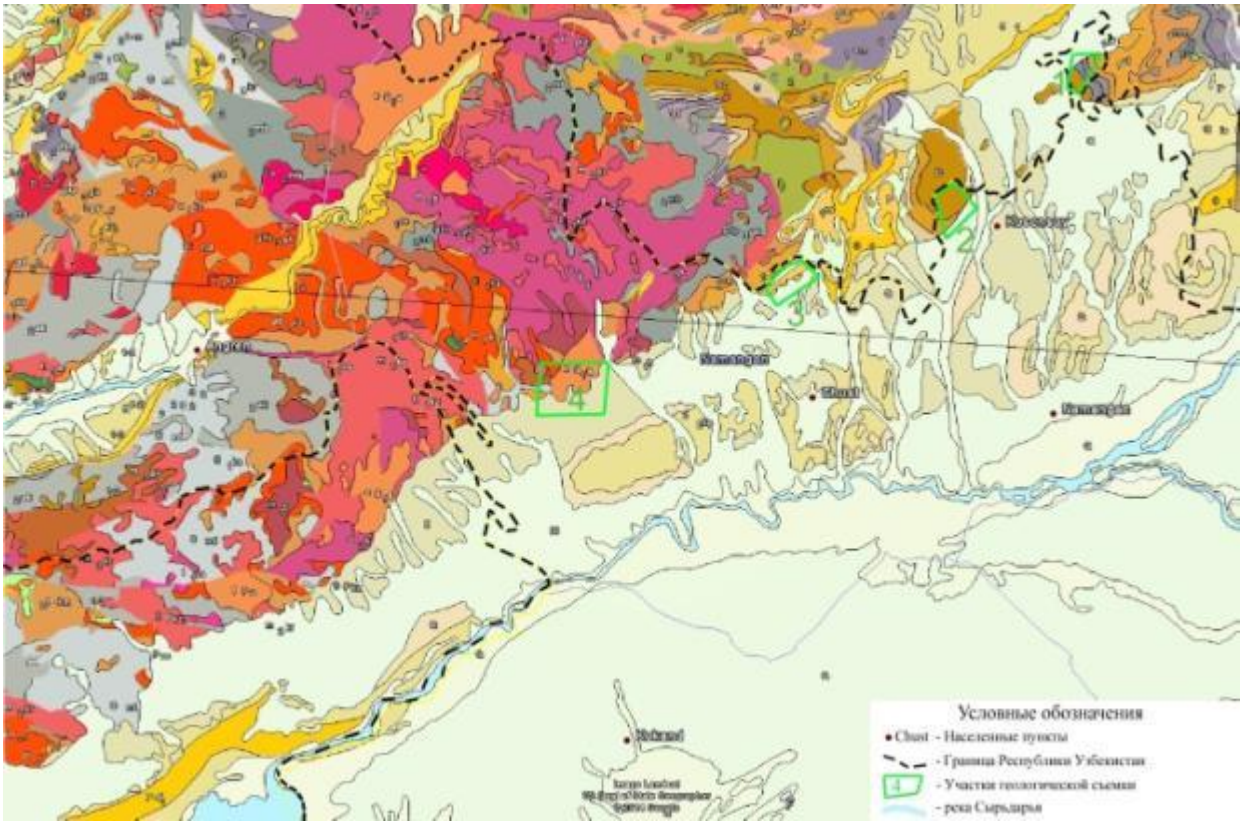


Fig.1. Overview map of the areas of the work area on a geological basis

MATERIALS AND METHODS

Studies aimed at studying the conditions of occurrence and lithological-petrographic characteristics of Cenozoic sediments were carried out by conducting geological surveys with appropriate selection of rock formations in various areas of the northern side of the Ferghana Depression (Fig. 1.). The sections were made according to which their macro and micro description was carried out, which in turn made it possible to study the lithological and petrographic characteristics of Cenozoic sediments, their diversity and, as a consequence, to identify patterns of sedimentation conditions and stratigraphic confinement of individual layers of the Cenozoic strata.

RESULTS AND DISCUSSION

Based on the conducted geological survey, it was found that **section 1** is represented by Paleozoic quartz formations of Devonian-carbon age. These deposits are highly dislocated and dense rocks.

Section 2 is located two kilometers northwest of Kasansai. Terrigenous-carbonate sediments of the Middle Paleogene and undifferentiated Upper Paleogene and Lower Paleogene sediments represented by terrigenous sediments were identified here (Fig.2.). It should be noted that in the process of interpreting geological and geophysical data, including the materials of the OGT 2D seismic survey, there may be a discontinuous disturbance at this site, which is not confidently traced on the surface. This situation is apparently related to the blackness of the upper part of the section, which worsens the mapping of discontinuous violations. Stratigraphically, the Middle Paleogene (Eocene) formations are represented by Turkestan layers. Lithologically, there are limestones, dolomites and marls, as well as silt-sand differences of terrigenous formations. Individual rock samples were petrographically studied under a microscope and based on the analysis of the sections, the following conclusions were made:

Slot 1 (Fig. 3-a). Dolomite is micro-grained, fractured. Dolomite is represented by rounded rhombohedral, less often rhombic crystals ranging in size from 0.015 to 0.05 mm. Inclusions of crystalline calcite (up to 0.1mm) are observed in a small amount, which forms small granular clusters, as well as gypsum in the form of

columnar crystals (up to 0.2 mm in size) and granular clusters (0.25 mm). There is a terrigenous admixture (≈5-7%), represented mainly by quartz, less often by feldspar (n/w) of siltstone dimension, less often the size reaches 0.1-0.2 mm. The cracks are thin, multidirectional, mineral. The cracks are filled with calcite. There are short cracks filled with brown organic matter(s). Organic residues represented by indeterminate recrystallized shell detritus are rarely found. In the rock, there is a displaced type of brown, rarely red-brown, which is located in weakened zones, develops along some shaped elements, fills cracks. This slot is made from samples of rocks of the Turkestan layers.

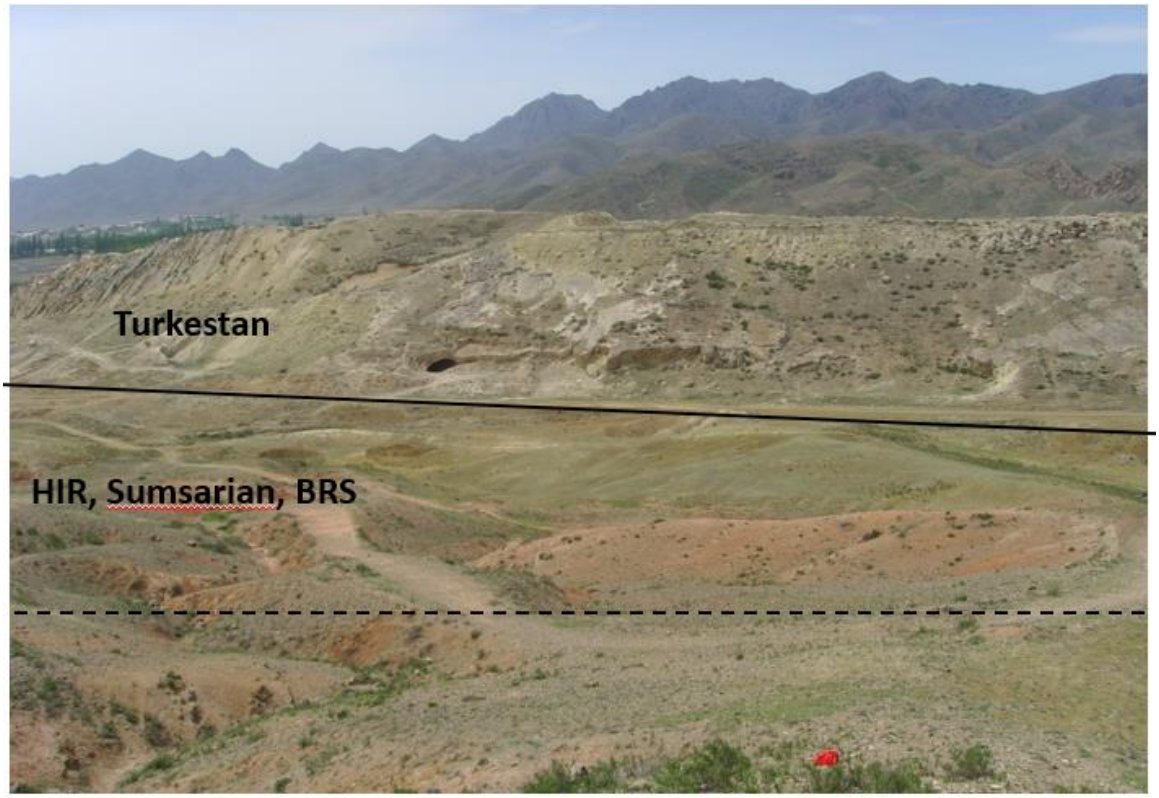


Fig.2. Plot 2. Zone of Paleogene and Neogene sediments out onto the day surface.

Slot 2 (Fig. 3-b). Unsorted mixed-grained terrigenous-carbonate rock, possibly lumpy limestone, almost completely recrystallized, sandy. The detrital part (≈45%) is represented by quartz (≈25%), p/w (≈16%), fragments of clay, siliceous-clay rocks, quartzites, clay shales. Single signs of biotite, zircon, anhydrite are observed. The fragments have different degrees of rolling, smoothed predominate. Size ≈0.1-0.9mm. The debris is characterized by carbonate corrosion. Quartz is pure, sometimes slightly dusty. The extinction is normal, sometimes wavy and running. There are fractured fragments. P/w are represented by potassium feldspar (k/p/w) and plagioclases of acidic, rarely medium composition. C/p/w are weakly pelitized, plagioclases are unchanged. Fragments of clay rocks are to varying degrees crystallized in the hydrogrowth. Carbonate (≈55%) secondary, apparently, replaced lumpy limestone, limestone lumps are observed in the carbonate mass, less often pseudoliths, sometimes recrystallized. There is a displaced type OV, which develops along some shaped elements of the rock. Iron hydroxides are found in small amounts. This slot is made from samples of rocks of the Brick-red formation (BRF).

Slot 3 (Fig. 3-b). It is represented by detritus-algae limestone, clump-fine-lumpy, sandy areas. The rock is intensively recrystallized with the formation of crystalline calcite, dolomite, rarely anhydrite and gypsum. The lumps and clumps are composed of micro-grained limestone, the size does not exceed 0.4 mm. Organic residues are represented by the remains of algae layers, galls and lumps of algae, fragments of foraminifera shells and undetectable shell detritus. Often organic residues are recrystallized. Terrigenous admixture (≈10%) is represented by quartz, p/w (k/p/ w and plagioclases of acid composition), fragments of siliceous-clay rocks, quartzites. Size ≈0.1-0.5mm, rarely 0.9mm. The fragments have different degrees of rolling, smoothed

predominate. Short cracks filled with clay-carbonate, bituminous material are rare. OV is small and is represented by a displaced type of brown and dark brown color, which develops along some shaped elements of the rock and borders them. This slot is made from samples of rocks of the Turkestan layers.

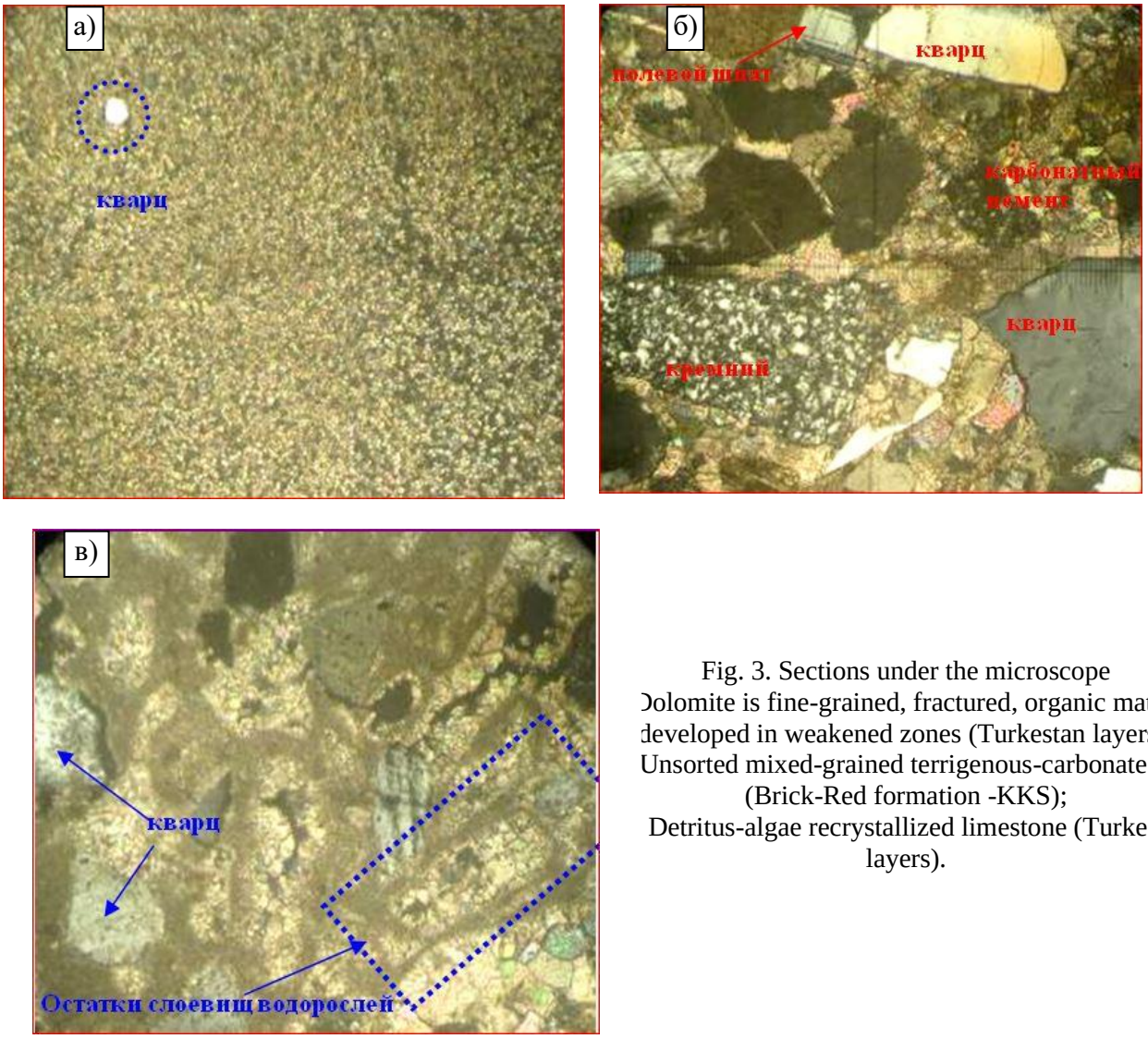


Fig. 3. Sections under the microscope
Dolomite is fine-grained, fractured, organic matter is developed in weakened zones (Turkestan layers);
Unsorted mixed-grained terrigenous-carbonate rock (Brick-Red formation -KKS);
Detritus-algae recrystallized limestone (Turkestan layers).

A more detailed study of Paleogene sediments allowed us to dissect and describe Eocene sediments. So, in particular, in Figure 4, the differentiation in the color scheme of the limestone of the Turkestan and Alai layers is clearly traced. The latter have darker greenish shades. Also an important factor is the presence of a large number of shell rocks in the carbonate deposits of the Alai layers in comparison with the Turkestan ones. This situation allows us to make an assumption that the northern side of the Ferghana Trench, in particular, the study area of site 2 in the Alai time was characterized by more stable marine sedimentation conditions. The change of sedimentation regime to coastal-marine, as evidenced by the light shades of the marl-like limestones of the Turkestan layers, is characteristic of this part of the Fergana Depression. These studies allow us to make an assumption that the regression of the Paleogene sea in the north of Fergana began in Turkestan time.

Section 3 is located in the border zone with the Republic of Kyrgyzstan, north of the city of Chust. Here we have mapped the outcrops of Paleogene sediments, which can also be traced on the geological map (Fig. 1). At certain points of this site we have traced and stratified the Lower and Middle Paleogene sediments (Fig. 5).

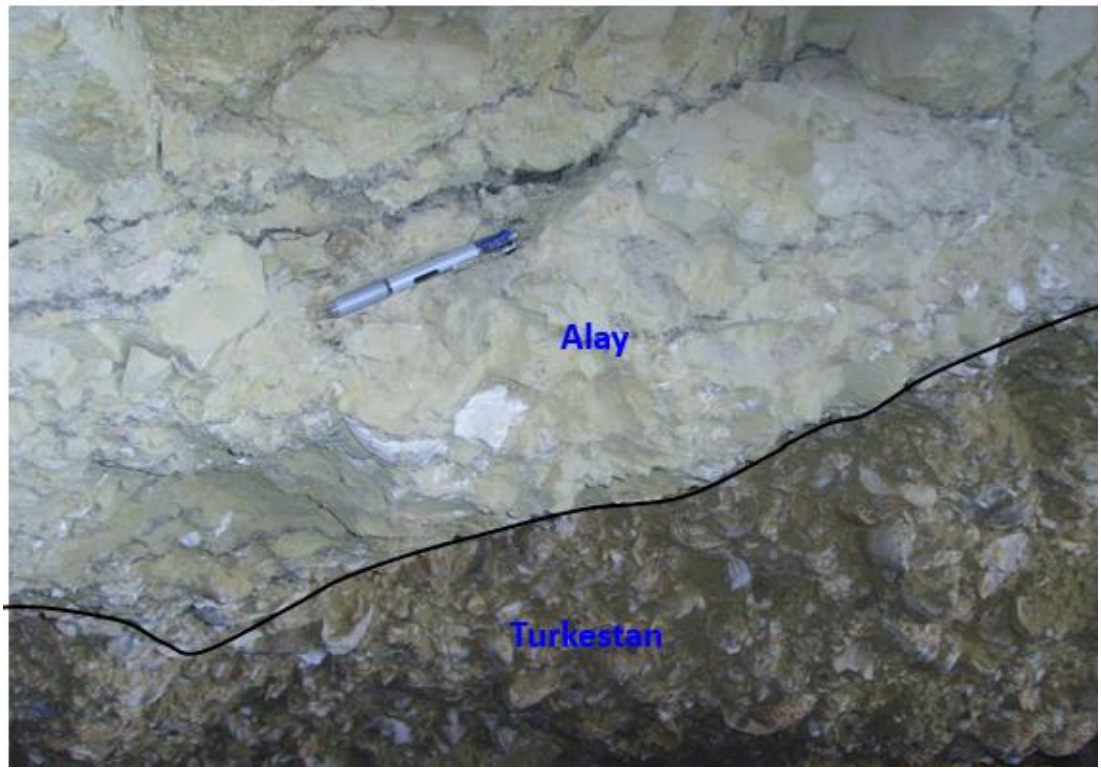
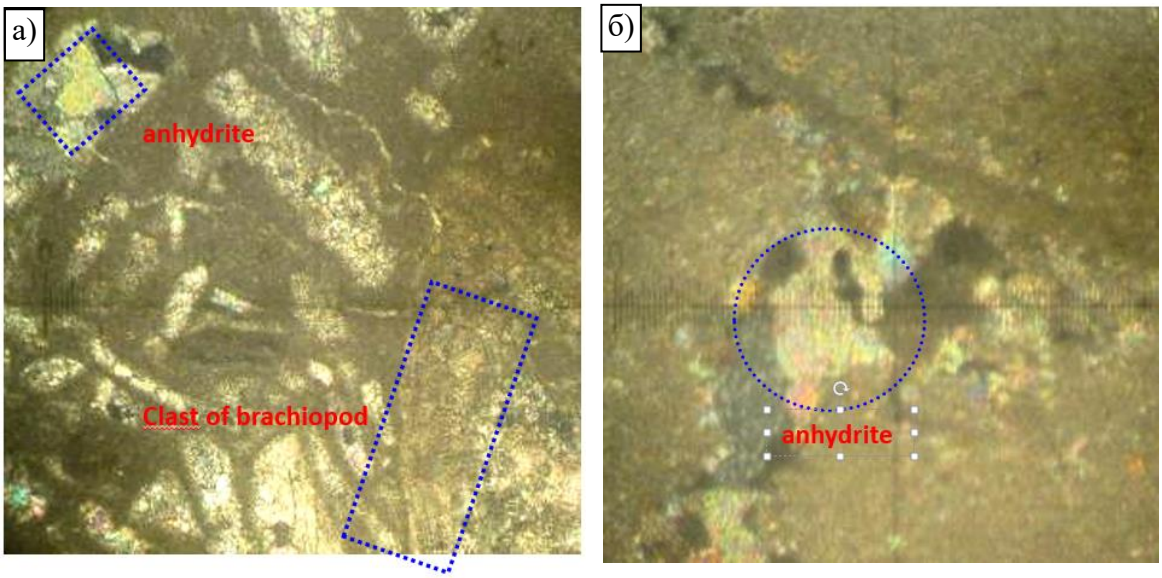


Fig. 4. Dissection of Paleogene Eocene sediments within section 2.

Fig. 5. Dissection of Paleogene sediments within section 3.

So, in particular, the dissection of Paleogene sediments made it possible to distinguish the Lower Paleogene Suzak layers lithologically represented by reddish clay-siltstone differences of terrigenous rocks. Sedimentation, this type of section was formed in continental conditions, as evidenced by the color of the rocks. Above the section, without visible angular inconsistencies, there are deposits of the Middle Paleogene, represented by Alai and Turkestan layers, represented by carbonate and carbonate-terrigenous rock differences. The Alai layers have a lighter color compared to the Turkestan ones. Comparison of the section of these deposits, including the lithological composition and color of the rocks, with similar sections of site 2 makes it possible to assume that the conditions of sedimentation at these two sites were different. First of all, this applies to the paleosurface of the sedimentation area, which at the time of accumulation of the Alai layers within the 3rd site may have been located hypsometrically higher compared to the 2nd section. Thus, the depth of the Turkestan paleomorph at the 2nd section was greater compared to the 3rd section.
At the same time, the analysis of the sections of individual rock samples taken from section 3 was carried out.
Slot 4 (Fig. 6-a). Detritus-algal limestone, clumps of small-lumpy, sandy, intensely recrystallized, terrigenous admixture occurs in an amount of = 3-5%, large fragments of recrystallized brachiopod shells up to 1 mm in size are observed. This slot is made from samples of rocks of the Alai layers.



6. Slots under the microscope

etritus-algal limestone recrystallized with large fragments of brachiopods (Alai layers)
lump-lumpy limestone, organogenic-clastic (Turkestan layers)

Slot 5 (fig. 6-b). Limestone is clumpy-lumpy, organogenic-clastic. The lumps are weakly outlined, composed of micro-grained limestone. Size ≈0.1-0.3 mm. In a small amount, oolites are observed (up to 0.5 mm in size). The rock is selectively recrystallized, along weakened zones with the formation of crystalline calcite, in the mass of which there are accumulations of anhydrite, sometimes plastered, as well as dolomite (epigenetic). There is diagenetic dolomite (≈10%), which forms irregularly shaped grains and less often rhombic crystals. The size does not exceed 0.08 mm. There is a terrigenous admixture (≈3-5%), represented by quartz, n/w, with a size from 0.1 to 0.4 mm. The fragments have different degrees of rolling, smoothed predominate. Pyrite is unevenly distributed in the rock, occurs in the form of hypidiomorphic grains that develop along the shaped elements of the rock, sometimes pyrite forms clusters of irregular shape. Organic remains (≈15-18%) are

represented by recrystallized fragments of shells of bivalves, brachiopods, ostracods, large fragments of mosses with areas of silicified. Remnants of algae layers are observed. The rock is fractured, the cracks are multidirectional, thin, mostly filled with displaced type S, cracks filled with calcite and siliceous matter are rarely observed. There are few S, represented by a displaced type with characteristic forms of selection. This slot is made from samples of rocks of the Turkestan layers.

Section 4 is located in the immediate vicinity of the village of Varzyk. According to the geological map (Fig. 1), the research area is represented by Paleozoic formations, however, our studies, including analysis of selected rock formations and comparison with drilling materials, allowed us to conclude that this site is represented by Paleogene deposits (Fig. 7).

This assumption is based on relatively similar lithological and petrographic properties and structural and mineralogical features of the sections made from rock samples corresponding to the limestones of all three sites.

Below is a description of two grinds made from rock samples taken from the 4th site**.**

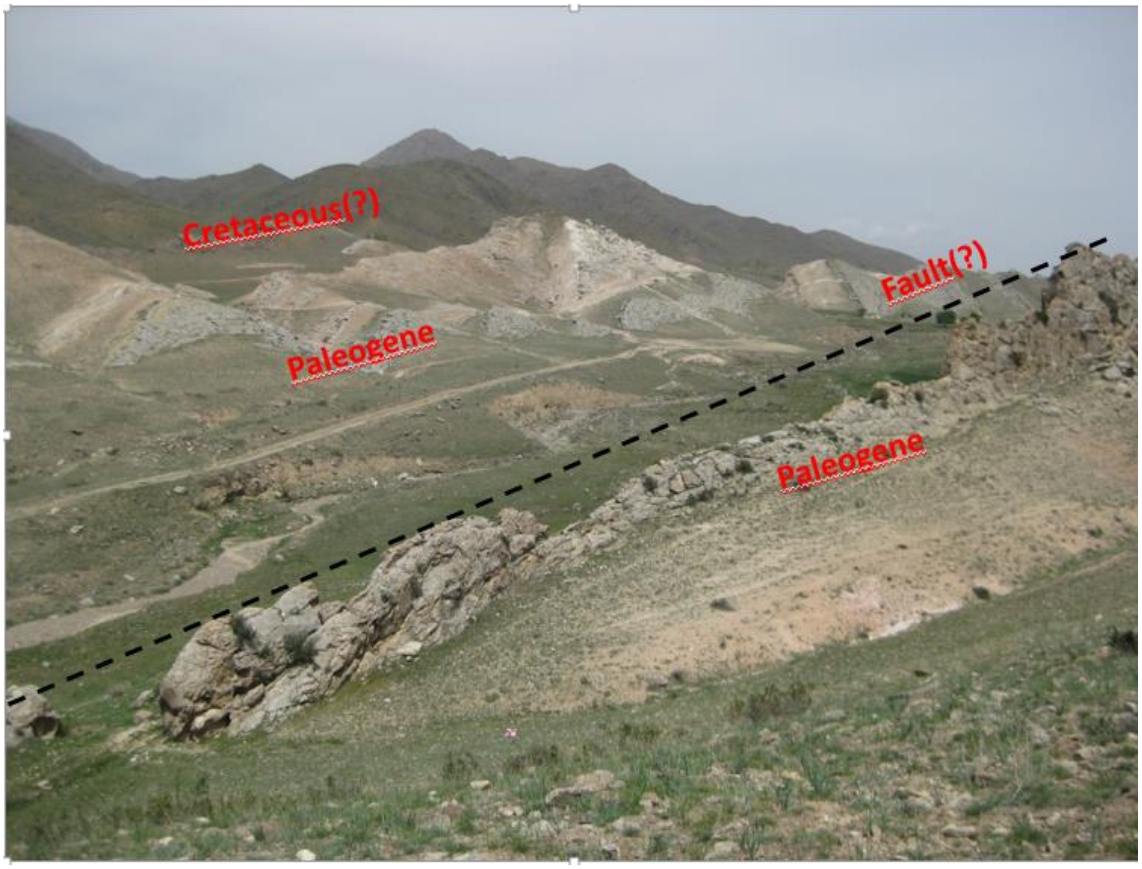


Fig. 7. General view of the section 4.

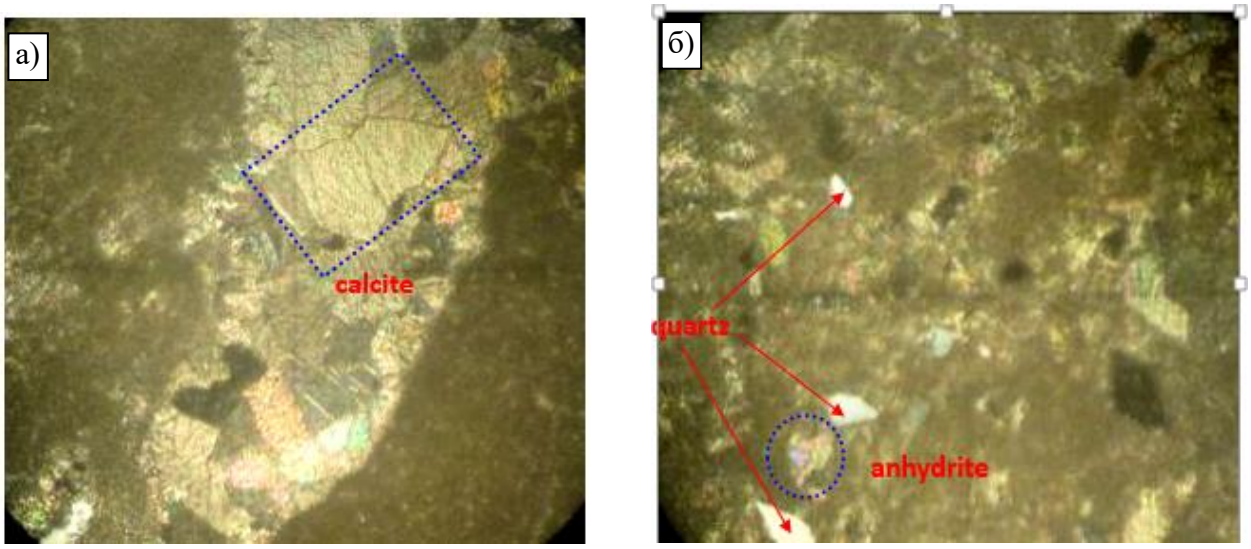


Fig. 6. Slots under the microscope
a) lumpy-clump limestone, organogenic-clastic, sandy
b) Algal-detritus limestone

Slot 6. Limestone is lumpy-clumpy, organogenic-clastic, micro-grained, sandy in sections. The lumps are composed of micro-grained limestone, sometimes the middle parts are recrystallized, the size is ≈0.1-0.6 mm. There are oolites, in the middle part of which terrigenous fragments are observed. The rock is selectively recrystallized, with the formation of calcite, less often dolomite. Calcite forms heterogeneous clusters, sometimes large (up to 3 mm), located in weakened zones. Dolomite (epigenetic) forms fine-grained clusters up to 0.4 mm in size. Diagenetic dolomite is found in a small amount, which forms rhombic crystals and irregularly shaped grains, the size does not exceed 0.1 mm. The terrigenous part (≈10-12%) is represented by fragments of quartz, s/w, siliceous rocks, quartzites, quartz-chalcedony rocks, size ≈0.1-0.5 mm, rarely 0.65 mm. The fragments have different degrees of rolling, smoothed predominate. Quite often, the fragments are corroded by a carbonate substance. Organic residues are represented by undetectable recrystallized shell detritus, algae residues. Open porosity is not observed, the pore space is closed. The rock is fractured, the cracks are thin, multidirectional, filled with displaced type S, less often with calcite, there are rare stylolite seams filled with s. OV is small and represented by a displaced type, which borders individual shaped elements, sometimes develops along them, fills cracks and stylolites. The color is brown, dark brown.
Slot 7. Limestone is algal-detritus, intensively recrystallized to form calcite, less often dolomite (epigenetic), gypsum and anhydrite. Organic remains (=30-35%) are represented by recrystallized fragments of brachiopods (up to 1 cm), fragments of mosses, remnants of algae layers and undetectable shell detritus. Moves of worms are observed. According to some organic residues, anhydrite develops, sometimes plastered. A terrigenous admixture (≈5-7%) is observed in the rock, unevenly distributed in the rock, represented by quartz, s/w, fragments of siliceous rocks. Size =0.1-0.35 mm. The fragments have different degrees of rolling, smoothed predominate. Open porosity is not observed, the pore space is closed. There are rare cracks filled with terrigenous-siliceous-hydrosluidic material through which iron hydroxides develop. The breed is slightly hardened.

Conclusion

Thus, the conducted studies of Paleogene deposits of the northern side of the Ferghana Trench revealed some patterns of sedimentation conditions and stratigraphic confinement of individual layers of the Cenozoic strata. In particular, based on the analysis of the sections, it was revealed that the limestones of the

Turkestan layers in most cases are represented by an algal-detritus type. It was also found that the sedimentation and formation of individual strata and layers at individual sites were different, which is apparently related to the depths of the Paleogene paleomorph and the hypsometric marks of the paleosurfaces.

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