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FACIAL-PALEOGEOGRAPHICAL PROPERTIES OF PALEOGEN SUSTAINABLE DISTRIBUTION IN THE FERGANA BASIN

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ABSTRACT:

As result of facial-paleogeographic studies of the Paleogene deposits of the Fergana depression are distinguished underwater delta, wave-cut, shallow-bay (lagoon) and central-desilting facial belts. The article gives a detailed description of the lagoon facies with their separation into 4 types, which can be the criteria for the prospecting and exploration of nonmetallic minerals, such as palygorskite clays, dolomites and gypsum.

Keywords: Fergana depression, facial belt, lagoon, stratigraphy, facies-paleogeography, paleogenic, lithological, petrographic, tectonic, shell, rishtan strata, Alay strata, Turkestan strata.

INTRODUCTION:

Currently, there are publications devoted to geology, stratigraphy, lithology, paleogeography, oil potential of the Paleogene of the Ferghana basin. The history of the geological study of the Ferghana Depression is described in detail in the works of A.M. Gabrilyan [4] and R.F. Gecker [3], A.M. Akramzhodzhaev [1], G.A. Godovannikov [5], M.Z. Zakirov [6], B.I. Yusman [16], V.S. Popov [11], P.S.Sultonov [12.13] and others. These works give complete information about the state of study of stratigraphy, lithology, paleogeography, oil content, non-metallic minerals, formation conditions and practical application of clay deposits for the study area.

Paleogene sediments occupy the entire Ferghana Valley. In its central part, they are hidden under the thickness of Neogene, Quaternary and modern sediments. The Paleogene extends to the day surface along the edges of the basin. Cretaceous, Paleogene and Neogene deposits form discontinuous rings of outcrops; Paleogene towards the mountains are replaced by deposits of Cretaceous, and towards the center of the basin - Neogene. Within the anticlinal folds between the Paleozoic and the Cretaceous ring, there are strips of Jurassic deposits.

The paleotectonic conditions of the Ferghana Depression, which is part of the Turan Plate, were characterized by a stable platform regime throughout the Paleogene period, and the surface topography was characterized by the highest leveling [14,15]. Paleoclimatic conditions varied from extra-arid in the Paleocene to semi-arid and seven-humid at the end of the Eocene [6].The facial-paleogeographic conditions for the formation of the Paleogene sedimentary formations of the Fergana bay of the Eocene sea were complex and multiphase with constant mutually changing descending and ascending mountain

structures. Due to the limited influence of the open Eocene sea through the Khojent and Alai straits, the Fergana bay had a predominantly salting water basin of the lagoon type [3]. This gives bases to state that there were all the prerequisites (facial and climatic) for the accumulation of palygorskite clays, gypsum, dolomites, phosphorites, sands, etc.[12,13].

In this regard, more and more theoretical and practical importance gain a thorough and comprehensive study of facies and paleogeography with a view of minerals in the Paleogene deposits covering the space of the Fergana Intermountain Depression (FID), which is the largest alpine megasincline of the Western Tien Shan, and has the following boundaries: in the south - Turkestan, in the south-east - Alai, in the north-east - Ferghana, in the north - Chatkal and Kuram ranges, and in the west - Mogoltau mountains (Fig. 1), where these deposits are classically exposed on the surface and go deep into the hollow under a thick cover of sedimentary rocks of the Neogene-Quaternary age [Fig.1].

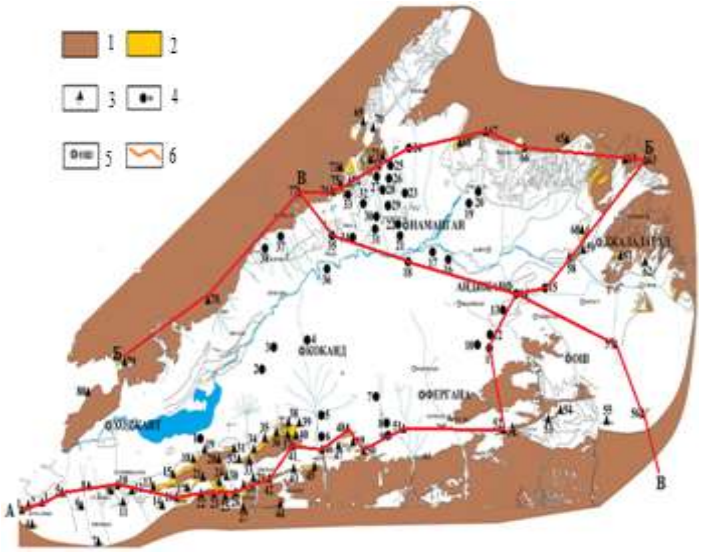

Figure. 1. Map of factual material (compiled by the author on the basis of a geological map of scale 1: 200000).

Legend: 1-outputs of the pre-Paleogene sediments; 2-outputs of Paleogene deposits; 3-place descriptions of sections; 4-Location of wells; 5-centers of settlements; 6-line profile.

The most difficult issue in the geology of the Paleogene of the Ferghana basin is the stratigraphic division of the lower and upper parts of the sections and their correlation. For over 70 years, various patterns of dismemberment and correlation for complexes of various organisms have been developed: for oysters, microfauna, nanoplankton, etc. The first such scheme was developed in the 30s of the last century by O.S.Vyalov based on fossil oysters in the eastern part of Central Asia. For a long time, this scheme was the basis for various geological constructions, geological mapping and production work. However, this scheme is based on an endemic group of fauna and did not give the possibility of regional correlation and coordination with the international scale.

The study of nanoplankton did not give satisfactory results for the regional correlation of sections. The problem is that many stratigraphic intervals of different regions do not contain nanoplankton. Therefore, to solve this issue, it is necessary to use the complex biorhythmostratigraphic method for section partitioning and correlation, which provides for the simultaneous use of bio-, rhythm-, and lithostratigraphic methods, proposed by V. I. Popov [8, 9] and supplemented by our research.

The entire section of the Mesozoic-Cenozoic sediments of Central Asia is combined into an alpine geological complex (GC), which is divided into three rhythm complexes (RC): 1) Late Triassic-Neocomian Karakoram; 2) Neocomian-Neogene Himalayan and 3) Quaternary Alatau. Paleogene sediments belong to the Danish-Paleogene Ferghana rhythmic thickness (RC) of the Himalayan rhythmic complex.

The Danish-Paleogene Ferghana rhythmic thickness (RT) within the Ferghana

depression is divided into three rhythm thicknesses: the Danish-Middle Eocene Lower Fergana, Late Eocene-Early Oligocene Middle Fergana and Oligocene Upper Fergana. This article discusses the stratigraphic features characteristic of the Danish-Middle Eocene Nizhne-Fergana RT.

Danish-Middle Eocene Nizhne-Fergana (Sogdian) RT:

The rhythm is singled out and named Popov. This rhythm subdivision is divided into Danish-Paleocene Bukhara, Early Eocene Suzak, Early Middle Eocene Suzak-Alai and Middle Eocene Alai-Turkestan rhythm suites (PT).

Danish-Paleocene Bukhara RT:

The Danish-Paleocene Bukhara PC of the Ferghana depression below is limited by the Danish break and a slight disagreement. It is mainly developed in the southern part of the Ferghana Depression, where it is formed at the bottom by regressive lagoon gypsums and I know the Palygorskite dolomitic clays at the top, on which the Eocene Suzak rhythm suite lies intermittently.

The following peculiarity is captured in the distribution of sediments: mainly sulfates were deposited in the eastern and southeastern parts of the lagoon, but their accumulation was intermittent and they were often replaced by dolomite silts with the fauna of Corbula (Cuneocorbula) anguluta Lam, Meretrixsp. Bullsp., with a capacity of 30-50m (Changirtash, Sufikurgan, Sugut).

In the southern part of the lagoon, sulfates (gypsum gypsum) were deposited almost exclusively, in places with a subordinate layer of limestone with the fauna of Corbula (Cuneocorbula) biongulata Dech. Modiolajeremejewi Rom., with a capacity of 5-10 to 30m (Kyzylbel, Dzhumangul, Tul, etc.).

In the west, north, northeast, the Bukhara layers are represented by red-colored delta and lagoon faunistically uncharacterized sediments with a thickness of 10–20 m (Surkhi, Narin). Powerful accumulations of gypsum indicate that the lagoon was very shallow and the evaporation was very intense. The composition and distribution of sediments and fauna of the Bukhara layers indicate a high salinity of the basin, so the conditions for the mass living of organisms were unfavorable. Where the influence of a more open sea basin (the Alai Strait) affected, at some moments, marine fauna could exist.

Early-Middle Eocene Suzak-Alai RT:

Within the Ferghana depression, we divide this rhythm suite into 4 rhythm packs. These are the Early Suzak RP - szk^1, the Middle Suzak RP - szk^2, the Late Suzak RP - szk^3 and the early Alai rhythm pack (RP).

Early Suzak RT szk_1:

The boundaries of the Suzak and Bukhara layers in southern and northeastern Ferghana are drawn where lagoon sediments of the underlying RT are replaced by terrigenous ones. In the west, lagoon deposits are absent, and the Suzak layers occur directly on the Paleozoic Upper Cretaceous deposits. At the beginning of the sediments of the Early Eocene Suzak rhythm suite within the southern part of the Ferghana depression, a change of lagoons with shallow bays appeared, into which underwater deltas and remotely pelitic sediments penetrated. They are represented mainly by hydromica and montmorillonite composition, transferred by paleorecs. In sediments of small bays palygorskite formation developed.

Thus, the sediments of the Suzak rhythm suite up the section are composed of yellowish-green, highly palygorskite clays (thickness 4-

8m), light gray carbonated siltstones (thickness 8-20m), yellowish-gray, clayey sandstones (thickness 5-18m), dark - gray, more finely weathered than underlying clays. The color of the clay gradually turns tobacco green, and then green (thickness 9-15m).

Srednesuzakskaya RT szk$_2$:

The boundary of these layers with the lower ones is conditionally set. At this time, the composition of precipitation in the Ferghana basin changed significantly, but the size and shape remained almost the same. Various carbonate deposits with remains of the fauna of Meretrix, Pectunculus, and others are widespread in the northern and northeastern parts. In the lateral part, sandy-calcareous sediments with burrow holes, algal limestones, Cardita, Cucullaea, Raporaea, and others are represented. The northernmost part of the depression is represented red-colored delta sediments with a thickness of 4.0-11.4 m (Changirtash, Surkhi), in the Alai Strait - sandy-calcareous sediments with mixed foraminifera complexes. The sediments of the southern part of the bay are limestones and dolomites with fauna and various other mollusks. Power - 3 - 15m (Kyzylbel, Kan). To the west, carbonate deposits are mixed with sand - siltstone with the fauna of Cardita, Arca, Perna, Pectunculus, Cardium, etc., with a thickness of 20-40m (Madigan, Zumratsho).

According to the nature of precipitation and their large thicknesses in the southwestern part of the depression, it can be assumed that at that time the active upliftment of Paleoturkestan continued here. As a result of the drainage of the Turkestan - Alai Islands, the cone of removal of the rivers Paleokhodzhabakirgan and Paleoisfara formed. They filled weakly bent territories of depression with their products, i.e. its southwestern part.

Late Suzak RP szk$_3$:

The border with the average Suzak rhythm packs is marked everywhere by the change in marine sediments of the middle Suzak lagoon. Only in the north and northeast continued to exist continental red-colored delta formations with a thickness of 16-28 m (Surkhi, Changirtash). The lagoon sediments of the late Suzak are represented by the alternation of layers of white gypsum with a thickness of 0.3-1.0 m with dolomite and thin palygorskite clays below the reddish-brown, above the greenish-gray color, with a thickness of 0.3-1.5 m and more. Often, these clays are enriched with tartar gypsum. The thickness of the late Suzak rhythm pack varies from west to east from 7-10 (Andarhan, Jumangul-2) to 25-30m (Zumartsho, Isfara, Akturpak), reaches 38m (Kan).

During sediments of the middle Suzak rhythm pack in the eastern part of the bay, the lagoon occupied only a small area, which is caused by progressive uplifts both in the accumulation region and on the surrounding land. In the western part of the bay there was an increase in land due to the narrowing of the Khojent Strait. According to the outlines, the lagoon approached the salt lagoon of the Bukhara century, but there was no complete drainage of the western part and a weak connection with the open sea remained. In other places in the composition of the Late Suzak layers, organic residues were not found. In addition to the western part of the bay, in some parts of the southern coast (Kyzylbel), as well as near the Katran island, gypsum is absent and only clay siltstones are deposited. The total thickness of the Suzak layers in the south is 45-50 m (Oilma, Madigen) - 90-97 m (Kan, Akturpak, Shurab): in the west - 40-50 m (Topkok, Ambargaz, Sulukta): in the north and northeast - 34.9-42-, 9 m (Surkhi, Changirtash), in the southeast - 62 m (Budalik). The history of the Ferghana Gulf, during the Bukhara and

Suzak centuries, represents a complete cycle of sedimentation. The lagoon of the Bukhara century, in which the first signs of sea advance appeared, gradually changed in the early Suzak time with the strengthening of downward movements by the basin, which is well connected with the open sea. In the middle Suzak, ascending movements began to appear, the number of islands and shallows increased, and in the late Suzak time, with progressive shallowing, the bay again turned into a salt lagoon. Thus, lagoon sediments begin and end the cycle.

RESEARCH METHODS:

The work uses universally recognized methods of lithological and facies-paleogeographic studies developed by the school of lithologists [8.15] and oilmen [1, 4] of Uzbekistan.

We have defined the concept of "facies" according to V.I. Popov. For various time intervals of the Paleogene epochs, facies-paleogeographic maps were constructed, the actual materials for which were the geological sections and core of the wells drilled in the central part of the depression, described in layers in the field. On the maps, in addition to units of the paleolandscape (riverbeds and floodplains of rivers, deltas, directions of currents, etc.), lithological types of rocks are indicated, which facilitates the tracking of lithological-facies substitutions and zoning in the area of a single catchment basin.

In identifying facies units in the Paleogene sedimentary basin, we used dynamic and hydrochemical principles. The stage-by-stage dynamic principle of the facies analysis of sedimentary formations is based on the stage-by-stage regular change of facies units (facies complexes, belts and zones) on the surface of the earth, starting from its highest points to the final water bodies of the runoff [8, 9,10]. It is based on the gradual attenuation of the relief energy and is valid in relation to the mechanical differentiation of clastic material. The combination of hydrodynamic and hydrochemical sedimentation conditions controlled the ratio of terrigenous and dissolved substances entering the sedimentary basin from the feeding provinces. In this case, there is a strong suppression of the introduction of granular material and an increase in finely fragmented clay and dissolved components. Granular material was deposited in the coastal zone of the basin, clay particles were carried deep into the basin, and dissolved components played a role in the salinization of the basin and increasing the alkalinity of the medium.

RESULTS AND DISCUSSION:

Research Objectives:

The main tasks in the study of facial-paleogeographic conditions for the formation of Paleogene deposits are:

1. Facial-paleogeographic features of Paleogene deposits of the Fergana depression;
2. Conditions for the formation of a shallow-bay (lagoon facial) belt of the Paleocene-Lower Eocene sediments;
3. Shallow-bay - lagoon facies of carbonate-sulfate type;
4. Shallow-bay - lagoon facies of sulfate type;
5. Shallow-bay - lagoon facies sulphate-silt type;
6. Shallow-bay - lagoon facies of terrigenous-salty saline and slightly saline type.

Facial-paleogeographic features of Paleogene deposits of the Fergana depression:

A purposeful study of the facial-paleogeographic conditions for the formation of Paleogene deposits began in the 1940s in parallel with lithological studies or geological

surveys to elucidate the patterns of formation and prediction of the location of deposits of sedimentary non-metallic minerals, including oil and gas [3].

The methodology for compiling, maintaining, assigning lithologic-facial and lithologic-paleogeographic maps proposed by oilmen and facial-paleogeographic maps proposed by lithologists differs significantly, which is associated with a different understanding of the term "facies".

We have taken the definition of "facies" proposed by V.I. Popov [8]. For the Paleocene (Bukhara layers) - lower Eocene (Suzakian layers) including the lower Oligocene (Sumsarian layers) times of the Paleogene epochs [3] facial-paleogeographic maps were constructed, the actual materials for which were served 80 geological sections described layer-by-layer in the field conditions and 40 wells drilled in the central part of the depression. On maps, in addition to paleolandscape units (river beds and floodplains, deltas, bottom currents, etc.), the content of rock types in the form of columns and their thicknesses (in the volume of the stage or suite and slice) is provided, which facilitates the tracking of a single catchment basin of lithologic -facial substitutions and zonations.

According to the scheme of the stepwise dynamic dissection of the terrestrial and submarine facial complexes [8], studied by us in the Paleogene section revealed: subsurface, shallow-bay (lagoon), wave-cut and central-desilting facial belts, which are distributed unevenly in the area in connection with paleogeographic factors.

Conditions for the formation of a shallow-bay (lagoon) facial belt of the Paleocene-lower Eocene sediments:

The dissection and formation conditions of the shallowbay facies are most fully characterized by D.V. Nalivnik [7], N.M. Strakhov, V.I. Popov, S.D. Makarova [8], and others.

A shallow-bay or a lagoon is a shallow, semi-enclosed space formed by the separation of barrier spit or embankment from the sea bays, bays, or estuaries. The lagoon can become freshened if occur a significant inflow of fresh water into the closed water area and vice versa saline if the connection with the sea is short-time or insignificant.

In the Fergana bay of the Paleogene Sea, such conditions for the formation of lagoons were influenced by two straits - the Khojent and Alai. They were opened or closed during the Paleogene period. The formation of this facies is associated with regressive stages of sedimentation. Formation of the facies was completely subordinated to the paleogeographical situation, which indicates a difficult connection between the bay and the open sea in the west of the depression due to the narrowing of the Khojent strait and the almost absent connection in the east in the Alai strait area.

The shallow-bay (lagoon) facies are confined to the Bukhara strata of the Oligocene (the Gaznau group of gypsums), and early, middle and upper Suzakian layers of the lower Eocene and Sumsarian layers of the Oligocene bypassing the Middle and Upper Eocene sediments. Maximal development facies reaches in the south and south-east of depression. In the north, it is almost entirely replaced by the sandstones of the wave-cut facies.

According to climatic features, coloration, lithological composition of sediments and the organic remains enclosed within them, four types of shallow-bay lagoon facies (with the exception of sulfate-chloride facies) are found within the areas studied by us: 1) carbonate-sulfate; 2) sulfate; 3) sulphate-silt

and terrigenous; 4) terrigenous-silt salted and freshwater.

The shallow-bay - lagoon facies of the carbonate-sulfate type:

Deposits of this facies are developed in the south and south-east of the depression, in the western part they are replaced by terrigenous wave-cut conglomerates and in the north and northeast - by pattums (mixture of unsorted terrigenous rocks) of the foot-fan facies.

They are usually formed in an arid climate. These include a series of rhythmically interbedded gypsum and carbonate rocks (limestones, dolomites) of the middle suzak, lying in the sections of the interfluves of Isfara and Sokh [Fig.2].

In the Middle Suzak sedimentation basin, which had small (30x20 km) dimensions, the sediments of this facies are usually located near the shore of the Paleoisfara river and the submarine ridges in the west. The thickness of the precipitation is small (6.5-10.0 m).

Gypsum rocks form nodules or lenticular layers with a thickness of 0.1-0.3 m in prevailing carbonate rocks (3-5 m). Limestone and dolomite are often overfilled with small foraminifera shells, thin-walled shells of mollusks and lenticular gypsum. Deposits of the sulfate-carbonate facies from all sides are limited by wave-cut clay-carbonate sediments.

The shallow-bay - lagoon facies of the sulfate type:

The shallow-bay - lagoon sulphate-type facies use limited distribution, and includes the Goznau gypsum formation, which represents transgressive series of Late Paleocene age formed after the Danian-Paleocene break due to the transgression of the sea basin through the Alai strait (Fig. 3).

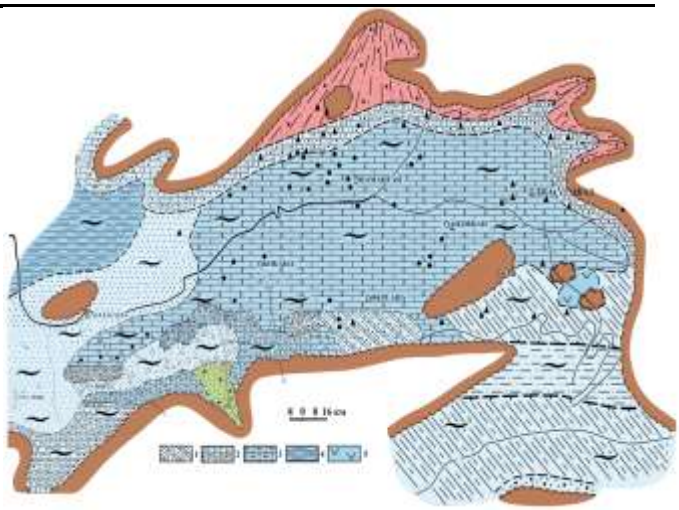

Figure 2. Facies-paleogeographic map of the Middle Suzak time of the Paleogene of the Ferghana basin (4th rhythm pack).

Legend: 1 - sandstones with interbeds of organogenic limestones, 2 - calcareous sediments: foraminiferous, detritus and oyster, 3 - organogenic limestones with pebbles, gravel and sands, 4 - finely dispersed diatomaceous clays, 5 - gypsum.

Gypsum white, gray, greenish-gray, sugar-like or recrystallized into coarse-crystalline differences, thick-plated, sometimes with indistinct horizontal layering, or not layered. In them, a superficial veined selenite is widely developed, and chalcedony is less common. The thickness of the separate layers does not exceed 10-15 m. The thickness of the facies in the region of Alai strait and in the Eskinaukat basin reaches 50 m or more.

In the east of depression in gypsum there are thin layers of white or yellowish gypseous dolomite, usually without organic residues, but sometimes with small suppressed forms of pelecypods and gastropods. Less frequent are interlayers of dolomitized green clays.

In the south, in the roof of gypsum there are interlayers of dolomites, in which micropaleontological studies revealed a complex of organic remains consisting exclusively of agglutinated shells of

foraminifera of the lower Paleocene. In the western part of the lagoon, occupying most of the Fergana Valley, terrigenous sediments of the Paleocene (conglomerates, gravels) was deposited in the same period of time. In the extreme east of the depression, sediments of this type are found in early Alayan sediments.

Shallow-bay - lagoon facies of sulphate-silt type:

The shallow-bay - lagoon facies of sulphate-silt type are fixed mainly in the upper suzak (Figure 3). In the lower part of the deposit, it is represented by brown aleuritic, and in the upper part - by gray-green, sometimes lilac, bluish and dark gray (Tul) aleuritic clays predominantly of palygorskite composition with an admixture of hydromica and montmorillonite. Lamination is indistinct, horizontal or absent. In the peripheral sections near the insular uplifts in the clays, the admixture of sand material increases considerably. Clay rocks are usually interlayered everywhere with whitish-gray, bluish gypsum, often with a loamy texture. The thickness of individual layers or lenses of gypsum is from 0.1-0.5 to 1.5 m, clays from 0.2 to 8.0 meters. The dimensions of gypsum nodules, which comprise up to 40% of the rock volume, range from 5-6 to 20 cm.

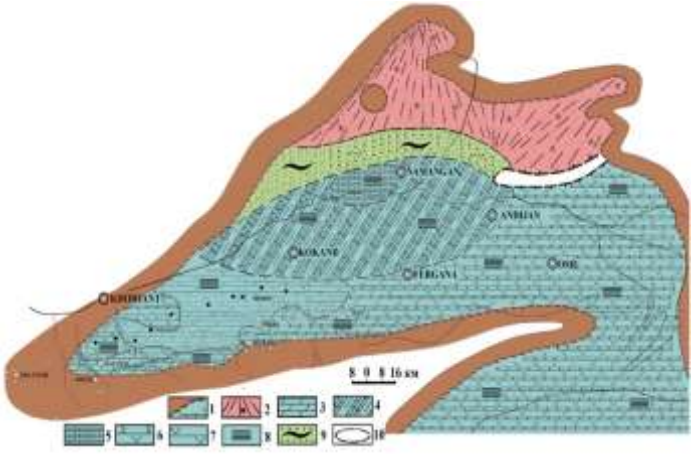

Figure. 3. Facial-paleogeographic map of the Bukhara time of the Paleogene of the Fergana depression (the gypsum formation of Goznau).

1 - the boundaries of the uplifts, 2 - the reddish sediments of the facies of the terrestrial plains, 3 - the zone of distribution of the marls, 4 - the alternating organic limestones and clays, 5 - the zone of distribution of chemogenic limestones, 6 - the gypsum with the interlayers of dolomite, 7 - the gypsum, 8 - the facies of lagoons, 9 - coastal surfy-detrital zone, 10 - boundaries of facial zones. Other legends are shown in Fig. 2-3.

The ubiquitous predominance of ascending movements in the late Suzak time in conditions of dry and hot climate led to a sharp shallowing of the bay at the beginning of the late Suzak and to the extension of clastic facies. In particular, in the north of the depression, reddish deposits of the terrestrial facies belt are wedged in the sediments of the shallow bay, and in the south there is a significant enrichment of sandy materials with brownstone sediments with a manifestation in significant volume the authigenic sulfate accumulation.

The detrital facial zone of the shallow-bay facial belt of the late Suzak in the south of the depression is represented by low-thickened (no more than 5 m), mainly brownish, often gypsum-aleuric sandstones with poikilitic cement and textures characteristic of the surf zone: shallow crossed layering, ripple of roughness, traces of roiling with redeposition. In clayey varieties, layering is usually absent. Sandstones are interbedded with clays of the silt facial zone, and sometimes with beds of gypsum. Gravelites occur less often and even thin layers of the pattum conglomerate described in the north of the depression in the Alai Strait region, are less common. In the latter, in connection with paleogeographic features, the thickness of brown-reddish coarse-grained gravel-sand sediments reaches 10-15 m with almost complete absence of clay differences. The facial paragenesis of shallow-bay coarse-grained sandstones with brown-red-colored pattum

gypsum becomes dominant. The total thickness of the deposits of the detrital zone of the shallow-bay facial belt here reaches several tens of meters, which generally indicates an extremely shallow-water (before transition to the lagoon) character of the basin and high rates of sedimentation.In the southeastern part of the depression, gypsum is absent since it is replaced by coarse-dispersed silty clayeys of the underwater delta facial belt, which indicates the entry of fresh water from the area of demolition. Paleontological remains are absent.

With the removal from the areas of drift into the depth of depression, the gypsum disappears and the degree of sandiness of clays decreases. Organic residues in these sediments are not available everywhere. Carbonate content varies considerably and often reaches 25-35%. The thickness of clay in the silty zone of the shallow-bay belt alternating with the gypsum layers ranges from the first meters to 10-20 m, and reaches 40 m in a number of regions. In the western direction, with the approach to the Khojent strait and, obviously, under the influence of the latter, in clays of the shallow-bay facies the gypsum disappears and the overtopped fauna appears.

The distribution of authygene palygorskite in the clays of the shallow-bay facies on the territory of South Fergana turned out to be practically uniform across all the studied sections. Within the eastern and northern sides of the depression palygorskite also dominates among the clay minerals of the late-Suzak shallow-bay minerals. This gives grounds for attributing palygorskites of this type to the chemogenic-sedimentary genetic type, subordinated mainly to facial control.

Judging by the distribution of the facies, the bottom of the basin had a shallow depth (10-50 m) and a flat landscape, and geochemical conditions were characterized as oxidizing and reducing, and changed mainly once, only occasionally - several times. This can be judged by the bimembrate structure of the sections: the deposits in the lower part of the upperSuzakian layers are brown, and in the upper part - green.

The leading role of the alkaline environment in the formation of precipitation is indicated by the high content of silicon and magnesium in their composition with the formation of palygorskite-containing clays (%): SiO_2 - 44.2-49.2; Fe_2O_3 - 3.01-4.79; FeO-0.36-3.96; TiO_2 - 0.56-0.65; MnO = 0.03-0.05; P_2O_5 - 0.16-0.22; Al_2O_3 - 11.05-14.65; CaO: 4.0-5.4; MgO: 4.16-5.40; Na_2O: 0.77-2.73; K_2O = 2.52-3.86; CO_2 9.57-11.54; H_2O = 2.52-3.86.The upper Suzak shallow-bay-sulphate-silt facies are in the paragenesis with wave-cut facies.

Due to the high (up to 70-80%) content of palygorskite in these clays, the lack of gypsum and the insignificant admixture of terrigenous material in some of its sections, the palygorskite clays of this facies are of practical interest in a number of promising areas.

Within the southern part of the Fergana depression clay sediments with a thickness of 10 to 40 meters are crimson, indistinctly horizontally-layered or not layered, less often wavy-layered, or even double-sided-feather-like layered clays of siltstones or clean, to a different degree carbonate, greasy to the touch with an ellipsoidal unit and a pronounced conchoidal fracture. Occasionally there are interlayers with fauna of thin-walled pelecypods and gastropods, among which there are no representatives of the deep-sea zone. The composition of clays is dominated by a structurally perfect finely dispersed hydromica with sharply subordinated content of montmorillonite. To the west of the Shurab region, the mineral composition of Sumsar clays changes sharply and is universally represented by hydromica-palygorskite association with palygorskite content up to 50% and more clay fraction volume. Fine-dispersed crimson clays

of Sumsarian layers gradually transform along the section into brick-red aleuritic clays formed in continental and lake facies. We have established that the thickness of crimson clays in the southern part of the depression from east to west is gradually reduced to zero.

Lagoon sediments of terrigenous-silt type are underlain in the south of depression by fine silty sediments with abundant traces of burrowing crayfish, in the north by interlayers of shellfish with large washed shallow water oysters or siltstones, and in the northwest by gravel-sand sediments, which indicates a considerable shallowing of the basin.

In the top of the clay pack in facial paragenesis with crimson clays described interbeds of wave-cut sandstone with ripple of chopiness, cross-layering, abundant secant passageways of worms of deposit feeders, large traces of underwater swimming, and appear subordinate interlayers of detrital sandstones – underwater-delta formations. The thickness of shallow water surf-detrital sandstones in the roof of the Sumsar shallow-bay facies in certain regions reaches 10-20 m.

The Sumsar terrigenous-siltyshallow-bay facies are paragenetic with Sumsarian surf-detrital and underwater-delta facial belts.

CONCLUSIONS:

1. The formation of deposits of various types of nonmetallic raw materials in the Paleogene sedimentary basin of the Ferghana Depression is due to the differentiation of sedimentary matter, due to the influence of hydrodynamic and hydrochemical factors in a stable platform mode, the maximum leveling of the bottom topography and climate aridity;
2. Within the entire Paleogene period, submarine-delta, shallow (lagoon), wave-breaking, and central-sedimentary facies belts are distinguished, which are distributed unevenly over the area;
3. The shallow (lagoon) facies belts were mainly controlled with the facies factor and are widespread in the Paleocene-Early Eocene part of the Paleogene section, which are associated with significant reserves of palygorskite clays, gypsum, and dolomites of industrial interest.

The litho-facial analysis method developed by V.I. Popov made it possible to distinguish within the entire Paleogene period of the Fergana depression the underwater-delta, shallow-bay (lagoon), wave-cut and central-settling facial belts that are distributed unevenly in the area in connection with paleotectonic, paleostructural, paleoclimatic, stratigraphic and facial factors. The shallow-bay (lagoon) facial belts were mainly controlled with a facial factor and distributed in the Paleocene-early Eocene part of the Paleogene section, which is associated with significant reserves of palygorskite clays, gypsum and dolomites of industrial interest.

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