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Abstract. The article discusses the lithological and petrographic properties of pre-Jurassic sedimentary rocks under the influence of the Barsakelmes pipe and the drilling of wells in the adjacent territories. The results of substantiating their age are also presented. In the section of pre-Jurassic deposits, 8 lithostratigraphic complexes have been identified.

1. Introduction

The determination of the geological structure of Ustyurt always causes difficulties due to the absence of outcrops of ancient rocks on the surface and the great depth of their occurrence, the closeness of the territory and the limited drilling information. As a result, many questions about the material composition, filtration-capacitance properties, stratigraphic confinement, genesis and degree of transformation of rocks of the Permo-Triassic and Paleozoic complex still remain unresolved. Wells were drilled mainly before the opening of the roof of the Permo-Triassic red-colored strata, which excluded the possibility of studying the lower parts of this complex and older deposits. A small amount of core was taken from the wells, especially from Paleozoic deposits. At the same time, there were practically no paleontological remains [2, 3]. Drilling of new deep wells (Kartpai 1, East. Ats 1, Jack 1, Kubla Assake audan 1, Zhes 1, Tejenkazgan 1) allowed to highlight to a certain extent the features of the geological structure, material composition, facies-paleogeographic conditions for the formation of Paleozoic deposits of the studied territories (figure 1).

The exploratory wells drilled at the present stage significantly supplemented the idea of the composition and properties of the Paleozoic (pre-Permian) floor and clarified the data on the regional tectonics of the cover and the transition complex [4, 5, 7, 11].

To date, Jurassic sediments exposed at a depth of 2.5 - 3.5 km are considered productive horizons on the territory of the Barsakelmessky trough and adjacent areas. However, at this stage of study, the possibility of identifying new deposits in known productive horizons is very limited. In this regard, there.

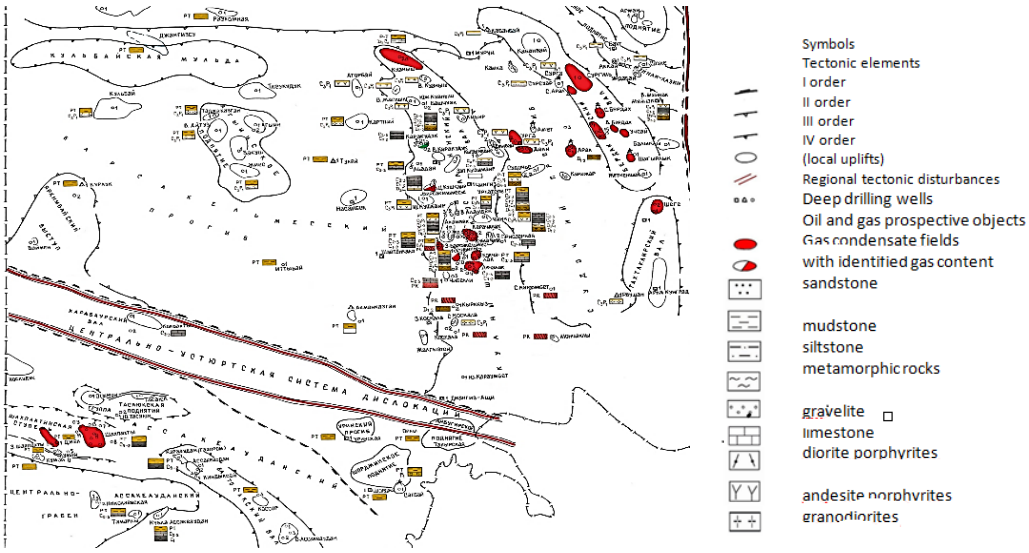

Figure 1. Overview map and study of pre-Jurassic deposits of the Barsakelmessky trough and adjacent territories.

Is a need to search for potential objects at new poorly studied stratigraphic levels, including pre-Jurassic formations [12,13,14]. Thus, the formulation of this question on the study of the pre-Jurassic complex, including in terms of oil and gas potential, is reasoned and serves to fulfill the tasks provided for by the Decree of the President of the Republic of Uzbekistan No. UP-4947 of February 7, 2017. "On the Strategy of Actions for the Further Development of the Republic of Uzbekistan", by Resolutions No. PP-3372 dated November 3, 2017 "On approval of the State Program for the development and reproduction of the Mineral Resource Base for Uzbekneftegaz JSC for the period 2017-2021" [15].

2. Methods and materials

In the course of the work, all available factual materials (core, GIS data) on drilled and previously drilled wells within the studied region were analyzed and reinterpreted, with the clarification of lithological and paleontological features, with the establishment of the genesis of sediments and their transformation by secondary processes [16,17]. A lithological description of the core, a petrographic description of the sections, paleontological studies, chemical, litho-physical, etc. were carried out. analytical work, lithological-facies and stratigraphic features, filtration-capacitance potential are determined, the specificity and degree of change of rocks by secondary processes are revealed. The prospects of the Pre-Jurassic deposits in terms of their oil and gas potential are considered [18,19,20].

3. Results and discussion

The pre-Jurassic complex of the Ustyurt region is still poorly studied and probably contains a high potential for oil and gas (by analogy with sections of adjacent territories of the Caspian Sea, etc.), the effectiveness of which is largely determined by the degree of its study [21,22]. The volume of core material obtained over the last period contributed to the filling of a number of "white spots" in the geological structure of the Pre-Jurassic section of the studied area and adjacent zones [5].

Jurassic deposits everywhere occur with erosion and angular disagreement on Permo-Triassic formations, sometimes carboniferous, which is clearly recorded by a sharp change in the nature of the curves of standard logging.

The Pre-Jurassic deposits within the study area are represented by various lithological and petrographic rock differences: sedimentary, sedimentary-volcanogenic, erupted, intrusive-subvolcanic and metamorphic [4]. Stratigraphically, they are represented by formations of Permo-Triassic (P2-T1), Lower Permian (P1), Upper Carboniferous-Lower Permian (C3-P1), middle-Upper Carboniferous (C2-

3), lower and middle Carboniferous (C1-2), Upper Devonian-lower Carboniferous (D3-C1), Devonian (D) and Proterozoic deposits (PR).

8 litho-stratigraphic complexes of Pre-Jurassic deposits have been identified according to the features of lithogenetic types of rocks: terrigenous red-colored Permo-Triassic; halogen-carbonate Lower Permian; terrigenous-effusive upper carboniferous-Lower Permian; carbonate-terrigenous middle-upper carboniferous; terrigenous-carbonate lower-middle carboniferous; clay-carbonate upper Devonian-lower carboniferous; terrigenous-igneous Devonian; shale-gneiss Lower Paleozoic-Proterozoic.

The depth of opening of pre-Jurassic deposits in the studied area varies from 2684 m (Sarytekiz-1) to 4254 m (Urga-2), within the adjacent areas from 750 m (Aybugir-203) to 4230 m (Northern Dzhangizsu-1).

Below is a description of the litho-stratigraphic complexes of the Pre-Jurassic deposits stratigraphically from the bottom up.

3.1. Shale-gneiss lower paleozoic proterozoic

The complex is not characterized paleontologically, it is conditionally allocated in the study area and is represented on the squares of Koskala, Chibelli, Northern Karaumbet, Baschuak (square No. 2) and East. Karakuduk shales and gneiss, which are products of metamorphosis of sedimentary rocks and form raised foundation blocks that existed before the Early Jurassic. The shales of the Cascades area by V.S. Knyazev (1970) are attributed to the Riphean formations according to the boundary velocities of the basement surface of these areas (5.6 - 6.3 km/s). The same opinion was held by K.K. Kurbaniyazov and others. ((1976), who attributed the garnet-chlorite-muscovite shales of Koskala to the lower sub-formation of the Sultanuizdag formation, presumably of Upper Riphean age. On Baschuak and East Karakuduk, according to X. Uzakova (1996), revealed orthoslanes of feldspar-mica-chlorite, intensely calcified and carbonated, metasamotically altered. On the East Karakuduk square, they are blocked by Permo-Triassic rocks of small capacity.

3.2. The terrigenous-volcanogenic

Devonian complex is confidently identified in wells No. 6 Karakuduk and No. 1P Urtatepa, on Murun, Kyrkkyz and Aral Pl. and is represented by volcanogenic, sedimentary and volcanogenic-sedimentary formations. Intrusions of acidic composition (granodiorites) overlapping with sandy-clay deposits are rarely found in the thickness. The age of the deposits is justified (H. Uzakov, 1996) on Karakuduk - 6 square, in the range of 3791 - 3799 m, where O.V. Orlova identified algae of the genus *Ungdrella* sp., *Arcnaesphaera minima* Sul., *Ar. Crassa Lip*., *Ruberitina* sp., *Riaplopnragmella* sp., widely known in the Upper Devonian – Carboniferous. Also, the foraminifera Eotuberitina sp., Endothyra sp. were determined in the range 4165 - 4172 m. late Devonian age, and in the interval 4221 - 4224 m, the same specialist found Tuberitina sp., Endothyra sp. foraminifera, widespread in the Upper Devonian.

On the western side of the Kuanysh-Koskalinsky shaft, intrusions, mainly of medium, less often acidic composition, spread throughout the territory up to the junction with the Sudoch deflection (square No. 1 Urtatepa). Terrigenous deposits of the Devonian, occupy the southeastern part (Kubla-Chink) and the central part (Khibiny) Kuanysh-Koskalinsky uplift. Black almond-stone diabase porphyrites (essexite) were found on the Murun Square, and trachyandesite porphyrites, breccated, rounded greenish-gray in color, were found on the Kyrk Kyze. The Paleozoic in the Aral area was opened by wells No. 2 and 3. The section of well No. 2 is represented by dark gray mudstones of clay-hydrosluidic composition, with carboniferous plant remains and volcanomictic sandstones, with fragments of quartz, plagioclase, acid decomposed glass. Siltstone mudstones of dark gray color with a greenish tinge were discovered in well No. 3.

3.3. The clay-carbonate upper devon-lower carbon complex

The clay-carbonate upper devon-lower carbon complex is well established in the wells of Kuanysh Square. In the square. 2P at a depth of 3402 m, these deposits are represented by dark gray, almost black mudstones, dense, strong, with low-power layers of siltstone and sandstone. Occasionally there are thin

layers of limestone and porphyrite, while limestone is enriched with charred plant remains, contains siderite and a lot of microfauna, sulfides (pyrite) are noted in porphyrites [23,24]. Mudstones are thinly layered, the angle of inclination of the layers to the core axis is 50-60o, sandstones and siltstones are often with tuff inclusions. In the range of 3448-3770 m R.V. Goryunova identified mosses of the species Safordotaxis af. meltispinotus (Morozova), Mediopora sp., characteristic of the Upper Devonian and Lower Carboniferous. In addition, algae of the genus Ungdrella sp., Arcnaesphaera minima Sul., Ar. Crassa Lip., ruberitina sp., riaplopnragmella sp., widely known in the Upper Devonian - Carboniferous, have been identified here in int. 3791-3799 m in the clump-detritus gray dolomitized limestone of O.V. Orlova; at depths of 4165-4172 m, Foraminifera Eotuberitina sp., Endothyra sp., of Late Devonian-Early Carboniferous age have been identified in detrital, fine-grained, partially recrystallized organogenic limestone. In int. 4221-4224m, foraminifera of poor preservation are found, where Tuberitina sp., Endothyra sp., widespread in the Late Devonian - Early Carboniferous are identified. The above-described deposits in all respects resemble the flyschoid strata of carboniferous.

3.4. Terrigenous-carbonate lower-medium carbon complex

Deposits of lower-middle carboniferous are distributed within the Kuanysh-Koskalinsky shaft on the western side in the area of Karakuduk (figure 2), Abadan, in the south - on the Akchalak, Chibelli squares, in the east - on the Priozernaya Square and in the central part - in squares No. 3, 4 Kokchalak and No. 18 Akchalak. The limestones are fine-grained gray, light gray polydetrite, intensively dolomitized in areas with the formation of interlayers of secondary dolomites.

Figure 2. Cavernous secondary dolomite, sle. Karakuduk 6, int. 3685 m.

Calcite in limestones is partially recrystallized, inclusions of dolomite are rhombic in shape. The rocks are impregnated with a carbonaceous substance with relics of an organogenic-clot structure in the form of fragments and whole shells of foraminifera made of calcite. In the square. Centre. Kushkain-1 (int. 3600-3700 m) N.M. Mikhno identified foraminifera Archaesporites crassa Idp., Eovolutina sp., Eotuberitina sp., Ammobaculites aff. sarbaicus Mal., Asteroarchaediscus sp., Endothyra cf. bradyi Mikh., Eostaffela sp., Milerella cf. umbilicata Kir., Globivalvulina sp. In sq. 2 (int.3625-3630m) foraminifera are installed Eostaffella ex. gr. postmoquensis Kir., E. (Plectostaffella) ex. gr. varvariensis Brazhn., Globivalvulina sp., In sq. 3 (int. 3767-3768 m) defined Tuberitina maljavkini Mikh., Ammodiscus ex. gr. compactus (Brazhn. et Pot.), Paleotextularia sp., Globivalvulina sp., Asteroarchaediscus parvus (Raus.), Glomospira aff. elegans Jip., Bradyina sp., Eostaffella ex. gr. varbariensis Brazhn. et Pot., allowing to consider the host deposits as the tops of the lower (Verkhneserpukhov sublayer) - the bottoms of the middle (Lower Bashkir sublayer) carboniferous.

On the Karakuduk area (sq. 1P, 2) under a low-power red-colored pack, almost horizontally lying carbonate rocks were uncovered, represented mainly by organogenic, organogenic-clastic, clastic, weakly metamorphosed limestones (figure 3) with foraminifera remnants: Tuberitina maljavkini Mikh.,

Howchinia sp., Tetrataxis sp., Hyperammina sp., Eostaffella sp., Tolypammina sp., Glomospira sp. Based on the definition of these forms, Z.S. Rumyantseva concluded about the Early Carboniferous (Serpukhov century) age of the host rocks.

Figure 3. Micrograin limestone, tiled (Karakuduk 2 square, depth 3864 m).

Dense organogenic-clastic and oolitic limestones were discovered on the South Kashkair area. E.G. Minyaeva determined from these deposits *Earlandia vulgaris. var. minor (Raus.), E. minima (Bir.), Endothyra sp., Howchinia exilis (Viss.), Milleralla (?) sp., Neotuberitina maljavkini (Mikh.), Tetrataxis sp., Cribrastomium sp., Asteroarchaediscus ex. gr. baschkiricus (Krest. et Theod.), E. ex. gr. prisca Raus., Archaediscus karrori. Braby, Arch. ex. gr. meolleri Raus., Mediocris cf. breviscula (Gan.),* that allowed her to draw conclusions about the Visean age of the host rocks.

3.5. Carbonate-terrigenous medium-upper carbon complex (C2-3)

They are distributed within the Kuanysh-Koskalinsky shaft on the western side in the area of Karakuduk squares, Center. Kashkair, Abadan, in the south - on Akcharlak, Chibelli squares, in the east - on Priozernaya Square, in the central part - in squares No. 3, 4, 21 Kokchalak (figure 4) and No. 18 Akchalak.

Terrigenous deposits with interlayers of carbonate and volcanogenic sedimentary rocks were uncovered in wells of Kachalka Square (SLE. 12, 13, 14, 16).

Figure 4. Kokchalak square 21, int. 3276-3280 m (C2-3). Oil priming along the dolomite caverns.

For example, brownish mudstones with inclusions of scales of hydroslude, sericite, chlorite, carbonaceous particles and siltstones polymictic, sandy, dolomitized, consisting of quartz fragments (90%), plagioclase, fragments of mica, clay and quartz rocks were studied in well No. 16 in int. 3266-

3273 m and 3300-3305 m. In siltstones int. 3300-3305 m Yu.N. Belyaeva identified spores *Tripartites sculptilis (Balme) Smit.et Butt., Spinisisporites sculptilis (Balme) Smit., et Butt., Dictyotriletes aff. falsus Potonie et Kremp.,* common in the middle-upper carboniferous of the Donetsk basin.

3.6. Terrigenous-effusive upper carbon-Lower Permian complex (C_3-P_1)

There is no Kuanysh-Koskalinsky shaft. Volcanogenic-sedimentary formations were uncovered by wells in the areas of Baymen (sq. 1P), Cyber (sq. 1), Aslambek (sq. 1P, 2, 3, 7), Priozernaya (sq. 2), Kyzylkair (sq. 1), Chink (sq. 1), Vostochny Zhaslyk (sq.. 1), East Aituz (square 1), Kartpai (square 1), Atorbai (square 1), etc. They are represented by overlapping volcanomictic sandstones and siltstones, medium-large-block tuff conglobreccias and gravelites with interlayers and bundles of mudstones and siltstones of dark gray and black color. In the square. East. Aituz-1 Upper carboniferous - Lower Permian deposits were studied by kern in the intervals of 3822 figure 4. Kokchalak square 21, int. 3276-3280 m (C2-3). Oil priming along the dolomite caverns - 3828.5 and 3752 - 3755.66 m and are represented by magmatic erupted formations of acid composition - rhyolite-felsites of brown, lilac-pink color. The sediments are characterized by the texture of currents, sometimes felsic. The structure is cryptocrystalline. Nests and geodes made of fine-grained quartz are often found, in places core samples have an intensely fractured structure, sometimes with gaping cracks. Often the cracks are made of quartz. Mineralogically, the deposits are represented (figure 5) by quartz up to 56%, potassium feldspar - up to 22%, include albite - 21%, mica - 19%, hematite - up to 13%. The open porosity of rocks ranges from 3.71 to 6.04%, averaging 4.84%, the permeability is almost zero.

Deep drilling also opened them on the square of Urga. Sev. Urga, Muynak, Berdakh, where they are mainly represented by black, calcareous, thin-layered mudstones, with sulfide mineralization, with sponge spicules and radiolariums. The rocks contain fragments of microfauna and charred plant remains, layers of siltstones, fine-grained sandstones and dolomites. Biotite weakly cataclazed granites have been uncovered on Raushan Square. From the bottom-hole interval (4472 - 4476 m) North square. Urga represented by tufocarbonate breccia, foraminifera (F.R. Bensh) of Quasifusulina sp. were determined, indicating the Late Carboniferous-Early Permian age of the deposits. At a maximum capacity of 880 m, deposits of the upper carboniferous - lower Permian were uncovered at the Aktumsuk dislocation system in the SLE. 2P Baiterek and Sarytekiz 1 [10].

3.7. The halogen-carbonate Nizhnepermsky complex (P1)

The halogen-carbonate Nizhnepermsky complex (P1) was first discovered at Ustyurt by drilling the first exploratory well on Satbai Square, located within the Shordzhinsky uplift. The complex presumably characterizes the Lower Permian deposits of the Kungurian tier. It is represented by a two-membered structure: the lower halogen and upper terrigenous strata [1, 7].

The lower stratum is represented by halogen formations (figure 5), layered with black calcareous mudstones with a vertical angle of incidence, with dark gray limestones and gray anhydrites (int. 1859 - 3058 m).

Figure 5. Fragments of clay limestones with layers of anhydrite in salts. Satbai-1, int. 1859 - 1866 m.

In int. 2168.6- 2170.0 m, black bituminous clay limestones with a faint brownish tinge were uncovered. Here, clayey bituminous black limestones overlap with crystalline calcite, less often halite. At the same time, calcite fills large cracks in places, with the formation of brushes. In the lower part of the section of the lower strata, there are areas where fragments of black limestones are noted in the halogen formations, often overlapping with anhydrites.

The upper stratum in this well is passed in int. 1325 – 1628 m and is represented by gray calcareous siltstones sandy-clay.

The obtained data on sle. Satbai-1 and the above-described structural features of the Lower Permian rocks of the Shakhpakhtinskaya area indicate the formation of rocks in a subaqual, mainly restorative environment. The accumulation of halogen formations predetermines the existence of closed intracontinental lake-type basins.

3.8. Terrigenous red - colored permo triassic (P-T)

They cover the area of Abadan, West squares. Barsakelmes, Chingiz, Urtatepa, Alambik, Chink, East. Alambek, Barsakelmes, Karachalak, Zap. Barsa kelmes, Khibiny, Kokchalak. The capacities of P-T deposits are increasing in wells located in the western part of the shaft closer to the Barsakelmessky trough. In addition, there is an increase in capacity in the area of the square. No. 1P Alambik (610 m) and No. 1P East. Aslambek (502 m), which indicates the presence of deep depressions in the paleorelief at the time of accumulation of these sediments. In the square. Terenkuduk-1 at a depth of 2114 - 2111 m in the thickness of brown-red, strong mudstones, siltstones and sandstones with veins of calcite, slightly dislocated at an angle of incidence of about 100 E.N. Nevzorova identified spores of Leptochylus sp., Stenzonotriletes sp., Danae sp., and pollen of coniferous Podocarpus sp. and others that give reason to attribute the strata containing them to the Lower Triassic age.

Figure 6. Sle. East Aituz-1. Brick-red clay siltstone, int. 3664.3-3675.0 m.

Permo-Triassic deposits in the sle. East. Aituz-1 were studied by core in the range of 3662 - 3680 m and are represented by brown, brick-red siltstones, silt-mudstones and thin-layered sandstones. Mineralogically, the predominant components in the rocks are mica and quartz, the content of hematite reaches 13%, kaolinite, siderite and calcite are noted in small amounts (figure 6).

4. Conclusion

The main oil and gas prospective strata of the Pre-Jurassic section may be carbonate-terrigenous rocks of middle-late Carboniferous age, terrigenous-carbonate lower-Middle carboniferous formations and clay-carbonate - Upper Devonian-Lower carboniferous deposits [6, 8, 9] and possibly rocks of other stratigraphic complexes characterized by the development of fractured reservoirs.

Paleozoic sediments in the research area are overlain by a powerful cover of Permo-Triassic sediments, sometimes evaporites [10]. This cover can be a reliable tire, where oil and gas deposits of

the Paleozoic could be buried. Prospects for the search for hydrocarbons in the Pre-Jurassic complex are also confirmed by the results of geological exploration, for example, from pre-Jurassic formations in the territory under consideration on Karakuduk 1OP Square, Center. Kushkain 1, East. Barsakelmes 1, Akcharlak 18, Karachalak 1, Sev.Karaumbet 1, Khibiny 1, etc., oil and gas occurrences and even industrial inflows of hydrocarbons were obtained.

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