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LITHOLOGICAL AND STRATIGRAPHIC FEATURES OF THE GEOLOGICAL STRUCTURE OF THE ASSAKEAUDAN TROUGH

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Abstract: This article examines the lithological and stratigraphic features of the geological structure of the Assakeaudan trough. Based on the drilling data, a structural map and a thickness map were compiled, and correlation schemes were analyzed to clarify the structure of the studied territory. Discovering productive horizons based on research results presents the greatest difficulties. In almost all fields of the Assakeaudian trough, opening and drilling in productive formations were carried out with a significant excess of bottomhole pressure over reservoir pressure. The possibility of absorption occurring and its intensity depend not only on the excess of the bottomhole pressure over the formation pressure, but also on the reservoir properties of the rocks, on what the reservoir is filled with.

Keywords: geological structure, Jurassic deposits, trap, structural type of deposit, trough, fold, lithological wedging, stratigraphic unconformity.

The development of the oil and gas industry is due to an increase in the volume of prospecting and exploration work due to the active introduction of their new methodological techniques into the detailing of non-structural and combined (structural, structural-lithological, tectonically screened) types of traps in zones of lithological pinch-outs and stratigraphic unconformities in many sediments of the world. In this regard, one of the priority tasks of oil and gas geology is the search and exploration of new oil and gas fields in poorly studied areas in deeply submerged horizons of the sedimentary cover of raw materials.

Rocks from the Upper Paleozoic to Neogene-Quaternary formations take part in the structure of the sedimentary cover and the intermediate structural level of the territory. Information on six drilled wells on the site in combination with deep drilling materials, i.e., mainly, data from reference and parametric wells (Shakhpakhty 2p, Tasayuk 1p, Assakeaudan 1op), adjacent territories, allowed us to get an idea of the geological structure of this territory.

Sediments of the Cambrian, Ordovician, Silurian, Devonian systems within the study area are not currently exposed.

Within this territory, terrigenous formations dated as Upper Carboniferous-Lower Permian were discovered. In wells located within the block (Kossor 3p, V.Assakeaudan 3) and in adjacentareas (Shakhpakhty 2p, Kindyksay 1, etc.) they are represented predominantly by gray-colored mudstones, siltstones, sandstones and gravelites.

At the boundary of the Carboniferous-Lower Permian stratigraphic interval and the overlying Upper Permian-Triassic [55; With. 256] the Kungur-Kazan deposits are distinguished, taking into account drilling and seismic data.

According to his data, the Kungur-Ufa deposits on Ustyurt should include the predominantly black mudstone-siltstone strata exposed in the Sudochi trough, on the Takhtakair swell and in the Assakeaudan trough. It does not contain volcanic rocks and rests with sharp unconformity on Carboniferous-Lower Permian carbonate-terrigenous and volcanic rocks.

Sandstones are gray, sometimes greenish-gray, fine-, medium- and coarse-grained, quartz feldspathic, clayey, calcareous, micaceous. In some layers, inclusions of pebbles ranging in size from 0.5 to 1 cm of medium roundness are observed.

Siltstones are gray, dark gray, brownish-brown in places, quartz feldspathic, with poor visible porosity, sandy, polymictic, with gravel, slightly calcareous, with cracks oriented at an angle of 60–75° and filled with calcite.

The mudstones are dark brown, siltstone, calcareous, banded, with an uneven fracture, dense, and strong.

Outside the western part of the block, in well No. 1 Kindyksay, in deposits of this age, petrographic studies revealed heterogeneous tuff sandstone of a brownish-gray color, with a predominance of lithoclasts [60%], where andesitic and andesite-basaltic porphyries, often ferruginous, are widespread.

Rocks in general are characterized by compaction and steep dips of layers [60–700]. There are interlayers of limestone, micrograined with organic remains and an admixture of carbonized plant detritus. Poorly preserved organic remains are mostly undetectable; occasionally, the remains of echinoderms and foraminifera are distinguished among them.

The age of thiunevens strata is established based on the study of organic remains, the age of which was determined by Kh. Uzakov (1996) as Upper Carboniferous-Lower Permian.

In well No. 3p Kossor, the contents in the rock of a large number of three-rayed sculptured spores of the genus Laevigatosporites Ibrahim., as well as single-sac pollen, indicate the Early Permian age of the sediments that host them (Yu.M. Kuzichkina, Kh.. Uzakov. 1990).

The exposed thickness of terrigenous formations is 60 m. Within the Assakeaudan trough, sporadic development of the Permian-Triassic with a thickness of 0 to 1000 m or more is observed, the age of which is substantiated by the spore-pollen complex described by various researchers.

The composition of these deposits is somewhat different from the formations of Ustyurt characteristic of this age in that they are saturated with coarse clastic rocks - gravesites and conglomerates.

Within the study area, in well No. 3p Kossor, a fairly thick [about 1009 m] red-colored strata of the Upper Permian-Lower Triassic was discovered, which, with stratigraphic and angular unconformity, lies on sediments of Upper Paleozoic age.

Lithologically exposed deposits are represented by red conglomerates, gravelites, sandstones, siltstones and mudstones.

In the lower part of the section there are sandstones and mudstones with interlayers of organogenic and organogenic-clastic limestones, siltstones and gravelites, dense, red-colored.

Sandstones are gray, dark gray, cherry-brown, quartz-feldspathic, fine-, medium- and heterogeneous, polymictic, clayey, slightly calcareous, slightly mica, fractured, with an uneven fracture, dense, strong.

Siltstones are greenish-gray, brownish-cherry with a greenish tint, spotted, fine, medium and inequigranular, weakly calcareous, clayey with small cracks, often filled with carbonate matter, lens-shaped, with an uneven fracture, dense, strong.

In the middle part there are gravelites, sandstones, siltstones, mudstones and thin layers of limestone. In the pebbles of carbonate rocks, G.D. Kireeva identified the Schwagerinasp. fauna, characteristic of the Early Permian.

The gravelites are brownish-brown, dense, strong, quartz-feldspathic, with the inclusion of large pebbles up to 5 cm in size, an gray sandy-silty-clayey fracture with rare interlayers of lens shaped siltstones and sandstones. The sandstones are polymictic, brownish-brown, with greenish-gray spots, fine, medium and heterogeneous with rare inclusions of gravel grains, slightly clayey, calcareous, slightly mica.

Siltstones are brownish-brown, cherry, quartz-feldspar, with inclusions of gravel grains of quartz composition up to 1 cm in size, dense, medium strength, clayey, calcareous, weakly mica.

In the upper part there are red sandstones, siltstones, clays with numerous interlayers and lens like inclusions of gravelite and conglomerate.

Sandstones are brown, reddish-brown, strong, dense, quartz-feldspathic, spotted. Siltstones are brownish-brown, medium and coarse-grained with rare inclusions of gravel grains up to 1 cm, slightly calcareous, clayey, slightly mica with an uneven fracture, dense, of medium strength. The gravelites are brownish-brown, quartz-feldspathic, calcareous, weakly mica, clayey with interlayers of coarse-grained sandstone and siltstone, of medium strength, dense and with an uneven fracture.

This section is also characterized by the presence of a large number of rock fragments of siliceous and effusive formations, and in places, tuffs. Permo-Triassic strata are depleted in organic matter due to the oxidizing nature of their formation environment.

Chemical and bituminological studies (using the example of well No. 3p Kossor) have established that the content of organic matter is on average 0.07%, chloroform bitumen “A” per rock is 0.004%. The ratio of iron forms indicates a weakly oxidizing

Sedimentation environment. The reservoir properties of sandy-silty rocks are low: open porosity - 3.02–5.5%, total porosity 3.4–5.9%, no permeability, density 2.55–2.61 g/cm3 .

Permian-Triassic strata exposed within the northern side of the Assakeaudan trough (Kossor 3p, Shakhpakhty 2p) can be classified as typical mollas: large thickness, coarse-grained and a mixture of all types of rocks.

Sedimentation of Permo-Triassic deposits occurred mainly under oxidizing conditions. The almost complete absence of organic remains and the widespread development of red flowers suggest the accumulation of sediments in a dry, hot climate.

Jurassic deposits occur with erosion and angular unconformity, represented by three sections, the stratigraphic completeness and thickness of which vary from west to east.

Terrigenous deposits of Lower Jurassic age are noted to be of low thickness throughout the Assakeaudian trough. The territory of the investment block was no exception.

The sediments are composed predominantly of sandstones and siltstones, with a high content of carbonized residues.

Sandstones are light gray, gray, fine and fine-grained, dense, micaceous-clayey cement of the pore type, with a gradual transition to siltstone with poor visibility porosity. The rock is heavily clayey in places, spotted, weakly layered, with abundant inclusions of plant remains.

The siltstone is light gray, highly clayey, slightly calcareous, slightly mica, with streaks of gray mudstone-like clays and inclusions of charred plant remains.

In well No. 3p Kossor in the interval 2472–2482 m L.S. Khachieva encountered the following spore-pollen complex: Cyathidites minor Couper, C.junctus [K.-M.] Alim, Monosulcitessp., M.

Subopanulosus Couper, Disaccites, etc. , which makes it possible to date the age of the host sediments as Lower Jurassic.

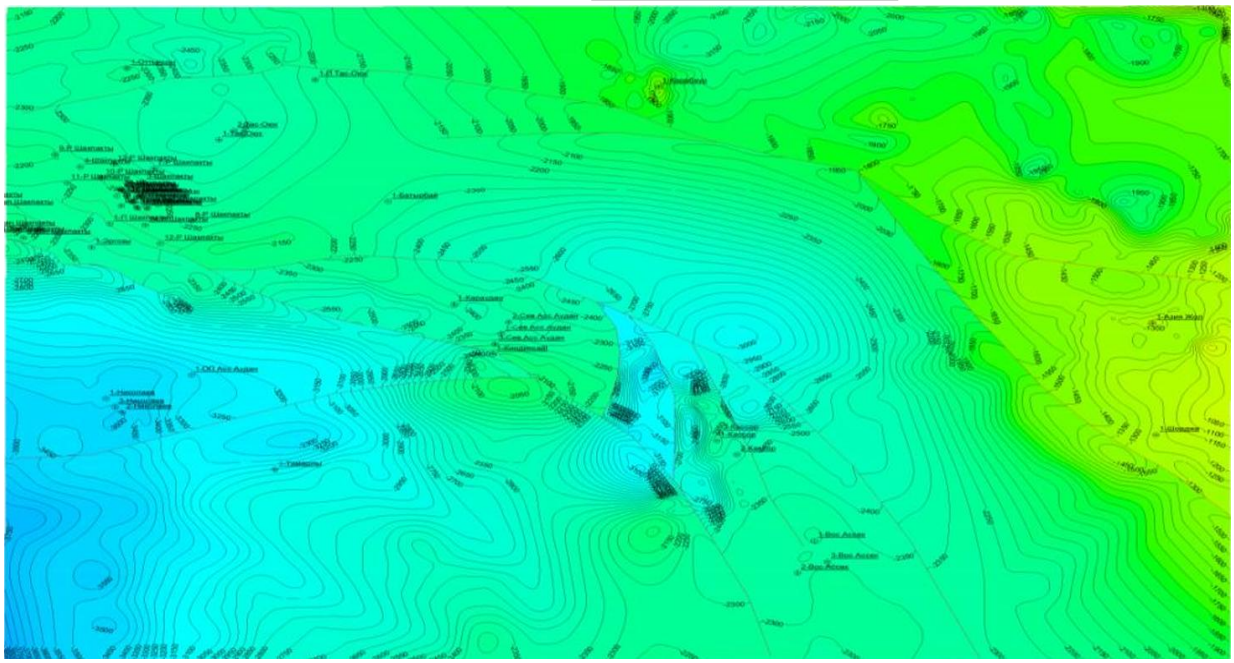
The ratio of iron forms suggests that weakly reducing conditions prevailed during the period of accumulation and transformation of Lower Jurassic sediments. The reservoir properties of the rocks are characterized by the following indicators: total porosity - 9.2%, open - 8.6%, density within 2.43 g/cm3, no permeability. From the Lower Jurassic age, humidity of the climate and reduction of arid zones began; sedimentation took place in a desalinated shallow basin in a warm, humid climate.

The thickness of Lower Jurassic deposits decreases from northwest to southeast. If in well No. 1 Kindyksay the thickness of sediments is 172 m, then within the Kossor area it is 124–157 m, in the East Assakeaudan area it is 76–98 m.

Middle Jurassic deposits within the study area are widespread and are represented by the undivided Aalenian-Bajocian and Bathonian stages.

Lithologically, the Middle Jurassic deposits are represented by a terrigenous sequence of interbedded gray sandy-silty-clayey rocks. The Aalenian-Bajocian stage is represented by frequent alternation of sandstones, siltstones and clays with an abundance of carbonized plant remains and thin layers of coal (2–4 cm). It is characterized by thin horizontal bedding and lens-shaped microbedding. The thickness and lithological composition of the rocks varies greatly, which is associated with the continental nature of the genesis of sediments.

A structural map for the conditionally reflecting horizon TIV, J2, near the top of the Middle Jurassic deposits is shown in Picture. 1. The Bathonian stage in the lower part is represented by sandstones with thin interlayers of gravestones, in the upper part - by frequent alternation of gray and dark gray sandstones, siltstones and clays. The rocks are rich in charred plant remains and pyrite.



Picture.1. Structural map based on the conditionally reflecting horizon TIV, J2 near the top of the Middle Jurassic deposits (according to G.V. Abrasimova and G.V. Surkov, 2009)

Conclusion. The conditions of sedimentation and the relief of the Pre-Jurassic surface predetermined the structural features of the Lower Jurassic deposits, their composition, thickness, and reservoir properties. In the western part of the Assakeaudan trough, the section of Lower Jurassic deposits is stratigraphically divided into two age units: the lower one belongs to the undivided Early Sinemurian-Pliensbachian age, and the upper one belongs to the Toarcian age. In the eastern part of the territory, where the thickness of the Lower Jurassic deposits has predicted anomalous values of up to 4–6 km, the upper part of the section (1435 m) also has a two-tier structure.

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