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Oil and Gas Potential in the Territory of the South-Eastern Part of the Bukhara-Khiva Region

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Abstract

The article analyzes the oil and gas content of the southeastern part of the Bukhara-Khiva region. It is shown that this territory is the main promising target for prospecting for new oil, gas and hydrocarbon deposits. It was revealed that the main productive deposits are carbonate deposits. It has been established that the most widespread and large ones are massive deposits in traps of the structural-lithological type, confined to the Callovian-Oxfordian reef deposits and distinguished by high capacity and filtration properties. It is argued that the lower part of the reservoirs is flooded in all fields of this type. The characteristic is given of 44 open oil, oil and gas condensate, gas condensate and gas fields of the specified region. Pre-Jurassic deposits contain hydrocarbons. The features of the structural plans of carbonate and salt-anhydrite formations and their influence on the location of oil and gas deposits within the southeastern part of the Bukhara-Khiva region for increasing hydrocarbon reserves have been determined. The fields under development in the stage of deep drilling have been clarified. Recommendations for deepening geological exploration are offered.

Key-words: Oil and Gas Content, Gas, Hydrocarbons, Sediments, Reservoir, Oil, Callovian-Oxford, Oil and Gas Condensate.

1. Introduction

As you know, the territory of the southeastern part of the Bukhara-Khiva region (BKhR) is the main promising target for prospecting for new oil, gas and hydrocarbon deposits at the Chardzhou stage. The main productive deposits are carbonating Upper Jurassic and to a lesser extent terrigenous

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Lower and Middle Jurassic deposits. Nowadays, 44 oil, oil and gas condensate, gas condensate and gas fields have been discovered in the south-eastern part of the BKhR. The most widespread and large ones are massive deposits in traps of the structural-lithological type, confined to the Callovian-Oxfordian reef deposits and characterized by the high reservoir and filtration properties. The main type of deposits is associated with the zone of development of barrier reefs - Shurtan, Northern Shurtan, Kumchuk, Garmiston, Shakarbulak. In all fields of this type, the lower part of the reservoirs is watered. The tributaries from the reef horizon are much higher than from the sub-reef.

2. Materials and Methods

Each type of deposit is due to a combination of favourable structural and tectonic conditions in the development zone of the barrier reef. The zone of development of barrier reefs is most associated with large deposits, the largest Shurtan deposit and the strip of reef traps stretching from it - Northern Shurtan, Kumchuk, Turtsari, Shakarbulak, Garmiston. Fields were discovered that belong to the carbonate reservoirs of the barrier-reef system (Khanabad, Shakarbulak, Turtsari, Karatepa), bioherms (Feruza, Yangi Karatepa, Chilkuvar, Sherkent) and anticlinal structures (Garmiston, North Guzar). The highest density of discovered deposits is confined to the western slope of the southeastern part of the BKhR (New Alan, Kapali, Chilkuvar, Aknazar, North Aknazar).

In its central part, there are deposits Shakarbulak, Shurtan, Beshkent-Kamashi, in the eastern part of the trough - Khanabad, Feruza, Karatepa. In the northern part of the southeastern part of the BKhR, in the zone adjacent to the Bukhara fault, not a single field has been discovered, which is associated with the low level of knowledge of the southeastern part of the BKhR. A seismic survey program has now been developed to study the structural features of this part of the region. Another type of deposit is associated with lithologically limited deposits confined to local formations such as bioherms (Kultak, Girvan, South Alan, etc.).

Here, under the lower anhydrite, there is a high-gamma member, below which organogenic permeable limestones are exposed. Abnormally high reservoir pressures (abnormally high formation pressures) were noted everywhere. Gas inflows were obtained in the Girsan-3 well and others - (949.2 thousand m^3 / day).

In the southeastern part of the BHR, as noted, 44 fields were discovered - Chilkuvar, Yangi Karatepa (Beshkent - Aknazar gas and oil region (SPR), Nishan (Alachavan SPR), Chigil, Divkhona. Shim. Girsan (Girsan SPR), Talimarzhon, Ilim, Ernazhon Alyaudinskiy SPR), Namazbay (Shurtan

SPR), Feruza, Turtsari, Khanabad, Myrmiron (Tarmoksk SPR), Alachagykuduk, Tarnasai (Talimarjan SPR).

In 2011. 5 more fields were discovered: Darakhtli (Darakhtlinsky State Oil Republic), Sherkent, Ruboyi (Beshkent - Aknazar State Oil Reserves), Oidin (Shurtan State Oil Reserves), Karatepa (Tarmoksky State Oil Reserves). On the territory of the southeastern part of the BHR, facts of the presence of hydrocarbons in the sediments of the pre-Jurassic complex were noted. These are the results of testing the section of these deposits in well No. 1 of Kungurtau. As a result of gas-logging, anomalous gas readings were revealed in the intervals 3015–3040; 3050–3060; and 3070-3090 m, and it was assumed that the interval 3015-3040 corresponds to the oil reservoir.

In the process of drilling from a depth of 3008–3010 m (top of Pz), an oil seepage was noted, expressed by the fact that oil flowed through a chute system. This phenomenon was observed down to a depth of 3090 m. However, as a result of testing in the intervals of 3056–3040 m, 3032–3007 m, inflows of saltwater with a specific gravity of 1.105 and 1.086 g / cm^3 were obtained.

Let us consider the state of hydrocarbon resources in the southeastern part of the BKhR, and also determine the features of the structural plans of carbonate and salt-anhydrite formations and their impact on the location of oil and gas deposits within this part of the BKhR for increasing hydrocarbon reserves.

Our research is based on a comprehensive analysis of materials from geological and geophysical surveys, first of all, drilling data, geophysical studies of wells and seismic exploration, we have compiled structural maps and geological sections that clarify geological models of predicted deposits. In terms of oil and gas geological zoning, the BKhR is subdivided into Bukhara and Chardzhoi oil-and-gas regions (OGR). The territory of the Chardzhou OGR covers an area of 16264 km^2. It drilled 896 wells with a drilling volume of 2497955 running meters.

The study was 18.2 km^2 / well. and 153.6 m / km^2. Dengizkul-Zevardinsky - 7.3 km^2 / well is characterized by the highest drilling density. and 403.5 m / km^2 and the Ispanly-Chandyr gas field - 9.0 km^2 / well. and 300.8 m / km^2, the smallest one is the Shortaklinsky oil field - 308.0 km^2 / well. and 8.6 m / km^2. The southeastern part of the BKhR also belongs to the territory with a high degree of drilling. With an area of 7859 km^2, 400 wells were drilled here with the volume of drilling 1394153 running meters. The level of exploration is 19.6 km^2 / well, and 177.4 m / km^2 [1].

The structures associated with salt tectonics consist of two or more blocks, which can have different gas-water contact (GWC) and oil-water contact (OWC), and according to Geophysical survey of wells (GSW), they are characterized by unequal filtration-volumetric properties (density, permeability, fluid -saturation). In the northeastern-southeastern part of the BKhR, several

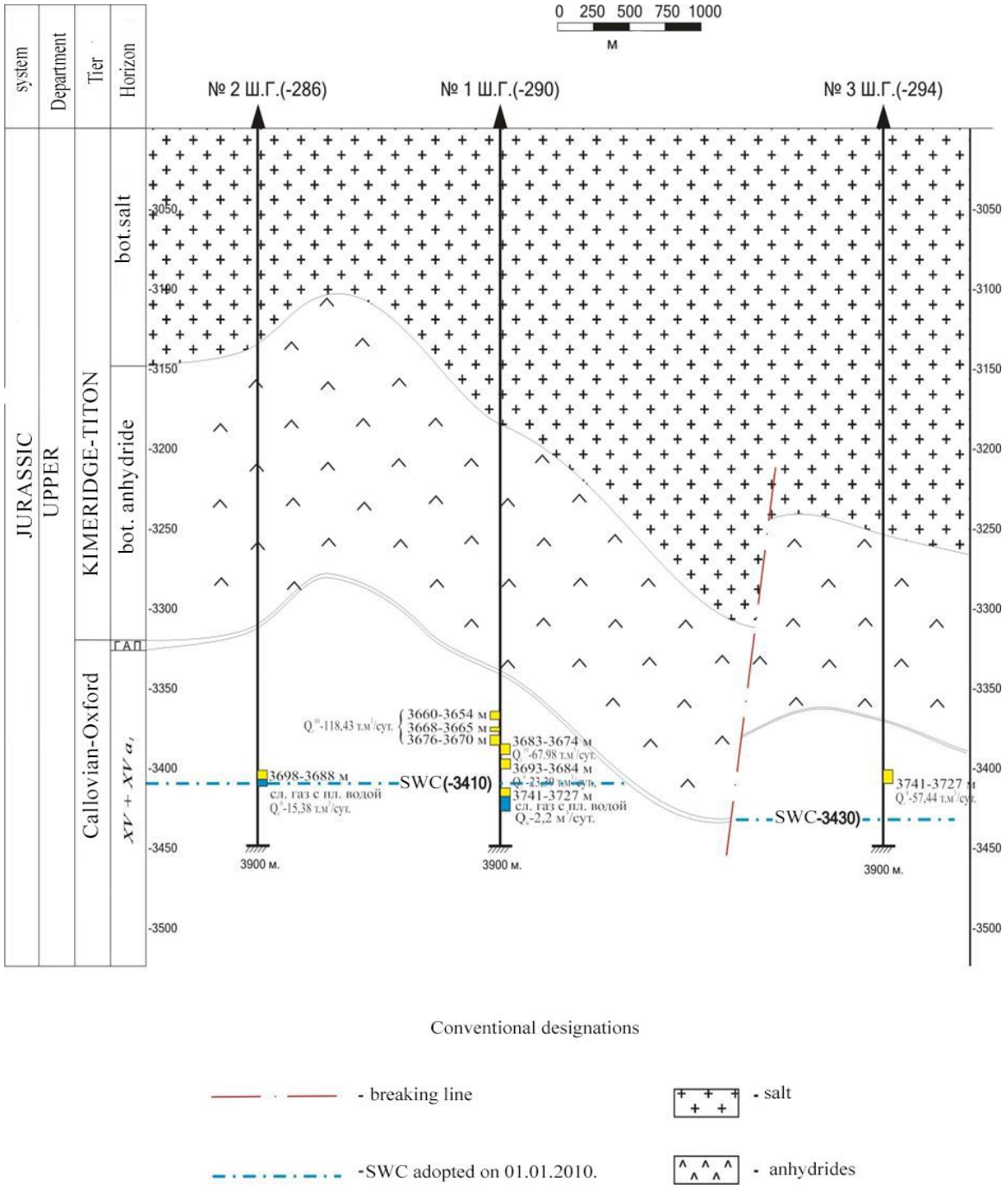
medium-sized and reserves of gas condensate and oil fields have been discovered: Garmiston, Meson, Northern Guzar, Kumchuk, Chunagar and Northern Shurtan. Within the study area of the region, deep drilling was carried out in 86 areas (including those in drilling): in 44 - the carbonate formation was penetrated by one well, in 14 - with two, in the rest - with three or more. Of the 44 discovered oil and gas fields in the exploration stage - Mirmiron, Turtsari, and in the exploration stage - Khanabad, Mezon and Feruza [2]. With the emergence of new material on parametric wells that exposed pre-Jurassic deposits along the way with the study of sedimentary cover rocks, in [3], the priority zones for exploration work are identified to reveal the internal structure of Paleozoic sediments and objects of accumulation of hydrocarbons in their section.

3. Results and Discussion

As a result of sampling the production horizons of the Lower and Middle Jurassic within the southeastern part of the BKhR, numerous non-commercial inflows and signs of gas, oil and gas condensate were also found. On the territory of the south-eastern part of the BKhR, the Kashkadarya troughs and the South-Western spurs of the Gissar ridge (SWSGR), accumulations of industrial-grade hydrocarbons have not yet been identified. Signs of oil were obtained at the Tashlinskaya (XVII horizon) and Kungurtau (XVIII) structures, gas - at the Babasurkhan (flow rate from the XX horizon - 35 thousand m^3 / day, with water - 134 m^3 / day), South-Tandyrchinskaya (from the XVII horizon - 7 thousand m^3 / day), Shurtan (from XX horizon - 8 thousand m^3 / day, with water - 3.5 m^3 / day), Amanatinskaya and Gumbulak (from XX and XXI horizons - manifestations of formation water with dissolved gas). On the rest of the structures, commercial horizons are mostly dry or aquifers [4].

Let us consider the conditions that determine the productivity of the terrigenous Jurassic. Sandy horizons are cemented by clay material (according to the results of particle size analysis, the clay content ranges from 10 to 22%). This is due to the facies conditions of sedimentation in the corresponding geological section. It is this factor that explains the low reservoir properties of sandy rocks in the Shurtan, Gumbulak, Amanata, Azlyartepa, etc. areas. Their porosity here varies from 2 to 8%, mainly 5–6%, permeability is low, in many cases absent. Therefore, when testing wells, many sandy horizons turned out to be dry. The southern half of the southeastern part of the BKhR and the South-South Pacific is complicated by a series of submeridional thrust faults formed in the alpine phase of folding.

Figure 1. Geological Profile along the Line of Wells No. 2-1-3 of the North Girsan Field



As a result of these movements, the territory acquired a block structure, which is reflected in geological profiles and structural maps. On tectonically complicated structures in the section of the Jurassic terrigenous formation, traps for the accumulation and preservation of hydrocarbon fluids can be associated with sub-thrust objects (fig.1.). Within the tectonic swells and inter-swell grabens of the southeastern part of the BKhR and the Kashkadarya trough, the top of the terrigenous formation lies at an elevation of minus 3000–4100 m. In the southern direction, it gradually sinks to minus 4200 m.

Its thickness in the northern ends of the southeastern part of the BKhR (near-fault zones) is 400 m, in the southern - 1800 m (according to O.P. Mordvintsev - up to 2000 m) [4].

In the areas of development of the Upper Oxford-Kimmeridgian reef complexes (Shurtan, Urtabulak, etc.), the upper part of the Mubarek formation is composed of a thick stratum (up to 100 m and more) of massive organogenic-detrital formations, where the main algal-bryozoan biocenosis with fragments of brachiopods, bryozoans, bivalve, foraminifera. In shallow waters, bio thermal formations developed widely, which underwent intensive destruction and were compensated by normally layered accumulative formations. As a result, a thick bioclastic stratum accumulated, which later served as the basis for the formation of reef complexes of the Upper Oxford-Kimmeridgian age.

A slightly different section of the Mubarek Formation is observed within the northwestern part of the Chardzhou Step and at the Bukhara Step in the trans-reef lagoon zone formed as a result of screening by the barrier-reef system of the Upper Oxford-Kimmeridgian age. Here, the sediments are represented by organogenic-detrital, detrital, oolitic, sometimes sandy limestones, to a large extent porous, which compose flattened hills and prominent bodies (40–60 m), distinguished as biostromes [5].

The age of the lower stratum is determined as Upper Callovian based on the complex of bivalves and foraminifera, some of which are in the outcrops of the SWSGR together with the Upper Callovian ammonites. In an integral oil and gas geological mega system of each region, the object of the territorial forecast is oil and gas bearing areas and oil and gas accumulation zones, as well as their constituent places of accumulation. The object of forecasting the oil and gas content of the lithosphere section is the regional oil and gas complexes (ROGC). In our study, the object of the territorial forecast is the southeastern part of the BKhR, and the oil and gas accumulation zone is the Beshkent trough, the place of accumulation is the Chilkuvar, Northern Nishan, Kamashi, Girsan, etc. For the formation and preservation of hydrocarbon (HC) deposits in the composition of oil and gas complexes, as a rule, there should be oil and gas source strata, reservoirs and seals (seals). In the study area, the oil and gas source rocks of the terrigenous formation contain organic matter (OM) of humus and humus-sapropel composition. Oil and gas source strata in the Late Jurassic were in the zone of the upper phase of gas formation and began to emit gaseous hydrocarbons [6].

Terrigenous formation of the southeastern part of the BKhR, according to well data No. 25 Shurtan, No. 1P - Berdykuduk, composed of rhythmic interbedding of mudstones, uneven-grained grey, dark grey sandstones with interlayers of clays, siltstones, gravestones and sometimes coals.

One of the constituent parts of the oil and gas complex is oil and gas reservoirs. In the section of the sediments, there are a frequent alternation of reservoir rocks (sandstone beds) and low-permeability seal rocks (clays). For the considered strata of the Chardzhou step, as noted by A.K. Maltsev et al., The increase in the section of the proportion of sandy rocks from west to east towards the southeastern part of the BKhR is indicative. According to the lithological composition in the study area, the reservoirs belong to the group of sandy-siltstones [7].

The formation and preservation of oil and gas accumulations in reservoirs are possible only if there are low-permeable or practically impermeable strata, called seals, above the reservoirs. In the section of the terrigenous formation (TF), layers of thick clays serve as a seal. The immediate proximity of the platform part of Western Uzbekistan with the orogenic area of the SWSGR significantly affected the development of this region. The territory of the southeastern part of the BKhR experienced this influence more than in the northwestern part of the Chardzhou stage, where several deposits were discovered in terrigenous deposits.

The territory of the southeastern part of the BKhR turned out to be a system of faults, divided into several blocks. O.A.Karshiev made a map of the oil and gas potential of the southeastern part of the BKhR [8].

To determine the boundaries of the distribution of deposits by types of fluid, schemes of distribution of gas, gas-oil and oil deposits in two areas have been drawn up [1].

The principle of differential capture of hydrocarbons during the formation of oil and gas deposits has become the basis for dividing zones by fluid types. In the Alenia time, within these promising areas, floodplain formations were formed, mainly of mudstones and siltstones with thin sandy interlayers. Mudstones dominate, which can serve as seals for the underlying Lower Jurassic deposits. In the Lower Bajocian, coarse-detrital conglomerates, gravestones, and sandstones of the foothill-fan-shaped and plain-channel genesis up to 50 m thick accumulated.

In the direction of the Karatyubinsky and Gissar paleo-uplifts, they pinch out. In the upper Bajocian, in the Karatepa area of the Shorbulak clinoform structure, submarine deltaic sediments were formed (Karshi-Karatepa submarine delta). It is assumed that they are composed of well-sorted sandstones up to 150 m thick and are a natural reservoir for the accumulation of hydrocarbon fluids [9].

To the north, they are replaced by channel and floodplain complexes. The channel sand beds here are bounded on both sides by impermeable silty-clayey rocks. M.E. Egamberdiev identified them as traps associated with the sediments of river channels [10].

Callovian-Kimmeridgian carbonate deposits, which are 228–288 m thick, are consistently overlying terrigenous deposits. They are represented by rocks of carbonate composition - alternating clayey limestones and weakly dolomitized limestones. Limestones contain numerous remains of algae and corals. Limestones are fractured and cavernous-porous in areas.

In the Bathonian time (Batt stage), shallow-sea wave-breaking conditions prevailed on the Karatepa Shorbulak and Yartepa structures, and silt formations dominated. In the Shurtan area, in the section of the Tangduval Formation, the XVIII - 2-3 horizons are distinguished, in the lower, middle and upper parts - under horizons up to 12 m thick, increasing, according to our data, in a northern direction. The thickness of the deposits is 174 m, gradually decreasing to the north. They occur with angular unconformity on the underlying sediments and correspond to the Karatepa Shorbulak clinoform structure, where oil and gas traps of lithologically screened type were found in the deposits of the XVIII horizon. On the facies-paleogeographic maps in the identified prospective zones, the facies belt of the Early Callovian time is conventionally marked as bottom flow. The lithological composition is represented by unevenly interbedded mudstones, limestones, siltstones, marls, less often - with thin sandstone interlayers (up to 5 m). Mudstones predominate (up to 90%), possibly serving as a cover for the underlying sediments [9,10,11].

At present, the second place after the Dengizkul uplift in terms of total gas reserves in the BHR is occupied by the southeastern part of the BKhR. Within the southeastern part of the BKhR, the largest in Western Uzbekistan Shurtan gas condensate field has been discovered, as well as a number of smaller ones: Northern Nishan, Beshkent, Kamashi, Chilkuvar, Girsan-Divkhona-Shimoliy Girsan, Shakarbulak, Northern Shurtan, etc. In all the fields identified here, as in most in Western Uzbekistan, commercial oil and gas content is associated with the Middle and Upper Jurassic carbonate deposits, which are a regional productive stratum within the BKhR and SWSGR.

4. Conclusion

As you know, the fund of large traps in the carbonate formation of the Jurassic age is practically exhausted, and now medium and small traps are becoming targets for exploratory drilling, with which it is difficult to associate the identification of promising deposits with large reserves. In the process of exploration for oil and gas in the BKhR, hydrocarbon deposits have been practically explored to a depth of 3500–3600 m.

These deposits in the northwestern part of the BHR are located in the Lower, Middle and Upper Jurassic and Cretaceous sediments. In 1970, the Kamashinskaya structure was included in the

category of fields after receiving an industrial flow of gas with condensate from the Upper Jurassic carbonate deposits.

As of January 1, 2020, in the studied area in the period 2005–2019. the following objects were put into development: in 2005 - Feruza, Northern Shurtan, Buzakhur; in 2006 - East Buzakhur; in 2007 - Northern Nishan, Ilim; in 2008 - Kamashi; in 2009 - Kumchuk; in 2010 - Meson, Turtsari, Alachikuduk, Shimoliy Girsan, Divkhona, Ernazar, Chigil; in 2011 - Nishan, Chunagar, Sherkent, Ruboya; in 2012 - Aknazar, Shimoliy Aknazar, Tarnasai, Nazarkuduk; in 2013 - Karatepa; in 2014 - Namazbay; in 2016 - Sovligar; in 2017 - Myrmiron; in 2018 - Khanabad and in 2019 - Talimarjon. Analysis of the oil and gas content of the studied area, basically, showed that all hydrocarbon deposits were identified in carbonate deposits of the Jurassic age. The fields in the development process, structures in the deep drilling stage were clarified, objects were identified and recommendations for further exploration activities were proposed.

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