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PROSPECTS FOR THE PALEOZOIC OIL AND GAS POTENTIAL OF THE WESTERN TIEN- SHAN ACCORDING TO GEOPHYSICAL DATA

Annotation

The purpose of this article is to consider the prospects for oil and gas potential along the profile "Guzar - Shakhrisabz - Samarkand - Chelak - Uchkulach". During analyzing previous materials, the data of the seismic exploration of the MCWE and geodensity modeling were interpreted. Using these methods, the structures of pre-Mesozoic formations were revealed and deep faults were determined, which create favorable conditions for the massive development of tectonically shielded oil and gas traps.
Key words: profile, Tien Shan, fault, graben, synclinal, anticline, Mohorovichich, Paleozoic, Meso-Cenozoic, geodensity, earth's crust.

ПЕРСПЕКТИВЫ НЕФТЕГАЗОНОСНОСТИ ПАЛЕОЗОЯ ЗАПАДНОГО ТЯНЬ-ШАНЯ ПО ГЕОФИЗИЧЕСКИМ ДАННЫМ

Аннотация

В статье рассматриваются перспективы нефтегазоносности по профилю «Гузар – Шахрисабз – Самарканд – Челак – Учкулач». При анализе исследований были интерпретированы данные сейсморазведки МОВЗ и геоплотностного моделирования. С помощью этих методов были выявлены структуры домезозойских образований и определены глубинные разрывные нарушения, которые создают благоприятные условия для массового развития тектонически экранированных ловушек нефти и газа.
Ключевые слова: профиль, Тянь-Шань, разлом, грабен, синклиналь, антиклиналь, Мохоровичич, палеозой, мезокайнозой, геоплотностной, земная кора.

G‘ARBIY TYAN-SHANNING PALEOZOY YOTQIZIQLARINING GEOFIZIK MA’LUMOTLAR BO‘YICHA NEFT VA GAZGA ISTIQBOLLIGI

Annotatsiya

Ushbu maqolada "G‘uzor - Shahrisabz - Samarqand - Chelak - Uchqulach" profili bo‘ylab hududning neft va gazga istiqbolligi ko‘rib chiqilgan. Seysmorazvedka MOVZ ma’lumotlarini tahlil qilish va geozichlik modellashtirish ma’lumotlari talqin qilingan. Bu usullar yordamida tomezozoy hosilalari strukturalari va chuqur yoriqlari aniqlangan bo‘lib, ular tektonik ekranlangan neft va gaz tutqichlari bo‘lishi mumkinl.
Kalit so‘zlari: profil, Tyan-Shan, yoriq, graben, sinklinal, antiklinal, Mohorovichich, paleozoy, mezo-kaynozoy, geozichlik, yer qobig‘i.

Introduction. The theory of the origin of certain minerals is associated with the improvement of knowledge about the geological structure of the Earth and its evolution. It is naturally reflected in the development of ideas related to hydrocarbons. Currently the world of oil and gas industry, including Uzbekistan, experiencing a very tangible shortage in the growth of hydrocarbon resources. Nowadays, widely spread theory is that the connection of oil and gas fields with deep faults and rifts, the most permeable zones of the earth's crust. Sequences of sedimentary rocks with reservoir properties can be exposed to fluids and gases that come from the upper mantle of the Earth, that is, from the subcrustal layers.[1].

The solution to the above approach is a comprehensive study of the deep structure of the Earth's interior: starting from the structure of the interfaces in the sedimentary cover, the crystalline basement, and ending with the interfaces in the Upper mantle. It is important to study the velocity and density characteristics of these complexes of the Earth's crust and Upper mantle. The territory of Uzbekistan, which is the Turan Plate on the one hand and the orogenic structures of the Tien Shan on the other, has a very long history of its development and, as a result, a complex structure. The study by geological and geophysical methods is very uneven. Most of all, the places of prospecting and development of hydrocarbon deposits and ore manifestations have been studied.

Research Methodology. The most complete and unambiguous information about the structure of the Earth's crust and Upper mantle has been obtained during regional seismic studies of the RWCM and DSS since the middle of the last century. However, the study of deep boundaries with the help of elongated travel time branches obtained at distances 2–20 times greater than the distances from the explosion points to the initial points leads to a significant averaging of the crustal interfaces.

Disadvantages of these methods are: the difficulty of studying narrow basins with large angles of inclination of the boundaries, the impossibility of identifying modern fault zones, and the use of mainly one class of longitudinal waves. Complex and expensive observation systems are required to unambiguously determine the nature of the waves recorded by RWCM and DSS.

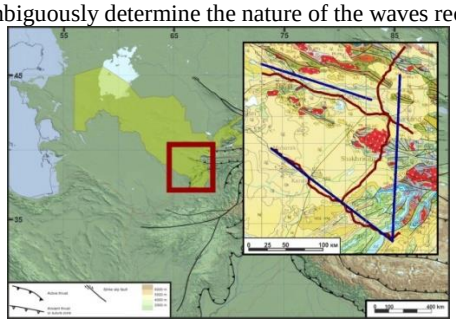

Figure. 1. Layout of MCWE profiles and geodensity modeling

Analysis and results. Since 1966, the JSC "Uzbekgeofizika" has done a great job of studying the deep structure of the earth's crust using the method of converted waves [4,7]. The MCWE profiles were used on almost all large tectonic units. The results of the work correlated well with the results obtained by other methods (RWCM, DSS). However, it should be noted that the territory of Uzbekistan, as mentioned before, is unevenly covered by deep geophysical profiles. According to the map of regional geophysical knowledge of Uzbekistan, it can be seen that the most promising territories for oil and gas exploration today - the Ustyurt plateau, the Aral Sea depression, the Middle Syrdarya depression, the Central Kyzylkum, the Zaravshan depression are not sufficiently covered by the MCWE profiles. The available materials on the deep structure are still fragmentary information, which is not enough to present a complete picture of the structure of the region and draw adequate geodynamic conclusions on their basis. The concentration of observation points and the equipping of the network with modern stations could be conducive to obtaining more complete information about the deep structure. Let us consider the prospects for the oil and gas potential of each tectonic unit separately within the study area. Profile II-II of the MCWE and geodensity modeling, with a total length of 261.8 linear kilometers, extends along the line Guzar - Shakhrisabz - Samarkand - Chelak - Uchkulach (Fig. 2, Fig. 3.).

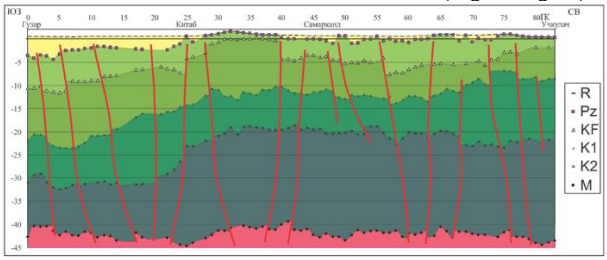

Figure. 2. Seismogeological section along the MCWE profile II-II

Kuramin-Fergana microcontinent. In recent years, the main attention in this region has begun to be given to pre-Mesozoic complexes. However, oil geologists do not have an unambiguous answer to this question, and especially in the region of the Middle Syrdarya Depression (MSD). Some consider the Paleozoic formations unpromising, due to a number of geological and tectonic reasons, while others place certain hopes on them. In favor of this conclusion, one can cite, for example, the geological situation on the northern side of the Donetks-Dniepro depression (DDD), which, like the MSD, does not contain either saline strata or saline diapirs. The crystalline basement is characterized by the presence of a dense network of concordant and discordant faults (mainly faults), which created favorable conditions for the mass development of tectonically screened oil and gas traps, alternation of horst-like uplifts and graben-like depressions. Intensified exploration work led to the discovery in the 80-90s of more than a dozen oil and gas fields. It has been established that hydrocarbon deposits in the crystalline basement can also be found in the sedimentary cover in the absence of them - the Gashinov oil deposit (DDD) (a similar picture is also characteristic of the Elley-Igayskoye and Maloichskoye deposits in Western Siberia). The study of the Yuzhno-Evgenyevskaya and Evgenyevskaya areas made it possible to draw a very important conclusion - the absence of oil and/or gas in the uplifted blocks and basement ledges does not mean their absence in the adjacent lowered blocks.

The available information indicates, in general, the presence of favorable structural-tectonic positions in the formations of the intermediate structural stage for the discovery of oil and gas accumulations in them. This conclusion is also supported by numerous, well-known facts of the discovery of bitumen, sulfur and gas manifestations in Devonian and Carboniferous limestones in the areas of Burchmulla, Maibulak, Maitepe, in the Azadbash valley. Based on the materials of previous studies, a significant improvement in the reservoir properties of rocks with depth relative to natural outcrops was established (porosity increases from 1-2% to 10-12%, wells 1-P, 2-P, 3-P Middle-Syrdarya) [2,4,8]. In the region of the Pistalitau mountains, the content of bitumen in rocks from a depth of 50 meters increases 2.2 times [2,4,8]; Lithological and petrographic analysis showed the reef nature of the Devonian limestones of the Givetian and Frankian stages (Nuratau Mountains). In general, a large number of both direct and indirect signs have been identified that indicate the possible large-scale presence of hydrocarbons in the sediments of the intermediate structural stage of the Middle Syrdarya depression, the listing of which can be continued for a long time, but we will limit ourselves to what has been said.

According to many researchers, the complex of Paleozoic deposits of the Middle Syrdarya depression is of undoubted interest as promising for the presence of hydrocarbons for the following reasons [4,5,6,8]:

- the presence in the Paleozoic section of carbonate rocks of Devonian and Carboniferous age, which can be receptacles for oil and gas. Among them there are also reef formations. The porosity of carbonate rocks ranges from 1-2% to 12% according to the core and up to 20% according to well logging, a reservoir of porous, fractured and fractured-pore type;

- Overlapping of Paleozoic carbonates by various types of effusive and hydrochloric-anhydrite rocks of Permian age, characterized by very low porosity and permeability. They can play the role of tires;

- the presence of direct signs of oil and gas content of the Paleozoic.

According to the world practice of prospecting for oil and gas deposits were also discovered in the Paleozoic rock complex during opening the entire Phanerozoic section with deep wells, along with Mesozoic-Cenozoic deposits. At the same time, oil and gas deposits were discovered both in subhorizontal platform-type rocks and in sedimentary-metamorphic and even igneous rocks of a folded basement. All of the above factors make it possible to draw conclusions about the prospects of the Middle Syrdarya depression in relation to the discovery of hydrocarbon deposits both in the deposits of the ISF and the Meso-Cenozoic sedimentary cover.

South Tien Shan folded suture (Fig.1, Fig.2.). Within the considered part of the geotraverse, the data of MCWE and geodensity modeling distinguish several large discontinuities, which probably cut the entire Earth's crust and serve as boundaries for geoblocks. In the central part of the Zaravshan depression, two parallel faults are recorded, which practically divide the profile into two parts: western and eastern. A feature of this fault zone is that the area between them is decompressed and can serve as a favorable channel for the penetration of deep fluids. From the point of view of the prospects for oil and gas potential and the discovery of other types of minerals, taking into account modern views, the sections of the profile can be considered the most favorable, where contacts of anomalously dense and decompressed geological bodies are noted, regardless of their location depth [3,4,5,6]. These are, first of all, the central and eastern regions of the profile, where objects with σ=2.65-2.70 g/sm3 and σ=2.90-2.95 g/sm3 come into contact at different depths. This dependence has been established for many regions of Uzbekistan [2].

Concluding the consideration of the deep geological structure of the Zaravshan depression along the profile I-I of the MCWE, it can be noted that the data obtained indicate rather high prospects for the study area for the discovery of hydrocarbon deposits within its boundaries.

Karakum-Tajik microcontinent. Within this marginal massif, the Kashkadarya trough and the western spurs of Baysuntau and Kugitangtau are very promising (Fig. 1, Fig. 2.) [2, 4]. In the Kashkadarya trough in 1974-75,two wells were drilled in the crest of the Yakkasaray structure, during testing of which negative results were obtained. Parametric well No. 1 was drilled to a depth of 3501 m and exposed Neocomian-Aptian deposits. 7 objects were tested in the well in XIII, XII, XI horizons. Formation water inflows were obtained, while testing in an open hole of the XII horizon at a depth of 3257 m, an intensive inflow of gas with oil was obtained (24.5 m / day of gas, 2.5 l of oil and 3 l of solution). In exploration well No. 2, 10 objects were tested in XVa, one in XV, two in XIII and XII horizons, all of them had water inflows. During sampling of the XIII horizon of the Lower Cretaceous in the well. No. 3 Yakkasaray in 1983 received industrial oil inflows. 7 objects were tested in the well in XIV, XIII and XII horizons. No inflow was received in the XIV horizon. Four objects were sampled in horizon XIII. Formation water inflows with a small amount of oil with a density of 0.826 g/sm3 were obtained from the two lower objects, and commercial oil inflows with a flow rate of 22.4 and 43.2 m3/day with 3 and 4 mm choke were obtained from the upper ones. The GOR was 121 and 132 m3/day, respectively. In horizon XII, two objects received weak oil inflows. OWC can be traced at a depth of minus - 2250 m. Later, well No. 3 was mothballed and in 1987 transferred to pilot operation. In the well No. 4, passed to a depth of 3600 m and left in the Neocomian-Aptian deposits of the Lower Cretaceous, 5 objects were tested in the XII, XIII and XIV horizons. When testing horizon XIII, formation water inflows were obtained. Formation water inflows with a small amount of oil were obtained in horizon XII.

The West-Yakkasaray structure was put into exploration drilling in 1988. A total of three exploratory wells have been drilled. Well No. 1 was drilled in the crest of the structure to a depth of 3350m in Neocomian deposits. In the Lower Cretaceous deposits, 8 objects were tested in the XIV, XIII and XII horizons. When testing horizon XIII, oil inflows were obtained with a flow rate of 10.3 m3/day. In the XII horizon, inflows of formation water with oil were obtained. In the rest of the objects, there were either no inflows (XIV horizon), or formation water inflows were received. Well No. 2 was drilled to a depth of 3350 m in Neocomian deposits. The well tested 4 intervals in the XIII and XII horizons. When testing horizon XIII, a weak inflow of formation water with oil was obtained. In horizon XII, formation water was obtained in one case, and water with a small amount of oil in the other. The best results were obtained when testing horizon XII, where an oil inflow with a flow rate of 4.8 m3/day was obtained through a 3 mm choke.

Horizons XVIII and XVII are distinguished in the section of terrigenous Jurassic sediments. These horizons were tested in 10 objects only in the Shurasan area (wells Nos. 1,3,4). As a result of the tests, formation water inflows were obtained without signs of oil and gas, while from the XVII-2 (int. 1745-1721 m) horizon in well No. 3 Shurasan, an insignificant amount of dissolved gas was noted to enter with water. Thus, the Jurassic terrigenous section of the Shurasan area is characterized as unproductive. However, the test results obtained in one area do not allow us to classify deposits of this age as unpromising.

However, the comprehensive studies carried out on the territory of the Kashkadarya trough show that the geological and tectonic structure of the trough is very complex.

Conclusion. As a result of the analysis of the received and available materials, the following conclusions can be drawn about the prospects for predicting the oil and gas potential of pre-Mesozoic rocks:

Nowadays, due to the emergence of new views on the origin of hydrocarbons, in addition to the traditional approach, the connection of oil and gas fields with the most permeable zones of the earth's crust - deep faults and rifts - is widely recognized. Sedimentary rock strata with reservoir properties can be exposed to fluids and gases that come from the upper mantle of the Earth, that is, from the subcrustal layers. This allows hydrocarbons to accumulate in almost any rock strata with reservoir properties (independently intrusive, effusive, or others);

The presence of carbonate rocks of Devonian and Carboniferous age in the Paleozoic section, can be receptacles for oil and gas. Among them, there may be reef formations (Devonian carbonates MDS). The porosity of carbonate rocks ranges from 1-2% to 12% according to the core and up to 20% according to well logging, a reservoir of porous, fractured and fractured-pore type;

Overlapping of Paleozoic reservoir layers by various types of effusive and hydrochloric-anhydrite rocks of any age, characterized by very low porosity and permeability. They can play the role of tires;

Almost horizontal layering of the entire Upper Paleozoic complex (intermediate structural floor ISF) in the Tashkent region, MDS and the presence of traps favorable for the accumulation of oil and gas, both in the internal structure of the ISF and in its topography in the form of local protrusions;

The presence of direct signs of the oil and gas potential of Paleozoic deposits;

The most favorable blocks can be considered in the earth's crust, where contacts of anomalously dense and decompressed geological bodies are noted, regardless of their location depth.

An analysis of the available materials on pre-Mesozoic formations in the study area indicates that there are potential opportunities in the region for increasing the proven reserves of oil, gas and condensate in order to ensure the growth of oil and gas production.

The study of the junction zone of the Turan Plate and orogenic structures of the Tien Shan and the forecast of the prospects for oil and gas potential of pre-Jurassic formations based on modern geological concepts were carried out by separating converted waves from earthquakes, geodensity modeling and morphostructural analysis.

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