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Lithological-Capacitive Characteristics Of The Jurassic Reservoirs Of The Chardjoy Stage Of The Bukhara-Khiva Oil And Gas Region

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ABSTRACT

As part of the study of the Bukhara-Khiva oil and gas region, a geologist performed a comprehensive analysis of geophysical information on wells - lithological description of the core, laboratory determinations of reservoir properties, log curves, test results. The article is presented. The most complete information on the structure of the surfaces of the suprasalt complexes was obtained from the top of the Bukhara layers of the Paleogene. The obtained data were incorporated into the logging interpretation algorithms, which made it possible to give a litho-petrophysical characteristic of each of the formations of the Jurassic Cretaceous oil and gas complexes within the Chardjoy stage of structural-facies zones.

KEYWORDS

Synclise, Turanian plate, organogenic, Jurassic-Cenozoic complex, Beshkent deflection, Kern, carbonate anhydrite

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INTRODUCTION

In different years, Babaev A.G., Davlyatov S.D., Ibragimov A.G., Ilyin V.D., Mirkamalov Kh.K., Abdullaev G.S., Akhmedov P.U., Krylov studied the tectonic structure, oil and gas content of the Amudarya syneclise.

The Amu Darya syneclise is the largest tectonic element of the Turan Plate, it is characterized by a stepwise immersion of its side parts, the central part of the syneclise is complicated by a number of protrusions, depressions and shafts limited by faults in the foundation, many of which are also traced in the sedimentary cover. In the regional parts of the Amu Darya syneclise, the following stand out: Bukhara, Chardzhou, Bagajin steps, Badhyz-Karabil uplift zone and Beshkent deflection [3].

The Chardzhou step is located south of the Bukhara step and extends in the northwest direction for 500 km with a width of 400 to 125 km. In the southwest and northeast, the step is bounded by regional faults along the Amu Darya River and the southern slope of the Bukhara step. In the structure of the platform cover of the region, which includes the Jurassic-Cenozoic complex of sediments, two floors are distinguished, separated by the Tithonian salt-bearing strata. The most complete information on the structure of the surfaces of the suprasalt complexes was obtained from the roof of the Bukhara layers of the Paleogene. This surface is penetrated by all deep wells drilled both in the Kokdumalak area and in neighbouring areas, as well as structural wells drilled in the considered area in different years in order to search for local anticlinal folds [5].Types and limits of collectors. At the Kokdumalak XV NR deposit, the horizon is represented by interlayer of permeable and dense limestones, strong, in places weakly fractured, cavernous. The rocks are composed mainly of algal varieties of limestones. Reservoir rocks of the XV P and XV PC horizons are represented by numerous varieties of organogenic and algal limestones, possess high filtration-capacity properties (FCP) with a wide range of their variation (Кп = 6–36%; Кпр = 0.1 10–3 32μm2); cavernosity is widely developed in them. Secondary processes are represented by calcification, dolomitization, leaching, and partly (in the uppermost part of the XV HP horizon) by anhydritization [2].

Dolomitization is developed sporadically in the XV HP, XV P and XV PC horizons and is 5-10%, practically not affecting the reservoir properties. According to the results of the microscopic study, the reservoir rocks of all productive horizons are characterized mainly by granular porosity, confined to inter-and intra-shaped elements. In general, based on the results of the analysis [4] of the structure of the reservoir space, it can be concluded that the main type of reservoirs, which is widespread within the XV HP, XV P and XV PC horizons, is the porous-cavernous type of reservoir. It is characterized by all the traditional logging features of reservoirs with granular porosity. The lower limits of porosity are determined from the petrophysical dependence of open porosity on permeability and are 6% for gas-saturated reservoirs, and 7% for oil-saturated reservoirs [2].

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Table1 contains the average values of the open porosity coefficient according to laboratory data, taking into account corrections for vugs and temperature and pressure conditions. Additional analysis and reinterpretation of the available data, at the last recalculation of reserves [2], indicate the unrepresentativeness of the obtained residual oil saturation value – 3-4%, taken for the first estimate of reserves. The value of this parameter, estimated from the reservoir pressure gradient, was 27%, which on average is 9 times higher than the previously accepted value [1]. (Figure 1). And this was one of the reasons for the initial overestimation of free gas and condensate reserves.

Table 1. - Average values of CP according to laboratory data

Horizon	Wed values of the coefficient of porosity	Permeability, μм^2	
		Parallel to bedding	Perpendicular to bedding
XV-HP		0,615	0,0117
XV-P	0,146	0,591	0,333
XV-P gas	0,132	0,759	0,483
XV-P oil	0,151	0,480	0,235
XV-PC	0,132	0,108	0,025

Filtration-capacitive properties of reservoir rocks. Core samples were taken from the sediments of the carbonate and terrigenous Jurassic using Nedra shells. In exploration well № 7, a core was taken from the productive part of the good section, in the amount of 59 linear meters. The core sampled in exploration well № 7 is loose limestone with a hydrocarbon smell. At the South Kemachi field, 18 wells were drilled with coring, including: in the South Kemachi area - 13 wells and 5 wells in the Kenja area. No core was taken from production wells in the South Kemachi field. The total penetration with coring was 1715.4 linear meters. meter. At the same time, 1108.45 linear meters were selected. the meter of core, which is 64.6% of the penetration. The main volume of coring fell on the XV-HP and XV-P horizons. As a result of the research, the content of mobile and oxidized (immobile) bitumen was determined. The content of mobile bitumen for the gas-saturated part of the section is 8.2% (relative); for oil-saturated - 10.2%. The proportion of stationary bitumen in the gas-saturated and oil-saturated parts of the reservoir practically coincided and amounts to 1.8% (relative). Due to the fact that the

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determination of the porosity was carried out on the extracted samples, the obtained average values of porosity and saturation were corrected for bituminous content. For the rocks of the gas-saturated part of the section, the correction for bituminous content was 8.2% (relative); for the rocks of the oil-bearing part of the section 1.8% (relative), i.e. minus the content of fixed bitumen. At the Arniez field, 22 wells were drilled, coring was carried out at the prospecting and exploration stage, in connection with which the physico-lithological characteristics of the productive strata by core are given from the report on the calculation of reserves, performed in 1995. With coring, four wells were drilled (№. 1, 2, 3, 4) with a total core penetration of 119 linear meters. m. At the same time, 83.9 running meters were selected. core, which accounted for 70.5% of the core penetration. No core was taken from the production wells [1].

In the section of the Upper Jurassic carbonate formation of the deposit under consideration, the following horizons are distinguished: XV-HP and XV-P, the depression equivalent of reef facies (DARF), below which the deposits of the XV-PR and XVI horizons lie. They are composed of carbonate rocks. The gas-oil reservoir of the considered field is confined to the carbonate complex of Jurassic rocks and covers the XV-NR and the upper part of the XV-P horizons. 7 wells were drilled at the Sardob field with core sampling with a total core penetration of 492.6 linear meters. At the same time, 225.7 running meters were selected. core, which is 45.8% of the penetration rate. No core sampling was performed for production wells. Within the considered field, gas and oil deposits have been identified, confined to the horizon of black shale (SHS), XV and XV-a horizons. As for the MES, core drilling was carried out in three wells (№ 7, 8 and 3 V. Urtabulak). The total penetration with coring was 23.8 linear meters. At the same time, 17.3 running meters of core were taken, which is 51.2% of the penetration or 17% of the exposed total capacity.

Lithological-petrographic and reservoir characteristics of productive horizons. The section of the productive strata is represented by Upper Jurassic deposits. According to production geophysical data, two productive horizons, XV and XVa, are distinguished in the sediment section. It should be noted that the data of laboratory studies characterize the non-reservoir rock, since the core was taken mainly from the dense part of the section. As a result of microscopic studies, various varieties of rocks were identified, information about the percentage ratios of the fractional composition of rocks, the limits of changes in their reservoir properties and the development of secondary processes. Above the XV horizon, a small amount of core was taken from the member of the lower anhydrite and the black shale horizon (BS). In well No. 8, from a member of lower anhydrites, a core was raised, represented by anhydrite and carbonate-anhydrite rocks of gray, light gray, spotty, uneven-grained, massive, dense, strong, fractured.

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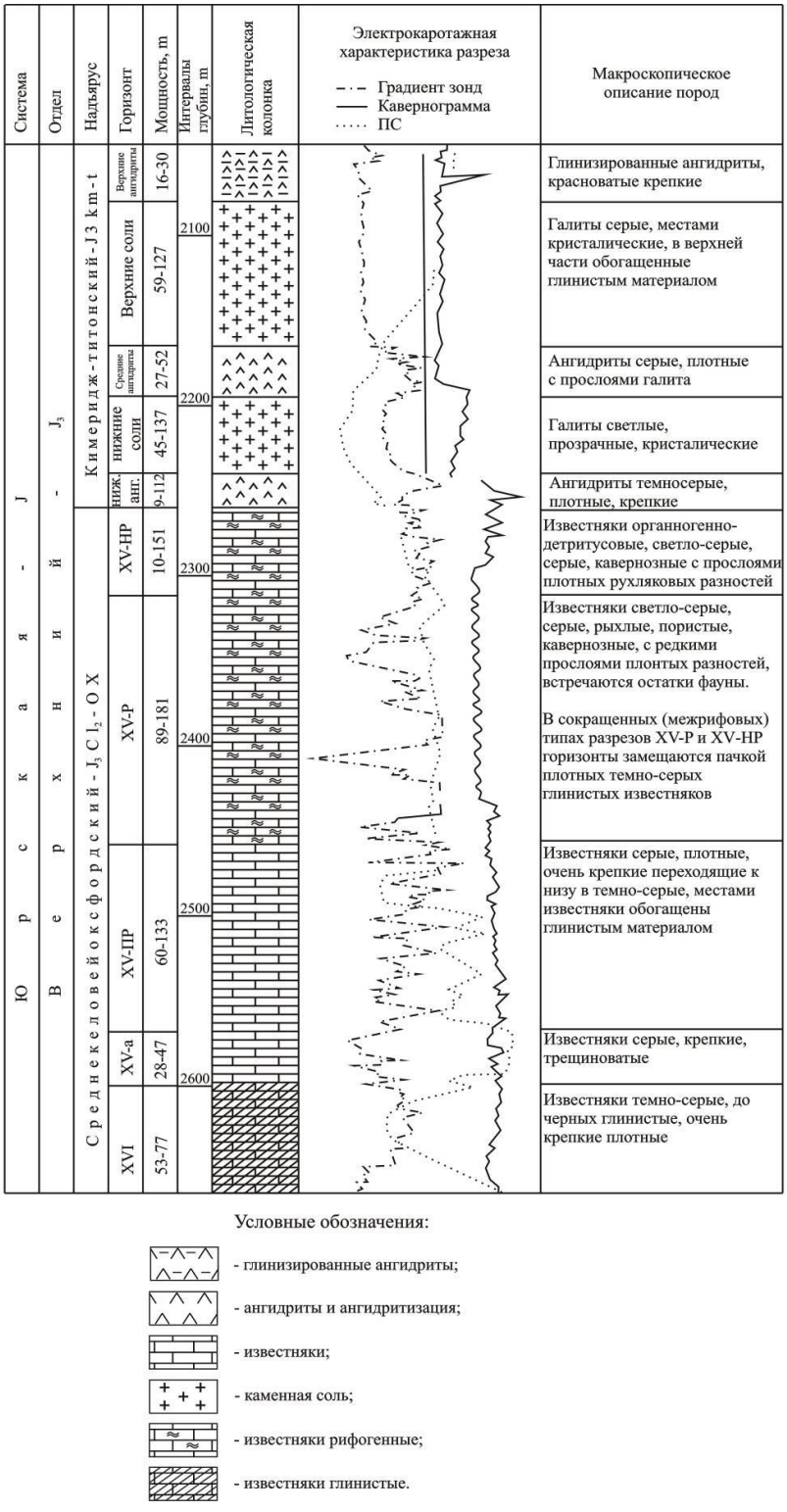

Figure 1 - Geological and geophysical section of the South Kemachi field

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In an insignificant amount, in the form of thin lens-like interlayers, there are micro-grained and micro-clot-algal limestones, unevenly recrystallized, intensely anhydrite, dense, strong, fractured. The pores and cracks in them are completely healed by secondary calcite and anhydrite.

For a quantitative interpretation of well logging data, it is necessary to obtain petrophysical dependencies for a given rock section, in particular, the relationship between the porosity parameter (P) and the open porosity coefficient (K_p), the dependence of open porosity on permeability, the saturation parameter (Q) on the residual water saturation coefficient (K_{ov}).

For example, the oil saturation factor is determined by petrophysical relationships $P_п = f(K_п); P_н = f(K_{ов});\ K_г = 1 - K_{ов}$ .For the area under consideration, the above dependencies are plotted for the rocks of the productive strata of the section.

In addition, for the rocks of the productive strata of the considered field, the dependences of the saturation parameter on the residual water saturation and the residual water saturation on the permeability were determined.

In connection with the determination of the porosity coefficient mainly for non-reservoir rocks, it is not possible to plot the dependence of open porosity on permeability in order to determine the boundary values of carbonate deposits of productive horizons.

For the purposeful study of the pre-Jurassic rock complex, only three wells were drilled within the BKHNGO: Barsa 1p, Yuzhny Kulbeshkak 1p, Beshtepe 1p. Information on pre-Jurassic sections in other wells drilled to study the Mesozoic-Cenozoic sedimentary cover was obtained along the way and was also analyzed as it became available. In total, 146 objects were tested in the pre-Jurassic complex of rocks, of which industrial, non-industrial hydrocarbon inflows were obtained in 37 objects and oil and gas shows were noted. In 11 out of 44 sites, positive results were obtained in sections at the Chardzhou step, and in 27 sites out of 103, positive results were obtained at the Bukhara step.

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