The American Journal of Engineering and Technology
(ISSN – 2689-0984)
VOLUME 04 ISSUE 02 Pages: 23-36
SJIF IMPACT FACTOR (2020: 5. 32) (2021: 5. 705)
OCLC – 1121105677 METADATA IF – 7.856
Publisher: The USA Journals

Journal Website: https://theamericanjournals.com/index.php/tajet

Research Article

ON THE OIL AND GAS BEARING CAPACITY OF THE SOUTHEASTERN PART OF THE BUKHARA-KHIVA REGION

Submission Date: February 11, 2022, **Accepted Date:** February 18, 2022,
Published Date: February 28, 2022 |
Crossref doi: https://doi.org/10.37547/tajet/Volume04Issue02-06

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ABSTRACT

In this article, it considered on the oil and gas potentiality of the southeast part of the Bukhara-Khiva region. Also analyzed the issue of the prospects for the oil and gas potential of the Lower-Middle Jurassic deposits within the Beshkent trough and have not yet been finally clarified. In the Shakarbulak area, only the uppermost part of terrigenous deposits, represented by impermeable rocks, was exposed.

KEYWORDS

Reservoir, reservoir, formation, horizon, rocks, zone, well, opening, section, inflow, flow rate, porosity, fracturing, hydrocarbon, gas saturation, oil saturation, reef, limestone.

INTRODUCTION

The Shakarbulak field is located in the Beshkent oil and gas bearing area, within which Aknazar, Kapali, Novy Alan, Girsan, Kirkuloch, North Nishan, Kamashi, Beshkent, Zafar, Shurtan, North Shurtan, Buzakhur North Guzar, Garmiston and Kumchuk fields have so far been identified.

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Of these, the last six fields, as well as the eastern section of Shakarbulak field are located within the Upper Jurassic barrier-reef system and in the associated zone of spreading of zarif facies (facies of closed shelf). All other deposits are located in the zone of distribution of depression faces (XV-DERF) and underlying facies of the open shelf (XV-PR, XV-horizons). The western section of the Shakarbulak field confined to the same zone.

Of the listed fields, only one is purely oil Garmiston), three (North Shurtan, Kumchuk, Shakarbulak) are gas-condensate oil fields; all others are gas-condensate, including the largest in the republic Shurtan field.

The question about the prospects of oil and gas bearing capacity of Lower-Middle Jurassic deposits within the Beshkent trough been definitively clarified yet. In the Shakarbulak area, only the uppermost part of terrigenous sediments, represented by impermeable rocks, has been uncovered.

Cretaceous deposits within the Beshkent trough are unpromising.

Industrial oil and gas content of the western part of the Shakarbulak area established by sampling in the production casing of well one of horizons: XV-PR and XV-DERF. From all six intervals, tested in this well, rather significant flows of liquid hydrocarbons with flow rates from 10.6 to 96.4 t/sec and gas with flow rates up to 600 thousand m3/sec received, that was unexpected for the section penetrated by the well, as there are almost no collectors with corresponding permeability and porosity in it.

According to GIS data, pore-type reservoirs in the section of Well 1 are predominantly distributed in the XV-a horizon and occur in the form of layers and bundles from 0.6 to 4.4 m thick among compacted limestones. Their total thickness is 12.4 m with a total thickness of 37 m, and porosity - 8-9.5%, except for two interlayers and the roof part of the horizon, the porosity of which clearly exceeds the conditionality boundary of reservoirs, set at 8%. Obtaining of 45.5 m3 per day from the first interval (3785-3772), where only one bed of 3 m is distinguished and porosity of 8.5 %, with a daily flow rate on 4-mm pipe. Indicates fracturing, as according to petrophysical dependence, represented reservoir capacity with 8.5 % porosity is only 1 mlD, whereas its calculated value according to different modes of testing is 36 mlD. The second interval of perforation (3769-3746 m) is the rest of the XV-a horizon, and this produced oil with 68.9 m3 of gas [1-12].

XV-PR horizon in the section of well №1 is represented mainly by clay limestone. Among which according to logging data are thin (0.6-1.2 m) interlayers of porous reservoirs with porosity from 6 to 10%, with total thickness of 12.2 m at total thickness of 58 m, and only 6.4 m from them are oil-conditional (with porosity of 8% and more). Most of the latter are concentrated in a narrow (14-meter) interval, not covered by the theme. In the lower interval of perforation (3739-3727), which gave oil, there is one 0.8 m thick interval with porosity of 8.5% and two with porosity below conditionality (6.5-7%), with a daily oil flow rate of 60.2 m^3 per 5 mm unit.

The upper perforation interval, which gave gas flow rate up to 488 thousand m^3/s and hydrocarbons (oil with condensate) up to 15 m^3/day is represented only by dense clayey limestones with porosity 1% according to rock samples taken from the roof part of the XV-PR horizon and the underlying part of the upper lying horizon (XV-DERF).

The latter is represented by dense clayey-carbonate bituminous rocks stratified by relatively clean limestones with porosity up to 5% and permeability of less than 0.01 mld in the matrix, up to 4 mld in fractures (according to core laboratory tests). Only in the roof part of the horizon, directly under the lower anhydrites of the Cimmeridge-Titon, according to GIS data, there is a porous reservoir layer of 0.8 m thickness and porosity of 10%, which is traced everywhere within the western part of the assessed area, as well as in the neighboring Zafar and Mangit areas. It is covered by sampling of the last perforation interval (3680-3670 m), which yielded gas flow rate of 89 thousand m^3/s and liquid hydrocarbons flow rate of 25.9 m^3/s at 6-mm.

Thus, at the western (no-reef) section of Shakarbulak area by sampling of well №1, commercial oil and gas content of the entire upper half (112m) of carbonate strata, starting from the top of the XVI horizon (the latter was not covered by sampling) was established. Exactly the same stratigraphic range of gas content established earlier at the adjacent Zafar gas-condensate field.

The results of well №1 test unambiguously indicate wide development of fracturing in the section of the carbonate formation penetrated by it. However, the performed complex of GIS and data of core analysis, selected in limited volume, do not allow distinguish in the section of productive formation the distribution and parameters of rock fracturing [13-19].

Well № 3, drilled in the vaulted part of the dome, concealed a generally similar section, but differing from the section of well №1 in the absence of pore-type reservoirs with porosity of 8% or more in the XV-PR horizon, as well as a slightly lower distribution of such reservoirs in the XV-a horizon. At the same time, all horizons of the carbonate formation were penetrated at higher levels than in well №1, which gave commercial flows of oil and gas from all perforated intervals without exception, with good quality of production string fastening (according to acoustic cement meter data). However, commercial gas inflow with condensate obtained only from the roof horizon XV-DERF, represented by pore-type reservoir with porosity of 9.5 % and thickness of 1.2 m. Of the six sampled intervals in sediments XV-PR, XV- a and XVI horizons, only two (one in each of the first two horizons) received weak water inflows with minor oil and gas occurrences in the upper interval of perforations XV-PR horizon. From the other intervals, (one in the XV-PR and XV-a horizon, two in the XVI horizon) inflows not obtained. At the same time, according to GIS materials, pores identified in the XV-a horizon and covered by sampling characterized as productive.

The section cut by well № 6 Zafar almost completely repeats the section of well №3, while all tested intervals (one each in XV-DERF and XV-a and 3 in XV-PR horizon) yielded no flows, including the top layer of XV-DERF horizon with porosity of 8%.

At first glance, it seems that the reason for the negative results of sampling wells 3-Shakarbulak and 6-Zafar is the absence or weak development of fracturing in the sections penetrated by them. However, analysis of geological and technical conditions of wells drilling allows us to put forward a different version. First, let us consider the data on well №1, which gave commercial flows from all tested intervals and regardless of its presence in the intervals of perforated reservoirs with high porosity: the upper part of carbonate formation, including XV-DERF and

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XV-PR horizons, passed in the solution density of 1.2 g/cm^3. From the depth of 3747 m the sinking was carried out on a light mud with density of 1.07 g/cm^3, because at this depth (top of XV-a horizon) the absorption of mud began. Thus, XV-a and XVI horizons were opened almost at equilibrium with formation pressure, and the upper part - with repression 47 kg/cm. In the same mode (with repression of 7-13 kg) the completely productive formation (XV-DERF, XV-PR, XV-a horizons) was penetrated by well №.1 - Zafar, which was the discoverer of Zafar gas-condensate field (1). Obviously, at such mode of productive stratum penetration the safety of fracture channels from clay mud penetration and subsequent plugging by solid components of flushing fluid ensured. All other wells drilled with weighted solutions, in which the fractures could be sealed with clay particles. Obtaining flows of formation fluids from such objects in the process of subsequent testing depends on block permeability of reservoir, depth of filtrate penetration of flushing fluid and residual oil and gas saturation in the zone of penetration. At the same time, these data do not prove the presence of fracturing (only open fracturing meant) in the sections of both wells.

Given the ambiguity of the solution of the issues considered by the above data, it is necessary to consider other aspects with the actual materials on Mangit area. Within which the wells opened sections of carbonate strata, similar to the sections of wells № three and six (Zafar). However, at much higher elevations in the absence of structural separation, which could provide isolation from the oil deposit of the western part of Shakarbulak area.

As a result of interval sampling of XV-a, XV-PR and XV-DERF horizons in wells №№ 2,3 and 4 from all intervals of perforation (except for one in well № 2) there were received inflows of formation water with weak oil manifestations, or weak oil inflows (their two top intervals of well № 4). In three cases, (two in well №4 and one in well №3), there was an overflow of 8 to 18 m/day, while in the remaining cases weak inflows were obtained.

The above data indicate that the results of sampling the wells of the Mangit area FES of the section penetrated by them, despite the use of dense solutions (1.44-1.48 g/cm^3). when drilling them, which is explained by abnormally high reservoir pressure established in this area, at which the calculated values of repression on formation were lower than in wells № 3 and 6 (Zafar).

Water saturation of reservoirs uncovered in the Mangit area at higher elevations than in the western part of the Shakarbulak area clearly explained by hydrodynamic isolation of this area from the evaluated one, which characterized by the lowest hydraulic potential compared to the adjacent areas. The Zafar area in hydrodynamic respect occupies an intermediate position. The hydraulic separation of the latter from both the Mangit and the assessed area caused by a discontinuity limiting this area. The nature of the hydrodynamic separation between the Mangit and assessed areas seen to be different, since the presence of a high-amplitude discontinuity between them is unlikely.

The paleo-structural map of the roof of the XV-PR horizon shows that the Shakarbulak area before the structural reorganization of the latest stage of folding is a relatively large brachiiform fold with an amplitude of 150 m. Recent data on the Ichki, North Umid, and

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Marjon fields (2) indicate the presence of epigenetically sealed oil deposits in layered sections of the Upper Jurassic carbonate sequence of the Chardzhou tectonic stage, the contours of which controlled by the paleostructural plan, namely the trailing paleoisogypsum. Their sealing in the VPC zone ensures the preservation of such deposits after structural reorganization by epigenetic and mineral formation. By analogy with the above deposits one may assume the formation of multilayer oil deposits in deposits of the productive strata (XV-DERF, XV-PR, XV-a) of the evaluated area, with the formation of sealing zones near the closing isohypses. With the only difference, that higher tectonic activity of the latest stage in this area and intensive fracturing associated with it could lead to their piriform formation into a single massive type, which we observe now.

At the same time, the fractured rocks as well as the block permeability of pore-type reservoirs were preserved here due to the preserving role of hydrocarbons whereas in the outline zone (the paleo-contour is meant). The formation of secondary materials could lead to complete healing of fractures and conductive pore channels, at least, to a sharp deterioration of the permeability of the entire section of carbonate hummocks.

From the position of the stated mechanism of formation of an impermeable zone separating the evaluated area from Mangitskaya area, the absence of flows from all tested intervals in well №6 - Zafar, which is not located in this very zone, becomes explainable. Negative results of sampling XV-PR and XV-a horizons in well №3 can be explained by their penetration at high underbalanced formations (71-79 kg/cm^3).

The non-triviality of the question about the phase state of hydrocarbons in the deposit is visible at least by the fact that in the documentation of the results of sampling of well №1 in all cases the received flows characterized as "oil with gas" or "gas with oil".

Meanwhile, the uppermost sampling interval 3680-3670 m (XV-DERF), judging by the value of the gas factor, exceeding 4 thousand m^3/t, is a gas condensate object, and the liquid production of the well, apparently, contained an admixture of darker than condensate oil.

Values of the gas factor for the lower three test objects (XV-a and the lower part of the XV-PR horizon) at small junctions are 426-521 m^3/t, which is an order of magnitude lower than in the upper horizon and indicates the oil saturation of the tested intervals.

Contradictory data obtained from intervals 3697-3690 and 3696-3686 m, which practically represent the same test object. However, they differ sharply in the nature of the obtained production: the lower interval gave gas with a flow rate of 300 to 600 thousand m^3 /s, with a small content of liquid hydrocarbons, and the upper - production with an inverse ratio of liquid and gaseous hydrocarbons. Formation oil samples in well №1 not taken due to watering of production.

Well №3, when testing the upper part of the XV-DERF horizon, gave a gas-condensate inflow, similar in the ratio of liquid and gas HC to the test data of the uppermost interval of well №1. The gas-condensate surveys performed at this site confirmed this. Wells have not penetrated VNK in the considered section of the evaluated area. It is impossible to determine the position of the gas-condensate complex based on the data of well №1, because of the great remoteness of

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the perforation intervals, which gave gas and oil; it is not traceable by the materials of GIS (geographic information system).

In connection with the above, we used piezogram of the Upper Jurassic productive reservoir to determine VNK and HNK. High accuracy of reservoir pressure registration, performed by Caster manometers, allowed us to obtain reliable information on pressure changes throughout the height of productive reservoir. Measurements filled in nine intervals of well №.1 and one interval of well №. 3 were perfectly laid on two straight lines, intersecting in a point with a mark of minus 3271 m, corresponding to a mark of GOC.

Elements I and II characterize, respectively, the gas-condensate and oil parts of the reservoir. Their different angles of inclination to the axis of absolute marks "reflect the density of reservoir fluids, numerically equal to the tangents of these angles and equal to 0.532 g/cm^3 in the gas-condensate part of the reservoir and 0.708 g/cm^3 in the oil-saturated interval. The high density of gas in formation conditions, more than two times higher than the calculated value determined by the composition of reservoir gas and equal to 0.25 g/cm^3, is noteworthy. Such a discrepancy explained by the presence of residual mobile oil in the pore space of the gas-condensate part of the reservoir. To confirm this, it is necessary to select and examine the sealed core. Failure to account for residual oil can lead to a significant overestimation of gas reserves (4).

Lack of data on reservoir pressure of the water-saturated part of the reservoir in the western part of the evaluated area does not allow to build a corresponding peplum and by it to determine KOC for this area. Nevertheless, attraction of data on the eastern part of the field allowed completing the piezogram of the reservoir for the whole area, including the water-saturated part. At the same time, the information about formation pressures in this area supplemented with data about the positions of VNK and GNK, established on the materials of GIS, respectively, at levels minus 3388 and 3327 m. As can be seen from the presented piezogram, the piezogram II, characterizing the oil-saturated part of the reservoir of the western part of the area, is common for both areas. It follows that the oil-saturated parts of the western (reefless) and eastern (reef) areas are communicated with each other and have a single VOC at minus 3388 m, while their gas-condensate parts are separated and have different VOC marks, which fully agrees with the refined geological model of the field.

To build an epiure of the gas-condensate part of the eastern reservoir, there are not enough pressure measurements at different elevations of the latter: as of the date of reserve calculation, there is only one pressure measurement made near well №.4, the value of which\ underestimated by 1.3 kg. In this regard, the epiure III of formation pressures of the gas-saturated part of the reservoir of the eastern section in view of the calculated density of gas in formation conditions, determined by the composition of formation gas of the eastern dome and equal to 0.25 g/cm$^{3.}$

Thus, the piezogram of the productive reservoir made it possible to solve and justify a number of important geological tasks:

- determine the GOC of the western section; confirm the VOC of the eastern section;
- justify the commonality of VOC for the entire area;
- justify the hydrodynamic connection between the western and eastern sections of the field;
- determine the density in formation conditions and phase state of hydrocarbons;
- justify the formation pressure in your part of the eastern dome.

As noted above, it is impossible to identify fracture-type reservoirs in the productive formation section and

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estimate their parameters according to the available data. In this regard, only fracture-pore type reservoirs with a standard porosity of 8% for oil and 6% for gas are included in the calculation of reserves.

XV-a horizon is the main (within the western part of the estimated field) by the volume of conditioned reservoirs, and all of them are oil-saturated. Since they are located significantly below the GOC and above VNK, taken respectively at minus 3271 m and 3388 m. the total effective oil-saturated thickness in the section of well 1 is equal to 12.4 m.

In the section of well №3, according to logging data, only three conditioned interlayers with a thickness of 3.2 m in total, accepted based on logging data as oil-saturated, despite the results of their testing by two intervals of perforation, which gave weak water inflows. The absence of chemical analyses of the water samples, proving that they belong to the formation water, allows us to assume that during the sampling process there were inflows of filtrate flushing fluid.

In the sections of the nearest wells (№№ 6-Zafar, 4-Shakarbulak), which concealed XV-a horizon, one 0,8 m thick interlay in well 4 and two interlayers of the total thickness of 2 m in well 6-Zafar were singled out. Taking this into account, as well as the results of sampling, oil-bearing capacity contour of the object under evaluation divided into two fields - eastern and western - with different category (C1 and C2) and different values of effective oil-saturated thickness, which are 12 m and 3 m, respectively.

The oil-bearing contours (external and internal) for the XV-a horizon are plotted on the structural map of the horizon roof in accordance with the adopted GOC and VOC marks up to the intersection with the eastern boundary of impermeable epigenetic nature, which limits the western part of the oil deposit.

In terms of typing, the oil deposit of the XV-a horizon, which is part of a larger massive deposit, should be qualified as a reservoir of the reservoir-well type, bounded by a zone of epigenetic mineral formation (impermeable zone of epigenetic nature), Dimensions of the deposit: length - 4 km; width - 3.5; height - 94 m.

The next (intermediate in the section) counting object is XV-PR horizon, in which reservoirs fracture-pore type are distinguished only in the sections of wells 1 and 6-Shakarbulak in the sections of the nearest wells (3-Zafar, 4-Shakarbulak) located beyond the contour of oil bearing on this object, they are absent. According to available data, it is impossible to establish the nature of their distribution over the area, especially within the contour of oil-bearing capacity. In this connection a small counting field around the well No.1, conditionally limited by a semicircle of radius 0.9 km, equal to half of the distance between the wells 1 and 3, and the line of the inner oil-bearing area contour of the given object was singled out.

Within the counting field, the productive part of the XV-PR horizon divided into two strata separated by a 12-meter interval of dense limestones. According to the adopted GOC at the level of minus 3271 m in the western part of the counting field the reservoirs of the upper member are gas-saturated. At the same time, the effective gas-saturated thickness is m within the inner gas-bearing contour of the upper member.

In the eastern part of the selected counting field, limited by the outer contour of gas content of the

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upper pack, both packs are oil-saturated. The area bounded by the outer and inner gas-bearing contours is a zone of two-phase saturation (gas and oil) in the upper member.

Considering this, the calculated field divided into two parts at the isotypes of minus 3260 m, corresponding to the middle line between the outer and inner contours of gas content, which allows calculating reserves according to a simplified scheme - without drawing maps of the effective thicknesses, with the allocation of three parts:

1) Gas-bearing, for which the total effective thickness of the upper stratum equal to 7.6 m is assumed, taking into account the lower porosity limit of 6% for gas-bearing reservoirs;
2) Under gas oil-saturated, for which the effective oil-saturated thickness of the lower pack of XV-PR horizon assumed 2.2
3) Eastern oil-saturated - with a total effective oil-saturated thickness equal to 7.8 m, taking into account conditioned reservoirs throughout the section of XV-PR horizon.

In the XV-DERF horizon, only 1 pore-type reservoir, 0.8-1.2 m thick and 0.1 open porosity coefficient, lies directly under the lower anhydrites of the Kimmeridge titon and distributed throughout the western part of the evaluated field, as well as in the adjacent areas.

The contours of gas and oil-bearing area drawn, respectively, at isohypses minus 3271 and 3388 m (according to the adopted levels of GOC and VNK) to their intersection with the boundary of the impermeable zone, which is limited to the deposit from the sides.

Dimensions in the accepted boundaries:

- Of the deposit as a whole: length - 5.5 km; maximum width - 4.5 km; height - 153 m.
- Oil-saturated part: length - 6 km along the isohypse minus 3320 m; width - 0.8 to 2.3 km; height - 117 m.
- The gas cap characterized by a dome-shaped contour measuring 3.2 x 3 km and with a height of 36.
- The deposit of this counting object by type is stratum-volumetric, limited by impermeable zone.

Considering the degree of exploration, calculated reserves distributed as follows:

- C1 category includes:
- Oil reserves XV-a horizon of the eastern part of the deposit and XV-PR horizon;
- Reserves of gas and associated components of the XV-DERF horizon.

Category C_2 includes:

- Oil reserves of XV-a horizon of the western part of the deposit and XV-DERF;
- Reserves of gas and associated components of the XV-PR horizon.

Exploration well №4, drilled in 1989, was the pioneer of the eastern, reef section of the estimated field. Moreover, tested in the production string in 1990. This is the first well in the area that opened the reef type of section. According to the refined geological model, the well opened the outer slope of the reef structure, characterized by a reduced thickness of the XV-P horizon, represented by reservoirs with high reservoir properties. With a porosity of up to 20% and a permeability of up to 536 mln (according to laboratory studies of a core taken from this interval with 100% - takeaway). At the same time, rather modest inflows obtained in all test modes, which clearly do not correspond to the FES of the enclosing collectors. The calculated value of permeability, determined from the test data of the interval 3765-3760 m and equal to 39 mln, turned out to be half an order of magnitude less than according to the study of the core taken from this interval with 100% recovery. Which is direct evidence of the natural permeability of reservoirs by penetration

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into drilling into the pore space of clay particles and fluid filtrate.

The negative impact of the penetration of the filtrate and solid components of the flushing fluid maximally manifested in reservoirs with deterioration in the reservoir properties and with a predominantly fractured permeability. This is what makes it possible to obtain non-industrial inflows from the top part of the XV-P and the bottom part of the XV-DERF, opened by well №4 above the WOC mark and represented, apparently, by fractured reservoirs, and the overflows from highly porous gas-saturated reservoirs when testing the lower, oil-saturated part of the XV- P horizon.

Taking into account the drilling conditions, one should also consider the results of testing well № 5, which revealed a thin-layered section of the XV-HP horizon with a low reservoir quality of pore-type reservoirs and massive high-capacity reservoirs of the XV-P horizon in a solution with a density of 1.34 g/cm³; with pressure on the layers of 106-115 kg/cm². At the same time, because of testing the XV-P horizon, formation water inflows with a flow rate of m³/day were obtained and from the intervals of the XV-HP horizon located above the mark, weak, non-commercial inflows of oil and water were obtained.

Well №7 opened a similar section (XV-HP, XV-P horizons), but only higher in elevation. GOC in this well opened in the uppermost XV-HP, and OWC 12 m below the roof of the XV-P horizon. The productive part of the section was not covered by testing, due to the collapse of the production string after testing a number of objects in the water-saturated part of the XV-P horizon, which gave formation water inflows with a flow rate of up to 108 m³/day. Field studies of OIPK, carried out in the process of drilling a well, obtained direct confirmation of the oil saturation of the upper part of the XV-P horizon - from a depth of 2832 m, which is 9 m higher than the accepted WOC, oil was obtained in the amount of 12 liters.

Well № 9 was drilled in the oil saturation zone of the XV-HP horizon, on a light mud with a density of 0.9 g/cm³, with a flow rate of 194 m/day through a 114 mm drilling tool. Based on GIS data, the WOC was determined at the level of minus 3388 m (depth 3834 m), in the lower part of the XV-HP horizon. However, in the process of testing two oil-saturated intervals in the middle and upper parts of the XV-HP horizon of which the first (3817-3810 m) is characterized by high reservoir properties (porosity - 12-19%. Permeability - 27-688 mln, according to laboratory studies of the presented of the core material taken from the perforation interval), weak oil inflows obtained which clearly contradicts the data of the study of a large number of core samples, IPG and well logging. In this case, the negative influence of drilling in technology and, possibly, well casing is so obvious that there is no need to bring in any additional reasons to explain the results of testing. In addition, this despite the fact that the well was drilled with relatively small repressions.

Well №12 drilled on the northern, high-elevation tectonic block, outside the estimated area according to the updated geological model. The well opened a full section of the XV-HP, XV-P horizons and, partially, the XV-PR horizon.

When testing the lower half of the XV-HP horizon, improved in terms of reservoir properties, as well as the upper part of the XV-P horizon, weak water inflows with minor oil shows (in the form of films) obtained in the intervals of the XV-HP horizon.

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The upper part of the XV-HP horizon, in which reservoir interlayers with degraded properties are widespread, not sampled as of the date of reserves estimation. Nevertheless, the oil and gas potential of the dome, in the arch of the second well drilled, is estimated by us as low, given its small size and small amplitude, as well as the low FES of reservoirs that may turn out to be oil or gas saturated.

Well №13 laid on the recommendation of the Uzbekgeofizika association, according to the updated map (S.N. Zuev and S.I. Kalugin) in optimal structural conditions and within the predicted position of the reef crest. At the bottom of 3651 m, it liquidated for technical reasons. Judging by the limited logging data, the borehole penetrated the top of the lower Kimmeridgian-Titonian anhydrites at a depth of 3622 taking into account the estimated thickness of the last 26 m (from the beginning of the record, see BK). The top of the XV-horizon was exposed at a depth of 3648 m (-3219 m), which turned out to be significantly higher than on the above map.

Well №14 laid according to the definition of the "Uzbekgeofizika association as a backup well. №13 in order to clarify the geological structure of the field, the phase state of HC, OWC and GOC, the selection and subsequent study of the presented deep oil samples to determine the volumetric coefficient for calculating the reserves of the field.

From the above data, it seen that the geological effectiveness of exploration drilling in the eastern section of the estimated area is very Low. Of the 6 wells drilled here, commercial inflows were obtained from only two intervals of the XV-P horizon in well № 4 and one interval of the XV-HP horizon in well № 9 (in an open hole during PDT). All this makes a negative impression regarding the industrial value of the deposit and causes distrust among many specialists, including foreign experts, in the reserves of recoverable for 5 million tons. For the eastern section, accepted on the state balance sheet based on the materials of the operational calculation of reserves, performed by the association "Uzbekneftegazgeologia". This attitude towards the estimated field caused by the traditional approach to the geometrization of reef reservoirs, in which significant errors made in the estimates of oil and gas reserves confined to them. In this regard, below is a brief description of the method used (3).

Characterization of the methodology used and the results of the geometrization of the reef reservoir in the eastern section of the field.

The technique of geometrization of reef traps in Western Uzbekistan developed in 1982 and since then it has been used and presented in reports on the calculation. Moreover, recalculation of oil and gas reserves in many fields (Southern Kemachi, Umid, Jarchi, Zevardy, Alan, Dengizkul, Shurtan, Kokdumalak, South Tandyrcha, Dzharkuduk, etc.), so there is no need to lay it out in detail.

The essence of the methodology is to use a fundamental sedimentation model common to all reef structures in the region, according to which they characterized by:
Flat-topped structure;
Steep outer slopes;

The presence of a narrow ridge in the massive part of the edifice (XV-P horizon) associated with the outer slope of the edifice (in single edifices located in the depression zone, they close and form an annular ridge,

The American Journal of Engineering and Technology
(ISSN – 2689-0984)
VOLUME 04 ISSUE 02 Pages: 23-36
SJIF IMPACT FACTOR (2020: 5. 32) (2021: 5. 705)
OCLC – 1121105677 METADATA IF – 7.856
Publisher: The USA Journals

and within the barrier reef it can be traced in the form of a narrow strip along the outer slope);

Compensation of the inner slope of the XV-P horizon with sedimentary-layered deposits of the XV-HP horizon, which are deposits of the back-reef lagoon of the barrier reef and internal lagoons of single structures;

Thinning of the XV-HP horizon from the rear zone of the reef towards the outer boundary until it is completely wedged out on the crest;

Reduced (10-30 m) in the top zone of the reef mass and sharply increasing on the outer slope to a maximum value in the conjugated part of the depression zone with a thickness of overlying important Kimmeridgian-Titonian anhydrites;

Maximum under the crest and outer slope of the reef, reduced in the depression zone to 5-10 m and in the inner zone of the reef until the thickness of the enclosing sediments of the XV-DERF horizon is completely wedged out.

Taking into account the above features, a sedimentation model of the Shakarbulak barrier reef fragment built in the form of a section, as well as a map of the total thicknesses of the XV-HP horizon. Which subsequently used when delivering a structural map of the limestone roof a hypsometric map of the surface of the XV-P horizon and a profile section of the productive strata. The hypsometric map of the surface of the XV-P horizon compiled by the method of convergence – by summing up the structural map of the top of the limestones of the thickness map of the XV-HP horizon. The use of the sedimentation model of the reef mass made it possible for the first time to perform a separated geometrization for the estimated field and, on this basis. Calculate oil and gas reserves differentially for the XV-P and XV-HP horizons, despite the absence of wells that opened the reef crest zone, which led to a radical reassessment of the potential oil and gas potential of the eastern section of the field due to the XV-P horizon. Which almost completely represented by cavernous-porous rocks with high reservoir properties.

Taking into account the established levels of water-oil contact (-3388 m) and GOC (-3327 m), the contours of oil and gas potential were determined, which were drawn along the corresponding isohypses on maps of the limestone roof and the surface of the XV-P horizon.

The oil and gas condensate deposit of the eastern section, confined to the reef complex (XV-P+XV-HP horizons), belongs to the massive type. The size of the oil part of the deposit - in general for the eastern section: by - 8.2 km; width - 3.0 km; height -61m;
Along the XV-P horizon:
Length - 8.2 km; width - 1.52 km; height - 61 m.
XV-HP horizon:
Length - 7.8 km; width - 2.2 km; height - 61 m.
Gas cap dimensions:
In general for the eastern section: length - 5.8 km; width - up to 2 km; height 08 m.
Along the XV-P horizon:
Length - 5.8 km; width - up to 1.2 km; height - 107 m;
XV-HP horizon:
Length - 5.7 km; width - up to 1.7 km; height.

The need to separate the XV-P and XV-HP horizons into independent countable objects is due to the completely different character of the structure and distribution over the area of both total and effective thicknesses.

The effective oil-saturated thickness of the XV-P

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Publisher: The USA Journals

horizon is practically the total thickness of the oil-saturated interval and is 60 m in the case of the gas-bearing contour for this horizon, which is also the internal oil-bearing contour. Outside this contour, the average oil-saturated thickness is 30 m.

The maximum effective gas-saturated thickness of the XV-P horizon in the apical part of the gas cap is 100 m the weighted average thickness within the gas-bearing contour is 43 m.

Along the XV-HP horizon, a zone of increased oil-saturated thicknesses with a maximum value of up to 13.6 m form a narrow strip, the axial line of which almost coincides with the line of the outer contour of the gas content, and in some places the line of the inner contour of the oil content. Within this strip, the effective oil-saturated thickness ranges from 4 to 13.6 m, and the weighted average value is 8.5 m.

More than half of the entire oil-bearing area of the XV-HP horizon occupied by an annular zone bounded by 4-meter and zero isopachs. Taking into account the difficulties of extracting oil reserves of this zone, confined to low-permeable reservoirs, the contour for calculating oil reserves along the XV-HP horizon taken according to a 2-meter isopod of effective oil-saturated thicknesses.

The nature of the distribution of the effective thicknesses of the XV-HP horizon controlled by the line of the internal gas-bearing contour of the given horizon (it is also the gas-bearing contour of the XV-P horizon). In addition, is in good agreement with the geological model – on both sides of this line, the total thickness of the gas-saturated interval of the section XV-HP horizon is reduced to zero. The maximum effective gas-saturated thickness is determined somewhat to the south of well №7 and is 10 m by analogy with the sections of wells №.7 and 9 and taking into account the total thickness of the XV-HP horizon in this place. With a wound of 40 m according to the total effective gas-saturated thickness according to sections of these wells is 11 m, taking into account the boundary value of porosity for a gas-saturated reservoir of 6%.

Based on the research conducted, the following conclusions and recommendations drawn:

1. Drilling of priority project wells carried out in the XV-P area of the horizon. The proposed development zone of the XV-P horizon is located in the area limited by wells № 2,9,7,5,4. Wells № 14, 20 and drilling № 17 are located in this zone. The need for priority drilling of the zone of distribution of the XV-P horizon explained by the fact that more than 80% of recoverable oil and gas reserves are concentrated on this horizon.
2. The coefficients of productivity, hydraulic conductivity and permeability of the formations determined by the results of well research vary according to the results in a very wide range. This is because in exploratory wells, horizons XV-P, XVa, XV-PR and XV-DERF, which differ sharply in their filtration-capacitive properties, were tested.
3. Comparison of the porosity properties of the horizons determined by the methods of steady production and pressure recovery shows that in all the studied intervals, the reservoir properties of the remote part of the formation are higher than in the bottom whole zones. In this regard, when inducing inflow from the reservoir, it is necessary to carry out methods of intensifying oil production.
4. The results of calculations of lateral rock pressure show that the decrease in well productivity at large drawdowns does not occur due to the closure of fluid-conducting fractures. Most likely, with an

increase in drawdown, the oil-containing pores of the rocks do not completely feed the main filtration channels (fractures).

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