SOI: 1.1/TAS DOI: 10.15863/TAS
International Scientific Journal
Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2023 **Issue:** 09 **Volume:** 125

Published: 01.09.2023 **http://T-Science.org**

Issue Article

Annaguly Rejepovich Deryaev
Scientific Research Institute of Natural Gas of the State Concern „Turkmengas"
Doctor of Technical Sciences, Principal researcher,
Corresponding Member of International Academy of
Theoretical and Applied Sciences,
Ashgabat, Turkmenistan
annagulyderyayew@gmail.com

BASIC PRINCIPLES OF STUDYING WELL SECTIONS AND THE OCCURRENCE OF OIL, GAS AND WATER IN DEPOSITS

Abstract: *The article analyzes the compilation of a geological section and profile, as well as deposits for drilling directional wells for the Western part of the oil and gas fields of Turkmenistan in order to increase oil and gas production from productive layers of the horizons of the red-colored strata. To analyze the choice when drilling directional wells, materials of previously operated wells, geological and operational characteristics of deposits and analysis of comparative data of deposits from other countries, as well as the advantage of drilling horizontal wells in fractured deposits were used.*

The paper provides a detailed analysis of the study of the geological structure of various deposits, as well as recommendations for drilling directional wells in difficult mining and geological conditions. This work can be used and useful for the successful fulfillment of the tasks set in the development of fields with difficult mining and geological conditions and in order to increase the production of hydrocarbon resources from oil and gas wells.

Key words: *intensification, gas content, oil content, water content, metamorphic, formation, massive, lithological, tectonic, stratigraphic, deposit.*

Language: *English*

Citation: Deryaev, A. R. (2023). Basic principles of studying well sections and the occurrence of oil, gas and water in deposits. *ISJ Theoretical & Applied Science, 09 (125),* 153-160.

Soi: http://s-o-i.org/1.1/TAS-09-125-10 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2023.09.125.10

Scopus ASCC: *2209.*

Introduction

The development of the oil industry in the continuous improvement of drilling, technology and technology of oil production require deep technical knowledge from oil engineers, wide application of theoretical provisions in solving practical problems, obtaining constant information about the development of technology and technology in the oilfield business.

In our country, the commissioning of new oil fields is ensured, the widespread introduction of highly efficient methods of field development with the maintenance of reservoir pressures, as well as the use of highly efficient equipment for production, and the widespread introduction of various methods of processing bottom-hole zones of wells in order to intensify oil production.

Compiled on the basis of data obtained from complex observations, mainly the results of core studies, electrical and radioactive logging.

The well section is depicted graphically, using conventional signs to show the lithological composition of the drilled rocks. At the appropriate depths in the section, signs of the presence of oil, gas and water, possible collapses of the walls of the well, cessation of fluid circulation, etc. are indicated.

In addition, the technical data indicate the depth of the casing descent, their diameter, the height of the cement lifting, etc.

When drawing up a geological section, wells are divided into formations, horizons and formations in the following order:

The formations are distinguished by stratigraphic feature, using data from microfauna, macrofauna and complex observations.

Within the stratigraphic formation, bundles of rocks are distinguished by lithological characteristics: sandy, clayey, sandy-clayey, carbonate, etc.

Within the lithological bundles, horizons are distinguished: gas-bearing, oil-bearing and aquifers.

Within the horizons, layers are distinguished: gas-bearing, oil-bearing, water-bearing, marking, etc.

A normal (or typical) well section for a field is made after a general correlation of the well sections of a given field. The correlation consists in the identification of support layers (horizons) and determining the depths of their occurrence in order to establish the sequence of occurrence of rocks, to identify the layers of the same name to track changes in their thickness, lithological and facies compositions and various directions.

The geological profile (section) of the deposit is a section of the deposit with a vertical plane.

The following geological profiles are distinguished:

a) Transverse (profile by fall), carried out in the cross of the prostration of rocks;

b) Longitudinal (parallel to the strike), carried out along the strike of rocks;

c) Diagonal with respect to the strike and fall of rocks.

A normal (or typical) section should reflect the average section of the field, i.e. inherent in most wells of this field.

d) Geological characteristics of the deposit and justification of the data for the design.

e) Justification of the development system (drilling of the field).

g) Determination of technological indicators of the deposit according to the options under consideration.

h) Justification of drilling methods, opening of formations and foundations.

The geological study of the deposit begins with the drilling of the first wells in it. The general geological characteristics of the deposit are determined, its stratigraphy and tectonics are established, oil-bearing, gas-bearing and aquifers are identified, a connection is established between them, as well as between individual layers within the same stratigraphic horizon, operational facilities are identified. For each object, the characteristics of rocks (porosity, etc.), their oil - water content, the gas content in oil, the quality of oil and its properties and reservoir conditions (saturation pressure, total coefficient, viscosity, etc.) characteristics of reservoir waters are determined. During the trial operation of exploration wells, reservoir pressure and well productivity are determined, the energy characteristics of the formations and their modes are studied. According to the data obtained, geological reserves of oil and gas are calculated, and industrial recoverable reserves are determined. After the accumulation of geological and physical data at the fields and the determination of oil reserves, the procedure for the development of individual operational facilities is established, and the development of its individual horizons and deposits is started.

The rocks composing the earth's crust, depending on their origin, are divided into three groups: 1) igneous, 2) sedimentary, 3) metamorphic sedimentary rocks. Newly formed rocks are called metamorphic. The main ones are quartzites, schists, gneiss, marble, amphiboles, etc. Metamorphic rocks are devoid of fossils, their crystalline-granular structure is similar to that of igneous rocks, and the parallel-linear arrangement of mineral grains resembles sedimentary rocks. The main difference between metamorphic rocks is shale, i.e. the property of the rock to split into thin parallel layers.

Industrial oil and gas reserves are mainly contained in sedimentary rocks (sands, sandstones, limestones and conglomerates). In igneous and metamorphic rocks, oil is rare and, as a rule, has no industrial significance.

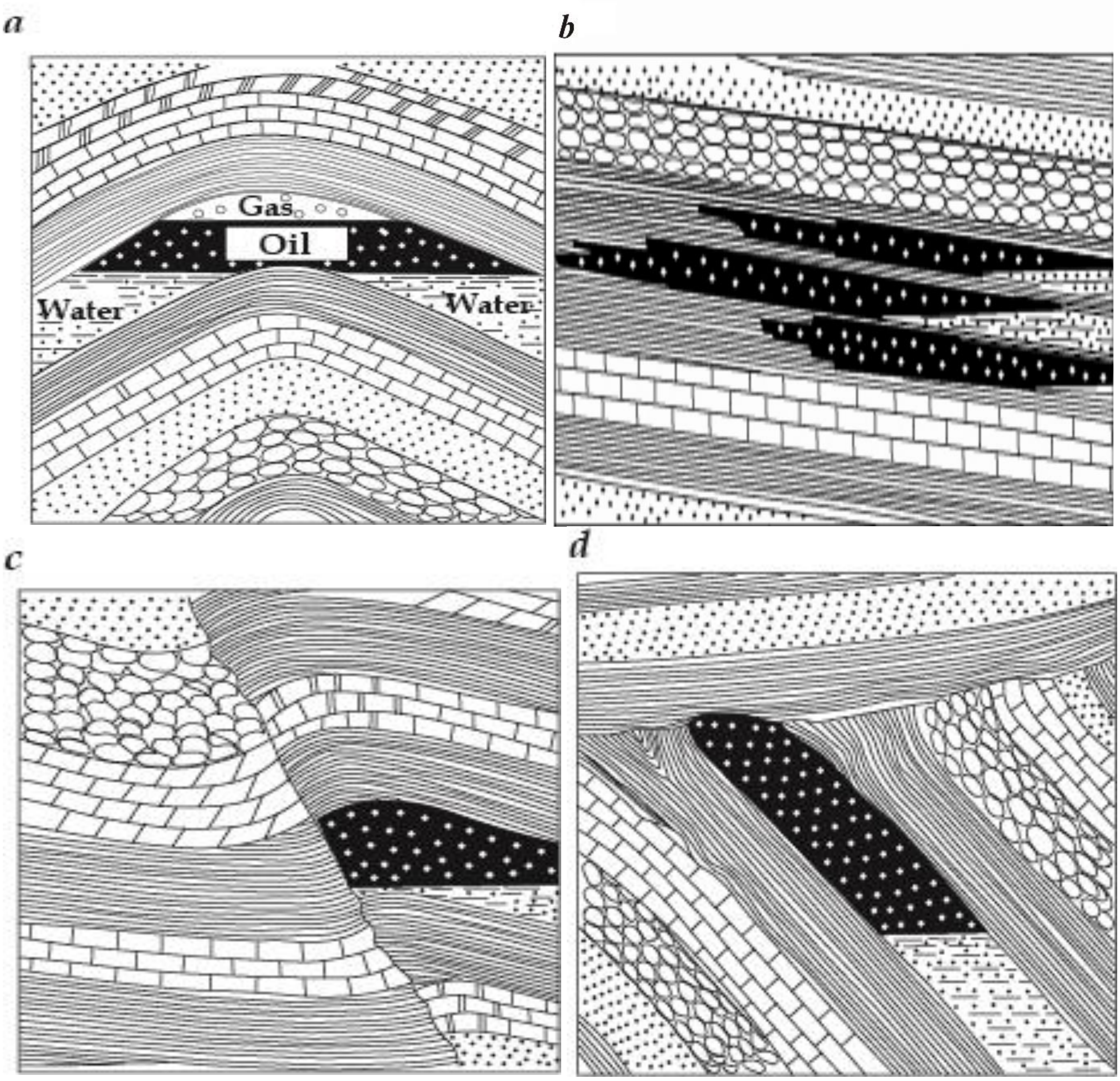

Figure 1. Accumulation of oil, gas and liquid.

Natural accumulations of oil and gas in the bowels of the earth are called oil or gas deposits. In the case when the reservoir rock contains only gas, the deposit is called gas. If both oil and gas are present in the deposits at the same time in a free state, then such a deposit is called an oil and gas one. An oil deposit or formation is usually limited above and below by impermeable rocks, clays, which do not allow oil and gas to spread throughout the thickness of the earth's crust. The thickness of oil (gas) reservoirs ranges from a few centimeters to several hundred meters.

The number of oil or gas reservoirs (deposits) in various fields can be very different - from one to several dozen. Depending on this, deposits can be single-layer or multi-layer. According to the conditions of occurrence, oil and gas deposits are divided into stratified, massive, lithologically, tectonically and stratigraphically shielded (Figure 1).

The most common reservoir deposits are vaulted, located in the vaulted parts of anticlinal structures (Fig.1a) Massive deposits are formed in reservoirs of large thickness (sometimes of different ages and composition) and are underlain by plantar waters. Lithologically shielded deposits are usually formed in the strata of poorly permeable rocks, where there are local porous and permeable lenses, cavernous zones, etc. (Fig.1b). Tectonically shielded deposits are located on the wings of anticlines or monoclines and are limited up the rise of the formation by tectonic disturbances (Fig.1b) or stratigraphic inconsistencies (Fig. 1d).

Oil, gas and gas-oil mixtures, depending on their composition, ratio, pressure and temperature, can be in deposits in various states: in liquid, gaseous or in the form of gas-liquid mixtures.

Due to the different porosity and permeability of oil and gas reservoirs, as well as due to the capillary rise of water in the pores, there is no clear separation between the water and oil parts of the reservoir. The vertical water content gradually changes - from 100% in the aquifer to the residual water saturation in the elevated parts of the deposit. This part of the productive reservoir is called the transition zone. The thickness of the transition zone can reach 3-5 m, depending on the clay content and permeability of the reservoir. Therefore, the calculation of oil and gas reserves is carried out taking into account the size of the transition zone based on the porosity and permeability of the reservoir.

Liquids and gas in the reservoir are under pressure, which is called reservoir pressure. The reservoir energy reserve and the properties of liquids and gases in reservoir conditions depend on the magnitude of reservoir pressure. Reservoir pressure determines the reserves of a gas deposit, the flow rates of wells and the operating conditions of deposits.

The magnitude of the initial reservoir pressure depends on the depth of the productive formation. If the well is filled with liquid and does not overflow (does not gush), the reservoir pressure is defined as hydrostatic;

$$P_{res.} = H\rho g, \qquad (1)$$

where P_{res} is the initial reservoir pressure, Pa;

H is the depth of the formation, m;

ρ is the density of the liquid, kg/m^3;

g is the acceleration of the free fall of the body (g=9.81 m^2/s).

If the well overflows (gushes), then the reservoir pressure can be determined by the formula

$$P_{res.} = H\rho g + P_{w.h.}, \qquad (2)$$

where $P_{w.h.}$ is the pressure at the wellhead, Pa.

If the liquid level in the well does not reach the mouth, the reservoir pressure is determined by the formula

$$P_{res} = H1\rho g, \qquad (3)$$

where $H1$ is the height of the liquid column in the well, m.

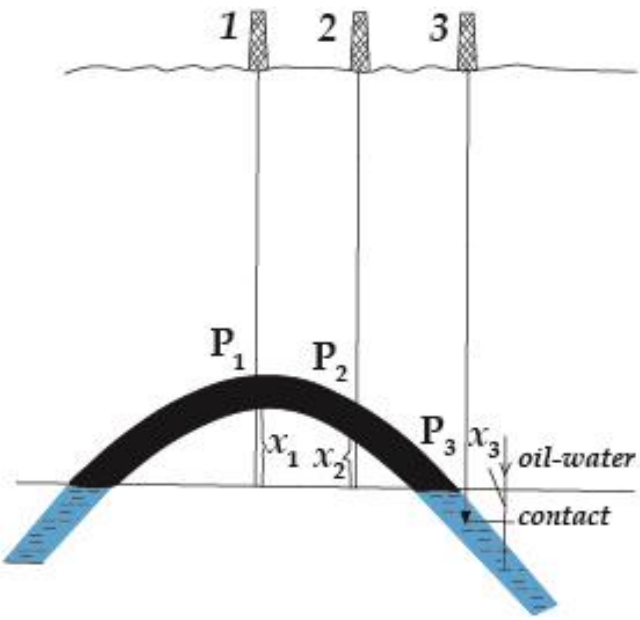

Figure 2. Determination of the reduced reservoir pressure

The scheme for determining the reduced reservoir pressure in the deposits. In a gas deposit or the gas part of an oil reservoir, the reservoir pressure is almost the same over its entire area.

In oil deposits with significant angles of incidence, the reservoir pressure in different parts of the deposit is different: on the wings - the maximum, in the vaults – the minimum. Therefore, the analysis of changes in reservoir pressure during the operation of the deposit is difficult.

It is more convenient to relate the values of reservoir pressure in the deposits to any one plane. For such a plane, the sea level or the conditional plane of the initial position of the oil-water contact is taken. The pressure in the formation attributed to this conditional plane is called the reduced reservoir pressure.

The given reservoir pressures are determined by the formulas (see Figure 2).

$$P_{red.res} = P_1 + \chi_1 \rho g$$

$$P_{red.res} = P_2 + \chi_2 \rho g$$

where p_1 and p_2 are the reservoir pressures measured in the well; x_1 and x_2 are, respectively, the distances from the initial position of the oil-water contact to the point where the reservoir pressure was measured by the borehole pressure gauge.

Systematic monitoring of changes in reservoir pressure allows us to judge the processes occurring in the reservoir, and regulate the development of the field as a whole. Reservoir pressure in wells is determined using borehole pressure gauges, which are lowered into them on a scraper wire.

With an increase in the depth of the productive layers, the temperature also increases. The change in depth, which corresponds to an increase in temperature by 1 °C, is called a geothermal step. On average, it is equal to 34 m. However, the geothermal stage is not the same for different deposits. For example, in the fields of the North Caucasus, the temperature at a depth of 1000 m reaches 90-100 °C, and in Baku the geothermal stage is 50 m.

Currently, there continues to be a tendency to increase the volume of drilling horizontal wells. However, their flow rate is quite sharply different, although they are drilled at the same field. The flow rates of wells located even on a separate local site of the field often differ.

Considering that the cost of construction of horizontal wells is 2-3 times more expensive than vertical or obliquely directed, the question arises of the feasibility of further increasing the volume of construction of horizontal wells. The flow rate of horizontal wells most often depends on the length of the horizontal shaft in the productive thickness.

When the flow rate has not increased sharply, the first reason is considered to be the calcification of the permeable rock by the dispersed phase of the solution by particles of the selected rock or polymer introduced into the drilling mud as chemicals. In foreign practice, horizontal wells are often laid in such a way that their hole opens vertical cracks that secrete productive layers. At the same time, if the productive reservoir is limited by plastic rocks from above and below, anhydrous oil is obtained during the operation of wells for a long time. If the crack passes through nearby permeable aquifers, then the well is flooded during operation. Carrying out horizontal wells that open vertical cracks requires the creation of a special technique for determining the direction of the horizontal hole in terms of the site on which the well is supposed to be drilled.

The generality of the direction of fracturing within any of the structures under consideration depends on their type, shape, and formation features. However, within the local area of the field, the location of cracks can be established only on the basis of a detailed study of the distribution of fracture systems in the layers located above and below the productive ones. It is of interest to predict the direction of the most brittle cracks based on data on the distribution of zones of intensive absorption of drilling mud in carbonate formations that are above and below productive deposits. Today, we can assume that direct links have been established between tectonics and the structure of the modern relief.

There is a great potential to increase the flow rate of horizontal wells if the horizontal well is carried out directionally, so that their hole intersects vertical cracks or weakened zones crossing the massif in rocks. The opening of vertical cracks will multiply the area of oil filtration into the well, the greatest effect can be achieved by wiring horizontal wells along large cracks. The wiring of horizontal wells abroad is most often economical when developing depleted fall sites due to the intersection of a number of vertical faults with one hole. In the practice of drilling horizontal wells, the effect of increasing their flow rate due to the opening of vertical cracks is not (yet) used, although for most rather depleted deposits, it would be possible to predict the development of fracturing systems of tectonic and natural origin based on the analysis of structural features of structures and a number of various indirect signs noted during drilling and production wells. Based on the above, it is possible to develop recommendations for determining the direction of horizontal wells that can be used in many oil areas. So far, the largest number of horizontal wells is carried out in oil areas where oil fields are located at a late stage of operation. Productive layers on them are located under the thickness that have received a forecast assessment of their oil and gas potential.

The choice of the drilling angle and drilling system depends on the goals set by the drilling team and the complexity of the rocks, as well as on the drilling conditions that may occur during the work.

The horizontal hole in the productive horizon allows for a smoother extraction of oil from the reservoir and reduces the tendency and formation of depressions characteristic of vertical holes along which the underlying water or gas from the gas-bearing part above the oil reservoir zone moves intensively to the well. With such phenomena, the life of the well is sharply shortened, an unprocessed part of the reserves remains, and compaction of the field development grid is required. Slowing down these processes with horizontal wells makes it possible to develop oil-bearing sections of the reservoir with a much smaller thickness than with vertical shafts. In reservoirs where the vertical permeability is significantly greater than the horizontal one, the hole running through the reservoir multiplies the flow of oil into the well. In fractured and heterogeneous reservoirs, the hole, resembling the formation, meets a large number of areas with increased permeability and porosity. Thanks to horizontal shafts carried out from early drilled wells, it is possible to extract oil remaining in certain sections of the reservoir after prolonged operation.

The success of well wiring is largely determined by the preparation for its implementation (planning work before it begins) and operational planning to optimize decision-making in the drilling process.

Exceptional attention is paid to drilling technology, including the quality of drilling mud, drilling regime, and issues of reservoir placement. In the presence of data on productive formations, it is necessary to choose the most economical technology, which is determined by the target task that the mining company sets for horizontal drilling, the properties of the formation and drilling conditions during the work. The technology is largely determined by the radius of curvature in the transition zone from the vertical direction of the barrel to the horizontal.

In fact, the drilling of horizontal sections turned into continuous tool detachments and descents with a lead-up to the bottom-hole of the bit and a short, up to 20-30 seconds of time, drilling, after which the tool separation followed again.

- bit 215.9 millimeters (calibrator 215.9 millimeters);
- electric drill E164-8R: 3 with mechanism of curvature (MC) CE1 64,
- isolation monitoring device (IMD), drill collar (DC)146 millimeters - 75 meters;
- drill pipes with the inner end (DPIE) 127x10 “E, L” -300-375 meters;
- drill pipes with the outer end (DPOE) 140 millimeters.

was changed to the following:

- bit 215.9 millimeters (calibrator 212 millimeters);
- electric drill E164-8R: 3 IMD;
- drill pipes with the inner end (DPIE) 127x10 “E, L” -300-375 meters;
- drill collar 146 millimeters -75 meters;
- drill pipes DPOE 140 millimeters.

In fact, the drill collars were presented in a part of the hole with an angle of less than 60 degrees, in the “shoe" of the column. Further drilling was carried out with the rotation of the columns by the rotor at low speeds, for which the layout was removed a telemetry system, a flimsy housing that could withstand high torsion torques. After changing the layout, the cases of the tool hanging when bringing it to the face immediately stopped. To create an axial load on the bit, a much smaller load from the surface was required, which is clearly reflected in the cartogram. The penetration per bit also increased significantly from 16-18 meters to 28-22 meters per crushing, which is shown on the cartogram. The rearrangement of the drill collar made it possible to significantly reduce stiffness in the interval of intense curvature, which, along with turning the tool, made it possible to reduce hanging and realize the axial load at the bottom most fully, and immediately affected an increase in penetration on the bit and a slight decrease in the durability of the bits, since they began to work with large axial loads. Moreover, the output of the layout of the bottom-hole assembly (BHA) from the interval of intense curvature into the horizontal part of the hole is not the reason for the decrease in hanging, as clearly evidenced by the drilling of the well, where the last 3 hollows in the horizontal hole section were made by an electric drill. The cartograms of the hydraulic weight indicator indicate that tool freezes took place before the end of drilling.

References:

1. Deryaev, A.R. (2022). Monitoring of the technological regime of wells and borehole equipment. *European Science Review Scientific journal* №9-10 –Vienna: Publishing: “Premier publishing”, pp.20-23.
2. Deryaev, A.R. (2022). Operation of wells by fountain, gas lift methods and technical and technological measures to increase production. *Scientific discussion* vol 1, №70 – Praha – Czech Republic: Publishing: “Scientific discussion”. pp. 12-14.
3. Deryaev, A.R. (2022). *Justification of the adopted methodology for forecasting technological indicators of development for gas condensate fields. “Innovative areas of solving problems of science and practice”.* Proceedings of the VII International scientific and practical conference. Publishing: Norway – Oslo: International Science Group «isg-konf.com». pp. 609–613.
4. Deryaev, A.R. (2022). Analysis of technological modes of operation and justification of the methodology for forecasting development for gas condensate fields. *International Journal of Recent Advances in Multidisciplinary Research* vol. 09, issue 10 – India – Deli: Publishing: “International Journal of Recent Advances in Multidisciplinary Research”, pp. 8083-8090.
5. Deryaev, A.R., Gulatarov, H., Esedulaev, R., & Amanov, M. (2020). *Tekhnologiya burenie naklonno-napravlennyh i gorizontal'nyh skvazhin i raschety proektirovaniya: Nauchnaya monografiya*. (p.608) – Ashgabat: Ylym.
6. Deryaev, A.R., & Esedulaev, R.(2017). *Osnovy tekhnologii bureniya pri osvoenii neftegazovyh*

plastov metodom ORE: Nauchnaya monografiya. (p.239) – Ashgabat: Ylym.

7. Deryaev, A.R. (2015). Tekhnologicheskie osobennosti vskrytiya mnogoplastovyh produktivnyh gorizontov i osvoenie ih dlya odnovremenno-razdel'noj ekspluatacii. *Sbornik instituta "Neft' i gaz".* Vypusk 11 - Ashgabat: Turkmenskaya Gosudarstvennaya sluzhba pechati, pp.183-193.
8. Deryaev, A.R. (2013) Razrabotka konstrukcii skvazhin dlya metoda odnovremenno-razdel'noj ekspluatacii neskol'kih neftyanyh plastov. *Nauchnyj zhurnal "Nauka i tekhnika v Turkmenistane"* № 6. Ashgabat: Ylym, pp. 71-78.
9. Deryaev, A.R., Gulatarov, H., & Mantrova, S.V. (2014). Rekomendacii po burovym rastvoram dlya odnovremenno-razdel'noj ekspluataciej neskol'kih produktivnyh gorizontov na mestorozhdenii Severnyj Goturdepe. *Sbornik instituta Nefti i gaza*, vypusk 8 - Ashgabat: Turkmenskaya Gosudarstvennaya sluzhba pechati, pp. 249–259.
10. Deryaev, A.R. (2012). Burenie naklonno napravlennyh skvazhin na mestorozhdeniyah Zapadnogo Turkmenistana. *"Nebitgazylmytaslama".* Vypusk 2 (29) - Ashgabat: Turkmeniskaya Gosudarstvennaya sluzhba pechati, pp. 267-276.
11. Gulatarov, H., Deryaev, A.R., & Esedulaev, R.E. (2019). *Osobennosti tekhnologii bureniya gorizontal'nyh skvazhin sposobom elektrobureniya: monografiya.* (p.227). – Ashgabat: Nauka.
12. Deryaev, A.R., Mamedov, B., & Amanov, M. (2021). *Vnedrenie receptur burovyh rastvorov dlya burenie naklonno-napravlennyh i vertikal'nyh skvazhin.* Mezhdunarodnaya nauchno-prakticheskaya konferenciya studentov, magistrov, aspirantov i doktorantov "Rynok i effektivnost' proizvodstva-18", posvyashchennaya 30-letiyu Nezavisimosti Respubliki Kazahstan. Sbornik trudov. (pp. 258–261). Kokshetau.
13. Deryaev, A.R. (2012). Opyt bureniya skvazhin s gorizontal'nym okonchanie stvola Zapadnom Turkmenistane. *Sbornik stat'ej instituta "Nebitgazylmytaslama".* Vypusk 2 (29) - Ashgabat: Turkmeniskaya Gosudarstvennaya sluzhba pechati, pp. 277-285.
14. Deryaev, A.R. (2021). Rekomendacii po ispol'zovaniyu burovyh rastvorov dlya uspeshnogo vedeniya burovyh rabot na mestorozhdenii Severnyj Goturdepe. *Aktual'nye issledovaniya.* №51 (78) – Belgorod: Izdatel'stvo "Agentstvo perspektivnyh nauchnyh issledovanij", pp.14–22.
15. Deryaev, A.R., & Deryaev, S.A. (2022). *Prigotovlenie burovyh rastvorov i metody regulirovaniya ih svojstv v slozhno termogeohimicheskih usloviyah gorizontal'nogo bureniya skvazhin (na primere Turkmenistana).* "International scientific review of the problems and prospects of modern science andeducation". LXXXIV International correspondence scientific and practical conference. (pp. 9 –13). USA– Boston: Publishing house: «Problems of science».
16. Gulatarow, H.G., & Deryaev, A.R. (1998). Osobennosti bureniya naklonno-napravlennyh skvazhin elektroburom. *Sbornik stat'ej. Modelirovanie processov razrabotki gazovyh mestorozhdenij i prikladnye zadachi teoreticheskoj gazogidrodinamiki* - Ashgabat: Ylym, pp. 62-70.
17. Deryaev, A.R., & Orazklychev, K. (2015) *Sposob odnovremenno-razdel'noj i sovmestnoj ekspluatacii neskol'kih produktivnyh gorizontov odnoj skvazhinoj i ustrojstvo dlya ego osushchestvleniya.* Patent № 644 ot 08.06.2015 (nomer zayavki 15/101320).
18. Deryaev, A.R., & Orazklychev, K. (2015) *Sposob odnovremenno-razdel'noj i sovmestnoj ekspluatacii neskol'kih produktivnyh gorizontov odnoj skvazhinoj i ustrojstvo dlya ego osushchestvleniya.* Patent № 643 ot 08.06.2015 (nomer zayavki 14/101317).
19. Deryaev, A.R. (2022). Zadachi issledovaniya dlya metoda odnovremennoj razdel'noj ekspluatacii mnogoplastovyh mestorozhdenij. *Innovacionnye nauchnye issledovaniya* №2-2 (16) – Ufa: Nauchno-izdatel'skij centr "Vestnik nauki", pp. 43–51.
20. Deryaev, A.R. (2022). Treatment of drilling mud with "PACS-T" additive. "Innovative approaches in the modern science" Proceedings of CXV international scientific – practical conference. *International scientific journal* №7 (115) – M: pp. 74–77.
21. Deryaev, A.R. (2022). Vybor skvazhinnogo oborudovaniya dlya odnovremenno sovmestnogo otbora gaza iz dvuh produktivnyh plastov odnoj kolonnoj NKT. *Sbornik statej Mezhdunarodnoj nauchno-prakticheskoj konferencii "Science and technology research 2022".* (pp.12-18). – Petrozavodsk: Nauchnoe izdanie: MCNP "Novaya nauka".
22. Deryaev, A.R. (2022). *Rekomendacii po burovomu rastvoru dlya bureniya sekcii 295,3 mm otkrytogo stvola naklonno-napravlennoj skvazhiny.* Sbornik statej II Mezhdunarodnoj nauchno-prakticheskoj konferencii "Nauka, obshchestvo, tekhnologii: problemy i perspektivy vzaimodejstviya v sovremennom mire". (pp.7-11). – Petrozavodsk: Nauchnoe izdanie: MCNP "Novaya nauka".
23. Deryaev, A.R. (2022). Features of drilling technology for dual completion, joint operation

of several horizons in a multi-layer field. *"COGNITIO RERUM" scientific journal* №5 M: Academic publishing: "Scientific artel", pp. 12-21.

24. Deryaev, A.R., & Gulatarow, H.G. (1998). *Issledovanie konstrukcii gorizontal'noj skvazhiny dlya dobychi nefti i gaza. Sbornik statej. Modelirovanie processov razrabotki gazovyh mestorozhdenij i prikladnye zadachi teoreticheskoj gazogidrodinamiki.* (pp. 49–57). – A: Ylym,