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GEOLOGICAL, TECHNOLOGICAL PARAMETERS AND METHODS IN THE EXPLOITATION OF OIL AND GAS FIELDS

Abstract

Oil and gas play a leading role in the development of our country's economy. The dynamic and sustainable development of other areas of the economy depends on the development of this industry.

İn his research, the author tried to focus on the geological, technological parameters and methods of development and exploitation of oil and gas deposits.

Azerbaijan is one of the only countries in the world where people began to extract oil on land since ancient times. At that time, they used primitive methods. Over time, science has developed and the oil industry has been developed based on scientific principles. The author tried to study these scientific bases in his article.

Keywords: *oil, gas, the well, the rock, condensate*

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Neft-qaz yataqlarının istismarında geoloji, texnoloji parametrlər və üsullar

Xülasə

Ölkəmizin iqtisadiyyatının inkişafında neft və qaz aparıcı rola malik olmaqla böyük əhəmiyyət kəsb edir. İqtisadiyyatın digər sahələrinin dinamik və davamlı inkişafı məhz bu sənaye sahəsinin inkişafından asılıdır.

Müəllif araşdırmasında neft-qaz yataqlarının işlənməsinin, istismarının geoloji, texnoloji parametrlərinə və üsullarına diqqət yönəltməyə çalışmışdır.

Azərbaycan dünyanın yeganə ölkələrindən biridir ki, çox qədim zamanlardan insanlar quruda neft çıxarmağa başlamışlar. Bu zaman onlar primitiv üsullardan istifadə etmişlər. Zaman keçdikcə elm inkişaf etmiş və neft sənayesi elmi əsaslara söykənərək işlənmişdir. Müəllif məqaləsində bu elmi əsasları tədqiq etmişdir.

Açar sözlər: *neft, qaz, quyu, süxur, kondensat*

Introduction

It should be noted that recently the science of oil and gas mining geology and related experimental methods have developed significantly. This field of science includes the appropriate methods of hydrodynamics, mathematical statistics, probability theory, etc. sciences and ensures the effective solution of targeted issues. The computer solution of the appropriate algorithm and programs helps to obtain various versions of the data (map, profile, graph, table, etc.) required for various geological-mining studies.

"It is known that drilled wells are the main source of information in the study of oil and gas formations. The depth of the wells and the distance between them, the geological-geophysical data of that layer reflect not the entire volume of the deposit, but only its characteristics at individual points. Simple approximation methods (triangles, profiles, etc.) are used in the construction of area or volume models from point data, which makes it difficult to reveal the real distribution

characteristics of the studied layer parameters. The reliability of the maps is lower in the case of the complicated structure of the reservoir and the small number of wells. In fact, they reflect the description of the structure of the reservoir with a certain probability (Bağırov, 2011:17).

In the process of development of oil and gas deposits, geological and technological parameters are accompanied by numerous factors that are in a complex relationship with each other. These factors vary significantly in the oil extraction process, depending on the natural geological conditions and field development systems. In the development process, some geological, mining, and technological parameters are encountered, which are also subject to interaction in terms of time and space. The study of these parameters implies the application of methods that reduce the negative effect of these parameters in order to increase the final oil yield coefficient, which is one of the main issues in the development of fields, in addition to studying the reasons for the diversity of the rate of exploitation of oil reserves.

"Quite a large volume of data has been collected on the application of methods that increase the oil yield of layers in fields that have been in development for a long time. The characterization of individual layers with different geological conditions, the variability of the physico-chemical properties of rocks and oils for each working object, as well as for the entire field, leads to the fact that the development of new development projects in hard-to-extract fields requires an independent approach to each individual object" (2).

The efficient exploitation of reserves depends primarily on the justification of applied geological-mining measures and reliable geological-mining analysis of the obtained results. According to the analysis of complex geological, technological, economic and other data, the study of a number of issues in the preparation of geological-technological projects is of great importance for the effective completion of the development process of oil and gas reservoirs.

These including:

- natural conditions of accumulation of hydrocarbons underground and distribution boundaries;
- tectonic faults and their role in the distribution of formation fluids;
- energy properties of reservoirs;
- distribution of the volume of resources on the area of productive layers;
- Separation of operational objects in the cross-section of the reservoir;
- application of artificial influencing methods on layers;
- determination of factors affecting the oil yield of layers;
- exposure to various changes of layer parameters (reservoir pressure dynamics, displacement of water-oil and gas-oil phases, physico-chemical properties of reservoir fluids);
- summarization, analysis, etc. of the results of research conducted in this direction (geological-mining and geological-mathematical methods).

"The well-known research methods related to the opposite issues of hydrodynamics make it possible to determine the parameters of the layer to a certain extent. These methods are implemented by applying data showing the dependence of liquid and gas production on the wellbore (determined research method) or the time-dependent dynamics of these indicators (determined research method). In some cases, reservoir and well parameters are determined by processing the thermal effects data from the reservoir during the movement of liquid and gas to the wellbore" (Mirzəcanzadə, Xasayev, Bayramov, 1981:16).

The hydrodynamic foundations of drilling wells in complex conditions were laid by Academician Azad Mirzajanzadeh and are currently widely used in science and industry by his school. During drilling, certain complications occur due to hydraulic fracturing of layers, and their elimination takes a lot of time and money. For this reason, it is necessary to study some issues. When choosing a well structure, it is important to determine the hydraulic fracturing pressure, mainly in determining the length of the collector and in regulating their copies when performing technological processes. There are several methods for this. However, there is no exact method depending on geological and technological factors.

"Sometimes, during hydraulic fracturing, the circulation of fluid in the well is interrupted, and the level of the drilling fluid in the annulus decreases. Under such circumstances, according to the proposed method for determining the hydraulic fracturing pressure, it is necessary to record the hydraulic fracturing time of lowering and changing speeds of the tool during drilling, the change of the annular space level and the weight of the drilling tool during hydraulic fracturing" (4).

The operating mode of the wells is determined depending on the geological and technical conditions. It is always possible to control the movement process of fluid from the formation by changing the mode of the wells. However, it is not always possible to control the movement process by changing the number of wells. Therefore, it is necessary to correctly determine the number of wells, their placement and start-up procedure in advance. If it is necessary to change the number of wells during the development, then this may be due to additional capital investment, or an inappropriate use of the invested capital expenditure..

"One of the main issues of development is to artificially affect the layer in order to change its energy balance. By artificially influencing the formation (injecting water or gas into the formation, affecting the bottom zone, etc.), the process in the formation can be completely changed. The layer can be artificially affected at the very beginning of processing or after a certain period of time has passed" (5).

Geological factors shape the natural regimes of layers in oil fields. These include:

- the feature of the subduction system of the region to which the reservoir belongs and its location in this system;
- Geological-physical characteristics of the reservoir - thermobaric conditions, phase condition of hydrocarbons, characteristics of reservoir rocks and bedding conditions.

The sum of natural forces that ensure the movement of oil and gas to production wells in reservoir conditions is called the natural regimes of reservoirs. The main forces that move oil in oil fields include:

- external water pressure;
- elastic expansion of rocks and water as a result of external waters;
- gas pressure in the gas cap, pressure dissolved in oil;
- gravity of oil.

"If the geological diversity is not sharp in the layer, the permeability of the rocks is high, and the viscosity of the oils is low, it can be expected that there will be an unambiguous active subduction regime in this field. However, if this type of formation is characterized by a high gas factor and its lying angle is large, then there is a gas pressure regime, and if the lying angle is low, then it can be expected that there will be a gas regime dissolved in oil in the formation. The initial samples obtained from the wells indicate that the permeability of formation rocks is low, and the viscosity of oils is high, in the development of this field will be inactive. Here, it can be predicted that there will be gas dissolved in oil at the beginning of processing, and gravity regime a little later" (6).

At present, oil fields are exploited using methods such as fountain, compressor and depth pump.

Oil extraction by the Fountain method:

- In this method, the force that compresses the oil to the bottom of the well and lifts it to the surface, often with great pressure, is mainly gas dissolved in the oil and also accumulated under high pressure in the arch part of the anticlinal mixture. In some cases, the water accumulated at high altitude on the wings of the anticlinal fold compresses the oil under high pressure and raises it to the surface. That is, the gas that comes out with the oil is the force that moves the oil.

Today's fountain wells produce 300-400 tons of and more oil per day.

Oil extraction by compressor method:

-After a certain time after fountain process, the pressure in the oil layer drops and the pressure of natural gas or reservoir water can no longer lift the oil to the surface. Thus, the fountain of the well is cut off. However, after the period of pumping, the oil level in the well is high. If the fountain period is viewed as the youth period of the well, the post-fountain period can be viewed as the

mature period of the well. At this time, the most convenient way of operating an oil well is the compressor method. Two rows of pipelines are laid in the well to extract oil using the compressor method. A large-diameter pipeline is released approximately to the bottom of the well.

The method of extracting oil through depth pumps:

- The cycle of compressor operation of the well may last for a certain period of time. As the well works, the pressure of the oil layer decreases, the level of oil in the well decreases, and as a result, it is necessary to drop the riser pipes lower. Finally, the level of oil in the well drops so low that it is no longer profitable to extract oil by compressor method. Because it takes a lot of compressed air or gas to extract a very small amount of oil. A lot of energy is spent on getting compressed air. Therefore, in such cases, instead of operating the well using the compressor method, they switch to using a depth pump. Submersible pumps are more suitable for operating wells with low oil levels.

"About one-third of the oil in an oil field can be removed by fountain, compressor, and submersible pump methods. Two-thirds of the oil remains in "depleted" oil fields. This is due to the lack of gas or water pressure that brings the oil into the well. If we can artificially create such a pressure, the oil should still flow from the reservoir to the well. Creating such an artificial pressure in the oil field is now widely used. This is called the enhanced oil recovery method" (7).

Gas and gas-condensate fields are located at different depths of the earth layer. Gas and gas-condensate wells are drilled into the fields to extract hydrocarbons (oil, gas, gas-condensate) from 250 m to 10,000 m and more. Drilled gas wells are for these purposes:

- In order to ensure the extraction of gas from the formation to the surface (mining facilities) through wells;
- In order to prevent rocks from flying into the well along the geological section of the wells;
- In order to separate the oil, gas and water layers;
- In order to prevent gas loss underground.

Gas wells are operated for a long time under complex and rapidly changing conditions. Indeed, gas pressure in gas wells can reach up to 100 MPa, and its temperature reaches up to 523 degrees (K) in some cases. Behind the operating pipelines of very deep gas and gas-condensate wells, the pressure increases to 250 Mpa.

"The longevity of gas and gas-condensate wells depends greatly on the chosen well construction. The construction of gas and gas-condensate wells should include intermediate (technique) and operational pipelines of different diameters and lowered to depths inside the concentrically (inside) drilled wellbore. These pipelines are isolated both with each other and along the geological section by injecting cement mortar from the wellbore to the wellhead. After some time, cement hardens and turns into cement stone" (İsmayılov, Süleymanov, Novruzova, Məlikov, Abdullayev, Əliyev, 2022: 11-12).

During the operation of wells, great attention is paid to the reliability, longevity and safety of their work, prevention of open gas fountains, and environmental protection. Both the construction of the gas well and the well body and wellbore equipment must satisfy the conditions of reliability, longevity and safety. The underground equipment of the wellbore should enable the following:

- protect the well from the open fountain;
- mastering, exploring and stopping the well without suffocating it with liquid;
- the effect of formation on the bottomhole zone in order to intensify the flow of gas into the well;
- operation of the well in the determined technological regime;
- replacing the pump-compressor (fountain) pipeline without suffocating the well with liquid.

"Protective well equipment of gas wells consists of two separate parts:

1) packer;

2) the shut-off valve itself.

The requirements for packers, which are used in combination with wellbore cut-off valves, are very high: 1) continuous operation; 2) reliable isolation of the layer from the pipe space; 3) the

possibility of installation at any given depth; 4) construction simplicity, minimum possible main dimensions and metal volume; 6) resistance to aggressive environments at high pressure and temperatures.

Downhole shut-off valves prevent an open fountain in the event of damage and collapse of wellhead equipment and pump-compressor-pipelines above the location of the downhole shut-off valves. They serve as an automatic shut-off device during the dismantling of the wellhead equipment, lifting the pump-compressor-pipeline without suffocating it with liquid from the well" (İsmayılov, Həsənov, Həsənov, 2019: 112).

During the drilling and operation of wells, the natural permeability of rocks decreases due to a number of reasons. As is known, clay solution is of great importance in the process of drilling wells. However, after the layer is opened, the clay solution has a harmful effect on it. Fine dispersed clay particles enter the layer and accumulate between large grains and in cracks. The clay solution filtrate enters the formation, where it causes swelling of the clay particles in the rock and the formation of adsorbed layers on the surface of the productive rock particles.

"Paraffin and tar sediments sometimes form at the bottom of production wells. In such cases, paraffin sinks to the bottom of the well and blocks the channels and reduces the productivity of the well. Paraffin, resin, etc. they must be dissolved to remove the substances from the well. There are several methods for this.

The most important of these methods is to affect the wellbore through heat generated by chemical reagents. The thermochemical zone also dissolves the crusts formed by the clay solution and salts in the wellbore. The most common method is to use the heat of reaction between hydrochloric acid and metallic magnesium" (10).

The main principles of the system of efficient development of oil fields also apply to gas fields. However, the development of gas fields is different from the development of oil fields. This is due to the following characteristics of gas fields:

1. The physical properties of gas and oil are quite different, gas has a lower viscosity, specific gravity and a very high compressibility than oil.
2. Gas also differs from oil in its commodity quality.
3. In addition to the use of the gas extracted from the reservoir as a raw material for the fuel and chemical industry, its mechanical energy, i.e. pressure energy, is also used. At present, this energy is used only for extracting the gas from the reservoir and transporting it to the consumer. But the pressure energy of the gas can be used for other purposes.

"Therefore, several wells should be drilled in the formation to exploit the gas fields. The development process of a large gas field with high initial pressure can be divided into two successive stages. In the first stage, which is called the compressor-free development period, the formation pressure is greater than the pressure required at the beginning of the main gas pipeline, so long-distance gas transportation is due to formation energy. At this time, the bottom pressure will be greater than the pressure at the beginning of the pipelines, as well as the pressure lost in the wellbore and mine gas pipelines" (11).

It is very important to take into account natural-climatic conditions, hydrometeorological and mountain-geological conditions during the exploitation of offshore oil and gas deposits. Because just those conditions justify the selection method of exploitation, the appropriate reservoir.

"Modern offshore oil and gas fields, consisting of highly mechanized, automated complexes, allow drilling and operation of wells, gathering, processing and transportation of oil and gas. The types of offshore oil and gas fields are: surface; underground; underwater; above water; combined" (12).

Conclusion

The conducted research shows that conducting fundamental research works is one of the very important conditions for obtaining regular, complete geological-geophysical information about oil and gas industry operations, development, reservoirs. As the author has done a lot of research to

achieve his goal in this article and scientifically proved the issues that will contribute to the oil and gas industry.

Ədəbiyyat

1. Bağırov, B.(2011). Neft-qaz mədən geologiyası. Bakı, 17 s.
2. https://www.aak.gov.az>Azə...
3. Mirzəcanzadə, A., Xasayev, A., Bayramov, M. (1981). Neft çıxarılmasının texnika və texnologiyası. Bakı: Azərb.MKİ, 16 s.
4. Salavatov, T., Səfərov, Y., İsmayılov, E., Əsədova, G. (2019). "Azərbaycan neft təsərrüfatı" jurnalı, № 01, 8 s.
5. https://www.com>document
6. https://www.researchgate.net>3197
7. https://facebook.com>photos
8. İsmayılov, S., Süleymanov, A., Novruzov, S., Məlikov, H., Abdullayev, M., Əliyev, İ. (2002). Neft və qazın quyu ilə çıxarılması texnologiyası. Bakı, 11-12 s.
9. İsmayılov, F., Həsənov, F., Həsənov, İ. (2019). Neftqaz və qazkondensat yataqlarının istismarı. Bakı, 112 s.
10. https://azkurs.org>refs
11. https://elmtehsil.com>elm-ve-heyat
12. https://m.facebook.com>posts

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