

Analysis of reservoir geological characteristics and development countermeasures

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Abstract: Under the background of the continuous improvement of the scale of modern petroleum engineering construction in our country, the level of oilfield development technology has been improved in an all-round way, which provides sufficient resources for the development of society. In the process of oilfield development, it is necessary to do a good job in the analysis of the geological characteristics of the reservoir to clarify the basic geological characteristics of the reservoir, based on which the development of the oilfield can improve the scientific work of reservoir development. Therefore, it is necessary to strengthen the analysis of geological characteristics and strengthen the innovation of exploration and development technology. Therefore, this paper will conduct in-depth research and analysis on the geological characteristics of the reservoir and development countermeasures, and summarize some measures based on practical experience, in order to be helpful to the related engineering.

Keywords: Reservoir field; Geological features; Development strategy; Developing technology; Optimization measures.

1. Introduction

Oil and gas resources are the basic energy in social production, but the total reserves of oil and gas resources are insufficient, and the development of many oil and gas reservoirs is difficult. In order to ensure the sufficient energy of the society and the national energy security, we must do a good job in oil and gas reservoir development. Oil and gas storage of geological environment is complex and variety, and in the process of reservoir development, will continue to consume the energy, the development of the current way to complement formation energy, so in order to improve the efficiency of reservoir development, need to combine the basic conditions of reservoir geological characteristics, optimize the development mode, strengthen geological exploration of stored oil resources, Under the condition of accurately mastering the geological characteristics of the reservoir, it can provide sufficient guarantee for the subsequent reservoir development operation.

2. Analysis of reservoir geological characteristics

2.1 Geological characteristics of the

The reservoir geological characteristics of in certain oilfield, mainly for the delta facies, delta plain subfacies include distributary channel and distributary interchannel,

including underwater distributary channel subfacies and delta front position, front mud, mouth bar, between tributary bay, etc., the small layer structure characteristics of different areas to study the reservoir with high similarity, in a good inheritance.

2.2 Reservoir characteristics

Through the exploration of the characteristics of the reservoir, it is clear that the reservoir is mainly composed of mineral cementation and particle cementation, and the arrangement of mineral cementation particles can directly affect the oil quality. In this reservoir, the overall sorting of the reservoir throat is poor, the structural quality of the throat is poor, has the characteristics of low permeability, the degree of weathering of the oilfield is medium, the overall particle sorting way is good, it is a high-quality reservoir area. In the exploration of the reservoir, the reservoir of the reservoir thickness of about 13.8 km, 0.68 MD, permeability reservoir in the region is suitable for the low permeability limited mining technology, through scientific optimization of recovery techniques, effectively improving the quality of oil field development, in the discovery in the process of oilfield development, however, there are water crack problems during water injection, Therefore, in order to give full play to the advantages of low permeability development technology, it is necessary to optimize the development technology based on the geological characteristics of the reservoir to ensure the

improvement of reservoir development efficiency and quality [1].

3. Analysis of difficulties and influencing factors in reservoir development

3.1 Difficulties in reservoir development

Because the reservoir lithology density, seepage resistance is larger, and the characteristics of the pressure conduction ability is poor, has its own rimland flexibility is poor, lack of natural resources, the characteristics of leading to a low permeable reservoir has a larger penetration resistance, so in the process of the special low permeability oil reservoir energy consumption too fast, need a lot of energy in the mining, In addition, with the development of ultra-low permeability reservoir, the overall productivity of the oilfield will gradually decrease. Compared with other oilfield types, the attenuation rate of ultra-low permeability reservoir is faster, so the exploitation effect of ultra-low permeability reservoir is poor, and it is difficult to maintain stable exploitation. Which is a super-low permeable lithologic reservoir, the reservoir belongs to the typical low pressure and physical property is poor, because the oil region development scope is larger, ready for a large-scale oilfield, on the longitudinal development of many sets of reservoir, the plane has good sand body connectivity, reservoir scale to large, early try oil yield is higher, producing fluid volume dropped from 5.90 m³ / d in the early to the current 2.07 m³ / d, The water cut increased from 5% at the beginning to 30% at present, and the daily production of a single well decreased from 4.10t /d at the beginning to 1.20t/d at present. The reservoir was developed for a long time, most of the reservoir was injected later, and the well pattern was locally imperfect, resulting in a rapid drop in formation pressure.

3.2 Analysis of influencing factors of development

In the development process of this reservoir, the design adopts the water injection development mode, but in the actual development process will be affected by a number of factors, including the following: (1) water quality factors. Water quality is a key factor in the application of water injection development technology. If the water quality is poor, it will have a direct impact on the exploitation. However, in most low permeability reservoirs, due to the corresponding water quality problems, the production work is more difficult. During the water injection recovery period, the water quality is not up to the standard. There are many impurities in the water, which will have a great negative impact on the downhole pipe string and reduce the water absorption effect of the reservoir, which is not conducive to the smooth implementation of the exploitation work. (2) Water injection pattern factors. In the process of low permeability oil reservoir, in order to guarantee the production efficiency, improve to the requirement of mining technology, the traditional pattern of water

injection is difficult to achieve good results, there exists a problem of energy shortage and low efficiency is, so you need to do optimization of water injection mode, but the current unreasonable parts used in oil field water injection mode, make the efficiency of low permeability oil reservoir is low [2]. (3) Test factors. In low permeability reservoir development process, the water injection development technology can reach the effect, directly affecting reservoir development effect, so usually need to do a good job of testing water injection development technology, provide data support for the subsequent application, but some early test of field work and test the lack of management, the cause is not in conformity with the test results and the actual situation, Thus, the subsequent water injection recovery effect is insufficient, so it is necessary to strengthen the preliminary test optimization of water injection development technology.

4. Analysis of reservoir development strategy

Can clear the combination of the above analysis, the characteristics of the reservoir with low permeability, so need to be combined with geological characteristics, with the development of science and technology, to ensure the quality of the overall development work, to strengthen the analysis of geological features, in accurately on the basis of geological characteristics, through the optimization of the development process, can effectively improve reservoir development efficiency and quality. Therefore, this paper combined with relevant practical experience, according to the basic characteristics of the reservoir, summed up a number of development countermeasures.

4.1 Technical feasibility analysis

In the process of the reservoir development, combined with the feature of the basic characteristics of reservoir, water injection development technology, it is proposed the main on the basis of developing unit division, for the separate development of the reservoir, reservoir boundary well tracking, design reasonable injection-production well pattern, improve the reservoir sand body, injection-production relation between optimization of injection-production parameters, overall waterflooding reservoir. With the help of natural energy, the ultimate recovery factor is relatively low, while water injection artificially replenished energy to maintain reservoir pressure has the advantages of sustainable high and stable production, high displacement efficiency, relatively high ultimate recovery factor and good economic benefits. In this block, water injection Wells decline more slowly than Wells without water injection, and currently produce significantly more than Wells with natural capacity. Therefore, it can be seen that the waterflooding development method of low permeability reservoir is an effective method. In this reservoir, the content of reservoir intercaulk is 10-15%, and the intercaulk is dominated by clay minerals such as chlorite and kaolin, while other minerals are relatively few. Therefore, there will be no minerals that expand and clog the formation when exposed to water, and the reservoir sensitivity is weak. Thus, it provides a good

application condition for water injection development technology [3].

4.2 Application design optimization of water injection development technology

The reservoir is the main problem is the local injection-production well spacing is not perfect, because of the large longitudinal reservoir development result in injection-production corresponding, to finish Good injection-production well spacing, increase the well by the effect direction, continue to increase the intensity of oil well transfer, increase the well the effect direction, the formation of "weak point and strong plane" injection-production pattern, maintain formation pressure, increase the degree of water drive, Measures such as "shutdown, adjustment, union, diversion and blocking" are taken to further improve the injection and production well pattern and improve the corresponding degree of single sand body. Only by realizing reasonable injection and production well pattern in the plane and achieving water injection balance in each layer in the longitudinal direction can we ensure good and sufficient water injection and ensure scientific, effective and sustainable production operation of the oilfield.

The principle of water injection design is to give full consideration to the distribution of sedimentary facies, sand body and oil reservoir, to expand the affected area of water injection and improve the degree of water driving based on reasonable water injection pressure and the principle of balance of injection and production. In order to balance formation energy and prevent over-rapid flooding of production Wells, it is necessary to determine a reasonable injection-production ratio, gradually restore and balance formation pressure in the oil area, and determine the injection-production ratio in stages according to the recovery of formation pressure in the oil reservoir. The general principle is as follows: In the early stage of water injection, due to the serious formation energy deficit and low fluid production of the oil well, it is meaningless to design the water injection volume completely in accordance with the principle of balance of injection and production. On the premise that the water absorption capacity of the formation is sufficient and the oil well is not flooded, water injection volume should be as large as possible to restore the formation pressure at a fast speed. Therefore, the initial injection-production ratio is set as 1.7 ~ 2.0 compared with the experience of similar fields. To water injection later period, formation pressure level is higher, production pressure differential can enlarge appropriately to improve liquid producing capacity, the water injection main purposes for strengthening regional overall water cut rising velocity control, and prevent the well water flooded, so on the basis of lower injection-production ratio with water, the design of 0.8-1.1, in the whole process of water injection development, in order to make regional plane by equilibrium, The overall distribution of formation pressure is uniform, and the water injection in a single well must be adjusted according to the production dynamics. The general principle is that the intensity of water injection can be appropriately increased for the well

groups with no or no obvious effect of long-term water injection, while the intensity of water injection can be strictly controlled for the well groups with Wells that are flooded or have high overall water cut [4].

In terms of water injection pressure adjustment, for the most part need to make sure that all reservoir or reservoir water at the same time, and ensure that ensure the injection-production balance or accomplish a certain production index as the prerequisite, ensure that water injection technology can achieve pressure range at the same time, to ensure that the injection pressure limit shall not exceed the fracture pressure of reservoir rocks, thus to realize optimization water injection pressure. It is the key to improve the technical level of water injection development and has a good effect in this reservoir.

4.3 Reservoir development quality control optimization measures

In the process of reservoir development, in order to ensure the application effect of water injection development technology, it is necessary to do a good job in technical application quality control, which mainly adopts the following control methods: (1) Optimization of water quality management. In the application process of water injection development technology, in order to improve the efficiency and quality of oil recovery, it is necessary to do a good job in water injection water quality management, otherwise it will have a direct impact on water injection oil recovery efficiency. With the development depth of low permeability reservoir gradually increasing, the difficulty of exploitation is gradually increasing. In order to ensure the development effect of low permeability reservoir, it is necessary to strengthen water quality management and reasonably deal with diversified and complicated water quality. For example, the backwashing frequency control technology of sewage treatment tank can be adopted. Through the advantages of frequency control and automation technology, the efficient treatment of sewage can be realized, so as to improve the water quality and avoid the negative impact on the exploitation of low permeability reservoir. In the application process of this technology, it is necessary to ensure the standard operation of the flushing pump and improve the accuracy of the pump running speed control during the operation of the system, so as to improve the effect of water injection oil recovery and reduce the influence of the complex environment of low permeability reservoir on oil recovery, which is an effective optimization measure for the application of water injection development technology. (2) Optimization of water injection development mode. Water injection technology in low permeability reservoir is affected by the model, so it is necessary to optimize the water injection recovery model according to the actual situation of low permeability reservoir. In the water injection oil recovery mode, the centrifugal pump is the core equipment. It is necessary to clarify the curve characteristics of the centrifugal pump, comprehensively optimize the equipment power, displacement and other technical parameters, and adjust the technical parameters according to the characteristics of low permeability reservoir to ensure that the operation efficiency of the

centrifugal pump can be improved. Reciprocating pump as an important infrastructure during water flooding oil recovery, the efficiency will be affected by the influence of the pump valve, so you need to do the optimization of the overall system, to optimize the water injection pipeline, the reciprocating pump and integration, to ensure that it can have enough power, combined with the operation parameters of accurate calculation, can make the system running effect, Thus, the optimization of water injection oil recovery mode is realized, and the goal of improving the efficiency of water injection oil recovery is realized [5]. (3) Test management optimization. Effect to enhance early water injection oil production testing, it is necessary to do a good job of testing management, innovation for the test system and related technology, intelligent technology can be used, for example, through the intelligent technology to build perfect testing system, test system needs to be included in the underground test, the ground water injection test, etc., so that they can get more comprehensive test information, Realize the high efficiency transfer of test information. In ground water injection test system, intelligence technology is used to analyse the information and data collection, to ensure that the test system running continuity, so that they can get more accurate test results, improve test efficiency, make it meet the demand of the implementation of the low permeability reservoir water flooding oil recovery technology, can effectively improve mining efficiency and security.

5. Conclusion

To sum up, this paper briefly expounds the address of a reservoir characteristics and the basic situation of the reservoir characteristics, and the difficulties of reservoir development work and detailed analysis of the factors affecting technology application, and finally puts forward several development countermeasures and measures, hoping to have some reference for oilfield development and help enhance the technical level of reservoir development, Promote the development technology level of petroleum engineering.

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