# Discussion on the influence of geological parameters on reservoir development in Daqing Oilfield

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**Abstract.** With the improvement of social development level, the development speed of all walks of life has been rapidly improved. This increase in speed makes the industry's demand for energy also show a growing trend. Based on this, relevant departments have also increased the research on oilfield exploration and reservoir development. Among them, through research, it is found that geological parameters have a very significant impact on the oil reservoir development effect. Only based on geological parameters can the developed oil reservoir have the support of objective data and guarantee the development effect. This paper will analyze and study the influence of geological parameters on reservoir development in Daqing oilfield.

**Key words:** Daqing Oilfield; Geological parameters; Reservoir development; Effects on.

## 1. Introduction

Aiming at the development of Daqing oilfield, it has a history of decades in China, which belongs to the water injection development series. Up to now, the water content in Daqing oilfield shows a trend of increasing development, which makes the distribution of oil in Daqing oilfield more and more dispersed. At the same time, coupled with the change of water quality and pollution, the difficulty of reservoir development is deepening, and the traditional reservoir development scheme is not suitable for the current situation of Daqing oilfield. Through the research and exploration of the staff, the study of geological parameters can reasonably optimize the development plan of oil reservoir and ensure the development effect. Therefore, in order to smooth the actual development work, this paper will elaborate on the relationship between the two.

## 2. An overview of Daqing Oilfield

Daqing Oilfield is a super-large continental sandstone oilfield, which is rare in the world. By the end of 2021, the annual output of the third oil recovery of Daqing Oilfield has once again exceeded 10 million tons, and the total cumulative production of crude oil has reached 286 million tons. In 1959, the Ministry of Petroleum Industry discovered the first oil field in songliao Basin and officially named it Daqing Oil Field. In 1960, it was put into experimental development, and in 1963, the end of the test, began comprehensive development, and developed the "Lamadian oil field", "Saertu oil field" and "Xingshugang oil field" three major oil, for China to get rid of the label of lean oil. In 2021, through independent innovation, daqing Oilfield is predicted to have 1.268 billion tons of "shale oil", which marks another breakthrough in China's shale oil exploration.

## 3. An overview of geological parameters

Geological parameters refer to the quantitative indicators of hydrogeological performance of rocks, and are the data obtained from hydrogeological and groundwater resource assessment calculated in hydrogeological survey of water supply. The basic geological parameters include water conductivity coefficient, permeability coefficient, pressure conductivity coefficient, precipitation infiltration coefficient, water level conductivity coefficient, water release coefficient and so on. The author will give a detailed introduction to the above coefficients. ① Water-carrying coefficient refers to the water-carrying capacity data of all the thickness of the aquifer, the hydraulic gradient is one, the unit aquifer through which the groundwater passes, and the vertical section flow is the water-carrying coefficient. In formula calculation, water conductivity coefficient is equal to aquifer permeability coefficient multiplied by aquifer thickness, expressed as T=Km; (2) Permeability coefficient, permeability coefficient, refers to the water conservancy slope is a, groundwater in the ring permeability velocity, can also be called hydraulic conductivity coefficient. It is closely related to the properties of medium, specific gravity, viscosity coefficient and temperature of groundwater. (3) Pressure conductivity coefficient refers to the ratio between water release coefficient and water conductivity coefficient. Under elastic dynamic condition, the

parameter of water head transfer velocity of confined aquifer is pressure conductivity coefficient. The calculation formula is a=T/s; (4) Precipitation infiltration coefficient refers to the ratio between the amount of precipitation infiltration into recharge groundwater and precipitation per unit area. The coefficient is directly proportional to the permeability of the overlying strata and the permeability of the overlying soil layer. (5) Water-level conductivity refers to the variable propagation velocity parameter of the phreatic aquifer under elastic dynamic conditions, namely water-level conductivity, which can also be called hydraulic diffusion coefficient. The calculation formula is AW =Kh/μ. 6 release water coefficient, refers to head down a level, aquifer per unit area, all the thickness of the cylinder, because rock compression, water swelling, the release of water is water coefficient, water level can also be called the elasticity, the coefficient is, as reflected in all the thickness of the aquifer, water capacity of parameter data, calculating formula forS=mSs.

## 4. Analysis on the effect of geological parameters on reservoir development in Daqing Oilfield

In the process of oil reservoir development in Daqing oilfield, the influence of geological parameters on it is reflected in many aspects. This paper will focus on the production situation of oil reservoir, water-flooded oil reservoir, injection-production well spacing, permeability and start-up pressure, so as to provide a basis for the subsequent development of oil reservoir.

### 4.1 Influence on reservoir production

Through the analysis of the basic conditions of Daqing oilfield, it is found that the number of layers and width of the oilfield have an impact on the exploitation effect. In practice, operators need to control the two. With the increasingly complex geological conditions of Daqing oilfield in recent years, the final results may be different even if the exploitation conditions are the same. It is necessary to determine the permeability difference in time and ensure its difference. At the same time, it can be determined that the more layers, the wider the field, the less effective the operation. The effect of geological parameters on oilfield development is mainly reflected in the use of oil layers. For example, when the number of oil layers is 10, the use effect can reach 80% and the thickness of oil layer is about 10 meters. As the number of oil layers increases, the use effect will decrease [1].

### 4.2 Influence on water-flooded reservoir

With the improvement of technological level, the development of petroleum exploitation industry is very rapid, but in this rapid development, there are corresponding problems. The effect of reservoir parameters on reservoir properties at ultra-high water cut stage is no longer significant, so new countermeasures need to be explored to deal with related problems. As mentioned above in Daqing Oilfield, water content is increasing, geological conditions are becoming more complicated, and oil distribution is becoming scattered and sporadic, which is very unfavorable for oil reservoir development [2]. Based on this, the staff will be on the water flooded reservoir physical properties, electrochemical properties, make full analysis, relying on these geological parameters, to build log interpretation model experiment usually adopts the rock physics experiment method, the method of water flooded layer physical parameter measurement, reservoir permeability, porosity, etc., has very important value. Reservoir, such as produce water flooded condition, nature can produce change, the change of resistivity in particular, for this, the relevant staff must observe carefully saturation index changes, the cementation index, etc., all data to carry on the comprehensive analysis, according to the corresponding development principles, explore the root cause of the influence of daqing oilfield development, and build the fact model, In order to facilitate the smooth development of development practice.

### 4.3 Influence analysis of injection-production well spacing

In the actual development work, some technicians will carry out thin inspection and improvement of oil reservoir to promote the improvement of oil reservoir development effect. Based on this, a series of experiments are required to detect the fluctuation of reservoir permeability at different injection-production spacing, which is also related to the active diameter. Injection-production well spacing, effective active diameter and reservoir development effect are closely related to each other. According to the test data, once the permeability of oil reservoir is different, the injection-production well spacing will shrink and show a decreasing trend, and then the startup condition will improve. After the operation is above the injection-production well spacing, the decrease of well spacing means the decrease of permeability [3]. For example, the injection-production well spacing is 100 meters, and the formation to be activated is 20×10-3μm2. Through the judgment and analysis of the above data, it can be concluded that the geological situation of Daqing oilfield is very complicated, and any parameter data will affect the final oil reservoir development effect, among which the influence of injection-production well spacing is more obvious.

### 4.4 Influence analysis of permeability

From the perspective of permeability analysis, there are two aspects of influence. On the one hand, it is the influence of permeability level difference; on the other hand, it is the influence of reservoir combination with high and low permeability. As for permeability difference, its position in geological parameters is very critical, and it also plays a key role in the description of stratified heterogeneity. Relevant staff should pay attention to it in real time. For the geological parameter detection of Daqing oilfield, professional teams and scientific methods should be selected [4]. The formation of multiple of water injection can be created by grouping permeability level difference on the premise of low permeability reservoir. According to the literature, the increase of water injection multiple means that the recovery degree of Daqing oilfield is also increasing, but when the recovery degree reaches 20%, the increase of water injection multiple has no obvious effect on recovery degree. This shows that there is no obvious influence between permeability level difference and water injection multiple, but it is closely related to the recovery degree, and the permeability level difference will become larger when the mining time is longer.

The influence of high and low permeability reservoir combination can be determined by staging the geological parameters of Daqing oilfield. If there is a high permeability and low permeability oil layer combination, plus for daqing oil field water content analysis, can be concluded that travel high permeability reservoir, low permeability reservoir recovery factor, the impact has obvious difference, if you use a solid form, can appear permeability is higher, the higher the recovery, differential have obvious increment. In the case of co-production, the permeability increases in the high permeability zone but the recovery remains unchanged, while the recovery decreases in the low permeability zone, according to the data in Table 1.

**Table 1** Analysis of the relationship between permeability differential combination and recovery factor

| Single well production | | | commingling | | | | |
|---|---|---|---|---|---|---|---|
| | | | High permeability reservoir | | Low permeability reservoir | | Alloy layer |
| permeability($10^{-3}\mu m^2$) | recovery (%) | differential | permeability($10^{-3}\mu m^2$) | recovery (%) | permeability($10^{-3}\mu m^2$) | recovery (%) | recovery (%) |
| 150 | 37.81 | 3 | 150 | 37.82 | 50 | 26.57 | 32.18 |
| 200 | 38.43 | 4 | 200 | 38.36 | 50 | 23.88 | 31.12 |
| 300 | 39.22 | 6 | 300 | 39.03 | 50 | 19.88 | 29.46 |

### 4.5 Influence analysis of starting pressure

For Daqing oilfield, the influence analysis of starting pressure is mainly for low permeability reservoir, and based on this premise, the reservoir development is studied and analyzed. In general, the increase of start-up pressure will lead to the decrease of permeability. When the reservoir permeability exceeds 50×10-3μm2, the start-up pressure will disappear automatically, and when it is lower than 20×10-3μm2, the start-up pressure will appear again and increase continuously. From this, we can also see the complexity of geological parameters in Daqing oilfield. The generation of such complex geological parameters will adversely affect the oil reservoir development effect [5]. This, combined with the increasing resistance to fluid flow, makes it possible to determine the type of sand body and the starting pressure, and there is a correlation between the two.

## 5. Conclusion

To sum up, the exploitation history of Daqing oilfield is very long. Due to the effect of various factors, the geological situation of Daqing oilfield is very complicated at the current stage. Therefore, relevant researchers still need to continue to study the impact of geological parameters on the reservoir development effect, so as to provide reference for the subsequent development work. In this paper, the author makes the above five aspects of analysis and elaboration on the influence of geological parameters on the development effect. In the analysis, we can also see the complex situation of Daqing oilfield, which requires the staff to take certain measures to alleviate the corresponding situation, so as to improve the development effect of oil layer.

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