[*IDENTIFICATION OF MAIN CONTROLLING FACTORS OF OIL RESERVE ABUNDANCE IN DEEP RESERVOIR*]

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Overview

In this study, the oil proved reserve abundance (OPRA, refers to the scale of oil proved reserves of unit area and its measurement is often based on the unit of 10^4t/km^2.) of 775 oil reservoirs over 3500m deep distributed in the basins in eastern, central and western China were counted to find out the relationships between the OPRA and 7 factors (the basin, trap type, reservoir lithology, porosity, oil saturation, reservoir thickness and reservoir depth). The main influencing factors of oil reserves abundance in different reservoirs are identified, and the method basis is provided for the determination of oil reserves abundance in unknown zones by analogy method. At the same time, a method of dealing with discrete parameters is used to determine the relationship between the factors and the abundance of reserves. This method has some reference significance for dealing with the relationship between data of similar types.

Methods

The OPRA is affected by many factors. According to the reserve calculation method (the trap volumetric method), factors which directly affect the OPRA include the reservoir thickness, porosity, oil saturation and so on. The reservoir depth has a direct effect on porosity and an indirect effect on the OPRA. In addition, the statistical results from 775 oil reservoirs show that the OPRA is also affected by the reservoir lithology, trap type and basin. In order to discuss the main controlling factors of the OPRA, the lithologic types of reservoirs are subdivided into the Conglomerate-coarse sandstone, sandstone-silt, dolomite, limestone, igneous rock, metamorphic rock.

(1) Continuous parameters

Continuous parameters include the reservoir thickness (Rh), porosity (Phi), oil saturation (Og) and depth (Rd). If the correlation coefficients between the Rh, Phi, Og, Rd and the OPRA are greater than 0.5, it is a key factor. Otherwise, it is not.

(2) Discrete parameters

Discrete parameters include the trap type (Tr) and basin (Bs). In order to find out relationship between the Tr, Bs and the OPRA, discrete parameters have to be processed. Taking the sandstone-silty reservoir in the basin as an example, the average reserve abundance of the seven basins is taken as the variable value (X-coordinate value), The X coordinate values of Bohai Bay, Ordos, Sichuan, Qaidam, Tarim, Tuha and Junggar basins are 48.81, 31.69, 8.19, 31.88, 46.22, 109.05 and 54.1 respectively. In the same way, the X coordinate values of trap type anticline structure, non-anticline structure, lithology and strata are 59.8, 48.9, 48.75 and 33.03 respectively.

The relationship between discrete parameters and reserves abundance can be obtained by using the above method.

. (3) Key factors and weights

The correlation coefficients between four continuous parameters (Rh, Rd, Phi, Og) and two discrete parameters (Tr, Bs) and the OPRA are taken as the basis for determining the weight. The formula for calculating the weights of each parameter is as follows:

$$W_i = \frac{R_i}{\sum_{i=1}^{n} R_i} \times 100$$

where Wi: the weight of parameter i, %;

Ri: the correlation coefficient between parameter i and the OPRA, decimal;

n: the number of parameters, is 6 in this paper.

The better the correlation with reserves abundance, the greater the weight.

Results

The weight of each parameter of different reservoir oil reservoir is calculated by the above method. (1) the reservoir of conglomerate and coarse sandstone reservoir: the main factors (the first three) are reservoir thickness, basin, oil saturation; (2) the sandstone-silt reservoir: the main factors are reservoir thickness and oil saturation; (3) the dolomite reservoir: the main factors are reservoir thickness and oil saturation; 4) the limestone reservoir: the main factors are the basin and depth; (5) the igneous rock reservoir: the main factors are porosity and trap type respectively; (6) the metamorphic reservoir: the main factors are reservoir thickness, porosity and oil saturation.

Conclusions

The main controlling factors of reserve abundance are different in different lithologic reservoirs, and the quantitative relationship between reserves abundance and discrete data can also be described.

References

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