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Quantitative fluorescence technology in tight reservoirs application research

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Summary

The target layer for the study is the Mesozoic Triassic Yanchang Formation,Ordos basin,China. Based on logging and oil testing data, this project will analyze and summarize the response characteristics of 3D quantitative fluorescence logging of different reservoir fluids. Summarize the rules of these response characteristics, and obtain the three-dimensional quantitative fluorescence interpretation evaluation chart and standard of the tight reservoir. The research results of this project have essential application value and prospects for discovering new oil and gas reservoirs and improving the coincidence rate of field oil and gas interpretation.

Method

The reservoir characteristics are analyzed based on the thin section of the rock reservoir, reservoir physical properties, and mercury intrusion. On this basis, the pyrolysis and three-dimensional fluorescence analysis are comprehensively adopted, and the oil and gas classification standard and chart of low permeability reservoir are established in combination with the oil test data.

Results

This study collected standard drilling fluid systems in the study area, identified six typical additive samples that may produce fluorescence, conducted three-dimensional quantitative fluorescence collection and analysis of common organic additives in different drilling fluid systems, and analyzed the drilling fluid additive atlas database and data. On this basis, the 3D fluorescence data of 10 wells are analyzed.

In evaluating oil and gas reservoirs, we introduced the oil index (Oc) to characterize the difference in oil quality better[1-3]. The oiliness index refers to the ratio of the heavy and medium components' burning intensity to the light components' burning intensity in the same lithologic sample. The higher the oiliness index is, the heavier the oil is and the higher the crude oil density is; On the contrary, the lighter the oil, the smaller the crude oil density. For the quantitative fluorescence logging method in the oil field, the oil content (oil concentration C) is equivalent. The calculation of oil concentration generally adopts the single-point calibration method. That is, the burning intensity of the prominent peak is used to calibrate the calculation to calibrate the oil content of the reservoir in the study area. Therefore, the oiliness index of crude oil with different properties in the study area is summarized, and the oil concentration chart of the oiliness index is obtained.

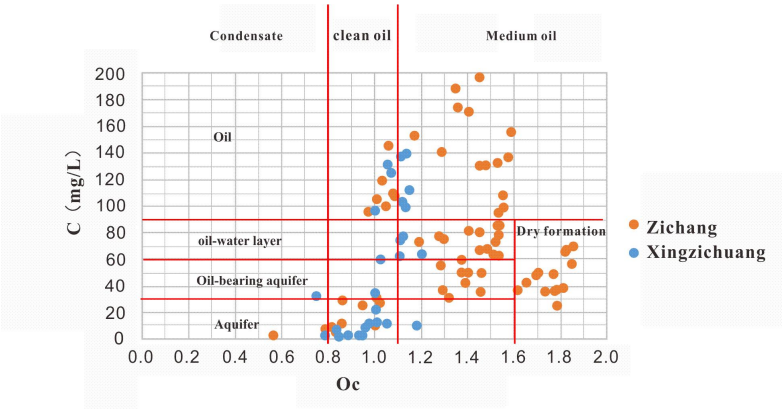

Fig. 1 Three-dimensional fluorescence characteristics of of different oil-bearing reservoirs

Figure 1 shows the statistical relationship between the oil index and oil concentration of samples from 10 wells and tight reservoir intervals in the study area. The analysis chart shows that the two parameters, C and Oc, complement each other. With the increase of Oc, the limit value of the oil layer division keeps rising; Considering the oil quality, the oil concentration in the oil area, oil-water area, and dry area decreases in turn; When the C value is fixed, the Oc increases, and there is a sign of water content. The sample oiliness index of Xingzichuan Oil Production Plant is between 0.7 and 1.2, belonging to the light oil - medium oil type; The sample oiliness index of Zichang Oil Production Plant is between 0.5 and 1.9, including light oil, medium oil, and heavy oil. See Table 2 above for the classification criteria of oil quality types. The equivalent oil content of the samples from the Xingzichuan Oil Production Plant is 1.79-139.74mg/L, and the equivalent oil content of the samples from the Zichang Oil Production Plant is 2.63-196.79mg/L.

Conclusion

1. The reservoir interpretation and evaluation method and chart applicable to the three-dimensional quantitative fluorescence logging technology of the Yanchang Formation in the study area have been established. The condensate and light oil easily lost in conventional logging can be found in time, and the discovery rate of oil and gas display in logging can be improved.

2. As a new logging method, the quantitative fluorescence logging technology has improved the application value of more reliable data under some unique reservoir and special drilling technology conditions. It is more practical to popularize this technology.

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