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Porosity well logging prediction for tight oil reservoirs with variable matrix parameter in Zahaquan area, Qaidam Basin

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Tight oil reservoirs were found in the lower member of Upper Ganchaigou Formation, Zahaquan area, Qaidam Basin. The sandstones with complex and variable mineral composition are the main tight reservoirs. The mud content and carbonate content are the variable parameters in the sandstones. The variable skeleton parameters are difficult to be determined. The porosity quantitative prediction is more difficult in well logging processing and interpretation [1]. Meanwhile, because of the low porosity, the pore contribution to the well logging responses is smaller, which affects the porosity accuracy prediction. In view of the complex geological characteristics and well logging response characteristics of tight reservoirs, it is proposed to predict the tight reservoir porosity by selecting the sensitive well logging responses and by the multiple optimization methods.

1. According to the natural gamma-ray spectrum (NGS) and neutron (CNL) well logging data analysis, the mud content is predicted in sandstone. Furthermore, because the well logging response characteristics of acoustic (AC), density (DEN) and neutron (CNL) well logging data are the comprehensive results of sand, mud, carbonate and pore, by NGS, AC, DEN and CNL data and by core porosity analysis, multiple regression equations can be established and the porosity can be predicted.

2. The rock thin section identification and the X-ray diffraction analysis results reveal that the sandstone detritus are quartz and sodium feldspar, the main cementing minerals are calcite and dolomite, the clay mineral is illite. Therefore, the mineral compositions are determined as quartz, sodium feldspar, calcite, dolomite and illite. Then, using the well logging data of the photoelectric absorption index (Pe), AC, DEN, CNL, NGS and the core data, the regression equations based on multi mineral optimization model can be established to predict the tight reservoir porosity [2].

3. The relative content of the various and complex mineral components are calculated by elemental capture spectrum well logging data processing and interpretation. Then, the mud content and the skeleton parameters of AC, DEN and CNL can be calculated, the porosity can be predicted by AC, DEN, CNL and NGS well logging data processing and interpretation.

4. Through the high resolution nuclear magnetic resonance well logging data acquisition, as far as possible to capture the information of fine pore in tight reservoirs, so porosity and pore structure parameters can be effectively evaluated in the tight reservoirs [3].

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