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Study on Pore Structure Characteristics of Tight Sandstone Oil Reservoir: Evidences from Chang 7 Member in Ordos Basin, China

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Pore structure of tight sandstone oil reservoir has a strong influence on reservoir physical property, and it is one of the core issues to evaluate reservoir (Zou et al. [1]). Based on NMR core analyzing system, samples of tight sandstone reservoir from Chang 7 Member in Ordos Basin are analyzed. Taking into account of porosity, permeability, movable fluid saturation and other key physical parameters (Zhao et al. [2]), the paper proposes "effective porosity of movable fluid" (φem), a new parameter to characterize the pore structure of tight sandstone oil reservoir. Data analysis reveals that the new parameter has a slight correlation with porosity and movable fluid porosity, but a better correlation with permeability and movable fluid saturation, which indicates that φem is influenced by more than one factor. In addition, φem integrates multiple physical parameters of reservoir, and specifically includes movable fluid that cannot be separated from pore due to the restriction of tiny throat. Therefore, φem can make a more comprehensive and accurate evaluation on characteristics of pore structure. Based on the definition and macroscopical analysis of the new parameter, control action of diagenesis on φem is investigated from microscopic view, by using casting thin sections and scanning electron microscope. The results show that destruction and modification of compaction has a strong impact on reservoir pore structure, making φem reduce obviously. Cementation results in blockage of pore space, generating the decrease of φem. Dissolution plays a great role in the improvement of pore-throat connectivity, and φem increases with dissolution intensity. According to the three physical parameters, porosity (φ), movable fluid porosity (φm) and effective porosity of movable fluid (φem), tight sandstone oil reservoir can be quantitatively divided into three types. Type I reservoir has porosity 7%~10%, movable fluid porosity larger than 3% and φem larger than 2%. Type II reservoir has porosity 4%~7%, movable fluid porosity 1.5%~3% and φem 1%~2%. Type III reservoir has porosity smaller than 4%, movable fluid porosity smaller than 1.5% and φem smaller than 1%. Combined with oil testing data, the results show the reliability of using new parameter φem to investigate pore structure of tight sandstone oil reservoir and make reservoir classification.

References:

[1] Zou C et al. (2011) In: *Unconventional oil and gas geology*: Beijing Geology Publishing House, 1-310.

[2] Zhao J et al. (2014) China Petroleum Exploration 19(5): 73-79.