

Research on Tight Sandstone Oil Accumulation Process of the Third Member of Shahejie Formation in Dongpu Depression, China

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Abstract : In recent years, tight oil has become a hot spot for unconventional oil and gas exploration and development in the world. Dongpu Depression is a typical hydrocarbon-rich basin in the southwest of Bohai Bay Basin, in which tight sandstone oil and gas have been discovered in deep reservoirs, most of which are buried more than 3500m. The distribution and development characteristics of deep tight sandstone reservoirs need to be studied. The main source rocks in study area are dark mudstone and shale of the middle and lower third sub-member of Shahejie Formation. Total Organic Carbon (TOC) content of source rock is between 0.08-11.54%, generally higher than 0.6% and the value of S1+S2 is between 0.04-72.93 mg/g, generally higher than 2 mg/g. It can be evaluated as middle to fine level overall. The kerogen type of organic matter is predominantly type II1 and II2. Vitrinite reflectance (Ro) is mostly greater than 0.6% indicating that the source rock entered the hydrocarbon generation threshold. The physical property of reservoir was poor, the most reservoir has a porosity lower than 12% and a permeability of less than $1 \times 10^{-3} \mu\text{m}$. The rocks in this area showed great heterogeneity, some areas developed desserts with high porosity and permeability. According to SEM, thin section image, inclusion test and so on, the reservoir was affected by compaction and cementation during early diagenesis stage (44-31Ma). The diagenesis caused the tight reservoir in Huzhuangji, Pucheng, Weicheng Area while the porosity in Machang, Qiaokou, Wenliu Area was still over 12%. In the process of middle diagenesis phase stage A (31-17Ma), the reservoir porosity in Machang, Pucheng, Huzhuangji Area increased due to dissolution; after that the oil generation window of source rock was achieved for the first phase hydrocarbon charging (31-23Ma), formed the conventional oil deposition in Machang, Qiaokou, Wenliu, Huzhuangji Area and unconventional tight reservoir in Pucheng, Weicheng Area. Then came to stage B of middle diagenesis phase (17-7Ma), in this stage, the porosity of reservoir continued to decrease after the dissolution and led to a situation that the reservoirs were generally compacted. And since then, the second hydrocarbon filling has been processing since 7Ma. Most of the pools charged and formed in this procedure are tight sandstone oil reservoir. In conclusion, tight sandstone oil was formed in two patterns in Dongpu Depression, which could be concluded as 'density first then accumulation' pattern and 'accumulation first next density' pattern.

Keywords : accumulation process, diagenesis, dongpu depression, tight sandstone oil

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