

Tight Oil Accumulation of Yanchang Formation in Ansai Area, Ordos Basin, North China

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Abstract

The Ordos Basin, situated at the west of the Northern China Platform, is the second largest hydrocarbon-bearing onshore basin in China. Exploration has confirmed that the Ansai area in the mid-east of the Ordos Basin is one of the most important tight oil enrichment zones. However, a poor understanding of the tight oil accumulation model and enrichment mechanism has impeded petroleum exploration. This paper attempts to describe the tight oil accumulation characteristics and analyze the tight oil dynamic accumulation processes in the Ansai area. We propose the concept of reservoir critical porosity for the dynamic reservoir evaluation, establish a mathematical model of sandstone porosity evolution for the paleoporosity reconstruction, calculate the migration force for the analysis of oil migration process, determine the critical burial depth to evaluate the sealing property by the functional relationship between mudstone displacement pressure and burial depth, and simulate the critical condition for oil charging into sandstone with an oil-charge simulation experiment. The results indicate that the reservoir critical porosity of the Yanchang Formation in the Ansai area was 10% during the accumulation period. The present tight sandstone reservoirs were conventional reservoirs during the oil accumulation with relatively high porosity and permeability, beneficial for oil accumulation at the time. As for the migration condition during the accumulation period, the migration force, ranging from 8MPa~10MPa, is far more than the resistance. The tight oil reservoirs can be effectively sealed because the burial depth of the mudstone is greater than the critical burial depth (1200 m). The critical hydrocarbon accumulation threshold for a sandstone reservoir depends on the coupling of reservoir critical porosity and critical charging pressure during oil accumulation. In conclusion, the conditions of the reservoir property, migration force and sealing property are favorable for oil accumulation. Moreover, the reservoir critical porosity and critical injection pressure appear to be the main controlling factors of tight oil accumulation in Ansai area.