Geologic Characteristics and Hydrocarbon Accumulation Mechanism for Continuous Oil Reservoirs in Songliao Rift-Depression Basin in NE China

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A typical case on unconventional continuous oil reservoirs in Upper-Cretaceous Quantou tight sands formation in south Songliao basin in NE China is cited in this article, and geologic characteristics and hydrocarbon accumulation mechanisms on such type unconventional reservoirs are summarized.

1. Geological characteristics

In post-rift-depression phase of Late-Cretaceous, large-scale fluvial-delta Quantou sands and lacustrine Qingshankou mudstone sequently deposited in Songliao basin which covers an area of 260 thousand km2 in NE China, and a close reservoir-source contact construction formed, with a 200 to 500 meters thick cap rock above. Quantou sands are 110-120 meters thick, with porosity 5-12%, permeability lower than 10 mD, even pore throat diameter 20-200 nm, and excess pressure 6-14 MPa; Qingshankou mudstone are 100-150 meters thick, with TOC 1.06-2.68%, Ro 0.8-1.3%. Furthermore, Quantou reservoirs feature continuous tight sands distribution, oil-water inversion, non Darcy infiltration flow, weak fluid differentiation, diverse oil saturation, no uniform oil/water or gas/water contacts and pressure system, excess pressure mainly from hydrocarbon generation and limited role of buoyancy, commonly lower production, but local enrichment.

2. Hydrocarbon accumulation mechanisms

As located in the center or slope of the basin, oil generated from Qingshankou mudstone was blocked by seals above and forced to migrate downward to Quantou sands. This hydrocarbon accumulation model in deep tight sands in Songliao basin can be called “Overpressure Hydrocarbon Reversed Accumulation Model”. In the burial history, when the pressure generated by source rock maturation exceeded buoyancy and capillary pressure, oil was displaced downward to Quantou sands by the overpressure. In this process, overpressure from source rock, faults, and favorable sands are the factors which control the forming and distribution of large-scale continuous oil reservoirs.

3. Application

Oil pool with low or ultra-low permeability in the center or slope of Songliao basin falls into typical unconventional continuous oil reservoir. Ordos basin and many other similar basins in China have such hydrocarbon accumulation conditions. Using the theory of unconventional continuous oil reservoirs, more and more continuous tight oil reservoirs will be found in depression syncline areas.