

Exploration of Low-Permeability Lithological Reservoirs in the Triassic Yanchang Formation, Ordos Basin, China

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The Triassic lacustrine Yanchang Formation (500 to 1200 m thick) in the Ordos Basin contains several reservoir intervals. Most of the reservoirs are of low to extra-low permeability of 3~0.1 mD and moderate porosity of 9~12 %. The reservoir distribution is primarily controlled by delta sand bodies that spread across a large area in the NE-SW orientation in the basin. The deltaic front sub-facies were identified as the most favorable facies for oil or gas accumulation. The early developed chlorite films are found to have enhanced the pressure-resisting capability of pores and pore throats of the sandstones and protect the primary intergranular pores. Secondary pores formed by dissolution of some easily-dissolved minerals such as laumontite and feldspar further improved the oil and gas-bearing capability of the sandstones. With a favorable tectonic depositional setting in the basin, the reservoir sand bodies integrate with the tight lithological zone in the up-dip direction and the mudstone cap-rock laterally, forming large-scale lithological traps.

A suite of adapted technologies for exploring the low-permeability lithological reservoirs has been formulated including (1) the integration of seismic data with reservoir geology to delineate the main oil-bearing sand-body zones, and (2) the application of innovative log analysis method to improve the success rate in identification of low permeability, low resistance, and complex lithological reservoir intervals. With the implementation of the innovative exploration technologies and a dynamic assessment of petroleum resources, the proven reserve of petroleum resources in the Ordos Basin has increased steadily in the past few years.