INTRODUCTION

The Sulige Gas Field in the central Ordos Basin (Fig. 1) was discovered in 2000 and was put on stream in November 2003. The field was estimated to contain 18.85 Tcf of proven in-place gas in a gas-bearing area of 6,500 square kilometers, making it the largest in China. The stratigraphic reservoirs are characterized by low gas richness, low reservoir pressure, low permeability, and significant reservoir heterogeneity. The net pays consist of relatively high permeability sandstones that are encased among the low permeability tight sands (Fig. 2).

STRATIGRAPHY

Reservoirs in Sulige Gas Field are dominated by coarse-grained sandstones of the Lower Permian Shihezi and Shanxi formations, especially those of the Shihezi 8 and Shanxi 1 units (Fig. 3). These sands, with an average burial depth of 3,200-3,500m, were deposited in a braided-river environment.

PETROPHYSICS

Sandstones in the Sulige Gas Field are characterized by low porosity and low permeability (Fig. 4). The porosity and permeability cutoff for net pays is 5% and 0.03 mD, respectively. Coarser sands have higher porosity and permeability, and hence better reservoir quality (Fig. 5&6). However, medium- and fine-grained sandstones do not form productive reservoirs.

RESERVOIR SANDSTONES ARE CHARACTERIZED BY LOW POROSITY AND LOW PERMEABILITY. THE POROSITY AND PERMEABILITY CUT-OFF FOR NET PAYS IS 5% AND 0.03 MD, RESPECTIVELY. COARSER SANDS HAVE HIGHER POROSITY AND PERMEABILITY, AND HENCE BETTER RESERVOIR QUALITY. HOWEVER, MEDIUM- AND FINE-GRAINED SANDSTONES DO NOT FORM PRODUCTIVE RESERVOIRS.

SANDSTONE PETROGRAPHY & DIAGENESIS

SANDSTONES IN THE SULIGE GAS FIELD ARE CHARACTERIZED BY LOW POROSITY AND LOW PERMEABILITY. THE POROSITY AND PERMEABILITY CUT-OFF FOR NET PAYS IS 5% AND 0.03 MD, RESPECTIVELY. COARSER SANDS HAVE HIGHER POROSITY AND PERMEABILITY, AND HENCE BETTER RESERVOIR QUALITY. HOWEVER, MEDIUM- AND FINE-GRAINED SANDSTONES DO NOT FORM PRODUCTIVE RESERVOIRS.

Reservoir sandstones are typically lithic sandstones, with rock fragments dominated by quartzite, phyllite/slate, and volcanics (Fig. 7). High content of quartzitic fragments and quartz grains (Fig. 8) in coarse-grained sandstones is responsible for the preservation of primary porosity. Fluid circulation in primary pores resulted in the formation of secondary porosity. In contrast, medium- and fine-grained sandstones have a high content of soft rock fragments. These soft rock fragments experienced tight compaction, leading to a decreased primary porosity and poorly developed secondary porosity. Sedimentary facies control sandstone textures and compositions, diagenetic facies, and reservoir quality (Fig. 9).