

Filling Characteristics, Reservoir Features and Exploration Significance of a Thick Volcanostratigraphic Sequence in a Half-Graben Basin

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ABSTRACT

A volcanostratigraphic unit composed primarily of thick massive trachyandesite is present at the bottom of the Huoshiling formation in the Wangfu rift depression, Songliao basin, NE China. This volcanostratigraphic unit represents approximately 58% of the volume of the fault-controlled depression and approximately 28% of the volume of the entire Songliao basin. This volcanostratigraphic unit has experienced different burial stages. This volcanostratigraphic unit developed 3 types and 6 sub-types of reservoir space. Secondary pores are the most common, primary pores are the second most common, and fractures are the least common. The widespread weathering/leaching, deep-burial alteration and tectonism formed large quantities of secondary pores and fractures. Moreover, secondary pores, a few primary pores and some secondary fractures form a reservoir with low to moderate porosity and permeability values. The porosity ranges from 0.3-16.7%, and permeability ranges from 0.0004-93.78 mD. The reservoir composed of pyroclastic lava and clastic rocks is usually good, and a belt of high porosity/permeability is located within the range of 0-70 m from the upper volcanostratigraphic boundary. The release and capture of volatile matter, particle-supported characteristics, weathering and deep-burial alteration promoted the development of a good reservoir, and weathering and deep-burial alteration were the main factors responsible for the formation of an excellent reservoir at the top of the volcanostratigraphy. Based on daily single-well output data, weathering/leaching appears to be a necessary condition for the formation of an industrial-scale gas reservoir. The areas with weathering and leaching or with weathering all belong to volcanic inherited highlands, which later formed structural traps. In conclusion, excellent reservoirs developed in the thick volcanostratigraphy of half-graben basin; these reservoirs of the Wangfu rift depression are located in the middle slope area, the western sag and several large-scale palaeohighs in the eastern uplift.