

NEOPROTEROZOIC RIFT AND RELATED HYDROCARBON SYSTEMS OF THE TARIM BASIN

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Introduction

As an ancient set of source rocks in global petroliferous basins, the Nanhua and Sinian source rocks are widely distributed in many cratons including the Eastern Europe, Siberia, North America, Africa, Australia, North China, South China, and India.

In recent years, large Sinian carbonate gas reservoirs were also found in the Sichuan Basin, South China Craton that further confirm the existence and huge exploration potential of the Neoproterozoic source rocks. Being the largest petroliferous basin in China, the Proterozoic and Lower Paleozoic in the Tarim Basin have become important exploration targets along with the deepening of hydrocarbon exploration. Synchronous source rocks are supposed to develop in the Tarim Craton as well in view of its similar evolution process to that of the South China Craton during the Neoproterozoic.

Under the background of Neoproterozoic global rifting, the outcrop, drilling, and seismic data were integrated in this study to research on the Neoproterozoic rifts and related source rocks in the Tarim Basin. The focuses are the identification of rifts, evaluation of source rocks, and further determining the structural control factors and sedimentary model for the development of source rocks. All these will provide a scientific basis for the deep hydrocarbon exploration in the Tarim Basin.

Results and Discussion

Outcrop, drilling, and seismic researches are integrated in this paper to focus on the Precambrian rifts and related hydrocarbon systems in the Tarim Basin. The Tarim is composed of three Nanhua to Sinian rift systems, i.e., the Manjar, Awati, and South Tarim rift basins that show a distribution of south and north differentiation. Compared with the Nanhua basins, the Sinian basins are characterized by deposits with small thickness and wide distribution.

The Nanhua to Sinian rifts have a typical dual structure, namely the Nanhua faulting and Sinian depression with distinct structural and sedimentary characteristics. The Nanhua faulting basins are dominated by a series of grabens or half grabens, which have a wedge-shaped rapid filling structure. The rift basins evolved into Sinian depressions when the faulting and magmatic activities diminished, and widespread overlapping sedimentation occurred.

The distributions of the Nanhua and Sinian source rocks are obviously controlled by the Neoproterozoic rifts. The present outcrops are mainly located in the margin of the Nanhua faulting basins where the rapid deposition dominates and the argillaceous rocks have low total organic carbon (TOC) contents, but the source rocks with high TOC contents probably developed in the center of the faulting basins. The Sinian source rocks with TOC content

of 0.3-1.0% in the outcrops formed in deep water environment of the Sinian depression basins, and may be widely distributed in the Tarim Basin with thickness of 50-200 m and distribution area of more than 200,000 km². The discovery of the Nanhua and Sinian source rocks would open up a new field for the deep hydrocarbon exploration in the Tarim Basin.