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Sedimentary facies and gas accumulation model of Lower Shihezi Formation in Shenguhao area, northern Ordos basin, China

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The Lower Shihezi formation of lower Permian series in Shenguhao develops the highest gas abundance of upper Paleozoic in China, which has already commercially produced on a large scale. The structural location of Shenguhao belongs to the transition zone of Yimeng uplift and Yishan slope of northern Ordos basin, China. Based on the data of core, well logging and seismic, the sedimentary facies and gas accumulation model have been studied in this paper. Sedimentary facies analysis shows that the braided delta is the major facies type developed in this area during the period of Lower Shihezi formation. The braided delta can be further divided into two microfacies, distributary channel and flood plain. The distributary channel sandbody develops the characteristics of scour surface, trough cross beddings and normal grading sequences. Its seismic reflection structure is with the shape of flat top and concave bottom. Its gamma-ray logging curve is mainly in a box or bell shape. The flood plain is mainly composed of thick mudstones. Its seismic reflection structure is with the shape of parallel or sub-parallel sheet. Its gamma-ray logging curve is mainly in a linear tooth shape. On the whole, the distribution of sandbody is characterized by large thickness, wide area and good continuity. Based on the analysis of the sea level change and the restoration of the ancient landform in the period of Lower Shihezi formation, the sea level relative change and morphology of ancient landform have been considered as the main controlling factors for the development and distribution of sedimentary facies. The topography was with big topographic relief, and the sea level was relatively low in the early stage of Low Shihezi formation. The sandbody distributed chiefly along the landform depressions. The sandbody mainly developed in the pattern of multiple vertical superpositions with thick layer. In the later stage, landform gradually converted to be flat, and strata tended to be gentle. With the sea level gradually increasing, the lateral continuity of sandbody gradually became worse and gradually transformed into the pattern of single and isolated. The analysis of the typical gas accumulation profile of the Lower Shihezi Formation in the study area reveals that the formation of gas pools is mainly controlled by the distribution of sedimentary facies, faults and high point of structures. Generally, the types of gas pool developed in the study area can be divided into up dip pinch out gas pool, fault block gas pool and microstructure gas pool. The coal bearing strata of the underlying Taiyuan Formation and Shanxi Formation are the main hydrocarbon source rocks of the Lower Shihezi Formation. The gas transporting channel and lateral sealing composed by fault and sandbody constitute the key to form an effective gas pool, which usually made up of good lateral sealing, great thickness and good connectivity.