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Study on tight sandstone gas accumulation process in transition zone of basin-margin: A case study of Duguijiahan block, Hangjinqi area, northern Ordos Basin, China

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Hangjinqi area is located in the northern margin of Ordos Basin in north China, the main body of which is on the inherited palaeo-uplift, and has been considered as a favorable oil-gas accumulation direction area. Duguijiahan block structurally located in the middle of Hangjinqi area, in the fault transition zone of Boerjianghaizi fault and Wulanjilinmiao fault, which is a transition area from quasi-continuous gas reservoir to continuous gas reservoir. By analyzing the reservoir characteristics and evolution process of tight sandstone gas reservoirs, the thermal maturation history of source rocks and the history of natural gas charging in Lower Shihezi Formation, this paper studies the natural gas accumulation process in the transition zone between quasi-continuous and continuous gas reservoirs, hoping to contribute to tight gas exploration in Ordos Basin and other basins with similar tectonic backgrounds in the world. The results show that the initial porosity of the Lower Shihezi Formation in Duguijiahan block is about 32~36%, and experienced the porosity decreasing of compaction (avg. = 18.58%) and cementation (avg. = 11.03%), and porosity increasing of dissolution (avg. = 1.24%). The sandstone densification (porosity <10%) occurred in the mid-late Jurassic (~170–150 Ma). Due to tectonic uplift from the end of the Early Cretaceous to the present day, the present porosity has basically inherited the characteristics of the end of the Early Cretaceous, and the average porosity is only 8.4%. On the other hand, based on the homogenization temperature test of fluid inclusions, laser Raman spectroscopy analysis of gas inclusions and basin simulation, the hydrocarbon charging time of the Lower Shihezi Formation gas reservoir in Duguijiahan block is early Cretaceous (~145-100Ma), indicating that the gas charging time of the gas reservoir in the study area is later than the reservoir densification time. Furthermore, the natural gas charging time in the study area is characterized by gradual charging from south to north, indicating that the early natural gas charging is mainly affected by the maturity of underlying source rocks. From the end of early Cretaceous to now, it is the adjustment period of natural gas accumulation in the study area. The continuous tectonic uplift leads to the decrease of geothermal temperature, the loss of reservoir pressure and the formation of fractures. The natural gas charged in the early stage gradually migrates and accumulates along the northern up-dip direction of the fracture zone. The Lower Shihezi Formation was pinched out in the northern Gongkahan uplift to form effective blocking. The migration process of natural gas has been confirmed by the present exploration findings, the relationship between porosity and permeability of reservoir physical properties and the difference

of natural gas components in the north and south.