Characteristics and its mainly controlling factors of dolomite reservoir in the late Ediacaran Dengying Formation, central Sichuan Basin, SW China

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The late Ediacaran Dengying Formation (known as Sinian in China) is one of the oldest carbonate reservoir in the world. Carbonate reservoirs, especially karst reservoirs, have significant heterogeneity. Research on their developmental characteristics and genetic mechanisms has been a hot and difficult issue in sedimentary and reservoir geology research at global. In 2011, the well GS1 in the Gaoshiti-Moxi tectonic belt in the central of Sichuan Basin produced about more than 1 trillion m³, demonstrating good prospects for exploration in this area. The analysis of reservoir characteristics and main controlling factors in central Sichuan is an essential because of the old stratum, deep burial, and complicated diageneis.

To fully understand the reservoir rocks, the reservoir types, the physical characteristics and the reservoir genetic types in the D4 member (the fourth of Dengying Formation), studies of the core and field profiles as well as reservoir analysis were undertaken. According to the characteristics of carbonate reservoirs in this area, the controls of sedimentary facies, high-frequency sequence interface, diageneis and tectonic movement are analyzed. The results show that the rock types in D4 member are mainly dolomitized grainstone, algal-rich dolomitized wackstone dolomite and micritic dolomite. The reservoir spaces include caves and dissolved vugs, followed by fractures, and have generally low porosity and low permeability. Three types of reservoirs are identified, which are early-stage karst mound-shoal reservoirs, late-stage karst superimposed reservoirs and other factors impacted reservoirs (fracture modified reservoirs and hydrothermal-tectonic reservoir). The sedimentary facies are the material basis for a favorable reservoir. Among them, the shoal and microbial mounds developed in the platform margin and platform interior have the best physical properties. The shoal reservoirs include acicular-shaped and dissolved pores and holes and the microbial mounds reservoir spaces are dominated by Straight layer dissolved pores and caves. The fourth-order sequences strictly control the development of the early-stage karst mound-shoal reservoirs, and the high-quality reservoirs generally develop at the top of the high-level system domain. The key factors of karstification for the improvement of reservoir quality are meteoric water erosion and organic acid erosion. The meteoric-water karstification controlled late-stage karst superimposed reservoirs which reservoir spaces are honeycomb-shaped caves and dissolved vugs. The organic acid karstification enlarge the existing pores and fractures. The fractures formed by the tectonics improve the permeability of the reservoir and play a vital role in the formation of high-quality reservoirs.

Key words: carbonate reservoir, reservoir characteristics, Sichuan basin

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