

Emei Taphrogeny and Distribution and Gas-Bearing Properties of Permian Volcanoclastic Rock in Sichuan Basin

Danlin Ying, Guohui Li, Guang Yang, Yi Fan

Exploration and Development Research Institute of PetroChina Southwest Oil & Gasfield Company

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Emei taphrogeny was a wide-ranging tectonic movement and a strong extensional movement of the Upper Yangtze Platform from the Devonian Period to the Middle Triassic System. It was characterized by massive basic and ultrabasic magmatic exhalations in the Southwest Region, with the climax of basalt eruption in the Late Permian Emeishan. It was a major geological event, which not only had the effect in six southwestern provinces and formed the Youjiang Continental Margin Rift Basin (D-P), the Xianggui Intracontinental Rift Basin (D3-P) and the Lower Yangtze Rift Basin (C-P) in South China, but also impacted the vast area of Tarim Fossil Plate. At the end of 2018, a high-yield industrial gas stream was obtained in an Upper Permian Volcanoclastic Rock Exploration Well in the Southwestern Sichuan Basin. It was the first volcanoclastic rock industrial gas well in Sichuan Basin, indicating an important gas-bearing layer of volcanic rocks in Sichuan Basin. Early studies suggested that the Upper Permian basalts in Sichuan Basin were distributed in the southwestern and eastern regions of Sichuan, of which the former was the volcanic overflow lithofacies and the latter the intrusive lithofacies. Recent exploration studies have shown that there were central volcanic effusive lithofacies in the basin, of which the lithologic association and distribution characteristics were significantly different. The regional geological analysis based on outcrop, core and seismic data has been made to study the volcanic rock distribution and gas reservoir characteristics in the basin, finally forming the following understandings: 1. For both central eruption and fissure effusion, the volcanic activity is controlled by the deep tensile fault. 2. The fissure effusion and the

central eruption show different volcanic rock combinations and distribution characteristics, but both have a typical rhythmic structure, which reflects the cyclicity of volcanic activity. 3. Permian volcanoclastic rock in the gas-producing well is characterized by low SiO_2 and high $\text{Na}_2\text{O}+\text{K}_2\text{O}$ contents, and belongs to the alkaline transitional rock between the tholeiite series and alkaline basalt series. The rock and mineral analysis indicates intense secondary alteration of basalt. 4. Volcanoclastic rock is mostly an early product of volcanic activity and is featured by distribution around crater. 5. Volcanoclastic rock develops with many types of pores, mainly micron-sized micropores, which may come into being by devitrification. The rock reservoir has good physical properties compared with overflow basalts, so it may form gas reservoir under other desirable geological conditions, which is a new type of gas reservoir in Sichuan Basin.