Hydrocarbon Storage Space, Migration History and Driving Force of the Daanzhai Member of Jurassic in Sichuan Basin

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Abstract

Reservoir rock of Daanzhai Member of Jurassic in Sichuan Basin is very tight. Whether this reservoir is a typical tight oil reservoir or a fracture oil reservoir is a great question. Since the development technologies are so different between these two reservoirs, figuring out this question is of great significance. Different kinds of methods, including casting and fluorescence thin section, mercury injection, fluid inclusion analysis, FESEM, ESEM, Nano-CT and physical simulation of hydrocarbon migration were utilized to study the reservoir. Through research, 3 scales of storage space were found in reservoir matrix, including macro-scale (>1.0mm), micro-scale (1.0μm-1.0mm), and nano-scale (1.0nm-1.0μm). Nano-scale pores is the major storage space, accounting for 91.28% of the whole storage space volume in tight reservoir. According to the diagenesis study and fluid inclusion analysis, it was found that reservoir tightness had almost finished when hydrocarbon charged. And the homogenization temperature of inclusions are mainly between 55-75℃, 80-100℃, and 105-135℃, corresponding to Middle-Late Cretaceous, Middle-Late Paleogene, and Late Neogene-Quaternary. Only the first charging stage coincided with the end of cementation. In short, when most hydrocarbon accumulated, reservoir rock was already tight. Physical analog experiment of hydrocarbon generation revealed that the maximum overpressure caused by hydrocarbon generation in the study area could reached to 38 MPa, large enough to break through the migration resistance of tight oil. Moreover, the positive correlation between single well output and formation pressure coefficient of tight oil layers contacted with the source rock is another proof for the viewpoint

that overpressure caused by hydrocarbon generation is closely connected with the accumulation of tight oil. In brief, reservoir rock of Daanzhai Member is very tight, but numerous matrix pores developed within it, and the tightness almost finished before the hydrocarbon charging. Though the reservoir is very tight, hydrocarbon could still migrate and accumulate within the reservoir rock, and the huge driving force caused by hydrocarbon generation of source rock is the key factor.