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Geological Control Factors and Corresponding EUR of Tight Reservoir, A Case Study of Daanzhai Formation, Jurassic of Central of the Sichuan Basin, China

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1 Introduction

Estimated Ultimate Recovery (EUR) is a key criteria for oil production capacity and resource potential assessment. Besides drilling, completion and stimulation methods, geological elements also have influence on EUR. Shelly limestone of the Jurassic Daanzhai formation is light tight oil bearing reservoir in central of the Sichuan Basin, China. The reservoir is extremely tight with porosity below 2% and permeability below 0.1 millidarcy. Many researchers consider the shelly limestone is fractured reservoir because of its poor physical properties. This study takes Daanzhai formation as a case, the aim is to find the link between geological elements and their corresponding EUR.

2 Methods

Source rock Pyrolysis, outcrop investigation, core observation, thin sections analysis and scanning electron microscopy (SEM) were used in considering the oil bearing and controlling factors. By combining log-log well testing pressure buildup curve and production decline curve, oil storage space was confirmed. 500 vertical wells' EUR were combined with corresponding geological parameters (TOC, well space, source rock and reservoir thickness, porosity, oil saturation) to seek the link between EUR and geological elements.

3 Results

First of all, the source rock should discharge sufficient oil to fill the reservoir space. This need the source rock has high enough TOC ($\text{TOC} > 1\%$) and stay at the peak of hydrocarbon generation widow ($R_o = 0.8-1.3$). Within the

distribution area of excellent source rock, different types of shelly limestone reservoir space have different EURs. As we find from macro to micro scale, all shelly limestone storage space is oil-bearing. Secondary dissolution caves, micro- and nanometer-size intergranular pores, and micro fractures are three types of reservoir space. The increase-decrease-increase log-log well testing pressure buildup curve and decline in the beginning but later stably low-yield production curve of vertical wells are evidences to indicate the light tight oil storage space is not fractures only. Given the relative proportions of the three storage space types, the shelly limestone reservoir could be divided into three types: (1) fracture-cave, (2) fracture-pore, and (3) fracture. The proportion of the three reservoir types in central of the Sichuan Basin is 10%, 52%, and 38% respectively. Fracture-cave reservoir has the highest EUR with a value of 200MSTB (P50) of oil. The EUR contribution ratio for fracture and cave is 20% and 80% respectively. Fracture-pore reservoir has the medium EUR with a value of 50MSTB (P50) of oil. While the EUR contribution ratio for fracture and pore is 40% and 60% respectively. Fractured reservoir has the lowest EUR with a value of 7MSTB (P50) of oil. The results of the work should give new recognition of the shelly limestone reservoir and provide a more reliable assessment of the resource size of light tight oil in Jurassic Daanzhai formation.

References

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