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Oil-bearing property and controlling factors of shale strata with different lithofacies in the E_1f_2 of the Qintong Sag, Subei Basin

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As hydrocarbon exploration shifts from conventional to unconventional resources, continental shale oil exhibits tremendous resource potential in China[1].Although previous studies have extensively investigated the lithofacies characteristics, hydrocarbon generation potential, and oil-bearing properties of the E_1f_2 shales[2], the lithofacies classification did not consider the relative proportions of the three end-member components. This study focuses on the E₁f₂ shales in the Qintong Sag. Through core observation and analyses including XRD, TOC, rock pyrolysis, soluble organic matter extraction, and Py-GC-MS, the lithofacies of the shales in the study area were classified, and the organic geochemical characteristics of different lithofacies were clarified. The oil-bearing properties and their main controlling factors for different lithofacies were revealed. Based on the relative contents of clay minerals, carbonate minerals , and felsic minerals , as well as lamina thickness, the shales were classified into 5 lithofacies: MCM, MFM, MCAM, LFM, and LCAM.

Py-GC-MS was used to restore the volatilized hydrocarbons (S_1) in different lithofacies shales. Extraction and post-extraction pyrolysis experiments were conducted to correct the soluble hydrocarbons (S_2) in different lithofacies. The oil-bearing characteristics of different lithofacies shales were then analyzed. The results show that laminated/stratified shales have the best oil-bearing properties and medium shale oil mobility. Massive felsic mixed sedimentary rocks and laminated/stratified felsic mixed sedimentary rocks exhibit medium oil-bearing properties but relatively good shale oil mobility, making them favorable lithofacies for shale oil exploration in the E₁f₂ of the study area(Fig. 1). The hydrocarbon generation potential and thermal maturity of the source rocks are the primary factors controlling the oil-bearing properties and oil mobility of the E₁f₂ shales . Mineral content also have certain influences. Clay mineral content around 28% and quartz content around 25% appear most favorable for shale oil enrichment and production (Fig. 2).

[1]Jin, Z.J., Wang, G.P., Liu, G.X et al., 2021. Research progress and key scientific issues of continental shale oil in China. Acta Petrolei Sinica. 42(7), 821-835.

[2]Li, S.J., Tang, X., Zan, L.,et al., 2024. Shale lithofacies combinations and their influence on oil bearing property in the 2nd Member of Funing formation, Qintong Sag. China Offshore Oil and Gas. 36(2): 37-49.

