Heterogeneous geological conditions and differential enrichment characteristics of middle-high maturity lacustrine shale oil of China

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Shale oil accumulation has been discovered in many regions around the world so far, and the total geological resources reach 409 billion tons, showing promising prospect of exploration. Although the geological conditions of China's lacustrine shale oil are different from those of the United States, the exploration potential is tremendous and deserves high attention. China's lacustrine shale oil is consistent with the broad concept of shale oil in North America, which refers to the oil resources that remain in the lacustrine shale formation and the internal tight reservoirs within hydrocarbon source rocks, including liquid hydrocarbons that have not yet been migrated from the shale formation system and organic matter that has not yet been converted into petroleum. These resources are retained in the intra-source shale, transition lithology (silty sandstone, marlite, muddy carbonates, tuffaceous mudstone, etc.) and tight reservoir (siltstone, fine sandstone etc.) of the organic rich source rocks. Whether liquid hydrocarbons exist in the oil rock without long-range secondary migration, is a key feature of high-maturity lacustrine shale oil. Compared with the favorable geological conditions and wide distributions of shale oil formation in North America, China's lacustrine basin also exhibit good geological conditions for the formation of effective shale oil. Multi-cyclic tectonic evolution forms multi-stage lake basins, not only providing a place for the large-scale development of lacustrine shale oil, but also forming high-quality source rocks, multi-type

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storage spaces and complex and diverse source reservoir combinations. The hydrocarbon expulsion capacity of high-quality source rocks affects the degree of shale oil enrichment. Freshwater hydrocarbon source rocks with TOC 2.5% contain high content of residual hydrocarbons and are the in source sweet spots, while saline hydrocarbon source rocks with TOC of 2% to 10% preserve high retention volume and are the sweet spots. Liquid hydrocarbons migrate along the organic laminae, diagenetic fractures and thin sandstone layer in the organic rich shales, and accumulate in the layers of siltstone, find sandstone and marlite layer containing low organic richness.