

Are organic-matter-rich shales with laminations the right targets for lacustrine shale oil exploration?

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Giant shale oil resources are accumulated in lacustrine strata in China. However, these shale oil resources have not been commercially produced because of series of challenges, of which how to choose the right targets is an important issue. The great success of shale gas in both North America and China indicate that organic-matter-rich shales (OMRS) with laminations are the most favorable targets. Most of previous publications agree that this conclusion is still right for lacustrine shales, while recent researches indicate that this may not be always true. Different from marine OMRS which are the targets of shale gas in South China, the clay minerals of most lacustrine OMRS are dominated by more ductile illite/smectite mixed layers and chlorites but less brittle and stable illites. Lacustrine OMRS in China are formed in two different environments, as well as their mineralogy and texture. Permian Lucaogou shales in the Junggar Basin and Palaeogene Shahejie-Kongdian shales in the Bohai Bay Basin were formed in saline lacustrine, and the content of carbonate and clay mineral are >40% and <20%, respectively. Triassic Chang 7 shales in the Ordos Basin and Cretaceous Qingshankou shales in the Songliao Basin were formed in fresh water lacustrine, and the content of carbonate and clay minerals were <10% and >40%, respectively. Geochemical analysis indicated similar HC generation potential for OMRS with laminations formed in these different lacustrines. As is known to all, mineralogy evaluation is one of important issues for unconventional petroleum E&P, and it will bring great effects on the texture of rock, porous structure and hydro-fracturing. Moreover, the OMRS with more brittle minerals and more pores are the right targets for shale oil exploration. In a word, the carbonate-rich OMRS with laminations are the right targets for shale oil E&P in saline lacustrines. However, the clay-rich OMRS with laminations may be not the right targets of shale oil E&P in fresh water lacustrines. The recent exploration practices in the Ordos Basin and Junggar Basin also verify these conclusions. Although these are only preliminary findings which need further proof, the results may provide valuable references for lacustrine shale oil sweet-spotting in China.