Source-reservoir rock microstructure and tight-oil accumulation - An example of tight oil study in the Cretaceous Xiagou Formation, JiuQuan basin, Northwestern China

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Source-reservoir distribution mainly controls the accumulation and distribution of oil and gas. Under macroscopic meter-scale, structure layout between source rock and reservoir rock affects the formation of conventional hydrocarbon traps. Under microsopic centi-micrometer scale,distribution relationships of organic and non-organic minerals influence accumulation of unconventional tight oil and gas. In the tight-oil reservoir of the Cretacous Xiagou formation, JiuQuan basin,north-western China, many rock types are mainly mixtures of dolomite, feldspar, quartz and organic matters. Under microscopic scale, multi-lamination structures of organic and non-organic minerals act as the foundation of symbiosis of tight oil source and reservoir rock,and also control the storage, flow,and accumulation characteristics of tight oil. Some pieces of evidence are illustrated below:

1) Lithology associations include argillaceous dolomite and dolomitic mudrock. They develop multi-laminations of organic matters, dolostone, feldspar and clay minerals, particularly, the organic matters are of laminated and scattered distribution types, all of which act as the foundation of symbiosis of tight oil source and reservoir rock.

2) In the laminations of high-content carbonate or felsic minerals, intragranular corroded micropores in dolomite and intergranular micropores in feldspar develop,with the pore diameter ranges from 500nm to 2300nm, mostly enriching pore throats of micrometers. In the laminations of high-content organic or clay minerals, nano-scale organic micropores dominate,the size of which is from 50 to 800nm. Some micro-fracture systems of crude oil fluorescence features develop between organic-rich and non-organic laminations, with an extension of 1 to 10um, acting as the main pathways of occurrence and movement for tight oil.

3) The source-reservoir rock microstructure and fracture systems predominantly control tight-oil accumulations. Laminated organic matters expel hydrocarbon more easily and they are the preferable collection area for tight oil at low-maturity evolution stage of organic matters. Scattered organic matters have trouble inhydrocarbon expulsion, and they are advantageous collection area for tight oil at high-maturity evolution stage of organic matters.