

Geochemical Characteristics of Tight Gas and the Comparison of their Source Rocks Generation Potential in the Upper Paleozoic of Linxin-Shenfu Block, northeast margin of Ordos Basin, China

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Introduction

The Ordos Basin is secondary big sedimentary basin of China. A series of giant tight gas fields had been proven in the Upper Paleozoic strata, including Sulige, Wushenqi, Daniudi, Shenmu etc, with in-place reserves of about $3.53 \times 10^{12} \text{m}^3$ (Yang et al., 2012). Numerous investigations on the Upper Paleozoic gas and their source rocks have been conducted in the central of the basin (Dai et al., 2005; Wu et al., 2016), and the gas-source correlation in the northeast margin of Ordos need to be strengthened. This study was undertaken to better understand gas potential of Upper Paleozoic source rocks in Linxin-Shenfu (LS) block, northeast margin of Ordos basin.

Results

The stable carbon isotopes of the Upper Paleozoic tight gas from LS area were investigated to study the geochemical characteristics. Eleven gas samples from Lower Shihezi (P_{1x}) and Shanxi formation (P_{1s}) displayed a normal order of $\delta^{13}\text{C}_1 < \delta^{13}\text{C}_2 < \delta^{13}\text{C}_3$ without any reversal, Indicating the possibility of mixed source is small. Based on the kerogen carbon isotope, the identification of gas origin and gas-source correlation indicate that tight gas is coal-type gas, and supported that P_{1x} and P_{1s} gas was derived from C_{3b} and P_{1s} coal.

Two coal samples derived from Benxi (C_{3b}, Ro = 1.08%) and Shanxi (P_{1s}, Ro = 0.84%) formation were collected for gold tube pyrolysis experiments, during the thermal simulation progress at 350-600°C, the composition and evolution characteristics of C_{3b} and P_{1s} coal in the Upper Paleozoic are similar, but gas yield are significantly different, whether it is peak or cumulative yield of the final overall yield, the P_{1s} coal is about 1.5 times the cumulative yield of gaseous hydrocarbons of the C_{3b}. The maturity of the C_{3b} coal is slightly higher than that of the P_{1s} coal, but they are both still earlier than the gas generation peak, so the early generation amount is small and has little effect on the yield of gas.

Conclusions

1. Based on the gas and source rock carbon isotope results, the Upper Paleozoic tight gas is coal-type gas, and derived from C_{3b} and P_{1s} coal.
2. The P_{1s} coal is about 1.5 times the cumulative yield of gaseous hydrocarbons of

- the C₃b. Initial maturity of source rocks play a limited role in simulation results.
3. P₁s coal developed in the large continental lake environment, higher plants and freshwater aquatic herbs provided the source. However, C₃b coal formed in coastal environment, tidal salt plants and brackish water or salt symbiotic organisms were the source (Yang et al., 2016). Therefore, the difference of coal-forming environment leads to the high hydrogen-rich component of P₁s coal, resulting to its higher yield than C₃b coal.

References

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