

## GEOCHEMICAL CHARACTERISTIC AND GENERATING POTENTIAL OF SOURCE ROCK IN ES4 MEMBER, LIAOHE DEPRESSION, BOHAI BAY BASIN, NE CHINA

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The Liaohe western depression located in Bohai Bay Basin, is a large petroliferous continental rift depression in NE China. Drilling discovered the Eocene- Oligocene Shahejie Formation is prime importance for petroleum exploration and included four members (Es1-4) in depression. The Es4 member is a significant source unit characterized by large thickness, wide distribution, high abundance of organic matter in west slope belt of the depression. Samples were collected from Es4 including mudstone and shale to assess the source rock. On the basis of the geochemical analysis of a total of 48 samples, the origin of organic matter, thermal maturity, paleoenvironment of sediment deposition and hydrocarbon potential of the source rock was investigated.

The samples analysed had the TOC contents ranging from 0.14 wt% to 5.06 wt% with an average of 1.62 wt%. The %Ro of samples varied from 0.23% to 0.69%, indicating source rock principally at the relative low maturity stage. And the *T<sub>max</sub>*, element analysis of kerogen and thermal maturity of biomarker confirmed this assertion. According to the atomic H/C vs. O/C diagram, the samples contained predominantly type I–II<sub>1</sub> kerogen. The organic matter of the source rocks mainly originated from aquatic algae and microbes with a minor contribution of terrestrial higher plants. This conclusion was demonstrated by stable carbon isotopic and element composition of kerogen, and further supported by the Pristane/Phytane and the C27/(C27+C29) regular steranes ratios. Moreover, the source rock was typically characterized by high pregnane, and a high gammacerane index. Those clearly indicated the source rock was deposited in a saltwater reductive lacustrine environment corroborated by the relation between the pristane/phytane ratio and that of the C27/(C27+C29) regular steranes as well. Previous studies corroborated that the immature organic matter derived from algae and microbes in saline reductive environment were important of immature oil occurrence (Wang et al., 1995). Based on basin model and parameters of area, thickness and density of effective source rock, an improved method on chloroform A used to evaluate petroleum resource suggested that total hydrocarbon expulsion of immature hydrocarbon from Es4 source rock was 18.25×108t in Liaohe western depression. The discovery of sizable immature petroleum reservoir in Niuxingtuo and Gaosheng area had proved the potential of immature oil and gas resource for exploration.

Therefore, samples of mudstone and shale were collected to study on assessment of the Es4 source rock in Liaohe western depression. Dominated by type I–III<sub>1</sub> kerogen, the source rock might yield immature hydrocarbon and controlled the distribution of petroleum reservoir in west slope belt of the depression for exploration.

### References

Wang Tieguan, Zhong Ningning, Hou Dujie et al., Genetic mechanism and occurrence of immature hydrocarbon [M]. Beijing: Petroleum Industry Press, 1997