

7.10 Li, Zhongxuan. Paleozoic oil-source correlation in the Tarim Basin

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There has been disagreement about the major source rocks for Paleozoic reservoir oil in the cratonic region of the Tarim Basin. Previous studies using certain geochemical parameters such as the distribution of steranes to suggest that the majority of the petroleum originated from Upper Ordovician (O₂₋₃) source rocks instead of the deeper Cambrian-Lower Ordovician (Є-O₁) source rocks (Huang et al., 2016). This result, however, contradicts with the limited thickness and low total organic carbon contents of the O₂₋₃ source rocks. In this study, the characteristics of light hydrocarbons (C₄-C₇) and aryl isoprenoids have been comprehensively investigated to test the oil-source correlation. 52 crude oil samples, 12 adsorbed oils recovered by sequential extraction from reservoir rocks, as well as the extracts of source rocks were examined by gas chromatography (GC) and GC-mass spectrometry (MS).

The relative content of *n*-alkanes as a proportion of the C₄-C₇ compounds in the crude oil samples is in the range of 61.7–77.1%, and the aromatic hydrocarbons range from 0.18–1.68%. These values are close to those of the ZS1 oil from the Cambrian reservoir (Figure 1). In contrast, the oils which were previously interpreted to come from the Upper Ordovician contain 16.6–35.6% *n*-alkanes and 50.4–67.7% aromatic hydrocarbons, indicating variation in source inputs (Figure 1). A large amount of aryl isoprenoids has been found in all the crude oils and reservoir extracts, in spite of their varied biomarker characteristics. The widespread occurrence of aryl isoprenoids has been regarded as an exclusive character of Cambrian-derived crude oils (Zhang et al., 2017), thus providing further evidence that the oils in the Paleozoic reservoirs were mainly derived from the Є-O₁ rather than O₂₋₃.

This study provides geochemical evidence for the identification of the major source rock in the Tarim Basin, and therefore is significant for future exploration in the Tarim Basin. The study also shows that biomarker features alone are not necessarily valid in oil-source correlations, because these form just a minor part of crude oils, and can easily be influenced by thermal cracking, biodegradation or oil mixing processes. Future studies should pay more attention to the possible variation of biomarkers during thermal maturation and migration process, and try to explain any inconsistencies in biomarker characteristics and geological background.

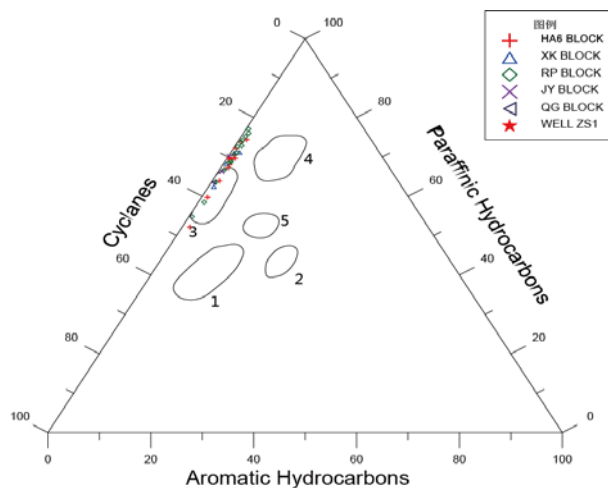


Figure 1: Triangular diagram of light hydrocarbon (C_4-C_7) from Paleozoic reservoir in the Tarim Basin

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