

THE SOURCE OF NEWLY DISCOVERED OILS IN SOUTHERN Tabei UPLIFT, TARIM BASIN

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Introduction

Oils produced from the Paleozoic reservoirs in the Tarim basin were considered to have been derived from the Middle and Upper Ordovician source rock based on steranes, diamondoids and carbon isotopes (e.g. Chen et al., 2018). This proposal is not supported by, 1) aryl isoprenoids (Sun et al., 2003; Cai et al., 2009a & b), 2) sulfur isotopic composition (Cai et al., 2009a & b; 2015; 2016), 3) one suite of the Cambrian source rocks and ZS1 and ZS5 oils from the Middle Cambrian reservoirs showing similar distribution of steranes and carbon isotopes to the Middle and Upper Ordovician (Cai et al., 2015). The recently found Halahatang and Hade oilfields located in the south of the Tabei Uplift are expected to supply a new case to determine the source of the oils in the Ordovician.

Results and Discussion

Oils in the Ordovician in the Halahatang area have the similar biomarker characteristics as those in the Carboniferous in the Hade Oilfields. The samples show that the C₂₃ tricyclic terpane is more abundant than both C₂₁ tricyclic terpane and C₃₀ hopane ratio, C₂₄ tetracyclic terpane higher than C₂₆ tricyclic terpane, C₂₉/C₃₀ hopane ratio approximately equal to 1, and high gammacerane/C₃₀ hopane ratios from 0.22 to 0.29. In the sterane series, C₂₁ pregnanes are remarkable in the m/z 217 mass chromatograms of all of the samples. The C₂₇, C₂₈ and C₂₉ regular steranes for all crude oils show a similar “V” type distribution with C₂₇ sterane contents of 35.0% to 37.5%, C₂₈ of 17.4% to 21.5% and C₂₉ sterane of 41.9% to 45.9%. However, this distribution is found to occur in both the Cambrian Xiaerbulake Fm source rocks in Keping area and Upper Ordovician source rocks. Therefore, the sterane distribution cannot conclusively be used to determine the source of the oils.

Mass chromatograms for m/z 134 revealed the distribution of a pseudo-homologous series of aryl isoprenoids in all the analyzed oils in the wells Ha7-7, Ha11 and HD24. The major components possess the 2,3,6-trimethyl substituted pattern with a predominance of C₁₄–C₂₂ homologs. The components are interpreted to be the diagenetic products of aromatic carotenoids of the green sulfur bacteria (Chlorobiaceae) in ancient restricted ocean. To our knowledge, aryl isoprenoids indicating a strong reduced environment. This feature is consistent with the geological setting of the Cambrian, aryl isoprenoids have been reported in the Cambrian source rocks but not in the Upper Ordovician (Cai et al., 2009). Therefore, The widespread occurrence of aryl isoprenoids in the oils can be used as evidence that they were originally derived from the Cambrian source rocks.

These oils have $\delta^{34}\text{S}$ values from +16.8‰ to +20.3‰ in the Ordovician in the Halahatang area, from +13.3‰ to +14.1‰ in the Carboniferous in the Hade Oilfields. The values are close to those kerogen samples from the Cambrian source rock with $\delta^{34}\text{S}$ values between +14.0‰ and +21.6‰ and significantly higher than those from the Ordovician kerogen ($\delta^{34}\text{S}$ of between +3.8‰ and +8.7‰) (Fig. 1).

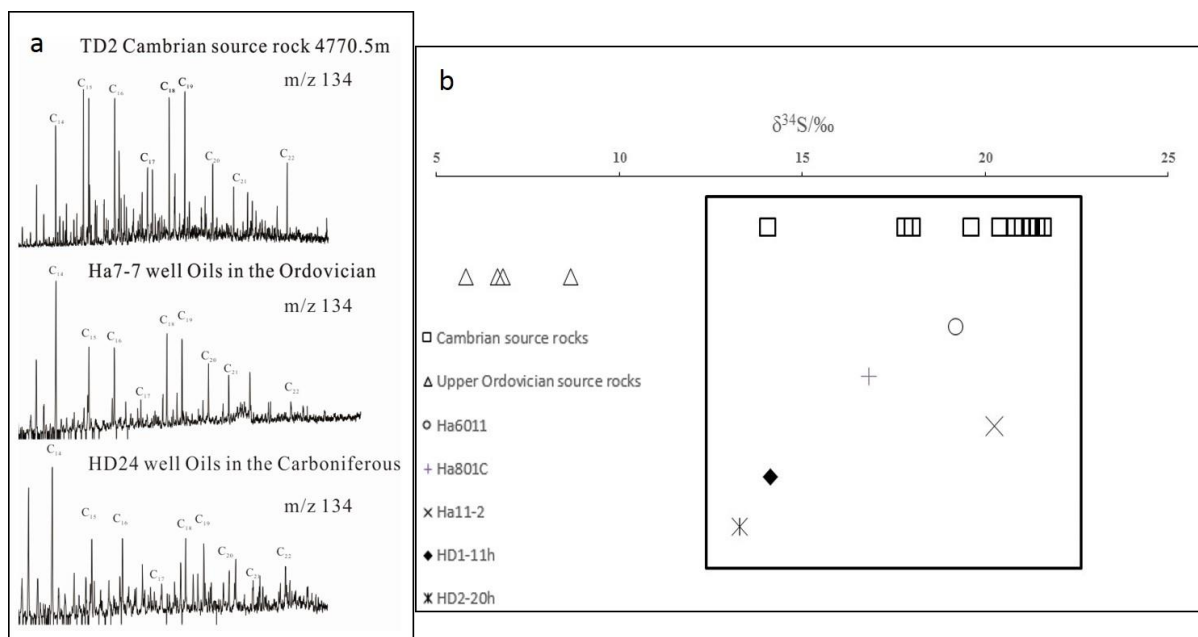


Figure 1 Correlation of the oils in the Tabei area and potential Cambrian and Ordovician source rocks: a Aryl isoprenoids; b Sulfur isotopic compositions

Conclusions

The oils in the Harahatang and Hade areas were derived from source rock deposited in an euxinic environment and thus show the widespread occurrence of aryl isoprenoids. This feature along with heavy sulfur isotopic compositions support that the oils were derived from the Cambrian source rocks not from the Upper Ordovician as proposed recently (Chen et al., 2008).

References

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