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CLASSIFICATION OF CRUDE OILS FROM THE WESTERN KUQA DEPRESSION, TARIM BASIN AND ITS SIGNIFICANCE

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It is generally believed that there exist two suits of different source rocks, the Triassic lacustrine source rock and Jurassic coal-measures source rock in the Kuqa depression, Tarim Basin. Since the discovery of the Kela-2 giant gas field, it has been commonly held that Kuqa is a depression rich in natrural gases that are derived from the Jurassic coal-measures source rock (Liang et al., 2003; Zhao et al., 2005), which neglects a fact that it may be also a depression full of crude oils. Up to now, about 60 million tons of crude oils derived from the Triassic lacustrine source rock have been found in the Yaha area of the southern Kuqa depression, a considerable number of crude oils have been found in the Yudong, Quele and Yilake structures, and recently some oils derived from the lacustrine source rock have been time and again discovered in the Yinmaili area.

In fact, there exist various types of crude oils in the western Kuqa depression, which vary greatly in color, density, fractions, isotope composition and biomarkers. The crude oils from the western Kuqa depression can be divided into five types:

The first is the oils from the Yinmaili and Yaha structures, which is characterized by the light carbon isotopic composition, i.e. the $\delta^{13}C$ values are under -29.5‰ for the whole oil but generally less than -30‰ for the C_{12}^{+} n-paraffins. The distribution of biomarkers shows a typical character of lacustrine oils, for instance, tricyclic terpanes have predominant C_{21} or C_{23} but relatively low C_{19}, the C_{24} tetracyclic terpane /C_{26} tricyclic terpane ratio is under 2, there is a certain amount of gammacerane, ααα-C_{27}, C_{28} and C_{29} 20R steranes have an asymmetrical "V-shaped"distribution with C_{29} predominance.

The second is the oil from the Kela-2 and -3 structures, which has the $\delta^{13}C$ values ranging between -26‰ and-29‰ for the whole oil and -27‰ to -30‰ for the C_{12}^{+} n-paraffins. Tricyclic terpanes are abundant, even higher than hopanes. Noticeably, the oil has a very rare hopane distribution that the abundance of C_{34} hopane exceeds that of C_{33} hopane, which shows a character of marine oils and implies a special oil source.

The third is the oil from the Baichen coalmine and the Yiqikelike structure, which show a typical character of the Jurassic coal-measures oil of western China (Chen et al., 2001), i.e. the $\delta^{13}C$ values are under -27‰ for the whole oil and around -27‰ for the C_{12}^+ n-paraffins, while the Pr/Ph ratios vary between 4–5, tricyclic terpanes are predominated by C_{19} and decrease with the increase of carbon numbers, C_{24} tetracyclic terpane remarkably exceeds C_{26} tricyclic terpane and their ratio is over 3, the abundance of gammacerane is very low, C_{29} sterane is predominant in all the steranes including both regular ones and diasteranes.

The fourth is oil from the Dawanqi structure. The obvious difference of this oil from the others lies in the sterane distribution, namely very scarce C_{27} sterane, abundant C_{28} and C_{29} steranes but few diasteranes. In addition, the oil has relatively abundant C_{28}^+ tricyclic terpanes and a relatively high gammacerane.

The fifth includes crude oils and condensates mainly from Well Wucan-1, Quele, Yangtake and Yudong structures. Basically, the $\delta^{13}C$ values vary between -25 – -28‰ for the whole oil and -26 – -30‰ for C_{12}^+ n-paraffins, respectively. As for the distribution of biomarkers, most tricyclic terpanes are predominated by C_{19} tricyclic terpane and decrease with the increase of carbon numbers. Particularly, the pentacyclic terpanes are characterized by abundant Ts, C_{29}Ts and C_{30} diahopane, a relatively low content of gammacerane.

The oils of the first and third types mentioned above are derived from the known Triassic lacustrine and Jurassic coal-measures source rocks, respectively, while that of the fifth type is likely to be genetically related with the upper Middle Jurassic fresh-lake source rock, or to be a mixture of Triassic lacustrine oil and Jurassic coal-measures derived oil. However, the source of the second and fourth oils still remains uncertain, of which the second is somewhat characteristic of marine oils and the fourth similar in property to the Permian lacustrine oil from Junggar Basin that is apart from Kuqa Depression by the Tainshan mountains. Therefore, all the present data show that there still exist some source rocks in the western Kuqa depression that have not yet been recognized up to now and they are worthy of further prospecting and investigation.

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