Effects of secondary geochemistry on the carbon isotope of *n*-alkanes in the oil-source correlation

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Carbon isotopic value in oil is dependent upon the value of the kerogen in the source rock from which it was derived. The value of kerogen depends, in turn, on the types of organisms preserved and the values of its substrate. Therefore, carbon isotopic value is widely used as oil-source correlation parameter. In the case of the Palaeozoic oils in the Tarim Basin, majority oils have their $\delta^{13}C$ values of in the range of -31.0‰ and -33.0‰ with a few exceptions (Zhang et al., 2004; Cai et al., 2009). Because TD2 oil has the heaviest $\delta^{13}C$ value and it is reservoired in Cambrian strata, it was regarded as standardized end member for the Cambrian sourced oils in all studies. Only a few oils from wells TZ62(S), T904(O) and ZS1C(□) have similar bulk carbon isotopic values as TD2 oil, which were regarded as pure □-O_1 origin (Tian et al., 2012; Jia et al., 2013). The most $\delta^{13}C$ depleted oil is automatically selected as the O_{2-3} sourced end member. The early selection with $\delta^{13}C$ around -35‰ was an oil from well YM2 (Li et al., 2010). Recently, Li et al. (2015) reported one more $\delta^{13}C$ depleted oil from well YG2 with $\delta^{13}C$ value of -37‰, which was selected as new end member for the O_{2-3} sourced oil. Majority other oils were considered as mixture from both the O_{2-3} source rocks and the □-O_1 source rocks.

Carbon isotopes of bulk organic matter can be influenced by many factors including carbon isotope fractionation during primary and secondary production, detrital organic carbon input, post-depositional alteration through diagenesis/ metamorphism, and hydrocarbon contamination. Thermal simulation experiments of the heavy oil from well S74 illustrated that carbon isotope of the residual extracts increase gradually with temperature (Liu, 2008). Well ZS1C condensate contains only trace amounts of biomarkers, and high $\delta^{13}C$ value of n-alkanes. It is characterized by ultra-high thermal maturity. Unusually high concentrations of dibenzothiophenes (DBTs) and heavy $\delta^{34}S$ value of DBTs suggest a close genetic relationship with TSR alteration (Li et al., 2015). High $\delta^{13}C$ values result from TSR alteration rather than indicate Cambrian source signature. Thus, under the thermal maturation of carbon isotope composition of the dramatic changes, the carbon isotope of abundant *n*-alkane may be affected by different degree of isotope fractionation.