# BIOMARKER, DIAMONDOID HYDROCARBONS AND INDIVIDUAL CARBON ISOTOPES OF CRUDE OILS IN TAZHONG AND TABEI UPLIFT IN TARIM BASIN, NW CHINA

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## Introducion

The Tarim Basin is a large petroliferous basin of an area of 560,000km$^2$ in northwest China. The Tazhong and Tabei uplifts in Tarim Basin separated by the Manjiaer Depresion, constitute the main part of the cratonic region. Oil–source correlation in the cratonic region has long been controversial. Two main source units identified in the basin are Cambrian–lower Ordovician (Є–O1) and Middle-Upper Ordovician ($O_{2-3}$) strata. Biomarker correlation results show that vast majority of oils in the cratonic region are derived from the $O_{2-3}$ source rocks (Hanson et al, 2000; Zhang et al.,2000). The relatively low TOC values and limited thickness of the source rocks within the Middle–Upper Ordovician strata penetrated by boreholes appear to be inconsistent with the huge reserves of oils in the cratonic region. Some geologists anticipate that the Є–$O_1$ would be the main source rocks with geological evidence and sulfur isotopic compositions (Cai et al., 2009). Based on the carbon isotopic composition, the majority of oils in the cratonic region are attributed to mixed origin these two sets of source rocks (Li et al., 2010). The recent discovery of Cambrian oils from the ZS1 further complicated this issue. The ZS1 oil (Є2a) has typical characteristics of $O_{2+3}$ source rocks. However, some geologists suggested that the ZS1 oil (Є2a) was derived from the Cambrian source rocks based of the geology background. It was also assumed that maturity and biodegradation might have impact on oil-source indicating parameters, which could lead to misinterpreting marine oil sources in the area. It is necessary to systematically study the deep oils and source.

## Results

75 crude oils in Tazhong uplift and 31 crude oils in Tabei uplift were analyzed by GC, GC-MS and GC-IRMS. The $\delta^{13}C$ values of individual *n*-alkanes among the 75 oils in the Tazhong uplift vary a lot. While the crude oils in the Tabei uplift have the concentrated this values (Fig.1). The crude oils in Tazhong Uplift contain relatively low amounts of terpanes and steranes, but high amounts of diamondoid hydrocarbons. On the contrary, oils in Tabei contain a lot of terpanes and steranes, but less diamondoid hydrocarbons. Crude oils in Tazhong in general have higher ratios of Ts/(Ts + Tm), $C_{29}$Ts/($C_{29}$ Ts + $C_{29}$ hopane), $C_{27}$ diasteranes/($C_{27}$ diasteranes + $C_{27}$ regular steranes) and diamondoid hydrocarbon indices (A/MAs, MAs/DMAs, MAI, EAI, DMAI-1, DMAI-2, TMAI-1, TMAI-2) than Tabei. Even if the carbon isotope composition of the monomer is similar to that of the Tabei crude oil, the crude oil in the Tazhong still has the difference between the above biomarkers and the diamondoid hydrocarbons composition. Content of 4-methyldiamantane and 3-methyldiamantane of the crude oils in Tazhong has good correlation with the weighted average $\delta^{13}C$ value of individual *n*-alkanes, ranging from 83 to 1735ppm. This value is quiet low and concentrated in Tabei oils, ranging from 27 to 87ppm. This indicates that the crude oil in the Tazhong has undergone a higher intensity cracking than that in Tabei.

## Conclusions

It shows that the differences of carbon isotope composition for individual *n*-alkanes and characteristic for biomarker and diamondoid hydrocarbons between crude oils in Tazhong and Tabei uplift are caused by different hydrocarbon accumulation modes. The reservoir in Tazhong area was initially accumulated and formed after oil generation and discharge from the source rocks, and finally filled and formed after high-strength cracking. Therefore, the crude oil in the Tazhong has high adamantanes and diamantanes concentration and isomerization index. However, reservoir in Tabei was first generated and discharged from the source rock. After the initial accumulation, it was always in low-intensity cracking due to its shallow burial, so the biomarker characteristics of the early filled crude oil were preserved.

There is another possibility. Oils in Tazhong and Tabei are deriving from separate source kitchen. The source kitchen of Tazhong crude oils may have variable carbon isotope composition of individual n-alkanes in different layers. The source kitchen has higher maturity when the crude oils accumulated in Tazhong uplift. Crude oils in Tabei uplift come from another source kitchen, which has a relatively consistent biomarker characteristic and carbon isotope composition of individual n-alkanes. The maturity of this source rocks is obviously lower than the source kitchen of Tazhong oils at the time of hydrocarbon accumulation.

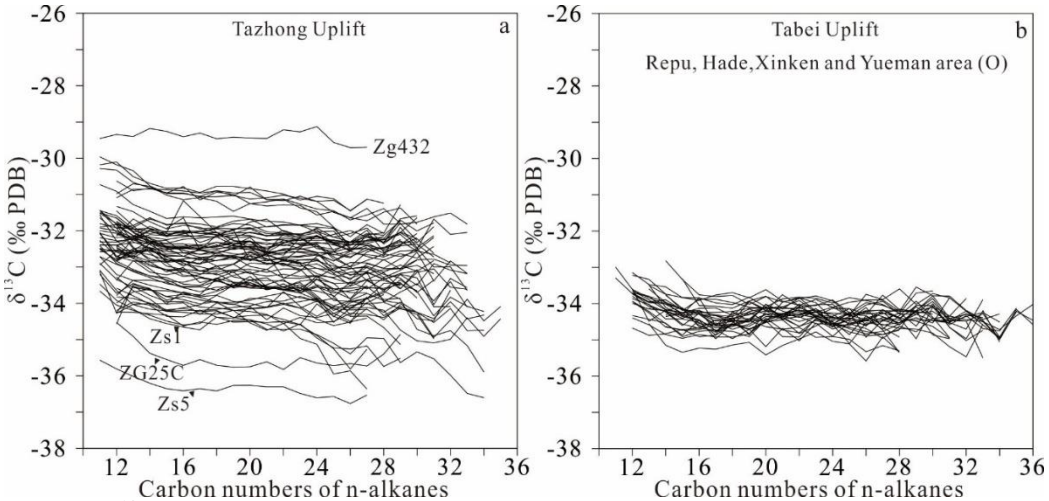


***Figure 1*** *The $\delta^{13}C$ value of individual n-alkanes for crude oils in Tazhong and Tabei Uplift.*

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