The biomarkers comparison of bitumen and expelled oil of lacustrine marlstone determined by hydrous pyrolysis: application to the migration of tight oil reservoir

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Shale oil or tight oil is considered to migrate from very adjacent source rock or be impregnated in situ within thick source rock.Hydrous pyrolysis was employed to heat immature organic-rich lacustrine marlstone from the third member of Shahejie Formation in Shulu Sag, Bohai Bay Basin and the hydrocarbon production expelled from and remained in the rock (bitumen, solube extract from source rock) were collected and analyzed by GC-MS to examine their hydrocarbon composition and biomarkers alteration during the maturation of the source rock.

The result shows that the ratio of Pr/Ph、Pr/nC_{17}、Ph/nC_{18}、isomerization ratios of 22S/(22S + 22R) for C_{32} homohopanes and aromatic hydrocarbon parameters such as (C_{20}+C_{21})/(C_{20}+C_{21}+C_{26}+C_{27}+C_{28}),methylphenanthrene distribution index (MPIF),dibenzothiophene maturity parameters (MDR-4 and MDR-2+3) and the dibenzothiophene demethylation index(DDI) are effective over whole range of experimental temperature.It is also implied that the distribution patterns of biomarkers in expelled oil varies a lot even experiencing a short distance migration. This variation is probably due to the hydrocarbon expulsion, geochromatography effect and experimental conditions. Furthermore, the variation of saturated hydrocarbon parameters in bitumen and expelled oil is more complicated than aromatic hydrocarbon parameters. Finally, A set of effective maturity indicators for tight oil fields are demonstrated. For example, 20S/(20S+20R) and αββ/（αββ+ααα）for C_{29} steranes are commonly used for maturity assessment in tight oil at the lower mature stage, although significant reversal phenomenon happened when samples at the high or post-mature stage. For oil source with high maturity,some aromatic hydrocarbons are potential maturity indicators for tight oil than saturated hydrocarbons. This study has certain reference value for prediction of tight oil “sweet spot” in Shulu Basin and any other areas.