

Isotopic Fractionation Effect of Primary Migration in Simulation Experiment of Selected Terrestrial Source Rocks

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Previous studies showed that there are fractionation effects in generation and expulsion of terrestrial kerogen on both chemical compositions and isotopic compositions. This research simulates the primary migration of hydrocarbons by adding deuterated n-C15 into source rocks. The $\delta^{13}\text{C}$ values of both deuterated n-C15 and individual n-alkanes generated were analyzed, the results suggested that there exist strong isotopic fractionation effects (about 3‰ in less than 10cm distance) in primary migration of vitrinite-rich coal, but there is no obvious isotopic fractionation ($\leq 0.3\%$) in primary migration of fusinite-rich brown coal and mudstone.

Combined together with the previous published experimental results of Liao (2004) from the same simulation experimental system, conclusion is that the maturation of organic matter, secondary crack of hydrocarbons and the adsorption-desorption process of hydrocarbons have influence on the fractionation effect on isotopic compositions in generation and primary migration of hydrocarbons. All of these factors make the n-alkanes retained in residual organic matter richer in ^{13}C . Because vitrinite-rich coals have larger internal surface and high adsorptive capacity, the adsorption-desorption process is more complicated and the diffusion of hydrocarbons in kerogen matrix is more difficult, and thus the isotopic fractionation effect is aggravated in vitrinite-rich coals. This isotopic fractionation effects should be considered in oil-source correlation if vitrinite-rich coal is potential source rock.