Evidence on the initial stage of oil migration as water solution from thermal simulation experiment

TIANZHU LEI[1], JINGONG CAI[2] AND LANTIAN XING[1]

[1]Key Laboratory of Petroleum Resources Research, Institute of Geology and Geophysics, CAS, Lanzhou, Gansu 730000, China (leitianzhu@163.com)

[2]State Key Laboratory of Marine Geology, Tongji University, Shanghai 200092, China

To obtain information on migration pattern, we carried out thermo-pressure simulation expelled experiment for clay from source rock. Our data of expelled experiment supports the water solution migration pattern during initial stage.

Experimental result shows that the ratio of $R_{AL+AR/NO+AS}/E_{AL+AR/NO+AS}$(R=residual oil, E=expelled oil) is higher than 1 when the experimental temperature is between 300 and 400 °C, indicating that the non-hydrocarbons fraction(NO) and the asphaltenes fraction (AS) were expelled more easily than the other two fractions. And the ratios of $R_{AL/AR}/E_{AL/AR}$, $R_{NO/AS}/E_{NO/AS}$ are also higher than 1, further indicating that the aromatic hydrocarbon(AR) was expelled more easily than the saturated hydrocarbon(AL) and the asphaltene than the non-hydrocarbon. Apparently, the expelled oil is enriched in more soluble components and the residual oil contains more insoluble components. This characterization supports the water solution migration pattern during the initial stage.

GC-MS analysis shows that the ratio of $R_{C21+C22/C28+C29}/E_{C21+C22/C28+C29}$ is lower than 1 for the saturated fraction when the experimental temperature is between 250 and 600 °C, and also the ratio of $R_{\Sigma 22-/\Sigma 22+}/E_{\Sigma 22-/\Sigma 22+}$. This indicates that short chain n-alkane is extruded more easily than long chain n-alkane. It maybe demonstrates that the primary factor influencing the fractionation of various components is their difference in the polarity and the next in the density.

This work was supported by National Natural Science Foundation of China (Grant No. 41072107).