Hydrocarbon gas generation from Cambrian source rock and oil: insights from pyrolysis experiments for bitumen “A”and extracted bituminous dike

YONGLI WANG[1]*, ZHIFU WEI[1], XIANBIN WANG[1], BAOXIANG WU[1], ZIXIANG WANG[1], HUI YANG[1]

[1] Key Laboratory of Petroleum Resources, Gansu Province/Key Laboratory of Petroleum Resources Research, Institute of Geology and Geophysics, Chinese Academy of Sciences, Lanzhou 730000, PR China.
(*correspondence: wyll6800@lzb.ac.cn)

Two sets of pyrolysis experiments were performed for bitumen “A” and extracted bitumen of low-maturity bitumen at two heating rates of 2 °C/h and 20 °C/h in confined systems (gold capsules). The main observations can be listed as follows:

(1) Bitumen “A” and extracted bitumen have similar evolution characteristics of hydrocarbon gas generation. (2) Asphaltenes, resins and extracted bitumen are more likely to produce methane, and under the same temperature conditions, the relative amount of methane is relatively higher for type III than for type I kerogen, while saturates are more likely to produce wet gases. Bitumen “A” and extracted bitumen have wide activation energy, and the “slightly continuous” generation of asphaltenes, and resins might be the main contributor of natural gas in the deep. (3) The evolution of stable carbon isotope values of individual hydrocarbon gases could be divided into three stages, and the $\delta^{13}C_2$ are similar for conventional natural gas and pyrolysis simulative gas at the same Ro%/EasyRo%. (4) Wet gas generation is more complex than cracking, and the maximum yields of individual wet gases decrease with a faster heating rate.

In addition, the extracted bitumen and bitumen "A" were considered Cambrian source rock and oil, respectively, and the oil charge into Sinian in the Early Jurassic, and then the kinetic parameters derived for extracted bitumen are applied to Cambrian strata and the parameters for bitumen “A” to Sinian strata. The conversional rate of C_{1-5} and C_1 are 0.71 and 0.48 for Cambrian source with a Ro ~ 2.2%, 0.90 and 0.81 for charged oil cracking with a Ro ~ 3.0%, respectively. The calculated wetness are far higher than the natural gas. More hydrocarbon gases, especially methane, have been generated in Sinian strata, and the dryness of natural gas is higher for Sinian than Cambrian in Gaoshiti-Moxi area.