Geophysical Research Abstracts
Vol. 19, EGU2017-2922, 2017
EGU General Assembly 2017

Isotope Geochemistry of Natural Gas in Xujiahe Formation of the Upper Triassic in Sichuan Basin, China

Shizhen Tao, Jingkui Mi, Chun Yang, Xiaohui Gao, Songtao Wu, Zhenglian Pang, and Jianwei Fan
Research Institute of Petroleum Exploration and Development, China (tsz@petrochina.com.cn)

Terrestrial tight sandstone gas is abundant Xujiahe(XJH) Formation in Sichuan Basin, China. Its reserve is over 0.6×1012m3. Though has such a huge reserve, origin and evolution of this tight sandstone gas haven't been studied thoroughly.
This study is to clarify geochemical characteristics of gas formation and evolution in XJH Formation based on the comparative geochemical analysis of gas samples from fluid inclusions and gas fields.
Experiments showed the great differences between gas in inclusions and from fields. There are low-medium maturity coal-derived tight sandstone gases in XJH Formation. Source rocks are mainly kerogen type-II2 and III, but coal series are type-III. The Ro is 0.8-1.4%. They are presently at post-mature to early high-mature stage, but the gas/oil ratio in present gas reservoirs is high. XJH reservoir rocks have large amount of gaseous hydrocarbon inclusions, few liquid hydrocarbon inclusions, indicating coal series type generates mainly gas (Dai et al., 1997; 2012). XJH natural gas is dominated by methane, with higher concentration of heavier C2+ hydrocarbons, belonging to kerogen-degraded gas. The gas dryness ratios are normally less than 0.95, mainly wet gas. The content of methane in the inclusions is low, rather lower for those of C2+ hydrocarbons, while that of non-hydrocarbons (CO_2) is higher.
Isotopic features show that tight sandstone gas of XJH Formation is typical coal-derived gas. The gas δ13C1 ranges from -45.5‰ to -36.5‰ and δ13C2 from -30‰ to -25‰The δ13C1 and δ13C2 in fluid inclusions are similar, but mostly slightly heavier, with a δ13C1 of -36‰$\sim$-45‰ and δ13C2 of -24.8‰$\sim$-28.1‰ characterized as coal-type gas. The δ13CCO_2 of gas from fields ranges from -15.6‰ to -5.6‰ and that of inclusions is lighter, ranging from -16.6‰ to -9‰ which is organic origin. The CO_2 captured in the inclusions in a relatively closed system, characterizing as heavier carbon isotopic composition for alkane gas and lighter for that of CO_2, was derived from source rocks, and biogenic CO_2 was mixed less. The gases in inclusions reflect primitive state when source rocks were generating gas, and rather weak isotopic filtration for gases in a closed system, thus it is characterized as heavier carbon isotopes for alkane gas and lighter for non-hydrocarbon CO_2.
In short, the causes of the difference between gases from inclusions and reservoirs are the maturity of source rock, migration fractionation effect and contamination of water soluble gas.