Geochemistry and origins of natural gas in the Mahu sag, northwestern Junggar Basin, NW China

JIAN CAO[1*], KEYU TAO[1], BAOLI XIANG[2], KUN LENG[2], JIANGLING REN2, WANYUN MA2, NI ZHOU[2] AND LEI XIE[1]

[1]State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210023, China, jcao@nju.edu.cn (* presenting author)

[2]PetroChina Xinjiang Oilfield Company, Karamay 834000, China

The Mahu sag, located in the northwestern Junggar Basin of NW China, is a famous lacustrine hydrocarbon source depocenter, and in theory can generate both oil and gas. However, the present hydrocarbon exploration and production are oil in dominance, and thus the gas exploration prospects are questionable. Here, to improve the understanding of this issue, we address the origins of gas based on a relatively comprehensive study of gas geochemistry including composition, carbon isotopes, light hydrocarbons and biomarkers of retrograded condensates. Then, combined with the geological setting, we discuss the gas exploration prospects. Results indicate three types of gases in the region, i.e., sapropelic-type gas derived from the lower Permian Fengcheng Formation (P_1f), humic-type gas sourced from the Carboniferous and the lower Permian Jiamuhe Formation (P_1j), and humic-type gas derived from the middle Permian lower-Wuerhe Formation (P_2w). The P_1f-sourced sapropelic-type gas has at least two accumulation periods including lowly mature oil-associated gases and mature-highly mature kerogen/oil-cracking gases. In contrast, the Carboniferous and P_1j sourced humic-type gases are mainly highly mature-over mature kerogen-cracking gases, without obvious geochemical characteristics of multi-period accumulation. The P_2w-sourced gas is mature and humic-type. Of these three types of gas, the former two types form the predominant gas occurrence and exploration targets. The Mahu sag has good gas exploration prospects in general. Further gas exploration in the region should be focused on deep anticlines in sag area with both kerogen- and oil-cracking gases. The deep burial of favorable targets caused few drilling and thus is one of the critical reasons why there are not giant discoveries of natural gas exploration in the study area at present.