

Carbon and hydrogen isotopic ratios of gases in the eastern part of southern Altun slope in Qaidam basin, NW China

S. X. ZHOU^{1*}, J. LI¹, K. F. CHEN¹, C. ZHANG¹, P. P. LI
Z. X. SUN AND Y. H. ZHANG¹¹

¹ Key Laboratory of Petroleum Resources Research, Institute of Geology and Geophysics, CAS, Lanzhou, 730000
(sxzhou@lzb.ac.cn)

Recently, petroleum exploration has made significant progress in the eastern part of southern Altun slope in Qaidam basin. In order to determine natural gas origin and gas-source correlation this area, carbon and hydrogen isotopic ratios of organic matter of source rock, oil and natural gases were measured.

Natural gases in the Jiantan and Dongping 1 and 3 area have similar geochemical characteristics, Dry coefficients (C_1/C_{1-5} ratios) are more than 0.95 and with higher N_2 content, their $\delta^{13}C_1$ range from -16.4 to -28.5‰ with an average of -23.2‰, $\delta^{13}C_2$ values range from -19.6‰ to -25.2‰ with an average of -22.1‰. It is showed that natural gases in these structural belts are generated probably from Lower Jurassic source rocks, but from stable isotope signatures of C and H, thermal maturity decrease in the order: Dongping 3 (Jiantan) > Dongping 1 > Dongping 17. Partial isotopic reversal of carbon $\delta^{13}C_1 < \delta^{13}C_2 > \delta^{13}C_3$ indicates admixtures of gases of various origins.

Niudong gas field contain less N_2 than Dongping 1 and 3 and Jiantan gas field, dryness ranges from 0.85 to 0.97, indicating an abundance of wet gas. The carbon and hydrogen isotopic compositions of the methane vary from -30.9‰ to -38.3‰ and from -201.5‰ to -255.2‰ respectively, while the carbon isotope value of ethane ($\delta^{13}C_2$) is relatively more enriched in ^{13}C , which ranges from -20.8‰ to -27.2‰ with an average of -22.5‰, if cutoff $\delta^{13}C_2$ value is $> -28\%$ for coal-derived gas, then the Niudong gas fields are coal-derived. According to the calculation with empirical $\delta^{13}C_1$ -Ro% relationship, the thermal maturity (vitrinite reflectance Ro%) of the source rocks range from 0.83 to 1.29%. Compared with Dongping and Jiantan gas fields, the Niudong natural gas have lower thermal maturity, which are also derived from the Jurassic source rocks.

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