

Kerogen Carbon isotopes of Lower-Cambrian and Middle-Upper Ordovician, northwestern Tarim Basin, China: Implications for the oil-source rock correlation

XIAOWAN TAO^{1*}, GUANGYOU ZHU¹, CHUNLEI ZHOU¹, TINGTING LI¹ AND DEBO MA¹

¹Research Institute of Petroleum Exploration & Development, PetroChina, Bieijing 100083, China.

(✉correspondence✉taoxiaowan@petrochina.com.cn)

After more than 20 years of extensive studies, most researchers believe that the main Paleozoic hydrocarbon source rocks in Tarim Basin are mainly composed of two sets, the Middle-Upper Ordovician and the Lower-Middle Cambrian. But it's still difficult to determine the source rock distribution area, thickness and organic abundance, as well as to determine the contribution of each source rock to forming petroleum reservoirs.

Organic carbon isotope can be used as a reliable indicator for the oil-source rock correlation. The Lower Cambrian Yuertusi Formation of Shiirike section at the northwestern margin of the Tarim Basin were sampled and analysed systematically. These samples are characterized by interbedded black shale, silicate and dolomite with TOC in the range of 0.05% to 11.50%. The kerogen carbon isotopes ($\delta^{13}\text{C}_{\text{ker}}$) values range from -38.9‰ to -32.0‰, except for one sample (-30.5‰), indicating variable contributions of chemosynthesis derived organic matter. The $\delta^{13}\text{C}_{\text{ker}}$ values of the samples with TOC content higher than 0.6% range from -33.3‰ to -36.2‰, similar to the value (-34.2‰)[1] of the Xinghuo1 well Yuertusi Formation.

The TOC contents of the Middle-Upper Ordovician Salgan and Yingan Formations at Dawangou section are obviously lower (0.10% to 2.83%, mean 1.36%) and the $\delta^{13}\text{C}_{\text{ker}}$ values are between -27.4‰ and -30.3‰ [2-3], which is similar to that of Tazhong Lianglitage Formation(-25.5‰ ~ -30.15‰).

Based the study above, it can be concluded that the Lower Cambrian source rocks are obviously better than that of Middle-Upper Ordovician. And the Paleozoic crude oils with $\delta^{13}\text{C}$ values lighter than -33.0‰ may be mainly originated from Lower Cambrian.

[1] Cai *et al.* (2015), *OG* **83-84**,140-152. [2] Gu *et al.* (2012) *Petroleum Geology & Experiment* **34**, 257-266. [3] Wang *et al.* (2008) *Xinjiang Petroleum Geology* **29**, 687-689.