

## The Petroleum System Characteristic of Permian and Triassic in Sichuan Basin, SW China

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A number of medium-giant gas fields have been discovered in Permian Changxing reef and Triassic Feixianguan oolitic reservoir in NE Sichuan, SW China. Based on a series of geochemistry studies, petroleum system characteristic was discussed. It is pointed that the natural gas in reef and oolitic reservoir derived from multi-source rocks, where the gas source supply are sufficient. Three evidences discussed are as follows. (1) The gas component and its isotope characteristics are the direct basis for the determining the origin of the natural gas; the carbon isotope is the most effective and practical index. According to the cross-plot of natural gas  $\delta^{13}\text{C}_1$ - $\delta^{13}\text{C}_2$ , the  $\delta^{13}\text{C}_1$  and  $\delta^{13}\text{C}_2$  values of natural gas in oolitic reservoir distribute between those of coaled natural gas generated from Longtan coal measures and those of oil cracking gas derived from the deep source rocks of Silurian and Cambrian. (2) According to the accumulative time effect of argon isotopes, the value of  $^{40}\text{Ar}/^{36}\text{Ar}$  can be used to estimate the age of natural gas source rocks. The value of  $^{40}\text{Ar}/^{36}\text{Ar}$  in Puguang gas field was found to range from 1280 to 1690[1], which reflects that the gas source age ranges from 383 Ma (Later Devonian Period) to 323 Ma (Earlier Carboniferous Period). However, these two sets of source rocks in the Sichuan Basin are absent, so the test results are inconsistent with geologic conditions. A more reasonable explanation is that the natural gas in oolitic reservoirs should come from several sets of source rocks, which were deposited prior to 383 Ma (Cambrian and Silurian) and more recently than 323 Ma (Carboniferous), instead of a single source. (3) Gas source rocks can also be identified with carbon isotope fractionation variation index. The  $\delta^{13}\text{C}^2$  value of Natural gas is 1-2‰ lower than that of kerogen, while the  $\delta^{13}\text{C}$  value of solid bitumen is consistent with that of kerogen. A chart of the  $\delta^{13}\text{C}$  value is achieved to demonstrate the correlation among natural gas, solid bitumen and Kerogen. Natural gas in oolitic reservoir is correlative with the source rocks of Upper Permian, Lower Permian, Silurian and Cambrian. Obviously the natural gas in reef and oolitic reservoir has multi-Source genetic characteristics. It is believed that more natural gas reserves derived from multi-source rocks could be found here in the near future.

[1] Liang D G, *et al* (2008) *Marine Oil & Gas Geology* **13**, 1-16.