Geochemistry Characteristics, Genetic Types and Source of Natural Gas of the Sinian Dengying Formation in the Sichuan Basin, China

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The Sinian Dengying Formation was the key target for deep oil and gas exploration in the Sichuan Basin, China. Natural gas was mainly distributed in the Ziyang-Weiyuan and Gaoshiti-Moxi area. However, the genetic types and source of the natural gas were still unclear and controversial. The chemistry composition, stable carbon isotopes and biomarkers were used to analyze geochemistry characteristics, genetic types and source-gas correlation. The results showed that the natural gas was the typical dry gas with the average dry coefficient (C1/C1+) of 0.9992, which reflected high methane content and low heavy hydrocarbon gas content. In non-hydrocarbon gas, CO2 (0.01%~26.34%), N2 (0.03%~24.95%), H2S (0.10%~3.19%) and He (0.01%~0.34%) were mainly distributed. Compared to the Gaoshiti-Moxi area, the characteristics of higher N2 content and lower CO2 content were in the Ziyang-Weiyuan area. Although the carbon isotopes had not been reversed, the values of δ13C2-δ13C1 had difference between the Ziyang-Weiyuan and Gaoshiti-Moxi area, of which was higher in the Gaoshiti-Moxi area. The assemblage relation between natural gas composition and carbon isotopes indicated that gas types were dominated by oil-cracking gas in Sinian Dengying Formation. N2 and He come from mudstones at high maturity stage of thermal evolution. And most of CO2 were formed by deep carbonate metamorphism. H2S mainly belonged to thermal decomposition of sultides (TDS). Three sets of source rocks were developed in the Sinian-Cambrian which may be

possible gas sources. The source-gas correlation showed that the natural gas of the Ziyuan-Weiyuan area were derived from Dengying-2, 3, 4 member and the gas in the Gaoshiti-Moxi area mainly originated from Dengying-2, 4 member. The established hydrocarbon generation model of the carbonate rocks indicated that the Sinian Dengying Formation has a good potential for gas-rich.