Source Correlation and Forming Model of Natural Gas in Devonian-Middle Permian Fornatiom in Sichuan Basin,China

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The major breakthroughs have been made for natural gas exploration of Devonian-Middle Permian formation in Sichuan Basin in recent years, but its natural gas source is still not clear, affecting the next exploration deployment decision. Based on organic geochemistry and organic petrology testing techniques, a comprehensive study is conducted on the geochemical characteristics of Devonian-Middle Permian natural gas, the biomarkers of reservoir bitumen and source rocks. The results show that the Devonian-Middle Permian natural gas is secondary cracking dry gas, including more than 92% of methane content, a small amount of ethane, propane and a non-hydrocarbon gas such as nitrogen, carbon dioxide and hydrogen sulfide. The natural gas maturity varies slightly in different regions. The values of natural gas $\delta^{13}C_1$ = -35.7‰ to -27.3‰, $\delta^{13}C_2$ = -38.7‰ to -26.6‰, and $\delta^{2}H_1$= -141‰ to -138‰, indicating the genetic type of natural gas is the sapropelic type and the mixture type dominated by sapropelic type; The difference of $\delta^{13}C_1$, $\delta^{13}C_2$ and $\delta^{2}H_1$ in different regions is related to the contribution ratio of source rocks from different ages. The gas of Devonian-Middle Permian of Shuangyushi Structure in Northwest Sichuan, Middle Permian of Southwest Sichuan and Middle Permian of Paleo-uplift in Central Sichuan are mainly derived from Cambrian Qiongzhusi and Middle Permian source rocks. Middle Permian natural gas of Eastern and Southern Sichuan are mainly derived from Silurian Longmaxi and Middle Permian source rocks; Devonian-Middle Permian gas reservoirs are mainly characterized by multi-source hydrocarbon supply and accumulation. There are three modes of hydrocarbon supply. The research results have important guiding significance for developing exploration and deployment solutions for natural gas of Devonian-Middle Permian formation in Sichuan Basin.

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