

胡国艺,汪为胜,廖凤蓉. 2012. 煤成气轻烃地球化学特征及其影响因素——以四川盆地须家河组为例. 岩石学报, 28(3): 905-916

煤成气轻烃地球化学特征及其影响因素——以四川盆地须家河组为例

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基金项目: 本文受中国石油科技项目(2011B-0601)和国家油气专项(2011ZX05007-001)联合资助。

摘要:

轻烃在天然气中含量虽低,但因其含有丰富的地球化学信息,在天然气成因等研究方面引起了关注。作者以四川盆地须家河组煤成气和雷段油型气为例,采用GC和GC-IR-MS技术对煤成气轻烃的地球化学分布特征及其影响因素进行了系统分析。煤成气C<sub>7</sub>轻烃组成具有甲基环己烷分布优势,在甲基环己烷、正庚烷和二甲基环戊烷相对组成中,甲基环己烷含量最高,分布在48%~73%,平均为63.9%,煤成气轻烃单体烃同位素重 $\delta^{13}\text{C}$ 分布在-25.1‰~-20.0‰之间,大部分分布在-23.0‰~-21.0‰。轻烃的分布受到多种因素影响,天然气成熟度对轻烃中芳烃含量变化影响复杂,在成熟和高成熟阶段,天然气轻烃中芳烃含量低,成熟度对芳烃的含量影响较小,而在过成熟阶段,芳烃含量高,成熟度对芳烃含量影响大。通过凝析油和天然气轻烃组成对比,蒸发分馏作用对热演化参数Ctemp和庚烷值、甲苯/正庚烷等影响较大,但对成因类型参数如MH+2,3-DMP/C<sub>7</sub>与(3-MH+2,4-DMP)/C<sub>7</sub>,P2/C<sub>7</sub>与N2/P3,正庚烷、甲基环己烷和二甲基环戊烷相对含量关系等影响小。天然气成因类型对轻烃Mango参数K1值、正庚烷、甲基环己烷和二甲基环戊烷相对含量关系以及轻烃单体烃碳同位素影响大,因此,可以利用这些参数进行天然气成因类型判别。

英文摘要:

Light hydrocarbon in natural gas has been concerned widely in the study of the origin of natural gas due to its abundant geochemical information, although the content of light hydrocarbon in natural gas is very low. Authors considered coal-derived gas of Xujiahe Formation and oil-associated gas of Leisan Formation in Sichuan Basin as an example and analyze the geochemical characteristics and influencing factors of light hydrocarbon in coal-derived gas by means of GC and GC-IR-MS technologies systematically. The content of methylcyclohexane among C<sub>7</sub> in coal-derived gas is the maximum. Among the relative contents of methylcyclohexane, n-heptane and dimethylcyclopentane, methylcyclohexane has a content ranging from 48%~73% with an average of 63.9%. Carbon isotope values of monomer hydrocarbon in light hydrocarbon in coal-derived gas are large with  $\delta^{13}\text{C}$  ranging from -25.1‰~-20.0‰, and most of them range from -23.0‰~-21.0‰. The distribution of light hydrocarbon is influenced by various factors. The influence of maturity of natural gas on the content variation of aromatics is complex. When in the stage of maturity and high maturity, the content of aromatics in light hydrocarbon is low, and the maturity has little influence on the content of aromatics; but in the over maturity stage, the content of aromatics is high and the influence is obvious. Based on the comparison of compositions of light hydrocarbon in natural gas and condensate oil, evaporative fractionation affects the thermal evolution parameters, such as Ctemp, the heptane value and toluene/n-heptane value obviously, but slightly on genetic type parameters such as (2-MH+2,3-DMP)/C<sub>7</sub>, (3-MH+2,4-DMP)/C<sub>7</sub>, P2, N2/P3, n-heptane value and the relative content of methylcyclohexane and dimethylcyclopentane. The genetic type of natural gas has great influence on Mango parameters of light hydrocarbon such as K1 value, n-heptane and the relative content of methylcyclohexane and dimethylcyclopentane, which can be used to discriminate the genetic types of natural gas.

关键词: [煤成气](#) [轻烃组分](#) [单体烃碳同位素](#) [成因类型](#) [四川盆地](#)

投稿时间: 2010-12-11 最后修改时间: 2012-01-12