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石油学报 » 2015, Vol. 36 » Issue (10): 1199-1209,1298 DOI: 10.7623/syxb201510003

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建南气田天然气地球化学特征及成因

李爱荣¹, 李净红², 张金功³

1. 西安石油大学地球科学与工程学院 陕西西安 710065;
2. 武汉工程科技学院地质科学与工程学部 湖北武汉 430200;
3. 西北大学地质系 陕西西安 710069

Geochemical characteristics and genesis of natural gas in Jiannan gas field, the western mid-Yangtze area

Li Airon¹, Li Jinghong², Zhang Jingong³

1. School of Earth Science and Engineering, Xi'an Shiyou University, Shaanxi Xi'an 710065, China;
2. Department of Geology Science and Engineering, Wuhan University of Engineering Science, Hubei Wuhan 430200, China;
3. Department of Geology, Northwest University, Shaanxi Xi'an 710069, China

摘要

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全文: PDF (5710 KB) HTML (1 KB)

输出: BibTeX | EndNote (RIS)

摘要

中扬子西部地区经历了多旋回沉积-构造演化,纵向上发育多套生储盖组合,烃源岩为碳质页岩、碳酸盐岩及煤等多种岩性,多数达到了过成熟阶段,深部震旦系-寒武系烃源岩均处于过成熟晚期,具有多阶段生烃、晚期原油裂解供气特征。在多旋回构造演化中,中扬子西部海相天然气呈现多源多期或同源多期混合聚集、多期调整及晚期次生变化的复杂成藏过程。基于对中扬子西部地质演化背景分析和前人研究成果,分析了区域有效主力烃源岩,从天然气组分含量、组分参数相关性、烷烃气碳同位素等资料剖析了建南气田各层系天然气地球化学特征,结合区域油气成藏地质及川东气区资料,厘清了建南气田海相天然气成因及气源。研究认为,建南气田海相天然气均为干气,烷烃气碳同位素呈部分倒转,发生过原油裂解供气;二叠系长兴组及下三叠统飞仙关组、嘉陵江组气藏气源来自二叠系烃源岩,基本没有志留系甚至更深部气源供给,由原油裂解气和多类型干酪根降解气混合聚集而成,原油裂解气占主体;志留系韩家店组气藏和石炭系黄龙组气藏属于同源不同阶段天然气混合成因,原油裂解气占主体,气源母质为上奥陶统五峰组-下志留统龙马溪组碳质页岩,几乎没有受到来自震旦系-寒武系烃源岩的天然气充注。因此,中扬子西部地区海相天然气勘探潜力大,尤其以保存条件较好的鄂西渝东地区为主,震旦系、寒武系及志留系天然气勘探前景甚好。

关键词 : 中扬子西部, 主力烃源岩, 天然气, 地球化学特征, 气源

Abstract :

The western mid-Yangtze area has experienced multi-cycle sedimentary and tectonic evolution, where multiple sets of resource-reservoir-cap assemblages are developed. The source rocks consist of diversified lithologies, such as carbonaceous shale, carbonate rock and coal, most of which enter the over-maturity stage. The deep Sinian-Cambrian source rocks are in the late period of over-mature stage, characterized by multi-stage hydrocarbon generation and crude-oil cracking gas in the late period. In the multi-cycle tectonic evolution, marine natural gas in the western mid-Yangtze area showed a complex accumulation process of multi-source multi-stage or consanguineous multi-stage mixed aggregation, multiphase adjustment and secondary changes in the late period. Based on previous research results and analyses for geological evolution background of the study area, regional effective chief source rocks were explored, and then the geochemical characteristics of natural gas in Jiannan gasfield were analyzed according to the component content of natural gas, the correlation between component parameters, carbon isotope of alkane gas and other data. In combination with regional hydrocarbon accumulation geology and gas zones of eastern Sichuan Basin, the genesis and source of marine natural gas in Jiannan gasfield, the western mid-Yangtze area were clarified. Studies have indicated that marine natural gas in Jiannan gasfield is dry gas; alkane gas shows certain carbon isotopic reversal, and crude oil cracking has occurred for gas supply. The gas reservoirs of Permian Changxing Formation, Lower Triassic Feixianguan Formation and Jialingjiang Formation were derived from Permian source rocks. There is basically no Silurian or deeper gas-source supply. The natural gas in Jiannan gasfield is generated from mixed aggregation between crude-oil cracking gas and multi-type kerogen degradation gas, of which crude-oil cracking gas is dominant. The gas reservoirs of Silurian Hanjiadian Formation and Carboniferous Huanglong Formation are consisted of consanguineous multi-stage natural gases, of which crude-oil cracking gas is dominant. Meanwhile, the parent material for gas source is carbonaceous shale in Upper Ordovician Wufeng Formation and Lower Silurian Longmaxi Formation, rarely charged by natural gas of Sinian-Cambrian source rocks. Therefore, a huge potential exists in the exploration of marine natural gas in the western mid-Yangtze area, especially dominated by the western Hubei-eastern Chongqing area with good preservation condition. Moreover, Sinian, Cambrian and Silurian natural gases have a favorable exploration prospect.

Key words : western mid-Yangtze region chief source rock natural gas geochemical characteristics gas source

收稿日期: 2015-03-09

中图分类号: TE122

基金资助:

中国地质调查局优选项目"非常规与常规油气成藏统一机理与分布规律研究"(No. 12120113040700)资助。

通讯作者: 李净红,男,1985年10月生,2004年获西安石油大学学士学位,2011年获西安石油大学硕士学位,现为武汉工程科技学院讲师,主要从事石油地质学的教学与研究工作。Email:oil-and-gas@sohu.com **E-mail**: oil-and-gas@sohu.com

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作者简介: 李爱荣,女,1976年5月生,1999年获中国石油大学(北京)学士学位,2015年获西北大学博士学位,现为西安石油大学讲师,主要从事油藏描述、油气田地质与开发的教学与研究工作。Email:lar9503@163.com

引用本文:

李爱荣, 李净红, 张金功. 建南气田天然气地球化学特征及成因[J]. 石油学报, 2015, 36(10): 1199-1209,1298.

Li Airong, Li Jinghong, Zhang Jingong. Geochemical characteristics and genesis of natural gas in Jiannan gas field, the western mid-Yangtze area[J]. Acta Petrolei Sinica, 2015, 36(10): 1199-1209,1298.

链接本文:

<http://www.syx-cps.com.cn/CN/10.7623/syxb201510003> 或 <http://www.syx-cps.com.cn/CN/Y2015/V36/I10/1199>

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通讯地址: 北京市西城区六铺炕街6号 (100724)

电话: 62067137(收稿查询), 010-62067128(期刊发行、地质勘探栏目编辑), 62067139(油田开发、石油工程栏目编辑)

E-mail: syxb@cnpc.com.cn(编辑部), syxb3@cnpc.com.cn(收稿及稿件查询), syxb5@cnpc.com.cn(地质勘探栏目编辑), syxb7@cnpc.com.cn(油田开发栏目编辑), syxb8@cnpc.com.cn(石油工程栏目编辑), syxb4@cnpc.com.cn(期刊发行)

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京ICP备13000890号-1