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渝东南牛蹄塘组页岩有机质特征及沉积环境研究

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Organic Matter Characteristic and Sedimentary Environment of the Lower Cambrian Niutitang Shale in Southeastern Chongqing

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PDF (PC)

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摘要/Abstract

摘要:

下寒武统牛蹄塘组页岩是四川盆地震旦系成藏的主要烃源岩,同时也是四川盆地页岩气勘探的目标层位之一。为研究富有机质页岩TOC含量在垂向上的变化规律,探讨沉积环境对富有机质页岩的控制作用,对渝东南酉阳地区牛蹄塘组页岩新鲜露头剖面进行系统野外观察、连续采样,进行有机碳、硫含量、Rock-Eval热解、有机质碳同位素、生物标志化合物、全岩X-射线衍射和黏土矿物含量等测试分析。结果表明:页岩有机碳含量分布在2.43%~9.89%之间,平均高达7.0%;有机碳同位素值分布在-32.4‰~-31.1‰之间,为典型的海相I型干酪根;正构烷烃、萜烷以及规则甾烷的分布特征反映了泥页岩有机质低等的水生生物和菌藻类母质来源特征;富含硫和黄铁矿,且与有机碳含量呈较好正相关性,表明强还原沉积环境有利于有机质的富集;富含石英矿物,平均为61%,与有机质含量呈正相关,黏土矿物平均为17.6%,与有机质丰度负相关,表明深水陆棚相沉积环境中,越靠近深海,页岩石英矿物与有机质越富集,黏土矿物含量越少。

关键词: 渝东南,牛蹄塘组,页岩,有机质,矿物组成,沉积环境

Abstract:

The Lower Cambrian Niutitang shale is not only the source rocks for Sinian conventional gas reservoirs but also one of the most prospective strata for shale gas exploration and development. In order to study the vertical variation, the controlling factors of sedimentary environment on rich organic matter in Niutitang shale, organic carbon and sulfur content, Rock-Eval pyrolysis, organic carbon isotopes, and mineral composition of shale samples were analyzed. The results show that shale samples are enriched in organic matter (TOC varying from 2.43% to 9.89% with an average of 7.0%), indicating typical marine Type I kerogen ($\delta^{13}C_{org}$ ranging from -32.4‰ to -31.1‰). Researches on biomarkers indicates that the organic matter in Niutitang shale is derived from low grade hydrobiont and algae. The higher relative abundance of sulfur and pyrite show rich organic matter deposited in strong reducing sedimentary environment. The average content of quartz and clay mineral of Niutitang shale are 61% and 17.6%, respectively. The relationship among quartz, clay mineral and organic matter content show Niutitang shale has higher amount of quartz and organic matter in deep sea.

Key words: Southeastern Chongqing, Niutitang Formation, Shale, Organic matter, Mineral composition, Sedimentary environment

中图分类号:

TE132.2

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