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川南地区热史及下寒武统筇竹寺组页岩热演化特征

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Paleo-heat Flow and Thermal Evolution of the Lower Cambrian Qiongzhusi Shale in the Southern Sichuan Basin, SW China

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PDF (PC)

282

摘要/Abstract

摘要 :

川南地区古生界海相页岩是我国页岩气勘探的主要目标层系之一。利用镜质体反射率古温标恢复了川南地区5口典型钻井的热史,在此基础上模拟了下寒武统筇竹寺组页岩的热演化过程。结果表明,川南地区在古生代热流值较低,二叠纪热流开始增大,川西南地区热流峰值约为110mW/m²,川东南地区为70~90mW/m²,此后热流值快速降低,最终保持在55~65mW/m²并持续至今。川南不同地区的筇竹寺组页岩由于热史和埋藏史的不同,使得烃源岩热演化过程存在差异。川东南地区筇竹寺组页岩在志留纪开始成熟,二叠纪快速演化并达到过成熟阶段。川西南地区筇竹寺组在石炭纪开始成熟,二叠纪在高温流作用下迅速成熟,R_O值达到2.5%,其中乐山—龙女寺古隆起地区的筇竹寺组在加里东期和二叠纪埋深相对较浅,烃源岩在古生代处于未成熟阶段,中—晚二叠世开始成熟,三叠纪末期进入高成熟阶段,侏罗纪—白垩纪在深埋增温作用下进入过成熟阶段。

关键词: 热演化, 页岩气, 热史, 筇竹寺组, 川南地区

Abstract:

The Paleozoic marine shale in the southern Sichuan basin is one of the most favorable fields for current shale gas exploration in China. The paleo-heat flow history of 5 wells in the southern Sichuan basin were reconstructed by using the vitrinite reflectance (R_O) data. The heat flow in the Paleozoic was relatively low, but a heat flow peak occurred during the Permian, with a maximum value of 110mW/m² in the southwestern area and 70-90mW/m² in the southeastern area. After the Triassic, the heat flow gradually reduced to the present 55-65mW/m². Based on the thermal history results, the thermal evolution of the Lower Cambrian Qiongzhusi shale were modeled. Due to the difference in burial history and heat flow history, there are differences in the thermal evolution of the Qiongzhusi shale in different regions in the southern Sichuan Basin. In the southeast area, the Qiongzhusi shale began to generate oil during the Silurian, then it experienced a rapid thermal evolution stage and became overmature during the Permian. However, in the southwest area, the Qiongzhusi shale became mature in the Carboniferous period, and it evolved rapidly in the Permian, during which time the R_O reached 2.5%. The burial depth of the Qiongzhusi shale in the Leshan-Longnansi paleo-uplift area was relatively small during the Caledonian period, so the source rocks remained immature during that time. These source rocks didn't begin to generate oil until the Middle-Late Permian, then they began to produce gas during the Triassic and became overmature in the Jurassic.

Key words: Thermal evolution, Shale gas, Thermal history, Qiongzhusi Formation, Southern Sichuan Basin

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