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鄂尔多斯盆地张家滩页岩粉砂质夹层/纹层分布、分形特征和估算方法研究

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The Distribution,Fractal Characteristic and Thickness Estimation of Silty Laminae and Beds in the Zhangjiatan Shale,Ordos Basin

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摘要/Abstract

摘要 :

鄂尔多斯盆地延长组长7油层组下部的张家滩页岩是重要的页岩油气勘探层位,其中广泛发育的粉砂质夹层/纹层在页岩油气的储集、输导、压裂和开发中均起着重要的作用,确定粉砂质夹层/纹层的厚度及其分布特征对页岩储层评价、页岩油气资源量估算具有重要意义。露头、岩心及薄片观测结果表明,粉砂质夹层/纹层碎屑颗粒粒度较大,其累计厚度可占页岩段总厚度的7%~26%,单层厚度多为0.5~8mm,平均发育频率为8~40层/m,纵向分布具有强非均质性。粉砂质夹层/纹层的厚度及分布在分米级、厘米级和毫米级3个尺度范围内具有统一分形特征,分形维数在3个厚度尺度内具有标度不变性。采用Number—Size计算模型可利用厚层粉砂质夹层数据预测薄层粉砂质纹层的厚度及层数,预测结果和实测结果吻合较好,表明Number—Size计算模型是估算粉砂质纹层层数、累计厚度、砂地比等参数的有效方法。

关键词: 张家滩页岩, 粉砂质夹层/纹层, 分形特征, 估算方法, 鄂尔多斯盆地

Abstract:

The Zhangjiatan shale of the Lower Chang 7 member of Yanchang Formation,Ordos Basin is an important exploration target for shale gas.Since the silty beds/laminae in the shale play an important role in gas storage,fluid flow,fracturing and development of shale gas/oil,it is of great significance to ascertain the thickness and the distribution characteristic of the silty beds/laminae.The measurement results from outcrop,core and thin section show that the silty beds/laminae have larger detrital grains than those in the clayey laminae and the silty laminae thickness mainly ranges from 0.5mm to 8mm.Their total thickness can occupy 7%~26% of the shale formation with an average density of 8~40 layers/m,which shows strong vertical heterogeneity.The thickness distribution of silty beds/laminae presents a fractal distribution on a dm to mm scale and the fractal dimension D has scale invariance over the whole thickness range.According to the data from the relatively thick layers of silty beds,the accumulative number of the thinner silty beds/laminae was estimated using the Number-size model.The accumulative thickness of silty beds/laminae and its ratio to the shale formation thickness were calculated.It has been verified that this method can ascertain the thickness of the silty beds/laminae effectively.

Key words: Zhangjiatan shale, Silty beds/laminae, Fractal characteristic, Estimation method, Ordos Basin

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