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四川盆地侏罗系流体包裹体与致密油形成演化

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摘要:

四川盆地侏罗系发育具有分型结构的超致密储层,孔隙度多数在5%之下,渗透率小于0.1mD.长期以来,有关侏罗系油藏是裂缝油藏,岩性油藏,还是致密油,一直存在争议;对于如此致密储层,在没有裂缝的情况下,石油能不能进入储层,是如何进去的,运移路径是什么;是储层先致密后进油,还是先进油而后储层致密化;致密油的运聚机理与富集因素是什么,应采取怎样的勘探思路等等,是勘探和研究中需要面临和解决的基础科学问题.本文运用流体包裹体、场发射和环境扫描电镜、纳米CT和成藏物理模拟等方法,从储层微观介质空间含油性、流体包裹体分布及特征、储层演化与生烃演化等研究入手,开展了侏罗系石油运移、聚集机理和富集规律研究,结果表明四川盆地侏罗系油层以致密油为主体,储层致密化过程中及以后发生石油充注,致密储层基质中各种成岩次生微缝、结晶矿物晶间缝隙、各种微-纳米缝隙等基质缝是石油运移和渗滤有效路径,生烃增压和毛细管压力差是致密油运聚的主要动力,致密储层非达西渗流特征明显,具有启动压力梯度.四川盆地侏罗系致密油具有"源储共控、近源富集、网状喊油、甜点高产"的分布规律,指出在勘探中需要遵循致密油的自身属性和地质规律,按照"整体部署、分层评价、优选甜点"的工作思路,实现创新研究、科学评价和效益勘探.

英文摘要:

Hyper-tight reservoir with fractal structure of Jurassic developed in the Sichuan Basin. It's porosity mainly below 5% and permeability under 0.1mD. The Jurassic reservoir type has been debated about it is fracture reservoir, lithologic reservoir, or tight oil for a long time. For such tight reservoir, if petroleum can charge reservoir without fracture, how it charged? Where is the migration path? Whether the reservoir compacted before petroleum charged or petroleum charged first? What's the mechanism of tight oil migration and accumulation? And what's the enrichment factor of tight oil? How we should do in tight oil exploration? Those are the basic problems we will confront in exploration and research. By using fluid inclusion analysis, field emission, environment scanning electron microscope Nano-CT and physical simulation of hydrocarbon migration, we observed oil saturation in reservoir microscopic media space, the distribution and characteristics of fluid inclusion, the evaluation process of reservoirs and hydrocarbon generation and carried out a study of petroleum migration and accumulation mechanism and pattern of enrichment of Jurassic. The results show that tight oil dominate Jurassic oil layer in the Sichuan Basin. Reservoir compacted before hydrocarbon charged. Various kinds of secondary micro-fracture, intergranular cracking, micro-nanometer gap are effective path of hydrocarbon migration and infiltration. Hydrocarbon generation pressurization and capillary pressure differential is the main drivers of tight oil migration and accumulation. Tight reservoir has obvious characteristics of non Darcy flow and threshold pressure gradient. The distributions of Jurassic tight oil in Sichuan Basin possess the characteristics of "controlled by source rock and reservoir, accumulated proximal source rock, distributed in reticulation, high production in sweet spot". We also pointed out that we need to follow the properties and regularity of tight oil in the exploration. According to the idea of "monolithic deployments, layering evaluation, optimizing sweet spot", we realizing innovation research, scientific evaluation and efficient exploration.

关键词: 流体包裹体 致密油 非常规油气地质 油气形成演化 侏罗系 四川盆地

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