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Pore structure characteristics and controlling factors of mud stone and shale of the 3rd section of Es3 in Zhanhua Sag

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In order to study the pore structure characteristics and its controlling factors of the mud stone and shale in the section of the third member of the Shahejie Formation (Es3x) in Zhanhua Sag, Jiyang Depression, Bohai Bay Basin, many experiments were conducted around rock minerals, geochemistry and reservoirs based on the cores from the only coring well (L69) in the study area. There are 3 cognitions obtained from the experiments above and some matching logging data: (1) there are not only nanometer-scale pores [1], but also microns-scale pores existed in the shale in Es3x based on MIP (mercury intrusion porosimetry) and FE-SEM (field emission scanning electron microscope); (2) there are different controlling factors when it comes to different scale pores based on statistics and FE-SEM. More specifically, there are a lot of microporous-mesoporous ($r<50nm$) in clay while a plenty of macropores ($r>50nm$) in carbonate minerals. Meanwhile, the microfractures play a significant role in providing the volume of macropores whether in clay or carbonate minerals; and (3) tests' results showed high carbonate minerals proportion and more micro-fractures in the bottom of Es3x, depth ranged from 3105m to 3125m. Meanwhile, the average oil saturation (obtained by NMR) of 2 samples in this section is up to 58.6% while the S1/TOC exceed 100mg/g, higher than in other sections. We consider the section that lies at a depth ranged from 3105m to 3125m as the promising section while macropores are more significant than microporous-mesoporous for the occurrence and mobility of shale oil [2].

References:

[1] Caineng Zhou (2011) Acta Petrologica Sinica 27(6): 1857-1864

[2] Nelson PHP (2009) AAPG Bulletin 93(3): 329-340