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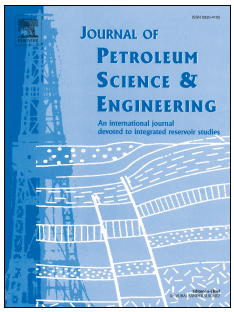

Microstructural controls on reservoir quality in tight oil carbonate reservoir rocks

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Microstructural controls on reservoir quality in tight oil carbonate reservoir rocks

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Abstract

In carbonate reservoir rocks the complex interaction between the petrophysical properties corresponds to the various depositional microstructures which are modified by various diagenetic processes that ultimately define the reservoir quality, and pose challenges to the prediction of permeability. The permeability heterogeneity in the carbonate oil reservoirs of northern Iraq varies widely and is thought to be controlled by a number of different factors. In this work, controls of matrix permeability for the Cretaceous Kometan formation selected from five oil fields in Kirkuk embayment zone have been investigated. Helium porosity, helium pulse decay permeability , brine permeability, Nuclear Magnetic Resonance (NMR), Mercury Injection Capillary pressure (MICP) , Scanning Electronic Microscopy (SEM), X-Ray diffraction (XRD), and photomicrography of thin section have been used to investigate the effect of microstructure on the variation of permeability in the Kometan Formation. The formation has porosities and permeabilities which range from 0.5±0.5% to 29±0.5% and from 0.65±0.08 μD to 700±0.08 μD respectively. Three types of pore systems have been investigated using pore type, pore size and pore-throat size as characterizing parameters. We have recognized three microstructural types: (i) matrix composed of nano-intercrystalline pores (pore diameter d_p smaller than 1 μm and a nanoporous pore-throat size), (ii) matrix composed of micro-intercrystalline pores (1<d_p<10 μm with a corresponding micron-scale pore-throat distribution), and (iii) meso-intragranular and moldic pores (d_p>10 μm) also with microporous pore-throat radii. The nano-intercrystalline pore system is common across northern Iraq and represents the effective pore system type in the reservoirs of the Kirkuk embayment zone. For these