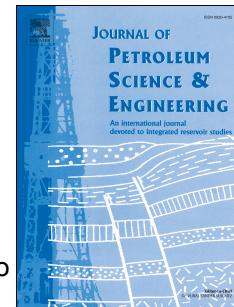


# Accepted Manuscript

Pore types, origins and control on reservoir heterogeneity of carbonate rocks in Middle Cretaceous Mishrif Formation of the West Qurna oilfield, Iraq

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1 Pore types, origins and control on reservoir heterogeneity of carbonate rocks  
 2 in Middle Cretaceous Mishrif Formation of the West Qurna oilfield, Iraq<sup>1</sup>

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10

11 Abstract

12 Carbonates in Upper Cretaceous Mishrif Formation of the West Qurna oilfield in Iraq are  
 13 characterized by complicated rocks and pores types, and strong heterogeneity. Based on the cores  
 14 and cast thin sections of three wells, pore types were identified, and pore origins were analyzed  
 15 from the perspective of sedimentary and diagenesis features. Porosity and permeability  
 16 measurement, and high pressure mercury injection capillary pressure tests were conducted to  
 17 determine the relationships between pores and reservoir heterogeneity. Six types of pores are  
 18 identified, and they are intragranular pores, moldic pores, residual moldic pores, intergranular  
 19 pores, micropores and intercrystal pores. The pore origins were controlled by the sedimentary  
 20 environments and diagenesis. Pore types were controlled by lime mud contents, bioclastic textures,  
 21 types and abundance that were controlled by sedimentary environments. Pore occurrence was  
 22 determined by various diagenesis, while pore occurrence was mainly attributed to dissolution,  
 23 which was influenced by the mineral composition of bioclastics. In addition, pores were altered by  
 24 micritization, cementation and compaction. Results from the comparison of reservoir parameters  
 25 show that the reservoir physical properties and pore structure of the each dominant pore type are  
 26 similar. The study proves that reservoir characteristics are controlled by dominant pore types and  
 27 reveals that pore type is a crucial cause for strong reservoir heterogeneity of carbonates.

28

29 *Keyword:*

30 Pore types; Pore origins; Reservoir heterogeneity; Carbonates; Mishrif Formation; West Qurna  
 31 oilfield

32

33 **1. Introduction**

34 Carbonate rocks are important petroleum reservoirs. Although carbonates account for only  
 35 about 20% of all sedimentary rocks, they contains more than 60% of global conventional  
 36 hydrocarbon resources (Ahr, 2008; Jia, 2012). The complicated depositional rock fabrics and  
 37 diversely diagenetic modifications have jointly resulted in the formation of complex pore systems  
 38 in carbonates, which refer to the diversity of pore types, pore sizes and pore origins, and  
 39 contribute to the complicated pore structures with strong heterogeneity (Flügel and Munnecke,  
 40 2004; James and Jones, 2016; Moore and Wade, 2013). Some pore classification schemes have  
 41 been developed to understand the complex pore systems of carbonates. The most widely-used pore  
 42 classification developed by petroleum geologists is the one from Choquette and Pray (1970), who  
 43 classified pores according to the fabric selectivity of the sediment. The most widely-used pore  
 44 classification developed by petrophysicists and reservoir engineers is the one from Archie (1952)  
 45 and Lucia (1983, 1995, 2007), who directly linked to pore types and flow properties, indicating  
 46 that pore type is a significant influence factor on the characterization of carbonate reservoir. A  
 47 novel and meaningful pore classification developed by Lønøy (2006) is texturally derived mostly  
 48 from that of Choquette and Pray (1970), incorporates Lucia's pore-size differentiation and  
 49 combines the sedimentologic and diagenetic characteristics with physical properties. However,

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