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The Relationship between Pore Types and Reservoir Flow Units in a Heterogeneous Carbonate Reservoir

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Heterogeneity in carbonate reservoirs, originating from various depositional, diagenetic, and fracturing processes, presents a significant challenge in identifying flow units and reservoir zonation. In this study, to identify the main productive units and understand the relationship between the pore nature and their role in development of different reservoir zones, core data and petrophysical logs from a well were used. Based on the modified Lorenz Plot, the reservoir rock was initially divided into 10 reservoir units. Reservoir heterogeneity assessments indicated that some zones still exhibit high heterogeneity. Therefore, using other methods such as cumulative permeability plot, normalized cumulative reservoir quality index, and calculation of pore throat radius, the identified zones were further divided into 20 sub-zones or flow units: high-speed, baffle, and barrier flow units.

The high-speed flow units (eight units), which approximately have a cumulative thickness of about 102 meters and contribute to over three-quarters of the well's production, correspond to dolomitized grainstone facies with interparticle and intercrystalline pores and an average pore throat radius of over 5 microns (macro and megapores). The baffle units correspond to grainstones with oomoldic porosity and predominantly dolomitized mud-dominated facies with pore sizes less than one micron (meso- and micropores). The barrier units, contributing less than one percent to the well's production, account for one-third of the reservoir rock thickness and predominantly correspond to low-porosity facies of reservoir units K3 and K1 and extend near the Permo-Triassic boundary sequence.

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