Integrated Reservoir Characterization for Evaluating Development Opportunities in Mature Oil and Gas Reservoirs (Miocene Kais Carbonates), Salawati Island, Papua, Indonesia

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Miocene Kais Carbonates was one of mature hydrocarbon reservoir of Salawati Basin, which has been producing oil and gas since 1936 in Papua-Indonesia. A sufficient number of wells, cores, and cuttings are available for the study, resulting in a more rigorous stratigraphic framework for accurate mapping of porosity and permeability required for reservoir zonation.

Enhanced petrographic analysis employed to 290 thin sections from 19 selected wells to resolve the relationship between reservoir quality and depositional facies, especially in massively dolomitized reservoirs. Petrophysical analysis and facies determination also conducted to well-log data from 32 selected wells. Careful examinations from previous studies combine with this study come to the idea that one geological model applied for the whole Salawati Island area is not sufficient. Reservoir compartmentalization, either structurally or stratigraphically is necessary.

Three distinct carbonate lithofacies subdivision identified within the reservoir unit: Open Marine Carbonate Shelf Facies, Shallow Marine Back Reef Lagoonal Bays Facies, and Shallow Marine Back Reef Carbonate Bays Facies. Each forms a separate flow unit, which characterized by different stratigraphic and organic skeletal characteristic based mainly on thin section analysis from cuttings and controlled by petrophysical analysis.

Within the reservoir unit, three distinct fluid flow pathways are defined. First, Most Conductive Flow Unit consists of wack-packstone to packstone lithologies, rich skeletal organic grains and dominated by intercrystalline, mouldic and vuggy porosities within matrix and grain, recrystallized to dolomitized cementation. Second, Less Conductive Flow Unit consists of wackestone to packstone lithologies, low skeletal organic grains and dominated by interparticle to intraparticle porosities within matrix and grain, low recrystallized or dolomitized cementation. Third, Non Conductive Flow Unit consists of mudstone, wackstone, and wack-packstone lithologies, very low skeletal organic grains and dominated by chalky porosities within matrix and grain, very low recrystallized or dolomitized cementation.