Integrated Electrofacies Analysis and 3D Seismic Interpretation of an Oligo-Miocene Carbonate Platform to Evaluate Reservoir Zones, NE Java Basin, Indonesia

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Ujung Pangkah is a conventional oil and gas field located in the NE Java basin, producing from Late Oligocene to Early Miocene shallow-marine limestones of the Kujung I and Tuban Formations. Scale-dependence data analysis issues make understanding and predicting reservoir quality of such carbonate platforms challenging. Sedimentological, petrophysical, image log and 3D seismic observations and interpretations were integrated to understand the development of the carbonate platform and the distribution of a palaeo-karst system to divide the platform into distinct reservoir zones.

The Kujung I stratigraphic succession is subdivided into three primary zones based on core and petrographic observations from 8 wells. A shallowing upward trend is identified from core in Reservoir Zones 4 and 3, transitioning from low energy offshore deposits to high energy platform margin facies. These high energy facies contained the most favourable reservoir properties, containing vuggy dissolution porosity and well-developed karsts. An extensively traceable surface, interpreted to be a sequence boundary, is identified at the top of Reservoir Zone 3. This surface highlighted major facies change, with a shift in depositional environment from shallow marine to offshore marine into Reservoir Zone 2. These deposits were notably poorer reservoir properties, due to a lack of dissolution and extensive cementation.

A geological reservoir rock type (RRT) classification scheme was devised using core and petrographic observations. This scheme was applied to a supervised electrofacies model and interpreted into the uncored intervals, with Formation Image (FMI) Logs used as a quality control. The validation of this scheme using core and petrography data enabled the correlation of the vuggy porosity zones from Zone 3 into uncored intervals, indicating the areas of best reservoir property zones across the field. Reservoir quality zone maps of each stratigraphic intervals were updated for geologic model input to aid future field development, based on the electrofacies abundance in combination with seismic observation.