

Very Low Quality Reservoirs, New Opportunity for Future Developments in Mature Field, a Case Study of Semberah Field, Kutei Basin, Indonesia

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ABSTRACT

Balikpapan formation is commonly known for deltaic sediments deposited during aggradational – progradational sequences that proven to hold significant amount of hydrocarbon. Two major facies, distributary channels and bars, are being depleted plus limited space on the crest of anticline for finding virgin reservoir pressure is more challenging. Those are major factors for declining hydrocarbon production in Semberah field. In other side, very low quality reservoirs are being undeveloped as perforation target. This study is focused on identifying and quantifying in very low quality hydrocarbon reservoirs -traditionally called shales due to high gamma- which are being overlooked as new opportunity for future development in order to optimize the production of remaining resources in Sanga sanga area.

The data sets are outcrops, cores, wireline logs, and production data. Outcrops illustrate reservoir geometry and connectivity while cores show the centimeter scale of subsurface condition. Several new core plugs from selected old cores interval in multi wells were taken for routine, petrography, and XRD analyses. The methodology is combining between sedimentological and petrophysical analyses. Sedimentological analysis generates depositional facies that derived from the bed thickness, sedimentary structures, and sand body geometries plus linked with biostratigraphy and petrography reports. Petrophysical analysis is defining the suitable reservoir properties by comparing several equations also validating with core plugs and production history from the proven very low quality reservoir intervals.

Cores and outcrops demonstrate that very low quality reservoirs in the lower delta plain to delta front can be divided into several depositional facies. The very low quality reservoirs are characterized by intercalation of clay to very fine grain size with lenticular, flaser and highly shallow marine bioturbation that is interpreted as tidal sand flat. The reservoir geometry is lenses with elongated shape and width up to 500 meter. Petrography, XRD and routine core analyses show that these very low quality reservoirs are abundant with quartz and organic material contents with minor clay and carbonate minerals also very poor porosity and permeability. The high quartz content in high gamma value clearly unlocks low quality hydrocarbon reservoir as potential candidates to exploit by using an advanced technique such as fracturing.

Pay determinations using depositional facies and re-interpretation of petrophysical properties combine with production data were clearly observed that the data sets are concentrated within the pay zone. This study propose new cut off for very low quality reservoirs that never been proposed before. Furthermore, the new pay cut off has been applied in other wells and unlock great additional potential pay beyond the existing pay zones.

Factors that made the very low quality reservoirs become potential are 1) Determination of depositional facies in low quality reservoirs; 2) New parameters for hydrocarbon reservoir cut off; 3) New insight from new core plugs; and 4) Refining the petrophysical properties with new data sets. This study illustrates how depositional facies, old cores with new core plugs, and production history can be linked to determine very low quality reservoirs pay zones with a reliable and effective approach. Finally, by using a suitable development scheme, this study is expected to open others low quality reservoirs in other mature fields.