New Exploration Perspectives In The Offshore Of West Sarawak

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Abstract

This work presents new insights on the prospective hydrocarbon resources located in the offshore of West Sarawak, including S.W. Sarawak, Tatau, West Luconia and N.W Luconia provinces. The area of interest is at different stages of exploration, depending on the provinces. Gas discoveries were made in West Luconia, which is relatively well explored, while oil discoveries have been made in South West (SW) Sarawak, where data are limited, and the related petroleum system remains to be assessed. The objective is therefore to assess the remaining hydrocarbon potential through a unified play-based approach up to lead/prospect assessment.

The workflow is centred on process-based geological modelling, making use of Forward Stratigraphic modelling (FSM source-to-sink), integrated Petroleum system modelling (PSM) and multi parameters uncertainty assessment. The input data of the models results from the regional geodynamic assessment, for structural style definition and sedimentary source location, GDE mapping of the various plays, homogenised horizon and fault interpretations, geochemical data, Pressure and Temperature and discovery data (volumes in place, API, GOR, CGR, and non-hydrocarbon concentrations). Model results (reservoir, seal and source-rock initial TOC and HI distribution) are calibrated on petroleum system components data observed at wells and derived from seismic.

The structural domains include from SW to NE the offshore Rajang complex, the Bukit Mersing (BM)
line and the Central Luconia platform. Each domain has its own structural behaviour, with Thrust faults reactivated as normal low angle faults in Rajang and crustal stretching in BM Lines with steeper faults with local inversion in the half grabens along the BM lines.
The study has identified 8 main plays, with associated sub-plays, from Pre-Cycle I (Late Cretaceous to Eocene), Cycle I, II and III (Oligocene to Lower Miocene), Cycle IV, with associated carbonate pinnacles, and younger Cycles (V to VIII).

These plays correspond to depositional sequences (from SB to SB) as defined in SE Asia sequences where reservoirs are located at the base of the sequence and seals located above.

The main unconformities (Late Eocene and Middle Miocene - MMU) and related tectonic features have an impact on the HC charge mechanism of the reservoirs present in the various Cycles. The depositional environments during Pre-Cycle I have led to the preservation of source-rocks of terrestrial type with significant potential locally, which can contribute to the charge of younger cycles when burial history is adequate, especially in SW Sarawak.
Local source-rocks of terrestrial origin (coals) are present in SW Sarawak grabens and are able to charge the grabens with liquid within a depth window of 2500-3000m.

In the other provinces, the present-day burial associated with high heat-flow regime due to lithospheric thinning drives the HC expulsion timing and HC preservation in traps. In areas where source-rocks are deeply buried (6000 to 8000m) below MMU, the post MMU reservoirs are not efficiently charged due to early expulsion migration. Shallower source-rocks appear to be effective and charging traps with liquids.

On the basis of the study, exploration opportunity maps are built, showing the type and potential volumes to be expected in the various plays, as well as the uncertainties on GIIP and OIIP (P90, P50; P10) and Probability of Geological success.