



ORAL PRESENTATION

Challenging the Existing Paradigm: A Case for Dual Petroleum System Operation in the Central Palembang Sub-Basin, South Sumatera Basin, Indonesia

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A recent comprehensive evaluation of the Central Palembang sub-basin presents a compelling case for dual petroleum systems, each with different source-reservoir couplets and operating within separate hydraulic regimes at different stages of the basin's evolution. The conventional Oligocene Talang Akar (TAF) source rock charges deep fractured-basement (BSMT), TAF sandstones and Baturaja (BRF) carbonate reservoirs (deep system), whilst often overlooked Upper Gumai (UGUF) source rocks charge younger Middle and Late Miocene Air Benakat (ABF) and Gumai (GUF) sandstone reservoirs (shallow system). Both petroleum systems are isolated from one another by an effective overpressured sealing shale of Lower Gumai (LGUF) age.

Our study area is the Merangin III PSC, located in the Central Palembang sub-basin, and part of the South Sumatra Basin. Our evaluation incorporates seismic interpretation, pore pressure and source rock studies, fluid analysis, basin modelling and post-mortem well reviews. The basin model is calibrated by two adjacent offset pools which act as primary controls: the giant Suban gas field and the Tampi oil field (South East Siera and West Belani fields), lying to the north and north-east of Merangin III respectively.

Five proven hydrocarbon plays are recognised in the area, with deeper BSMT, TAF sandstone, BRF carbonate, being dominantly gas prone, and younger, shallower plays (GUF and ABF sandstone) predominantly oil prone.

Fluid isotope signatures of both deep and shallow reservoirs indicate similar genetic provenance from mixed organic matter (OM) input into a transitional / shallow marine environment. Fluid signatures are correlatable with both TAF shale and UGUF shale source rocks. The main hydrocarbon kitchen identified in the study area is the Belani Deep depocentre (BD Kitchen). Our analysis indicates that the BD Kitchen hosts mature TAF and UGUF source rocks and is therefore responsible for charging both the Suban and Tampi fields, at discrete episodes in the sub-basin's history.

Pore pressure analysis of two flank wells in the area (Bingin Telok-1 and Kemang H-1) reveals that overpressure is preserved in the LGUF interval. It is considered likely that overpressure was developed and retained across the Merangin III PSC area, beyond the BD kitchen, in response to rapid Miocene burial of significant thicknesses of LGUF shale-dominated facies deposited in upper bathyal conditions. Moreover, this overpressure has been locally preserved despite post-Miocene basin inversion. The presence of a confirmed pressure regression below the LGUF shale provides an excellent hydraulic flow barrier between the deep and the shallow systems and suggests that lateral migration dominates within Lower Miocene and older sediments, whereas vertical flux is predominant in the younger post-Gumai section.

Delivered petroleum volumes and phase prediction from basin modelling support the dual petroleum system concept: alternative scenarios relying exclusively on the default Talang Akar paralic source, fail to account for the observed oil and gas distributions. TAF shales mainly provided gas to the fractured BSMT, TAF sandstone and BRF carbonate below the laterally

extensive LGUF shale, prior to significant maturation of the overlying UGUF counterpart. These younger UGUF source rocks, inferred from our regional South Sumatera source rock database and supported by outcrop data from the Sarolangun area, are currently oil mature in the centre of the BD Kitchen; they are interpreted to have recently charged the shallow GUF and ABF plays, with Tampi being currently the best documented example.

SPEAKER BIOGRAPHY

Welly Ramadan graduated from the Maths and Natural Science Faculty at the University of Padjadjaran in Bandung in 2005, and since then has honed his geological skills with a small but diverse range of quality companies, including IOCs and local Indonesian Operators. Besides Mandala, these include Premier, Bukit and Paradigm, and this experience set has provided exposure to new ventures, exploration, development and production geology – in both on- and offshore assets. Welly's recent appointment as Subsurface Technical Advisor in Mandala's Jakarta office reflects his proficiency and capabilities across a broad spectrum of technical inputs, and as an independent thinker. He has particular interests in the petroleum systems of Indonesia and will address some aspects of the South Sumatra system today