

Oil-Prone Paralic Coals: A Case Study from the Balingian Province of Sarawak, Malaysia

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The petroliferous Balingian Province of offshore Malaysia provides strong evidence for coal as an important source rock for oil as well as gas. These Miocene-Pliocene age coals were deposited within a coastal plain paralic setting. Based on lithofacies association, maceral types and biomarker distributions at least two distinct end member coal-bearing facies were identified from onshore analogues i.e. mangrove-derived coals and (marine-influenced) fluvial-derived coals. Their associated coaly sediments represent the intermediate member. The mangrove-derived coals are generally thin and very rich in mineral matter and high in liptinite content of predominantly suberinitic constituents. The coals and their associated coaly sediments possess good oil generating potential as suggested by pyrolysis and petrographic data. The fluvial-derived coals are relatively thicker and dominated by vitrinite with very low mineral matter and low liptinite content, and are generally less oil-prone compared to the mangrove-derived coals.

The known hydrocarbon distribution of offshore Sarawak appears to be strongly governed by paleogeography within the lower coastal plain: there is a distinct oil trend parallel to the Miocene Cycle II paleocoastline and a prominent gas trend eastwards towards the open sea. This is supported by oil composition. Biomarker distributions of hydrocarbons indicate a gradual reduction in terrigenous input from west to east: the relative abundances of oleanane, bicadinanes, and C₂₉ steranes decrease. There is less variation in biomarker distributions observed on the NW-SE trend, consistent with a northwest-southeast trending paleocoastline. Thus, oil and gas distribution, supported by biomarker fingerprints as well as petrological and lithofacies studies, agree with the proposed paralic coastal plain depositional model for source rocks of the Balingian Province.