

Facies, Depositional Systems and Sequence Stratigraphy of the Middle Miocene Nyalau Formation, Sarawak, Malaysia

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The Nyalau Formation (Middle Miocene) in Bintulu, Sarawak in East Malaysia is the onshore equivalent of the offshore, oil-bearing succession in the Balingian Province. It has been grouped into three major stratigraphic sections based on the Bintulu area structural geology, the relative age differences and facies association.

The oldest section is characterized by coal-bearing strata, which comprise fining-upward, shallowing-upward parasequences interpreted to have been deposited within a tide-dominated coastal setting. Coal layers (15 to 60 cm) are liptinite-rich with %Ro in the range of 0.49% and 0.70%, indicative of early oil maturity. Sub-environments within this setting include mangrove swamp, tidal channels and flats, pedogenic supratidal areas and estuarine bay. The intermediate sand/shale alternation successions consist of parasequences indicative of estuarine environment.

These heterolithic parasequences contain sandstones (1.0 to 2.0 m thick) that are moderately bioturbated by Ophiomorpha. N-alkane distributions show unimodal to bimodal patterns indicative of terrestrial and brackish-water sources. The cross-bedded, sand-dominated successions of north Bintulu, representing the youngest section, consist of parasequences indicative of tide-dominated, shallow-marine/brackish coastal embayment. The sandstones exhibit well-developed carbonaceous matter and mud drapes, with rare Ophiomorpha traces.

The Nyalau Formation successions were deposited during the transgressive Miocene period. The coal-bearing strata form early transgressive (E-TST) retrogradational parasequences sets. The intermediate, estuarine sand-shale succession comprises aggradational sets of parasequences representing the late transgressive system tract (L-TST). The thick, sandstone-dominated coastal embayment succession formed progradational parasequences sets of the highstand system tract (HST), deposited as the rising sea level begins to slow and gradually fall.