

Comparison of source rock geochemistry of selected organic-rich rocks from the New Airport Site and Tg. Kidurong, Bintulu, Sarawak: implication for oil generation from Terrestrial-derived organic matter

ISMAIL ELFORJANI SHUSHAN¹, WAN HASIAH ABDULLAH¹ AND ABDUL HADI ABDUL RAHMAN²

¹Department of Geology, University of Malaya
50603 Kuala Lumpur, Malaysia

²Geophysics Group, School of Physics, University of Science Malaysia
11800 USM Penang, Malaysia

Organic-rich sediments and coals constitute much of the Oligocene-Miocene Nyalau Formation that outcrops in south and north Bintulu area, Sarawak, East Malaysia. The main aim of this study is to examine the organic-rich sediments at Bintulu new airport and Tanjong Kidurong sites. The examination involved several organic geochemical source-rock analyses including petrological studies on polished sections e.g. vitrinite reflectance (%Ro), Soxhlet-extraction, thin layer chromatography (TLC) and GC/MS analysis to obtain biomarker distributions. Such methods are used to characterise the organic matter types and their contribution to hydrocarbon generation, and to determine the thermal maturity, and condition of deposition.

The liptinite maceral group (mostly sporinite) was found to characterise the coal samples at Bintulu new airport site, although the vitrinite group (mostly vitrodetrinite and collotelinte) constitute the major part of the organic-rich sediments of both areas. Occurrence of sporinite and other liptinites are relatively low in sediments from Tg. Kidurong.

Petrographic features indicative of oil-generation include the occurrence of exsudatinitite veins that are commonly thought to represent the very beginning of oil-generation in coals (e.g. Teichmuller, 1974; Wan Hasiah, 1997). Other oil generative features include cutinite and suberinite associated with oil-hazes.

Vitrinite reflectance (%Ro) was measured on collotelinite in coal and on dispersed vitrinite particles in other sediments. The data obtained is summarised in Table 1. Both areas were found to have Ro (mean) in the range of 0.49-0.64% indicating early oil window maturity. The sample possessing 0.49 %Ro was observed to be heavily stained with bitumen, thus lowering the reflectance value.

Biomarker parameters that support these maturity levels include the CPI values close to 1, the 22S/(22S+22R) ratios of 0.52-0.62 (for C₃₁), and 0.60-0.63 (for C₃₂).

The n-alkane distributions of the analyzed sample extracts at Bintulu new airport site (sbna9-2, sbna9-3, sbna7, sbna8), exhibit similar unimodal patterns that range from n-C₁₄ to n-C₃₇ and maximise at n-C₃₁ or n-C₂₉. They are marked by a strong contribution of higher-molecular weight n-alkanes generally from n-C₂₃ to n-C₃₃ which are indicative of terrestrial organic matter (Tissot and Welte, 1984).

The sample extracts at Tanjong Kidurong sites (mnlg4 and S8) generally show bimodal patterns ranging from n-C₁₄ to n-C₃₇ and maximizing at n-C₁₆ and at n-C₂₉. Consequently, they are characterized both by the predominance of the lower-molecular weight n-alkanes (mnlg4) and also by higher-molecular weight n-alkanes (S8). This suggests organic matter input from mixed marine and terrestrial environments (Tissot and Welte, 1984).

The sample extracts from Bintulu new airport site show higher values for the ratio n-C₃₁/n-C₁₅ that range from 3.5 to 25.5 (Table 1). The pristane / phytane ratios for both sites ranges from 2.8 to 4.5. These values are similar to those cited by Khorasani (1987) for coals deposited in dysaerobic conditions (i.e. intermediate between aerobic and anaerobic condition), thus suggesting similar condition of deposition for coals under current investigation.

The m/z 191 triterpane distributions show similar hopane distributions in both locations, which are dominated by 17a (H), 21b (H)-hopanes, the most abundant being C₃₀ (peak 6), with the C₃₁-C₃₅-homohopanes decreasing progressively. T_m (17a (H) 22,29,30-trisnorhopane; peak 2) is overwhelmingly dominant over T_s (18a (H) 22,29,30-trisnorhopane; peak 1). Oleanane (peak 5) is present in all the analyzed extract samples and indicates a

higher plant input (angiosperm) (Ekweozor *et al.*, 1979).

The available data in the present study confirms that the organic source matter in Bintulu new airport site is principally of a terrestrial type while in Tanjong Kidurong site it is principally of mixed marine and terrestrial types. No algal-derived organic matter was observed in the samples under current investigation.