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Aspects of oil generation from coals: A Sarawak case study. The importance of exsudatinite and variations in organic facies characteristics

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Coals from the onshore Tertiary Nyalau Formation, Bintulu area, and from offshore Balingian Province were sampled and subsequently subjected to detailed organic petrological and organic geochemical study. Thus study discusses the following aspects:

1) petrographic evidence of early hydrocarbon generation from exsudatinite,
2) probable precursors to the exsudatinite,
3) biomarker distributions of the coal extracts, and
4) oil to source correlations.

Petrographically the onshore coals can be subdivided into two groups: one group of coals contains higher abundances of exsudatinite whereas the other group of coals contains only trace amounts of exsudatinite. Gas chromatograms (GC) of the saturated hydrocarbon fractions of all the coals display a bimodal n-alkane distribution, high pristane/phytane ratios, and a strong

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odd to even predominance of normal alkanes in the n-C_{27} to n-C_{33} range. However, GCMS analysis shows that although all the samples contain abundant bicadinanes, 18α-oleanane (and several other triterpane compounds) is abundant in only the exsudatinite-rich coals.

The above observations were verified by studies of coal bearing sequences of the Balingian Province of offshore Sarawak. The onshore Nyalau Formation is considered to be stratigraphically equivalent to the Cycle I and Cycle II sequences of offshore Sarawak. This is supported by the organic facies characteristics recognised in this study.

The occurrence of particular maceral and biomarker assemblages is governed, in part, by organic matter source input. Factors other than source input, however, can also play a role. The two coal groups discussed above also correspond to two different maturity ranges: the exsudatinite-rich coals being lower maturity (0.45% to 0.50% vitrinite reflectance) and the exsudatinite-poor coals being of relatively higher maturity (approximately 0.75% vitrinite reflectance). Coals of different thermal maturity are known to exhibit different maceral assemblages; labile maceral types breaking down at particular maturity levels. The maceral exsudatinite exhibits such behaviour. It is suggested here that at maturity levels of less than 0.60% Ro the presence of exsudatinite is strongly controlled by the source input of organic matter. However, at maturity levels greater than 0.60% the effect of thermal maturity on exsudatinite has to be considered. The relative roles of thermal maturity and source input (hence depositional environment) to the presence of exsudatinite therefore require further study.

Two main oil types have been recognised in areas of offshore Sarawak. These two oil types correlate quite well, on the basis of biomarker assemblages, to the two coal types discussed above. This study suggests that the oleanane-rich oils in the Balingian Province are likely to be sourced from exsudatinite-rich coals whereas the oleanane-poor oils are likely to be sourced from exsudatinite-poor coals.