GEOLOGY POSTER 5

HIGH RESOLUTION BIOMARKER TECHNIQUE FOR SOURCE FACIES INTERPRETATION OF MALAYSIAN OILS

Abdul Jalil Muhamad, Awang Sapawi Awang Jamil, Nurfadhila Mohd Sharef & Farhana Jaafar Azuddin

PETRONAS Research Sdn Bhd, Lot 3288-3289, Off Jalan Ayer Itam, Kawasan Institusi Bangi, 43000 Kajang, Selangor, Malaysia

Malaysian crude oils discovered in the relatively young Tertiary Malay, Sabah and Sarawak basins are generated by variable source facies (PETRONAS, 1999). This is shown by the wide spectrum of biomarkers derived from different precursors present in the oils. Nevertheless, the two main source facies are the fluvial-deltaic, found in great abundance in the Baram Delta and offshore northwest Sabah, and the mixed fluvial-lacustrine found mainly in the Malay Basin. All these oils show presence of, albeit in varied abundance, terrigenous derived biomarkers such as oleanane and bicadinanes, indicating variable contribution from high land plant organic matter into the depositional environments (Awang Sapawi et al., 1991; McCaffrey et al., 1998; Peters et al., 2005). Characterising these oils into oil families based on their biomarker fingerprints is rather time consuming, simply due to the numerous biomarkers present in the samples and extracting the biomarker parameters. Thus, it was thought that a simple, but accurate method is needed to determine their source facies and classify them into oil families.

In this study, an attempt is made to develop a high resolution biomarker technique to provide a quick and accurate method to determine the source facies of oils. This geochemical interpretation tool was developed using a combination of significant biomarker parameters plotted in the form of cross- or ternary-plots. For this purpose, a total of 38 crude oil samples collected from various petroleum basins were selected for this study. Some of these oils were used as end-members for three main source facies, namely, fluvial-deltaic, lacustrine and marine. End-member oils are those oils whose biomarker fingerprints represent a specific source facies mentioned above.

From the numerous biomarker parameters or ratios generated, selected ones were statistically treated using hierarchical cluster analysis (HCA) and principal component analysis (PCA). Parameters with high PCA loadings were then further selected and tested using cross- and ternary-plots to determine the usefulness of the parameters and subsequently select the most significant parameters to be used as source facies interpretation.

Results show that only a few biomarker parameters are essentially needed to distinguish the different source facies into fluvial-deltaic, lacustrine, marine and carbonate when used in appropriate combinations. These parameters are:

Oleanane Index
Homohopane Index
Hopane/Sterane ratio
100*(Ta+Tb)/C27 steranes ratio
C26/C25 tricyclics ratio

REFERENCES

AWANG SAPAWI, A.J., MONA LIZA, A. AND ERIC SEAH, P.K., 1991. Geochemistry of selected crude oils from Sabah and Sarawak. Bulletin of the Geological Society of Malaysia, 28, 123 – 149.

MCCAFFREY, M.A., ABOLINS, P., MOHAMMAD JAMAAL, H. AND HUIZINGA, B.J., 1998. Geochemical characterisation of Malay Basin oils: Some insight into the effective petroleum systems. Ninth Regional Congress on Geology, Mineral and Energy Resources of Southeast Asia – GEOSEA '98. 17-19 August 1998, Kuala Lumpur, Programme and Abstract, 149.

PETERS, K.E., WALTERS, C.C. AND MOLDOWAN, J.M., 2005. 2nd ed. The Biomarker Guide, vol. 2, Cambridge University Press,Cambridge, 1155p.

PETRONAS, 1999. The Petroleum Geology and Resources of Malaysia. Petroliam Nasional Berhad, Kuala Lumpur, Malaysia, 665p.

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