

**STABLE CARBON AND HYDROGEN ISOTOPIC COMPOSITIONS AND ABUNDANCES OF ANGIOSPERM BIOMARKERS IN OILS AND SOURCE ROCKS FROM THE DEEPWATER PORTION OF THE KUTEI BASIN, INDONESIA**

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The Kutei Basin is a Tertiary depocenter in central Indonesia which has recently produced hydrocarbons in the deepwater. The reservoir rock is a Miocene sand, which is several kilometers thick throughout parts of the basin. The coaly type source rocks of a majority of the petroleum systems in the basin are profoundly dominated by land plant remains, attributed to the rapid growth of tropical plants on the island of Borneo, as well as the rapid accumulation of detritus from the River Mahakam and its tributaries (Curiale et al., 2005, and references therein).

Miocene-reservoired oils and coals of the Kutei Basin have been studied previously (Curiale et al., 2005 and Curiale et al., 2006). Both biomarker and stable carbon isotopic data of isoprenoids and *n*-alkanes have revealed that no bona fide and acceptable oil-source rock correlation can be made using these coals, and that multiple oil families are evident. Several explanations have been proposed to explain the lack of a correlation, including: i) coals are not sources of these oils; ii) oils consist of multiple accumulations; iii) relative low maturity of these coals prevents a correlation; iv) Kutei oils contain additional material (e.g. oleanenes) through migration-contamination, which also has an impact on traditional molecular maturity ratios.

The present study extends previous work on the Kutei Basin's complex petroleum systems addressing migration-induced compositional changes, maturity and/or source effects. Current understanding and preliminary findings suggest that all these processes have played major roles in the petroleum geochemistry of the Kutei Basin. A holistic approach is underway, involving stable carbon and hydrogen isotope measurements of several suspected and established age-diagnostic biomarkers mostly derived from higher plants, namely oleanenes, lupanes, bicadinane, land plant wax *n*-alkanes and cadalene present in 11 oils and 12 immature coaly source-rocks (Miocene and Eocene, 15 Ma to 36 Ma). In addition stable carbon isotopes of individual aromatics (alkylnaphthalenes, alkylphenanthrenes) and their abundance ratios (*cf.* van Aarssen et al., 1999), as well as stable hydrogen isotopes of isoprenoids and *n*-alkanes (e.g Dawson et al., 2005) are being determined to assess evidence

for multiple accumulations and maturity, respectively. An improved separation of the important higher plant components using a combination of molecular sieves and argentation liquid chromatography has been carried out in order to obtain  $\delta^{13}\text{C}$  and  $\delta\text{D}$  data of selected plant biomarkers (e.g. cadalene, norlupanes and bicadinanes). Quantitation of all the higher plant biomarker components by GC-MRM techniques using a polyethylene glycol column (*c.f.* Armanios et al., 1995; Nytoft et al., 2002) has been performed on the oils and source-rocks. It is suggested that two broadly distinct oil families exist, but both are rich in angiosperm biomarkers. Most oils are dominated by an usually high abundance of cadalane (Fig. 1), the source of cadalane is currently under investigation. The oils can be separated based on their oleanane, bicadinane, norlupane, bisnorlupane and taraxastane abundances (Curiale et al., 2005). Interestingly norlupanes and bisnorlupanes have been identified in high abundance in low-latitude oils and their abundance increases with decreasing latitude by about 10 fold. Stable carbon isotopes of pristane also separate into two distinct families, one family characterised by  $^{13}\text{C}$  depleted pristane and norlupane.

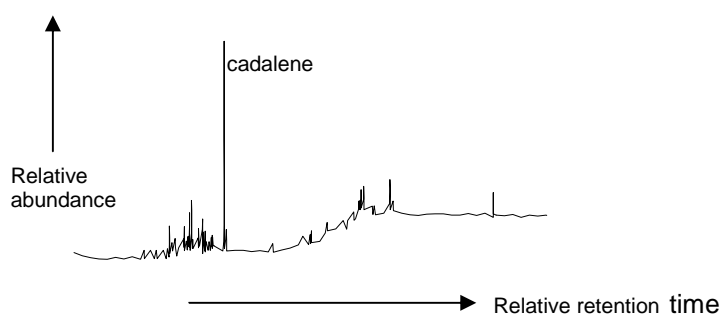


Figure. 1 GC-MS trace of an aromatic fraction of a Miocene oil from the Kutei Basin

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