

# Geochemistry of Oil Fields, East Java Basin: Biomarker Characterisation



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## Abstract

Biomarkers are molecular fossils derived from living organisms and these complex compounds are composed of carbon, hydrogen and other elements. Biomarkers show little or no change in chemical structure from their parent organic molecules in living organisms [1]. Biomarkers are very useful due to their complex structures, revealing precise information about the depositional origins. It has been recognized that biomarkers in oils and rock extracts reflect depositional environment [1-3]. Therefore, biomarkers are used to achieve the objectives in such study to know the characterization of oil samples.

**Keywords:** Fossils; Biomarkers; Oil; Isoprenoids; Marginal marine

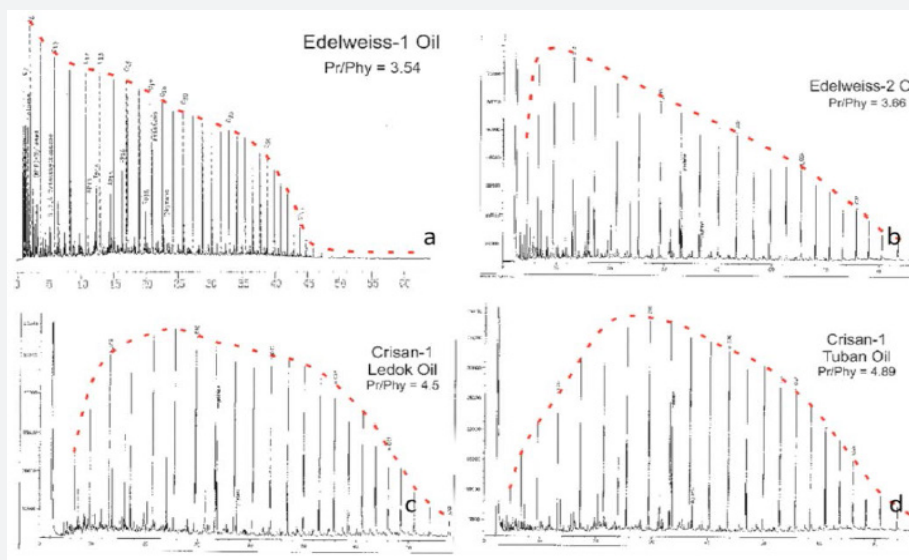
## Introduction

A study was conducted to analyze the oil characterizations in the oil Fields of East Java Basin (oil to oil correlation) based on biomarkers. The North East Java basin is located on the southeastern margin of a stable Sunderland micro continent, Indonesia. The biomarker data was obtained from GC and GC-MS analysis of normal alkanes, isoprenoids, triterpanes and steranes.

Every item of organic matter deposited in specific depositional environment or source facies developed a specific biomarker. In

geochemistry characterization of oil samples, biomarkers were carried out by doing pattern matching analysis and finger printing analysis through various geochemical crossplots.

Pattern matching method was done by using chromatogram GC of n-alkane and isoprenoids (Figure 1) also fragmentogram GCMS of terpane m/z 191 and sterane m/z 217 (Figure 2). The pattern matching shows that all oils have a relatively similar pattern, indicating that all the oil samples came from one family with deltaic to marginal marine source facies.



**Figure 1:** GC chromatogram of oil samples, East Java Basin.

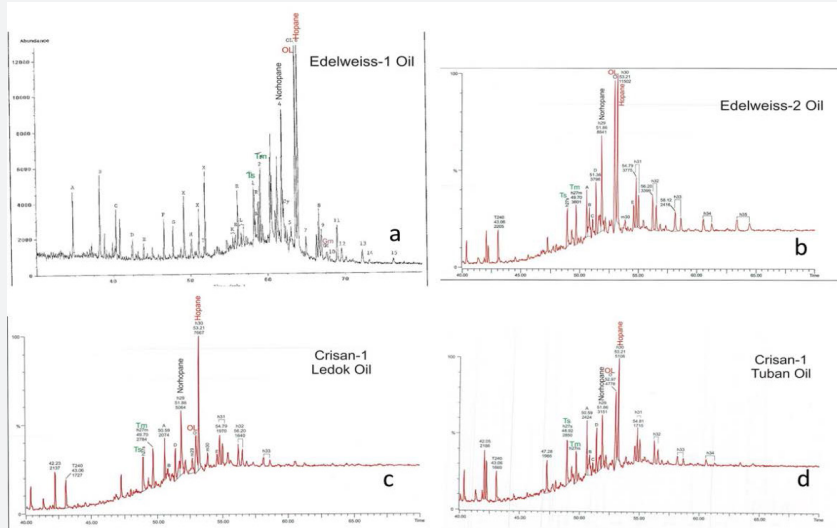


Figure 2: GCMS fragmentogram m/z 191 of oil samples, East Java Basin.

In addition, some biomarkers data from finger printing analysis that are used consist of:

A. Pristane/phytane ratio as an indicator of depositional environment. The results of this case study show that oil samples

have pristane/phytane ratios greater than 2.0 and pristane/n-C17 ratios are roughly similar with range 0.66-0.84, indicating deltaic or transitional with terrestrial input and deposition in a relatively sub-oxic to oxic environment (Figure 3).

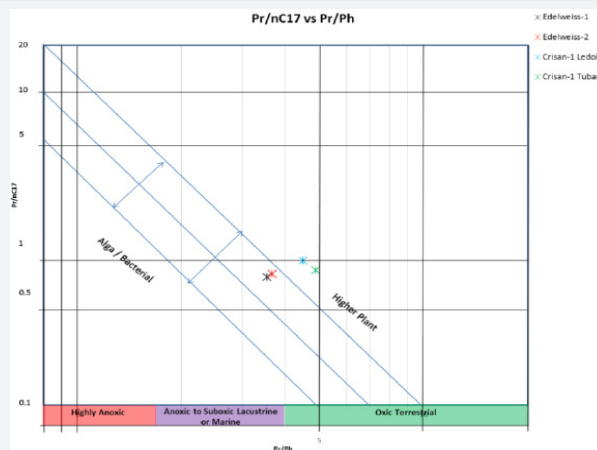


Figure 3: Plot of pristane/n-C17 versus pristane/phytane showing the depositional environment and the conditions of the studied oil samples [4].

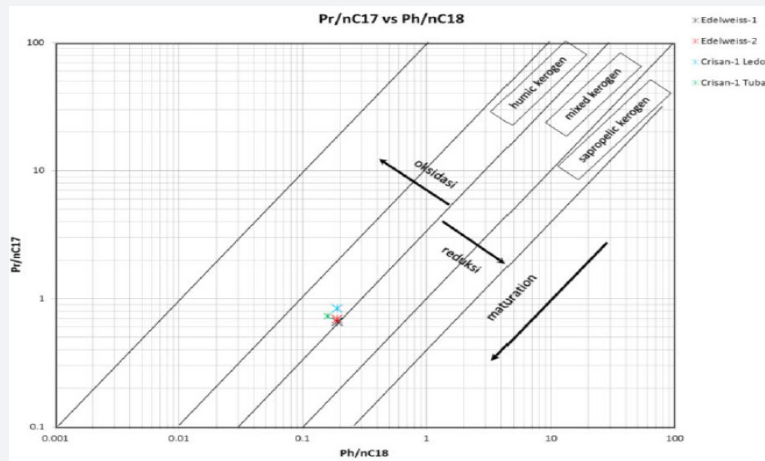


Figure 4: Plot of pristane/n-C17 versus phytane/n-C18 showing the organic sources and maturation of the studied oils [3].

B. The resultant ratios pristane/n-C17 and phytane/n-C18 (isoprenoids/n-alkanes) of all oil samples range from 0.66 to 0.84 and 0.16 to 0.19, respectively reflect that all the oils were from humic and mixed kerogen (organic facies), deposited under

transitional environment with oxidation to reduction conditions and show a degree of maturation (Figure 4).

C. Total hopane/sterane ratio from 4 oils are the same type of predominantly sub-oxic to oxic terrestrial influence (Figure 5).

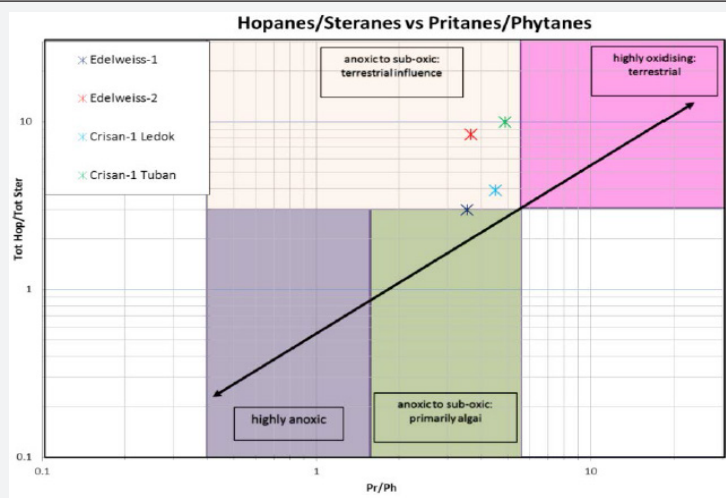


Figure 5: Plot of hopane/sterane versus pristane/phytane showing the organic source input and the environment condition of the studied oils (after Grantham, [5]).

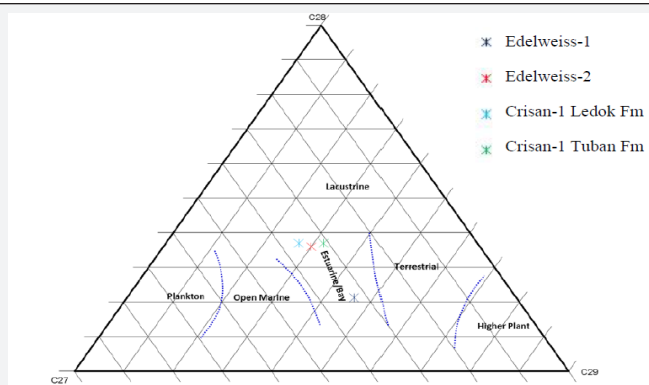


Figure 6: Ternary diagram of m/z 217 sterane C27-C28-C29 showing the depositional environment of the studied oil samples.

D. The ternary diagram of m/z 217 sterane C27-C28-C29 also show all the oils came from one family with a predominant estuarine or bay depositional environment (Figure 6).

Then, a crossplot of triterpane maturity parameter (Figure 7) show that all oil samples in the early mature stages [4,5].

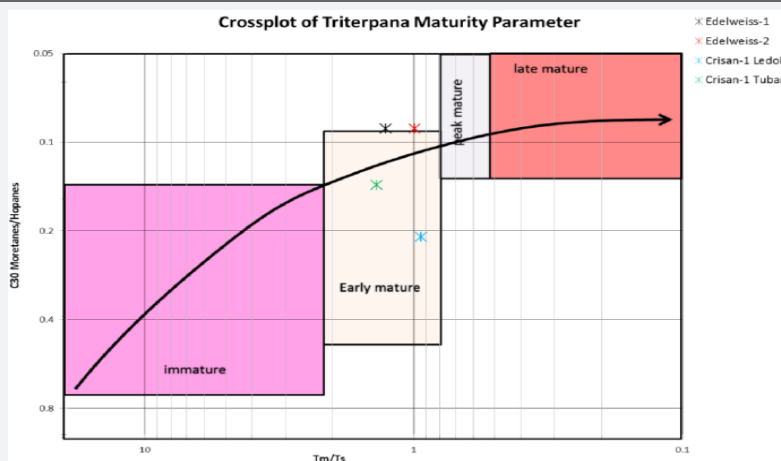


Figure 7: Plot of pristane/phytane versus C30 moretane/hopane showing the maturity of the studied oils [1].

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