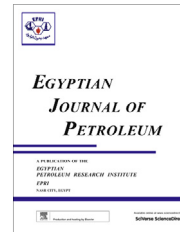




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FULL LENGTH ARTICLE

# Preliminary hydrocarbon analysis of crude oils from Umutu/Bomu fields, south west Niger Delta Nigeria

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## KEYWORDS

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**Abstract** Seven different crude oil samples were collected from two oil fields in the Niger Delta Nigeria. The bulk properties of these crude oils which include API gravity, Reid vapour pressure; kinematic viscosity, dynamic viscosity, moisture, gum content and cloud point were analysed. Aliphatic biomarkers were used as supporting tool to deduce the geochemical characteristics such as thermal maturity, depositional environments, source of organic matter and extent of biodegradation. Results show that API<sup>o</sup> gravity ranged from 29.00° to 85.00°, specific gravity 0.65 to 0.88, 3.00 to 9.00, Reid vapour pressure 3.00 to 9.00 kPa, kinematic viscosity 0.90 to 10.10 cSt, dynamic viscosity 0.70 to 8.90 cP, moisture content 0.13% to 26.00%, gum content 6.27 to 45.84 mg/L, cloud point 3.00 to 12.00 °C, pour point -7.00 to 4.00 °C and flash point < 30.00 °C. Distribution of *n*-alkanes (Pr/Ph, and isoprenoide/*n*-alkanes ratios) reflects that the oil samples originated mainly from terrestrial organic sources deposited in an oxic paleoenvironment.

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## 1. Introduction

The Niger Delta is important in crude oil correlation studies because it is one of the major hydrocarbon provinces of the world, with an estimated reserve of about 23 billion barrels of oil and 183 trillion cubic feet of natural gas [1]. Defining and evaluating exploration are helpful to characterise the

hydrocarbon source rocks, their range of thermal maturities and types of products generated [2].

An appreciable number of studies have been done on the Niger Delta crude oils which include the works of [1,3–5] but the question is, whether the hydrocarbons found within the Niger Delta basin are of the same origin. Hydrocarbons within the basin have been found to occur at different productive horizons at very great depth apart. The migration processes that determined the pooling of the hydrocarbons at different depths are yet to be clearly understood but it is known that the properties and composition of any petroleum systems are controlled by complex geological, physicochemical and biological processes during generation as well as accumulation in reservoirs.

The two fields of study are the Umutu field and the Bomu oil field in the Niger Delta Nigeria. Umutu field was termed

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marginal field, No empirical, analytical and geochemical data have been reported on the crude oil samples from these fields since their discovery.

This paper examines the preliminary geochemical parameters of these two oil fields which include bulk properties, aliphatic biomarkers of the crude oils and molecular ratios with the aim of understanding the type and quality of crude oils, their correlation, degree of thermal maturity, organic matter source, depositional environment and subsequent alteration.

### 1.1. Geologic setting of study area

The Niger Delta is one of the world's largest Tertiary delta systems and an extremely prolific hydrocarbon province. It is situated on the West African continental margin at the apex of the Gulf of Guinea [6]. It occupies an area of about 75,000 km<sup>2</sup> with clastic sequence which reaches a maximum thickness of 9000–12,000 m of sediment and a total sediment volume of 500,000 km<sup>3</sup> [7].

Stratigraphically, the thick sedimentary sequence is made up of three principal lithostratigraphic units namely, the Benin, Agbada and Akata formations [8]. The Benin formation is the alluvial or upper coastal plain depositional environment of the Niger Delta complex. It consists of mainly fluvial gravels and sands. It has a thickness in excess of 1820 m.

The Agbada formation underlies the Benin formation and is made up primarily of alternating sandstones and shales which are of fluvio-marine origin. The Akata formation is

the lowest unit of the Niger Delta complex. It was deposited in a typical marine environment.

The hydrocarbon habitat of the Niger Delta is mostly within the sandstone reservoir of the Agbada formation where they are usually trapped in over anticlines associated with growth faults.

## 2. Materials and methods

Seven crude oil samples were collected at stratigraphic depths ranging from 10500 to 11200 ft in two producing fields (Umutu and Bomu) onshore Niger Delta. The sample locations are shown in Fig. 1. Bulk properties of seven crude oil samples were measured and calculated using ASTM methods, i.e. Specific gravity [9], API° gravity [10], pour point [11], kinematic viscosity [12], Reid vapour pressure [13] and [11], dynamic viscosity [14], moisture content [15], gum content [16], Cloud point [17] (Table 2).

### 2.1. Column chromatography

The crude oils were fractionated by column chromatography on silica gel. The saturated, aromatic hydrocarbons and polar compounds were eluted using petroleum ether (75 ml), dichloromethane (75 ml) and methanol (75 ml) respectively. The fractions were recovered by careful evaporation of the solvent on the sand bath, followed by removal of residual solvent under nitrogen gas as reported by Abrakasa [18].

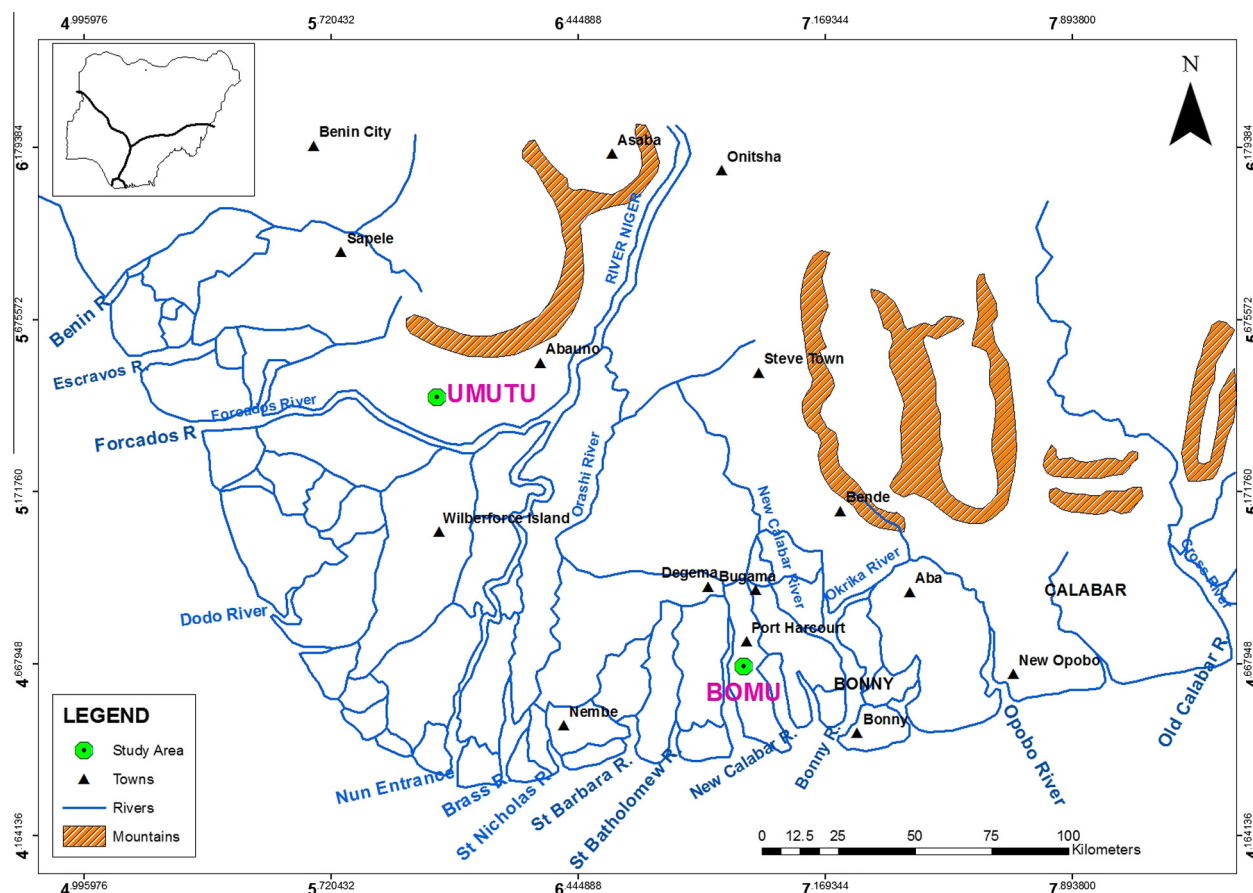


Figure 1 Map of Niger Delta showing the study locations.

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