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Evaluation of bio-molecular Signatures and hydrocarbon potential of upper Cretaceous Shale, NE Nigeria.

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ABSTRACT

The Bornu Basin is a sector of the Chad Basin located in the northeastern part of Nigeria, occupying about one-tenth of total area in Chad Basin. Twenty-eight representative shale cutting samples retrieved from *Tuma-1*, *Sa-1* and *Albarka-1* exploratory wells were analysed. Seventeen shale samples systematically selected from Gongila, Fika Shale and Chad Formations were subjected to Total Organic Content (TOC), Rock-Eval pyrolysis, Soluble Organic Matter, Liquid Chromatography, Gas Chromatography and Gas Chromatography/Mass Spectrometry analyses. This is to characterize and assess the potential capability of the shale units.

The results showed that TOC of the Coniacian – Paleocene shale units exceed the threshold (0.5wt%) needed for petroleum generation. This classifies it as potential source beds. Evidence from biomarkers indicates a preponderance of marine organic matter with subordinate terrigenous input. The quantity of gammacerane occurrence suggests normal saline environment. The presence of oleanane index indicates angiosperms input into Cretaceous -Tertiary source rock. C_{35}/C_{34} homohopane ratio showed the anoxia development towards the centre of the basin. $C_{29\alpha\alpha\alpha}$ (20R)/ $C_{27\alpha\alpha\alpha}$ (20R) sterane ratio indicate the dominance of marine organic matter with subordinate terrigenous input. The 22S/(22S+22R) ratio of C_{31} hopane have not reached equilibrium as evident by immaturity to early mature stages from diagnostic ratios of $\beta\alpha$ moretane/ $\alpha\beta$ hopane, Ts/(Ts+Tm), 28,30-bisnorhopanes/17 α -hopanes, diasteranes/regular steranes, $\alpha\alpha\alpha$ steranes/ $\alpha\beta\beta$ steranes and 20S/(20S+20R) C_{29} regular steranes respectively. This is corroborated with the Rock-Eval indices showing immature to earlier mature kerogen within the Fika Formation. It consists preeminently of Type IV, with subordinate Type III. The prospect for hydrocarbon in this part of the basin is only fair to moderate with potential for gaseous rather than liquid hydrocarbon.

Keywords: Biomarkers, kerogen, thermal maturation, organic matter, anoxia, gas chromatography-mass spectrometry.

1.0 Introduction

The Bornu Basin is the southern part of Chad Basin which is situated between latitude 11⁰15' N and 14⁰00' N and longitudes 11⁰453'E and 14⁰30'E, with a total sediment thickness of about 3600 m (Fig. 1). The lithologic heterogeneity and tectonic history is an ideal geo-reactor for all the necessary geochemical reaction that can lead to the formation of hydrocarbon deposit in

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