Journal of Palaeogeography, 2017, ■(■): 1–9

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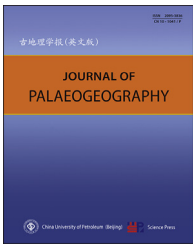

Biopalaeogeography and palaeoecology

Palynology and stratigraphy of the Upper Miocene Chad Formation, Bornu Basin, northeastern Nigeria

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Abstract Both lithological and palynological analyses were employed to decipher sedimentary stacking patterns and to date the sediments within the interval 50—325 m in Kemar-1 well, Bornu Basin, northeastern Nigeria. Eight different lithofacies units deposited in various environments were recognized. They are: (1) the grayish sandy claystone, rich in organic matter and associated with lignite, deposited in a continental to lacustrine environment; (2) the micaceous claystone, rich in muscovite flakes and organic matter, deposited in a lacustrine environment; (3) the lithified claystone which intercalates the dark gray shale, and deposited in a marine setting; (4) the shale; (5) the micaceous sandstone, which is characterized by presence of muscovite, silty to granular grain sizes, well sorted and deposited in a meandering setting; (6) the poorly-sorted sandstone. It is poorly sorted, poorly-graded, and coarse-grained, with erosive surfaces to underlying facies, and deposited in a fluvial environment; (7) the heterolithic clayey sandstone, poorly graded, grayish, with a degree of organic richness, suggesting an anoxic lacustrine environment; and (8) the grayish claystone which is non-lithic and rarely ferruginized marking the Upper Miocene/Eocene boundary.

One main palynological zone, *i.e.*, the *Echitricolporites spinosus* assemblage zone, has been established. The base of the studied section at 385 m is characterized by the last up-hole occurrence of *Grimsdalea magnaclavata* suggestive of Eocene boundary while the overlying sediments are characterized by Late Miocene marker species such as *E. spinosus*, *Elaeis guineensis*, *Anthocerus* sp., *Nymphaea lotus*, and *Retistephanocolpites gracilis*. The Chad Formation is dated as Late Miocene age unconformably overlying the Eocene Kerri-Kerri Formation which indicated that the Chad Formation was probably deposited during an alternation of lacustrine and continental settings, due to climatic change.

Keywords Palynology, Lacustrine, Continental, Late Miocene, Heterolithic, Unconformity, Bornu Basin, Northeastern Nigeria

Received 15 June 2016; revised 14 March 2017; accepted 14 March 2017; available online xxx

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Peer review under responsibility of China University of Petroleum (Beijing).
http://dx.doi.org/10.1016/j.jop.2017.03.002

Please cite this article in press as: Ola-Buraimo, A.O., Abdulganiyu, Y., Palynology and stratigraphy of the Upper Miocene Chad Formation, Bornu Basin, northeastern Nigeria, Journal of Palaeogeography (2017), http://dx.doi.org/10.1016/j.jop.2017.03.002

1. Introduction

Chad Formation is the youngest formation in the Bornu Basin, northeastern Nigeria (Fig. 1). Stratigraphic studies of the Chad Formation are not commonly discussed in literature like the other older formations in the basin. One of the recent studies is the work by Ola-Buraimo (2005) on the sedimentology of the formation, which differentiates the sediments into three members on the basis of color and claystone/sandstone proportions. Sedimentation of the Chad Formation has been a continuous process which started in the Late Miocene up to the present day whereby river and aeolian sand and clay particles are still being deposited. The documented stratigraphy of the Chad Formation was first described by Carter *et al.* (1963), followed by other researchers including Avbovbo *et al.* (1986), Olugbemiro (1997), Ola-Buraimo (2009, 2012), and Boboye (2012).

Ola-Buraimo (2005) illustrated and described the lithostratigraphy of Chad Formation present in Korowanga well, Dogara well and outcrop section at Abakire, all representing alternations of heterolithic sandstones and claystones in varying proportions. Some of the sands are silty while others are medium to coarse grained. In the Tuma-1 well the Chad Formation is dominated by light gray bulky claystone, minor sand grains, and some rare pebbly horizons, and shows some ferruginization in the sediments (Ola-Buraimo, 2012). Boboye (2012) described yellowish to grayish sandstones with dark-gray, fissile, organic-rich mudstones.

This study on Chad Formation in the Kemar-1 well is targeted at 1) investigating a series of sedimentary stacking patterns in order to give insight into other types of facies present in the Chad Formation which might not have been reported previously; 2) analyzing the depositional environment of each lithofacies unit; and 3) importantly dating the Chad Formation from biostratigraphic perspective since ages given by earlier authors have been suggested to be in conflict.

2. Geological setting and stratigraphy

The geology of the Bornu Basin has been widely studied (Barber, 1965; Carter *et al.*, 1963; Falconer, 1911; Reyment, 1968). The evolution of the Bornu

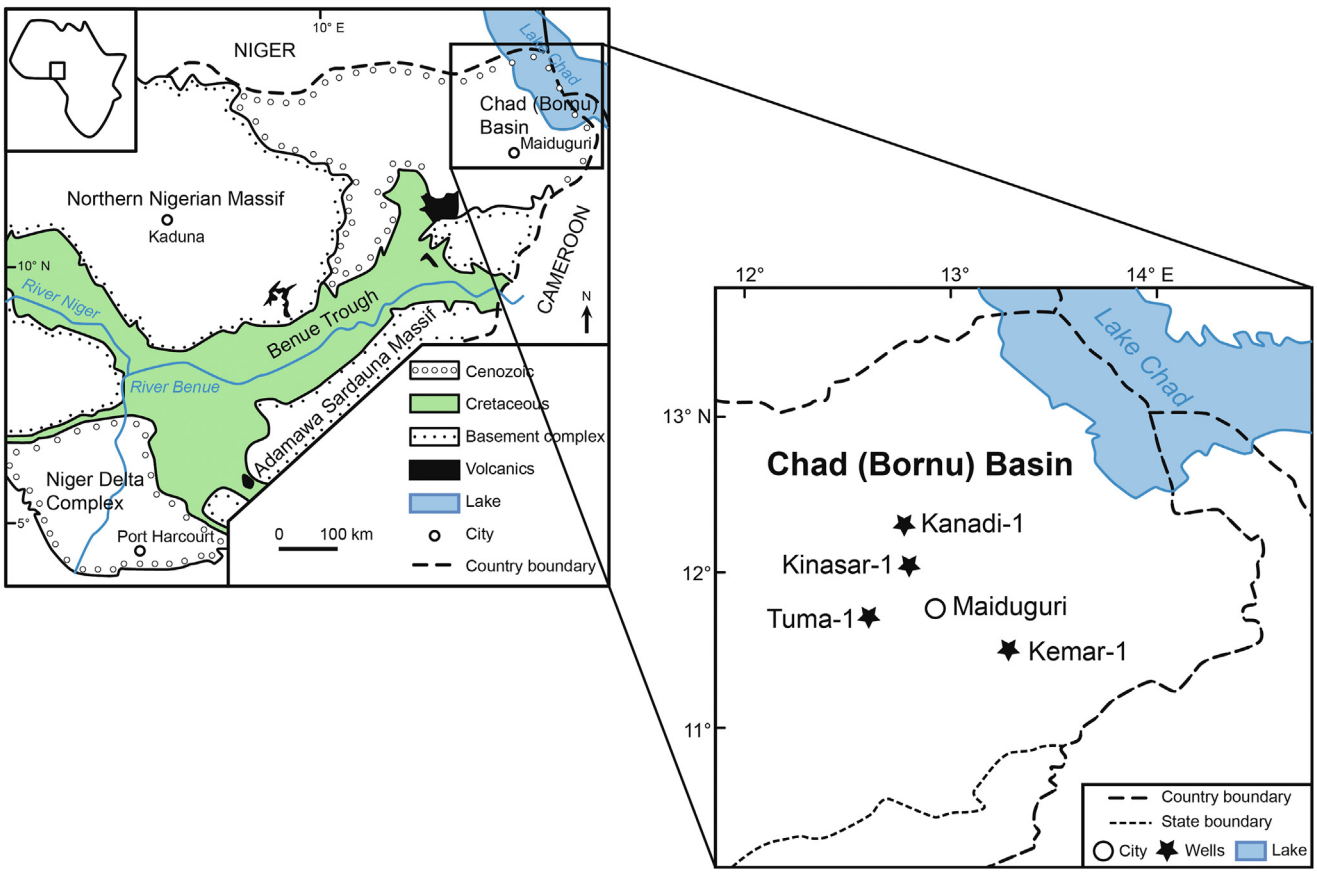

Fig. 1 Geological map of Nigeria, showing the Bornu Basin and the location map of the studied exploratory well Kemar-1 (modified after Whiteman, 1982).

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