



# Distribution of sedimentary formations in the Bornu Basin, Nigeria



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**Abstract:** By using drilling data and geophysical wireline logs of twenty-three wells in the Bornu Basin, the overall distribution of stratigraphic formations (Kerri-Kerri, Gombe, Fika, Gongila and Bima) in the basin have been simulated with software of Excel, Petrel and Surfer etc. Three major sags, labeled A, C and D and a structural high B, have been identified. Sag A is located in the northeast, while sags C and D are located in the southeast and southwest of the basin, respectively, structural high B separates sag A from sag C. All the existing stratigraphic formations (Kerri-Kerri, Gombe, Fika, Gongila and Bima) are widespread in the basin, but with variation in thickness. Drilling data of three deep wells (Kadaru - 1, Herwa - 1 and Kinasar - 1) showed that only the upper part of Bima Formation (middle to coarse grained arkose) have been penetrated, while the lower part of Bima Formation is not drilled yet, therefore, it is suggested that the deep formations in the sags be drilled to find their hydrocarbon potential.

**Key words:** Bornu Basin; Nigeria; subsurface sediment configuration; formation distribution features

## 1. Introduction

The Chad Basin, an intracratonic rift basin, is part of the West and Central African Rift System (WCARS), with a total area of about 2 335 000 km<sup>2</sup><sup>[1–6]</sup>. The basin straddles five countries, namely, Nigeria, Niger, Chad Republic, Cameroon and Central Africa Republic. The southeastern part of the basin, known as the Bornu Basin in Nigeria, which is about one-tenth of the total mega-Chad Basin, joins the Benue Trough (Fig. 1). The Bornu Basin and Benue Trough are a part of the same dominant NE-SW rift system. Due to the effect of tensional basement tectonic movements and zig-zag faults, horsts and grabens, buried hills and intrusive volcanics are commonly seen in the basin<sup>[7]</sup>. Faults, predominantly tensional, often cut down to basement and terminate beneath a regional angular unconformity at the boundary between the Cretaceous and Tertiary.

Bornu Basin has become a subject of intense study because it shares a lot of similarities with Termit Basin in Chad and Niger where commercial oil and gas reservoirs have been discovered<sup>[8]</sup>. Gas shows found in one of the 23 wells drilled in the basin by NNPC in the 1970s-1990s has proved the basin is petroliferous. One of the basic elements of petroliferous basins is thick sedimentary formations, in terms of oil and gas enrichment, areas with thick sedimentary formations have

high oil and gas potential than areas with thin sedimentary formations. The aim of this paper therefore is to figure out the basin subsurface configuration by use of the drilling and logging data of the 23 wells in this basin, and delineate areas with thick sedimentary formations.

## 2. Stratigraphic setting

Both the Chad and Benue Basins have platform sedimentation in a geotectonic setting related to rifting. The sedimentation was believed to start during the late Aptian - Albian (Fig. 2). In the first cycle of sedimentation, extensive deltaic sequences of poorly sorted, medium to coarse feldspathic sandstone with sparse fossils developed in the Bornu Basin, namely the Bima Formation (Fig. 2). This formation, composed of mainly sandstone, with shale intercalations in local areas, could be a potential reservoir, and the shale in it could be potential source rock<sup>[10–12]</sup>.

During the second cycle of deposition, the Benue trough connected the Tethys and the South Atlantic for the first time. Marine transgression overtopped the Zambuk ridge (subsurface structural barrier) and flooded the southern Chad Basin, depositing Gongila Formation shallow marine calcareous sandstone and shale. But in some places, there develops the marine Cenomanian Yolde Formation between the Bima and the Gongila Formations. The Gongila Formation is generally

**Received date:** 08 Aug. 2014; **Revised date:** 10 Jun 2015.

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**Foundation item:** Supported by Petroleum Technology Development Fund (PTDF).

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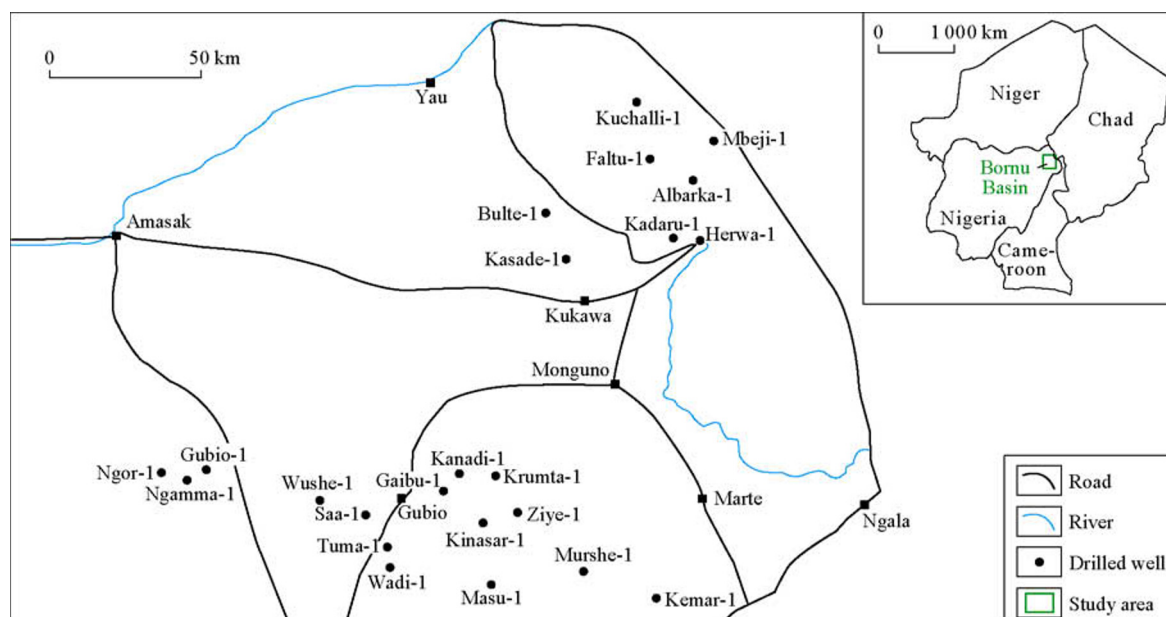


Fig. 1. Location of Bornu Basin and oil wells drilled in the basin.

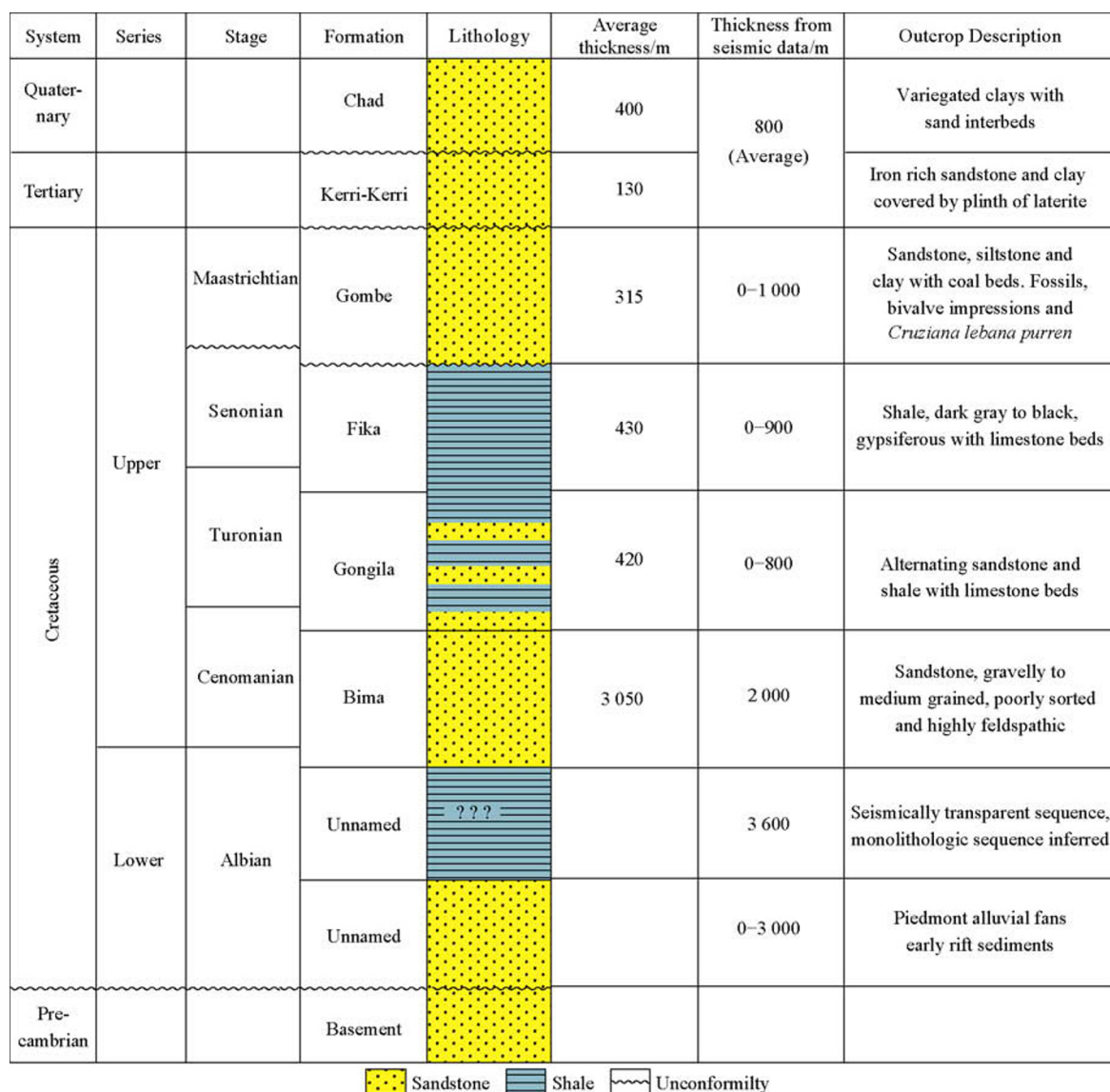


Fig. 2. Stratigraphic column of the Bornu Basin<sup>[9]</sup>.

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