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RESEARCH ARTICLE

SEDIMENTOLOGY OF EOCENE SANDSTONES AT OGBUNIKE AREA, SOUTHERN NIGERIA: INSIGHTS FROM PETROGRAPHIC AND GRANULOMETRIC ANALYSES

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ABSTRACT

The sedimentary facies exposed at Ogbunike Area belong to the Eocene Formation that made up the Anambra Basin. This research estimates the lithology, thickness, sedimentary succession, paleo-environment, reservoir quality and source area tectonics using geological mapping, petrography, grain size distribution and statistical analysis. Geological mapping shows that the section is approximately 27m thick and consists of sandstone, shale, siltstone and ironstone lithofacies. Granulometric analysis performed on selected samples shows that the sandstones are fine to medium grained (1.15 to 2.17 ϕ), moderately sorted (average 0.96 ϕ), fine skewed (average 0.16 ϕ) and leptokurtic (average 1.17 ϕ). Bivariate plot of skeweness against sorting and mean against sorting pinpoint a fluvial origin for the sandstones. The results from rose plot point to a bimodal-bipolar paleocurrent pattern while the bi-directional paleo-flow is in the northeastern-southwestern directions, which is an indication of tidal influence suggesting shore environment of deposition. Average permeability values derived from an empirical formula indicate good potential for reservoir rock. Deductions from field observations and petrographic analysis suggests that the sandstones are submature, with angular to sub-rounded quartz. The high percentage of goethite (average 30.4%) in the ferrugenized sandstones samples suggests an environment of low oxidation. Provenance and tectonic assessment reveal metamorphic source, humid climate, high relief, recycled orogeny, and derived primarily from Cameroon Basement Complex rocks.

KEYWORDS

Sandstone, Ameki Formation, Ogbunike, Provenance, Permeability, Tectonic

1. INTRODUCTION

Sandstones facies found around Ogbunike area constitute part of the Eocene Ameki Formation within the Anambra basin (Figure 1) in Southern Nigeria and it is made up of stepwise arrangement of sandstones, siltstones, mudstones, sandy shales and shales sandwitched with thin coal layers. These geologic units cover an area of about 40,000km^2 having an average thickness of 6km.

The tectonism associated with the evolution of Anambra Basin was reported by several researchers (Nwajide and Reijers, 1996). A previous researcher considered the trough as analogous to the tectonics structure in the Red Sea being a part of the unstable Ridge-Ridge-Ridge (RRR) triple plate junction as a result of plate dilation and opening of Gulf of Guinea in the Early Cretaceous (Nwajide, 1990). This was also supported by (Adegoke, 1969; Adegoke et al., 1980). The Eocene stage (Figure 2) was characterized by regressive phase that led to deposition of Ameki Group (Obi, 2000). The Ameki Group comprises predominantly Nanka Sand, Nsugbe Formation, and Ameki Formation, which are considered laterally equivalent (Nwajide, 1979). The formation age has been reported to be either early Eocene or early middle Eocene (Reyment, 1965; Berggren, 1960). Ameki Group and the younger Ogwashi – Asaba Formation are lateral equivalence of Agbada Formation in the Niger Delta Basin. Gradual accumulation of varying sediments in Anambra Basin during the Tertiary happens in areas where the proto-Niger Delta successions were deposited as a result of the Paleocene – Eocene transgression and deposition of the Imo Shale and the deltaic Oligocene – Miocene Ameki and Ogwashi – Asaba Formations as outcrop equivalents of the Niger Delta. The sedimentation process in the Anambra Basin was constrained by the morphologic proximity of sediment origin, transgression and regression during the Campanian to Eocene times coupled with the circulation system leading to gradual reshaping of the coastline. Hence, the stratigraphic succession provides a documentary history on transgressive-regressive cycles as well as the coastline arrangement which have to do with variations in sediment depositional pattern.

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