



## Paleo-environmental Reconstruction of 't' Well in the Niger-Delta Basin, South-South Nigeria

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**Abstract** Twelve (12) ditch cutting samples from 'T' well in upper Benue Trough were subjected to palynological and quantitative palynofacies analysis. The palynomorph groups are of two categories; terrestrial (miospores) and marine (dinocyst, pediastrum, foraminiferal test-linings and fungal spore). The cluster analysis for 'T' well based on the abundance and composition of the kerogen groups revealed three clusters which are: CL-1, CL-2, CL-3 known as the palynofacies unit. Quantitative data determined from the different organic matter constituents of the samples of 'T' well provided important information on possible depositional environments. The kerogen ternary diagram shows that samples of the well were deposited in marginal dysoxic-anoxic shelf conditions and Heterolithic oxic shelf (proximal shelf). Ternary plot of spores, pollen and microplankton, suggest that the clastic sediments of 'T' well are interpreted as being deposited in a near shore environment with a very shallow marine influence represented by marine shale horizons and intercalations of silty shale, sandy shale at the top of the sandstone body.

**Keywords** Paleoenvironment; Formation; Palynofacies; Upper Benue Trough

### Introduction

The palynofacies distribution of 'T' well is investigated based on palynology, its ecological significance and lithostratigraphy.



Figure 1: Geological Map of the Study Area Adapted from Obaje et al., 2005



The paleoenvironmental interpretations presented in this work mainly depend on quantitative palynofacies characteristics. The paleoenvironmental interpretations presented for each palynofacies type are based on quantitative analyses of selected palynomorph components, which are known to have paleoenvironmental significance. These include terrestrially derived palynomorphs such as miospores, terrestrially derived phytoclasts and aquatic phytoplankton. Certain sporomorphs are indicators of specific ecological parameters and thus allow not only a robust identification of paleoclimatic conditions but also permit reconstruction of the vegetation growing on the source areas.

**Methodology**

Two methods were employed in this study.

1. Lithostratigraphy.
2. Palynological Processing.

Twelve ditch cutting samples were used for the preparation of the palynological slides for palaeoenvironmental reconstruction of the well.

**Result**

The palynofacies and ternary plots are shown below;



CL-1

CL-2

CL-3

Figure 2: Photomicrograph of the kerogen cluster groups

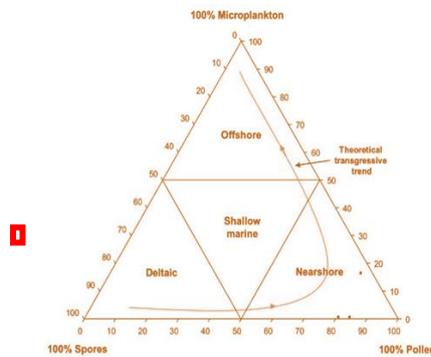


Figure 3: Ternary Plot of Spores, Pollen and Microplankton of CL-1

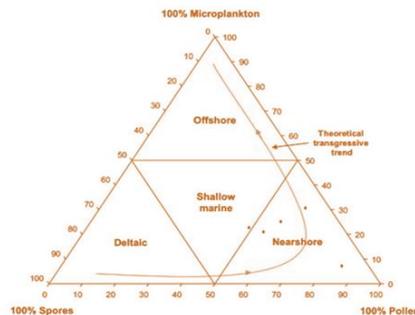


Figure 4: Ternary Plot of Microplankton, Spores and Pollen of CL-2



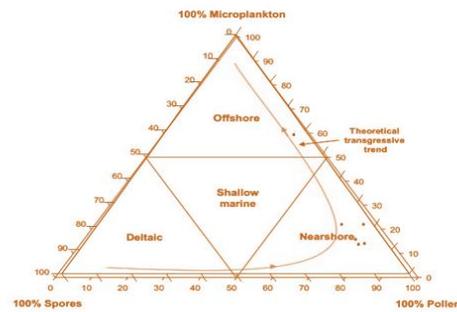


Figure 5: Ternary Plot of Microplankton, Spores, and Pollen of CL-3

### Lithology and Paleoenvironment of CL-1

Clastic units (silty shale, shale and sandy shale) represent the succession. Decreases in the open marine dinoflagellate species (*Oligosphaeridium* and *Florentinia*) recorded in this Palynozone suggest a near shore environment. Increase in abundances of pteridophyte spores, brown and black wood in samples of CL-1 suggests a relative fall in sea level [1-5]. This could be specially supported by the distribution trend of the sporomorphs concentrations in CL-1, where in ancient depositional environments sporomorphs absolute abundances have been found to decrease exponentially in an offshore trend. The ternary plot (fig. 3) shows that the environment of deposition is a near shore to shallow marine environment.

### Lithology and Paleoenvironment of CL-2

The unit consist thin shale, silt unit, sandy shale unit, fine carbonaceous materials, micas, pyrite and some calcareous materials. Moderate abundances of terrestrially derived organic matter, and the decline in dinoflagellate cyst abundance and diversity, are characteristics of marginal marine (brackish-coastal) conditions [6-9]. Pyrite and carbonaceous material present reflect occasional short-lived or local anoxic conditions. These reducing conditions are interpreted as Heterolithic oxic shelf conditions (fig.4) and the sediments of CL-2 were probably deposited in a paralic system which may have incised into or prograded out over the underlying pro-delta sequence as a response to sea level fall.

### Lithology and Paleoenvironment of CL-3

The sequence can be interpreted as a thick sandy shale unit, with a silicic to carbonate matrix, containing pyrite and traces of anhydrite [10-11]. The beds contain traces of carbonaceous material at the base of the assemblage and fissile light. This section is characterized by high abundant phytoclasts, low to moderate concentrations of sporomorphs and low abundant AOM. The ternary diagram (Fig.5) show samples were deposited in marginal anoxic basin and the environment of deposition range from shallow marine to near shore.

### Conclusion

The high concentrations of phytoclasts found here in shale sediments of CL-1, CL-2, CL-3 would also correlate with very near shore marine environments that were close to fluvio-deltaic and near shore environment. This interpretation would tie in with the suggested very shallow marginal marine conditions for the shale horizons. The low concentrations of spores are taken to indicate relatively distal near shore settings as they are known to show poor transport efficiency and lower abundances than associated gymnosperm producing plants.

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