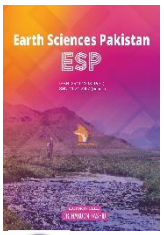
ZIBELINE INTERNATIONAL PUBLISHING

Earth Sciences Pakistan (ESP)

DOI: http://doi.org/10.26480/esp.02.2020.58.64

ISSN: 2521-2893 (Print)
ISSN: 2521-2907 (Online)
CODEN: ESPADC



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RESEARCH ARTICLE

THE LITHOSTRATIGRAPHY OF THE NEAR-SURFACE IN PART OF SEDIMENTARY KOLMANI FIELD IN NORTHERN BENUE TROUGH, NIGERIA, USING SOIL CORE AND SEISMIC REFRACTION DATA

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ARTICLE DETAILS

Article History:

Received 02 May 2020
Accepted 04 June 2020
Available online 10 July 2020

ABSTRACT

Soil samples from 31 shallow boreholes were acquired at depths 0m, 1m, 2m, 3m, 4m, 5m, 7m, 10m, 15m, 20m, 25m, 30m, 35m, 40m, 45m, 50m, 55m, and 60m in Pingida (Kolmani Field) in Ako LGA, Gombe State, Nigeria. Using the same boreholes, seismic refraction data was also acquired. The aim of the survey was to delineate the near-surface lithology and velocity layering. The boreholes were drilled using rotary drilling rig and the core samples acquired and described using Wentworth Scale. Seismic refraction data acquired using a single trace Stratavisor NZXP portable digital recorder. The recording spread consisted of a single SM4-10Hz geophone positioned at depths where the soil samples were taken. A hammer was used as the energy source and placed 3m away from the hole to obtain the first breaks. The refraction data was interpreted using UDISYS Version 1.0.0.0 software. The soil layers in the Kolmani Field have three distinct layers specified as follows, namely, top weathered and sub-consolidated layers made up of intercalation of sandstone, gravel ash clay and muddy coal shale. The lithologic strata do not correlate throughout the field resulting from the highly variable elevation which ranged from 317m and 524m with average of 389.16m. The top weathered layer of laterite intercalated with cobblestones with compressional wave velocity ranging from 342 ms^{-1} to 517 ms^{-1} with an average of 405.03 ms^{-1}. Beneath the weathered layer is the sub-consolidated Clay layer intercalated with silt and laterite of compressional wave velocity ranging from 440 ms^{-1} to 1854 ms^{-1} of average of 826 ms^{-1}. The underlying consolidated layer is the shale and coal layer having compressional wave velocity ranging from 1518 ms^{-1} to 4201 ms^{-1} with an average of 2162.65 ms^{-1}. The dominant lithologic sequences encountered are laterite, clay, silt, sand, gravel, coal and shale. The results of this work can be used for static corrections in seismic reflection processing, planning and assessing risk for engineering structures, and for groundwater exploration. The laterite, clay, silt, sand, gravel, coal and shale can be utilized in agriculture, construction, process industries, and environmental remediation.

KEYWORDS

lithology, stratigraphy, near-surface, seismic refraction, core, relief, geology, Northern Benue Trough, Nigeria.

1. INTRODUCTION

The lithology of a rock unit is its physical characteristics seen and described in terms of colour, texture, grain size, and composition (US Geological Survey, 2010; Bates and Jackson, 1984; Allaby and Allaby, 1999; American Heritage Dictionary, 2005). Lithology is the basis of subdividing rock sequences into individual lithostratigraphic units for the purposes of mapping and correlation between areas. In clastic sedimentary rocks, grain size is the diameter of the grains and/or clasts which are used to determine which rock naming system to use. In this system, sandstones and conglomerates, a word describing the grain size range is added to the rock name. Examples are "pebble conglomerate" and "fine quartz arenite". In rocks in which mineral grains are large enough to be identified using a hand lens, the visible mineralogy is included as part of the description.

In the case of sequences possibly including carbonates, calcite-cemented rocks or those with possible calcite veins, it is normal to test for the presence of calcite (or other forms of calcium carbonate) using dilute hydrochloric acid and looking for effervescence (Geology.com, 2016). The colour of a rock or its component parts is a distinctive characteristic of some rocks and is always recorded based on the Munsell colour system (US Bureau of Reclamation, 1998). Stratigraphy is concerned with the rock layers (strata) and layering (stratification). It is primarily used in the study of sedimentary and layered volcanic rocks. Though stratigraphy has two related subfields: lithostratigraphy (lithologic stratigraphy) and biostratigraphy (biologic stratigraphy). Most of the studies that have been carried out on the Northern Benue Trough focused on the stratigraphy, sedimentology, palaeoenvironmental interpretation, palaeontological and structural studies (Dike, 1993; Adegoke et al., 1986; Carter et al., 1963; Adegoke et al., 1978). However, studies focusing on seismic velocity

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	Website: www.earthsciencespakistan.com	**DOI:** 10.26480/esp.02.2020.58.64

Cite the Article: Glory G. Akpan, Etim D. Uko, Owajiokiche D. Ngerebara (2020). The Lithostratigraphy Of The Near-Surface In Part Of Sedimentary Kolmani Field In Northern Benue Trough, Nigeria, Using Soil Core And Seismic Refraction Data. *Earth Sciences Pakistan, 4(2): 58-64.*