



FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

THE TRAVERSES OF A STRATIGRAPHER IN NIGERIAN SEDIMENTARY BASINS

By

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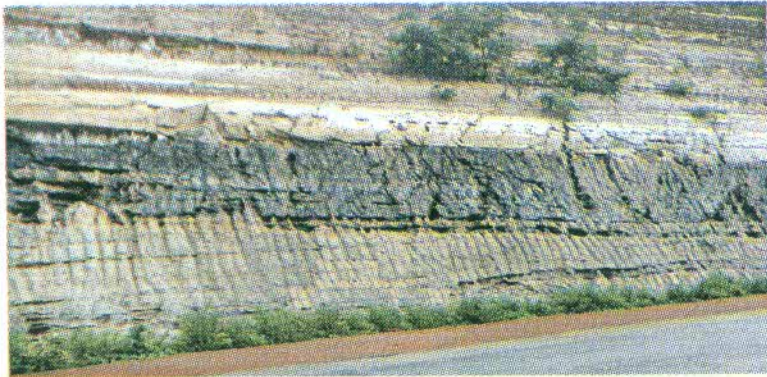
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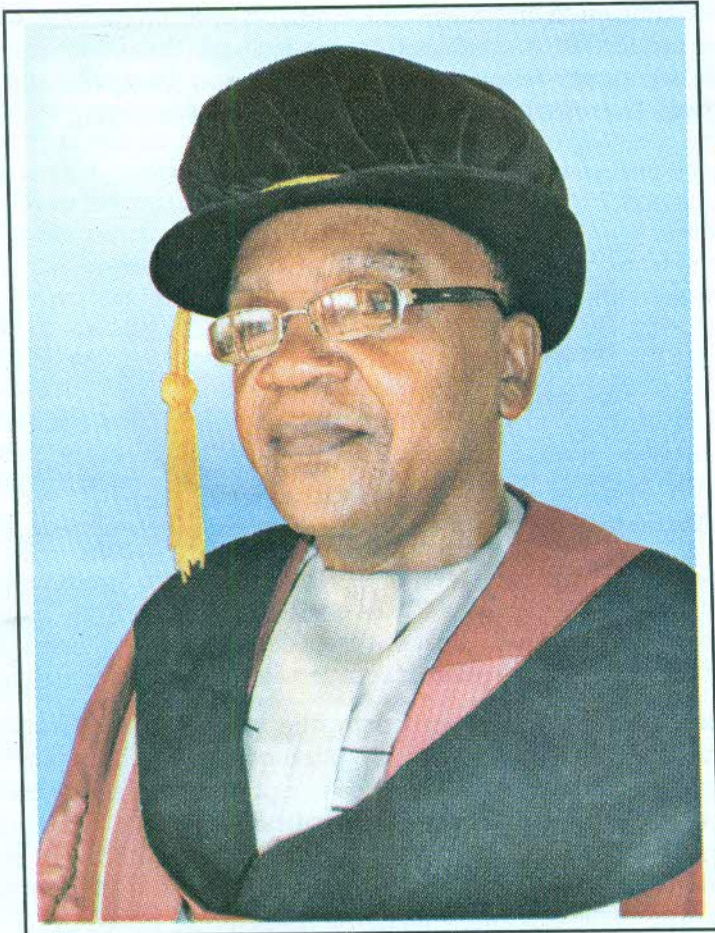
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1.0 Introduction

Stratigraphy is the description and classification of all rock bodies forming the Earth's crust into distinctive and mappable units on the basis of their inherent properties or attributes. It also includes the establishment of their distributions, relationship and succession in space and time respectively. The crust forms a relatively thin layer of rocks (Fig. 1).

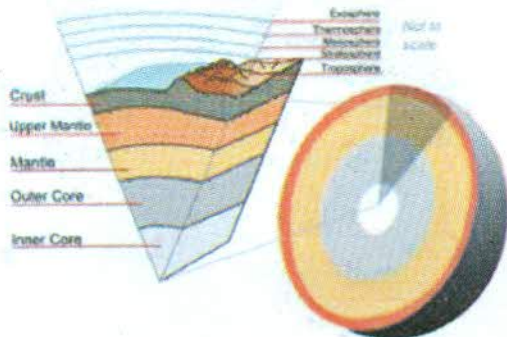


Figure 1. The subdivision of the Earth's interior ([en.wikipedia.org/wiki/Crust geology](https://en.wikipedia.org/wiki/Crust_geology))

The topic of this inaugural lecture "The traverses of a Stratigrapher in Nigerian sedimentary basins" was chosen to demonstrate how my research contributions in nearly three decades have addressed the keyword Stratigrapher in rocks of Cretaceous and Tertiary age in Nigeria.

Stratigraphic practice is governed by the principles and procedures enumerated in the 2nd edition of *International Stratigraphic Guide* (Murphy & Salvador, 1994). The *Guide* is a product of the International Subcommittee on Stratigraphic Classification of the International Commission in Stratigraphy. The document was published by the International Union of Geological Sciences and the Geological Society of America. The *Guide* is a follow up to the first edition, edited by Hedberg (1976). Both editions found wide acceptance among stratigraphers globally. The document also serves to promote international agreement on the principles and procedure of stratigraphic practice. The principles and procedures in the *Guide* have been the hallmark of my stratigraphic practice.

Three basic and fundamental principles: "*superposition*", "*uniformitarianism*" and "*floral and faunal succession*" are very important in stratigraphy. They serve as keys to the understanding of the geologic

past. The "Principle of Superposition" states that "in any undisturbed succession of rocks, the oldest is at the base while the youngest is at the top" (Stensen, 1669) and was formalized by Hutton (1815). The principle of "Uniformitarianism" states that the processes responsible for past geologic events are essentially similar to those operating today (Hutton, 1795). This can be interpreted to mean that the behaviour of nature (physical and chemical laws) is uniform throughout time, and the present is the key to the past. The principle of "Faunal and Floral Succession" states that "fossil plants and animals succeed each other in a definite and determinable order and that any period of geological time can be recognized by its respective fossils" (Smith, 1799). Strata containing identical flora and/or fauna in a generalized sense are of the same age irrespective of lithology and distance between the sequences. Such strata are correlatable. Correlation is the determination of equivalence in the geologic age and stratigraphic position of two or more formations in different areas or locations. The theory of organic evolution is of paramount importance in the biological scheme of dating or determining the ages of sedimentary rocks.





Rock bodies may be classified into five or more categories based on inherent properties or attributes (Tab. 1). Three categories or types of formal units will form the focus of this inaugural lecture: lithostratigraphic, biostratigraphic and chronostratigraphic units. Credible stratigraphic work requires strong adherence to sedimentologic and biostratigraphic principles.

Stratigraphic Categories	Principal Stratigraphic Unit-terms	Equivalent Geochronologic Units	
Lithostratigraphic	Group Formation Member Bed(s), Flow(s)		
Unconformity-bounded	Synthem		
Biostratigraphic	Biozones: Range zones Interval zones Lineage zones Assemblage zones Abundance zones Other kinds of biozones		
Magnetostratigraphic polarity	Polarity zone		
Other (informal) stratigraphic categories (mineralogic, stable isotope, environmental, seismic, etc.)	-zone (with appropriate prefix)		
Chronostratigraphic	Eonothem Erathem System Series Stage Substage (Chronozone)	Eon Era Period Epoch Age Subage (or Age) (Chron)	

Table 1. Categories and Unit - Terms in stratigraphic classification (Murphy & Salvador, 1994)

1.1 Lithostratigraphy

Adequate sedimentologic knowledge and practices are necessary for the study and comprehension of rocks classification and stratification (bedding). Classification of sedimentary rocks involves rock composition and grain size of particles (Tab. 2). There are terminologies for stratification (bedding) and grain size classes which are important for the description and classification of sedimentary rocks. (Ingram, 1954, Wentworth, 1922).

Clastic Sedimentary Rocks			
Texture (grain size)		Sediment Name	Rock Name
Coarse (over 2 mm)		Gravel (rounded fragments)	Conglomerate
		Gravel (angular fragments)	Breccia
Medium (1/16 to 2 mm)		Sand	Sandstone
Fine (1/16 to 1/256 mm)		Mud	Siltstone
Very Fine (less than 1/256)		Mud	Shale
Chemical Sedimentary Rocks			
Composition		Texture (grain size)	Rock Name
Calcite		Fine to coarse crystalline	Crystalline Limestone
			Travertine
		Shells and cemented shell fragments	Coquina
		Shells and shell fragments cemented with calcite cement	Fossiliferous Limestone
		Microscopic shells and clay	Chalk
Quartz		Very fine crystalline	Chert (light color) Flint (dark color)
Gypsum		Fine to coarse crystalline	Rock Gypsum
Halite		Fine to coarse crystalline	Rock Salt
Altered plant fragments		Fine-grained organic matter	Bituminous Coal

Biochemical Limestone

1.2 Biostratigraphy

Biostratigraphy is the study of rock strata using fossils. Although the principle of faunal and floral succession (Smith, 1799) was to be the cornerstone for all subsequent work in biostratigraphy, a closer look at fossil succession was needed. The improvement at the earlier principles was the recognition that unique assemblages of fossils may include many formations (lithostratigraphic units) in one place and only a single formation in another, leading the concept of stage (D'Orbigny, 1842).

Oppel (1856) conceived the idea of small scale units defined by the

stratigraphic ranges of fossil species irrespective of lithology. He noted that some fossils existed for a short geologic time, hence a short vertical range while others were quite long. Each of Oppel's zones was named after a particular fossils species, called an index fossil.

In the late 1800's, Gryzbowski realized that rock samples contained fossils that he could recognise from well to well. In addition, he could predict hydrocarbon reservoirs and even identify structural features such as faults and folds. The refinement of sequence stratigraphy by Exxon Group led to an increased demand for biostratigraphy, because high resolution biostratigraphy was a key component of this development. All these pave the way for applied biostratigraphy in exploration and production.

Rock samples from wells are often limited to ditch cuttings, but may also be sidewall samples or cores. These are then washed and prepared for picking of fossil forms to be followed by interpretation. The term microfossil is used here in its broad sense. However from a practical perspective there are three disciplines involved, micropalaeontology, nannopalaeontology and palynology. The separate disciplines have arisen due to differences in the size and chemical composition, specific preparatory and analytical procedures (Giwa *et.al*, 2004). The groups are listed below along with a brief description (Fig. 2).

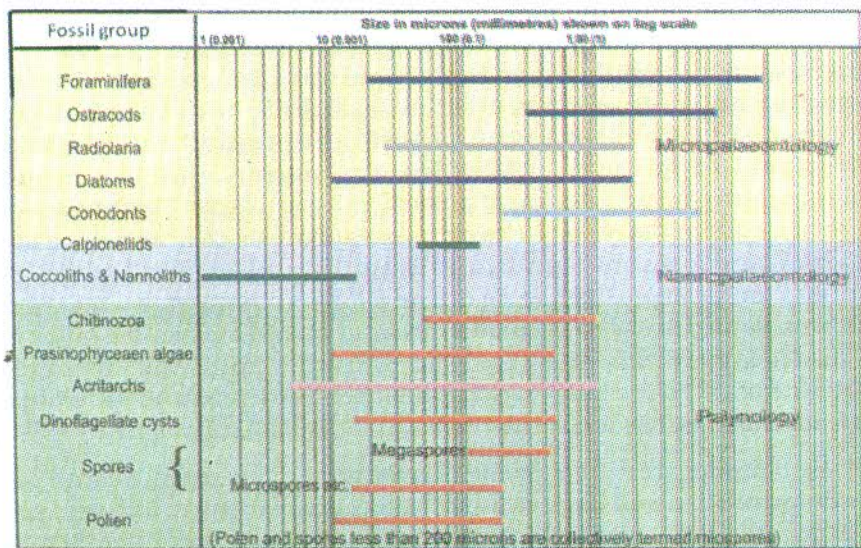


Figure 2. Microfossil groups from the Millennia consultant Website

