

# Geologic Mapping of Abeokuta Metropolis, Southwestern Nigeria

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**ABSTRACT-** A study was carried out in parts of Abeokuta metropolis to determine the lithologic features present in the study area. This study investigated the nature of occurrence, identify the various rock types in order to produce a geological map. These involved geological mapping, petrography of the rocks that underlie the area. The lithologies mapped in the study areas include Gneiss, Biotite- Granite and Porphyritic Granite with structures found on the outcrops such as joints and fractures. Rock samples were collected from seventeen locations and properly labelled to avoid mix up. The samples were cut and prepared into thin section slides. The thin slides were viewed under a petrographic microscope and displayed as microphotographs of each slide. The study area falls within the basement complex of Nigeria.

**KEYWORDS:** Abeokuta, Occurrence, Lithologies, Geological map, Petrographic, Microphotographs, Basement Complex.

## 1 INTRODUCTION

Geologic mapping on the field is one of the main functions of a geologist, which is the basis of understanding the geologic history of an area [1]. Rocks after formation are subjected to weathering be it physical or chemical from which disintegrated minerals pass through to the surface or underground water into streams and rivers. A Geological map was produced. This research attempts to unravel the underlying lithologic unit as well as assist in understanding the geological characteristics of major rock units by studying and analyzing the rocks in order to obtain and establish baseline geological information on the study area.

### 1.1 The Study Area

The study area includes the Abeokuta metropolis of South-Western Nigeria. Abeokuta, a community geographically located within the basement complex, can be described by Latitudes 7° 10' N to 7° 15' N and Longitudes 3° 17'E to 3° 26' E (Fig 1). The area is located in a hummocky terrain with a well pronounced undulating topography with prominent hills characterized by steep slope varying in altitude between 30 m and 180 m above sea level [2].

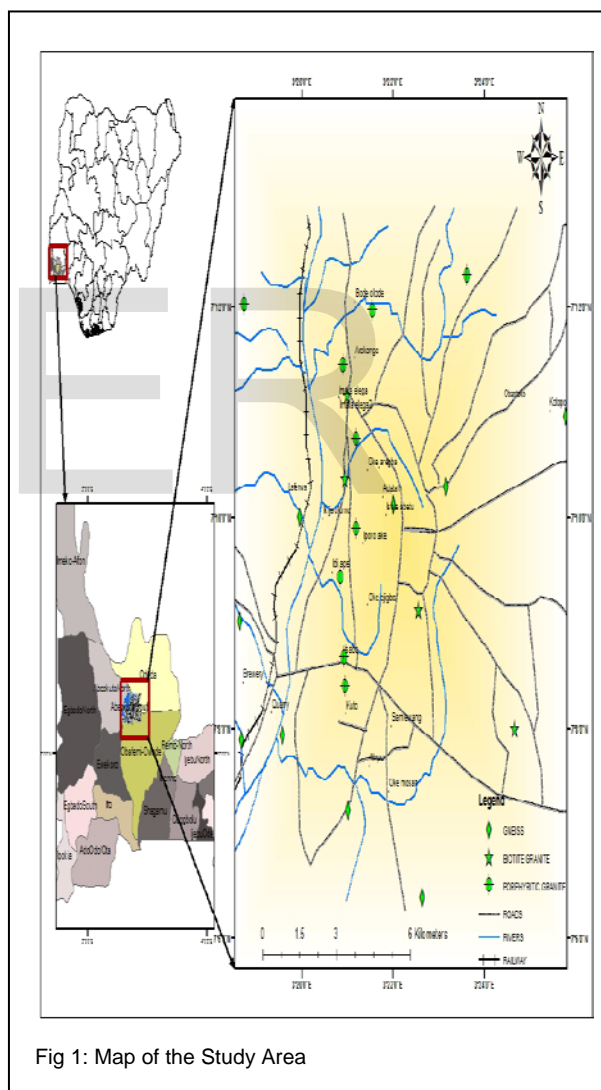


Fig 1: Map of the Study Area

## 1.2 Accessibility and Human Settlement

The metropolis covers the city of Abeokuta. The metropolis of Abeokuta is well connected with major roads and minor roads within the localities which were motorable and trekable, thereby making accessibility to the outcrops less difficult.

## 1.3 Climate and Drainage

The area enjoys a tropical climate with distinct wet and dry seasons with dry period of about 130 days [3]. The mean annual rainfall and temperature are about 1,270 mm and 28 °C respectively while the estimated mean annual potential evaporation is 1,100 mm. Actual Water Availability (AWA) of this area is 2314mm (AWA = Available Precipitation + Regional Evapo-transpiration) [4]. The metropolis is majorly drained by the River Ogun, River Oyan and many small streams. Some of the streams take their source from local rocky hills while some are distributaries to the major rivers. The river Ogun serves as drainage basin of all the smaller streams which take their source from flow areas of high altitude and flow through to discharge their flow into the Ogun River

## 2 METHODOLOGY

Various materials were used for the different aspect of this research work, some of the materials include sample bags used in storing rock samples before it was transported to the laboratory. The samples were carefully labelled with permanent markers to avoid mix up. Other materials included compass clinometers, global positioning system (GPS). The method adopted for this work involves systematic geologic mapping of the basement rocks. It involves both field work and laboratory exercises. The field work is essentially geologic mapping. Systematic geological mapping was carried out on a scale of 1:50,000 using grid-controlled sampling of the rock outcrops.

Fourteen representative rock samples were selected and cut into smaller chip with a micro-cutting machine at the University of Ibadan, Ibadan. The cut rock samples were mounted with smooth cut surfaces on a clean glass using araldite adhesive. The mounted chips were placed on a hot plate upside down for more than one hour to dry. The

slides were left to cool and excess cement adhesive was scraped off the slide. The slides were taken to the University of Ibadan Geological Laboratory for microscopic studies. The slides were washed at each stage and constantly examined under the flat stage of a photographic microscope to identify features not seen with the hand lens on the field. Microphotographs of the features were also taken.

## 3 RESULTS AND DISCUSSION

Table 1 shows the field descriptions of different lithological units mapped in the study area. Table 2 - 4 shows the condensed modal composition of the lithologic units per location. Fig 2-4 shows the microphotographs of the three lithologic units in the study area. Gneiss is a foliated metamorphic rock commonly derived from granite, shale, diorite and other rocks by regional metamorphism. This metamorphic rock was found cutting across the mapped area from the Northeastern part to the Southwestern part. A few exposures were also observed in the southeastern part of the study area. It is foliated, medium to coarse grained in texture and leucocratic in colour. Granites are called Porphyritic when large crystals especially of feldspar are observed in it. These crystals are believed to have been formed first and later surrounded by a fine grained crystalline mass of minerals. This covers mostly the Northern part of the mapped area. A few exposures were also recorded at the southern part of the study area. The outcrops were well exposed occurring as huge, massive outcrops as well as flat low lying outcrops (Fig 5). They were medium to coarse grained. There was presence of large phenocrysts of feldspar pinkish in colour. Xenolith lenses of about 3cm by 6.5cm and usually finer grained than the host rock were associated with the rock. The rock served as host for some veins which appeared to be rich in feldspar. Biotite Granite occurs as pockets within the Southeastern part of the mapped area. Upon physical observation, a lot of biotite minerals were observed in the outcrop. It was melanocratic in colour showing some dark green patches suspected to be hornblende. The presence of veins were also observed which was mainly feldspathic in composition. They occurred mainly as low lying outcrops.

Location Minerals present in percentage composition (%)

Loc	Latitude N07°	Longitude E003°	Texture	Rock	TA BL E 2 MO DA L C O M P O S I T I O N O F G N E I S O U T C R O P S I N T H E M A P P E D A R E A	FIELD DESCRIPTION OF MINERALOGIES						
						QU	MIC	PL	BM	MUS	HB	OP
A	11.016'	25.436'	Medium - Coarse	GN	A	65	20	10	-	2	3	
B	10.305'	22.107'	Medium Grained	GN	B	73	10	6	2	5	-	4
C	10.907'	21.767'	Medium Grained	BG	D	83	12	-	3	3	2	-
D	10.027'	21.845'	Medium Grained	GN	I	55	30	-	15	-	-	-
E	09.755'	21.340'	Coarse Grained	PG	K	68	-	-	28	-	-	5
F	09.166'	21.443'	Medium Grained	B G	N	80	-	10	9	1	-	-
G	09.482'	20.663'	Coarse Grained	PG								
H	09.987'	20.456'	Medium - Coarse	GN								
I	08.151'	19.333'	Medium Grained	GN								
J	07.401'	21.902'	Medium - Coarse	GN								
K	07.641'	21.478'	Medium Grained	GN								
L	08.204'	21.956'	Medium Grained	BG								
M	08.340'	18.174'	Medium Grained	GN								
N	08.439'	18.713'	Medium Grained	GN								
O	08.140'	20.962'	Medium - Coarse	PG	E	47	3	-	5	-	35	1
P	08.673'	20.921'	Medium - Coarse	PG	O	38	30	5	7	-	20	1
Q	10.452'	21.439'	Coarse Grained	PG	P	48	25	2	10	-	5	-
R	10.476'	21.697'	Coarse Grained	PG	R	69	13	-	8	-	10	-
S	11.136'	20.805'	Medium Grained	PG	T	85	-	5	10	-	-	-
T	11.124'	20.831'	Medium - Fine	BG								
U	12.049'	21.164'	Coarse Grained	PG								
V	11.57	21.16	Coarse Grained	PG								

A- Kotopo, B- Carwash, D- Isale Abetu, I-Quarry road, K- NNPC, N- Brewery, QTZ- Quartz, MIC- Microcline Feldspar, PL- Plagioclase Feldspar, BM- Biotite Mica, HB- Hornblende, OP- Opaque

TABLE 3

MODAL COMPOSITION OF PORPHYRITIC GRANITE OUTCROPS IN MAPPED AREAS

LOC	Minerals present in percentage composition (%)						
	QTZ	MIC	PL	BM	MUS	HB	OPQ
E	47	3	-	5	-	35	1
O	38	30	5	7	-	20	1
P	48	25	2	10	-	5	-
R	69	13	-	8	-	10	-
T	85	-	5	10	-	-	-

E- Iporo Ake, O- Kuto, P-Isabo, R-.Elega, T- BodeOlude, QTZ- Quartz, MIC- Microcline Feldspar, PL- Plagioclase Feldspar, BM- Biotite Mica, MUS- Muscovite, HB- B-Hornblende, OPQ- Opaque

TABLE 4

### MODAL COMPOSITION OF BIOTITE GRANITE OUTCROPS IN MAPPED AREAS

Loc Minerals Present In Percentage Composition (%)

	QTZ	MIC	PL	BM	MUS	HB	OP
C	70	-	6	7	5	12	2
F	79	7	-	10	-	2	2
L	82	-	4	10	-	3	1

C- Adatan, F- Okeejigbo, L- SamEwang, QTZ- Quartz, MIC- Microcline Feldspar, PL- Plagioclase Feldspar, BM- Biotite Mica, MUS- Muscovite, HB- B-Hornblende, OP- Opaque

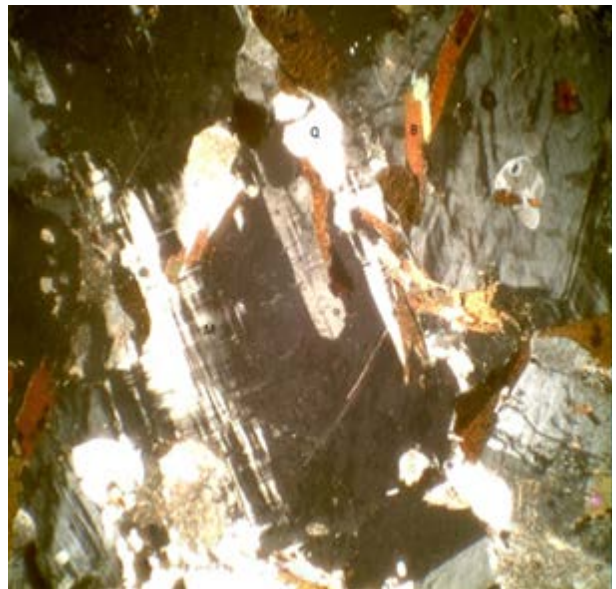


Fig 2b. Microphotograph of Gneiss at IsaleAbetu

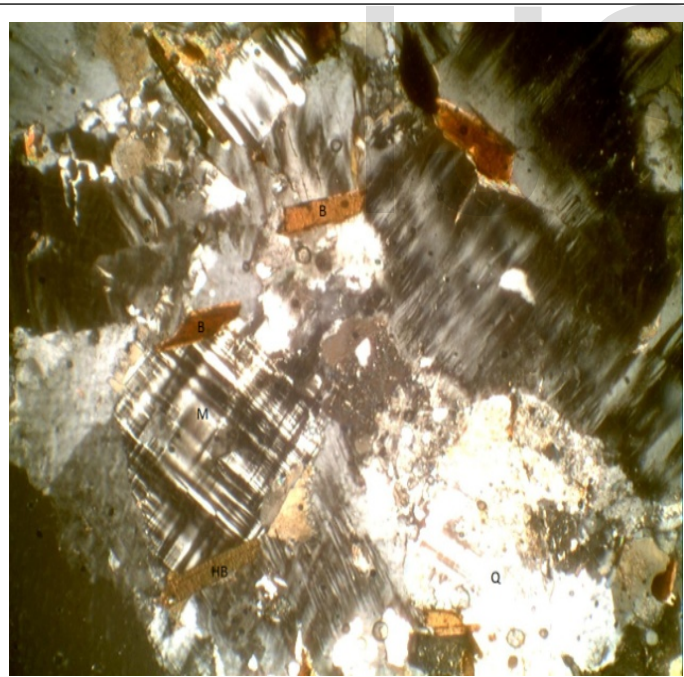


Fig 2a. Microphotograph of Gneiss at Kotopo



Fig 3a. Microphotograph of Porphyritic Granite at IporoAke



Fig 3b. Microphotograph of Porphyritic Granite at Kuto

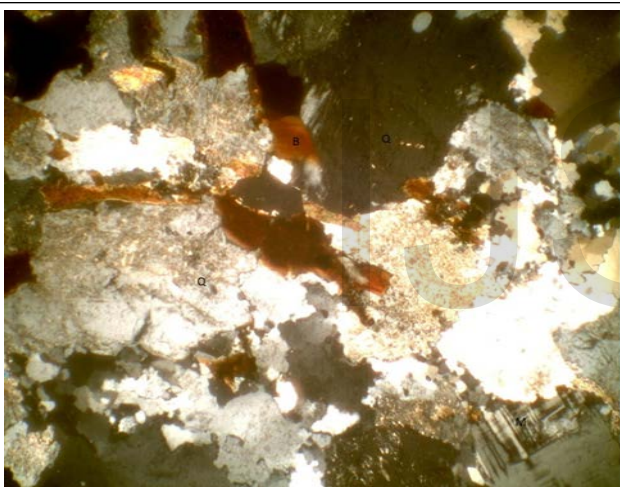


Fig 4a. Microphotograph of Biotite Granite at Okeejigbo



Fig 4b. Microphotograph of Biotite Granite at Adatan

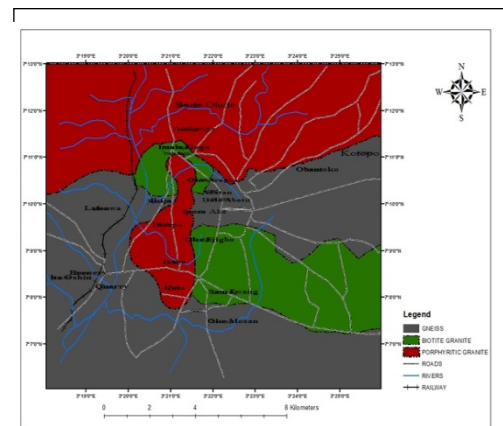


Fig 5. Geological Map of the Study Area

#### 4 CONCLUSION

Geologically, the study area falls within the Precambrian Basement rocks of southwestern Nigeria [5] with six major lithologic units namely; Quartzite, Banded-gneiss, Biotite-gneiss, Biotite-Schist, Quartz-Biotite Schist and Pegmatite.

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