FIELD GEOLOGY OF GUBI AREA, NORTHEASTERN NIGERIA

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ABSTRACT

Basement rocks of the Gubi area of Northeastern Nigeria were assessed and found to comprise of Pre-Cambrian basement rocks invaded by Pan-African granites generally referred to as the 'Older Granites'. The area was composed mainly of Migmatite gneiss, granite gneisses and calc-alkaline granites. The tectonic structures in the study area trend mostly NE – SW and subordinately NW-SE and N-S conform with the regional deformational structures which occurred during the Pan African thermotectonic events in the Nigerian basement.

Keywords: Gubi, Calc-alkaline granites, Pan-African, Older Granite, Northeastern Nigeria

1.0 INTRODUCTION

The Gubi area is located within latitude: 10º24'00"Nand 10º28'20"N and longitude: 09º48'15"E and 09º51'37"E, the study area covers an area of 48km^2 and rise to the height of approximately 755m above mean sea level in some areas.The geology of the Gubi area is mainly characterised by metamorphic and plutonic rocks (basement complex) of the neoproterozoic belt of north-eastern Nigeria. Some of the rocks found within the area are characterised by intensive deformation which are imprints of Eburnean (2.2-1.9Ga) and Pan African (750-450Ma) orogenic events (Ogezi, 1977). The rocks within the area also exhibit foliations planes and other structural features are usually found trending in the N–S direction which a distinguish characteristics of the Pan-African orogenic event.

2.0 GEOLOGIC SETTING

The Gubi area is located in the Northern Basement complex of Nigeria (Fig 1) and is the composed of mainly metamorphic and plutonic rocks with granite gneisses and migmatite gneisses representing the metarmorphosed rock units and Pan african granites represent the plutonic rock units found in the area (Fig 2).

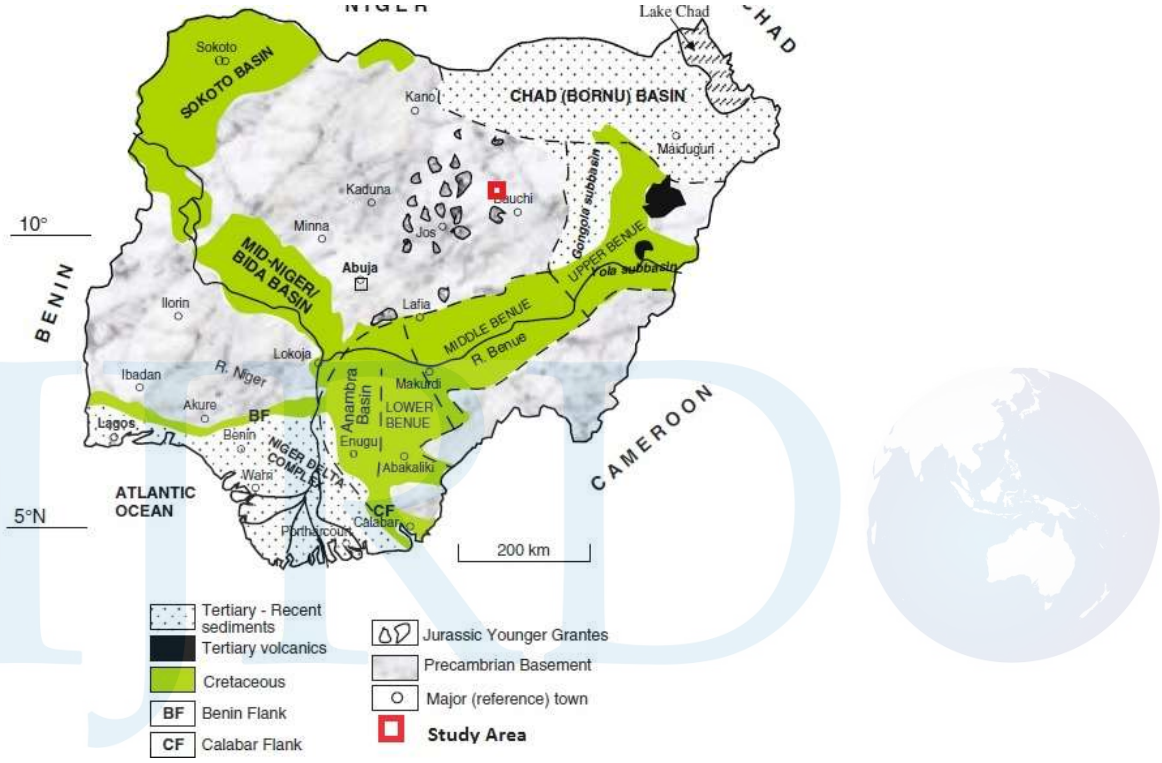

Fig 1. Geologic Map of Nigeria showing the study area (Modified from Obaje, 2009)

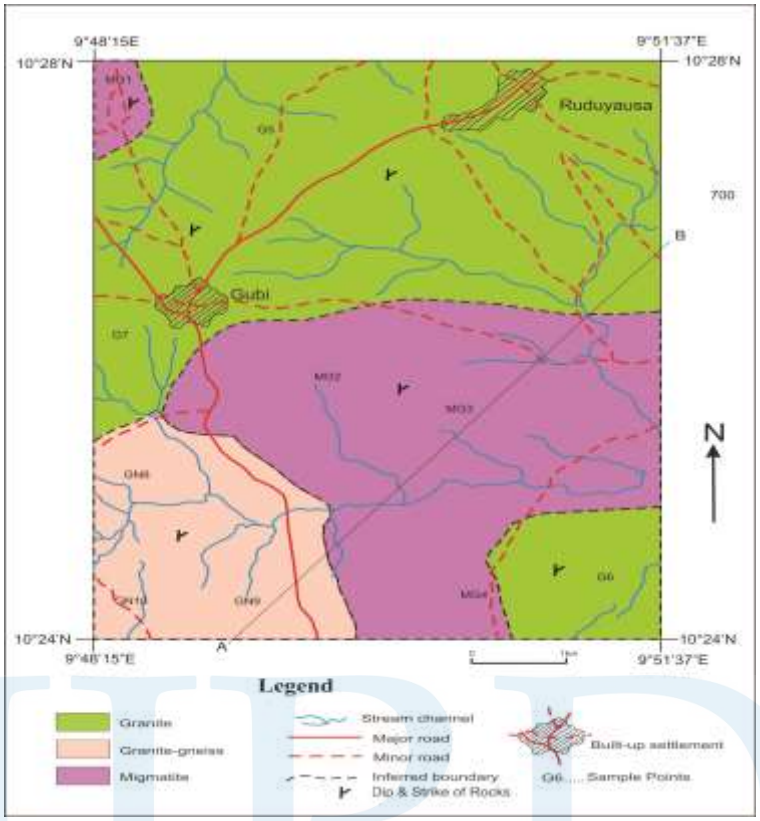

Fig 2. Geologic Map of the Gubi Area

3.0 SAMPLING AND ANALYTICAL TECHNIQUE

The samples were taken in a well grided manner to enable collection of representative rock samples of the different rock units in the Area. Petrological observation was conducted using a Microscope at the Department of Geology, Modibbo Adama University of Technology, Yola. The samples were prepared, mounted and viewed both under plane and polarized light.

4.0 FIELD GEOLOGY AND PETROGRAHY

4.1 Field Studies

The Area under study is comprised of Migmatite gneisses, granite gneisses and calc-alkaline granites. Geological structures such as quartz veins, pegmatite dykes, folds, joints and fault zones were observed in the rocks of the Basement Complex (Fig. 3).

4.1.1 The Older Granite Complex

The granite of the study area covers about 50% of the total study area. Field observations indicate that they are massive and vary widely in texture. The minerals are randomly oriented and show well oriented tabular feldspars (typically perthitic microcline or orthoclase) with

plagioclase (calcic albite or oligoclase) and/or flaky biotite grains. They are porphyritic with phenocrysts of quartz and feldspar in a groundmass of biotite and hornblende. They are medium to coarse grained with average grain size between 1mm-30mm (0.1cm-3.0cm).

Fig 3. Quartz vein on a granite outcrop

4.1.2 The Migmatite-Gneiss Complex

The gneisses are coarse-grained, banded crystalline rocks with phanerictic mineral grains for the

dark colored mineral the biotite occur in association. The banding arises from the segregation of various minerals that are present into dark-colored (melanocratic) and lightcolored (leucocratic) layers. The dark bands consist of dark minerals such as biotites and horneblende whereas light bands consist of light coloured minerals such as quartz and feldspar. The thickness of the bands is between 2mm to 2cm. The rock are intensely deformed resulting in the formation of joints, shear zones and fractures.

Fig 4. Outcrop of Migmatite Gneiss

4.1.3 The Granite-Gneiss Complex

The granite gneiss which is found in the southern part of the study area is strongly foliated and closely associated with the migmatite-gneiss. The rock type is light to dark colored and medium to coarse grained in texture. They contain feldspar, quartz, biotite and muscovite with poorly developed leucocratic layers.

Fig 5. Outcrop of Granite Gneiss

4.2 Petrography

4.2.1 Migmatite

The following properties of the migmatite were observed under the microscope as shown in plate (1): Abundant colourless minerals with few patches of ferromagnesian minerals with thin parallel lines indicating a one directional cleavage.

Ferromagnesian minerals showed changes as the stage was being rotated evident of phleocroism and low relief of the minerals.

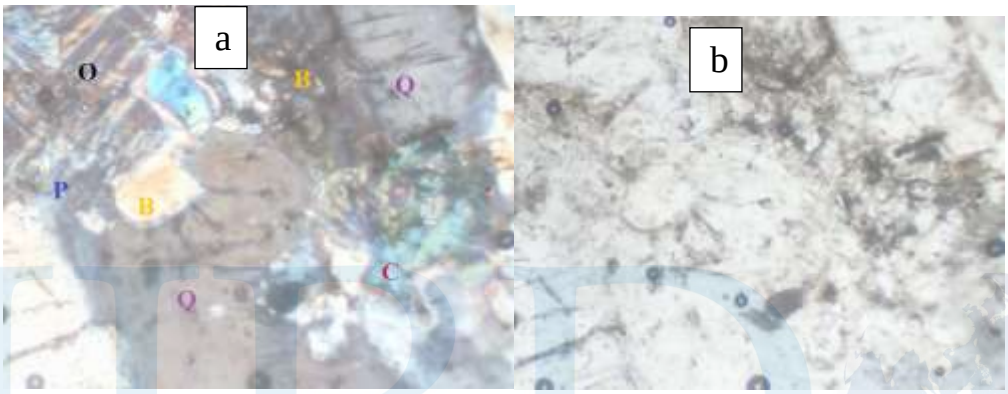

Plate 1: Photomicrograph of migmatite under XPL and PPL.

Note: Q = Quartz, O = Orthoclase, P = Plagioclase, B = Biotite and C = Chlorite.

4.2.2 Granite

The following properties of granite shown in plate **(2)** under the microscope**:** Colourless and brown coloured minerals were identified with Perfect one directional cleavage was identified on the brown mineral which is phleocroic with sub-hedral mineral form and a medium relief.

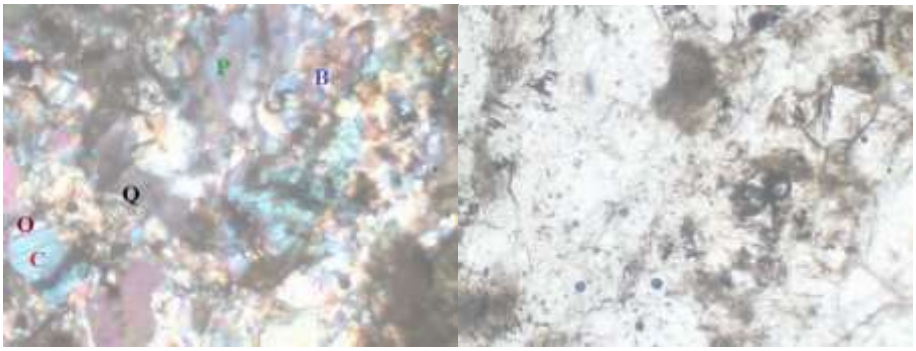

Plate 2: photomicrograph of granite under XPL and PPL.

Note: Q = Quartz, B = Biotite, C = Chlorite, O = Orthoclase and P = Plagioclase.

4.2.3 Granite Gneiss

The following properties of the granite gneiss were recognized under the microscope: They was an almost equal division of rock forming, ferromagnesian and ore minerals with ore minerals having a perfect one directional cleavage. The brown minerals are phleocroic, with a sub-hedral mineral form and a medium relief.

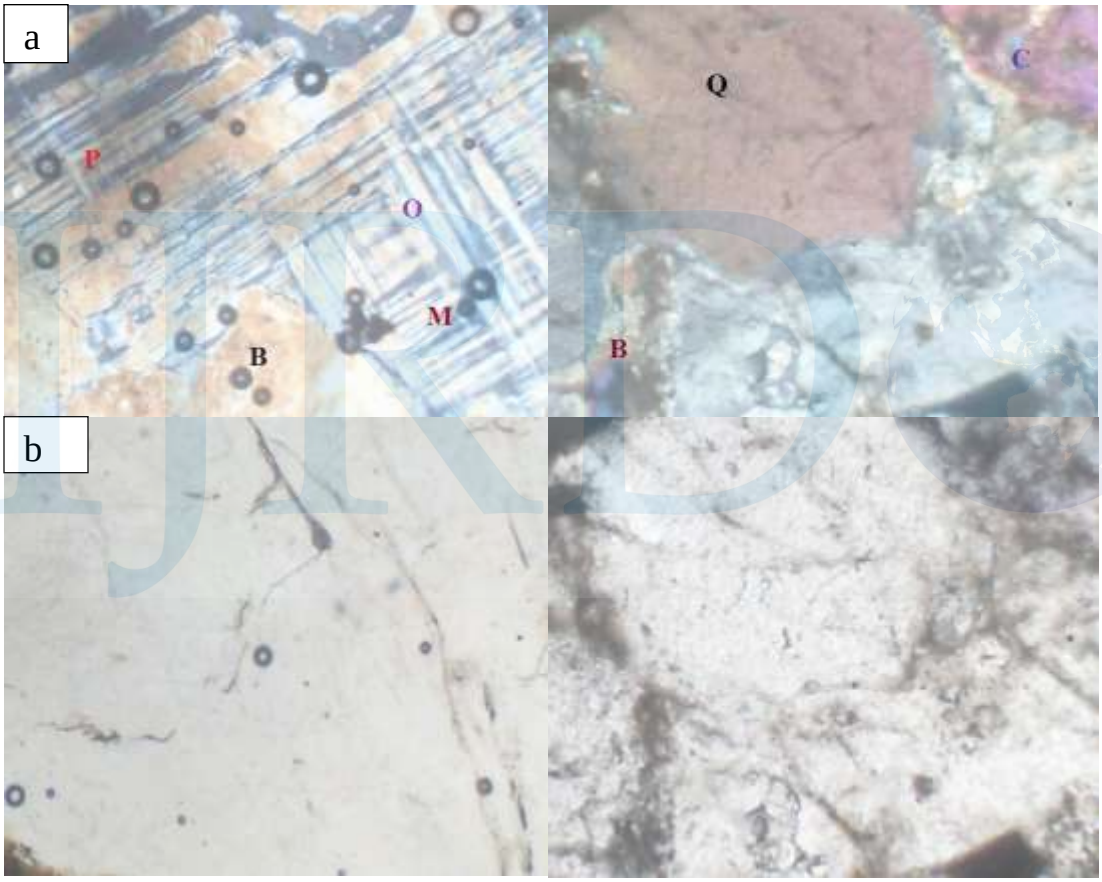

Plate 3: photomicrograph of granite gneiss under XPL and PPL.

Note: Q = Quartz, B = Biotite, C = Chlorite, O = Orthoclase, P = Plagioclase and M = Microcline.

5.0 DISCUSSION

The Gubi area shows a variety of rocks representative of orogenic events that affected the basement of rocks, Migmatite and granite gneisses significant of Eburnean and Pan African events and Calc-alkaline concordant granitoids commonly referred to as the 'Older Granites' of Nigeria representative of intrusions during the Pan-African orogenic event (McCurry and Wright, 1971; Rahaman and Lancelot, 1984). The tectonic structures in the study area trend mostly NE – SW and subordinately NW-SE and N-S conform with the regional deformational structures which occurred during the Pan African thermotectonic events in the Nigerian basement (McCurry, 1976).

6.0 CONCLUSION

Field studies and petrographic investigations indicate that the Gubi area consists of granites, granite gneisses and migmatite gneisses. The granites of the Gubi area are high-K calc-alkaline synonymous with the Pan-African granitoids of Nigeria (Rahaman and Ocan, 1978; Rahaman and Lancelot, 1984). This magmatic suite is metaluminous to peraluminous. Earlier workers classifiy the Pan-African granitoids as pre, syn and post tectonic granite which were formed during the Pan African thermotectonic events in the Nigerian Basement Complex. Further geochemical and isotope studies of the Gubi rocks is ongoing.

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REFERENCES

Ekwueme, B.N., 2003: The Precambrian Geology and Evolution of the South Eastern Nigerian Basement Complex, University of Calabar, Press, 2003, 135 p.

McCurry, P., and Wright, J.B., 1971; On Place and Time in Orogenic Granite Plutonisan; Geological Society of America Bulletin, Vol. 82, p. 1713 – 1716

McCurry, P., 1976. A general Review of the Geology of the Precambrian to lower Paleozoic rocks of the Northern Nigeria, In: Geology of Nigeria, Kogbe, C.A. (Ed), pp. 13 – 37

Obaje, N.G., 2009: Geology and Mining Resourcs of Nigeria. Springer 221p

Ogezi, A. E. O. 1977: Geochemistry and geochronology of basement rocks from northwestern Nigeria. Doctoral dissertation, University of Leeds.

Rahaman, M.A and Ocan .O., 1978: On relationships in the Precambrian Migmatite-gneisses of Nigeria. Niger J Min Geol 15:23–32

Rahaman, M.A and Lancelot J.R., 1984: Continental crust evolution in SW Nigeria: constraints from U/Pb dating of pre-Pan-African gneisses. In: Rapport d'activite 1980–1984 – Documents et Travaux du Centre Geologique et Geophysique de Montpellier 4:pp 41