FIELD GEOLOGY OF SOME GRANITIC ROCKS IN THE KALTUNGO AREA, NORTHEASTERN NIGERIA

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ABSTRACT

Granitic rocks of the Kaltungo Inlier were assessed in a view to glean more information about their origin. The area comprised of coarse granied porphyritic granite, pegmatite and diorite. 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.

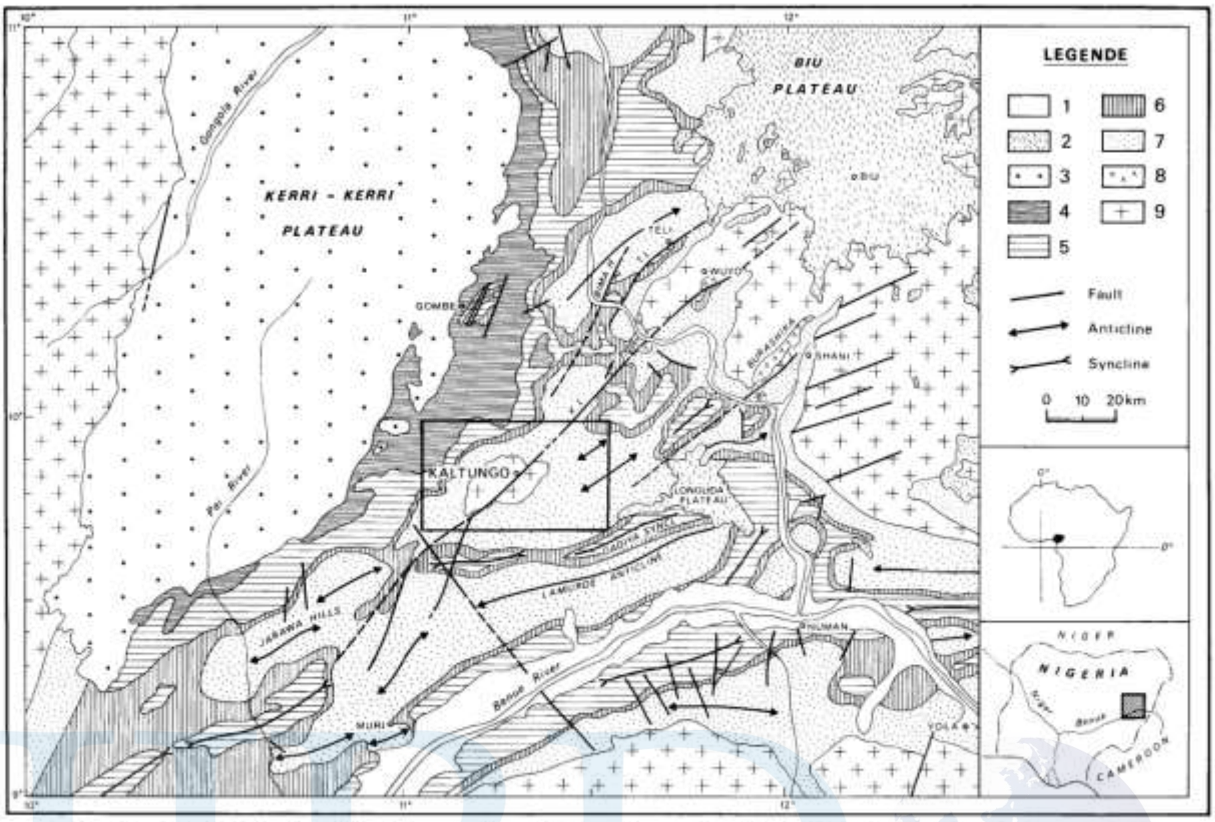
Keywords: Kaltungo, Calc-alkaline granites, Pan-African, Inlier, Northeastern Nigeria

1.0 INTRODUCTION

The area under study is located between latitude $9^0 46' 30''$ and $9^0 49' 20''$N and Longitude $11^0 12' 20''$ and $11^0 15' 00''$E part of sheet 173 NW Kaltungo and it covers an area extent of about 30sqkm^2.The geology of the granitic rocks in the inlier is assessed to give futher infromation about its relationship to the enclosing sediments. 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). T

2.0 GEOLOGIC SETTING

The Kaltungo area is located within the Benue trough of Nigeria (Fig 1) and is the composed of mainly of sedimentary rocks straddling calc-alkaline 'Older Granites' with the area under study being comprised of Coarse grained porphyritic granite, pegmatite and diorites. (Fig 2).



Simplified geological map of the Upper Benue Valley. 1, Quaternary alluvium; 2, Tertiary to Recent volcanism; 3, Kerri-Kerri formation; 4, Gombe sandstone formation; 5, Pindiga formation; 6, Yolde formation; 7, Bima sandstone formation; 8, Burashika group (Mesozoic volcanism); 9, Undifferentiated basement complex (Precambrian). Major fault zones: BL, Burashika lineament; KL, Kaltungo lineament; TL, Teli (or Zambuk) lineament.

Fig 1. Map showing the Kaltungo area (From Maurin et al., 1985)

The upper Benue trough is structurally marked by numerous NE-SW trending mylomitic shear zone generally during the late Pan-African phase, and reactivated as sinistral strike-ship faults during the Cretaceous (Benkheli, 1986; Maurin et al., 1985). Generally, three major fracture zone trending northeast have been recognized: the Gombe fault, the Kaltungo lineament which extends for about 150km and the Burashika fault. The major fractures cross-cut the cretaceous deposits and affects the basement. The tectonic deformation along these major fractures is represented by Cataclastic and breciated bands that are about 300m to 1km wide in the basement, and over 100m wide crushed zone in the sedimentary cover. According to Ntekim and Orazulike (2004) Sthe present tectonic setting of the Kaltungo area is influenced by the late intense compression earth movements dominated by series of long and narrow simple fold structures. They went further to state that large scale faulting occurred after the faulting events and resulted in grabens. The reactivation of the major basement faults is responsible for sinistral faults in Kaltungo, Teli-wuyo and Gombe areas. Bassey (2006) identified the Chibok lineaments which align N50^{0}E to be similar to the trend of the Kaltungo fault zone and the Wuro-Gubrunde lineaments. Bassey (2006) also reported a Chibok NE-SW trending lineaments which are intrabasement extension of the Benue trough lineaments traceable to Kaltungo inliers through Wuro-Gubrunde-Shani fault zones.70% of the area is underlain by the basement complex rock which include porphyritic and biotite granite. The porphyritic and biotie granite belong to the older granite of the Nigeria basement complex. The porphyritic granite are coarse to very coarse grained with large while or pink prismatic phenocrysts of microline while the biotite granite have granular texture with wide range of grain sizes. (Rahaman, 1976, Van Breeman, et al., 1997).

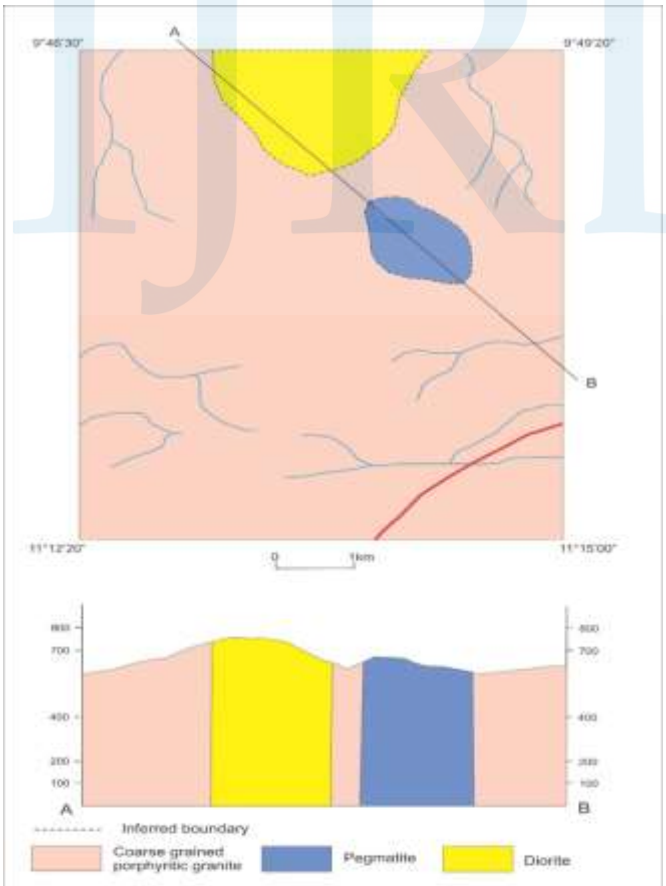


Fig 2. Geologic Map of the Area under study

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 calc-alkaline and some alkaline granites. Geological structures such as quartz veins, pegmatite dykes, folds, joints and fault zones were also observed in the granitic rocks.

4.1.1 Coarse Grained Porphyritic Granite

This covers most part of the study area it has a Porphyritic texture with phenocrysts of feldspar. It is composed of minerals like quartz, feldspar, Biotite and other accessory minerals. The rock is highly fractured and weathered.

4.1.2 Pegmatite

This rock occupies a portion of the north eastern part of the study area. It is holocrystalline, intrusive igneous rock and the mineralogy composedof interlocking phaneritic crystals usually larger than 2.5 cm in size. It is dominantly composed of quartz and little feldspar.

4.1.3 Diorite

This covers Kuyo hill of the study area. It is a light-coloured, volcanic equivalent of andesite. It has fine texture and composed of minerals such as plagioclase, hornblende, biotite and other accessory minerals.

4.2 Petrography

4.2.1 Coarse Grained Porphyritic Granite

In hand specimen, the rock exhibits a porphyritic texture, with large minerals of feldspar as phenocryst and a medium to coarse grained ground mass comprising Quartz, Feldspars and Biotite.

The modal estimates of the minerals in the rock are:

Quartz 35%

Biotite ………………………....10 %

Orthoclase Feldspars ………….50%

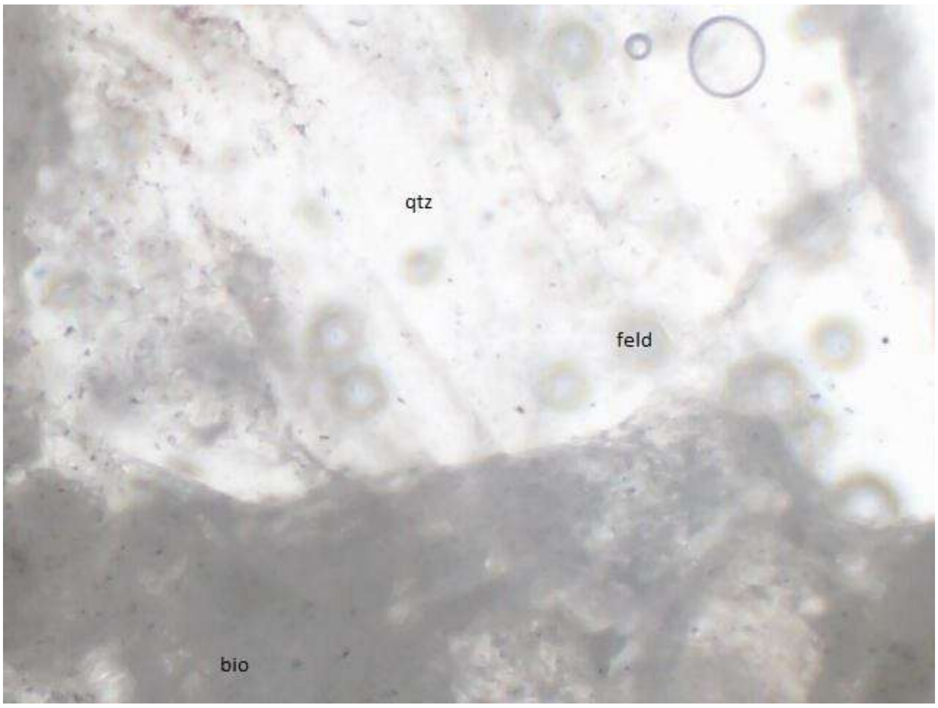
Accessories 5%

Quartz: The quarts amounts to about 35% of the rock and has colorless grain with low relief and are anhedral and euhedral in form under plane polarized light.

Feldspars: The orthoclase feldspars in thin section amount to 50% of the whole rock which show a perfect Carlsbad twining.

Biotite: The Biotite occupies 10% of the whole rock and occurs as dark brown to black in colour. They are subhedral in form and are highly ploechroic. They show perfect cleavage in one direction.

Accessories: Iron and other mineral make up the remaining 5% of the whole rock.



Qtz=quartz,Feld=feldspar, Bio=biotite

Plate 1: Photomicrograph of Coarse Porphyritic Granite Showing the Constituents Mineral under PPL (mag. X 10)

4.2.2 Pegmatite

In hand specimen the is medium grain and light coloured (leucocratic). The minerals present are dominantly quartz and little feldspar.

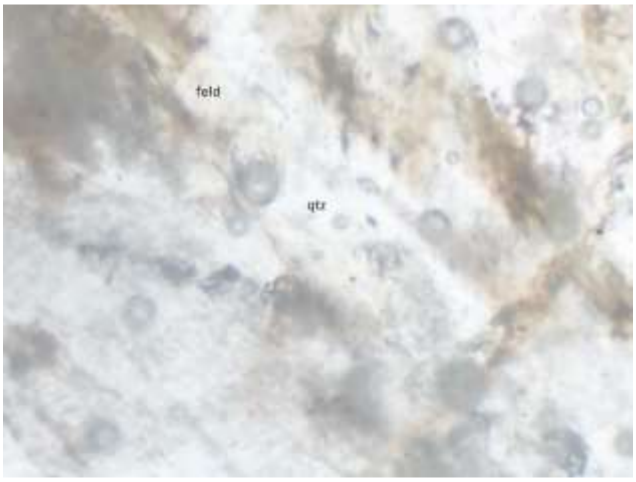
The modal estimates of the minerals in the rock are:

Quartz………………96%

Feldspars…..……….4%

Quartz: The quartz amounts to about 94% of the whole rock. They have subhedral and colourless grains.

Feldspars: the feldspars present are the orthoclase feldspar which occupies about 5% of the whole rock.



Qtz=quartz,Feld=feldspar

Plate 2: Photomicrograph of Pegmatite Showing the Constituents Mineral under PPL (mag. X 10)

4.2.3 Diorite

In hand specimen, the rock is medium grain and mesocratic. The minerals present are alkali feldspars, plagioclase, hornblend, biotite.

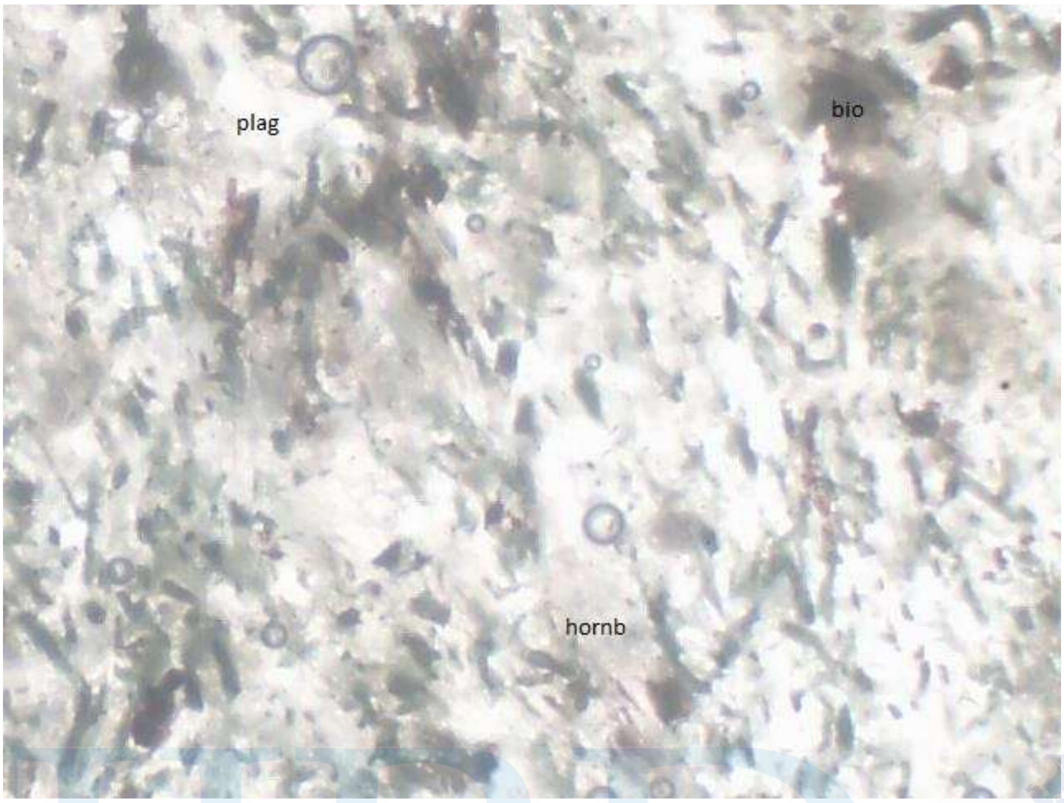
The modal estimate of the minerals in the rocks are:

Plagioclase……………60%

Hornblende………….10%

Pyroxene…………….15%

Biotite………………..15%



Plag=plagioclase, **Bio**=biotite, **Hornb**=hornblende

Plate 3: Photomicrograph of Diorite Showing the Constituents Mineral under PPL (mag. X 10)

4.3 Structures

4.3.1 Faults

Faults are well-define cracks in rock along which the rock masses on either side have relative displacement, they are known as disjunctive dislocations. Faults displace primary structures in rocks and this differentiates them from joints. Major fault was observed in the study area trending $N240^0$.

Fig 3: Photograph showing Dextral Strike-slip fault.

4.3.2 Xenoliths

These are inclusions or fragment of older and foreign materials that have been incorporated into magma during upwelling (upward migration) but, which restricted being melted and so it exist as a foreign body within a new (younger) rock formed by magma. And the xenoliths may be of any rock type. The xenoliths observed in the study area are within the coarse porphyritic granite (Plte 4)

Fig 4: Xenolith of diorite in coarse porphyritic granite

4.3.3 Joints

There are various joints sets found within the area of study with the strike of the prominent sets of joints trends in North East-South west (NE-SW) direction (Fig 6) with the joints were found to be predominantly in the coarse grained porphyritic Granite.

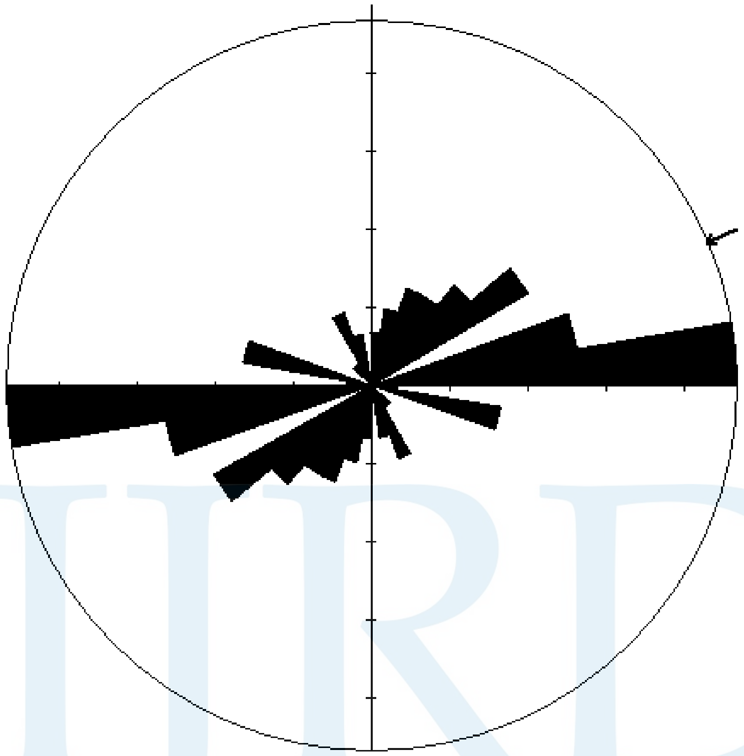
Fig 5: Joint set in coarse porphyritic granite

The data of the fractures/joints are plotted on a rose diagram (plot), in order to determine the dominant trends and also their intensities. Below is a table showing the frequency strikes and the back-azimuth of fractures/joints.

TABLE 1: The table below shows the frequency distribution of fractures/joints.

S/N	CLASS INTERVAL	FREQUENCY
1	0 - 30º	5
2	31 - 60º	11
3	61 - 90º	16

4	91 - 120^{o}	9
5	121 - 150^{o}	10
6	151 - 180^{o}	9



No. of Data = 60

Sector angle = 10°

Mean Resultant direction = 067-247

Fig 6: Rose Plot for Joint in coarse porphrytic granite with major trend NEE-SWW

5.0 DISCUSSION

The mapped areas around Kaltungo shows a variety of rocks representative of 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) and some alkaline rocks that might represent anorogenic emplacements. 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 granitic rocks of the Kaltungo area consists of granitic rocks. The granites of the Kaltungo 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 granitic rocks of the Kaltungo inlier rocks is ongoing.

REFERENCES

Bassey, N.E. 2006: A tectonic interpretation of a linear magnetic anomaly over Chibok, NE Nigeria. Global Journal of Geological Sciences Vol. 4 No 1, pp 73-78

Benkhelil, J. 1982: Bcnue Trough and Benue Chain, *Geol. Mug.*, 119. 155-168.

Benkhelil, J. 1989: The origin and evolution of the Cretaceous Benue Trough, Nigeria. J Afr Earth Sci 8:251–282

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

Maurin J.C, Benkhelil J and Robineau B. (1985): Fault rocks of the Kaltungo lineament (Northeastern Nigeria) and their relationship with the Benue Trough. J. Geol. Soc. London 143: 587-599

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

Ntekim, E.E. AND Orazulike, D.M. (2004). Structural and lithologic characteristics of Lamurde-Lau area in Upper Benue Trough, NE, Nigeria: A strategy for gypsum prospecting. Nig. J. Pure& Appl. Sci. Vol 19, pp 1692-1697.

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

Rahaman, M. A (1976): Review of the basement geology of SW Nigeria 2nd ed Elizabeth publ. Lagos, Nigeria PP 39 – 56.

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