Scientia Africana, Vol. 23 (No. 3), August, 2024. Pp 465-472
© Faculty of Science, University of Port Harcourt, Printed in Nigeria *ISSN 1118 – 1931*

PETROGRAPHY OF BASEMENT ROCKS IN PARTS OF IKOM AND ISO – BENDEGHIA, SOUTHEASTERN NIGERIA

Nule, H. C., Egesi, N. and Onwualu-John, J. N.
Department of Geology, Faculty of Science, University of Port Harcourt, Nigeria
E-mail: henros2004@yahoo.com,Ndukauba.egesi@uniport.edu.ng&Josephine.onwualu@uniport.edu.ng

Received: 30-07-2024
Accepted: 04-08-2024

https://dx.doi.org/10.4314/sa.v23i3.41

Journal Homepage: http://www.scientia-african.uniportjournal.info
Publisher: Faculty of Science, University of Port Harcourt.

ABSTRACT

The petrography of somepetrography of basement rocks in parts of Ikom and Iso – Bendeghia, in Cross Rivers State, Southeastern Nigeria were evaluated. The rock samples collected from the study area were subjected to field observation delineate the parameters for their field names and petrographic evaluation to decipher in common mineral composition of the rock samples. Thin sections were prepared from rock samples collected from the sample points in the area to estimate the percentage composition of minerals. This petrographic study was able to decipher rock type within the study area. The basement rocks found in the area include igneous rocks (pegmatites, granites, dolerites/basalts, charnockites) and the metamorphic rocks (schists, gneisses, granite gneiss, quartzites). The average modal composition of minerals in granite, pegmatites, dolerites, charnockites and gneiss was obtained from the modal composition of the rock samples. Some of the schistsfrom Iso – Bendeghia area were weathered rock bodies and the gneisses were mainly granite gneiss.

INTRODUCTION

The Basement Complex in southwestern and northern of Nigeriahavereceived much field geological review by many Geoscientists compared to southeatern with fewer field geologic studies to ground truth results gotten from LANDSAT, Remote Sensing and Aeromagnetic. This study evaluated the petrography of basement rocks in parts of Bansaraand Ikom, located within Boki Local Government and Ikom Local Government areas respectively in Cross River State, The study area is the boundary zone of the Bamenda highlands from Cameroon to southeastern Nigeria, Egesi&Ukaegbu, (2010). Egesi & Ukaegbu (2013a& b), Egesi (2015) and Ukaegbu, (2003).

The basement rocks in Nigeria played host to most precious and green energy mineral particularly in pegmatites. The study to decipher to the modal composition of minerals cannot be overemphasized. The study area has thick and high rise vegetation cover that is common with equatorial rainforests and the rugged topography have remained a barrier to detailed geological studies particularly during the rainy season where the ground would be extremely slippery. In this research publication, attempts were made to characterize the rock type using petrographic evaluation of rock samples collected as outcrops and exposures. Over time, the geological findings of the eastern part of (northeast and southwest) of Nigerian

basement have shown sharp contract to that of the western part of Nigeria in (southeast and northwest) area, (Ekwueme, 2003) Ibe & Obiora, (2019). Figure 1 shows the sample points within the study area.

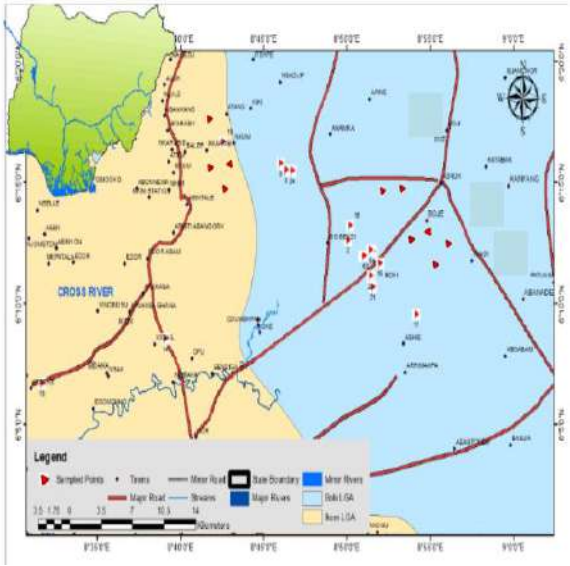

Figure 1: The sample points within the area.

Local Geology

The rock types are predominantly migmatite-gneiss-schist complex and granitoids, which consist mainly of granites, granodiorites, and enderbites and occur as stocks and bosses; other rock units are amphibolites, quartzites, pegmatites, aplites, cataclasites, and mylonites, (Egesi 2015). The structural imprints in the Bansara area are scarce, except for an aeromagnetic survey covering Obudu Plateau and Oban Massif which does not have ground-truthing in the study area. Field evidence shows the Pan-African orogeny has left its structural imprints on the rocks. Opinion has been divided on the occurrence of these structural imprints in the basement rocks of southeastern Nigeria. McCurry (1971) and Rahaman (1976), are of the view that the last tectonothermal event (Pan-African) was so pervasive that it erased all earlier structural imprints. However, Grant (1978); Onyeagocha and Ekwueme (1982); Ekwueme (1987); Oluyide (1988); Ukaegbu (2003); Ukaegbu and Oti (2005), Egesi, (2013a& b), Egesi (2015) stressed that though pervasive, the Pan-African event left some traces of the earlier structures.

Toteu*et al.* (1990) in their study correlated structural orientations in the NW-SE directions to an older Pan-African deformation in northern Cameroon. The rocks in the Bansara area were classified as undifferentiated basement (granulites) terrain by the Nigerian Geological Survey Agency (2006), without appropriate mapping to delineate the boundaries.

MATERIALS AND METHODS

The major materials used for the study were contact men for remote terrains, sample bags, field notebooks, marker pens and pencils, masking tape and measuring tapes/rules, topographic map of the area, camera among others. The petrographic analysis of the rocks started from the field during which the contact relationship of the igneous rocks and host rocks was studied. The rocks were analyzed megascopically in hand specimensas to determine the textures, colour index and pattern of crystallization of the megascopic minerals.

The mineral modes, textures, structures, alterations, inclusions, and optical properties of the thin section were examined in cross-polarized light (XPL) and plane-polarized light (PPL). A crucial component of the petrologic interpretation of the rock samples was the determination of the mineral compositions, modes, microstructures and shapes

RESULTS AND DISCUSSION

The modal analysis was carried out from the rock samples collected within the study area to decipher the nature and composition of minerals present.

Scientia Africana, Vol. 23 (No. 3), August, 2024. Pp 465-472
© Faculty of Science, University of Port Harcourt, Printed in Nigeria *ISSN 1118 – 1931*

Plate 1: Field photograph showing migmatites schist on one of sample points along Afi River, Boje road.

Plate 2: Field photograph showing the sharp contact of pegmatites overlying granites along Iso-BendeghieNkorasi II roadside outcrop on both sides of the minor road.

Plate 3 (a – d): Field photographs showing some sample points in KathuanIrran, and other parts of the study area.

Igneous petrography

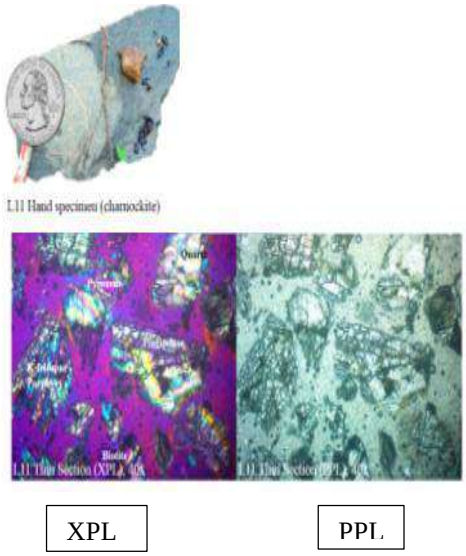

Plate 4: Photographs showing hand specimen and photomicrograph of Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from charnockite.

Plate 5: Field photograph showing dolerite dyke intrusion of 2m to 3m length and 0.3m to 0.5m width and 3 m to 2 m in lenght on the host rock schist at Boje Bridge along the Boki Local Government Area Headquarters

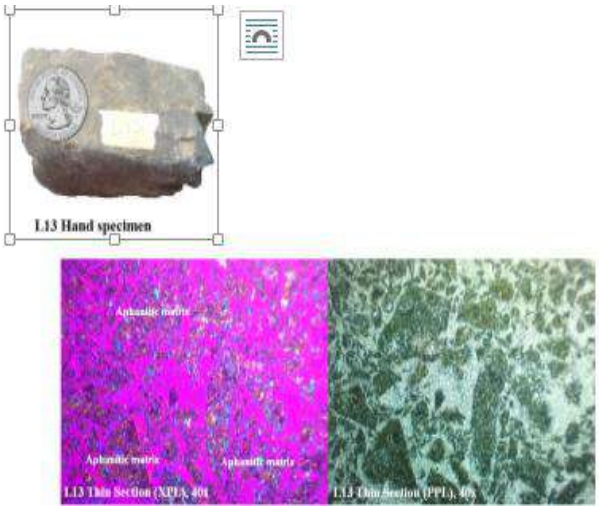

Plate 6: Photographs showing hand specimen, photmicrographs Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 13 (L13) Porphyritic Basalt.

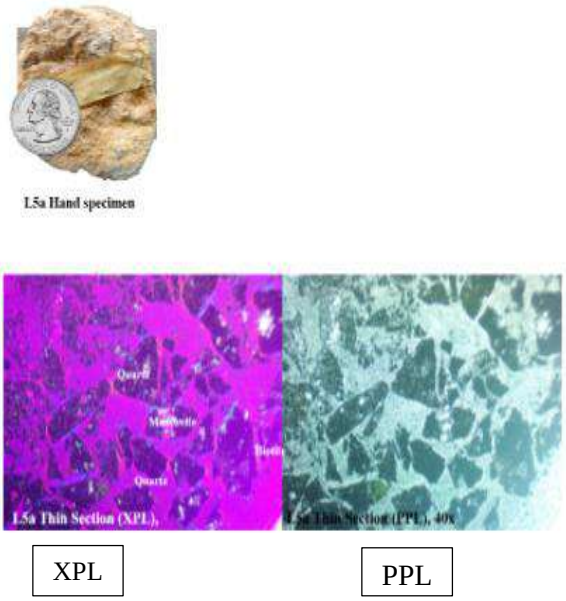

Plate 7: Photograph of hand specimen, photomicrographs of Cross Polarized Light (XPL)and Plane Polarized Light (PPL) from sample 5a (L5a), Pegmatite.

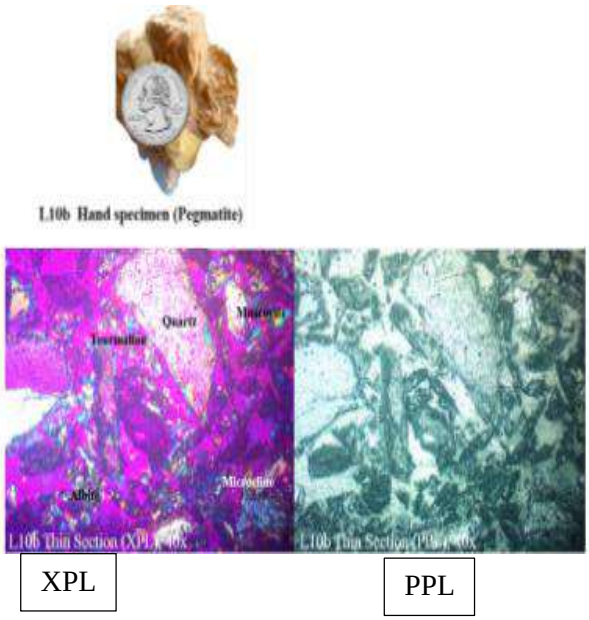

Plate 8: Photograph showing hand specimen, photomicrographs of Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 10b (L10b), Pegmatite.

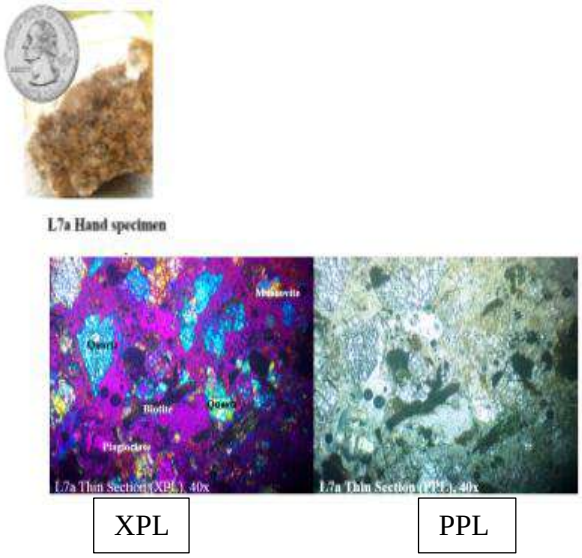

Plate 9: Photograph of hand specimen and photomicrograph of Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 16c (L16c), Granite.

Table 1: The average modal composition of minerals in igneous rocks in Study Area

Minerals	Pegmatites	Dolerite	Granites	Charnockite
Quartz (%)	28	9	26	36
Biotite (%)	-	23	7	7
Feldspar (%)	19	-	29	-
Plagioclase (%)	35	41	24	27
Muscovite (%)	8	-	9	-

Scientia Africana, Vol. 23 (No. 3), August, 2024. Pp 465-472
© Faculty of Science, University of Port Harcourt, Printed in Nigeria *ISSN 1118 – 1931*

Hornblende (%)	-	8	7	6
Pyroxene	-	25	-	22
Olivine (%)	-	13	-	-
Tourmaline (%)	12	-	-	-
Apatite	-	-	-	2
Accessory minerals (%)	4	-	-	-

Metamorphic Petrography

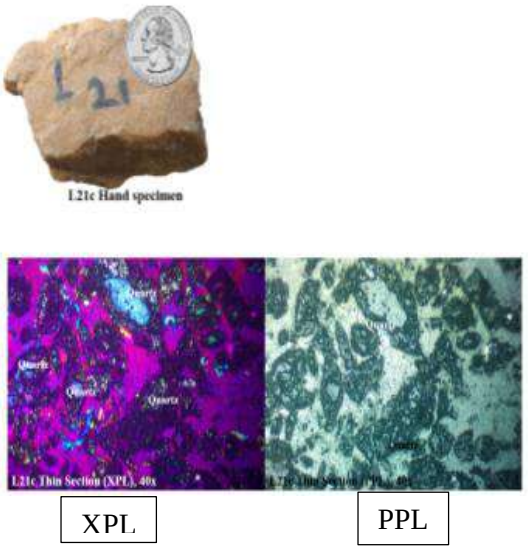

Plate 10: Photograph showing hand specimen, photomicrographs of Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 21c (L21c), Quartzite.

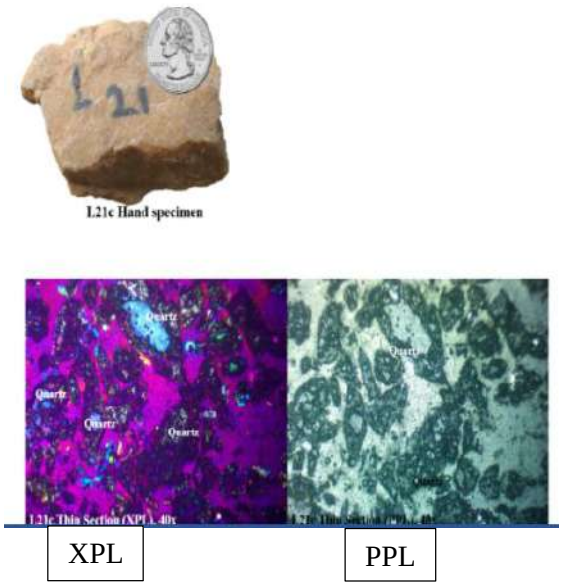

Plate 11: Photograph of hand specimen and photomicrographyof XPP and PPL from sample L21.

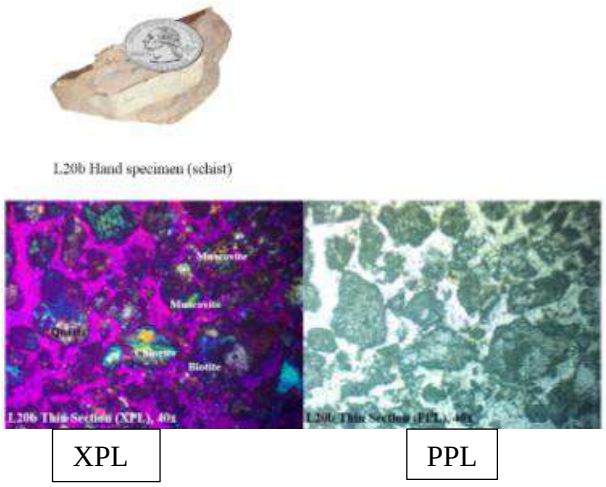

Plate 12: Photograph of hand specimen, photomicrographs of Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 20b (L20b), Mica Schist.

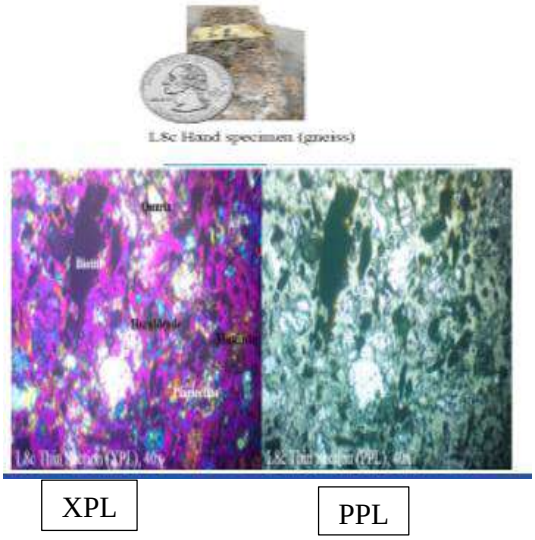

Plate 13: Photograph of hand specimen and photomicrographs showing Cross Polarized Light (XPL) and Plane Polarized Light (PPL) from sample 8c (L8c), Gneiss.

Table 2: The average modal composition of minerals in metamorphic rocks in Study Area

Minerals	Granite Gneiss	Schist	Quartizite
Quartz (%)	21	39	94
K-Feldspar (%)	28	-	3
Plagioclase (%)	31	-	-
Honblende (%)	6	-	-
Muscovite (%)	8	17	3
Biotite (%)	4	28	-
Chlorite (%)	-	17	-
Pyroxene	-	-	
Olivine (%)	-	-	-

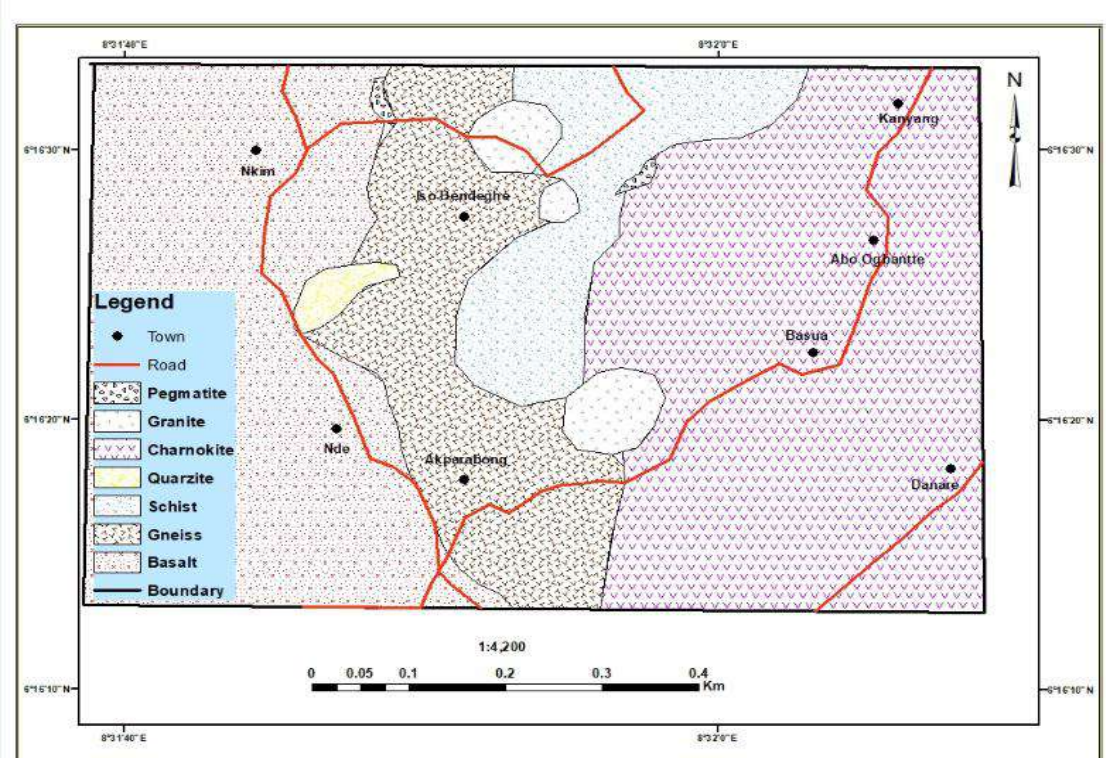

Figure 2: Geological map developed from the study area.

DISCUSSION

The rock outcrop and exposures of igneous and metamorphic rocks was mapping in the study area. These thin sections was prepared and interpreted according to percentage mineral composition of the rocks to infer the name of the rock and to ground-truth the field name. In igneous rocks; pegmatite samples exhibit varying modal compositions, whereas more complicated samples may contain valuable minerals such as tourmaline, garnet, beryl, fluorite, lepidolite, spodumene, apatite, and even topaz. The average modal composition of pegmatites; quartz 28%, K-feldspar 19%, plagioclase 35%, muscovite 8%, tourmaline 12% and accessory minerals of 4%.. In the course of the cooling and subsequent crystallization of the igneous granitic rock body, pegmatite crystallized at the last stage. Some the charnockites boulders in some of the study areas suffered exfoliation weathering while others outcropped as fresh samples. In charnockites, the average modal composition gave quartz as 36%, biotite 7%, plagioclase 27%, hornblende 6%, pyroxene 22% and small apatite 2%. The mineral composition of the parent body crystallizes in stages as it cools. Alongside this, certain

Scientia Africana, Vol. 23 (No. 3), August, 2024. Pp 465-472
© Faculty of Science, University of Port Harcourt, Printed in Nigeria *ISSN 1118 – 1931*

volatiles that form residual in magma, such as water (H2O), boron, fluorine, chlorine, and phosphorus, may escape. Grantic minerals in the study area had average modal compositions of 26% of quartz, biotite 7%, K-feldspar 29%, plagioclase 27%, hornblende 7% and muscovites, 9%. Dolerite average modal composition quartz 9%, biotite 23%, plagioclase 41%, hornblende 8%, pyroxene25%, and olivine 13%.

The metamorphic petrography show that granite gneisses contented quartz 21%, K-feldspar 28%, plagioclase 31%, hornblende 6%, muscovite 8%, and biotite 4%. In Schistose roicks, the average modal composition are quartz 39%, muscovite 17%, biotite 28% and chlorite 17% and quartzite with quartz 94%, K-feldspar 3% and muscovite 3%.

CONCLUSION

The petrography of sections sheets 315 Ikom Northeast and 304 Bansara Southeast inIkom/ Iso - Bendeghia,Cross Rivers State Southeast Nigeria. This study has shown to the Basement Complex in the study area suffered magmatism and metamorphism of various degrees. The petrographic evaluation show the presences basement rocks; dolerites, pegmatites, granite, charnockites, gneiss, schist and quartzite.

REFERENCES

Egesi, N. and Ukaegbu, V. U., (2010). Petrologic and Structural Characteristics of the Basement Units of Bansara Area, Southeastern Nigeria.*The Pacific Journal of Science and Technology*, 11, 2 – 7.

Egesi, N. (2015). Petrology, Structural Geology and Geochemistry of parts of Bansara (Sheet 304) and Mukuru (Sheet 305) SE Nigeria. *Unpubd PhD Thesis Univ. of Port Harcourt*. 256p.

Egesi, N. and Ukaegbu, V. U. (2013a). Petrologic and structural features of basement rocks of parts of Mukuru area, southeastern Nigeria. *Earth Science*; 2(4): 96-103.

Egesi, N and Ukaegbu, V. U., (2013b). Dimension stone Exploration and Development in Boki Area, Southeastern Nigeria. *Journal of Applied Science & Environmental Management*. 17(3) 343-354.

Ekwueme, B. N., (1987). Structural Orientations and Precambrian Deformational Episodes of Uwet Area, Oban massif SE Nigeria. *Precambrian Res*. 34, 269-289.

Ekwueme, B. N, (2003). The Precambrian Geology and Evolution of the *Southeastern Nigerian Basement Complex. University of Calabar Press, ISBN* 987 – 007 – 010 – 9. 1 – 129.

Ekwueme, B. N., &Kröner, A. (1995). Single zircon ages of migmatitic gneisses and granulites in the Obudu Plateau: Timing of granulite-facies metamorphism in southeastern Nigeria. *Journal of African Earth Sciences*, *44*(4-5), 459-469.

Ekwueme, B. N., (1994). Structural features of southern Obudu Plateau, Bamenda massif, SE Nigeria: Preliminary interpretations. Journ. Mining Geol. 30 (1), 45 –59.

Grant, N. K., (1978). Structural distinction between a sedimentary cover and underlying basement in 600Mya Pan-Africa domain of North-western Nigeria, *West Africa. Geo. Soc. Am. Bull.* 89, 50 – 58.

Ibe, C. U. and Obiora, S. C (2019). Geochemical characterization of Granitoids in KatchuanIrruanarea: further evidence for peraluminous and shoshonitic compositions and post-collisional setting of granitic rocks in the Precambrian Basement Complex of Nigeria. *ActaGeochim*38(5):734–752.

McCurry, P., (1971). "Pan-African Orogeny in Northern Nigeria". *Geol. Soc. Am. Bull.* 82: 3251-3263.

Nigeria Geological Survey Agency NGSA (2006). The Geological map of Nigeria. *A publication of Nigeria Geological Survey Agency,Abuja, Nigeria*.

Oluyide, P.O. (1988). "Structural Trends in the Nigerian Basement

Complex".In:P.O.Oluyide.Precambrian Geology of Nigeria. *Geol. Surv. Nigeria: Lagos*, Nigeria. 93-98.

Onyeagocha, A.C. and Ekwueme B.N. (1982). "The Pre-Pan-African Structural Features of Northcentral Nigeria". *Nigerian J. Min. Geol.* 19(2): 74-77.

Rahaman, M. A., (1976). Progressive Polyphase metamorphism in pelitic schist around Aiyetoro, Oyo State, Nigeria. Nig. *Journ. Min. Geol*. 13, (2), 33 – 44.

Toteu, S. F., Macaudiere, J., Bertrand, J.M., and Dautel, D. (1990). "Metamorphic Zircons from North Cameroon: Implications for the Pan-African Evolution of Central Africa*". Geol. Rundsch*. 79, 777-788.

Ukaegbu, V. U., (2003). The Petrology and Geochemistry of parts of southern Obudu Plateau, Bamenda Massif southeastern Nigeria. *Unpubl. Ph.D. Dissertation*. Univ. of Port Harcourt, Nigeria .321p.

Ukaegbu, V. U. and Oti, M. N., (2005). Structural elements of the Pan-African Orogeny and their geodynamic implications in Obudu Plateau, southeastern Nigeria. *Journ. Min. Geol.* 4, 41-49.