ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

PETROGRAPHIC STUDY OF OSO AND ITS ENVIRONS, AFIKPO BASIN, NIGERIA

Oloto, I.N[1] Irinyemi O.A[2]

Senior Lecturer, Dept of Geology, university of Port Harcourt, Nigeria [1]

Graduate Researcher, Dept of Geology, university of Port Harcourt, Nigeria [2]

Abstract: This Petrographic study was carried out on eleven variously indurated sandstone sample obtained from Oso and environs located in Afikpo Basin, in the South Benne trough, Nigeria. The Area is bound within longitudes 7^0 47^1 30^1E and 7^0 55^1 E and latitudes 5^0 50^1 N and 5^0 55^1 N. The studied areas included the locations in Ndi-Obasi, Oso Edda, Oso-Uduma, Ndu Arusi, Amaso Nta, Ifu Obasi, Ndi Ikpo, Ndi Uche, and Oso Owuta. The rocks in the studied area are highly indurated arkosic Sandstone, siltstone, bioclastic siltstone, and shale from the Cenomanian-Turonian-Santonian formations of the Asu-River Group, Eze Aku Shale and Agwu Shale which has affected by tectonic and magmatic activities during the santonian orogeny. Petrographic, thin section analysis and photomicrographs indicate various initial stages or processes of early metamorphism in arkosic sandstone, siltstone and shale. The rocks are hornfels but with blastopsammitic and blastopelitic relict textures.

Keywords: Afikpo Basin,Petrography, metamorphism,,Southern Benue Trough

I. INTRODUCTION

Petrographic Study was carried out on eleven sandstones samples obtained from Oso and environs in Afikpo Basin,Nigeria. The Afikpo sandstone belong to the Afikpo syncline which is a well known sedimentary basin, it lies in the south eastern part of the lower Benue trough (Abakaliki Anti clinorium). The Benue rift ceased to spread by Late Cretaceous times and accommodation of the misfit closure motion between the North Atlantic – African and south Atlantic – African plates resulted (during Santonian times) in an extensive organic episode in the Benue depression. Original textures found in metamorphic rocks in the area include: Ophitic intergranular, intertestinal porphyritic, amygdaloidal. In sedimentary rocks there are Bedding, pebbles and fossils. while in metamorphic rock**,** there are banding, foliation, lineation, folds and porphyroblasts [1]. Metamorphic textures are subdivided on the basis of deformation and include intergranula textures such as foliated, lineated, mortar, flaser augen structure. Intragranular textures such as strained, polygonized, bent, twinned, exsolved etc. Crystallization and intergranular include textures such as granoblastic, porphyroblastic (maculose, knotted, spotted) heteroblastic, idiotopic, spherulitic and decussate textures, intragranular textures such as poikiloblastic and zonal textures with various intergrowths, overgrowths and reaction rims. Combination of crystallization and deformation consisting of foliated, lineated, layered, granoblastic, porphyroblastic and poikiloblastic textures. The degree of persistence of an original feature depends mainly on its size and the degree by which it differs from its surroundings. For instance, bedding marked by shaly parting is easily obliterated but bedding marked by alternations of contracting composition of sandstone and shale, is not; fine grained sediment is more easily recrystalized than coarses (arenite); small fossils or pebbles disappear more quickly than large ones; calcitic fragments or fossils in a calcareous matrix are easily destroyed but a calcareous fossil in an argillaceous matrix may be replaced by wollastonite (pseudomorphed) and be recognizable even after high-grade metamorphism. Vitroclastic and flow textures in acid volcanics are easily destroyed but large phenocrysts of quartz or feldspar may retain their characteristic shape even in strongly sheared rocks [5].

II. LOCATION OF THE STUDY AREA

The present study area (Fig.1) is bound within longitudes 7º47′30″E and 7˚55′E and latitude 5˚50´N and 5˚55´N in the Southern Benue Trough within the afikpo syncline and Abakaliki anticlinorium in south eastern Nigeria which is in Afikpo local government area of Ebonyi state, Nigeria. The studied areas are Ndi-Obasi, Oso Edda, Oso-Uduma, Ndu Arusi, Amaso Nta, Ifu Obasi, Ndi Ikpo, Ndi Uche, Oso Owutu road. Accessibility was by road, river channel and tracks

III. AIM AND OBJECTIVE OF THE STUDY

This study is focused on the petrographic interpretation of rocks obtained from Oso and environ in Afikpo in order to ascertain their various stages of metamorphiosm

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

Geology of the study area Afikpo Basin is located in the southern Benue Trough, between the Abakaliki Anticlinorium running northeast and the Cameroon line in the southeast.. It forms part of the lower Benue Trough and the adjacent Anambra basin. Sedimentation took place in the Afikpo basin ranging in age from Cretaceous to Maestrichian. The study area consists of Asu River Group and Eze-Aku formation deposited in alternating transgressive and regressive phases. The Asu-River Group consisting of shale, limestone and sandstone, it is the older lithostratigraphic unit in the area and was deposited during Albian transgressive phase [6]. It is also the oldest dated sedimentary rock unit in Southern Benue Trough Reyment and barber were of the view that the Asu River Group was deposited in a moderately deep water environment during the Albian, with abundant ammonities, forams, radiolarian, and pollens [2,4]. According to the Reyment, the Albian sediments were moderately folded in many places with the fold axes trending NE – SW [9]. On the other hand, the Ezeaku Formation is believed to represent typical shallow water deposit, consisting mainly of hard grey to black shales and siltstones. Facies changes to sandstone and sandy shales are common. The thickness of this Formation varies and locally may be up to 100m thick and passes laterally into sandstone ridges at Amasiri sandstone, lime stone, calcareous sandstone and sandy limestone [3,8].

IV. METHODOLOGY

The methodology used to carry out the research work are highlighted below;

A. Lithographic Studies.

The samples collected from the field were analysed for lithostratigraphy in which features such as colour, texture and lithology, grain size,roundeness e.t.c were analysed for each sample. In the classification of sedimentary rocks, two kinds of sedimentary components may be distinguished; one consists of material inherited from older rocks, and includes the primary minerals of the parent rock together with such undissolved decomposition products as the clay minerals; the other consists of material that has crystallized in the sedimentary environment. The first kind consists of minerals that originate outside the area of deposition, are transported into it in the form of solid particles, and are mechanically deposited.

B. Petrographic Studies

The sandstone samples collected from the field were analysed for their composition,,colour litholgy thin section and were taken for petrographic studies. Petrographic studies is an aspect of petrology which considers the description of the mineral content, chemical composition, texture, structure, and classification of rocks. It is study of rock sample with the use of thin rocks section to study the optical properties of minerals and rocks. This is done to observe the interrelationship of minerals using a microscope with an analyses and a polarizer.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

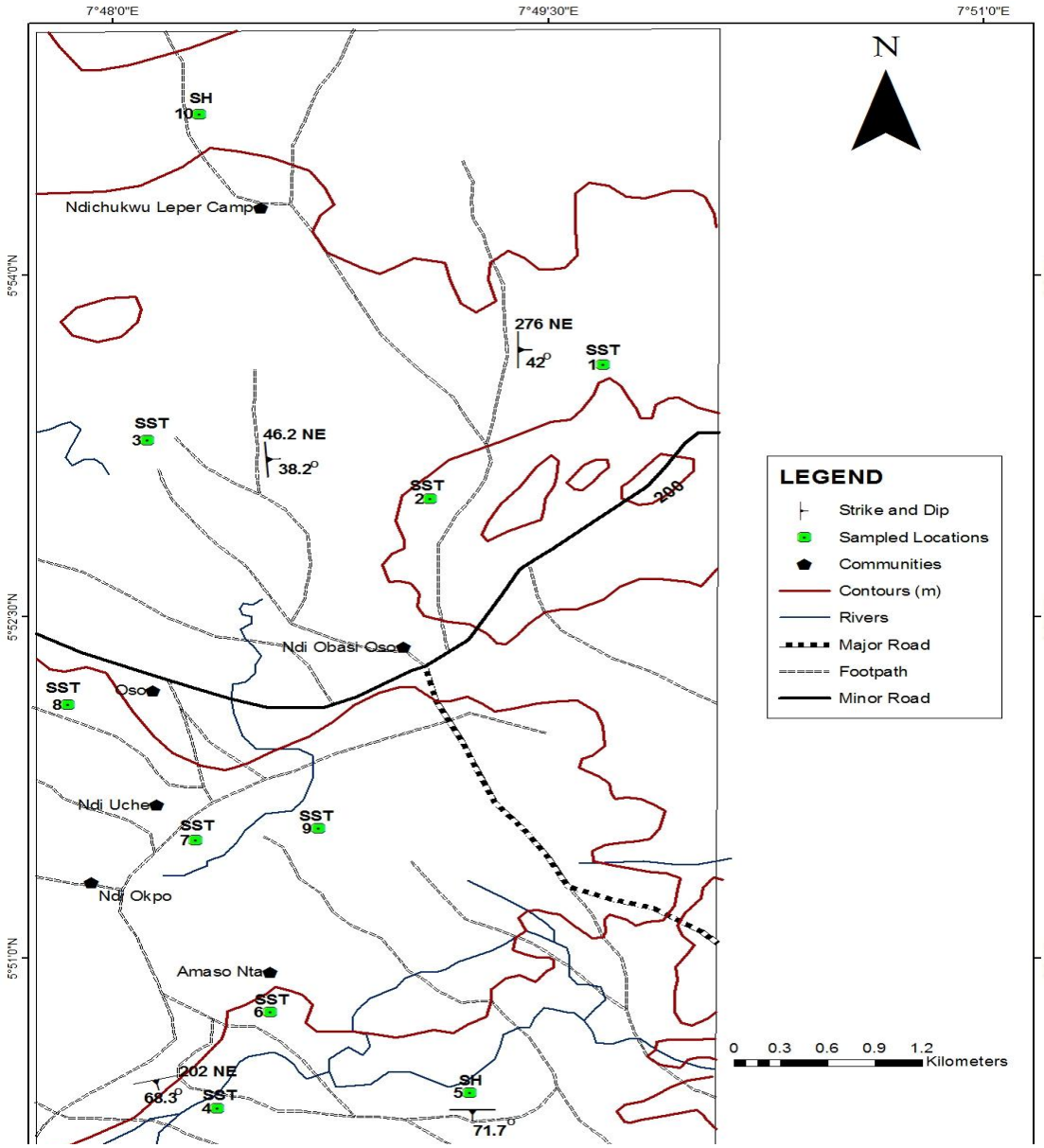


Fig 1; Location map of the study area

V. RESULT AND INTERPRETATION

Lithostratigraphic and petrographic analysis were carried out on indurated sandstone, shale, sittstone sample from location 1-9 in the Oso and environs of Afikpo area in Ebonyi state.Nigeria. The lithologic description and petrographic results are presented below. See plates 1 -2 for Photomicrographs result of Petrophsical studies

Lithostratigraphic and Petrograpphic Analysis

(i) *Location 1* is at Ndi – Uduma North east of the study area and it compose of Coarse, brownish indurated sandstone.

Petrography : Buchite of arkosic sandstone,poorly sorted subrounded/rounded grains, sparsely distributed in clay matrix, few pyrite, few spherical (foram?) organic matter Exsolution features in quartz, abundant oolithic prolific globular texture, and segregating along clusters of granoblastic boundaries and some scattered in clay matrix progressive metamorphism with blastopsammitic texture

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

(ii) *Location 2* is off the Ndi Obasi road, from Afikpo of the study area and it composes of Ferruginized, pebbly, ironstone,highly indurated.

Petrography :Ferruginized sandstone , grains irregular, subangular, subrounded floating in thick matrix of dark cement (hematite/glass)

(iii**)** *Location 3* is at Ndi Arusi, it composes of sandstone, arkosic whitish and Hornfels of arkosic sandstone

petrography: Subangular/subrounded grains of Feldspar and quartz fairly distributed floating in clay matrix with prolific globular oolithic exsolution texture in the matrix.

(iv) *Location 4* is at Ifu Abasi south west of the study area and it compose of sandstone, highly indurated, Floating in clay matrix

Petrography: Argillaceous hornfels, with elongate, angular subangular-subrounded grains of feldspar/quartz with abundant rods, globular oolitic exsolution texture. Calcareous/Calcitic

(v) *Location 5* is at 100m from Ifu Abasi east of the study area and is highly indurated, bedded , dark crystalline rock.

Petrography :Argillaceous rock, hornfels Finely divided, elongated, lensoid grains in glass and ferromagnesian matrix, arrayed in portions, thin lamination., equigranular polygonalization of feldspar aggregates offerromagnesian minerals, grains of quartz and biotite with granoblastic, cuspate texture interlocking crystals.

(vi) *Location 6* is at Amaso Mta north of location 4, it composes of sandstone, ferruginized, coarse grained.

*Petrography***:** medium grained, sparingly distributed in clay grains and dispersed matrix with prolific rods and oolithic globular exsolution texture,onset of progressive metamorphism, polygonization and partial interlockin clots of granoblasts

(vii) *Location 7* is at Ndi Ikpo and it composes of siltstone, bedded with rootlets cream/ferruginized.

Petrography : Arkose hornfels Few large spherical grains and medium grains of irregular boundary sparingly distributed in clay matrix with prolific rods oolitic globular exsolution texture.

(viii) *Location 8* Ndi uche and it composes of Sandstone, fine/medium grained, weathered.

petrography Arkose Hornfels Grains of feldspar, medium grained irregular boundary, matrix of clay, abundant. Sphaeroidal probably plankton with prolific nodular and elongate rods and pertithes exolution texture.Blastopsammite and blastopelitic segregation of globules.

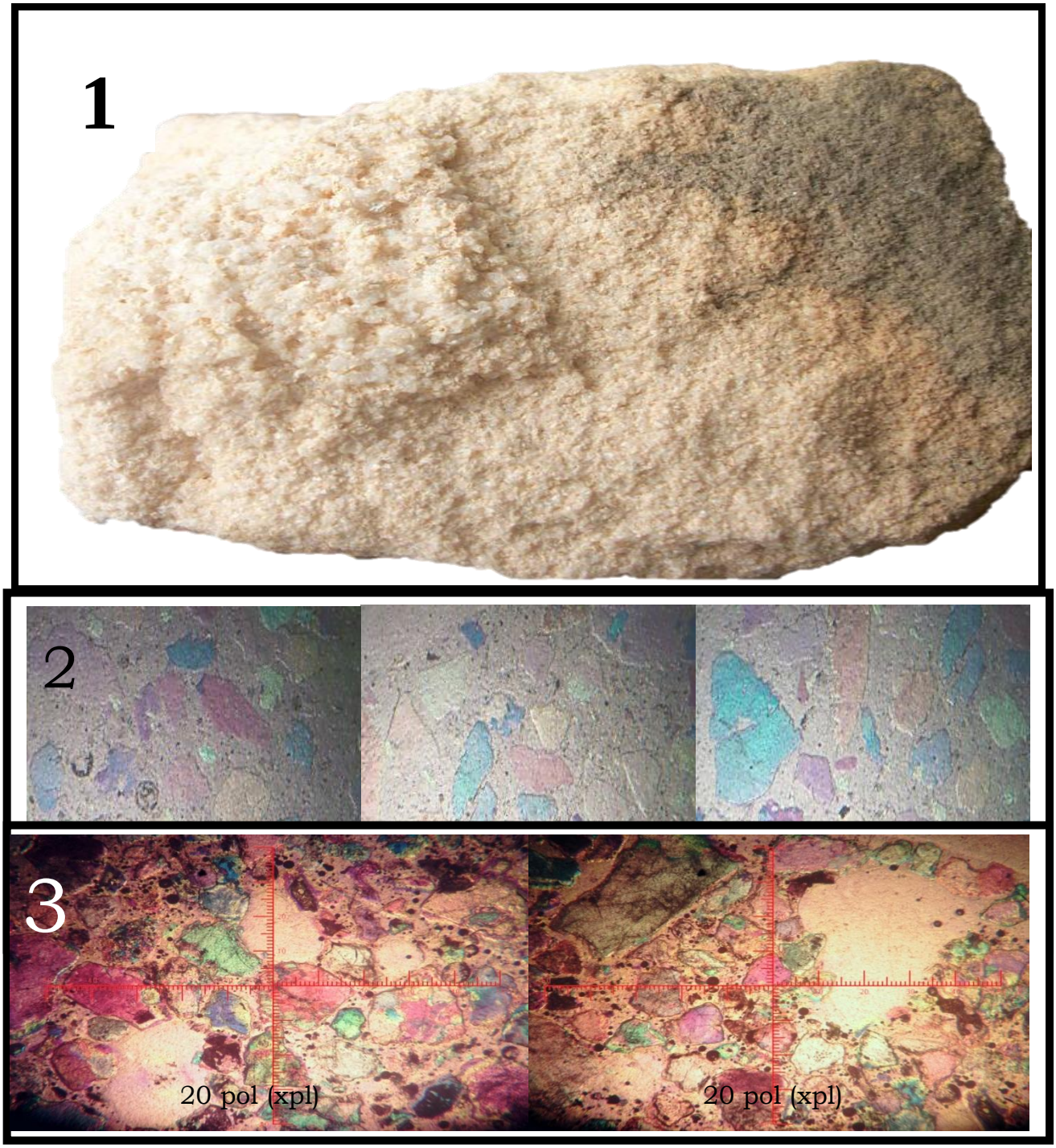
(ix) *Location 9* Afikpo-Ndi Obasi junction along Oso road on the right and composes of Sandstone, highly fossi liferous, reduction in number of fossil towards Owutu

Petrography Arkose Hornfels. Irregular rimmed grains, sparingly distributed in clay matrix with Prolific exsolution features of rods oolithic globular, perthitic texture. Calcareous Polygonalization reaction rims

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

PLATE A



ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

EXPLANATION TO PLATE A

1: Hand specimen of Arkosic sandstone (Location 1)Location 1 is at Ndi – Uduma North east of the study area and it compose of Coarse, brownish/pinkish indurate sandstone.

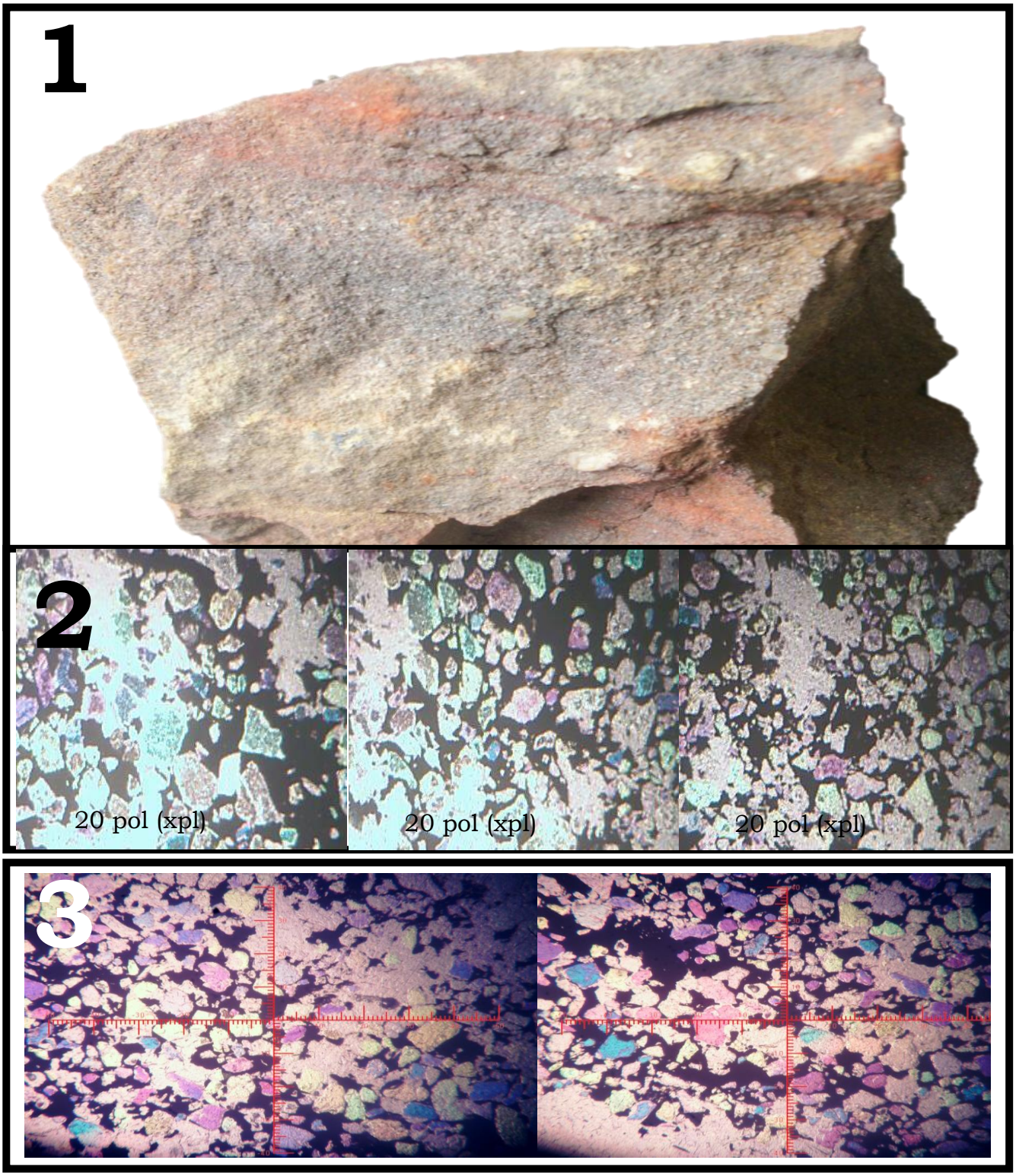
2:Photomicrograph of Arkosic sandstone (Location 1). Sandstone from Ndi-Uduma (Arkose sandstone) shows uncompacted sub rounded/rounded grains sparsely distributed in clay matrix, few pyrite, few spherical (foram). Exsolution fixtures in quartz, sericitization.

3:Photomicrograph of Arkosic sandstone (Location 1). (Arkose sandstone) shows uncompacted sub rounded/rounded grains sparsely distributed in clay matrix, few pyrite, few spherical (foram). Exsolution fixtures in quartz, sericitization

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

PLATE B



ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology
Vol. 2, Issue 5, May 2013

EXPLANATION TO PLATE B

1: Hand specimen of (Location 2)is off the Ndi Obasi road, from Afikpo of the study area and it compose of Ferruginized ironstone, highly indurated

2 Photomacrography of Ferruginized ironstone from Ndi Obasi off Ndi-Obasi road shows feroginization, subangular/subrounded grains with cemented of minerals. (heamatite)

3 .Ferogenized sandstone from off Ndi-Obasi road shows feroginization, subangular/subrounded grains with cemented of minerals. (heamatite) It contains less or no matrix and rock fragments are by far most abundant detritial grains

VI. DISCUSSION AND CONCLUSION

Petrographic study was carried out on eleven variously indurated sandstone sample obtained from Oso and environs located in Atikp Area, in the South Benne trough, Nigeria. The area is bound within longitudes 7^3 47^1 30^{11}E and 7^0 55^1 E and latitudes 5^0 50^1 N and 5^0 55^1 N. the studied areas included the locaters in Ndi-Obasi, Osso Edda, Oso-Uduma, Ndu Arusi, Amaso Nta, Ifu Obasi, Ndi Ikpo, Ndi Uche, and Oso Owuta. The rocks included highly indurated arkosic Sandstone, siltstone, bioclastic siltstone, and shale from the Cenomanian-Tunarian-Sandtomain formations of the Asu-River Group, Eze Aku Shale and Agwu Shale affected by tectoric and magrnatic activities during the santenian on agency [10] Most Hornfels contain sufficient palimpsest features to indicate their origin except at highest grades. For instance a hornfels derived from a mudstone differs considerably in texture from one derived from slate. Bedding is preserved in most hornfels as compositional layering [7]. A well developed shaly parting is enough to cause mimetic crystallization of mica along the bedding to produce a weak preferred orientation. The foliation in a slate or phyllite acts like bedding in a shale and controls the formation of mimetic mica flakes which may grow preferentially along both bedding and foliation.

Petrographic, thin section analysis and photomicrographs indicate various initial stages or processes of early metamorphism in arkosic sandstone, siltstone and shale. The rocks are hornfels but with blastopsammitic and blastopelitic relict textures. The texture include sparingly distributed grains of feldspar and quart floating in clay matrix. Grains and matrix are vengulfed by prolific rods, globules and perthite of exsoluten texture. They also include patches or cloths of feldspar, quarts, biotite, exsolued globules with polygonal granoblastic texture and reaction rims.

REFERENCES

[1] L.C Amajor.,Sedimentary facie analysis of Ajali sandstone (Upper cretaceous), southern Benue Trough,nigeria journal of mining and Geology,vol, 21 No. 1 and 2,1984

[2] E. Arumala,. Tectonic - Petrographic relationship of cretaceous sandstones in Afikpo syncline unpuublished B. Sc Thesis, University of PortHarcourt, pp 10 -52,1987

[3] W.R Dickson, Plate tectonics and sandstones compositions Bull. Amer. Assoc. Petro geol. Vol 63.pp 2164 -2182,1979

[3] M. Hoque, Significance of textural and petrographic attributes of several cretaceous sandstone, southern Nigeria. Bull Geol. Soc. India, Vol. 77 ,pp 514 – 521,1976.

[4] M. Hoque,. Petrographic differential of tectonically controlled cretaceous sedimentary cycles, southern Nigeria. Bull. Sed. Geol. Vol 17, pp 235 – 245,1977

[5] P.F. Kerri, Optical Mineralogy Mc. Grew Hill Inc. London pp 273 – 393,1977

[6] C.A Kogbe. Paleogeographic history of Nigeria from Albian times in Kogbe (ED) Geology of Nigeria Elizabethan. Pub Co. Lagos ,pp 257 – 263,1976

[7] R.C Murat,. Stratigraphy and Paleogeography of the cretaceous and lower – tertiary in Southern Nigeria. In Dessuvagies, T. F J and Whiterman A, J. (E .d) African Geology University of Ibadan press Ibadan,pp 251 – 264,1970

[8] S.O Nwachuckwu,1972, The Tectonic evolution of the Benue truogh, Nieria mag Vol. 109, pp 411 – 419,1972